May 26, 1925. 1,539,266

C. E. MOUNTFORD

VARIABLE RESISTANCE

Filed Dec. 29, 1922

Fig. 1.

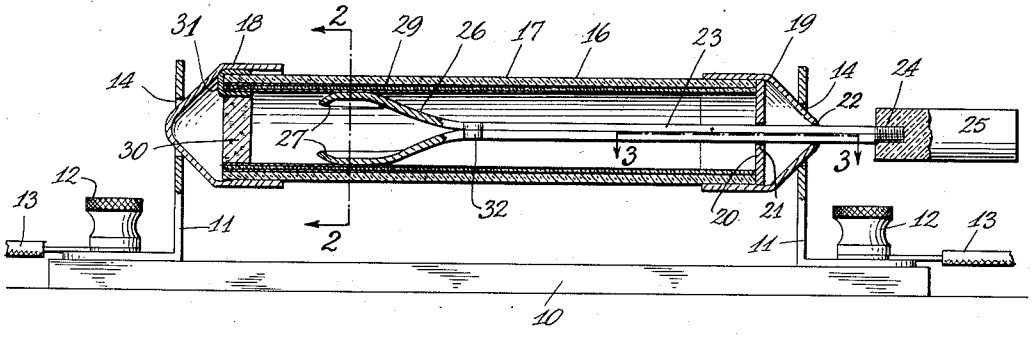


Fig. 2.

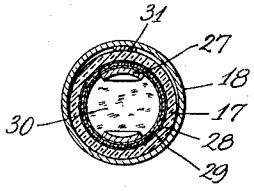


Fig. 3.

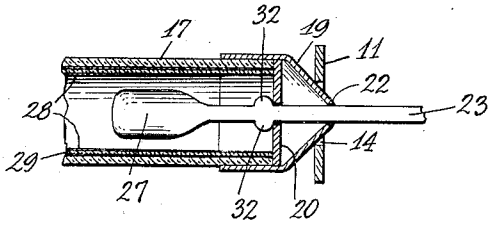
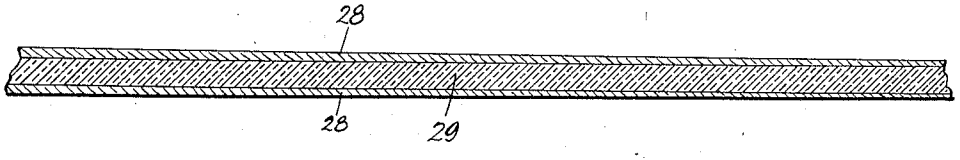


Fig. 4.



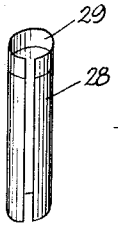


Fig. 5.

INVENTOR.
Clarence E. Mountford.
BY Richards & Geier
ATTORNEYS.

Patented May 26, 1925. 1,539,266

UNITED STATES PATENT OFFICE.

CLARENCE E. MOUNTFORD, OF BROOKLYN, NEW YORK.

VARIABLE RESISTANCE.

Application filed December 29, 1922. Serial No. 609,676.

To all whom it may concern:

Be it known that I, CLARENCE E. MOUNTFORD, a subject of the King of Great Britain, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Variable Resistances, of which the following is a specification.

The principal object of this invention is to provide a new and improved construction of great simplicity for an electrical resistance by means of which the value of the resistance interposed in a circuit may be varied as desired within certain predetermined limits.

Another object is to provide a construction of a variable resistance device especially adapted for high resistances such as are commonly used for grid leaks in connection with a radio receiving set.

A further object is to provide a variable resistance in which the variation of the resistance is obtained by a sliding contact which may be slid along the conductor of low conductivity forming the resistance element and which is so constructed as to present a varying cross sectional area longitudinally thereof.

For the accomplishment of these and such further objects as will hereinafter be apparent to those skilled in the art to which this appertains, the invention consists in the construction, combination and arrangement of parts herein specifically described and illustrated in the accompanying drawings, wherein is shown a preferred embodiment of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the claims hereunto appended.

In the drawings, forming a portion of this specification:

Fig. 1 is an enlarged longitudinal section through a grid leak embodying my invention.

Figs. 2 and 3 are cross sections on the lines 2—2 and 3—3 respectively of Fig. 1.

Fig. 4 is a greatly enlarged sectional detail showing the construction of the resistance element, and

Fig. 5 is a perspective showing the resistance element in its curved form (substantially in actual size) to illustrate more clearly its construction.

