March 18, 1930.

B. W. DAVID

1,751,231

VARIABLE RESISTANCE UNIT

Filed Feb. 24, 1925

Fig. 1

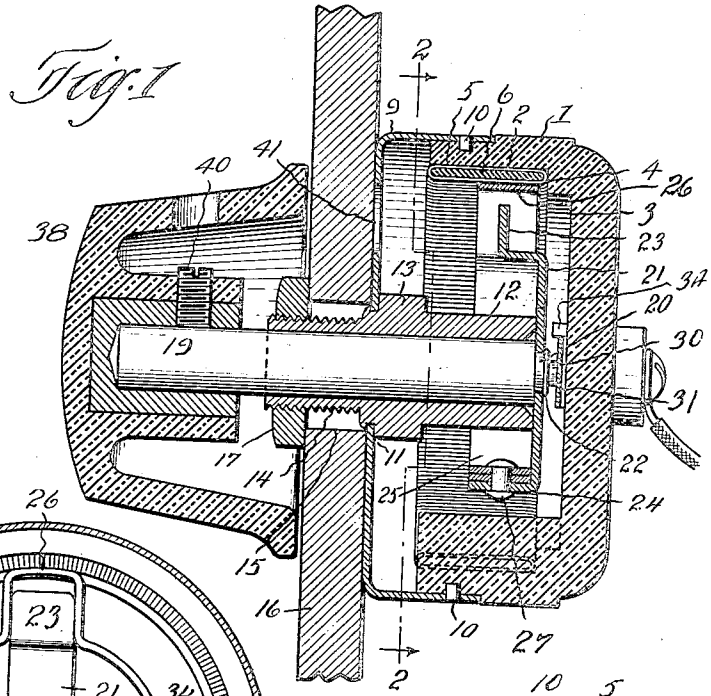
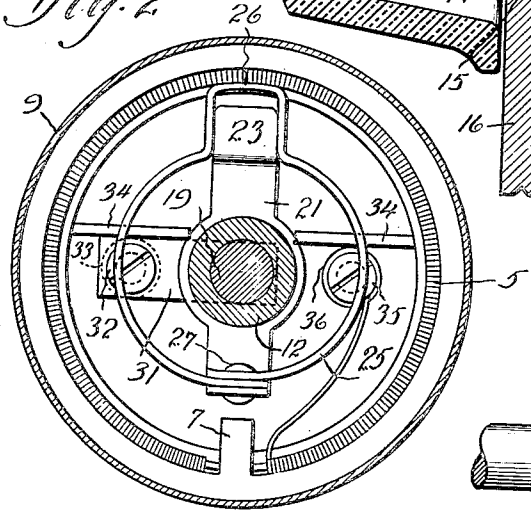



Fig. 2



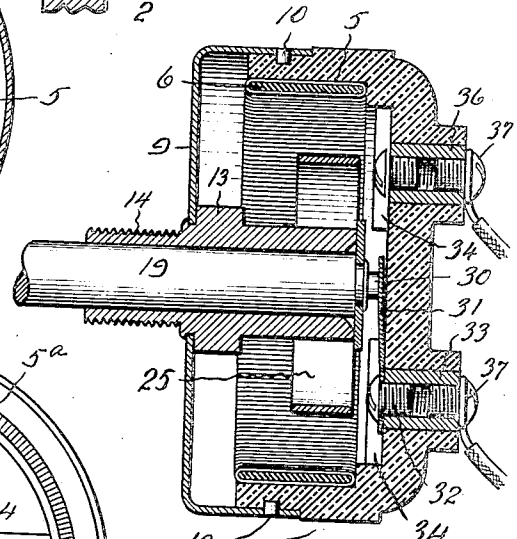




Fig. 3

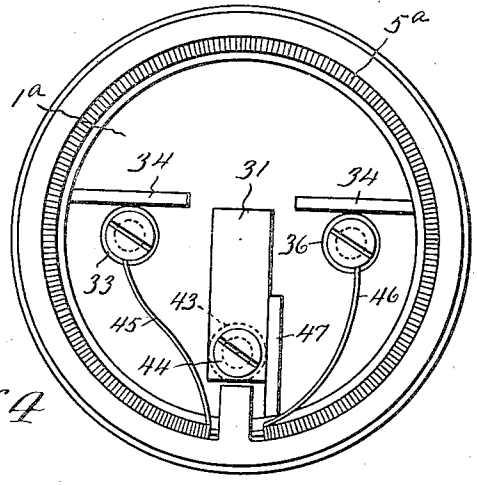



Fig. 4

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# UNITED STATES PATENT OFFICE

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## VARIABLE RESISTANCE UNIT

Application filed February 24, 1925. Serial No. 11,092.

