Nov. 19, 1968 M. H. COLBURN 3,412,360

ANGULARLY ADJUSTABLE CONTROL

Filed June 23, 1965

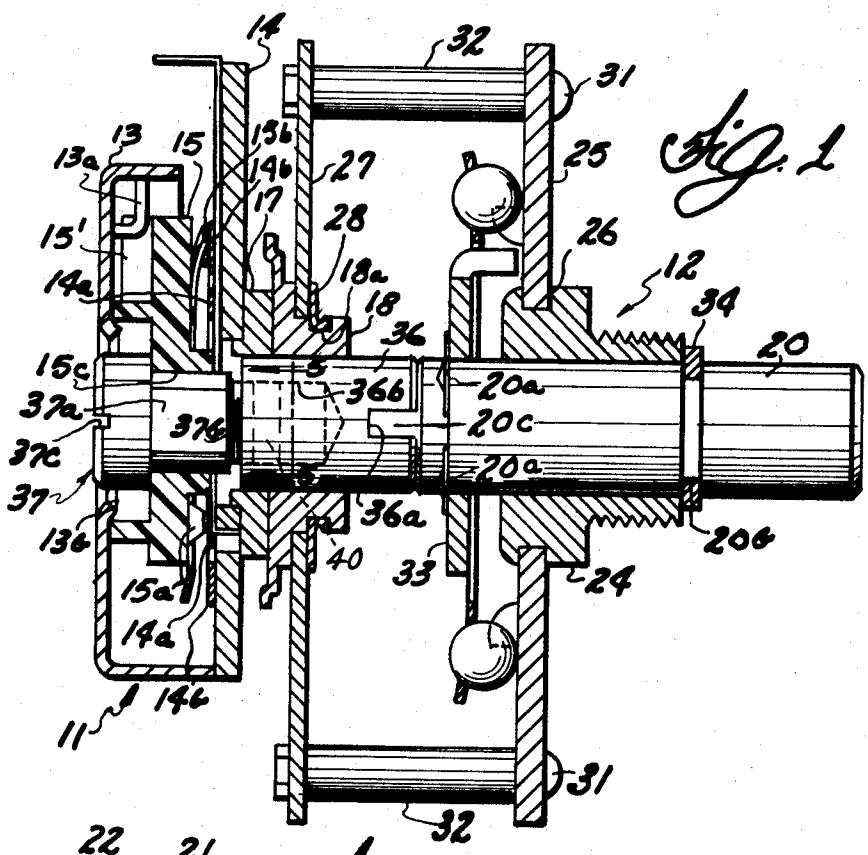


Fig. 1

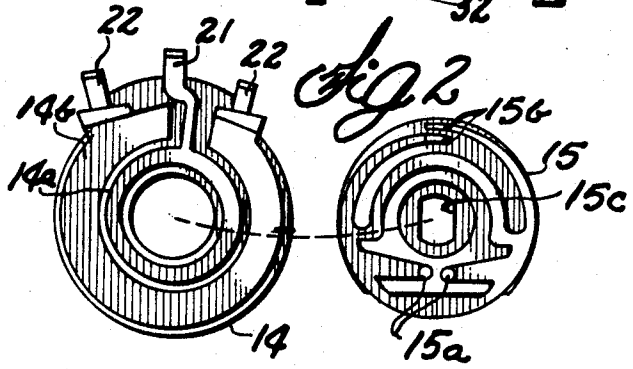


Fig. 2

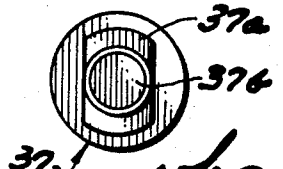


Fig. 4

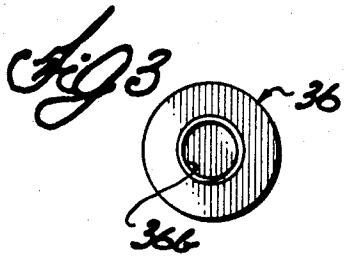


Fig. 3

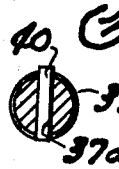


Fig. 5

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ANGULARLY ADJUSTABLE CONTROL

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ABSTRACT OF THE DISCLOSURE

A rotary electrical control is described. The driven element of the control is mounted on a first shaft which is threaded to a second shaft with a pliable insert to increase the friction. The second shaft is connected to a control shaft with a coupling allowing relative axial displacement but insuring a firm rotational drive. The control shaft is connected to a detent indexing mechanism. Rotation of the control shaft causes rotation of the driven element but the driven element may be rotated relative to the control shaft through the threaded coupling to permit angular adjustment.

