June 18, 1957 A. M. DAILY 2,796,501

VARIABLE RESISTOR WITH HIGH TORQUE ADJUSTMENT

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Fig. 1.

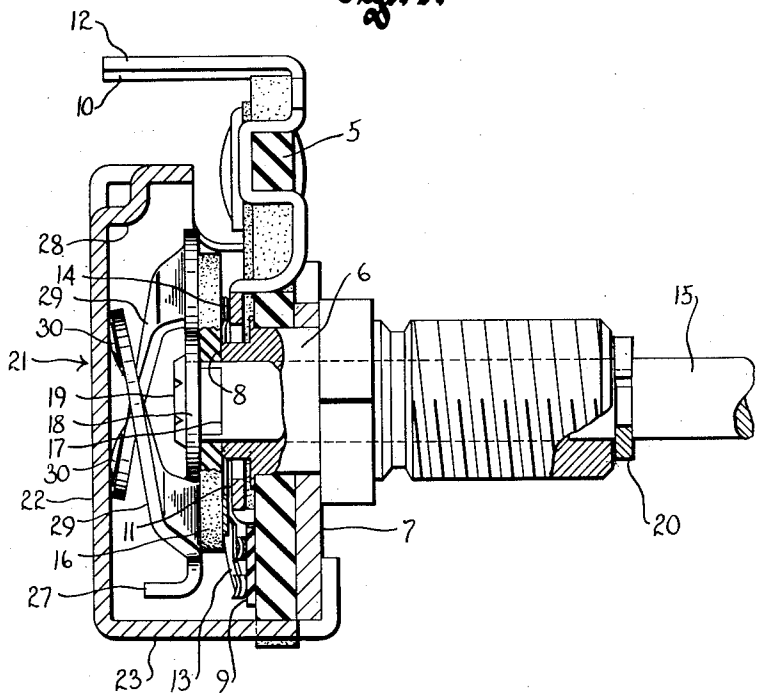
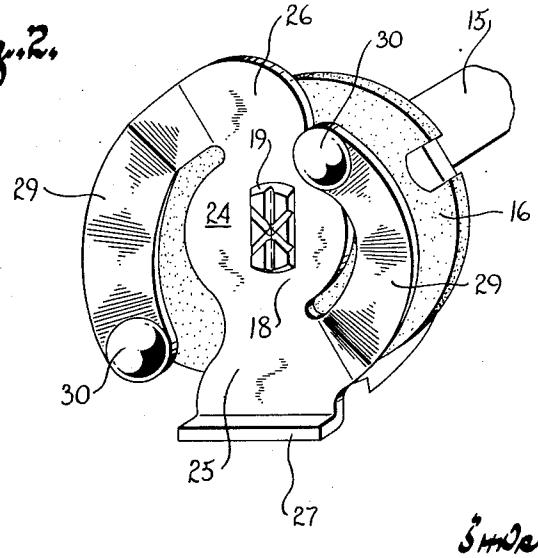


Fig. 2.



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7 Claims. (Cl. 201—55)

This invention relates to variable resistors of the type commonly employed in radio and television receivers and has as its general purpose to provide a variable resistor especially adapted for use in apparatus which is apt to be subjected to considerable vibration, as for instance the communication receivers of airplanes and the like. In such situations the ordinary variable resistor does not afford adequate assurance against unintentional changes in setting. The relatviely light resistance to rotation of its contactor leaves it prone to "creep" from a selected position of adjustment. Accordingly, some means must be provided to increase the torque necessary to effect adjustment of the resistor if it is to be satisfactory for use in apparatus apt to be subjected to serious vibration.

The broad concept of providing some means to effect this purpose is not new with this invention, but heretofore the incorporation of additional frictional resistance to adjustment has involved additional parts which not only increased the cost of the unit due to the added assembly time but in general was found to be rather makeshift and objectionable.

It is, therefore, the purpose of this invention to provide an improved manner of incorporating additional frictional resistance to adjustment of the resistor which eliminates all additional parts and therefore in nowise increases the cost of assembly, and because of its reduction in the number of parts achieves desirable simplicity.

More especially it is an object of this invention to incorporate the means for increasing the resistance to adjustment of the resistor in the stop plate of the rotating assembly of the unit, in the form of spring arms formed integrally with this plate and bearing against the end wall of the metal shell which forms part of the housing for the resistor.

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 drawing illustrates one complete example of the physical emboiment 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 this invention; and

Figure 2 is a perspective view of the rotating assembly of the resistor illustrating particularly the combination stop plate and spring friction arms.

