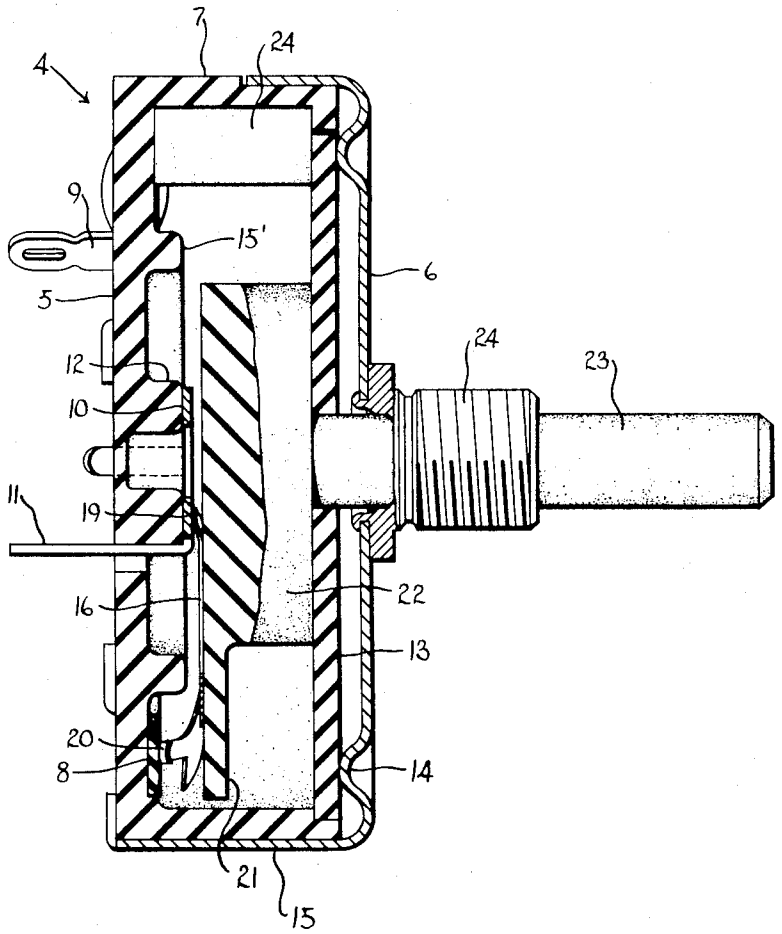
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HIGH VOLTAGE VARIABLE RESISTOR

Original Filed May 20, 1954 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

