June 28, 1960 W. H. BUDD 2,943,288

VARIABLE RESISTOR

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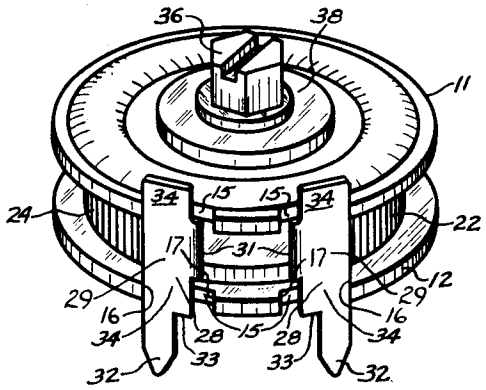


Fig. 1.

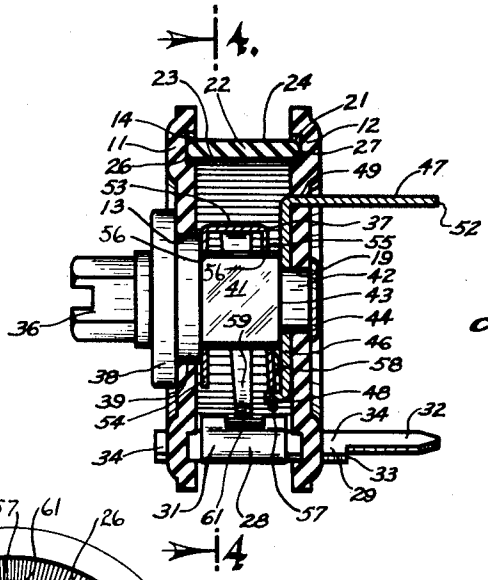
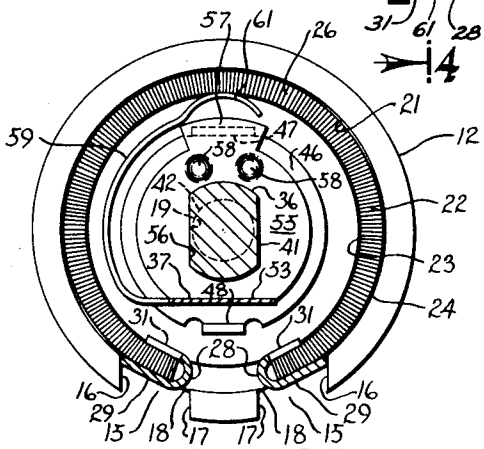


Fig. 2.

Fig. 4.