Referring now particularly to the accompanying drawing, the numeral 5 designates the base of the resistor which as is customary is a generally circular disc of suitable insulating material. Fixed in this base is a metal thimble 6. The securement of the thimble also

holds a metal ground plate 7 in position over the outer face of the base. The major portion of the thimble lies at that side of the base at which the ground plate is located and as is customary is threaded to receive clamping nuts (not shown) by which the entire unit may be mounted on a supporting panel. The opposite end of the thimble protrudes a short distance beyond the inner face of the base to provide a thrust bearing 8.

A flat split ring-shaped resistance element 9 is mounted on the inner face of the base concentrically to the thimble and, as is customary, has terminals electrically connected thereto and attached to the base, one of said terminals being illustrated and indicated by the numeral 10. Also overlying the inner face of the base is a collector ring 11 which has a terminal 12 formed integrally therewith and mounted on the base in the customary manner. The collector ring, like the resistance element, is concentric to the thimble and is encircled by the resistance element.

Spring contact fingers 13 and 14, respectively, traverse the resistance element and collector ring upon rotation of a control shaft 15 journaled in the thimble. The spring contact fingers 13 and 14 are mounted on an insulated drive arm 16 which, in turn, is rightly fixed to the shaft by being clamped between a shoulder 17 and a metal stop plate 18 fixed to the shaft by having the extremity of the shaft riveted or swedged thereover as at 19.

A C-washer 20 mounted in a groove in the shaft and arranged to bear against the adjacent outer end of the sleeve limits axial movement of the shaft and the rotating assembly carried thereby in the direction in which the tension of the spring contact fingers 13 and 14 urge the same. The C-washer thus serves to hold the shaft and the parts carried thereby assembled with the base.

The instrumentalities of the variable resistor are enclosed in a housing formed by the base 5 and a cup-shaped metal shell 21 having a flat end wall 22 and a cylindrical side wall 23, the latter being connected to the base in the customary manner with the end wall 22 in parallel spaced relation to the inner face of the base.

The metal stop plate 18 has a flat hub portion 24 from which diametrically opposite flat arms 25 and 26 extend. The arm 25 has its extremity bent outwardly as at 27 to provide a stop lug which coacts with an abutment 28 on the cylindrical wall of the metal shell to define the limits of rotation of the rotating assembly.

The diametrically oppositely extending arms 25 and 26 have curved spring arms 29 formed integrally therewith and projecting substantially circumferentially from opposite sides thereof. Thus, as will no doubt be clear, at the time the stop plate is blanked out the spring arms are coplanar with and embrace the circular hub portion 24, but thereafter the spring arms are sprung or formed to project from the plane of the hub portion 24 in the same direction as the stop lug 27.

The outer extremities of the arms are diametrically opposite one another and terminate on a common plane parallel to the flat hub portion but spaced outwardly thereof a distance greater than the height of the stop lug 27 and even greater than the space between the inner surface of the end wall 22 and the hub portion 24. Thus, when the cover or shell 21 is assembled with the base, these arms are depressed. Two points of frictional engagement are thereby established between the rotating assembly of the control and its cover or shell, and to assure smooth adjustment of the resistor the extremities of the spring arms are preferably formed with smooth convex contact surfaces 30.

Since the spring arms are of the same length and under the same spring tension the end thrust imposed upon the rotating assembly by their depression is balanced at diametrically opposite sides of the axis of rotation. This

end thrust exceeds that imposed upon the rotating assembly by the spring fingers **13** and **14** and, therefore, must be positively resisted to prevent excessive contact pressure on the resistance element and collector ring. To this end the insulated drive arm **16** bears against the thrust bearing **8** provided by the adjacent inner end of the thimble.

From the foregoing description taken in connection with the accompanying drawing it will be readily apparent to those skilled in this art that the frictional engagement between the contact surfaces **30** of the spring arms **29** and the back wall **22** of the cover or shell effectually resists rotation of the control shaft and thus increases the torque necessary to effect adjustment of the resistor. It will also be seen that this invention achieves the desired resistance to adjustment of a variable resistor and thus attains its objective in an extremely simple manner and without the need for increasing the number of parts beyond that customary in variable resistors of this type.