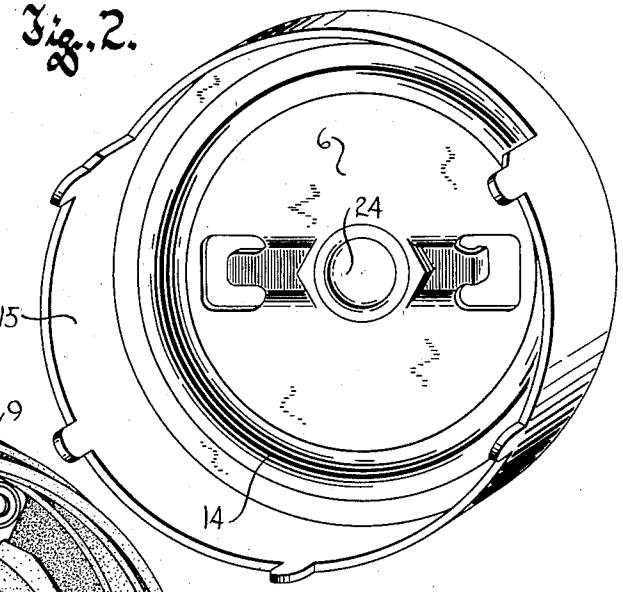
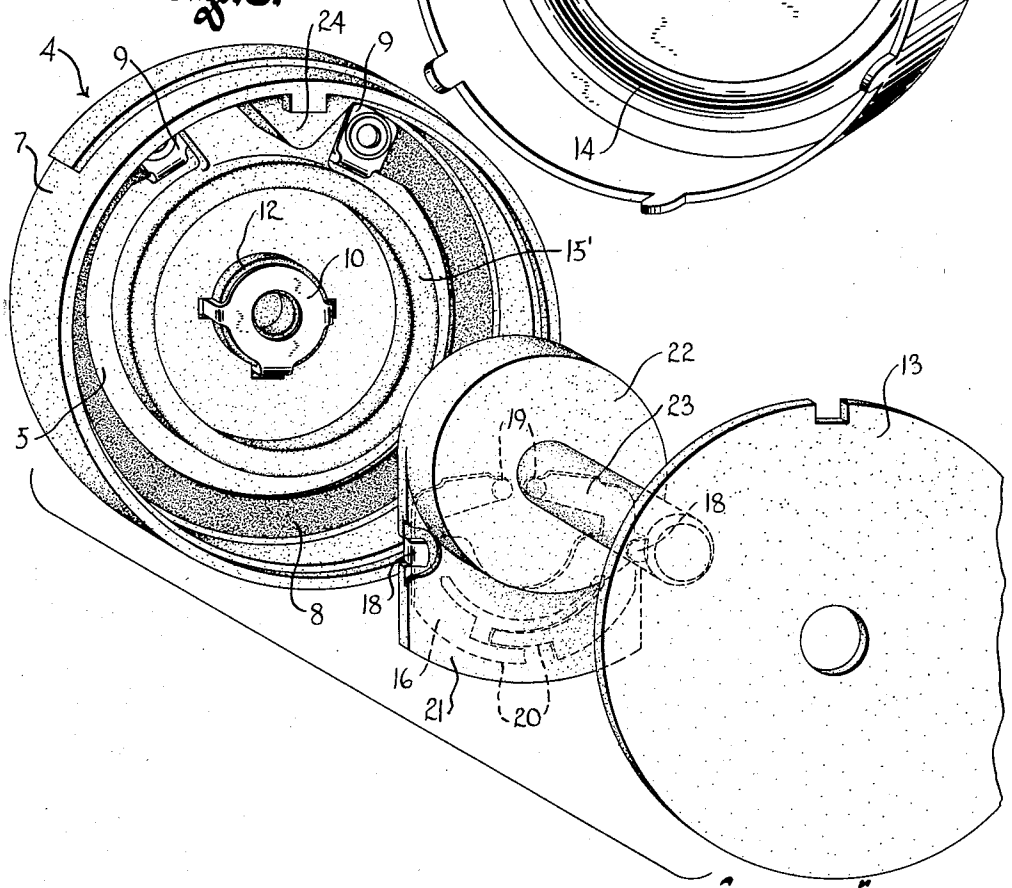


Fig. 3.



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HIGH VOLTAGE VARIABLE RESISTOR

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Original application May 20, 1954, Serial No. 431,124, now Patent No. 2,789,191, dated April 16, 1957. Divided and this application June 28, 1956, Serial No. 594,460

1 Claim. (Cl. 201—55)

This invention, like that of Patent No. 2,789,191 issued on our copending application Serial No. 431,124, filed May 20, 1954, of which this application is a division, relates to variable resistors of the type employed in radio and television receivers and has as its purpose to provide a control of this character especially adapted for use with high voltages. The advent of so-called color television has created a demand for low cost variable resistors capable of handling voltages on the order of 15,000 volts above ground and 5,000 volts across the end terminals of the resistor. These voltages are much greater than those safely handled by variable resistors now employed in radio and ordinary black and white television receivers.

Those skilled in this art will readily appreciate that voltages of this magnitude create a difficult problem in insulation; and this problem is greatly aggravated if the size of the control is limited. Heretofore demands for variable resistors capable of handling high voltages were generally met without regard for the over-all size of the control. Practically the only factor determining the design of such controls was the obtention of adequate insulation to assure against electrical breakdown. Thus it was common practice in the past to employ a relatively large molded housing and to arrange the resistance element as a curled strip extending along the inside surface of the cylindrical side wall of the housing. This arrangement provided maximum space between the resistance element and the grounded control shaft and also between the resistance element and the collector ring of the center terminal.

