March 15, 1960 W. A. BARDEN ET AL 2,929,040

COMBINATION ELECTRIC SWITCH AND VARIABLE RESISTOR

Filed June 12, 1958

3 Sheets-Sheet 1

Fig. 1.

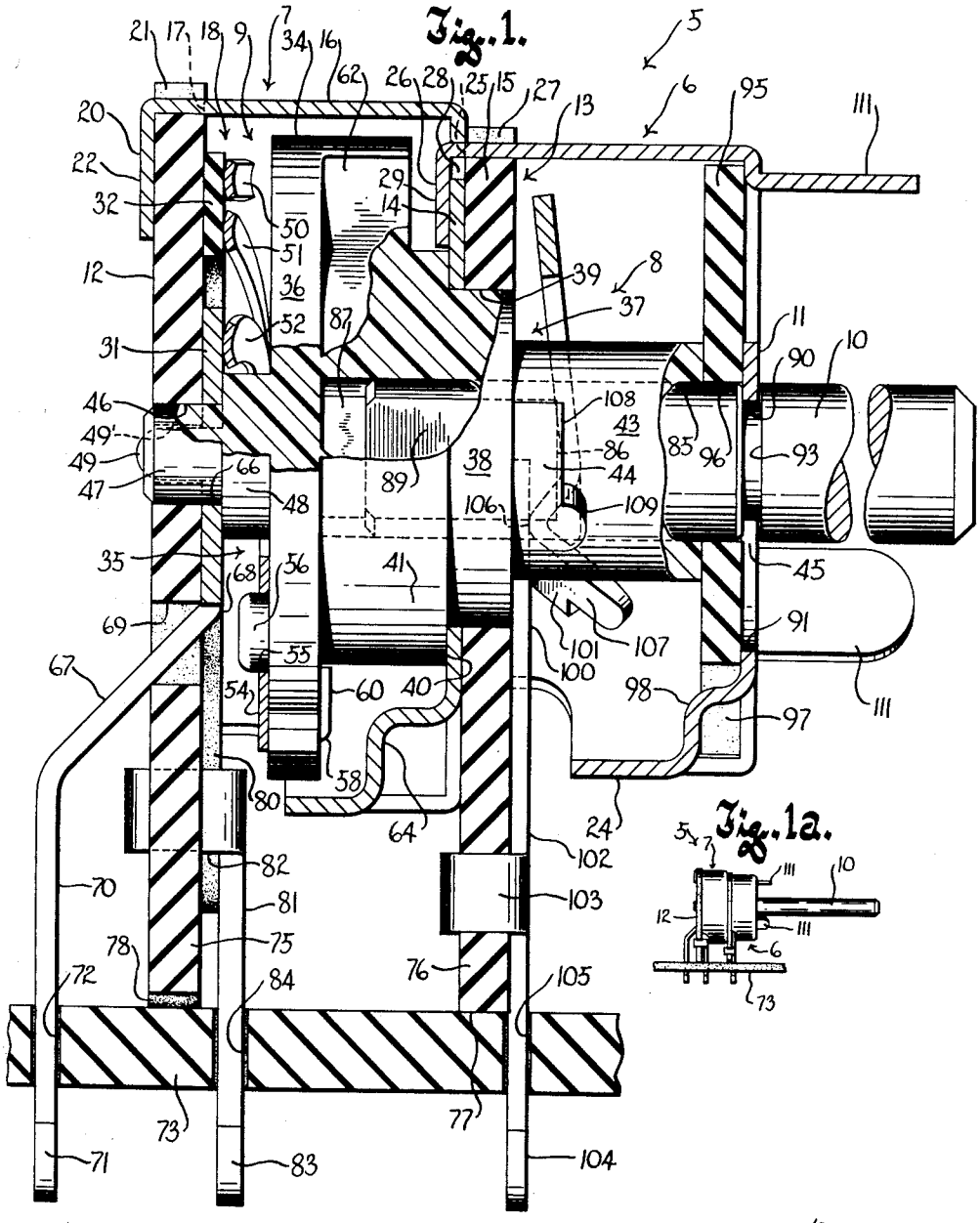


Fig. 1a.

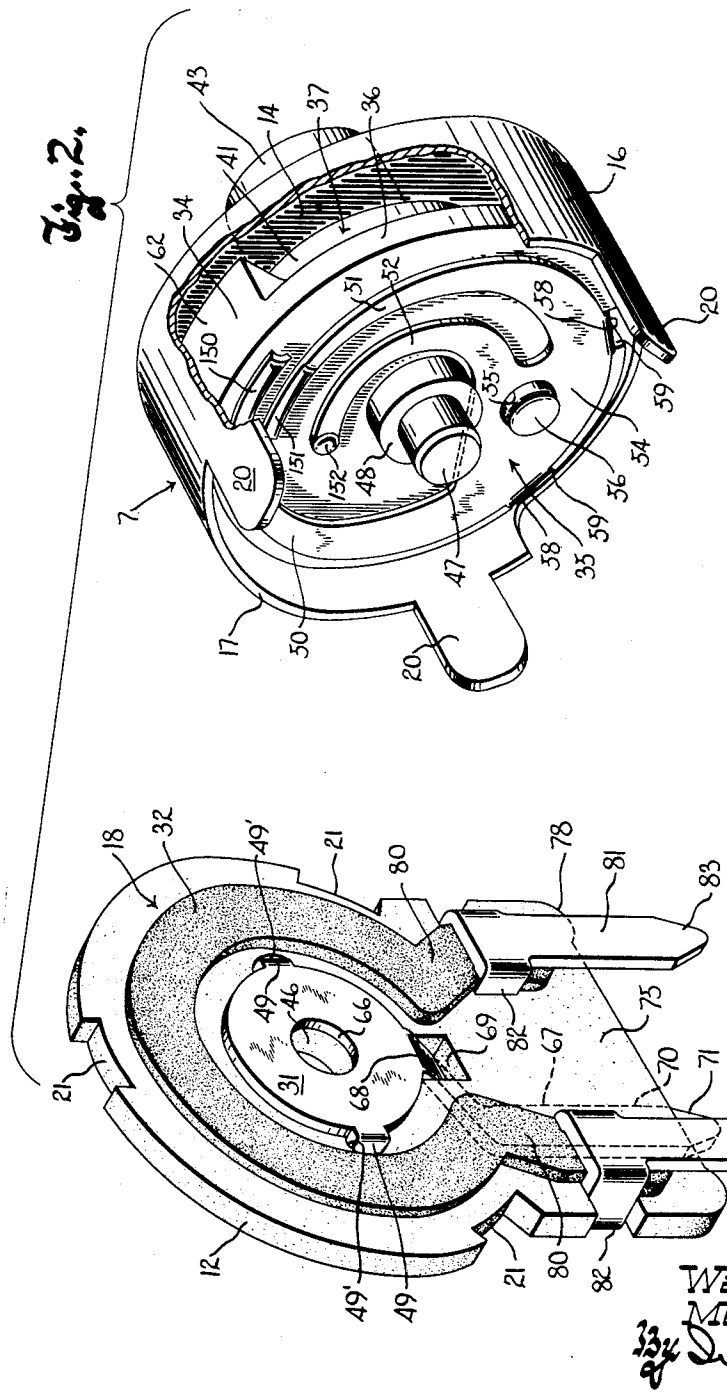
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COMBINATION ELECTRIC SWITCH AND VARIABLE RESISTOR

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Fig. 2.



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COMBINATION ELECTRIC SWITCH AND VARIABLE RESISTOR

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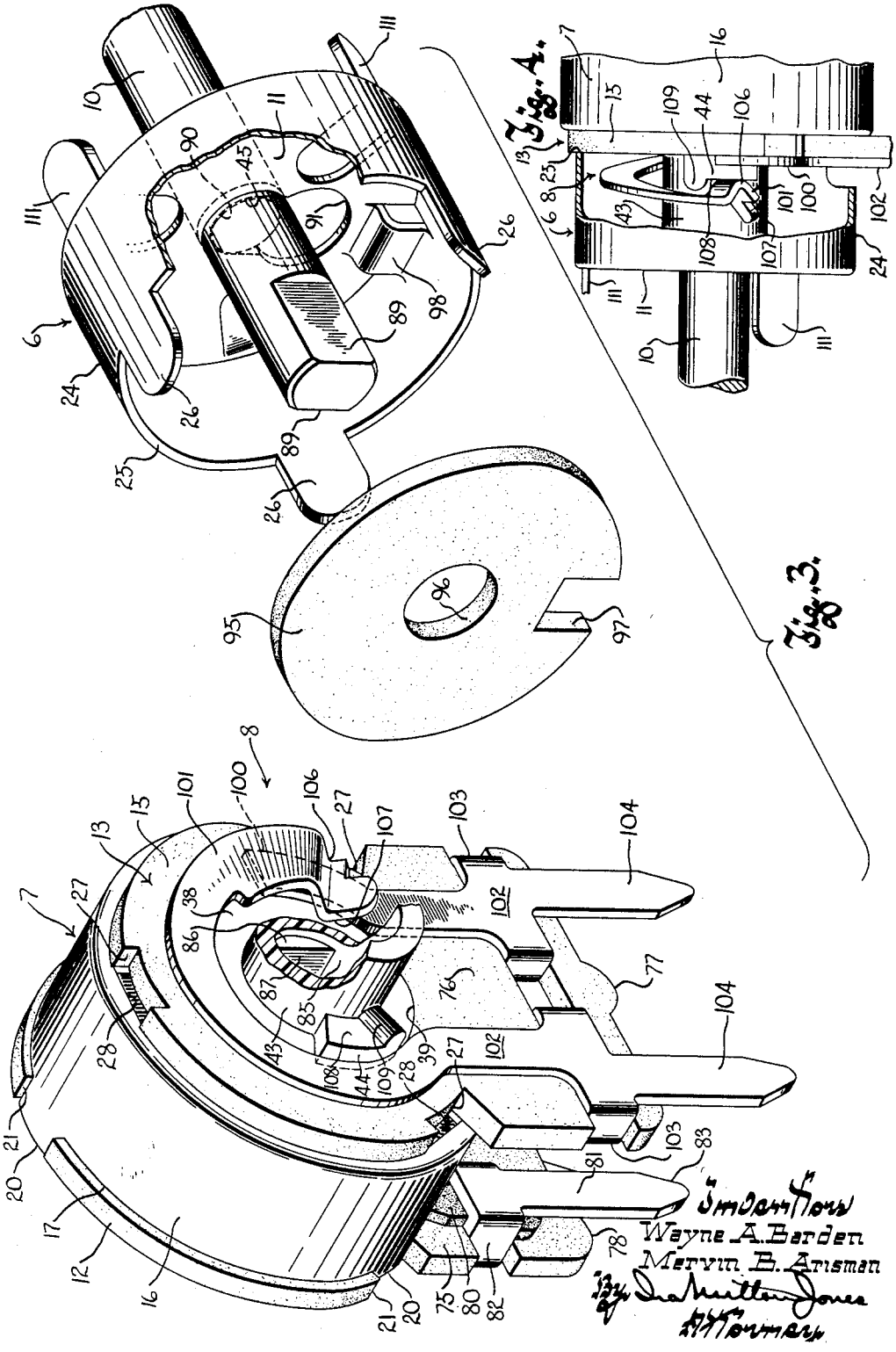


Fig. 3.