What I claim as my invention is:

1. A variable resistor of the type having a base of insulating material with a resistance element mounted thereon to be traversed by a contactor driven by a rotatable control shaft which passes through the base, and wherein the base coacts with a cup-shaped metal shell connected thereto to provide a housing for the instrumentalities of the variable resistor, and the end wall of the cup-shaped shell overlies the base in spaced relation thereto, characterized by the fact that: the operating shaft has a metal stop plate fixed to the end thereof within the housing and lying between the contactor and the end wall of the cup-shaped shell, which stop plate has a portion thereof positioned to engage with a shoulder on the inside of the housing to limit rotation of the shaft and the contactor driven thereby; and further characterized by the provision of spring finger means formed as an integral part of said stop plate and bearing against the inner face of the end wall of the metal shell with substantial spring force to thereby urge the stop plate forwardly towards the contactor and frictionally resist rotation of the control shaft and the contactor driven thereby.

2. A variable resistor especially adapted for use in locations subject to excessive vibration, comprising: a base of insulating material; a resistance element mounted on the base; a rotatable control shaft passing through the base; a contactor fixed to the control shaft to be driven thereby and to traverse the resistance element in response to rotation of the control shaft; a stamped cup-shaped metal shell fixed with respect to the base and coacting therewith to provide a housing for the instrumentalities of the variable resistor, said shell having an end wall opposite the base; a metal stop plate fixed to the control shaft; cooperating abutments on the metal shell and said stop plate to define the limits of rotation of the shaft and the contactor driven thereby; and a pair of spring arms formed integrally with said metal stop plate and projecting towards the end wall of the shell, the outer extremities of said arms bearing against the inner face of the end wall of the shell to thereby place said arms under spring tension and frictionally resist rotation of the shaft and the contactor driven thereby.

3. The variable resistor of claim 2 further characterized by the fact that the resilience of said spring arms urges the contactor into engagement with the resistance element; and further characterized by the provision of a thrust bearing means on the base and the rotating assembly to resist the end thrust imposed upon the rotating assembly by said spring arms.

4. In a variable resistor: a base of insulating material; a metal thimble fixed in said base with one end thereof projecting a short distance from one side of the base and its opposite end projecting a greater distance from the other side of the base; a resistance element mounted on the first side of the base concentrically to the axis of the thimble; a control shaft journalled in the thimble; an insulated drive arm fixed to the control shaft and bearing against the first named end of the thimble to thereby limit axial movement of said arm and the shaft in the direction to carry said arm toward the base; a contactor on the underside of said insulated drive arm bearing against the resistance element; a metal stop plate fixed to the shaft and overlying the other side of the insulated drive arm; a housing for the resistor including an end wall overlying the base and the rotating assembly carried by the shaft and spaced a definite distance from the stop plate; cooperating stop abutments on the housing and the metal stop plate to limit rotation of the shaft and rotating assembly; and spring arms integral with said stop plate, said spring arms being confined under tension between the inner face of said end wall and the stop plate and bearing against the end wall at equal radial distances from the axis of rotation to thereby hold the rotating assembly against its thrust bearing and frictionally resist rotation thereof.

5. In a variable resistor of the type comprising a housing having a pair of spaced apart, substantially parallel end walls, through one of which a rotatable control shaft projects and on one of which a resistance strip is mounted for engagement by a rotatable contactor carried by the shaft: a pair of flexible arms carried by the shaft and having end portions frictionally engaged with the end wall of the housing opposite the wall on which the resistance strip is mounted at diametrically opposite points spaced equal distances from the axis of the control shaft to frictionally resist rotation of the shaft.

6. The variable resistor of claim 5 further characterized by abutment means on the shaft engaged with an opposing abutment fixed on said wall through which the shaft projects to resist axial displacement of the shaft away from said opposite end wall of the housing against which said flexible arms are engaged to thereby maintain said rotatable contactor under constant tension and thus assure uniform contact pressure between the contactor and the resistance strip.

7. In a variable resistor of the type comprising a housing having a cylindrical side wall and pair of spaced apart substantially parallel end walls, through one of which the control shaft of a rotatable assembly projects and on one of which a resistance strip is mounted for engagement by a rotatable contactor which forms part of the rotatable assembly: a stop plate fixed to the shaft; cooperating stop abutments on the housing and on said stop plate to limit rotation of the rotatable assembly; a spring arm integral with said stop plate and having a portion biased into frictional engagement with the end wall of the housing opposite side end wall on which the resistance strip is mounted to thereby resist rotation of the shaft; and abutment means on the shaft engaged with opposing spaced apart abutments fixed on said wall through which the control shaft projects to confine the shaft against axial displacement.

References Cited in the file of this patent

FOREIGN PATENTS

479,045	Great Britain	Jan. 31, 1938
583,143	Great Britain	Dec. 10, 1946