The present invention relates in general to a variable electrical component and more specifically to a mechanism for use in a variable electrical component. While not so limited in its uses, the present invention finds particular advantageous utilization in connection with variable resistors.

A primary object of the present invention is to provide a new and improved variable electrical component. Another primary object is to provide a new and improved mechanism for use in a variable electrical component.

A more specific object of the present invention is to provide a new and improved mechanism for a variable electrical component which allows for rotating a control shaft and a control element thereof relative to one another. Another object is to provide a variable electrical component employing such a mechanism which is adapted for use with an index assembly. A related object is to provide such apparatus wherein the control shaft is associated with the index assembly and the mechanism allows for rotation of the control element relative to the control shaft when the control shaft is held in place by the index assembly. Another related object is to provide such apparatus which allows for varying the component value and for calibrating the component subsequent to installation thereof.

A general object of the present invention is to provide a new and improved variable electrical component characterized in its simplicity and economy. Another general object is to provide a new and improved mechanism for use with a variable electrical component which is likewise characterized in its simplicity and economy.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description taken in conjunction with the drawing.

In one form of the present invention a variable electrical component is provided which includes a rotatable control element and a rotatable control shaft. A member constructed in accordance with the teachings of the present invention is provided which includes first and second shafts drivingly connected to the control shaft and the control element so that the control element is rotated when rotational movement is imparted to the control shaft and which is adapted to allow the control element to be rotated relative to the control shaft.

The present invention will now be described in conjunction with the drawing wherein:

FIGURE 1 is a sectional side-elevational view of a variable resistor assembly including an indexing assembly

section and a variable resistor section which employs a mechanism constructed in accordance with the teachings of the present invention;

FIG. 2 is a view showing facing surfaces of a portion of the variable resistor section shown in FIG. 1;

FIG. 3 is an end view of a first shaft forming a part of the mechanism shown in FIG. 1;

FIG. 4 is an end view of a second shaft forming a part of the mechanism shown in FIG. 1; and

FIG. 5 is a sectional view of the second shaft taken substantially along line 5—5 in FIG. 1.

While the invention has been shown and will be described in some detail with reference to a particular exemplary embodiment thereof, there is no intention that it be limited to such details. Quite to the contrary it is intended here to embrace all modifications, alternatives and equivalents falling within the spirit and scope of the invention as defined by the appended claims. The mechanism constructed in accordance with the teachings of the present invention will be described in conjunction with a variable resistor. However, it will be readily apparent to those skilled in the art that the mechanism is adapted for use in conjunction with any variable electrical component or the like wherein it is desired to adjust the relative position of two rotatable elements.

Referring now to the drawing and more specifically to FIG. 1, a new and improved variable electrical component is shown which employs a mechanism constructed in accordance with the teachings of the present invention. The exemplary component includes a variable resistor **11** and an index assembly **12**.

The variable resistor **11** (FIGS. 1 and 2) includes a cup-like main outer housing or cover **13**. A stator **14** and a rotatable control element or rotor **15** are mounted within the housing **13** and are maintained therein by a front plate **17** which is suitably secured to the housing to close the open end thereof. As may be seen, a bushing **18** is associated with the front plate **17**. The control element or rotor **15** and the stator **14** are formed of a non-conductive material, such as phenolic, and are mounted so that the rotor may be rotated relative to the stator. A control shaft **20** is provided for imparting rotational movement to the rotor **15**, as will become apparent. The rotor **15** has a rearwardly extending projection **15'** which is adapted to engage a stop **13***a* formed as part of the housing **13** so that the rotor is limited to rotation through one revolution. The stator **14** has an inner conductive contact ring **14***a* mounted thereon which is electrically connected to a radially extending output terminal **21** and which is engaged by a resilient contact **15***a* mounted on the rotor **15**. Additionally, the stator **14** has an outer ring of resistive material **14***b* mounted thereon which is electrically connected to radially extending output terminals **22** and which is engaged by a resilient contact **15***b* mounted on the rotor. The resilient contacts **15***a* and **15***b* mounted on the rotor **15** are electrically connected together so that a circuit is completed thereby between the inner and outer rings **14***a* and **14***b* on the stator.

In view of the foregoing, it will be apparent that a resistance will be provided between output terminals **21** and **22** which is dependent upon the position along the ring of resistive material **14***b* with which the resilient contact **15***b* is in engagement. Moreover, it will be apparent that the resistive value provided between terminals **21** and **22** may be varied by imparting rotational movement to the rotor **15** and thus by varying the position along the ring of resistive material **14***b* with which the resilient contact **15***b* is in engagement.

