Nov. 11, 1958 M. E. BOURNS 2,860,217

ADJUSTABLE ELECTRICAL INSTRUMENTS

Filed Nov. 19, 1956

FIG. 1.

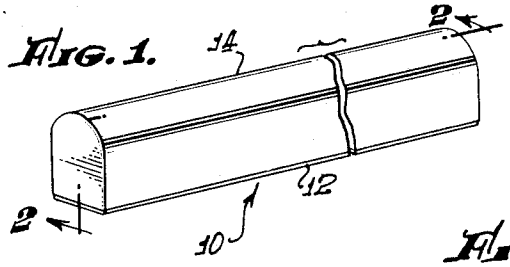


FIG. 3.

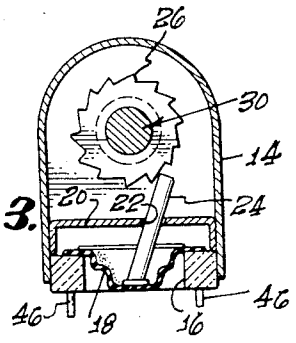


FIG. 2.

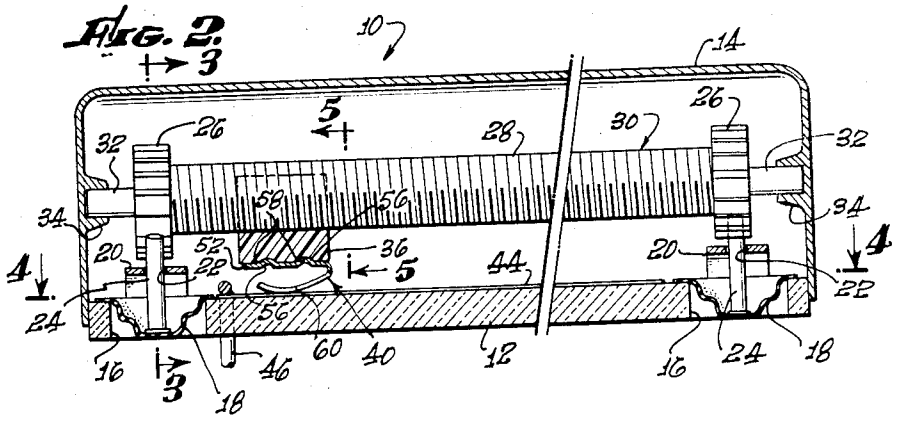


FIG. 4.

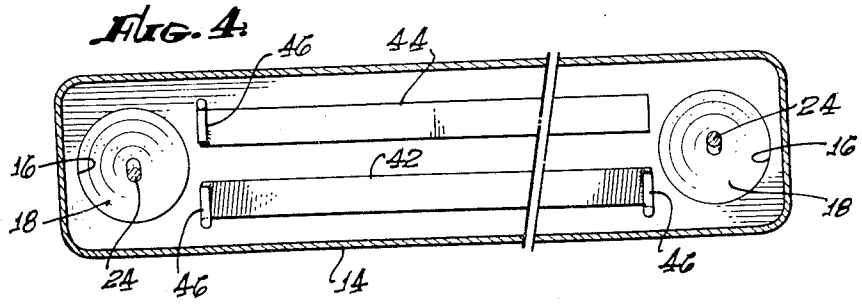
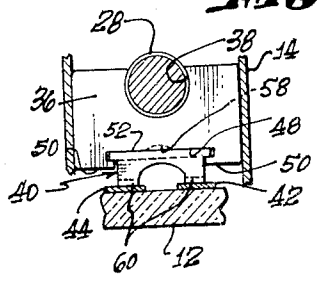


FIG. 5.



Marlan E. Bourns

INVENTOR.

By Edward D. O'Brien

ATTORNEY.

United States Patent Office 2,860,217 Patented Nov. 11, 1958

2,860,217

ADJUSTABLE ELECTRICAL INSTRUMENTS

Marlan E. Bourns, Riverside, Calif.

Application November 19, 1956, Serial No. 623,145

1 Claim. (Cl. 201—62)

This invention relates to new and improved adjustable electrical instruments.