Fig. 4.

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2,929,040

COMBINATION ELECTRIC SWITCH AND VARIABLE RESISTOR

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Application June 12, 1958, Serial No. 741,504

15 Claims. (Cl. 338—172)

This invention relates to combination electric circuit controlling instrumentalities of the type which comprise a switch and a variable resistor, and has more particular reference to a miniaturized combination electrical control instrumentality adapted for use in conjunction with transistorized appliances, especially those employing printed circuits.

The great savings in space afforded by the use of printed circuits and especially those incorporating transistors has led to an ever increasing demand for complementing miniaturized controls. In this respect, it is the main objective of this invention to provide a miniaturized combination electric switch and variable resistor by which full advantage of the space saving features of transistors and printed circuitry may be achieved.

While many existing combination controls of the type here referred to feature compactness and small overall dimensions, they have not proved adaptable to miniaturization to the extremely small dimensions necessary to complement printed circuits with transistors. It is a requisite in such controls that they be designed for higher ratings and heat capacities, along with overall smallness of their component parts. While the components of some existing combination electric switches and variable resistors might be scaled down to a certain extent, electrical clearances must remain at established safe limits. Heretofore, these limits have precluded scaling down the components of combination controls of existing designs to such small dimensions as to achieve true miniaturization of the controls.

It is another objective of this invention, therefore, to provide a combination electric switch and variable resistor having components of new and improved design which can be made small enough to achieve the desired miniaturization of the control without departure from the established electrical limits and clearances.

A further purpose of this invention is to provide a miniaturized combination electric switch and variable resistor of the character described which is comprised of a minimum number of component parts.

Still another object of this invention resides in the provision of a miniaturized combination electric switch and variable resistor which is of sturdy construction and capable of a long and satisfactory life, and which incorporates components that are designed for ease of assembly and efficient manufacture at low cost.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for

the practical application of the principles thereof, and in which:

Figure 1 is an enlarged longitudinal sectional view of the combination electric switch and variable resistor of this invention;

Figure 1*a* is an elevational view of the combination control instrumentality shown in Figure 1 but illustrating the actual size thereof;

Figure 2 is an enlarged group perspective view of the variable resistor showing the base thereof removed from the resistor housing;

Figure 3 is an enlarged group perspective view of the combination control instrumentality viewed from the front and with the switch housing detached; and

Figure 4 is an enlarged elevational view of a portion of the instrumentality, a portion of the switch housing being broken away to illustrate the switch mechanism therein.

Referring now more particularly to the accompanying drawings, wherein like reference characters have been applied to like parts throughout the views, the combination electric circuit controlling instrumentality of this invention comprises housing means generally designated **5** comprised of a front section or switch housing **6** and a rear section or variable resistor housing **7** secured to the back of the front housing section in coaxial relation therewith. Note that departure is made from most conventional combination electric switch and variable resistors in that the front housing section **6** contains the switch mechanism **8**, and the rear housing section **7** contains the variable resistor mechanism **9**. Both the switch and variable resistor mechanisms, of course, are adapted to be controlled by a common operating shaft **10** extending rearwardly into the switch housing section **6** from its front.

The housing means **5** includes a side wall, transverse front and rear walls **11** and **12**, and a transverse intermediate wall **13** substantially equidistant from the front and rear walls. Each of the housing sections **6** and **7** is comprised of a cuplike metal stamping having a flat forwardly facing bottom wall and a cylindrical side wall. The bottom wall **14** of the rear housing section **7** lies flat against the rear of an insulating disc **15** that provides the switch base, and together therewith constitutes the intermediate wall **13** of the housing means.

The cylindrical side wall **16** of the rear housing section extends rearwardly from the bottom wall **14** and has its rim **17** in abutting engagement with the rear wall **12** of the housing means. The rear wall **12** is formed of insulating material and provides a base upon which the stator elements **18** of the variable resistor are mounted. It is secured in position covering the open rear of the cuplike variable resistor housing by means of a number of circumferentially spaced mounting tabs **20** on the side wall **16** projecting rearwardly from its rim through notches **21** in the edge portions of the rear wall and bent over upon the rear face of the rear wall as at **22**.

The front wall **11** of the housing means provides the bottom of the cuplike switch housing **6**, and the cylindrical side wall **24** of the latter projects rearwardly therefrom to have its rim **25** in abutting engagement with the forward face of the switch base **15**. The side wall **24** of the switch housing also has a slightly smaller diameter than that of the side wall **16** of the variable resistor housing.

The two housing sections are secured together in coaxial end to end relation with the switch base **15** clamped between the bottom wall **14** of the rear housing section and the rim **25** of the front housing section. For this purpose circumferentially spaced mounting tabs **26** are provided on the side wall **24** of the switch housing, the tabs projecting rearwardly from its rim through suitable

notches 27 in the edges of the switch base and through perforations 28 in the bottom wall 14 of the rear housing section, and being bent inwardly over the rear face of the wall 14 as at 29. The apertures 28 in the bottom wall 14 of the rear housing section, of course, are located near the periphery thereof.

The stator elements 18 of the variable resistor are comprised of a collector ring 31 and an arcuate resistance strip 32 surrounding the collector ring in spaced concentric relation thereto. Both stator components are mounted flat against the forward face of the variable resistor base 12, and are coaxial with the two housing sections.

The variable resistor mechanism also includes a rotor which is comprised of a carrier 34 molded of insulating material, and a contactor generally designated 35 fixed to the rear of the rotor. The contactor carrier has a substantially disclike body portion 36 having the contactor 35 fixed to its flat rear face in a manner to be described later, and having a forwardly projecting stepped hub generally designated 37.

