

[54] **INSULATED WIRE WOUND RESISTOR**

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[51] Int. Cl. **H01c 5/02**

[58] Field of Search **338/174, 175, 162, 338/197**

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[57] **ABSTRACT**

A variable resistor which includes a one-piece molded

plastic insulating housing having an open-ended hollow socket in which is disposed an assembly consisting of a wire wound annularly-shaped resistance element having terminal legs projecting directly through and outwardly of the insulating housing, and a pair of electrically interengaged metal rings mounted on a molded plastic rotor coaxially centered within said hollow socket, one of said rings having a contact finger engaging the resistance element and the other of said rings having a terminal lug extending through and outwardly of the molded plastic housing, all of the foregoing assembly parts being operatively held within the one-piece housing by a molded plastic insulator ring fitted in the open end of said hollow socket, and a retainer shell locked to and embracing said socket and its end closure ring to secure the entire assembly together. A detent projection from the retainer shell extends into the housing and in conjunction with an extension on the molded plastic rotor provides rotation stops for the rotor contact finger. The entire housing is secured to a mounting plate by means of a pair of locking arms having hooked ends which are integral with and project forward from the housing and are designed to pass through mounting slots in the mounting board and grip the edges of the mounting slots to thereby firmly press the broad area front face of the one-piece housing against the rear surface of the mounting plate.

9 Claims, 7 Drawing Figures

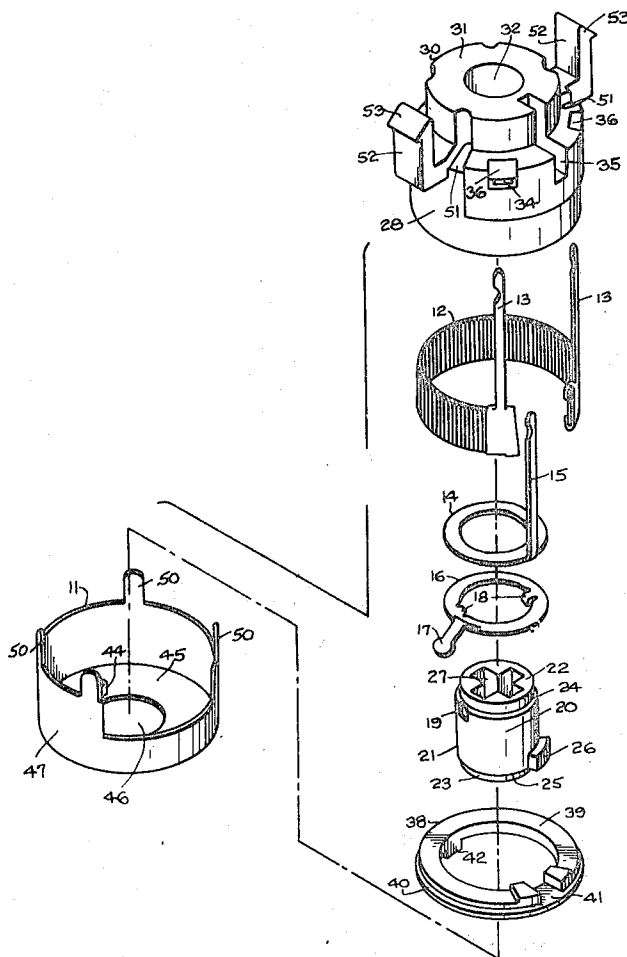


FIG. 1

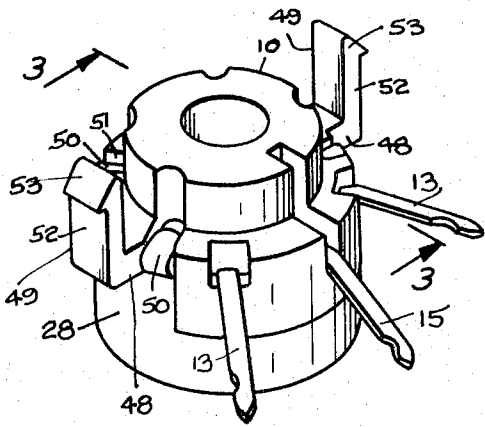


FIG. 2

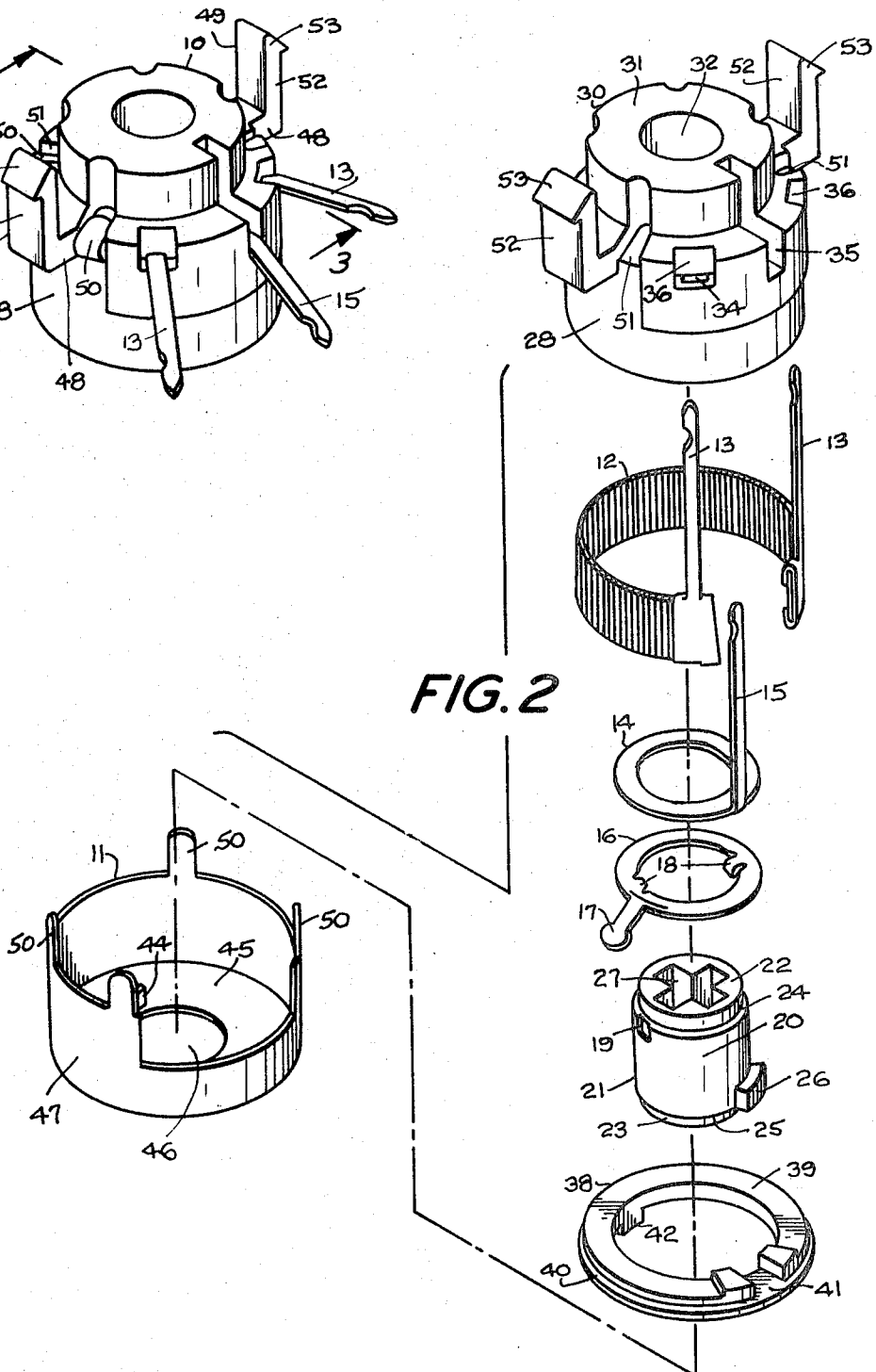


FIG. 3

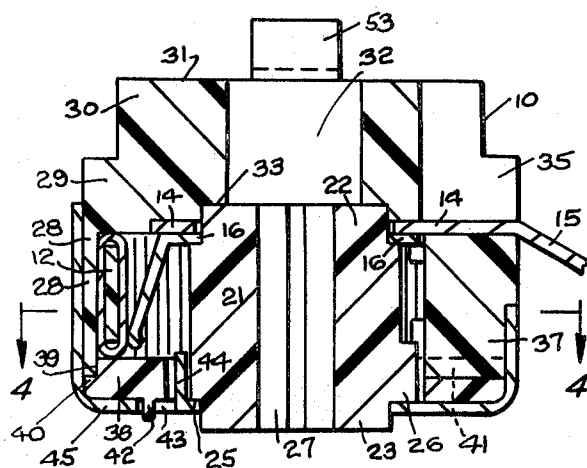


FIG. 5

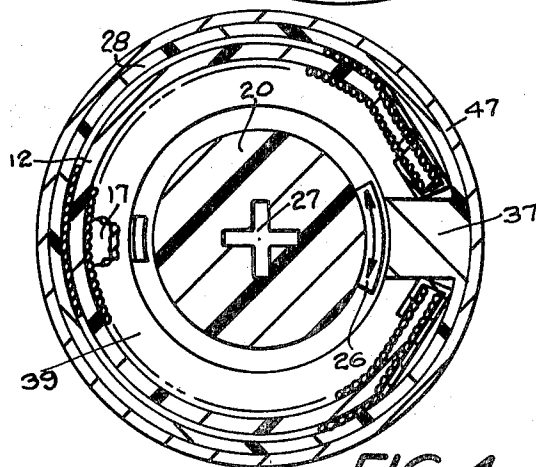
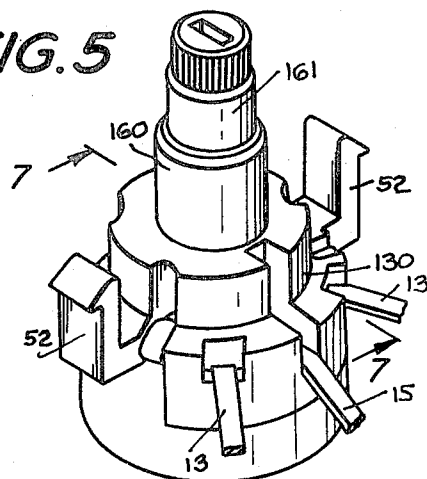


FIG. 4

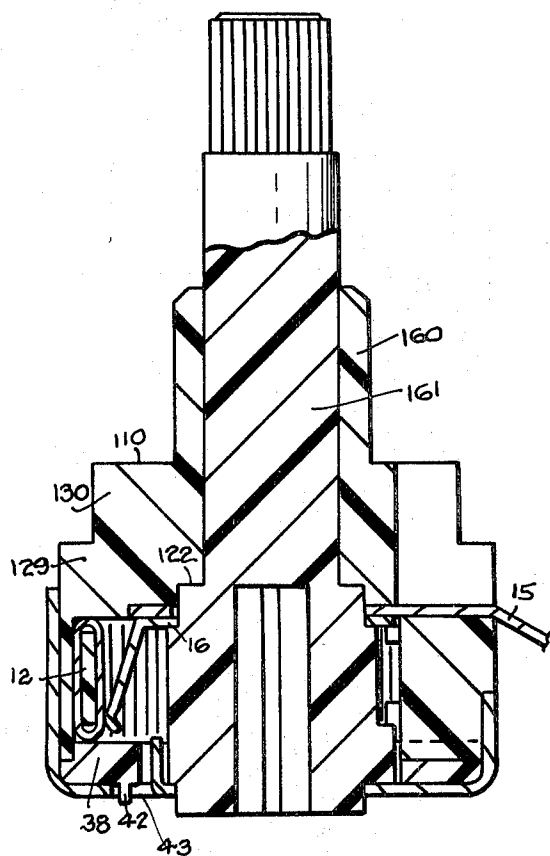


FIG. 7

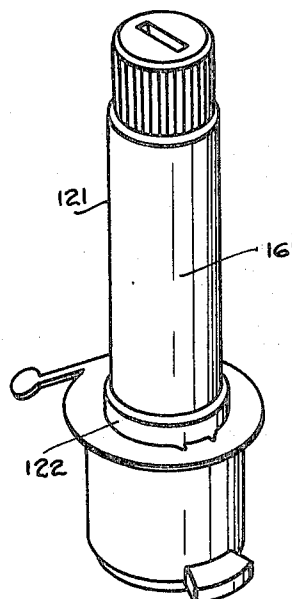


FIG. 6

INSULATED WIRE WOUND RESISTOR

This invention relates generally to variable electrical resistance devices such as potentiometers. The variable resistor according to the present invention embodies a number of novel features which cooperate to provide an electrically reliable, mechanically rugged unit of relatively low cost which may be easily and quickly assembled by comparatively unskilled personnel. A novel aspect of the variable resistor according to the invention resides in the utilization of a one-piece molded plastic insulating housing within which all of the operative structure of the unit is contained, these operative units being also insulated at the open end of the housing by the use of a molded plastic insulating ring. The entire assembly is held together by a rear retainer shell. Additionally, the one-piece molded plastic insulating housing is formed with a very broad bearing face designed to provide broad surface contact with the rear face of a mounting panel, the entire unit being held securely to the mounting plate by a pair of resilient plastic arms which are molded integrally with and extend from the body of the one-piece housing. The locking arms are provided with terminal hook formations adapted to be projected through appropriate slots in a mounting plate and to lock against the front surface of the plate after passing through the mounting slots.

All of the aforementioned parts are disposed within the housing and held in mechanically stabilized position by novel interlocking and detenting arrangements which do not require rivets, cementing or other permanent type securement. Accordingly, it is a primary object of this invention to provide a novel variable resistor incorporating the aforescribed features, and additional objects of the invention will become apparent from a reading of the following specification in conjunction with an examination of the appended drawings, wherein:

FIG. 1 is a perspective view of one form of the novel potentiometer according to the invention;

FIG. 2 is a perspective exploded view of the potentiometer shown in FIG. 1 showing the housing, resistance element, terminal ring, contact finger ring, rotor, insulating ring and rear retainer shell all physically separated from one another;

FIG. 3 is a vertical sectional view on an enlarged scale through the potentiometer according to the invention as would be seen when viewed along the line 3—3 of FIG. 1;

FIG. 4 is a horizontal sectional view through the potentiometer according to the invention as would be seen when viewed along the line 4—4 of FIG. 3;

FIG. 5 is a perspective view illustrating a modified form of the invention utilizing a different rotor structure;

FIG. 6 is a perspective view on an enlarged scale of the modified form of rotor structure utilized in the embodiment shown in FIG. 5; and

FIG. 7 is a vertical sectional view similar to that of FIG. 3 but taken through the modified form of the invention as would be seen when viewed along the line 7—7 of FIG. 5.

In the several figures, like elements are denoted by like reference characters.

Referring now to the drawings, and considering first FIGS. 1 through 4, the potentiometer structure discloses from external appearance a one-piece molded

plastic insulating housing designated generally as 10 to which is secured from the rear a retainer shell designated generally as 11, with the operating parts being disposed within and generally concealed by the housing and shell. As best seen in FIG. 2, the interior operating components include a split annulus wire wound resistance element 12 to the opposite ends of which are mechanically secured terminal legs 13 which are also electrically connected to opposite ends of the resistance wire.

Spaced immediately below the resistance element 12 in the showing of FIG. 2 is a metal terminal ring 14 from one edge of which upwardly extends a terminal leg 15. The terminal ring 14 is seated upon in electrically contacting engagement with an underlying metal contact finger ring 16 from one edge of which is downwardly turned a contact finger 17 which is normally disposed within and electrically engages the inside surface of the resistance element 12. Turned down from the inside edge of the contact finger ring 16 are a pair of detent tabs 18 which are disposed within the detent recesses 19 formed at the upper edge of the central cylindrical part 20 of the molded plastic rotor designated generally as 21.

The plastic rotor 21 is formed with upper and lower end bearing cylindrical parts 22 and 23 respectively of reduced diameter as compared with the central cylindrical part 20, thus forming an upper shoulder 24 and a lower undercut 25. The inner diameter of contact finger ring 16 is just slightly larger than the diameter of upper cylindrical part 22 of the rotor so that the contact finger ring slips downward around the rotor upper part 22 into seating engagement upon the rotor upper shoulder 24 with the detent tabs 18 disposed in the rotor detent recesses 19. This automatically indexes the contact finger 17 with respect to the rotor stop 26 which projects laterally from the lower end of the rotor central cylindrical part 20. The angular relationship between contact finger 17 and rotor stop 26 is such that the contact finger 17 wipes the entire resistance element 12 and stops at the opposite ends thereof without running off of the resistance element. A cruciform axial through-slot 27 extends longitudinally through the rotor 21 to provide for screw driver adjustment of the rotor from either front or back of the potentiometer. As best seen in the showing of FIG. 3, the inside diameter of the terminal ring 14 is slightly larger than the diameter of the rotor upper cylindrical part 22 so that the rotatable rotor does not drag against the terminal ring.

The one-piece molded plastic insulating housing 10 within which all of these other parts are disposed in the manner shown in FIG. 3, is formed with an open bottom lower cylindrical shell 28 which extends upward to a centrally axially apertured solid cylindrical formation 29 surmounted by a second such centrally axially apertured solid cylindrical formation of reduced diameter 30, which latter terminates at its upper end at a broad flat face 31, the central axial opening through the solid cylindrical formations 30 and 31 being coaxial and designated as 32. As seen in FIG. 3, the axial opening 32 terminates at its lower end within the solid cylindrical formation 29 at an undercut surface 33 which constitutes the upper end of an enlarged axial opening of diameter just large enough to accept therewithin the upper cylindrical part 22 of the rotor 21, the undercut surface 33 acting as a bearing face against which is seated the upper end surface of the rotor 21.

At the junction of the housing solid cylindrical formation 29 and open bottomed cylindrical shell 28 there are formed three openings through which are upwardly projected the resistance element terminal legs 13 and the terminal ring terminal leg 15, one of these openings being visible in the showing of FIG. 2 and designated as 34, the remaining openings 34 being concealed within the lead-out slots 35 and 36 formed in the housing.

Formed on the inside wall of the open bottomed lower cylindrical shell 28 and extending downward beneath the terminal leg opening through which the terminal 15 extends is a wedge shaped formation 37 against which the opposite ends of the split annulus resistance element 12 abut as best seen in the showing of FIG. 4. The wedge formation 37 is formed to such a width that the terminal legs 13 of the resistance element 12, when projected through their respective terminal leg openings, bring the ends of the annulus into abutting engagement with the wedge 37. With the resistance element 12 so installed, the terminal legs 13 are then bent downward at right angles through the lead-out slots 36 in the housing 10 to thereby lock the resistance element into the housing.

Underlying the lower conductive edge of the resistance element 12 is a molded plastic insulator ring designated generally as 38 in the form of a circular annulus having an upper section 39 of diameter which just fits within the open bottomed lower cylindrical shell of the housing 10, and having a lower section 40 of slightly larger diameter which seats upward against the bottom edge of the housing, all as best seen in the showing of FIG. 3. The annular upper section 39 is provided with an interrupted region 41 within which is disposed the lower end of the housing wedge formation 37 when the insulator ring 38 is properly seated. Projecting downward from the underside of the lower annular section 40 is a detent tab 42 which in the assembled unit extends downward through a slot 43 formed by the upward turning of rotor stop tab 44 from the base wall 45 of retainer shell 11.

The retainer shell base wall 45 is centrally circularly apertured as at 46 so that the lower cylindrical part 23 of the rotor 21 fits close fittingly therethrough with the rotor lower undercut surface 25 seated against the base wall 45 when the retainer shell 11 is secured to the housing 10. The retainer shell base wall 45 consequently functions as the lower bearing surface for the rotor 21. Extending upward from the shell base wall 45 is the generally cylindrical shell sidewall 47. The shell sidewall 47 extends upward to the undersurface of the horizontal legs 48 of the L-shaped locking arms which are designated generally as 49. Extending upward from the shell sidewall 47 at four places are bendable ears 50 which are turnable inward over the top edge of the plastic housing solid cylindrical formation 29 and into the ear slots 51 to thereby securely attach the retainer shell 11 to the housing 10 and complete the assembled unit.

The locking arms 49 are molded integrally with the housing 10 with the horizontal legs 48 being radial extensions from the housing solid cylindrical formation 29 and turning upward into the vertical legs 52 of the locking arms which terminate at their upper ends in a pair of outwardly turned wedge hooks 53. The horizontal legs 48 of the locking arms 49 are substantially thicker than the vertical legs 52, the relatively thinner

radially oriented dimension of the locking arms vertical legs 52 permitting radially inward flexing of the vertical legs when the unit is being installed to a mounting panel. This radial inward flexing occurs of course due to the sloped outer camming faces of the wedge hooks 53 as the latter are pressed through the appropriately positioned slots in the mounting panel.