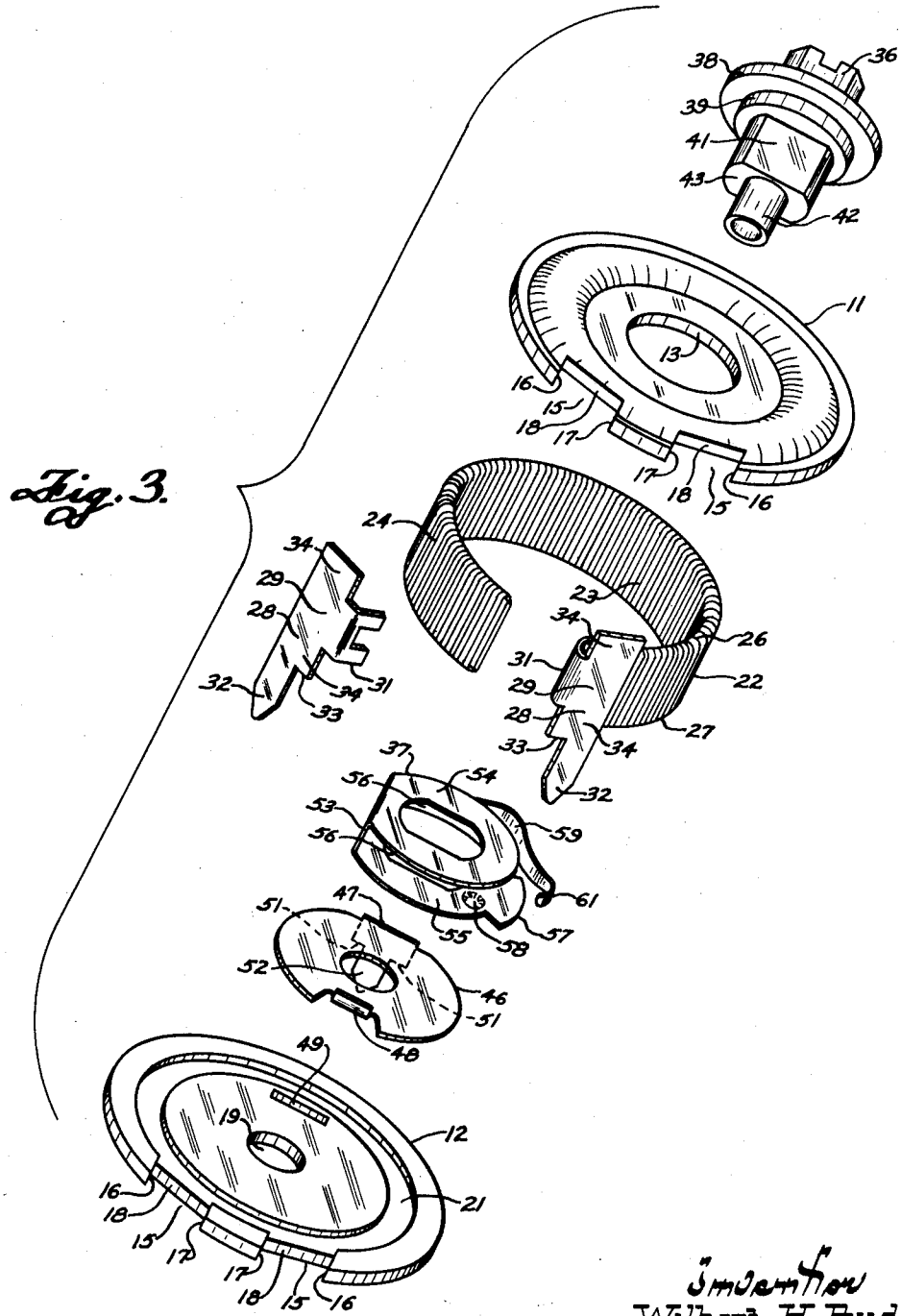
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VARIABLE RESISTOR

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Fig. 3.



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VARIABLE RESISTOR

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11 Claims. (Cl. 338—184)

This invention relates to variable resistors of the type used in television and radio receivers.

Television receivers, and especially color television receivers, require many variable resistance controls for the adjustment of their very sensitive electrical circuits. The majority of these controls are very seldom adjusted and, when they are, should be adjusted by a serviceman. Actually, the sensitive receiver circuits which incorporate these variable resistors are initially adjusted and aligned at the factory and rarely thereafter is adjustment needed. They have become known, therefore, as preset controls.

Recent advances in color television circuitry have increased the number of these preset controls required in each receiver. Competition has forced the set manufacturers to reduce the prices of their sets and inevitably, therefore, the control manufacturers have been beset with demands from the set manufacturers for lower prices for their controls, and especially their preset variable resistors. Such demands, however, are coupled with the admonition that price reduction must not be at the sacrifice of electrical performance.

Because preset controls are so seldom adjusted, it follows that they do not have to meet rugged structural requirements. This leeway affords an avenue for cost reduction in manufacture, and to take advantage of this possibility, the present invention has as its purpose to provide a variable resistor which is characterized by a novel relationship between its essential parts, whereby certain of the parts have more than one function, the individual parts lend themselves well to mass production at very low cost, and the assembly of the control likewise is simple and economical.

Stated in another way, it is an object of this invention to provide a low cost and easily manufactured variable resistor which may be quickly and easily assembled into a television receiver, and which, nonetheless, is reliably satisfactory in performance.

With a view toward meeting the ever present demand for lower priced controls, variable resistors of the preset type heretofore have been made without covers or housings. While this eliminates a piece-part and, hence, an item of cost, coverless or housingless controls are not entirely satisfactory.

This invention achieves the price advantage of a coverless or housingless control, but nevertheless has its operating instrumentalities as effectively enclosed as in the more expensive and more conventional variable resistors. To this end, the invention has as another of its objectives to provide a variable resistor which is so designed and constructed that parts thereof which are absolutely essential, and which heretofore have never served in the capacity of a cover or part thereof, are employed for this purpose. These parts, therefore, have a dual function.