The intermediate hub portion 38 provides a journal which is rotatably received in a main bearing hole 39 of substantially large diameter formed in the intermediate wall 13 of the housing means. As will be apparent from Figure 1, this bearing hole consists of coaxial holes of the same diameter in both the switch base 15 and the bottom wall 14 of the rear housing section. The contactor carrier receives its main support from the intermediate wall 13 and it is carried thereby for rotation coaxially of the two housing sections.

The forwardly facing shoulder 40 at the front of the largest hub portion 41 bears against the inner side of the bottom wall 14 on the rear housing section 7 to define the foremost axial position of the carrier in the variable resistor housing. The smallest diameter hub portion 43 projects forwardly from the intermediate hub portion 38 into the interior of the switch housing 6 and it is formed with an axial thrust switch actuating cam 44 on its side, adjacent to the rear of the switch compartment, to control the switch mechanism 8 in accordance with the position of rotation of the contactor carrier.

Both the front and rear walls 11 and 12 of the housing means are provided with apertures 45 and 46, respectively, at their centers. The aperture 46 in the base 12 of the variable resistor provides a pilot bearing in which a journal 47 projecting from the rear of the contactor carrier is received to cooperate with the main bearing hole in the intermediate wall 13 in the provision of an exceptionally stable support for the rotor of the variable resistor. The journal 47 projects from a slightly larger diameter boss 48 on the rear of the contactor carrier, and this boss bears against the collector ring 31 to hold the same against separation from the base 12 of the variable resistor, and in a fixed position defined by the engagement of rearwardly extending locating tabs 49 on the periphery of the ring in apertures 49' in the base 12.

With the construction thus far described it will be appreciated that the contactor carrier is constrained to rotation within the housing means, being held against substantially all axial motion by reason of the engagement of the boss 48 with the collector ring 31 at the rear of the carrier and the engagement of the front end of its largest diameter hub portion 41 with the front wall 14 of the resistor housing. Accordingly the disclike body portion 36 of the contactor carrier is at all times held at a fixed distance from the collector ring 31 and the resistance element 32, and this feature of the invention is utilized to assure proper tensioning of a plurality of spring fingers 50, 51 and 52 on the contactor 35, and engagement of paddles or contact portions 150, 151, and 152 on their respective free ends with the resistance element and the collector ring under adequate contact pressure. The contact portions 150 and 151 of the spring fingers 50 and 51 engage and ride upon the forwardly facing surface of the resistance element 32, while the contact engaging portion 152 of the spring finger 52 engages and rides upon the forwardly facing surface of the collector ring 31.

The construction of the contactor 35 and the manner in which it is secured to the rear of the contactor carrier 34 are also important features of this invention. Referring to Figure 2, it will be seen that the contactor, which is stamped and formed from sheet metal having good resiliency, has a body portion 54 located wholly to one side of the boss 48 on the rear of the carrier and which flatwise overlies and seats against the rear face of the disclike body 36 of the carrier. The body portion 54 of the contactor has a medial locating hole 55 therein to receive a protuberance 56 on the rear of the carrier, and it is secured to the carrier by a pair of mounting tabs 58 bent forwardly from the outer edge of its body portion and passing through suitable notches 59 in the periphery of the disclike body 36 of the carrier, the forward extremities of these tabs being bent inwardly over the front face of the disc 36 as at 60. Attention is directed to the fact that the mounting tabs 58 are located equal distances from a plane containing the carrier axis and passing through the center of the protuberance 56, so as to be equidistant from the protuberance.

The opposite side of the contactor is cut out to provide the arcuate but oppositely curved outer spring fingers 50 and 51 which emanate from areas of the body portion 54 adjacent to the securing tabs 58, and the inner spring finger 52 which emanates from the body portion 54 directly adjacent to the protuberance 56. The fingers 50 and 51 extend around and overlie the outer portion of the carrier body 36 and their contact end portions 150 and 151 closely radially overlap one another at the side of the carrier axis remote from the protuberance 56, behind a stop lug 62 formed on the carrier and projecting forwardly from the disclike body 36 thereof.

The inner spring finger 52 is also of arcuate configuration and it is substantially concentric to the outer finger 51. It curves around the boss 48 on the rear of the carrier, in radially spaced relation to the boss and to the adjacent outer finger 51, to have its contact end portion 152 radially adjacent to but spaced inwardly from the contact end portions of the outer spring fingers.

All of the spring fingers, of course, are sprung rearwardly away from the body disc 36 of the carrier so that when the carrier assembly is installed in the housing means in the manner described heretofore, the contact portions of the fingers will be flexed forwardly by their engagement with the collector ring and resistance path and thus held properly tensioned thereby.

The rotation stop 62, which is shown at the top of the carrier in Figures 1 and 2, is engageable with either side of a cooperating stop 64 in the rear housing section formed as an indentation in the side wall 16 thereof adjacent to the bottom wall 14 of the resistor housing. Consequently with the positions of the parts as shown, the contactor carrier is approximately one-half way between its limits of rotation.

The collector ring 31, of course, has a central aperture 66 of the same size as the pilot and through which the journal 47 on the rear of the contactor carrier projects, and forms part of the pilot bearing. The collector ring, moreover, is formed with a terminal 67 which is integral therewith, and which comprises an elongated strip of metal joined at one end to the periphery of the ring as at 68 and which is bent rearwardly and downwardly therefrom to extend at an angle through a locating hole 69 in the rear wall 12, to the rear of the housing means. The outer end portion 70 of the terminal is directed downwardly so as to be located in parallel but offset relation to the collector ring proper, and it has a pointed end 71 to facilitate insertion into a hole 72 in a panel 73 having circuit wiring printed thereon, to enable the terminal to

be soldered to the wiring. The engagement of the inner end portion of the terminal 67 in the hole 69 thus may serve to hold the ring against rotation on the rear wall 12, but as noted previously, the tangs 49 fitting in the holes 49' of the rear wall also serve to locate and hold the collector ring in the proper position on the resistor base 12.