This invention relates to variable resistance units and has particular reference to an improved form of potentiometer or rheostat such as commonly used in radio circuits.

The primary object of the present invention is to provide an improved form of variable resistance unit which shall be simple in construction, inexpensive to manufacture, and which shall be entirely enclosed and hence dust proof and efficient in operation.

Another object is to provide a resistance unit which shall include a resiliently mounted contact element which shall contact with the resistance element over a relatively large area thereby materially reducing the wear on the resistance element and also insure good contact at all positions.

A further object is to provide a resistance unit which shall be variable throughout its range with a particularly smooth wiping action and even pressure of the contact element with resistance element thereby providing what is commonly referred to as a smooth tread.

A still further object is to provide a resistance unit of the aforesaid character which may be constructed equally well as a potentiometer or a rheostat and which may be easily and quickly mounted on a panel.

With these and other objects in view, the invention consists in the various novel features of construction and arrangement or combination, all of which will be fully described hereinafter and pointed out in the appended claims.

In the drawing accompanying and forming a part of this application, Fig. 1 is a vertical sectional view through a rheostat constructed in accordance with my invention and showing the same mounted on a panel; Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1; Fig. 3 is a vertical sectional view taken at right angles to that shown in Fig. 1; and Fig. 4 is a front elevation of the casing with the variable contact finger assembly removed therefrom and showing the manner of connecting the resistance element when used as a potentiometer.

Describing the various parts by reference characters and referring particularly to Figs. 1 to 3, 1 denotes a portion of the casing of my device which is preferably formed from any suitable insulating material such as bakelite. This casing is provided with an enlarged recess 2 and with a smaller recess 3, said recesses defining a shoulder 4 within the casing. Recess 2 is adapted to receive a resistance element 5 which is wound transversely about a non-conductor 6. This resistance element may be wound with any suitable gauge resistance wire and is substantially circular in contour so that it may be positioned within recess 2 and seated against shoulder 4. The resistance element is prevented from rotating within the casing by the ends of the insulation 6 contacting with an inwardly projecting lug 7 formed within casing 1.

A metallic cap 9 normally closes the open side of casing 1 and this cap is preferably fastened to the casing by drilling a series of apertures through the side wall of the cap and casing and inserting therein suitable dowels or pins 10.

The cap 9 is provided with a central aperture 11 which is adapted to receive a bushing 12. This bushing is formed with a reduced diameter defining a shoulder 13 which normally contacts with the inner face of cap 9 to prevent withdrawal of the bushing from the casing, and the outer end of the reduced portion is swaged over to fasten said bushing to the cap. The outer end of bushing 12 is reduced and threaded, as indicated at 14, so that this outer end may be inserted through a suitable aperture 15 in a panel 16. A nut 17 may be threaded on the outer end 14 thereby to mount the device on the panel.

A shaft 19 is rotatably mounted within bushing 12 and the inner end of the shaft is reduced, as indicated at 20 to receive an arm 21, the same being retained on the inner end of the shaft by swaging over the reduced end 20 as at 22.

One end of arm 21 is directed inwardly and upwardly as indicated at 23 while the opposite end of said arm is directed inwardly as at 24. The inwardly directed portion 24 is adapted to receive and support a con-

tact element 25 which is preferably formed from relatively thin resilient metal bent substantially circular in shape and provided at one side with an outwardly directed projection 26 which forms a contact shoe. This contact shoe is preferably formed so as to enclose the inwardly and upwardly directed end 23 of arm 21 for a purpose to be referred to hereinafter. The ends of the contact element 25 are overlapped and riveted as at 27 to the inwardly directed end 24 of arm 21. This arrangement provides an exceedingly resilient contact shoe and at the same time provides a construction having sufficient strength to insure proper contact of shoe 26 with resistance element 25 at all times. It will be noted that the contact shoe is free to move radially to conform to any irregularities of the resistance element but is positively rotated about said resistance element at diametrically opposite points. In other words, the contact element is rotated by arm 21 through the inwardly turned end 24 and rivet 27 and also by the inwardly and upwardly directed end 23 which is positioned within the portion of the element refining the contact shoe 26, hence there will be a positive drive between shaft 19 and the contact element, so that the same will rotate directly therewith and without dragging when the shaft is rotated, and at the same time the contact shoe will be free to move radially to readily conform with the inner surface of the resistance element. The arm 23 also serves as a reinforcing member when the contact element is rotated against stop lug 7 and hence prevents the resilient contact shoe from becoming bent or jumping over the stop lug.