Considering now the modified embodiment shown in FIGS. 5, 6 and 7, comparison of FIGS. 3 and 7 discloses that the embodiments are substantially identical, differing only in that the one-piece molded plastic insulating housing 110 of FIG. 7 is provided with an additional integrally molded upper cylindrical extension 160 which provides additional bearing support for the extended shaft 161 of the rotor 121 illustrated in the showing of FIG. 6. The rotor 121 differs from the rotor 21 previously described only in the shaft extension 161 which is molded integrally with the rotor upper cylindrical part 122, the diameter of the extended shaft 161 being such as to close fittingly project through the axial opening of the housing, which is of course of the same diameter as the axial opening 32 of the previously described one-piece housing 10.

Having now described the invention in connection with particularly illustrated embodiments thereof, it will be understood that modifications and variations of the invention may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of the invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:

1. A variable resistor comprising in combination,
 - a. an open-ended one-piece molded plastic insulating unit having at one end thereof an axially apertured solid section and at its opposite end a co-axial cylindrical thin-walled section of an inside diameter substantially greater than that of the aperture through said solid section,
 - b. a molded plastic insulating annular end member non-rotatably fitted upon the open-end of said thin-walled section of said one-piece unit to provide conjointly therewith a completely insulated housing with an internal cavity having axially spaced front and rear annular abutments therein,
 - c. a wire-wound resistance element in the form of a split annulus disposed and held captive in said cavity between the axially spaced abutments thereof, said resistance element having a pair of terminal legs respectively projecting outwardly of said cavity through spaced openings formed in said insulating unit,
 - d. a shouldered plastic cylindrical rotor member having a reduced end portion journaled in said apertured solid section of said insulating unit and an opposite end portion projecting freely through said insulating annular end member,
 - e. a metal contact-finger ring having a contact finger extending laterally therefrom for sliding contact with said resistance element,
 - f. a metal terminal ring having a terminal leg projecting outwardly of said cavity through an opening formed in said insulating unit between and in spaced relation to said openings for the terminal legs of said resistance element,

1. said metal contact-finger ring and said metal terminal ring being disposed in overlying, electrically engaged relation between the shoulder of said rotor member and the front abutment of said insulated cavity, and

g. a rear retainer shell of generally cup-shaped form having a base wall overlying said insulating annular end member and a cylindrical wall closely embracing the thin-walled section of said unit, said shell being non-rotatably locked to the housing to thereby secure in fixed assembly said insulating unit and its end member as a complete insulating enclosure for said resistance element and its operatively associated parts.

2. A variable resistor as defined in claim 1 wherein said open-ended one-piece insulating unit is provided with a pair of diametrically opposed, integral mounting arms, which said arms project frontally beyond the front end of the solid section of said unit and are respectively provided with hooked extremities projectible through apertures formed in a mounting panel for the resistor.

3. A variable resistor as defined in claim 2 wherein said front end of said solid section of said unit is provided with a flat, front face of substantial area adapted for flat-wise engagement against the surface of the mounting panel when said mounting arms are hooked into the panel.

4. A variable resistor as defined in claim 3 wherein said mounting arms are generally of L-shaped form to provide each with a leg part which extends substantially parallel to the central axis of the resistor housing in out-

ward radially spaced relation to said insulating housing and with a laterally extending base part integrally united to said unit at points spaced rearwardly from said flat, front face of said solid section.

5. A resistor as defined in claim 3 wherein said rear retainer shell is formed of metal and is provided with circumferentially spaced locking tabs and wherein said insulating unit is provided with correspondingly spaced seats into which said tabs are respectively clinched, said seats being spaced rearwardly from said flat, front face of said insulating unit to thereby insure against contact of said clinched locking tabs with the panel upon which the resistor is mounted.

6. A resistor as defined in claim 1 wherein said base wall of said rear retainer shell is centrally apertured to provide a bearing seat for the rear end of said insulating rotor member.

7. A resistor as defined in claim 6 wherein said apertured base wall of the rear retainer shell and said rotor member are respectively provided with coacting means for limiting rotation of said rotor in either direction to a predetermined arc.

8. A resistor as defined in claim 1 wherein said contact-finger ring is keyed to said rotor member for rotation therewith relatively to said resistance element.

9. A resistor as defined in claim 1 wherein said thin-walled section of said insulating unit is provided with an internally projecting part disposed between the split ends of the resistor element to maintain the same expanded in annular form against the inner wall surface of said housing.

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