Still another object of this invention is to provide a preset variable resistor which is held in its assembled condition through the coaction of its component parts, and without the use of extra securing piece-parts.

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 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 a perspective view of a preset variable resistor embodying this invention;

Figure 2 is a longitudinal sectional view through the variable resistor;

Figure 3 is an exploded group perspective view of the component parts of the resistor; and

Figure 4 is a cross sectional view through Figure 2 on the plane of the line 4—4, but with the contactor turned to an intermediate position of adjustment for the sake of clarity.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts throughout the several views, it will be seen that the variable resistor of this invention comprises essentially a pair of front and rear end walls 11 and 12, respectively, which are stamped and formed from sheets of semi-rigid insulating material. Both of these walls are round and have a round hole at the center, the hole in the front wall being designated by the numeral 13, and the hole in the rear wall by the numeral 19. Each wall also has an annular groove concentrically encircling its central hole, the groove in the front wall being designated 14, and in the rear wall by the numeral 21. These grooves provide radially inwardly facing annular shoulders for a purpose to be described.

Extending inwardly from the periphery of each end wall is a pair of notches 15. The notches 15 are symmetrically disposed with respect to the centers of the end walls, and their side edges 16 and 17 are all parallel to one another. The bottom edges 18 of the notches are substantially tangent to the inwardly facing annular shoulders provided by the outer edges of the annular grooves 14—21. Hence, the junctions of the side edges 16, which are the remote or outermost edges, with the bottom edges 18 of the notches form acute angled locating corners.

Confined between the end walls 11—12 is a substantially cylindrical split ring type resistance element 22. Preferably the resistance element is of the wire-wound type, wherein a length of resistance wire is wound toroidally upon an initially flat mandrel strip and then curled into its substantially cylindrical form. In its curled condition, the resistance element 22 thus has inner and outer arcuate faces 23 and 24, respectively, and curved parallel edges 26 and 27.

Prior to curling the resistance element 22 to shape, terminals 28 are attached thereto. The terminals are stamped from sheet metal and each has a rectangular body 29 with an integral rectangular bifurcated tang 31 extending from one edge thereof. When the terminals are in place on the resistance element, the body 29 thereof flatwise overlies the outer surface 24 of the resistance element at the endmost portions thereof, and the tangs 31 are clinched over the ends of the element and have their bifurcations pressed down into the inner face 23. This disposes portions 34 of the terminals above and below the edges 26 and 27 of the resistance element; and projecting endwise from one of these portions 34 of each terminal is a terminal shank 32. The terminal shanks 32 are narrower than the adjacent portions 34 which results in locating shoulders 33 facing the ends of the shanks and spaced a substantial distance out from the adjacent edge 27 of the resistance element.

In assembling the resistance element 22 with the end walls 11 and 12, it is of course first curled into its sub-

stantially cylindrical shape then contracted sufficiently to fit into the annular grooves 14 and 21, inserted into the grooves and allowed to expand into snug engagement with the annular shoulders provided by the outer sides of the grooves. The natural resiliency of the curled element holds it firmly against the outer sides of the grooves, and because of predetermined dimensional relationship between the arcuate length of the resistance element and the location of the notches 15 in the end walls, the portions 34 of the terminals hook themselves into the locating corners of the notches.

The annular grooves 14 and 21, the locating corners of the notches 15, and the natural resiliency of the curled resistance element 22 thus combine to define the correct positional relationship between the resistance element and the front and rear walls 11 and 12, so that upon securement of the end walls against separation, a drum-like housing is formed by the end walls and the substantially cylindrical resistance element.

Inside this housing is the rotor assembly of the control. It consists of an actuator shaft 36 and a contactor 37. The actuator shaft 36 is journalled in the holes 13 and 19 in the front and rear end walls, and has axially opposed shoulders bearing against the outer faces of the end walls to hold the same in place with the resistance element clamped therebetween. These shoulders are provided by a flange 38 on the shaft near its front end, and by flaring the extreme rear end portion 42 of the shaft into a rivet head 44, the shaft portion 42 being tubular to facilitate this flaring operation.

The rear face of the flange 38 is stepped to provide a journal 39 which is rotatably received in the hole 13 in the front end wall 11, the axial length of the journal being slightly greater than the thickness of the end wall; and the rear end portion 42 of the shaft is journalled in the hole 19 in the rear end wall 12.