Terminal board extensions 75 and 76 on the register base 12 and the switch base 15 project downwardly therefrom beyond the side wall of the housing means to have their lower ends engage the upper surface of the printed circuit panel 73, to properly space the housing means of the combined control instrumentality from the panel and to locate the instrumentality with its axis parallel to the panel. Preferably the terminal board extension 76 has a single rounded downwardly projecting protuberance 77 on the medial portion of its lower edge to engage the upper face of the panel 73, while the terminal board extension 75 is provided with a pair of such protuberances 78 located near its opposite side edges. This in effect provides a stable tripod support for the instrumentality.

The resistance element 32 surrounds the collector ring in spaced concentric relation thereto, and its ends are disposed at opposite sides of and closely adjacent to the hole 69 through which the terminal 67 of the collector ring passes. Extensions or legs 80 on the resistance element project downwardly therefrom along the front of the terminal board extension 75 to provide for securement of the element in place upon the variable resistor base, as by means of terminal members 81 clamped onto the terminal board extension as at 82. These terminal members have prongs 83 extending downwardly beyond the lower edge of the terminal board extension 75 for engagement in holes 84 in the printed circuit panel. The terminals 81, of course, are adapted to be soldered to the wiring printed on the panel to connect the resistance element in a circuit.

According to this invention the stepped hub of the contactor carrier 34 has an elongated axial bore 85 therein extending rearwardly from the outer or forward end of the smallest hub portion 43 to the disclike body 36 of the carrier. The bore has a drive socket at its inner end provided by diametrically opposite bosses 86 formed on the side walls of the bore and having parallel spaced apart flat surfaces 87 which in effect constitute driving abutments.

The operating shaft 10 for the combined electric switch and variable resistor projects rearwardly through the aperture 45 in the front wall 11 of the instrumentality and into the switch compartment to be received in and supported by the bore 85 in the contactor carrier hub. The rear portion of the operating shaft terminates a short distance forwardly of the bottom of the bore 85 and it is broached to provide double flatted surfaces 89 which are received in the drive socket and cooperate with the abutments or bosses 86 to constrain the carrier to rotate with the operating shaft. The forward end portion of the operating shaft extends a distance beyond the front of the housing means, as seen in Figure 1*a*, and it may have the usual control knob (not shown) attached thereto.

It is a feature of this invention that the aperture 45 in the front wall 11 of the instrumentality has a keyhole shape, with the small end 90 of the keyhole coaxial with the bearing hole 39 in the intermediate wall 13 of the housing means, and with the large end 91 of the keyhole eccentric to the axis of the operating shaft and of a size to permit endwise passage of the shaft therethrough. The small end 90 of the key hole has a diameter less than that of the operating shaft and it engages in a circumferential groove 93 in the shaft in the assembled condition of the parts shown best in Figure 1 to hold the shaft against axial motion relative to the housing means and to assure that any endwise thrust upon the shaft will be carried directly into the front wall 11 of the housing means. Consequently, there is no possibility of rearward end thrust upon the operating shaft being transmitted to the contactor carrier to distrub or alter the predetermined and desired tensioning of the contact fingers on the contactor 35 of the variable resistor.

Accidental lateral displacement of the operating shaft 10 toward and into the large end 91 of the keyhole opening 45 is prevented, especially during assembly of the components of the instrumentality, by retaining means 95 in the nature of a washer of insulating material on the shaft 10, inside the switch housing. The washer 95 has a central hole 96 of a size to snugly but rotatably receive the operating shaft, and it is held against the bottom wall 11 of the switch housing by the small diameter hub portion 43 of the contactor carrier. It will be noted that the hub portion 43 of the carrier extends forwardly substantially entirely through the interior of the switch housing, to have its outer end in abutting relation with the washer 95 to hold the same confined between the end of the hub portion 43 and the wall 11.

The washer 95 has a diameter such that its periphery is contiguous to the inner surface of the side wall 24 of the switch housing, to thus coact with the side wall in holding the operating shaft against shifting in any lateral direction relative to the housing means. Preferably, the washer or shaft retainer 95 is provided with a notch 97 in its periphery to receive an indentation 98 in the side wall 24 of the switch housing, adjacent to the bottom wall 11 thereof, so as to assure against any rotational displacement of the washer as a consequence of rotation of the operating shaft.

The switch mechanism in the front housing section 6 comprises stationary and movable contacts 100 and 101, respectively, mounted on the base 15 so as to be located in the rear portion of the switch compartment. The switch contacts are stamped from resilient sheet metal and the lower end of each is formed with a combined terminal and mounting portion 102 which flatwise overlies the front face of the terminal board extension 76. These terminal and mounting portions are elongated and substantially parallel to one another, and they extend along opposite side edge portions of the terminal board extension to be clamped thereto as at 103 near the lower edge of the extension, to thereby secure the contacts to the switch base. Prongs 104 on the terminal portions project downwardly beyond the lower edge of the terminal board extension for engagement in suitable holes 105 in the printed circuit panel 73 where they may be electrically joined by soldering with wiring printed on the panel.

The stationary contact 100 has a short, arcuate upper portion which is concentric to the axis of the carrier and which is disposed edgewise adjacent to one side of the hub portion 43 on the carrier, but spaced radially outwardly therefrom a distance to enable the switch operating cam 44 to clear it when the contactor carrier is in its switch off limit of rotation seen in Figure 4.