Referring to Fig. 1 of the drawing, the numeral 10 indicates a suitable base member or support to which are secured a pair of knee brackets or uprights 11, each of which has projecting through its horizontal portion a binding post provided with a knurled thumb nut 12 serving to secure the wire terminals 13 to the bracket. This construction is the common and well known construction of these supports and forms no part of the present invention. Each of the uprights is constructed of spring metal and is provided with an aperture 14 in which is adapted to be received the tapered metal contacts of the resistance element or grid leak designated generally by the numeral 16. It is the common practice in the radio art to construct these grid leaks so as to provide a high resistance of predetermined value and to use a plurality of such grid leaks ranging in value from ¼ or ½ megohm to from 5 to 8 megohms so that when it is desired to vary the value of the resistance interposed in the circuit, it becomes necessary to remove a grid leak and substitute another of the required resistance.

According to my invention, an outer tube 17 of any suitable insulating material has secured thereto the hollow metal ends or contacts 18 and 19 each of which has its outer end tapered to form a cone shaped portion and its inner end of cylindrical configuration proportioned to snugly engage the outer circumference of the tube 17. A small metallic washer 20 provided with a central aperture 21 is mounted within the contact 19 and is held thereby against the end of tube 17.

The contact 19 is provided with a central aperture 22 in axial alignment with the aperture 21, the walls of these apertures forming supporting bearings for a sliding contact 23, the outer end of which has detachably secured thereto as by the threads 24, an actuating handle 25 of suitable insulating material. The diameter of this handle 25 is preferably less than the apertures 14 in the up-

rights 11 so that the resistance device may be readily mounted upon the support by passing the handle 25 through the aperture thereby avoiding the necessity of removing the handle.

The sliding contact 23 is of spring metal and has its inner end separated to provide a fork 26 the extremities of the branches of which are widened and curved transversely to substantially the curvature of the inner circumference of the tube 17, so as to form a pair of contacts 27. The outer surface of these contacts are highly polished so as to slide readily upon a coating 28 of a relatively low conductivity which is applied to a backing 29 of suitable insulating material such as paper. The coating 28 as clearly shown in the enlarged showing of Fig. 4 is applied to the backing in a layer the thickness of which increases uniformly from a point adjacent the contact 19 to the other end of the backing adjacent the contact 18. The backing 29 is uncoated for a distance from the contact 19 substantially equal to the cylindrical portion of the contact so as to prevent the current being communicated to the coating from the washer 20.

A small cylindrical plug 30 preferably of cork and of suitable dimensions to fit tightly within the tube 17 is inserted into the tube at the end adjacent contact 18 and serves to hold the backing 29 in position within the tube and to insure contact between the coating and a small flat strip 31 of metal which is bent into a U shape about the edge of the tube 17 to connect the coating with the contact 18, the cylindrical portion of the contact also serving with the plug 30 to hold the strip 31 securely in position.

I prefer to construct the sliding contact 23 of a pair of separate pieces but it is obvious that it could be formed of a single narrow strip bent at its center to form two juxtaposed lengths or of a solid piece having its inner end split to provide the forked inner end. It will be noted that each of the strips forming the sliding contact are provided adjacent the forked end with a widened part in the form of a pair of laterally extending lugs 32, which are adapted to engage the washer 20 to limit the outward movement of the rod.

Fig. 5 illustrates the manner in which the coated backing forming the resistance element is curled into a cylindrical shape to fit within the tube 17, the width of the backing being substantially equal to the inner circumference of the tube. The coating has been shown as applied to both sides of the backing so that the backing may be reversed to use the outer side should the coating of the inner side be damaged by the action of the sliding contact.

While I have shown the invention as applied to a grid leak, it will be obvious that the principles thereof are applicable to any form of a resistance device. In the preferred form the coating is arranged to furnish resistances varying from ¼ of a megohm at its thicker end to 5 megohm at its thinner end but obviously the value of the limits of the resistance element may be varied as desired, likewise the dimensions and shape of the device may also be considerably altered or varied without departing from the principles or spirit of the invention.

