

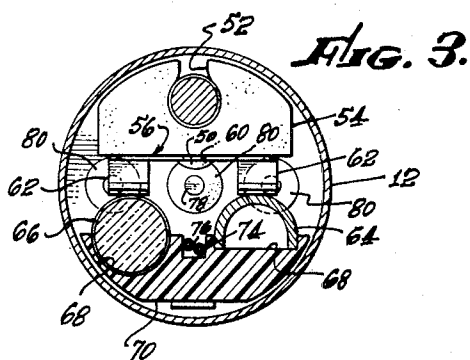
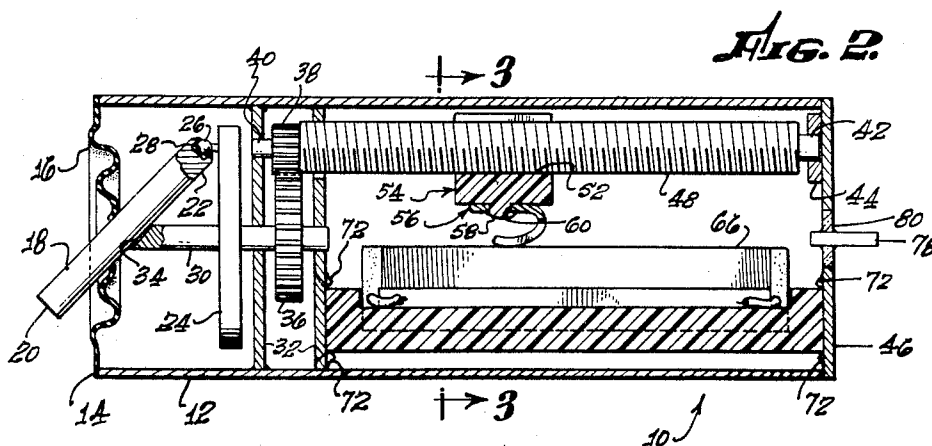
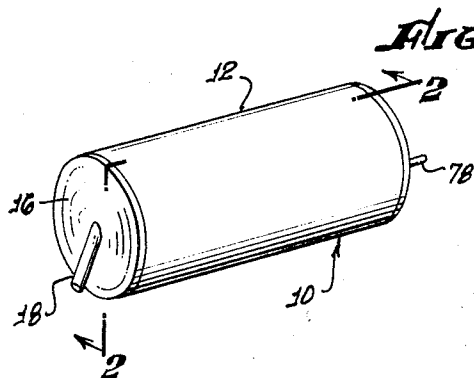
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VARIABLE RESISTOR

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1

2,873,340

VARIABLE RESISTOR

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5 Claims. (Cl. 201—62)

This invention relates to new and improved hermetically sealed electrical instruments.

Various commercial and military applications at the present time require hermetically sealed electrical instruments for use in various environments where such instruments are subjected to corrosive atmospheres, or for use in various environments where such instruments are subjected to extreme moisture, to damage by fungi or the like. A great many efforts have been made to produce satisfactory electrical instruments for such uses. In order that an electrical instrument may be satisfactorily employed in various circumstances such as are briefly discussed above, it is necessary that an instrument be immune to the various factors indicated and that it possess a high degree of reliability, that it be relatively inexpensive to manufacture and that it be resistant to extremely rough handling.

It is a broad object of the present invention to provide adjustable electrical instruments, such as, in particular, potentiometers which meet substantially all the above qualifications. A further object of the invention is to provide hermetically sealed electrical instruments employing a "wobbly" type shaft construction in conjunction with a flexible diaphragm to actuate or adjust various electrical means within the instrument. A still further object of this invention is to provide a construction in which effective use of the space within a housing is made by connecting, as will be more fully described, a centrally located shaft employed in adjusting an electrical instrument to another shaft carrying an operative part of this instrument, this other shaft being located at one side of the housing employed. Another object of this invention is to provide a novel post construction which may be slipped into place upon a threaded shaft, which post may be self threading in nature and which is capable of springing away from a threaded shaft when moved into engagement with an object so as to prevent damage.

Because of the nature of this invention it is not considered necessary to set forth in the specification a further long list of the various other objects and advantages of the invention. Such other objects and advantages of the invention will be more fully apparent to those skilled in the art to which this invention pertains from a detailed consideration of the remainder of this specification, including the appended claims and the accompanying drawing in which:

Fig. 1 is a perspective view of an adjustable electrical instrument of this invention;

Fig. 2 is a cross sectional view taken at line 2—2 of Fig. 1;

Fig. 3 is a cross sectional view taken at line 3—3 of Fig. 2.

In all figures of the drawing, like numerals are used to designate like parts. It is to be understood that this invention is not to be considered as being limited by the accompanying drawing. In this drawing there is shown a presently preferred unit of the invention. Those skilled

2

in the design and manufacture of electrical instruments will realize that the actual details of this unit may be varied within extremely wide limits without changing the operation of this specific instrument. Because of this, this invention is to be accorded comparatively wide latitude and is to be considered to being limited only by the appended claims.

In order that the invention may be more fully understood it may be stated in essentially summary form that it involves electrical instruments each of which is formed so as to include: a housing having an end; a diaphragm mounted upon the end of the housing so as to seal the housing; what may be termed shaft means secured to the diaphragm so as to extend from both sides of it; rotary means rotatably mounted within the housing so as to be engaged by an end of the shaft means projecting into the interior of the housing; an adjustable electrical instrument assembly mounted within said housing; and means operatively connected to the rotary means for adjusting this electrical instrument assembly. Those skilled in the art will recognize from the accompanying drawing that the electrical instrument assembly referred to in the above brief summary is, with the preferred embodiment of this invention as illustrated, a potentiometer. Obviously, however, the basic principles of this invention can be applied to a variety of other related electrical instruments.

The actual details of the invention are best explained by referring directly to the accompanying drawing. Here there is shown an electrical instrument 10 of the invention; as will be more fully explained in detail this instrument is a potentiometer. The instrument itself is formed so as to include an external can-like metal housing 12 formed of metal. This housing has an open end 14 across the top of which there is located a corrugated diaphragm 16 serving to seal this housing. This diaphragm may be conveniently formed of brass or other equivalent metals, or it may also be formed of such resinous materials as polytetrafluorethylene or the like. It is important, however, that the diaphragm 16 be flexible so that this diaphragm may bend to accommodate a "wobbly" type of movement of a shaft 18. As is best seen in Fig. 2 of the drawings, the shaft 18 is attached and a center section to the diaphragm 16 so as to have ends 20 and 22 extending from each side of the diaphragm 16. It will be specifically noted that with this construction the shaft 18 extends at an angle to the axis of the housing 12 and at an angle to a line drawn perpendicular to the center of the diaphragm 16.

The purpose of this construction is so that the diaphragm 16 will move or give as the shaft 18 is "wobbled" about the center of this diaphragm through engagement of the end 20. Such motion results in rotation of a rotatable disc 24 positioned within the housing 12 itself. This disc is provided with a small ball shaped extension 26 which is designed to fit within a spherical cavity 28 in the end 22 of the shaft 18. It will be recognized that the cavity 28 and the extension 26 constitute what may be termed a common ball and socket connection between the shaft 18 and the disc 24. Other equivalent connections may be utilized if desired.

The disc 24 is mounted upon a small elongated shaft 30 supported upon cross plates 32 positioned within the housing 12. These plates 32 serve as bearing means and may be conveniently secured to the housing 12 by welding or the like. The shaft 30 includes a grooved end 34 designed to support the shaft 18 during the movement of this shaft; it also carries between the cross plates 32 a comparatively large gear 36 which engages another smaller gear 38 mounted upon a shaft 40. This shaft 40 is carried in part by one of the cross plates 32 and is provided by an

3

extension 42 fitting within a small bearing bracket 44 secured as by welding or the like to the bottom 46 of the housing 12. The center section of the shaft 40 is provided as shown in Fig. 2 with a threaded section 48.

This threaded section 48 engages correspondingly shaped threads formed within a partially cylindrical groove 52 in a non-conductive post, or movable member 54. This post may be conveniently formed out of any of a large number of materials such as, for example, various phenolic compositions or the like. It is preferred, however, to form the post 54 as shown out of various flexible or semi-flexible resilient resinous materials such as various polyamides of which nylon 66 or nylon 68 are examples. When so formed, the groove 52 is smooth and is preferably not threaded during manufacture since this groove 52 is self threaded as the post 54 engages the threaded section 48 on the shaft 40. It is considered obvious from the above that the post 54 can easily be snapped into position by virtue of the curved entrance structure to the groove 52. As can be seen in Fig. 3 of the drawing, the bottom of this groove is of larger than semi-cylindrical configuration, while the entrance to the groove 52 is narrower than the diameter of the shaft 48. These size limitations result in a structure in which the post 54 can be secured to the shaft 48 by essentially a snapping process prior to assembly of the complete instrument. It is to be specifically noted that with the preferred construction shown that the post 54 will "give" so as to in effect enlarge the slot 52 when moved so as to hit against either the plates 32 or the bottom 46 so as to avoid the stripping of threads. This result is important, and obviously, the post structure shown can be employed with other electrical instruments in order to achieve this result.

Attached to the bottom of the post 54 is a small metallic contact member 56; one very convenient means of attaching this contact member 56 is to provide the post 54 with at least one small projection 58 which fits within corresponding holes in the base 60 of the contact member 56. These projections may, after being so located, be headed over as through the use of a soldering iron or the like so as to firmly secure the contact member 56 in an operative position. From the base 60 of this contact member there project resilient contact arms or fingers 62 which are designed to engage a metallic U-shaped electrical return 64 and a conventional wire-wound resistance element 66.

