Jan. 4, 1949. I. GORDY 2,457,814

SEALED POTENTIOMETER

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Fig 1

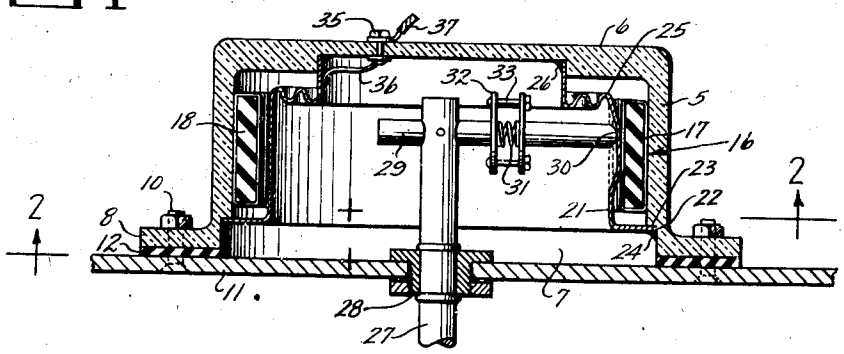
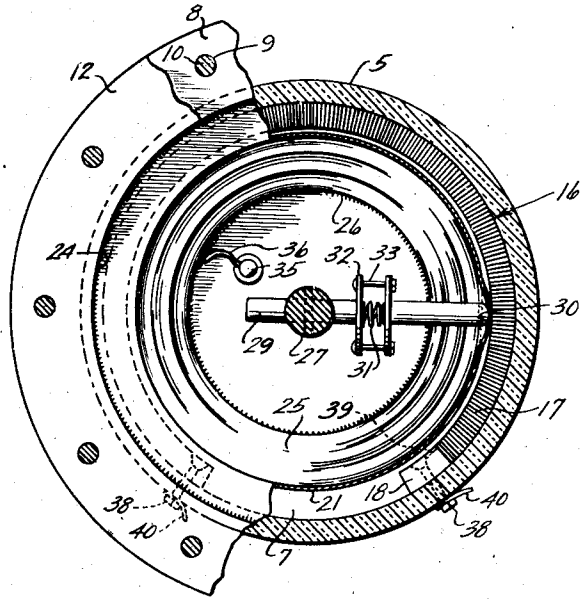


Fig 2



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SEALED POTENTIOMETER

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6 Claims. (Cl. 201—56)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to improvements in potentiometers, rheostats, and similar electrical resistance devices.

An essential object of this invention is to provide a potentiometer, rheostat, and the like, which is arranged and constructed so that all the current carrying portions of the component are protected from deleterious effects produced by moisture, salt, dust and other substances of the atmosphere.

A more particular object of this invention is to protect and seal the resistance strip with its current carrying wires in the casing by the use of a thin metal diaphragm mounted between said strip and the opening on the casing, said diaphragm being provided with bellows so as to allow for flexing of the diaphragm into engagement with the selected portion of the resistance strip and thereby complete the circuit through the device.

These and various other objects and advantages are attained with this invention as will become apparent from the following description, taken in connection with the accompanying drawings wherein the invention is shown in its preferred form, it being evident that other arrangements and forms of construction may be resorted to in carrying out the objects and purposes of this invention.

In the drawings:

Fig. 1 is a central sectional view through the potentiometer.

Fig. 2 is partly an end view and partly a sectional view, taken substantially on line 2—2 of Fig. 1.

The drawings illustrate my invention applied to a resistance mechanism which is shown in the form of a potentiometer, and it may likewise be applied to a rheostat and the like. The potentiometer as disclosed comprises a casing 5 which is substantially cup-shaped, and it is closed at one end 6 and has an opening 7 at the other end, the casing being constructed of ceramic or glass or other suitable insulating material. Flange means 8 extends radially outward from the open end 7 of the casing and is provided with apertures 9 for receiving fastening elements 10 whereby to secure the mechanism on a panel 11 or the like. The elements 10 are shown as secured through the flange 8 and the panel 11, and through a

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gasket 12 which is interposed between the flange and the panel.

