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CONCENTRIC TANDEM VARIABLE RESISTANCE CONTROL

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Fig. 1.

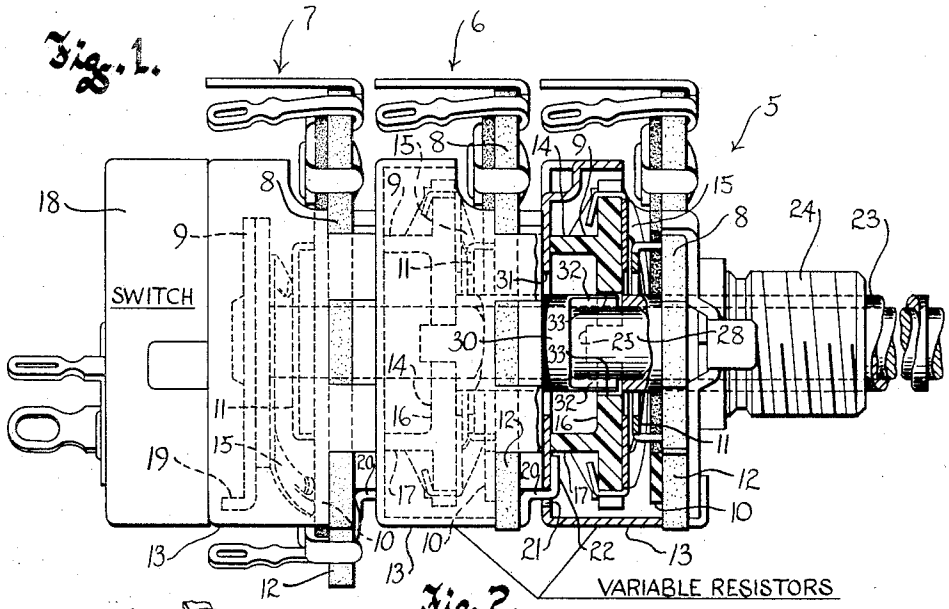


Fig. 2.

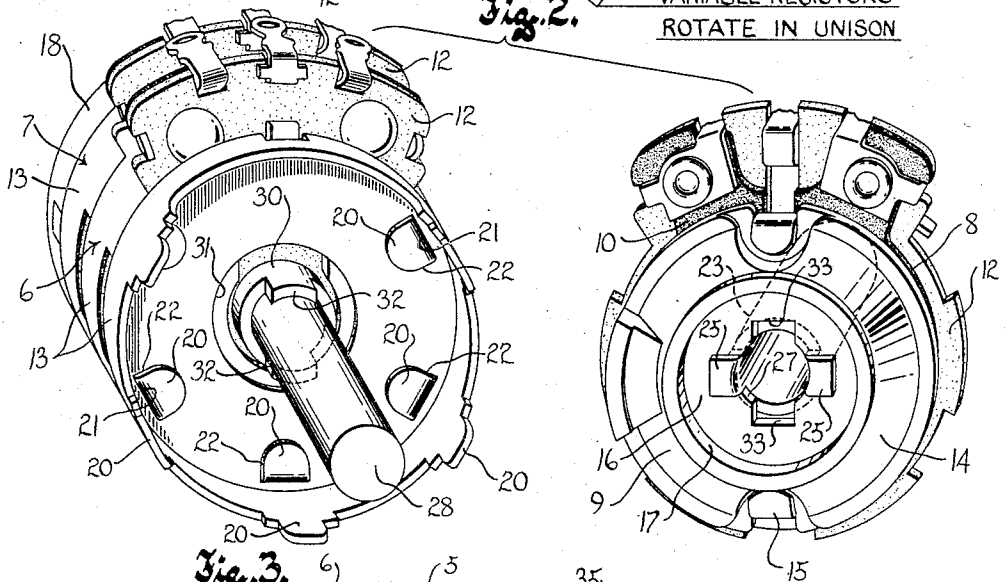
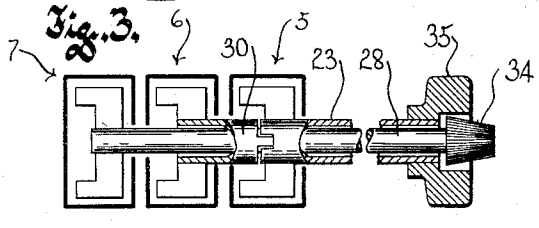


Fig. 3.