In the exemplary arrangement, a ball detent type indexing assembly **12** (FIG. 1) is associated with the control shaft **20** so that rotational movement of the control shaft is controlled thereby. More specifically, the control

shaft **20** is normally held substantially rigidly in place by the indexing assembly. The indexing assembly is mounted in spaced relationship with the variable resistor **11**. The ball detent assembly includes a hub **24** through which the control shaft **20** extends. A plate **25** is fixedly secured to the hub **24** in any suitable manner as by a rolled connection **26** and the plate **25** is fixedly secured to a support plate **27** associated with the variable resistor **11**. The support plate **27** is suitably secured to the bushing **18** such as by a Tinnerman fastener **28** which is received in a circumferential groove **18***a* provided in the bushing. The plate **25** may, for example, be secured to the plate **27** by means of bolts **31** extending through aligned apertures in the plates **25** and **27**, with cylindrical spacers **32** being carried by the bolts to maintain the plates in generally parallel spaced relationship. Additionally, the index assembly **12** includes a small plate **33** telescoped on the shaft **11** and held against axial movement along the shaft toward the variable resistor **11** by staked shaft portions **20***a*, thus holding shaft **20** against movement through the hub **24** in a direction to the right as viewed in FIG. 1. A C-washer **34** received in a circumferential groove **20***b* in the shaft **20** prevents movement of the shaft in an opposite direction. Since the ball detent type indexing mechanism **12** is of the conventional type and does not constitute a portion of the present invention, further details thereof will not be set forth herein.

In accordance with the present invention a mechanism is provided for connecting the control shaft **20** to the control element or rotor **15** so that the rotor is rotated with the control shaft and may be rotated relative to the control shaft when the control shaft is held in place by the indexing mechanism **12**. In its exemplary form the mechanism includes a first shaft **36** drivingly connected to the control shaft **20** and a second shaft **37** drivingly connected to the rotor **15**. As may be seen, the shaft **36** extends through bores provided in the bushing **18**, the front plate **17** and the stator **14**. For the purpose of drivingly connecting the first shaft **36** to the control shaft **20** a radial slot **36***a* is provided in the forward or right-hand end of the shaft **36** as viewed in FIG. 1 and the control shaft **20** is provided with a rearwardly extending radial projection **20***c* which is adapted to be keyed to or received in the radial slot **36***a* of the shaft **36**. For the purpose of drivingly connecting the second shaft **37** to the rotor **15** the shaft **37** is provided with an intermediate portion **37***a* which has a frusto-circular cross section as shown in FIG. 4 and which is received within a corresponding aperture **15***c* extending through the rotor **15**. In other words, the intermediate portion **37***a* of the shaft **37** and the aperture **15***c* of the rotor **15** have cross sections corresponding to a circle having diametrically opposite segments removed therefrom to define flat or straight side portions and the portion **37***a* is drivingly received within the aperture **15***c*.

In keeping with the present invention, the shaft **36** and the shaft **37** are connected together so that they may be rotated together or rotated relative to one another. For this purpose, the shaft **37** is provided with a threaded portion **37***b* (see FIGS. 1 and 4) which is threadedly received within a threaded bore **36***b* provided in the shaft **36** (see FIGS. 1 and 3). Consequently, the shafts **36** and **37** may be rotated relative to one another by threading the portion **37***b* of the shaft **37** into or out of the bore **36***b* of the shaft **36**.

For this latter purpose, the shaft **37** extends rearwardly of the variable resistor **11** through an aperture **13***b* provided in the housing **13** and the shaft **37** is provided with a rearwardly extending radial slot **37***c*. Accordingly, an object such as a screwdriver may be inserted within the slot **37***c* so that rotational movement may be imparted to the shaft **37** from the rear of the variable resistor **11**. Since the control shaft **20** is normally held substantially rigidly in place by the index mechanism **12** and the shaft **36** is drivingly connected to the control shaft **20**, it will be readily apparent that, when rotational movement may be imparted to the shaft **37** from the rear of the variable resistor, the shaft **37** is rotated relative to the shaft **36** so that the rotor or control element **15** is rotated relative to the control shaft **20**.

Thus, the mechanism allows for calibration of the rotor **15** with respect to the control shaft **20**.