The short arcuate contact portion of the stationary contact 100 member at all times lies flat against the front face of the switch base 15, but the movable contact 101 has a long arcuate upper portion or blade which may be flexed back and forth, toward and from the switch base. As seen best in Figure 3 the arcuate upper portion or blade of the movable contact has one end joined to its terminal portion 102 remote from the stationary contact, and it extends in a clockwise direction more than half way around the hub portion 43 of the carrier to have a V-shaped contact portion 106 on its free end overlying and cooperable with the arcuate portion 100 of the stationary contact. The V-shaped contact portion 106 is deformed rearwardly out of the plane of the arcuate blade, to have its apex normally engage the stationary contact 100 under the spring pressure incidental to the

tendency of the blade to assume a position flatwise against the switch base.

It is important to note that the free end portion of the movable contactor blade is widened in a radial direction so that it extends radially inwardly beyond the inner edge of the arcuate stationary contact, to enable it to be acted upon by the axial thrust cam 44 on the carrier. Also, one leg of the V-shaped contact portion 106 provides an inclined cam 107 which projects forwardly and downwardly to be engaged by the switch actuating cam 44 during rotation of the contactor carrier toward the switch off position seen in Figure 4, to enable the contact portion 106 of the movable contact to be cammed or lifted off of the stationary contact to open the switch.

The switch actuating cam 44 has an arcuate surface 108 that lies in a plane normal to the axis of rotation of the operating shaft and faces forwardly, upon which the V-shaped contact portion 106 of the movable contact rests in the switch open position seen in Figure 4, to hold the switch contacts separated. Initial switch opening engagement between the switch actuating cam and the cam portion 107 on the free end of the movable contact, however, is established between a forwardly projecting crown 109 on the switch actuating cam and the cam leg 107 of the movable contact. Consequently, during final rotation of the contactor carrier toward the switch off position seen in Figure 4, the crown rides under the apex of the contact portion 106 and flexes the contact blade forwardly a slight distance beyond that which it normally occupies in the switch off position. As soon as the crown 109 passes the apex of the contact portion 106, the contact blade snaps rearwardly to bring the apex of its contact portion onto the flat surface 108 of the switch actuating cam, by the inherent resiliency in the arcuate portion of the blade. This action takes place with a pronounced click by which an operator of the instrumentality is assured that the switch is open.

The provision of the forwardly projecting crown 109 on the switch actuating cam also provides assurance against accidental rotation of the contactor carrier 34 and its cam in the direction of switch closing motion, such as might be caused by vibration or the like. In such an event, the crown 109 might come into contact with the apex of the V-shaped contact portion 106, but the rearward bias of the contact blade is adequate to hold the contactor carrier against further rotation in the switch closing direction.

Ordinarily, the tripodal seating of the terminal board extensions 75 and 76 on the printed circuit panel 73, together with the soldering of the terminal prongs in the apertures of the panel, are sufficient to adequately and firmly mount the combined switch and variable resistor of this invention in place upon the panel. In electrical appliances such as small portable radio receivers or the like, additional support for the control instrumentality may be had through the provision of securing ears 111 struck forwardly from the front wall 11 of the instrumentality and projectable through suitable apertures in the chassis (not shown) of the receiver to be bent down over the front face of the panel.

From the foregoing description, together with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides a combined electrical switch and variable resistor having a minimum number of components which can be manufactured at low cost and in such a way as to facilitate assembly in the instrumentality, and which are so designed as to enable them to be incorporated in a truly miniaturized control without sacrificing electrical clearances or a long and useful life of the instrumentality.

What is claimed as our invention is:

1. In an electrical control instrumentality of the type comprising a combination switch and variable resistor: housing means for the instrumentality having side walls, spaced front and rear walls, and an intermediate wall of insulating material with a central bearing hole therein, said intermediate wall dividing the interior of the housing means into a rear compartment containing the variable resistor mechanism and a front compartment containing the switch mechanism; the switch mechanism including cooperating stationary and movable contacts mounted on said intermediate wall; the variable resistor mechanism including a contactor carrier rotatably supported in the bearing hole of said intermediate wall and having a switch actuating member thereon projecting forwardly into the switch compartment and cooperable with the movable switch contact therein to control the switch in accordance with rotation of the contactor carrier, said carrier having an axial drive socket therein opening forwardly to the switch compartment; the front wall of the housing means having an aperture therein aligning with said bearing hole; and a rotatable operating shaft on the instrumentality, projecting rearwardly through said aperture in the front wall into the switch compartment, the rear end portion of the operating shaft extending into said drive socket in the carrier and constituting a driver by which rotation is transmitted from the shaft to the carrier.

2. The electrical control instrumentality of claim 1, further characterized by: the fact that said contactor carrier has a hub which projects forwardly into the switch compartment and is provided with an elongated bore communicating with said drive socket and in which a portion of the operating shaft is received to be supported by the contactor carrier.

3. The electrical control instrumentality of claim 2, wherein that portion of the operating shaft which is received in the aperture in the front wall of the housing means has a circumferential groove therein, and wherein said aperture has a keyhole shape with the small end of the keyhole coaxial with said bearing hole and of a size to rotatably receive said grooved portion of the shaft so as to hold the shaft against axial motion relative to the housing means, the large end of the keyhole having a size great enough to enable the shaft to pass endwise therethrough; and further characterized by the provision of retaining means in the front of the switch compartment engaged with the shaft to prevent lateral motion of said grooved portion thereof out of the small end of the keyhole opening.

4. The electrical control instrumentality of claim 3, wherein said retaining means comprises a washer confined between the front of the hub on the carrier and the front wall of the housing means, said washer having a central hole to snugly but rotatably receive the operating shaft, and having its periphery contiguous to the side wall of the housing means and cooperable therewith to hold the washer, and hence the operating shaft, against lateral shifting out of the small portion of the keyhole shaped aperture in the front wall of the housing means.

5. The electrical control instrumentality of claim 4, further characterized by the fact that the side wall of the housing means is cylindrical and has an indentation therein adjacent to its junction with the front wall; and further characterized by the fact that said washer has a notch in its peripheral portion in which said indentation is received to hold the washer against rotation with the operating shaft.

6. The electrical control instrumentality of claim 1, wherein the movable contact of the switch comprises a resilient spring blade having an arcuate portion overlying said intermediate wall and substantially concentric to the axis of rotation of the contactor carrier, said arcuate portion having one end fixed to said intermediate wall at one side of the switch compartment and having its free end portion at the opposite side of the switch compartment and yieldingly biased toward the intermediate wall; wherein the stationary contact is fixed to said intermediate wall at a location to be normally engaged by the free end of the movable contact; and wherein the switch actuating member comprises a cam on the contactor carrier

extending axially therefrom for engagement with the movable switch contact to hold its free end flexed forwardly and disengaged from the stationary contact in one position of rotation of the contactor carrier.

7. In an electrical control instrumentality of the type comprising a combination switch and variable resistor: housing means for the instrumentality having spaced front and rear walls, and an intermediate wall of insulating material providing a switch base having a substantially large diameter bearing hole in its center, said intermediate wall dividing the interior of the housing means into a rear compartment containing the variable resistor mechanism and a front compartment containing the switch mechanism; the switch mechanism including a contactor blade having a resilient free end portion biased in one axial direction toward a switch closed position but capable of being flexed in the opposite axial direction to a switch open position; the variable resistor mechanism including a rotatable contactor carrier of insulating material having a large diameter hub portion received in said bearing hole whereby the carrier is rotatably supported from the intermediate wall of the housing means, and having a smaller diameter hub portion projecting forwardly into the switch compartment, said smaller diameter hub portion having a switch actuating member thereon which is engageable with the contactor blade to hold the blade flexed in a switch open position in one position of rotation of the carrier; and said variable resistor mechanism including stator elements fixed on the rear wall of the housing means, spring contact fingers on the rear of the rotatable carrier arranged to track upon said stator elements, and means on the carrier providing a forwardly facing shoulder engaging the rear of said intermediate wall to hold the spring contact fingers engaged with the stator elements under spring tension; said smaller diameter hub portion having a bore therein opening forwardly into the switch compartment and leading rearwardly of the carrier to a drive socket in the large diameter hub portion; the front wall of the housing means having a shaft receiving aperture therein aligning with said bore in the carrier hub; and a rotatable operating shaft for the instrumentality, said shaft projecting rearwardly through said aperture in the front wall and extending into the bore in the carrier to be supported on the instrumentality thereby, and the rear end portion of the shaft engaging in said drive socket and constituting a driver by which rotation is transmitted from the operating shaft to the carrier, the bottom of said drive socket being located rearwardly of the rear end of the operating shaft; and cooperating means on the shaft and the housing means for transmitting rearward end thrust on the shaft directly into the housing means so as to preclude the transmission of such thrust onto the contactor carrier.

8. In an electrical control instrumentality of the type comprising a combination switch and variable resistor: housing means for the instrumentality including front and rear housing sections connected in end to end relation and each comprising a metal cup having its bottom facing forwardly, a rearwardly extending cylindrical side wall, and a rear wall of insulating material extending across and abutting the rim of the cup to be held thereby in spaced parallel relation to the bottom of the cup, the rear wall of the front housing section being flatwise contiguous to the front wall of the rear housing section and being clamped between it and the rim of the front housing section by the end to end connection between the housing sections; said contiguous walls together providing a transverse intermediate wall of the housing means, and said intermediate wall having a substantially large diameter bearing hole therein; the bottom of the front housing section having an aperture therein coaxial with said bearing hole; switch mechanism in the front housing section including cooperating stationary and movable contacts mounted on the rear wall of said front housing section; variable resistor mechanism in the rear housing section including a contactor carrier having a hub which projects forwardly into said bearing hole to rotatably support the carrier from said intermediate wall; an operating shaft rotatably supported by the housing means and projecting rearwardly through the aperture in the bottom of the front housing section; and interengaging means on the carrier and the rear portion of the operating shaft providing a rotation transmitting connection between the shaft and the carrier.

9. In a combination electric switch and variable resistor: housing means having spaced apart substantially parallel front, rear and intermediate walls, the latter being of insulating material and providing a switch base which divides the interior of the housing means into a forwardly disposed switch compartment and a rearwardly disposed variable resistor compartment, said front and intermediate walls having aligning centrally located apertures therein; a rotatable operating shaft; means carried by the housing means constraining the shaft to rotation, with the shaft projecting rearwardly through said aperture in the front wall; a variable resistor in the rear compartment comprising cooperating rotor and stator assemblies, the stator assembly being mounted on the inner face of the rear wall, and the rotor assembly including a contact carrier having a portion rotatably journaled in the aperture of the intermediate wall and connected with the inner end portion of the operating shaft to be driven thereby; cooperating stationary and movable contacts carried by the switch base; and means on the contact carrier providing an actuator engageable with the movable switch contact to effect switch opening and closing motion of the movable contact with respect to the stationary contact as a consequence of rotation of the actuator with the operating shaft.