A curled resistance strip, however, does not lend itself to size reduction. Accordingly, the solution of the problem of providing a variable resistor which is capable of handling high voltages and still can satisfy the requirements of set manufacturers for reduction in over-all size compelled abandonment of the curled resistance element and the substitution of the familiar flat arcuate split ring shaped resistance element which lies flat against the base. Moreover, the flat arcuate element is better suited to production methods of manufacture and hence enables desirable cost reduction. But a flat arcuate resistance reintroduces the problem of maintaining adequate electrical spacing between the element and the center collector ring and the grounded shaft at least if the over-all size of the control is to be kept within the limits prescribed by set manufacturers. The present invention solves this problem in an entirely satisfactory manner by mounting and driving the contactor of the control in a novel way.

More specifically this invention provides a so-called high voltage variable resistor which is so designed and constructed that adequate electrical spacing between its resistance element and collector ring is made possible by a new and novel off center disposition of the contactor which allows its collector ring engaging contact fingers or paddles to travel in an orbit closely adjacent to the

axis of the control while its resistance element engaging contact fingers travel in an orbit spaced a substantial distance radially out from the axis.

Where the housing of the control is formed in the familiar way by a cup-shaped metal cover joined at its edge to the base of insulating material upon which the resistance element is fixed, the resistance element should be spaced from the cylindrical side wall of the cover a distance about as great as its shortest distance from the collector ring. This positional relationship utilizes the available space to achieve maximum electrical clearance between the resistance element and both the cover and the collector ring, but to attain this desirable condition within a cover of relatively small diameter requires that the collector ring be much smaller in diameter than has heretofore been customary. This in itself, would present no serious difficulty, but when coupled with the desire to use a contactor like that shown in Patent No. Re. 23,750, and which years of experience has proven to be highly satisfactory, a problem was encountered.

The solution of this problem is another object of this invention; and it resides in an extremely eccentric disposition of the contactor so that its spring contact fingers or paddles which ride upon the collector ring lie at the same side of the axis of rotation as the contact fingers or paddles which ride upon the resistance element, together with a novel mounting for the contactor assembly by which it is securely held against any possible rocking and smooth balanced operation of the control is assured.

A further object of this invention is to provide a resistor of the character described which is so designed and constructed as to lend itself readily to the incorporation of adequate insulating barriers between the portions of the control which operate at maximum potential difference.

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 claim, 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 claim.

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 a longitudinal sectional view through a variable resistor embodying one adaptation of this invention;

Figure 2 is a perspective view of the inside of the metal cover which forms part of the housing of the control; and

Figure 3 is an exploded perspective view of the other parts of the control.

Referring now to the accompanying drawings, the numeral 4 designates generally the housing of the variable resistor, which as is customary, is round and has flat end walls 5 and 6 and a cylindrical side wall 7. The end wall 5 provides the base of the resistor and has a flat arcuate, split-ring shaped resistance element 8 attached to or painted on its inside face. Where the resistance element is a separate piece as shown, it is held in place by terminals 9 secured to the base with portions thereof clamped against the ends of the resistance element and other portions projecting through the base to provide for the attachment of conductor leads thereto.

The base also has a collector ring 10 seated thereon coaxially with and inside the arcuate resistance element.

The collector ring is held in position by a center terminal 11 which extends therefrom and passes out through the base as shown, and it is to be noted that the collector ring rests directly on a central annular boss 12 which rises from the inner face of the base.

No part of the inside walls of the housing is metal. Accordingly, the end wall 5 which provides the base of the resistor and the cylindrical side wall 7 are formed as one integral cup-shaped molding of suitable insulating material, and a disc 13 of insulating material covers the inside face of the end wall 6 which is metal. The insulating disc 13 has its peripheral edge seated in a counterbore in the edge of the side wall 7 and is held in place by an annular bead 14 in the end wall 6. The end wall 6 is part of a cup-shaped metal cover fitted over the molded base unit with its side wall 15 encircling and telescoped over the side wall 7, in which position the cover is held by ears extended from the side wall 15 and folded over the edge of the base.

In keeping with the increased assurance against electrical breakdown afforded by this construction the base 5 has an annular insulating barrier 15' formed integrally therewith and lying between the resistance element and the collector ring, and it should be noted that the resistance element lies very close to the side wall 7 of the housing thus enabling a reduction in the size of the unit.