At the present time a large number of different varieties and types of adjustable electrical instruments, such as for example, potentiometers are manufactured. Many potentiometers manufactured and sold at the present time are constructed in such a manner as to have a rotatable shaft extending from one end of an instrument. Such shafts may be rotated either by engagement with another rotatable member, or may be rotated through engagement with a screwdriver or other similar tools. This type of unit is very satisfactory for many purposes, however, an individual does not always have the necessary means available required to turn a shaft. This is particularly the case in many applications where it may be desired to adjust an electrical instrument away from a repair shop.

A large number of other adjustable electrical instruments are manufactured in such a manner that an electrical value may be adjusted by merely pulling or pushing a shaft along a given line. This type of adjustable instrument is very widely accepted and used for certain purposes. However, it suffers from a disadvantage relating to the size or space required for an instrument of this category. A shaft projecting from an instrument frequently will take up or require in effect nearly as much space as the volume of the instrument itself. In many electrical assemblies it is virtually impossible to allow this much space to be occupied by a member used only to actuate an instrument.

It is an object of this invention to provide new and improved adjustable electrical instruments which may be easily and conveniently manually adjusted without the use of various auxiliary tools, such as for example, screwdrivers, wrenches or the like. A related object of this invention is to provide electrical instruments of this nature which occupy a comparatively small volume and which do not have various shafts or other similar members extending from them. A still further object of the invention is to provide electrical instruments of the adjustable variety which are hermetically sealed.

Those familiar with the manufacture of various types of small electrical instruments will realize that there is a very definite need for new and improved hermetically sealed instruments. Such instruments must be reliable, they must be inexpensive to manufacture, and they must be capable of withstanding a great deal of physical abuse. Hermetically sealed electrical instruments meeting these qualifications are needed for applications where instruments are subjected to moisture, various corrosive gases, attack by fungi or the like.

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

Fig. 1 is a perspective view of an 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;

Fig. 4 is a cross sectional view taken at line 4—4 of Fig. 2; and

Fig. 5 is a partial cross sectional view taken at line 5—5 of Fig. 2.

In all figures of the drawing like numerals are used to designate like parts. It is to be understood that the accompanying drawing is not to be taken as limiting this invention, inasmuch as those skilled in the art to which this invention pertains may readily design a wide variety of differently appearing electrical instruments which, in spite of their different appearance, utilize the invention described in this specification.

In order that this invention may be readily understood, it may be stated in essentially summary form that it involves adjustable electrical instruments, each of which instruments is manufactured so as to include: a housing; bellows means mounted upon this housing; shaft means rotatably mounted within the housing; pawl means mounted upon the bellows means so as to extend into the housing adjacent to said shaft means; ratchet means attached to such shaft means, said ratchet means being positioned so as to be engaged by pawl means when said bellows means are moved; means constituting an adjustable electrical assembly mounted within the housing; and means for adjusting this electrical assembly mounted upon said shaft means. It will be realized from this description that the present invention relates to electrical instruments which are formed so as to utilize ratchet and pawl means operatively positioned so as to be capable of being used to turn a rotatable shaft. It will be further realized that the type of assembly indicated in the preceding discussion may be readily formed so as to be hermetically sealed in category.

The actual details of this invention are best more fully explained in detail by referring directly to the accompanying drawings. Here there is shown an electrical instrument of this invention **10** formed so as to include a ceramic base **12** and a metallic cover **14**. This base **12** and cover **14** constitute what may be termed a complete housing for the entire instrument **10**. As will be best seen in Fig. 2 of the drawings, the edge of the cover **14** is attached directly to the base **12** as by various conventional techniques such as soldering so that the base **12** and the cover **14** are sealed with respect to one another. Within the base **12** there are located two openings **16**. These openings are designed so as to contain bellows members **18**. These bellows members **18** may be conveniently formed out of brass or other equivalent resilient metals so as to have a corrugated shape and so as to be capable of deformation with respect to the base **12**. If desired, the bellows members **18** may be formed in other equivalent non-conductive materials such as, for example, such various resinous compositions as polytetrafluoroethylene and the like. The bellows **18** are of a corrugated configuration and are of essentially conical shape, and are manufactured so that the enlarged ends of these bellows **18** are secured directly to the inside or upper surface of the base **12** as by soldering or other conventional techniques. It will be realized that these bellows **18** hermetically seal the instrument **10**.

Upon this base **12** there are positioned two generally U-shaped brackets or guides **20**. If desired, these guides may be secured as shown so as to be welded directly to the cover **14** in such a manner that they serve to space

this cover with respect to the base 12 during assembly. Within each of the guides 20 there are formed centrally located openings 22 designed to serve as guide openings or bearings for pawls 24, the bases of which are attached directly to the center of each of the bellows 18 as by soldering, brazing or the like. The ends of these pawls 24 are shaped as indicated in Fig. 3 of the drawings so as to be adapted to engage ratchets 26 formed adjacent to the ends of a threaded section 28 of a rotatable shaft 30. The ends of the shaft 30 are formed with small cylindrical projections 32 which fit within cylindrical bearings 34 attached to the ends of the cover 14. If desired, such bearings can, of course, be separate members and can be supported directly upon the base 12.

The bellows 18 are preferably formed of a spring-like character so as to automatically revert to the configurations illustrated in the drawing after being depressed. When the bellows 18 are not being deformed the pawls 24 are spaced from the ratchets 26 permitting free rotation of the shaft 30. It will be noted from the aforegoing description that when the bellows 18 at the left end of Fig. 2 is pushed toward the cover 14 the corresponding pawl 24 will be moved against the corresponding ratchet 26 causing this ratchet to be used in turning the shaft 30. The other pawl 24 at the other end or right end of the instrument 10 as viewed in Fig. 2 of the drawing is designed so as to engage the corresponding ratchet 26 in order to turn the shaft in a reverse direction from the pawl at the left end of this instrument 10 when the bellows 18 at this right end of the instrument 10 is depressed. Thus, by appropriate choice of one of the bellows 18, it is possible to turn the shaft 30 in either a clockwise or a counterclockwise direction.

This type of mechanism is designed so that a movable member or post 36 may be positioned so that an opening 38 in this post 36 engages the threads upon the threaded section 28 of the shaft 30, and so that the post 36 may be moved from one end of the threaded section 28 to the other end of this threaded section. The purpose of moving the post 36 is so as to move a contact member 40 along an electrical resistance element 42 and an electrical return 44. In the embodiment of the invention shown, the resistance element 42 and the return 44 are preferably formed directly upon the upper surface of the base 12 as through various known techniques, such as for example, printed circuit techniques, although other equivalent elements can be mounted in other manners upon this base 12. The ends of the resistance element 42 are secured directly to various wires 46 as by welding or like techniques and at least one end of the electrical return 44 is also secured to another wire 46. These wires 46 pass through the base 12 and are fused to it so as to be permanently held in position. Thus, the wires 46 serve as terminal means which may be utilized in connecting the instrument 10 into an electrical circuit.

For the purpose of interconnecting the resistance element 42 and the return 44, the post 36 is provided with a comparatively thin slot 48 and overhanging shoulders 50 which are adapted to support a central section 52 of the metallic contact member 40. In order to permanently locate this contact member 40 with respect to the post 36, it is normally preferred to provide several projections 56 on the section 52 which are adapted to extend within correspondingly shaped depressions 58 in the post 36. From the section 52 within the contact member 40, there extend curved resilient arms 60 of a known construction which resiliently engage the resistance element 42 and the electrical return 44.

Those skilled in the art to which this invention pertains will realize that the resistance element 42 and the electrical element 44 and the contact member 54 constitute the principal parts of a complete potentiometer and that a potentiometer is an adjustable electrical instrument; thus it may be stated that these three elements constitute an adjustable electrical assembly which is adapted to be adjusted through the movement of the post 36. It may be further stated that the post 36 constitutes a means for adjusting this cylindrical assembly.

The post 36 may be formed out of the wide variety of non-conductive materials. It is presently preferred to form this post 36 out of a non-conductive thermosetting resinous material. When it is formed out of any such materials of a resilient category, such as of various polyolefins as polyethylene or of various polyamides as nylon 66, threads within the opening 36 which are designed to meet with the threads upon the threaded section 28 of the shaft 30 may be created by the resilient engagement of the opening 36 with this threaded section 28. Thus, if desired, the post 36 may be formed so as to be of a self-threading category. The external sides of the post 36 are, as shown in Fig. 5 of the drawing, designed to bear against the interior of the cover 14 in such a manner as to prevent rotation of this post as the shaft 30 is turned. Hence, it may be stated that in the instrument 10 the cover 14 serves as means tending to prevent rotation of the post.