Between its journal portions 39 and 42, the shaft has a driving portion 41 of non-circular shaft cross section. The junction of the non-circular driving portion 41 and the rear small diameter journal 42 forms a rearwardly directed shoulder 43 which bears against a collector ring 46 and holds it in place flat against the inner face of the rear end wall 12. The collector ring is blanked and formed from sheet metal, and has a flat washer-like body provided with a centered hole through which the shaft portion 42 passes. A terminal 47 and a rotation limiting lug 48 extend perpendicularly from diametrically opposite edge portions of the collector ring. The lug 48 projects forwardly into the housing cavity, and the terminal 47 extends rearwardly through a slit-like opening 49 in the rear wall 12 and thereby precludes rotational displacement of the collector ring relative to the actuator shaft.

Externally of the rear wall the terminal 47 has a pair of locating shoulders 51 flanking its shank 52. These locating shoulders and the shoulders 33 on the end terminal of the resistance element, are coplanar and coact to spacially locate the variable resistor on a support panel (not shown) with the terminal shanks 32 and 52 projecting through holes in the panel for connection with circuits printed thereon.

The contactor 37 is mounted on the non-circular driving portion 41 of the shaft, and is, of course, inside the housing. It is blanked and formed from spring-like sheet metal and it is substantially U-shaped with flat front and rear arms 54 and 55, respectively, connected by a bight portion 53. The flat arms have non-circular holes 56 through which the non-circular driving portion 41 of the shaft projects so that the contactor is constrained to rotate with the shaft between limits defined by the engagement of a tongue 57 projecting from the rear arm 55 with the lug 48.

Adjacent to the tongue 57 the rear arm 55 of the contactor has rearwardly directed punctiform contact points 58 which slidingly engage the collector ring 46.

The contactor is so formed that, when free, its arms 54 and 55 are slightly divergent. Accordingly, in the assembled condition of the parts, the contactor is maintained under tension between the rear face of the front shaft trunnion 39 and the collector ring 46 to assure good electrical connection between the contactor and the collector ring.

The contactor, of course, also has sliding engagement with the resistance element. For this purpose a spring finger 59 extends from an edge of the bight 53 with its edges well spaced from the arms 54 and 55. This finger is substantially semi-circular in configuration and partially embraces the control axis. Its free extremity is formed with a rounded contact shoe 61 which rides upon the inner face 23 of the resistance element 22 to vary the resistance value as the shaft is turned; and to facilitate turning the shaft its front end has a hexagonal forward projection with a screw driver slit in its front end.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in this art that the variable resistor of this invention achieves the desired low cost through dual utilization of parts, and simplification of assembly, neither of which entail a reduction of quality and performance so necessary in controls of this type. It will also be seen that, because of its dual utilization of parts, the instrumentalities of the control are effectively housed without the need for separate housing parts.

What is claimed as my invention is:

1. A variable resistor comprising: a pair of spaced apart end walls; a rotatable actuator shaft journalled in axially aligned holes in the end walls; a contactor carried by the shaft between the end walls and having a radially outwardly biased contact finger; a substantially cylindrical split ring resistance element concentrically encircling the shaft and having its opposite edges engaged by the end walls, so that said end walls and the resistance element form an enclosure for the contactor, the contact finger traversing the inner surface of said resistance element as the shaft is turned; axially opposed facing shoulders on the shaft bearing against the end walls to hold the same clamped against the edges of the resistance element; and terminals electrically connected with the contactor and at least one end of the resistance element.

2. A variable resistor comprising: a substantially cylindrical member having means thereon providing an arcuate resistance path which is concentric to said member and on the inner surface thereof, said cylindrical member having a uniform length so that its opposite ends lie in planes normal to the axis of the member; a pair of parallel spaced apart end walls separate from but having the cylindrical member disposed therebetween; an actuating shaft journalled in axially aligned holes in the end walls and passing coaxially through said cylindrical member; means on the shaft bearing against the end walls and releasably clamping them against the opposite ends of said cylindrical member so that the end walls and the cylindrical member coact to form a housing; abutment means on the end walls to hold the cylindrical member and the resistance path thereon in concentric relationship with the shaft; a contactor carried by the shaft within said housing and having a radially outwardly biased contact finger bearing on said resistance path; and terminals electrically connected with the contactor and at least one end of the resistance path.

