April 11, 1944. G. J. MUCHER 2,346,598

VARIABLE RESISTOR

Filed Nov. 8, 1941

Fig. 1

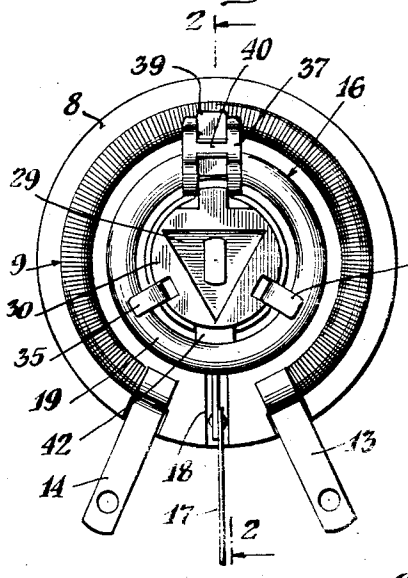



Fig. 2

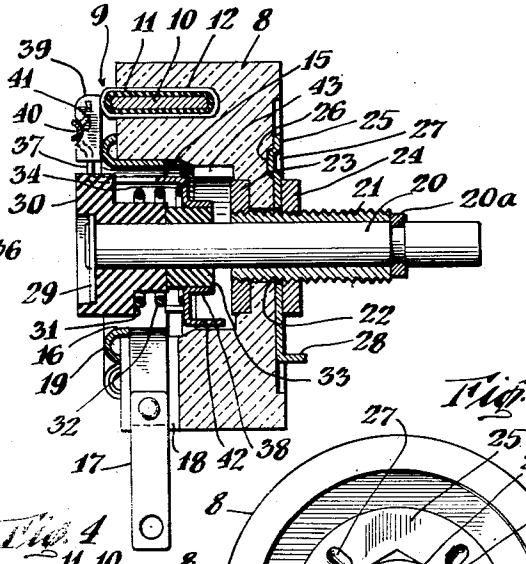



Fig. 3

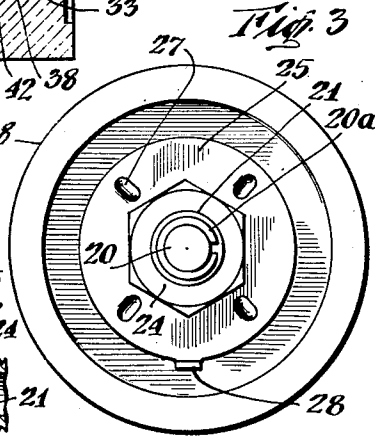



Fig. 4

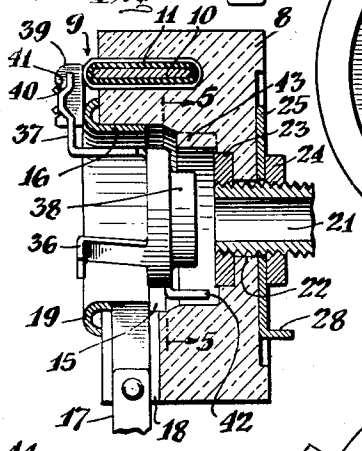



Fig. 5

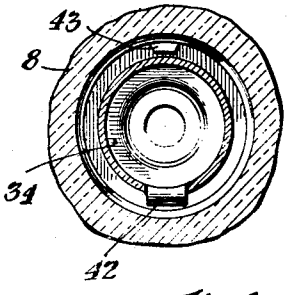



Fig. 6

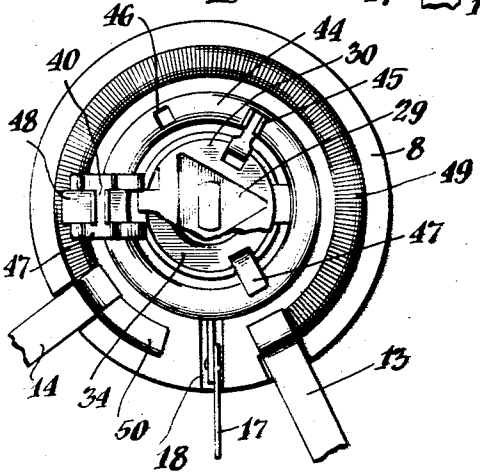
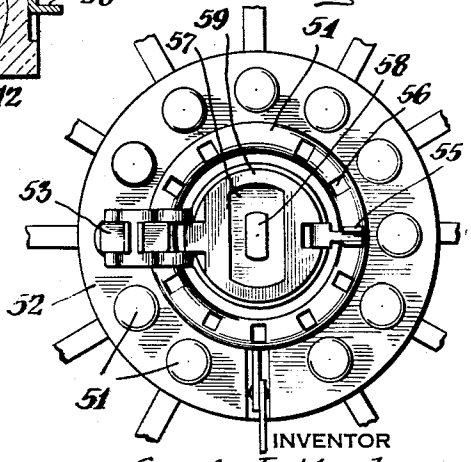