10. In a combination electric switch and variable resistor: housing means having spaced apart transverse end and intermediate walls, the latter being of insulating material and providing a switch base which divides the interior of the housing means into axially adjacent switch and variable resistor compartments, one of said end walls and the intermediate wall having centrally disposed axially aligning holes therein; a rotatable operating shaft; shaft supporting means carried by the housing means and constraining the shaft to rotation with one end portion of the shaft projecting into the housing means through the hole in said one end wall; cooperating rotor and stator assemblies in the variable resistor compartment, respectively carried by the intermediate wall and the end wall bounding said resistor compartment, the rotor assembly being connected with the shaft to be driven thereby and having a portion which projects through the hole in the intermediate wall and into the switch compartment; cooperating rotation stops carried by the housing means and the rotor to define the limits of rotor rotation; switch mechanism in the switch compartment comprising a stationary contact mounted on said intermediate wall, and a movable contactor mounted on said intermediate wall and having a contact engaging portion movable back and forth axially of the operating shaft toward and from engagement with the stationary contact, said contactor being biased toward engagement with the stationary contact; and means on said rotor portion engageable with the contactor at one limit of rotation of the rotor for holding the contactor separated from the stationary contact, and for effecting engagement of the contactor with the stationary contact as a consequence of rotation of the rotor away from said one limit thereof.

11. As an article of manufacture, a rotor assembly for a variable resistor, comprising: a contactor carrier molded of insulating material and having a disclike body portion, a hub projecting forwardly from one face of the body portion and comprised of axially adjacent inner, outer, and intermediate hub sections of large, small, and intermediate diameters, respectively, the intermediate hub section providing a rotor supporting journal, and said

hub having a bore therein opening to the front of the small diameter hub section, for receiving and supporting an operating shaft; circumferentially spaced driving abutments in said bore engageable with similar abutments on an operating shaft having an end portion supported in the bore to provide for the transmission of rotation to the rotor; means on the side of said outer hub section adjacent to its junction with the intermediate hub section providing a switch operating cam; a pilot bearing on the body portion projecting from the other face thereof, coaxially of the rotor hub; and spring contact fingers mounted on said other face of the body portion.

12. As an article of manufacture, a rotor assembly for a variable resistor, comprising: a contactor carrier of insulating material having a disclike body and a hub projecting from the front face of the body to provide a bearing by which the rotor may be rotatably mounted in a support; driving lugs on the hub to connect the rotor with an operating shaft for rotation with the latter; said disclike body having a protuberance projecting from its rear face at a location a distance to one side of the rotor axis, and having a pair of notches in its periphery near said protuberance but located equal distances to opposite sides of a plane containing the rotor axis and passing through the protuberance; and a contactor stamped from resilient sheet metal and flatwise overlying the rear face of the disclike body, said contactor having a body portion which is disposed wholly at said side of the rotor axis and has an aperture therein to receive and be located by said protuberance, and having securement tabs on outer edge portions thereof passing forwardly through the notches in the periphery of the disclike body of the rotor and bent over onto the front face of the body so as to cooperate with the protuberance in holding the contactor assembled with the rotor in a predetermined position thereon; and said contactor having a pair of opposing, oppositely curved outer spring fingers formed thereon, which fingers emanate from the body portion of the contactor adjacent to the securement tabs and extend in opposite angular directions, substantially concentric to the rotor axis, to the side of the rotor axis remote from said protuberance, the free end portions of said fingers being intersected by said plane and being spaced from one another radially of the rotor axis; and said contactor having an inner arcuate finger in spaced substantially concentric relation to one of said outer fingers, said inner finger emanating from the body portion at a location intermediate the bases of the outer fingers and having its free end portion radially adjacent to the free end portion of said one finger and intersected by said plane; and the free end portions of all of said fingers being offset outwardly and biased away from said other face of the body portion of the carrier.

13. In an electrical control instrumentality: spaced apart substantially parallel walls and a side wall extending between and secured to said parallel walls to define a housing for a variable resistor, said parallel walls having coaxial bearing holes in their central portions, and one of said walls being apertured alongside its bearing hole; variable resistor mechanism in said housing including a rotor of insulating material having a disclike body with journal means extending from the opposite faces thereof and rotatably received in said bearing holes to support the rotor for rotation in the housing, and a stator mounted on said apertured wall, concentric to the rotor axis, and comprising a collector ring lying flatwise against said apertured wall and encircling the adjacent journal means, and an arcuate resistance element encircling the collector ring in radially spaced relation thereto; means on the rotor providing shoulders engaging the inner face of the collector ring and the other of said parallel walls to inhibit axial motion of the rotor in the housing and to hold the collector ring against separation from said apertured wall; means on the collector ring engaged in the apertures of said apertured wall to preclude rotation of the ring with the rotor, said means including a terminal connected with the ring and projecting through one of said apertures to the exterior of the housing; and spring contact fingers on the rotor body riding upon the collector ring and the resistance element.

14. The electrical control instrumentality of claim 13, wherein said means on the collector ring which precludes rotation of the ring with the rotor includes locating tabs on the ring engaging in apertures in said apertured wall to hold the ring coaxial with the bearing hole in said apertured wall; and wherein the hole in the collector ring is of a size to rotatably receive the journal means surrounded by the ring whereby the ring cooperates with said parallel walls to rotatably support the rotor.

15. In an electrical control instrumentality: substantially parallel spaced apart walls and a side wall extending between and connected to said walls to define a housing for a variable resistor, one of said parallel walls having a main bearing hole in its center; variable resistor mechanism in said housing including a rotor of insulating material, and a stator mounted on the other of said parallel walls, concentric to said bearing hole; the stator comprising an arcuate resistance element, and a collector ring encircled by the resistance element and having a hole in its center which provides a pilot bearing; cooperating locating means on the collector ring and on the adjacent one of said parallel walls for holding the collector ring against shifting out of coaxial relation with said main bearing hole and for precluding rotation of the ring about its axis; journal means on the rotor rotatably received in said main and pilot bearing holes to support the rotor for rotation in the housing; means on the rotor providing shoulders engaging the inner face of the collector ring and said main bearing wall to inhibit axial motion of the rotor in the housing and to hold the collector ring against axial separation from the wall upon which it is mounted; and spring contact fingers on the rotor having pressure engagement with the resistance element and the collector ring, to traverse the same when the rotor is rotated.

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