3. A variable resistor comprising: a housing having side and opposite end walls fabricated from separate parts, the end walls being substantially parallel and spaced apart a predetermined distance; an actuator shaft rotatably journalled in said end walls; abutments on the shaft engaging the end walls to hold them against separation beyond said predetermined distance; a substantially cylindrical member having a length substantially equal to said predetermined spacing of the end walls and being axially

confined between them to hold them against said shaft abutments and against movement toward one another, said cylindrical member surrounding the shaft and having means thereon providing an arcuate resistance path on the inner surface of the member; interengaging means on the end walls and said cylindrical member holding the latter concentric with the shaft, so that the end walls and the cylindrical member therebetween coact to form a housing for the variable resistor, the side wall of which housing is provided by said cylindrical member; a contact finger carried by the shaft and biased outwardly therefrom into pressure engagement with the resistance path on said cylindrical member to traverse the same when the shaft is rotated; and terminals on the housing electrically connected with the contact finger and with at least one end of the resistance path.

4. The variable resistor of claim 2 wherein the contactor comprises a U-shaped stamping having substantially flat arms connected by a bight, said arms having aligned holes through which the shaft passes, at least one of said holes and the portion of the shaft received therein being of complementary non-circular shape to provide a driving connection between the shaft and the contactor; and the contact finger being an integral extension of the bight.

5. In a variable resistor: a pair of end walls; a substantially cylindrical side wall separate and distinct from said end walls and having its opposite edges engaged by the end walls; means connected with the end walls holding them firmly against the opposite edges of the side wall so that the end walls together with the side wall form a drum-like housing; means providing a resistance path on the inner face of the side wall; a control shaft for the resistor rotatable about the axis of the drum-like housing, said shaft having a part inside the housing and being accessible from the exterior of the housing to provide for adjustment of the shaft; and a rotatable contactor inside said housing drivingly connected with the shaft to be rotated thereby, said contactor having a resilient contact finger bearing upon the resistance path to traverse the same as the contactor is rotated.

6. In a variable resistor, the structure set forth in claim 5 further characterized by the fact that the control shaft is journalled in coaxial holes in the end walls; and by the provision of radially inwardly facing annular shoulders on the inner faces of the end walls concentric with the coaxial holes and engaging the external edge portions of the side wall to hold the side wall cylindrical and concentric with the shaft axis.

7. In a variable resistor, the structure set forth in claim 6 further characterized by the fact that the side wall is an initially flat strip of material possessing a degree of resiliency tending to maintain the same flat, said strip being curled into substantially cylindrical form with its ends unconnected so that the inherent resiliency of the strip tending to straighten it out holds the same firmly against the radially inwardly facing annular shoulders on the end walls.

8. In a variable resistor the structure set forth in claim 7 further characterized by the provision of terminals for the resistance path fixed to the end portions of said strip which forms the side wall, in electrical engagement with the ends of the resistance path, said terminals having portions thereof projecting beyond at least one edge of the side wall forming strip; and the end wall engaging said edge of the side wall having notches in its periphery in which said projecting terminal portions are received to secure the side wall against rotational displacement.

9. In a variable resistor, the structure set forth in claim 8 further characterized by the fact that the terminals have portions projecting beyond both edges of the side wall forming strip and by the fact that both end walls have circumferentially spaced notches in their peripheries in which said projecting terminal portions are received, the bottoms of said notches being substantially tangent to the annular shoulders and the remote sides of said notches forming acute angles with the bottoms of the notches so as to better retain the projecting terminal portions in said notches.

10. In a variable resistor, the structure set forth in claim 5 further characterized by the fact that the control shaft is journalled in coaxial holes in the end walls, and by the fact that the contactor is mounted on the shaft between the end walls and comprises a substantially U-shaped stamping having spaced apart overlying arms apertured to receive the shaft, the resilient contact finger being an integral extension of the bight of said U-shaped stamping; and a terminal for the contactor on the exterior of the housing electrically connected with the contactor.

11. In a variable resistor, the structure set forth in claim 10 further characterized by the fact that the spaced arms of the contactor through which the shaft passes are biased away from one another and confined under spring tension between the end walls, and further by the fact that the means electrically connecting the contactor with its terminal comprises a collector ring overlying the inner face of one of said end walls and confined between it and the adjacent arm of the contactor, the terminal for the contactor being integral with said collector ring and projecting outwardly therefrom through the adjacent end wall.

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