Fig. 7




INVENTOR

George I. Mucher

BY

Duell, Kane & Smoot

ATTORNEYS

Patented Apr. 11, 1944 2,346,598

# UNITED STATES PATENT OFFICE

2,346,598

## VARIABLE RESISTOR

George J. Mucher, Brooklyn, N. Y., assignor to Clarostat Manufacturing Co. Inc., Brooklyn, N. Y., a corporation of New York

Application November 8, 1941, Serial No. 418,394

9 Claims. (Cl. 201—56)

This invention relates to a new and improved electrical resistor or the like.

One major difficulty experienced with apparatus of this character is that arcing of the movable member while in use causes damage to the resistance winding and ultimate destruction of the resistor.

It is an object of this invention to provide a structure of this type in which the tendency of the contact shoe to arc when in motion across the winding of the resistor has been reduced to a minimum.

Another object is that of providing a device which is relatively simple in construction and which will function for long periods of time with freedom from mechanical or electrical difficulties or failures.

With these and other objects in mind, reference is had to the attached sheet of drawings, in which:

Fig. 1 is a plan view of one form of electrical resistor embodying my invention;

Fig. 2 is a cross section of the resistor shown in Fig. 1 taken along the lines 2—2 and looking in the direction of the arrows;

Fig. 3 is a plan view of the reverse side of the resistor shown in Fig. 1;

Fig. 4 is a side elevation partially in cross section showing the resistor illustrated in the preceding views;

Fig. 5 is a detail of the view shown in Fig. 4 taken along the line 5—5 looking in the direction of the arrows in that view;

Fig. 6 is a plan view of a slightly modified form of my invention; and

Fig. 7 is a plan view of still a further modification thereof.

Turning now to Figs. 1 through 5, we find an electrical resistor, for example, a rheostat which is provided with a conventional base 8 formed, for example, of a ceramic or other dielectric material and in which is embedded a core or resistance winding 9. The latter is preferably wound on a flat metal strip 10 which in turn, has been insulated by means of an inorganic insulating member such as asbestos or the like 11, and after the member has been wound with resistance wire, it is bent to assume the arcuate shape as shown in Fig. 1 and then placed in the slot 12 provided for that purpose in the base 8. If desired, the resistance may be held in position in said slot by any suitable cement or other adhesive. Lead members 13 and 14 are preferably secured to the opposite ends of said resistance winding, and are in turn, connected to any desired electrical circuit. The central portion of the base 8 is provided with a relatively large central opening 15 in which is disposed, for example, a collector ring 16 of metal or other electrical conductor which is substantially the diameter of said opening 15. Said collector ring may be, in turn, provided with a contact lead 17 extending, for example, through a slot 18 in the base 8 to a position between contacts 13 and 14. This collector ring may, as has been illustrated, be formed with an outwardly extending semi-circular flange portion 19 which rests against the rear face of the base 8. Disposed within said collector ring and centrally thereof, is a shaft 20 which rotates in a bushing 21 carried by a central opening 22 in the other face of the base 8. Nut members 23 and 24 engage the threaded outer surface of the bushing 21 and rest against the opposite sides of the opening 22 thus positioning the bushing against displacement. A key member 20a engages a slot in the shaft 20 just beyond the outer end of the bushing 21 preventing a withdrawal of the shaft from the rear. In addition, a plate 25 of metal or other suitable material may be located beneath the nut 24 on the front face of the base 8 and in contact therewith, said face being provided with indentures, apertures or recesses as at 26 which in turn cooperate with struck-in or beaded portions 27 of said plate, thus keying the plate to the face of said base and preventing relative rotation of the parts.

In addition, a lug or abutment 28 may be carried by said plate for cooperation with a mounting member designed to carry said resistor so that a rotation of the shaft 20, when the resistor is used, will not result in a rotation of the entire resistor. The shaft 20 carries at its inner end, a plate 29 which, as has been illustrated, may take the form of a triangle. This plate in turn, keys into an insulated actuating collar 30 surrounding said shaft and which may be formed of plastic, ceramic, or other insulating material. The collar may have a shoulder portion 31 adjacent its end and against which a coil spring 32 abuts. This coil spring encircles said collar as well as an insulating auxiliary collar 33 positioned below the main collar. It might be well at this point to draw attention to the fact that the collar 33 may just as well be made as part of the collar 30 and if so made, would still function as intended in this embodiment of my invention. The spring rests at its other end against a shoulder 34 of a metallic spider or spanning member which as has been shown, may comprise three leg portions, 35, 36 and 37. The lower

end of said spider 38 preferably engages the outer surface of the auxiliary collar 33 and is held in place thereby. The legs 35 and 36 of the spider extend outwardly and are bent over and in contact with the outer surface 19 of the collecting ring 16 while the leg 37 is formed as a yoke, for positioning a contact shoe 39. This shoe as has been illustrated, bridges the gap between the collector ring and the resistance windings and is in contact with both of them so that an electric current is caused to flow through the contact shoe from the collector ring to the resistance. A bridging member 40 carried by the leg 37, may, for example, cooperate with a groove 41 in the upper surface of the contact shoe and thus hold the latter member against accidental displacement. A lug 42 extends inwardly from the flange 38 of the spider and cooperates with a stop 43 extending outwardly from the opening 15 of the base 3 to limit the rotation of the spider to slightly less than 180° in either direction.

If desired, and as has been shown in Fig. 6, a modified collector ring 44 may be used and one of the leg members 45 may be rounded so as to cooperate with a slot 46 in the collector ring. Accordingly, and when the spider is rotated, the leg 45 will drop into the slot 46 causing the latter to act as a detent to indicate to the user of the rheostat that a definite position, for example, the "off-position" of the resistor has been reached. The leg 47 and the contact shoe 48, as will be seen, are both wide enough to bridge the slot 46 without any difficulty or interference so that it is only when the leg 45 reaches the slot 46 that the detent action occurs. In this connection, it will be noted that the windings 49 may be so positioned that a dead space 50 is provided for the contact shoe, and the latter may assume a position above such dead space at the time that the leg 45 rides into the detent 46 thus effecting an "off-position."

In Fig. 7 a further modification is shown in which individual contact points 51 are provided in an insulated base 52 and which are progressively spanned by the contact shoe 53 which in turn rides on the collector ring 54. In this embodiment only two legs have been shown, the one 55, being semi-circular in cross section to cooperate with a plurality of slots 56 in the collector ring. Thus, a detent action of the leg 55 cooperating with each of the slots 56 is such that the operator can tell when the contact shoe 53 is in contact with each of the contact points 51. Also, as has been shown in this embodiment, the end piece 57 carried by the shaft 58 and which cooperates with the insulating collar 59, may have irregular contour other than that shown in the preceding views.

In operation, it will be noted that in any of the devices described, the contact shoe will be at all times in firm spring pressed contact with both the collector ring and the resistance windings. Shock and strain imposed on the manipulating end of the shaft by either vertical or lateral thrusts, will in each instance be absorbed by the spider spring assembly and not transmitted through to the point of electrical contact. The likelihood of arcing is thus materially reduced, if not completely removed.

It is, of course, apparent that many changes might be made in the resistor construction before described and that many of the parts might be rearranged without in the least departing from the spirit of the invention. It is also apparent that details of design and choice of materials may vary over wide ranges in accordance with the specific needs of the particular device under construction.

I claim:

1. An article of the character described, including in combination, a base formed of non-conducting material, a circular resistance element embedded in said base so that one edge thereof is exposed, said element being adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respect to said resistance element and being also mounted on said base, said collector ring being also coupled to said electric circuit, a rotatable shaft mounted by said base, one end thereof being positioned within said collector ring, a collector member encircling said shaft and being coupled thereto, a plurality of bearing legs carried by said collector member and engaging the outer surface of said collector ring, and a contact shoe coupled to one of said bearing legs and making electrical contact between said collector ring and said resistance element, whereby rotation of said shaft will cause said contact shoe to progressively engage different portions of said resistance element and said collector ring.

2. A resistor including in combination, a base formed of non-conducting material, a circular resistance element embedded in said base so that one edge thereof is exposed, said element being adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respect to said resistance element and being also mounted on said base, said collector ring being also coupled to said electric circuit, a rotatable shaft mounted by said base, one end thereof being positioned within said collector ring, a collector member encircling said shaft and being coupled thereto, a plurality of bearing legs carried by said collector member and engaging the outer surface of said collector ring, a contact shoe coupled to one of said bearing legs and making electrical contact between said collector ring and said resistance element, whereby rotation of said shaft will cause said contact shoe to progressively engage different portions of said resistance element and said collector ring, and cooperating means carried by said shaft and said base for limiting the rotation of the former with respect to the latter.

3. A resistor including in combination, a base formed of non-conducting material, a circular resistance element embedded in said base so that one edge thereof is exposed, said element being adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respect to said resistance element and being also mounted on said base, said collector ring being also coupled to said electric circuit, a rotatable shaft mounted by said base, one end thereof being positioned within said collector ring, a collector member encircling said shaft and being coupled thereto, a plurality of bearing legs carried by said collector member and engaging the outer surface of said collector ring, a contact shoe coupled to one of said bearing legs and making electrical contact between said collector ring and said resistance element, whereby rotation of said shaft will cause said contact shoe to progressively engage different portions of said resistance element and said collector ring, and said collector ring being formed with a detent engageable by one of said bearing legs to retard further movement of the latter and to indicate that a predetermined position in the rotation of said shaft has been achieved.