The reduced inner end 30 of shaft 19 is adapted to bear against a conducting spring 31 which is mounted on the inner face of the casing 1 and is fastened thereto by means of a screw 32 which is threaded in a bushing 33 projecting through said casing. This spring is normally prevented from rotating about screw 32 by means of a boss 34 formed within the casing. One end of the resistance element 5 is connected to a screw 35 which is threaded into a bushing 36 located diametrically opposite bushing 33 and the outer ends of bushings 33 and 36 are adapted to receive each a screw 37 to facilitate electrical connection of the rheostat.

The outer end of shaft 19 is adapted to receive a suitable operating knob 38 of any suitable construction which may be conveniently fastened to the shaft 19 by means of a set screw 40. If desired, the cap 9 may be formed with a suitable number of apertures 41 so as to permit inspection of the resistance element and interior contact assembly and it will be noted that these apertures are normally closed when the device is mounted on a panel, thereby excluding dust from the casing.

In Fig. 4 I have shown a slightly modified form of construction which is desirable when the device is to be used as a potentiometer. In this instance, the casing 1 is provided with bushings 33 and 36, as before, and also with a third bushing 43. Plate 31 in this instance is fastened to bushing 43 by means of a screw 44, and bushings 33 and 36 have fastened thereto, the two ends 45 and 46 of the resistance element $5^a$. A third boss 47 is formed within the casing $1^a$ to prevent rotation of contact spring 31 about screw 44. In other respects the device is essentially the same as described in connection with the rheostat.

A resistance unit constructed as above described consists of few parts which may be readily assembled and the device as a whole may be easily and conveniently mounted upon a panel by drilling a single hole therethrough. The device is entirely enclosed so as to prevent the entrance of dust or other foreign matter which, as is well known, causes such devices to be noisy in operation, when used in radio circuits. The contact shoe 26 engages over a broad area of the resistance element rather than on the edge as in previous practice and hence wear due to friction between the shoe 26 and resistance wire is reduced to a minimum.

Good electrical connection between terminal 37 and the contact shoe is insured at all times by the pressure of spring 31 against the end 30 of shaft 19. This particular manner of providing electrical connection between the terminal and contact shoe provides an automatic takeup for any wear that might develop between the outer reduced end 30 of the shaft 19 and spring 31 which would not be the case if electrical connection were made through bushing 12 which is the usual practice. The device as a whole is normally sealed to prevent tampering although if access should be desired the dowels or pins 10 may be easily drilled out, whereupon the cap 9 may be quickly removed. The terminals of the device are spaced relatively far apart and are surrounded entirely by insulating material so that connection therewith may be easily made without danger of contact with metal parts. The bearing in the device is relatively long due to the use of a thin flat plate for arm 21 and hence all wobbling of the shaft and contact shoe is eliminated.

Having thus described my invention, what I claim is:

1. A resistance unit comprising a casing, a resistance element carried by said casing, a shaft, and a resilient contact element connected to said shaft and adapted to engage with said resistance element, said contact element being substantially circular in shape and provided at one side with a projection forming a shoe, a pair of binding posts carried by said casing, a conducting spring having one end secured to one of said binding

posts and the opposite end bearing against said shaft and an electrical connection between said resistance element and the other of said binding posts.

2. In a resistance unit of the class described, a casing having a pair of binding posts carried thereby, a shaft, an arm carried by said shaft and a contact element connected to said arm, said contact element being substantially circular in shape and having a resilient projection at one side adapted to engage with said resistance element and a conducting spring connected at one end with one of said binding posts and having its opposite end bearing against said shaft.

3. A resistance unit comrising a resistance element and a contact element engaging the said resistance element, a casing enclosing said resistance element and contact element, a shaft projecting through a wall of said casing and connected with said contact element, a pair of threaded bushings projecting through said casing, a connection between one of said bushings and said resistance element and a resilient connection between the other of said bushings and said shaft and means carried by said casing for preventing relative movement between said last named connection and casing.

4. A resistance unit of the character set forth comprising a casing having a resistance element supported thereby, a shaft arranged within said casing, an arm carried by said shaft, a contact element carried by said arm and being substantially circular in shape and provided with an outwardly directed resilient portion forming a contact shoe, a stop lug on said casing for limiting the movement of said contact shoe, said arm serving as a means for preventing said shoe from jumping over said stop lug.

5. In a resistance unit of the character set forth, the combination of a casing, a resistance element supported thereby, a shaft journaled in said casing, an arm carried by said shaft, a resilient substantially circular member carried by said arm and having an outwardly directed portion surrounding one end of said arm and defining a contact shoe, said arm serving as a positive drive between said shaft and contact element so that the same will rotate directly therewith, said contact shoe being adapted to move radially in conformity with the surface of the resistance element.

In testimony whereof, I hereunto affix my signature.

BRUCE W. DAVID.