The resistance strip 16 provided herein is shown as including the wire coil 17 wound upon a suitable insulating member 18. Said member or strip is in the form of a partial cylinder or partial ring providing two spaced end parts, and is mounted close to the cylindrical wall of the casing, substantially as shown herein.

A sheet member or diaphragm 21 of metal, such as phosphor-bronze, berillium, copper, etc., is mounted in the casing between the opening 7 and the resistance strip 16, and it is normally spaced from said strip. The diaphragm is substantially cylindrical or tubular in shape and it has its outward end 22 sealed onto a ledge 23 on the casing, by means of solder 24 or the like to provide a hermetical seal. The inner end of the diaphragm is mounted to allow for yielding or flexing, and it is therefore provided with bellows 25, which are preferably formed integral with said inner end of the diaphragm, and said bellows are secured sealed to the inner end 6 of the casing, by means of solder 26 or the like. The resistance strip 16 is thus hermetically sealed in the casing beneath said diaphragm 21 with its bellows 25.

An operating member is provided and includes a shaft 27 which extends rotatably through a collar 28 mounted in said panel 11. From the inner end of the shaft extends radially an arm 29 having a rounded end portion 30 which engages and is slidably movable over the cylindrical diaphragm 21, in such a manner as to depress the diaphragm into contact with the selected part of the resistance strip 16, thereby completing the circuit through the potentiometer and including the desired amount of resistance. The arm 29 is preferably arranged in two spaced parts having a spring 31 interposed therebetween, so as to constantly urge the end 30 against the diaphragm to move the latter in contact with the resistance strip; while the adjacent parts of said arm are each provided with a strap 32 operatively connected by bolts 33 extending through apertures provided in the two straps, so that these straps and the arm parts will be urged yieldably apart to press the diaphragm against the strip.

A terminal post 35 extends through the end wall 6 of the insulating casing, being secured sealed therein, and it has a wire conductor 36 connecting its inner end electrically with said bellows 25, while an electric conductor 37 is connectible to its outer end. In the potentiometer, a pair of terminal posts 38 are likewise extended through the casing and sealed therein with solder

or in some approved manner, said posts having their inner ends electrically connected by conductors **39** with the opposite ends of the resistance strip **16**, while the outer ends of these posts are connectible to electric conductors **40** in the usual manner. For the rheostat, one terminal post **38** only is used, being electrically connected to one end of the resistance strip.

I claim:

1. In a device of the class described, a tubular casing closed at one end with an opening in the opposite end thereof, a resistance strip mounted within the casing, a nonporous metallic tubular diaphragm mounted within the casing between the resistance strip and the opening and being normally closely spaced from said resistance strip, said diaphragm being secured at the outer end sealed to the casing, annular flexible sealing closure means formed at the inner end of the tubular diaphragm and extending from said end in sealing engagement with the closed end of the casing to protect and hermetically seal the resistance strip within the casing between the diaphragm and the inner wall of the casing, terminal posts extending through the casing wall and secured airtight therein, one post being electrically connected at its inner end with said diaphragm and another post extending into the closed space between the casing wall and the diaphragm and connected with said resistance strip, and rotatable shaft operating means extending centrally of the diaphragm and concentrically of the casing having means thereon to force a portion of the diaphragm into electrical contact with a selected part of the resistance strip to establish an electrical circuit including the resistance strip in the circuit of the device from said terminal posts through said diaphragm and said resistance strip.

2. In a device of the class described, a cylindrically shaped casing closed at one end and having at the other end an opening and means for mounting the casing in operative position, an electrical resistance strip having current carrying means in the shape of a circular ring mounted concentrically within the casing close to the cylindrical inner surface of the casing, a tubular shaped flexible metal nonporous contact diaphragm mounted centrally to and normally spaced from said resistance strip, said tubular diaphragm having its outer end sealed in the open end of the casing, yieldable nonporous sealing means provided at the other end of said tubular diaphragm, extending between the same and the inner end of the casing in sealing relation thereto, whereby that end is securely sealed to the casing but is afforded yieldable movement toward the resistance ring, said diaphragm and yieldable means hermetically sealing the current carrying means of the resistance strip within the casing, and electrical terminal posts sealed in the casing, one of said posts extending from the exterior into the casing between the closed end and the diaphragm yieldable sealing means with its inner end electrically connected to said resistance strip and another of said posts having its inner end connected to said diaphragm, the outer ends of said posts being adapted for connection with electricity conducting means, and movable operating means extending into the opening of the casing centrally of said tubular diaphragm including resilient pressure means bearing on the diaphragm to force the portion contacted thereby into contact with a selected part of said strip thereunder to close a circuit between said terminal posts through said resistance strip and said diaphragm.