On the other hand, it is desirable for the shafts **36** and **37** to be rotated together when rotational movement is imparted to the control shaft **20** so that the rotor **15** is rotated simultaneously with the control shaft **20** and the variable resistor **11** is thereby varied. To insure such concurrent rotational movement, a radial bore **37***d* (FIG. 5) is provided in the threaded portion **37***b* of the shaft **37** and an insert **40** formed of a pliable material is extended through the bore **37***d* so that it extends outwardly of the threaded portion **37***b*. In other words, the insert **40** is designed to be greater in length than the bore **37***d*. When the threaded portion **37***b* of the shaft **37** is threaded into the bore **36***b* of the clutch shaft **36**, the insert **40** is compressed within the bore **37***d* and the insert exerts an outwardly directed binding force against the bore **36***b* of the shaft **36** which insures that the shafts **36** and **37** rotate together in the absence of some opposing force being applied to one of the shafts. The insert **40** may be constructed of a material such as nylon and may be press fit into the bore **37***d*.

As previously mentioned, the exemplary rotor **15** has a projection **15'** which engages a stop **13***a* to limit rotational movement of the rotor. The index assembly **12** is preferably also provided with stop means (not shown) which is the controlling stop means. In order to insure that calibration of the variable resistor **11** in such an arrangement is not lost subsequent to the calibration thereof by relative rotational movement of the shafts, the index assembly will be provided with a smaller angular sweep than the rotor **15** and the amount of calibration of the variable resistor will be limited by the difference between the angular sweeps of the index assembly and the rotor. However, the invention may be readily modified to eliminate this limitation and, therefore, the invention is not intended to be limited to such detail.

In view of the foregoing it will be seen that a new and improved variable resistor element has been provided. More specifically, it may be seen that a mechanism is provided for utilization in connection with a variable electrical component such as a variable resistor. Moreover, it will be seen that a mechanism has been provided for use with a variable electrical component which allows for adjustment of the component to vary the value thereof and to calibrate the component even after the component has been secured to an indexing mechanism or the like.

I claim:

1. In a variable component, the combination which comprises a rotatable control element having a varying electrical characteristic dependent upon its rotational position, a control shaft, means supporting said control shaft for rotational movement but preventing axial movement, axially displaceable means coupling the control shaft to the control element for causing the control element to be rotated with the control shaft when rotational movement is imparted to the control shaft and for allowing the control element to be rotated relative to the control shaft whereby the electrical characteristic of said control element may be varied by rotating said control shaft or by rotating said control element relative to said control shaft.

2. In a variable electrical component, the combination which comprises a rotatable control element having a varying electrical characteristic dependent upon its rotational position, a control shaft, first and second axially aligned shafts drivingly connected respectively to the control shaft and to the control element, means for coupling said first and second shafts for causing the control element

to be rotated with the control shaft when rotational movement is imparted to the control shaft and for allowing the control element to be rotated relative to the control shaft whereby the electrical characteristic of said control shaft or by rotating said second shaft relative to said first shaft and said control shaft.

3. In a variable electrical component, the combination which comprises a rotatable control element having a varying electrical characteristic dependent upon its rotational position, a control shaft, a first shaft having a threaded bore formed therein and drivingly connected to the control shaft, a second shaft having a threaded portion extending therefrom which has a radial bore, and an insert formed of a pliable material positioned in the radial bore which is greater in length than the radial bore, the threaded portion being threadably received in the threaded bore and the insert allowing the first and second shafts to be rotated together with said control shaft and to be rotated relative to one another, the second shaft being drivingly connected to the control element whereby the electrical characteristic of said control element may be varied by rotating said control shaft or by rotating said second shaft relative to said first shaft and said control shaft.

4. The component as recited in claim **3** wherein the radial bore extends through the threaded portion.

5. The component as recited in claim **3** wherein the insert is formed of nylon.

6. A variable rotary component including a driven member threaded to a shaft, means for rotating said driven member relative to said shaft, a driving member coupled to said shaft through a rotary drive connection allowing relative axial displacement of said driven member and shaft, said driven member having a relatively fixed axial position with respect to said driving member, said driven member, said shaft, and said driving member being in axial alignment with one another.

7. The component of claim **6** further including means for increasing the friction at the threaded connection between said shaft and driven member.

8. The component of claim **7** wherein said means includes a resilient material carried by the threaded portion of said connection.

9. The component of claim **6** further including a housing in which said driving member is rotatably mounted and a detent for increasing the resistance to rotation between the driving member and the housing.

10. The component of claim **6** wherein said connection is a longitudinally extending slot on one of the coupled members and a longitudinal extension on the other of the coupled members, said extension and slot engaging one another.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,412,360 November 19, 1968

Michael Heath Colburn

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 21, before "shaft" cancel "clutch". Column 5, line 4, after "control" insert -- element may be varied by rotating said control --.

Signed and sealed this 31st day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents