Feb. 14, 1961 E. BLANCO 2,972,124

POTENTIOMETER

Filed July 14, 1958

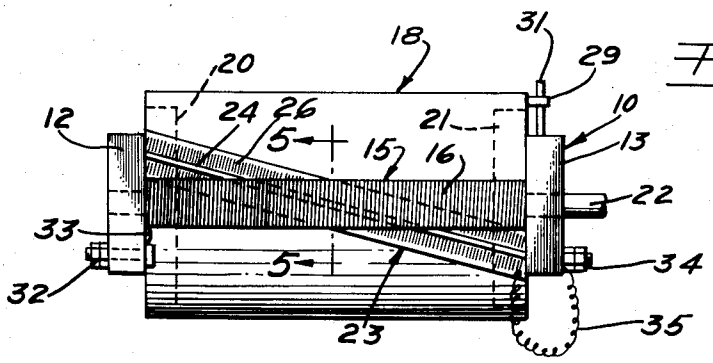


Fig. 1.

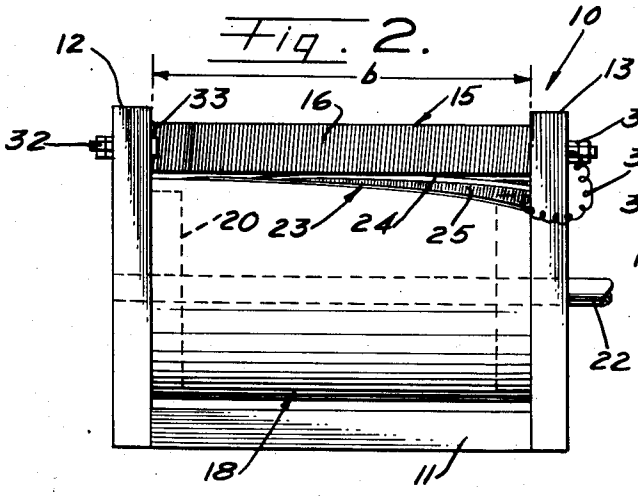


Fig. 2.

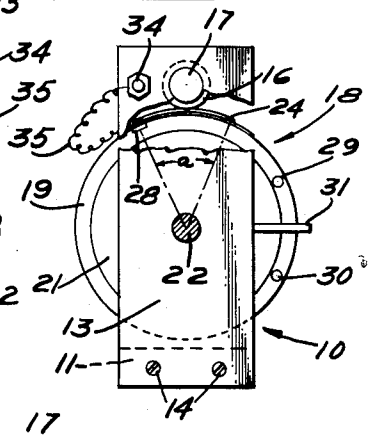


Fig. 3.

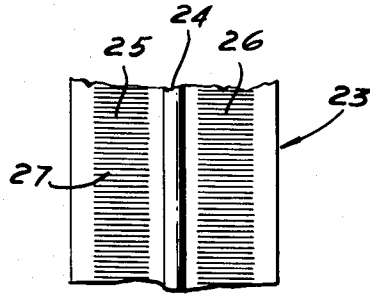


Fig. 4.

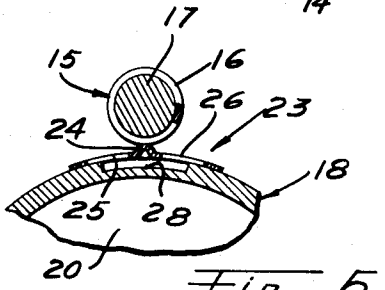


Fig. 5.

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2,972,124

POTENTIOMETER

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3 Claims. (Cl. 338—202)

The present invention relates generally to variable resistors or potentiometers, and is more particularly concerned with devices of this type which may be built in miniature or extremely small sizes.

Heretofore it has been a baffling problem to obtain in miniature or extremely small size potentiometers a high order of resolution, and in order to obtain the required fine adjustment over a relatively large number of turns of resistance wire, various expedients have been tried for amplifying the movement of the variable contact. Various mechanical arrangements have been utilized, but these have been more or less unsuccessful due to space limitations, and disadvantages which are inherent in the conventional tried mechanical movements, such as backlash, lost motion, and the like.

Having in mind the foregoing, it is one object of the herein described invention to provide a variable resistor wherein a high amplification of contact movement will be obtained to the end that fine resolution will result, and which will not embody the undesirable features of the prior devices.

A further object of the invention is to provide in devices forming the subject matter of the present application novel motion amplifying means whereby a small angular movement may be amplified to give a materially greater effective contact movement over the coil turns of a resistance element, which means will be of simple design and devoid of backlash and other undesirable characteristics.

A still further object of the invention is to provide a wiper contact of novel construction, wherein the contact point of engagement for each turn will be at a different place on the movable contact, thus materially increasing the life of the contact over arrangements wherein wiping engagement is always at the same point on the movable contact.

Still another object is to provide a variable resistor which will have a high stability against high frequency vibrations, and wherein the wiping contact will be held in pressure engagement by a plurality of springs of different resonant frequencies, as compared to a single spring which will respond to a resonant frequency of predetermined value.

Yet another object is to provide a novel contact strip which may be produced as an article of manufacture.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

Referring to the accompanying drawings, which are for illustrative purposes only:

Fig. 1 is a plan view of a variable resistor embodying the features of the present invention;

Fig. 2 is a side elevational view of the same;

Fig. 3 is an end elevational view, portions being cut away to disclose the cooperative relationship between certain parts of the device;

Fig. 4 is an enlarged fragmentary view showing the details of construction of the wiper contact; and

Fig. 5 is an enlarged fragmentary sectional view through the wiper contact and associated structure, taken substantially on line 5—5 of Fig. 1.

