

July 10, 1962

G. J. MUCHER

3,044,033

ELECTRICAL CONTROL DEVICE

Filed Dec. 8, 1960

Fig. 1

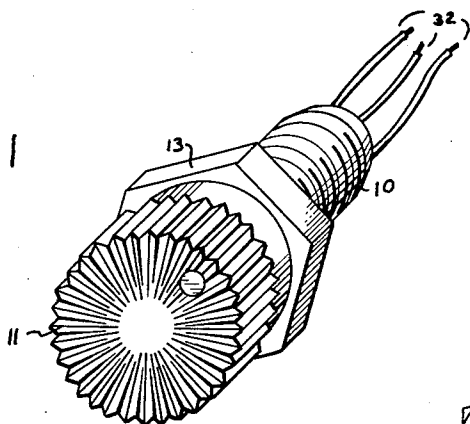


Fig. 2

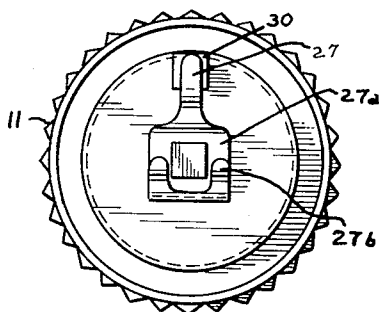
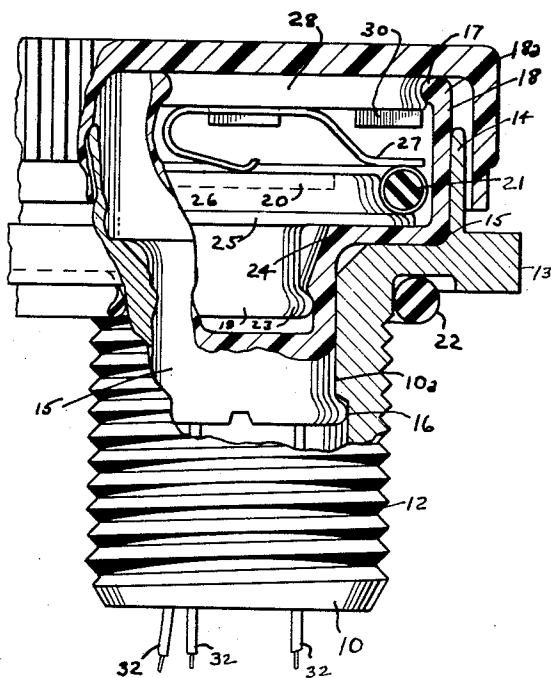


Fig. 3

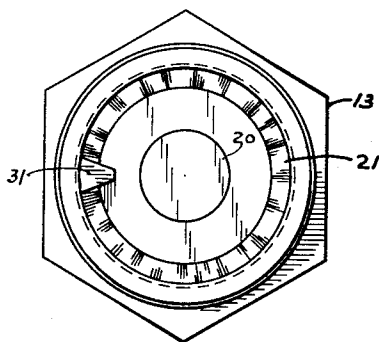


Fig. 4.

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3,044,033

ELECTRICAL CONTROL DEVICE

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Filed Dec. 8, 1960, Ser. No. 74,711

9 Claims. (Cl. 338-163)

This invention relates generally to an electrical control device and more particularly to a hermetically sealed variable resistance whose value is determined by the angular position of a contact arm which is adjusted by rotation of a shaft.

A control device referred to as a potentiometer consists essentially of a resistance section and a contact arm whose radial or angular position determines the position of the potentiometer or control device. There are potentiometers in existence today which are of the so-called single turn type which are such that a rotation of a shaft 360° results in a 360° rotation of the contact arm. There are other types in which several or many complete revolutions of the shaft are required in order to rotate the contact arm from one extremity of its travel to the other whether the contact arm is designed to move 360° or a fraction thereof. These potentiometers are generally mounted in a unit by means of a bushing through which the shaft controlling the contact arm projects so that the bushing can be rigidly mounted to a chassis or the casing of the equipment of which the potentiometer is a component. A potentiometer so mounted is adjusted for resistance value by rotation of the shaft within the bushing.

In such a device in order to achieve a hermetic seal it often becomes difficult to meet the turning torque requirements for a particular application. The reason for this is that with the designs presently available, in order to achieve a sufficient degree of hermetic sealing, the friction between the moving parts becomes so high that a very high torque is required to change the resistance value of the control device. An additional problem is encountered in control devices of this type, and especially in the miniaturization of control devices of this type, in that shaft eccentricities become difficult to cope with.

The invention herein disclosed has as its principal object the furnishing of a control device of the radial potentiometer type which has a hermetic seal which does not interfere with the changing of the resistance value of the device.

Another object of this invention is to provide a radial potentiometer whose turning torque is extremely low.

A further object of this invention is to provide a radial potentiometer in which the errors due to shaft eccentricities are substantially eliminated and one which is free from play and wobble.