The post 36 in the embodiment of the invention shown also serves another very important purpose. It will be realized from a detailed consideration of Figs. 2 and 3 of the drawing that normally neither of the pawls 24 contact either of the ratchets 26. Thus, the shaft 30 would normally be free to rotate, if it were not for the action of the post 36. This post in the embodiment of the invention shown fits tightly against the threaded section 28 in a resilient manner and serves to prevent unwanted rotation of this threaded section. Thus, the post 36 is, in the embodiment of the invention shown, analogous to a conventional latch member utilized in a conventional pawl and ratchet structure to prevent undesired rotation.

Those skilled in the art to which this invention pertains will realize that the basic features and principles of this invention can be utilized with other than the precise pawl and ratchet structure herein shown and described. Broadly, any pawl and ratchet structure may be utilized with this invention. It is preferred that a pawl and ratchet structure employed be actuated by two separate members substantially as shown, because of convenience of construction and because of ease of operation. In certain cases the pawl and ratchet means employed may be operated off of the same actuator, and the direction of shaft rotation obtained will depend upon the manner in which these means are actuated. Those skilled in the art to which this invention pertains will realize that it is not necessary to utilize a pawl and ratchet structure in conjunction with a bellows as shown and that a pawl may be employed so as to extend directly to the exterior of an instrument. Such use with a bellows, is however, advantageous inasmuch as such a bellows provides a convenient means for automatically returning a pawl to an initial position and a convenient means for hermetically sealing a complete electrical instrument.

The basic features of this invention can be applied to a wide variety of other different electrical assemblies besides potentiometer assemblies as shown. Thus, the basic features of this invention can easily be applied to variable resistors or the like. As an example of this, the precise electrical assembly shown can be connected into an electrical circuit as a variable resistor in a known manner without further modification by merely not connecting one of the wires 46 attached to the resistance element 42 into the circuit. Further, various equivalent structures may be substituted for certain of the members shown and described. Thus, for example, the contact means or member employed can be shaped so as to be connected to the post used in other than the manner shown. It will be realized that the ratchet means shown

and described in this application can be formed in other than the conventional manner. Thus, the ratchet means can comprise a rubber or similar roller designed to be turned by frictional engagement with an appropriate pawl means.

In view of the above factors this invention is to be afforded comparatively wide latitude and is to be considered as being limited only by the appended claim forming a part of this specification. Wherever the term "means" is employed in the claim, this term is to be taken as defining the corresponding structure as set forth in this application, or the equivalent thereof.

I claim:

A hermetically sealed variable resistor comprising an elongated housing having an enclosed cavity, a leadscrew journaled within said cavity parallel to the longitudinal axis of said housing, a resistance element mounted on said heousing within said cavity parallel to said leadscrew, a movable member operatively engaged by said leadscrew and movable thereby along the length of said resistance element when said leadscrew is rotated, contact means on said member wiping on said resistance element,

a pair of opposed ratchet wheels fixed to said leadscrew adjacent opposite ends thereof, a pawl engaging each of said ratchet wheels, and a flexible bellows operatively associated with each of said pawls, each of said bellows having an outer face exposed to the exterior of said housing, said bellows being yieldable inwardly under external pressure to engage and actuate the associated pawl against its respective ratchet wheel, thereby rotating said leadscrew in one direction or the other through an increment of rotation, each of said bellows being sealed to said housing around its entire perimeter to hermetically seal said cavity.

References Cited in the file of this patent

UNITED STATES PATENTS

2,363,132	Lightfoot et al.	Nov. 21, 1944
2,427,297	Modrey	Sept. 9, 1947
2,469,105	De Giers	May 3, 1949
2,501,674	Graham	Mar. 28, 1950
2,633,510	Schellman	Mar. 31, 1953
2,668,218	Searle	Feb. 2, 1954