3. In a sealed potentiometer and the like, a nonporous cup-shaped cylindrical casing having an opening at one end only, a cylindrically curved resistance strip mounted within the casing close to the inner peripheral wall thereof, a metallic tubular shaped nonporous diaphragm mounted concentrically within the casing between the resistance strip and the opening, in closely spaced relation to said strip, said diaphragm having one end flanged outwardly and secured and sealed to the casing between the resistance strip and the opening, a nonporous bellows formed integrally on the other end of the diaphragm and sealed to the closed end of the cylindrical casing to protect and hermetically seal the resistance strip in the casing between the diaphragm and the casing wall, three terminal posts extending through the casing wall, two of said posts extending into the sealed space between the tubular diaphragm and said wall and sealed therein, an electrical connection between the inner end of one of said posts and the diaphragm, and electrical connections between the ends of the resistance strip and the said two posts, and movable means extending centrally into said casing including resilient pressure means slidable on the interior of the tubular shaped diaphragm adjacent the bellows sealing portion to force a portion of the diaphragm into electrical contact with a selected part of the resistance strip.

4. In a potentiometer and the like, a cup-shaped cylindrical casing of insulating material closed at one end and open at its other end having radial flange means at the open end whereby to mount the casing on a support, a cylindrically curved electrical resistance strip mounted within the casing closely adjacent the inner wall thereof, a substantially cylindrical diaphragm of electrically conductive material mounted concentrically within the casing inwardly of said resistance strip in closely spaced relation thereto, said diaphragm having its end adjacent the casing opening secured and sealed to the casing and having a bellows portion formed at the other end extending concentrically into sealing relation with the closed end of the casing for mounting that end of the diaphragm flexibly to the casing, whereby to protect and hermetically seal the resistance strip within the casing between the diaphragm and the casing wall, terminal posts extending through the casing wall between the casing and the diaphragm and sealed therein, and an electrical connection between one post at its inner end and said diaphragm, electrical connections between two of said posts at their inner ends and the two ends of said resistance strip, and an operating shaft concentrically extending into the casing opening having an arm with radial pressure means thereon movable upon said diaphragm to force a portion thereof into electrical contact with said resistance strip.

5. In a hermetically sealed device of the class described, a cylindrical casing closed at one end, and an impervious flexible resilient cylindrical electrical contact diaphragm member disposed concentrically within the cylindrical casing in spaced relation to the inner wall thereof said diaphragm member having its opposite ends secured to the interior of the casing in hermetically sealed supporting relation thereto, to form an annular cylindrical hermetically sealed chamber within said casing, a cylindrically curved resistance strip concentrically mounted within said casing within said hermetically sealed chamber in closely

spaced relation to the outer periphery of said cylindrical electrical contact diaphragm, an electrical circuit terminal post extending from the exterior of the casing into the interior of said hermetically sealed chamber, an electrical connection within the said hermetically sealed chamber between said terminal posts and one end of the resistance strip, a second terminal post extending into said casing and electrically connected to said flexible resilient cylindrical electric contact diaphragm member, a rotatable operating shaft journaled concentrically within said casing, radial pressure applying means fixed on said shaft in contact with the interior of said cylindrical contact diaphragm intermediate its ends for forcing the contacted portion of said cylindrical contact diaphragm into electrical contact with the portion of the contact strip thereunder, to establish an electrical resistance circuit within said hermetically sealed chamber between said terminal posts through the inner resistance strip

and said flexible resilient electrical contact diaphragm member.

6. Apparatus as claimed in claim 5, in which the said flexible resilient cylindrical electric contact diaphragm is formed with an annular flexible bellows portion at one end adjacent the inner wall of the casing, to increase the flexibility of the diaphragm toward the resistance strip that is located in the sealed chamber.

IRVING GORDY.

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