A further object of this invention is to provide a potentiometer which is small for utilization within miniature installations.

The invention disclosed herein is described in terms of a potentiometer by way of example only and it should be understood that the inventive concept set forth herein can be applied by one reasonably skilled in the art to other variable parameter control devices whose value is altered by shaft movement, such as condensers, inductors, etc.

An electrical control device embodying the invention and the manner of using the same is described herein with references to the drawings in which:

FIG. 1 is a top perspective view of an electrical control device constructed in accordance with the teaching of this invention;

FIG. 2 is an elevational view of the electrical control

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device shown in FIG. 1 with portions thereof cut away to clearly disclose the internal elements thereof;

FIG. 3 is a plan view of the top portion of the electrical control device shown in FIG. 1 as viewed from beneath to disclose the contact arm; and

FIG. 4 is a plan view from above of the electrical control device illustrated in FIG. 1 with the top or cap removed therefrom disclosing the resistance coil and collector ring.

An electrical control device embodying the invention is illustrated in FIG. 1 wherein the radial potentiometer appears in a top perspective view. The device shown therein consists generally of a bushing 10 forming the housing and having a cap or top 11. Housing 10 is cylindrical having external threaded portion 12 and also having formed thereon a peripheral flange in the form of a hex 13. The hex and the threads can be metallic and the remainder of the housing can be formed of any other suitable material or the housing can be formed of a single material throughout. Housing 10 is further formed with a cylindrical wall portion 14 which is substantially rigid and projects upwardly from flange 13 forming therewith an internal shoulder portion 15 of the mounting which supports molding 16 formed of a nylon or a polyethylene material. Molding 15 is designed to be received and maintained within the bore of the housing and the molding 15 contains a cylindrical portion projecting downwardly therefrom with an external bead 16 and an inwardly projecting peripheral bead 17 at its extremities. Bead 17 is formed on an upwardly projecting cylindrical wall portion of molding 15 which is indicated by the numeral 18 in the figures. Cylindrical wall portion 18 of molding 15 has a greater diameter than has the cylindrical portion of molding 15 immediately adjacent outwardly facing peripheral bead 16. Molding 15 is hollow throughout and since it is formed of a resilient material it can be mounted within housing 10 by means of a press fit since outwardly facing bead 16 has a greater external diameter than the internal diameter of section 10a of the housing forms with a remaining portion of the housing a shoulder so that when the peripheral bead 16 of molding 15 is engaging the shoulder formed by section 10a of the housing and the greater diameter section 18 of molding 15 is engaging shoulder 15 of the housing, the molding 15 is prevented from motion within the housing.

A second molding which is designated in the figures by the numeral 19 is provided for supporting the collector ring 20 and winding or resistance coil 21. Molding 19 can be formed of any suitable material and it can be formed of the same material from which molding 15 is formed. It is preferred, however, that molding 19 be somewhat rigid and it is required in this embodiment that molding 19 be formed of a material which is an electrical insulating material so that the collector ring 20 and electrical resistance winding 21 are electrically isolated from the remaining parts of the assembly and insures that the collector ring and winding 21 are insulated from the chassis of the assembly which is not shown herein but which in the normal installation is generally flush against flange 13. It is for this mounting of the fully assembled component that flange 13 is in the form of a hex for which threads 12 are provided. Additionally, mounting seal or O-ring 22 is provided to aid in the mounting of the assembly to the chassis.

Molding 19 is formed with a downwardly projecting cylindrical portion with an outwardly facing peripheral bead 23 as was molding 15. The downwardly projecting cylindrical portion is formed to be received within the bore of molding 15 and bead 23 is provided for the same purpose for which bead 16 has been provided with re-

spect to molding 15. Additionally, the bore of molding 15 is formed to provide a shoulder 24 against which flange 25 of molding 19 seats in order to maintain molding 19 within molding 15 in the manner in which molding 15 itself is maintained within housing 10.

Flange 25 is also formed with a circumferential groove 26 for receiving therein winding 21. Collector disk or ring 20 is maintained in molding 19 by being rigidly fastened in a central recessed portion thereof formed for this purpose so that collector ring 20 and electrical winding 21 are concentrically arranged. The disk is cemented in the recess provided therefore and the electrical resistance wire is cemented in the groove. Both of these members have the upper surface thereof exposed so that they can be engaged by contact member 27 which is rigidly fastened to the under surface of cap 11.

Cap 11 is circular and has a cylindrical section projecting downwardly from its under surface and forming an outwardly facing groove 28 which has a radius sufficient for the groove 28 to receive therein bead 17 of portion 13 of molding 15. It is noted that section 14 of the housing provides a rigid backing for the major portion of cylindrical wall 18. However, an extreme portion 18a of resilient wall 18 does not have the benefit of rigid backing 14. It is on this extreme portion that the bead 17 is provided.

When bead 17 is received in groove 28 the cap 11 is firmly maintained on the assembly and the cap can be rotated.