The resistor of course has a rotatable contactor assembly which includes a contactor 16 like that shown in Patent No. Re. 23,750. The contactor thus has a pair of inner spring contact fingers or paddles 19 to traverse the collector ring 10 and a pair of outer spring fingers or paddles 20 to traverse the resistance element 8. The contactor is mounted upon a carrier or arm 21 extending radially out from a hub 22 on a shaft 23. The shaft, hub and radially extending contact carrier arm are one integral molding of insulating material.

The contactor assembly is rotatably mounted in the housing by having its shaft 23 journaled in a bushing 24 fixed to the metal end wall 6, and which bushing is externally threaded to receive a clamping nut (not shown) whereby the control may be mounted upon a panel in the conventional manner. The shaft of course, projects beyond the bushing to receive a control knob (not shown), and to provide a solid free running support for the contactor assembly capable of carrying the off center end thrust imposed upon the assembly by the tensioned spring arms or paddles, the hub 22 is relatively large and bears flat against the adjacent face of the insulating disc 13.

The limits of rotation of the contactor assembly are defined by a stop lug 24 formed integrally with the side wall 7, and with which the opposite side edges of the contactor carrier arm 21 engage.

Attention is directed to the fact that the thrust-carrying engagement of the hub 22 with the insulated disc 13 locates the contactor carrier in a definite position with respect to the base and more particularly maintains a uniform spacing between carrier arm and the resistance element so that the tension with which the spring arms of the contactor engage the element does not vary as the control is adjusted.

The contactor 16 is mounted directly on that side of the carrier arm 21 which faces the base and the resistance element, being held in place by ears 18 extended from the sides of the contactor and grippingly engaged in notches in the sides of the carrier arm.

A significant feature of the mounting of the contactor upon its carrier is the fact that its inner spring fingers or paddles 19 which ride upon the collector ring lie at the same side of the shaft axis as do the fingers or paddles 20 which traverse the resistance element. This enables the collector ring to be much smaller in diameter

than was heretofore customary and still permits use of a standard contactor like that shown in Patent Re. 23,750. The small diameter of the collector ring together with the close proximity of the resistance element to the cylindrical side wall of the housing achieves a valuable reduction in over-all size of the control without sacrificing its voltage carrying capacity.

From the foregoing description taken in connection with the accompanying drawings it will be readily apparent to those skilled in this art that this invention provides a variable resistor which not only is capable of handling exceptionally high voltages, but by virtue of its novel design and construction achieves an entirely unprecedented reduction in size for controls of this type and enables the control to be made with relatively inexpensive production methods.

What is claimed as our invention is:

In a high voltage variable resistor: a cup shaped housing of insulative material having a base and a side wall extending forwardly from one face of the base and provided with forwardly facing abutment means adjacent to its rim; means closing the open front of the cup shaped housing, comprising an inner front wall of insulative material extending across the housing and resting against said forwardly facing abutment means, and an outer front wall of sheet metal having portions bent rearwardly over the housing side wall and secured thereto so as to hold the inner wall clamped against said abutment means, said inner wall having a hole therein concentric with the housing side wall; means on said outer wall providing a shaft bearing coaxial with said hole in the inner wall; a flat substantially large diameter arcuate resistance element on said face of the base, concentric with the insulative side wall of the housing and located adjacent thereto; a substantially small diameter collector ring on said face of the base, concentric to but radially remote from the resistance element; an operating shaft rotatably journaled in said bearing and projecting inwardly through the hole in said inner wall; an arm of insulating material fixed to the shaft and extending radially in the housing with one side of the arm opposite said face of the base and in position to sweep across the base as the shaft is turned; a contactor having spring contact fingers thereon, the extremities of which are adapted to traverse the resistance element and the collector ring; means mounting the contactor on said side of the arm with the extremities of its spring fingers in position to traverse the resistance element and the collector ring but all at the same side of the shaft axis, whereby the spring fingers exert an off-center thrust upon the contactor carrying arm tending to tilt the same and cant the control shaft in its bearing; and means for receiving said thrust upon the arm and for carrying the same forwardly into the housing to thus relieve the shaft of tilting forces, comprising a hub integral with the contactor carrying arm and having a portion directly forwardly of the arm and the contactor thereon that bears against said inner wall at the front of the housing along an area thereof which extends radially outwardly of the shaft axis an extent at least equal to the distance from the shaft axis to an arc concentric to the collector ring and resistance element and located midway therebetween.

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