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CONCENTRIC TANDEM VARIABLE RESISTANCE CONTROL

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3 Claims. (Cl. 201—55)

This invention relates to variable resistance controls, and refers more particularly to concentric tandem variable resistance controls of the type wherein a plurality of variable resistor units are arranged one behind the other with their rotors coaxial. Controls of this nature are commonly employed in television and radio receivers, and usually comprise two variable resistors separately operated by concentric inner and outer shafts. Often such tandem controls also include a switch, which is mounted on the back of the rear unit, to be actuated concomitantly with adjustment of the rear unit through a fraction of its complete range.

In radio and television receivers, it is not uncommon for a circuit to require two variable resistors to be adjusted in unison, to provide for varying the attenuation of a signal without altering the impedance of the circuit. Such simultaneous adjustment of the two resistors is best achieved by connecting them in tandem with the shafts of the two units coupled to turn in unison so that, by turning a single control knob, the desired adjustment of both resistors is effected.

With a view toward holding the number of control knobs to a minimum, it is desirable that the tandem connected resistors be mounted in concentric tandem relationship with another necessary control, as for instance, the volume control of the set. While this does not obviate the need for a knob to adjust the volume control as well as a knob for the tandem connected controls, at least it places both knobs at the same place on the panel.

The mere statement of this broad objective probably, of itself, suggests the desirability of adding another variable resistor unit to the conventional concentric tandem control, and connecting the shaft of this additional unit to one of the shafts already present, but to do this in a commercially feasible way presented a problem. The problem was to reach the objective in a way which did not entail major changes in the design and construction of the variable resistors, from that which years of satisfactory performance had shown to be sound, and which would not render the individual units of the control special, to the extent of making them incapable of other more conventional uses.

It may be said, therefore, that the purpose and object of this invention is to provide a combination variable resistance control of the character described, in which more than two resistor units are combined, and the rotors of at least two of the units are adjusted by a single control shaft, but wherein the individual variable resistor units are substantially conventional in construction.

Those skilled in this art will appreciate that finite adjustment is usually demanded of resistors which must be operated in unison, and, of course, such fine adjustment is best assured if the control knob used therefor is as large as possible. This means that in a concentric tandem control having one independently adjusted resistor and two resistors with rotor shafts connected in tandem to be adjusted in unison, it is the outer one of the two

concentric control knobs which should be used to adjust the tandem connected resistors; and this means that the tandem connected units must have hollow or tubular shafts and must be the two foremost units of the control. Not only does this give the most critical part of the control the largest knob, but it also utilizes the largest available shaft diameter for the torque transmitting coupling, and this makes it possible to hold backlash in the coupling to a minimum.

Another advantage which flows from having the tandem connected units at the front rather than at the rear of the composite control, is that it adapts the control better to printed circuit applications since it places the two resistors which are to be operated in unison in the most favorable location from the standpoint of the arrangement and placement of the printed circuit or circuits controlled thereby.

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 hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates 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 view partly in side elevation and partly in longitudinal section, through a combination variable resistance control of the type to which this invention pertains;

Figure 2 is a perspective view of the control with the front unit removed from its cover and turned to show the rear thereof, so that the manner in which the shafts of the front and next adjacent unit are coupled, will be visible; and

Figure 3 is a diagrammatic view to better illustrate the invention as embodied in the control shown in Figures 1 and 2.