The electrical contact 27 is a three point contact and is provided with point 27a which is designed to engage the electrical winding 21 and points 27b which are designed to engage the collector ring. Such a three point contact and the absence of a shaft provide a bearing mounting with a maximum diameter available for a device of this size without a shaft, without journaling on metal, and it eliminates wobbling. Bead 17 within the groove 28 provides a hermetic seal as well as the means for rotating cap 11 and contact 27 so that the contact can sweep over the collector ring and the electrical winding. Additionally, it is provided that the extreme upper portion of portion 18 of molding 15 engages a circumference on the under surface of cap 11 to provide additional hermetic sealing.

In the particular embodiment disclosed herein, stops 30 and 31 are provided to present a device that cannot be rotated through an angle of more than 360°. Stop 30 is provided on the under surface of cap 11 and stop 31 is provided on molding 19. The stops are arranged so that stop 30 will abut stop 31 at the beginning of its rotation and will abut stop 31 again at the other extreme of its rotation.

The bore of housing 10, if it is desired, can be filled with filler compound so that there is sealing at this end. The filler compound if it is desired can be extended within the bore of molding 15 and leads, such as leads 32 as shown in FIG. 2, can be brought from the electrical portions of the assembly through the various bores, through the filler compound and out beneath the housing.

It is seen that such a device provides a relatively simple, compact device for effecting the resistance in a circuit. The cap can be formed of a semi-hard material such as a hard phenolic or nylon and as shown in FIGS. 1 and 3 can be provided with longitudinal grooves to make it easier to grasp with the fingers. Also, the height of the cylindrical wall portion 14 can be altered in order to alter the turning torque required since the resiliency of the material of the cylindrical wall portion 18 and the height of cylindrical wall portion 14 together with the coefficient of friction between groove 28 and bead 17 determine the torque required to turn the cap.

Such a device can be easily assembled. The collector disk and the electrical wire are cemented in position on molding 19 and molding 19 is pressed within molding

15. The cover is then applied to molding 15 by snapping it into position with the bead of the molding in the bead receiving groove formed on the cover. Molding 15 is then pressed within housing 10 thereby achieving a glove fit.

Thus, among others, the several objects in the invention as specifically aforementioned are achieved. Obviously, numerous changes in construction and rearrangement of parts might be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. An electrical control device including in combination a mounting, a molding supported by said mounting, a collector ring supported by said molding, a resistance coil supported by said molding, a cylindrical wall portion of said molding formed of a resilient material, a second cylindrical wall portion of said mounting formed of a rigid material and providing an external backing for said first cylindrical wall, an extreme portion of said first cylindrical wall unsupported by said second cylindrical wall, an inwardly projecting circumferential bead on said extreme portion, a circular cover for said device, a circular bearing portion of said cover extending downwardly therefrom and terminating above said molding, an outwardly facing circular groove of said cover formed to receive said inwardly projecting bead, said bead and said circular groove forming the sole bearing support for said cover, and a contact arm rigidly fastened to said cover whereby rotation of the cover with respect to the mounting will cause the contact arm to sweep the collector ring and resistance coil.

2. An electrical control device in accordance with claim 1 in which the collector ring is circular and positioned centrally of the molding and the resistance coil is concentric therewith and the contact arm has portions thereof engaging said resistance coil and said collector ring.

3. An electrical control device in accordance with claim 2 in which the material from which the cylindrical wall portion of said molding is formed is a polyethylene.

4. An electrical control device in accordance with claim 2 in which the bead and the bead receiving groove are formed of sufficient radius so that one edge of the groove can be drawn over the bead as the bead is moved by that portion of the groove to be engaged therein in snapping contact.

5. An electrical control device in accordance with claim 2 in which the second cylindrical wall portion is so formed that the height thereof can determine the resistance to relative rotation of the cover and the molding when the bead is disposed within said groove.

6. An electrical control device in accordance with claim 4 in which the force required to insert the bead in the groove is determined by the height of the second cylindrical wall portion.

7. An electrical control device including in combination a mounting, a molding supported by said mounting, a collector ring supported by said molding, a resistance coil supported by said molding, a cylindrical wall portion of said molding formed of a resilient material, an extreme portion of said cylindrical wall, an inwardly projecting circumferential bead on said extreme portion, a circular cover for said device, a circular bearing portion of said cover extending downwardly therefrom and terminating above said molding, an outwardly facing circular groove of said cover formed to receive said inwardly projecting bead, said bead and said circular groove forming the sole bearing support for said cover, and a contact arm rigidly fastened to said cover whereby rotation of the cover with respect to the mounting will cause the contact arm to sweep the collector ring and resistance coil.

8. An electrical control device in accordance with claim 7 in which the bead and the bead receiving groove are formed of sufficient radius so that one edge of the

groove can be drawn over the bead to be engaged in the groove in snapping contact.

9. An electrical control device in accordance with claim 8 in which the force required to insert the bead in the groove is determined by the resiliency of the cylindrical wall portion of said molding. 5

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