4. A resistor including in combination, a base formed of non-conducting material, a circular

resistance element embedded in said base so that one edge thereof is exposed, said element being adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respectt o said resistance element and being also mounted on said base, said collector ring being also coupled to said electric circuit, a rotatable shaft mounted by said base, one end thereof being positioned within said collector ring, an insulated member carried by said shaft at the end thereof which is positioned within said collector ring, a collector member encircling said insulating member and being keyed thereto, a plurality of bearing legs carried by said collector member and engaging the outer surface of said collector ring, a contact shoe coupled to one of said bearing legs and making electrical contact between said collector ring and said resistance element, whereby rotation of said shaft will cause said contact shoe to progressively engage different portions of said resistance element and said collector ring, and said collector ring being formed with a detent engageable by one of said bearing legs to retard further movement of the latter and to indicate that a predetermined position in the rotation of said shaft has been achieved.

5. A resistor including in combination, a base formed of non-conducting material, a circular resistance element embedded in said base so that one edge thereof is exposed, said element being adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respect to said resistance element and being also mounted on said base, said collector ring being also coupled to said electric circuit, a rotatable shaft mounted by said base, one end thereof being positioned within said collector ring, an insulated member carried by said shaft at the end thereof which is positioned within said collector ring, a collector member encircling said insulating member and being keyed thereto, resilient means interposed between said collector member and said insulating member, a plurality of bearing legs carried by said collector member and engaging the outer surface of said collector ring, a contact shoe coupled to one of said bearing legs and making electrical contact between said collector ring and said resistance element, whereby rotation of said shaft will cause said contact shoe to progressively engage different portions of said resistance element and said collector ring, and said collector ring being formed with a detent engageable by one of said bearing legs to retard further movement of the latter and to indicate that a pre-determined position in the rotation of said shaft has been achieved.

6. A resistor including in combination, a base formed of non-conducting material, a circular resistance element carried by said base and adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respect to said resistance element and also carried by said base, said collector ring also being coupled to said electric circuit and a bridging contact member for making electrical connection between said collector ring and said resistance element, a rotatable shaft mounted on said base and extending through the same to a position within said collector ring, an insulating member encircling said shaft and being keyed thereto for rotation therewith, a spider in turn encircling said insulating member and being spaced from said shaft by the latter, leg members carried by said spider and bearing against said collector ring, and a leg member of said spider being formed with yoke means for engaging said bridging contact member and supporting the same, during rotation of said shaft.

7. A resistor including in combination, a base formed of non-conducting material, a circular resistance element carried by said base and adapted to be coupled to an electric circuit, a collector ring concentrically disposed with respect to said resistance element and also carried by said base, said collector ring also being coupled to said electric circuit and a bridging contact member for making electrical connection between said collector ring and said resistance element, a rotatable shaft mounted on said base and extending through the same to a position within said collector ring, an insulating member encircling said shaft and being keyed thereto for rotation therewith, a spider in turn encircling said insulating member and being spaced from said shaft by the latter, leg members carried by said spider and bearing against said collector ring, a leg member of said spider having yoke means for engaging said bridging contact member and causing the same to travel over the resistance element and collector ring during rotation of said shaft, and coil spring means interposed between said insulating member carried by said shaft and said spider for permitting relative resilient movement between the parts as said shaft is rotated.

8. A resistor including in combination a base of non-conducting material formed with an opening, a resistance element carried on said base, a collector ring also carried on said base, a rotatable shaft mounted in said opening and provided with an insulated actuating collar at one end thereof, contact shoe mounting means encircling said shaft and in engagement with said actuating collar, said means provided with a plurality of bearing legs, a surface on said base for slidably engaging said legs, a contact shoe mounted on said means and engaging said resistance element and collector ring, a spring encircling said shaft and positioned between said shoe mounting means and said rotatable shaft actuating collar, means for holding said shaft in position compressed against said spring thereby providing for spring pressed contact between said contact shoe and said resistance and collector ring.

9. A resistor including in combination a base of non-conducting material formed with an opening, a resistance element carried on said base, a collector ring also carried on said base, a rotatable shaft mounted in said opening and provided with an insulated actuating collar at one end thereof and in axial sliding engagement fixed against rotation on said shaft, contact shoe mounting means encircling said shaft and in axial sliding engagement with said actuating collar, said means provided with a plurality of bearing legs, a surface on said base for slidably engaging said legs, a contact shoe mounted on said means and engaging said resistance element and collector ring, a spring encircling said shaft and positioned between said shoe mounting means and said actuating collar, means for holding said shaft in position with said spring compressed thereby providing for spring pressed contact between said contact shoe and said resistance and collector ring.

GEORGE J. MUCHER.