Referring more specifically to the drawings, for illustrative purposes, the variable resistance of the herein described invention is shown as comprising a frame structure **10** which may assume a variety of embodiments, but which is illustrated as comprising a base member **11** which has upstanding end brackets **12** and **13** secured thereto as by suitable screws **14** or other conventional means.

The end brackets at their uppermost ends support an elongate resistance element, as generally indicated by the numeral **15**, which is composed of a plurality of turns of resistance wire **16** wound on a core structure **17**, the wire being preferably devoid of insulation, and insulated between turns which are insulated with respect to each other by conventional means well-known in the art. It will be observed that the resistance element has its turns wound uniformly about a linear extending axis of the core **17**, and in the illustrated embodiment, the turns of the resistance element are depicted as extending between the end brackets **12** and **13** for a predetermined axial length as indicated in Fig. 2 by the letter *b*.

Below the resistance element **15**, there is provided a rotatably mounted structure, as generally indicated by the numeral **18**. This structure is shown as comprising a drumlike tubular shell, which may be of insulating or other suitable material. End inserts **20** and **21** support the shell upon an operating shaft **22** to which this structure is affixed in any suitable manner for rotation with the shaft. The shaft **22** has bearing support in the end brackets **12** and **13**, and one end of the shaft projects, for example, from the end bracket **13** where it may be secured to a knob or other means for manual rotation or through suitable connection to an actuating device. It will be observed that the axis of rotation for the rotatably mounted structure **18** is spaced from and parallel to the linear axis of the resistance element **15**.

The rotatably mounted structure **18** serves as a support for a contact element as generally indicated by the numeral **23**. The contact element is fabricated from an elongate strip of electrically conducting material and is provided with a longitudinally extending bead **24** which forms the contact wiping surface. On opposite sides of the bead, there is provided a row of laterally extending slits **25** and **26** that define narrow integrally formed bridging connectors **27** which serve to resiliently support the bead **14** in wiping engagement with the turns **16** of the resistance element, when the contact element **23** is mounted on the surface of the tubular shell **19** with the bead **24** disposed over and following a helically formed groove **28**, as shown in Fig. 5. The bead **24** similarly provides a helical contact surface which resiliently engages the coil turns **16** along linearly aligned points of engagement thereon.

The helically extending bead **24** is thus angularly disposed with respect to the linear axis of the resistance element **15**, so that upon relative movement between the contact element and the resistance element, the bead **24** will be successively wiped against the turns of the resistance element. As shown in Fig. 3, when the rotatably mounted structure **18** is rotated through an angle, as indicated by the letter *a*, the contact bead **24** will move from contact with a coil turn at one end of the resistance element over the intervening coil turns to a coil turn at the other end of the resistance element. By comparison of the length of arc of the wiping contact, as indicated by the letter *a*, it will be observed that mechanical amplification results and that a small rotational angle

of movement of the rotatably mounted structure 18 gives a change of contact over the greater axial length as indicated by the letter *b*. Thus, fine resolution is obtained. The mechanical structure is such that there will be no lost motion or backlash.

Further, the device utilizing the contact arrangement described above will be very stable with respect to high frequency vibrations, since each of the bridging members will in effect comprise a single spring and each of these will have a different resonant frequency so that there will be no tendency to vibrate at a single frequency as might result if a single spring were utilized.

As shown in Fig. 3, the angle of movement of the rotatably mounted structure may be limited by means of abutment pins 29 and 30 carried by the rotatably mounted structure 18, which are spaced apart and are coactively associated with a stop member 31 which is mounted on the adjacent end bracket 13.

Connection terminals are appropriately provided and are illustrated as comprising a terminal 32 which is carried by the end bracket 12 and is connected by means of a conductor 33 to one end of the resistance element. A terminal 34 on the end bracket 13 is connected by means of a pigtail conductor 35 to the contact element 23.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of my invention, and, hence, I do not wish to be restricted to the specific form shown or uses mentioned, except to the extent indicated in the appended claims.

I claim:

1. A variable resistance, comprising: an elongate resistance element including a plurality of turns of resistance wire uniformly wound around a linear axis; a structure mounted for rotational movement about an axis spaced from and parallel to said linear axis, said structure including a cylindrical surface section having a helical surface groove therein; an elongate strip of electrical conducting material secured over said groove, said strip having a deformed continuous surface portion positioned over said groove, said surface portion being laterally connected by integral spaced bridging portions providing a resilient support for said surface portion, whereby it will make resilient wiping contact with the turns of said resistance element in response to said rotational movement.

2. A variable resistance, comprising: an elongate resistance element including a plurality of turns of resistance wire uniformly wound around a linear axis; a structure mounted for rotational movement about an axis spaced from and parallel to said linear axis, said structure including a cylindrical surface section having a helical surface groove therein; an elongate strip of electrical conducting material secured over said groove, said strip having an upwardly deformed surface portion positioned over said groove; and a row of spaced parallel slits laterally extending from each side of said surface portion, whereby spaced bridging connectors are formed for resiliently supporting said surface portion for wiping engagement with the turns of said resistance element during said rotational movement.

3. As an article of manufacture, a contact element, comprising: a resilient strip of electrical conducting material; an elongate rib integrally formed of the strip material and providing a continuous contact surface; and a row of spaced parallel slits laterally extending from each side of said rib defining integral bridging portions for resiliently connecting said rib and the adjacent lateral edge marginal portions of said strip.

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