Both of these two latter elements are mounted within grooves 68 formed within a non-conductive support 70. This support 70 may be manufactured by various conventional techniques out of such rigid thermosetting resins as various phenolic compositions or the like; it is designed to be held in place within the housing 12 by means of small nipple like extensions 72 formed upon one of the cross-plates 32 and formed upon the bottom 46 of the housing 12. If desired, any other equivalent means may, however, be utilized so as to mount this support 70. It will be specifically noted that the support 70 is provided with a small groove 74 designed to carry electrical wires 76 from the ends of the resistance element 66 and the electrical return 68 to conventional terminals 78 insulated from the housing 12 by means of fused ceramic washers 80.

The operation of the instrument 10 is extremely simple. During use the shaft 18 is "wobbled" about the center of the diaphragm 16. As previously indicated, this diaphragm is of a flexible nature so as to permit such movement. As this movement occurs, the end 22 of the shaft 18 engages the disc 24 so as to cause this disc to rotate, and this in turn causes the shaft 40 to rotate. As the shaft 40 rotates the post 54 is moved along the threaded section 48 of this shaft. Since the contact member 56 is attached to this post, this results in the fingers 62 being moved along the electrical return 64 and the resistance element 66.

If desired, the instrument 10 can be modified in a num-

4

ber of ways. The particular structure shown is considered to be quite advantageous inasmuch as it makes a maximum use of the available volume or interior area within the housing 12 while at the same time permits a fairly restricted or limited amount of rotation of the disc 24 and the shaft 18 to result in a comparatively large amount of rotation of the shaft 40. If desired, this shaft 40 may be manufactured so as to constitute an extension of the shaft 30. It will be realized that with this type of construction the gear means described are omitted and that the threaded shaft 40 would in effect be located within the geometric center of the housing 12 so that its axis would be aligned with the center of the bellows 16. For space limitations this type of construction is not considered preferred with the invention.

It is also possible to modify the instrument 10 in a number of other manners. As an example of this, other bases of support besides the specific base or support 70 shown can be utilized, and similarly various other equivalent electrical resistance elements and electrical return structures besides those indicated can be employed. Also different types of posts and contact members besides those shown can be utilized. It is considered that the broad aspects of the features of the instrument shown can be readily applied to any electrical instrument which is designed so as to be adjusted by the rotation of a shaft. Further, the specific post structure shown can be employed with a wide variety of different instruments employing a member such as this post. Accordingly, the present invention is to be afforded comparatively wide scope and is to be considered as relating to other instruments as variable resistors and the like. Obviously the particular instrument 10 can be considered a variable resistor inasmuch as it is possible to connect the resistance element 66 and the return 64 into an electrical circuit so that this instrument can be used as a variable resistor.

Wherever the term "means" is employed in the appended claims defining the invention, this term is to be taken as describing the corresponding structure indicated in this specification or the equivalent of the same. Whenever the term "gear means" used in these claims appears, this term is to be considered broadly as defining equivalents of actual gears, such as, for example, frictional rollers. Such frictional rollers may be in the nature of rubber or similar wheels resiliently engaging one another. A friction drive of this category is advantageous in protecting an instrument in case the rotatable shaft employed is turned to such an extent that the post mounted on this shaft engages a part of the instrument so that further rotation of this shaft would cause damage to the instrument itself. In this case, when a friction drive is employed, the rollers would slip with respect to one another, preventing damage to the instrument.

We claim:

1. An electrical instrument which includes: a housing having an end; a diaphragm mounted on said end of said housing so as to seal said housing; shaft means secured of said diaphragm at the center thereof so as to extend from both sides of said diaphragm; rotary means positioned within said housing, said rotary means being designed to be engaged by an end of said shaft means within said housing; threaded shaft means operatively connected to said rotary means within said housing, said threaded shaft means being rotatably mounted within said housing; an electrical instrument assembly mounted within said housing adjacent to said threaded shaft means; and means carried by said shaft means for adjusting said electrical instrument assembly.

2. An electrical instrument as defined in claim 1 wherein said threaded shaft means are connected to said rotary means by gear means.

3. An electrical instrument as defined in claim 1 wherein said electrical instrument assembly includes: a non-conductive support; a resistance element mounted upon said support; an electrical return mounted upon said sup-

5

port; and wherein said means carried by said shaft means for adjusting said instrument assembly includes a non-conductive movable member operatively engaged by said threaded shaft means; and wherein said means carried by said shaft means includes contact means attached to said non-conductive means, said contact means engaging said resistance elements and said electrical return.

4. An electrical instrument which includes: a housing having an end; a diaphragm mounted on said end of said housing so as to seal said housing; shaft means secured to said diaphragm at the center thereof so as to extend from both sides of said diaphragm; rotary means positioned within said housing; said rotary means being designed to be engaged by an end of said shaft means within said housing; threaded shaft means operatively connected to said rotary means within said housing, said threaded shaft means being rotatably mounted within said housing; an electrical resistance element mounted within said housing parallel to said threaded shaft means; an electrical return mounted within said housing parallel to said threaded shaft means; a movable member having a threaded opening formed therein, said movable member being positioned so that the threads within said open-

6

ing engage said threaded shaft means; and contact means mounted upon said movable member, said contact means engaging said resistance element and said electrical return.

5. An electrical instrument as defined in claim 4 wherein said threaded shaft means are connected to said rotary means by gear means.

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