The operation of the device will be readily understood, it being a well known principle of electricity that the resistance offered by a conductor varies inversely as the cross sectional area and directly as the length of the conductor. Therefore, when the sliding contact is in the position shown in Fig. 1, the current passing between the wire terminals 13 and uprights 14, will travel from the contact 19, along sliding contact 23 to the extremities 27 thereof, from which it will pass to the coating 28 and be conducted from the coating to the contact 18 by means of the metal strip 31. By moving the sliding contact to the right of Fig. 1, the length of the path of the current along the coating is increased and at the same time due to the difference in the thickness of the coating the effective cross sectional area thereof is decreased, the coating offering its maximum resistance when the sliding contact 23 is fully withdrawn from the tube in the position shown in Fig. 3 and its minimum resistance when in its innermost position.

For high resistances such as grid leaks the variation of the resistance due to the changes in the length of the path of the current through the conductor is practically negligible in proportion to the variations of the resistance caused by the variation of the cross sectional area or the thickness of the coating, hence the length of the device may be considerably altered without materially changing the limits of the instrument.

It will be obvious that the resistance element could be made the sliding member and the contact 23 the stationary element if desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor of varying cross sectional area in circuit with one of said contacts and a second conductor in circuit with the other of said contacts, said second conductor having a contact in resilient engagement with said first named conductor and one of said conductors being relatively movable longitudinally of

the other of said conductors and said outer tube.

2. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts comprising a conductor, consisting of a backing of insulating material having a coating of conducting material of varying thickness longitudinally of said backing, said coating being connected to one of said contacts and a conductor in contacting relation with the other of said contacts, said conductor having a contact in resilient engagement with said coating, said backing with said coating, and one of said conductors being relatively movable longitudinally of each other.

3. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor of varying cross sectional area fixed within said tube, means for connecting said conductor to one of said contacts, and means for connecting said conductor to the other of said contacts comprising a sliding contact in engagement with said other contact and in resilient engagement with said conductor.

4. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor consisting of a backing of insulating material secured within said tube, and having a coating of conducting material applied thereto, said coating being of uniformly varying thickness longitudinally of said tube, means to connect the thicker end of said coating to one of said contacts, and a second conductor slidable longitudinally of said tube and having a contact in resilient engagement with said coating, said slidable conductor being in contacting engagement with the other of said first named contacts.

5. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor consisting of a backing of insulating material, secured within said tube, and having a coating of conducting material applied thereto, said coating being of uniformly varying thickness longitudinally of said tube, means to connect the thicker end of said coating to one of said contacts, and a second conductor slidable longitudinally of said tube and having a contact in resilient engagement with said coating, said slidable conductor being in contacting engagement with the other of said first named contacts, and means to limit the movement of said second conductor outwardly of said tube.

6. In a variable resistance, an outer tube of insulating material, a pair of electrical contacts mounted upon the ends of said tube, a conductor of low conductivity and varying cross sectional area enclosed within said tube and a conductor of greater conductivity slidably mounted for movement longitudinally of said tube on one of said contacts and extending within said tube to contact with said first mentioned conductor.

7. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor consisting of a backing of insulating material, secured within said tube, and having a coating of conducting material applied thereto, said coating being of uniformly varying thickness longitudinally of said tube, means to connect the thicker end of said coating to one of said contacts, and a conductor slidable longitudinally of said tube and having a contact in resilient engagement with said coating, said slidable conductor being in contacting engagement with the other of said first named contacts and means within said tube provided with a bearing to support said second conductor.

8. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor consisting of a backing of insulating material mounted within said tube and having a coating of conducting material applied thereto, said coating being of uniformly varying thickness longitudinally of said tube, a metal strip contacting with one of said contacts and said coating, means to hold said metal strip in engagement with said coating and to retain said backing in position within said tube, and a second conductor slidable longitudinally of said tube and having a contact in resilient engagement with said coating and said slidable conductor being in contacting engagement with the other of said first named contacts.

9. In a variable resistance, an outer tube of insulated material, a pair of contacts secured to the ends of said tube, and means to vary the resistance to an electrical current passing between said contacts, comprising a conductor, of varying cross sectional area, in circuit with one of said contacts, and a second conductor in circuit with the other of said contacts, said second conductor having a contact in resilient engagement with said first named conductor and one of said conductors being relatively movable longitudinally of the other of said conductors and said outer tube, and said movable conductor

having detachably secured thereto an actuating handle of insulating material.

10. In a variable resistance, an outer tube of insulating material, a pair of electrical contacts mounted upon the ends of said tube, a tubular conductor of low conductivity enclosed within said outer tube, and a conductor of greater conductivity mounted on one of said contacts for longitudinal movement within said tube and capable of contact with said tubular conductor.

In testimony whereof I have affixed my signature.

CLARENCE E. MOUNTFORD.