Referring now particularly to the accompanying drawing, the numerals **5**, **6** and **7** designate, respectively, a front variable resistor unit, an intermediate variable resistor unit, and a rear variable resistor unit. These three units are connected in concentric tandem relationship to form one composite variable resistance control.

Each of the three variable resistor units comprises a stator **8**, and a rotor **9**. The stator includes a resistance element **10** and a collector ring **11**, both mounted on the inner face of a base **12** of insulating material, which serves as the front wall of a housing enclosing the instrumentalities of the resistor unit. The housing is completed by a stamped metal cup-shaped cover **13** secured to the base **12** in the conventional manner.

The rotor **9** of the front and intermediate variable resistor units includes an insulated contactor carrier **14**, upon which a contactor **15** is mounted. The contactor **15**, as is customary, has resilient fingers which bear against and traverse the resistance element and the collector ring as the resistor is adjusted.

The insulated contactor carrier **14**, is preferably molded of insulating material, and has a flat wall **16** upon which the contactor is mounted and a rearwardly directed circular flange **17** which bears against the rear wall of the cup-shaped cover **13**, to firmly but freely rotatably support the rotor in a definite positional relationship with respect to the resistance element and collector ring.

If desired, the rotor of the rear variable resistor unit **7** could be the same as that of the front and intermediate units, but since the control also includes a switch **18**

mounted on the back of the rear unit 7, to be actuated during adjustment of the rear unit through part of its complete range, the rotor of the rear unit 7 is of different construction. It is of the type which includes an arm 19 transiently engageable with the switch actuating cam (not shown) to open and close the switch as the rear unit is adjusted.

For the purposes of this invention, however, the details of the switch and manner in which adjustment of the rear unit actuates the same is of no importance. Likewise, the manner in which the several units are connected to one another, is of no particular consequence, but it is desirable that the several units be so connected as to assure coaxiality between their respective rotors. One way of achieving this objective is by fastening tangs, or tongues 20 projecting forwardly from the side wall of the cover 13 and extending through slots 21 in the rear wall of the cover of the next forward unit, and then struck over as at 22. The tangs 20 also serve to hold the covers and bases of the units together, and in Figure 2, the tangs 20 which serve this function for the front unit are shown in their initial straight condition, preparatory to being clinched over the front of the base of this unit upon assembly thereof with the cover.

The shaft 23 of the front unit is tubular and projects forwardly through a mounting bushing 24 fixed to the front unit and by which the entire control may be mounted upon a panel (not shown). The tubular shaft 23 is secured at its inner end to the contactor carrier 14, of the front unit, the securement being effected in the manner shown in Reissue Patent No. 23,750. Briefly, this connection comprises a pair of ears 25 projecting rearwardly from the end of the tubular shaft through the wall 16 of the carrier 14, and clinched thereover to clamp the wall 16 against the rear end of the tubular shaft. A hole 27 through the wall 16 coaxially with the shaft and of a size corresponding to the bore of the shaft, accommodates a shaft 28 by which the rear unit is driven. This is conventional practice, but it does not provide for the adjustment of the intermediate resistor unit. For this purpose, the rotors of the front and intermediate units are coupled together so that, by turning the shaft 23, both these units are adjusted.

To couple the rotor of the intermediate unit to that of the front unit, a short tubular stub shaft 30 of the same cross sectional size as the shaft 23 is fixed to the contactor carrier 14 of the intermediate unit, in the same manner as the shaft 23 is secured to the contactor carrier of the front unit. This stub shaft 30 projects through a hole 31 in the rear wall of the front unit cover, and into the interior of the front unit, just far enough to be coupled to the rotor of the front unit. The coupling consists of two diametrically opposite driving lugs 32 projecting forwardly from the stub shaft into rearwardly opening notches 33 in the edge of the hole 27 between the clinched-over ears 25. To preclude increasing the contact pressure in the front unit by the driving connections between the shafts of the front and intermediate units, the lugs 32 must be short enough not to bear against the rear end of the shaft 23.

The rotors of the front and intermediate units, thus coupled together, turn in unison, and virtually without backlash.

The manner in which the coupling is constructed in nowise affects the utility of the front and intermediate units for general purposes, since the presence of the notches 33 in the wall 16 of the contactor carrier of the front unit, does not interfere with use of the front unit in the conventional manner as a single variable resistor, or in combination with just one other variable resistor unit, and perhaps a switch; and by the same token, the intermediate unit is capable of individual conventional use since its stub shaft could have a knob or other drive means attached thereto. More important, however, the addition of the notches 33 in the contactor carrier of the front unit to provide this unit with its part of the coupling is so slight a change from previous design and construction that the tooling changes needed to provide them are inconsequential; and the provision of the short stub shaft in the intermediate unit requires no change, whatever, from previous tooling.

The shaft 28 by which the rear unit is operated, of course, passes through both hollow shafts 30 and 23 and protrudes beyond the front end of the latter to receive its control knob 34 which (as shown in Figure 3) is concentrically received within the larger control knob 35 fixed to the shaft 23. Thus, as will now be readily understood, the two variable resistors which are to be adjusted in unison, being the two foremost units of the composite control, are operated by the larger of the two knobs so that the fine adjustment which these units usually require is easily achieved.

As will no doubt be readily apparent to those skilled in the art, especially in the light of the foregoing description taken in connection with the accompanying drawing, if desired, more than one intermediate unit could be incorporated in the control. However, in every instance, whether only a single intermediate unit or more such units are employed, the clutch or clutches connecting the shafts of the units to be adjusted in unison, are always located within the foremost one of the thus connected units and are always between the larger diameter hollow shafts. It is this feature which enables the individual units to be used in the conventional way, and which achieves the purposes and objects of this invention, without entailing more than the most insignificant changes in the design and construction of variable resistor units as heretofore made.

What is claimed as our invention is:

1. A combination variable resistance control of the type wherein a plurality of variable resistor units are arranged in tandem with their rotors coaxial, characterized by the fact that said control comprises: a front variable resistor unit, a rear variable resistor unit, and an intermediate variable resistor unit, each of said units having a shaft fixed to its rotor to turn the same; by the fact that the shaft of the front unit is tubular and projects forwardly of said unit; by the fact that the shaft of the intermediate unit is tubular and of substantially the same cross sectional size as the shaft of the front unit; by the fact that the shaft of the rear unit passes through the tubular shafts of the front and intermediate units and is rotatable relative thereto to provide for adjustment of the rotor of the rear unit independently of the rotors of the front and intermediate units; and by an endwise separable clutch connection between the rotor of the front unit and the shaft of the intermediate unit.

2. The structure of claim 1, further characterized by the fact that the tubular shaft of the intermediate unit is a stub shaft which projects forwardly beyond the front of said unit and enters the interior of the front unit far enough to have its front end portions thereof contiguous to the rear of the rotor of the front unit; and by the fact that said endwise separable clutch connection comprises forwardly extending drive lugs on the front end of the tubular stub shaft of the intermediate unit and rearwardly opening notches in the rotor of the front unit in which notches the drive lugs are received.

3. The structure of claim 2 further characterized by the fact that the rotor of the front unit comprises a contactor carrier of insulating material having a flat wall with front and rear surfaces which are substantially normal to the axis of rotation and having a hole through its center, the edge of said hole having two pairs of diametrically opposite notches therein with the notches equispaced circumferentially of the hole, and the hollow shaft of the front unit having its rear abutting the front surface of said rotor and having drive ears projecting rearwardly therefrom through one pair of said notches and bent outwardly over the rear surface of said rotor to secure the

front shaft thereto coaxially with the hole therein; and the drive lugs on the hollow shaft of the intermediate unit being received in the other pair of notches in the edge of said hole and being defined by diametrically opposite notches in the front of the hollow shaft of said intermediate unit deep and wide enough to clear the outwardly bent ends of said drive ears on the rear of the hollow shaft of the front unit.

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