United States Patent

Mack

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[54] **TRIMMER POTENTIOMETERS**

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Related U.S. Application Data

[62] Division of Ser. No. 774,682, Nov. 12, 1968, Pat. No. 3,597,837.

[52] **U.S. Cl.**.....**338/162,** 338/174

[51] **Int. Cl.**.....**H01c 9/02**

[58] **Field of Search**.....338/162, 174, 175

[56] **References Cited**

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[57] **ABSTRACT**

A potentiometer or variable resistor adapted to be fabricated in subminiature size. The potentiometer or resistor comprises a top assembly and bottom header, and an insulating shell or casing. The top plate assembly is co-molded with a plastic bearing member for the adjustable shaft carrying the contact brush or wiper. The top plate is also co-molded with the insulating brush block on the adjustable shaft. A plastic sleeve is positioned between the brush block and the adjusting shaft to secure the block in place, provide a friction-clutch drive for turning the brush block and contact wiper which will slip if the shaft is turned after the block strikes the stop at the end of its travel, and act as a cushion between the metallic shaft and the molded block when the potentiometer is subjected to relatively large temperature changes. Terminals are provided, in the bottom header, for the contact wiper and resistance element. The resistance element may be of any suitable type, such as wire-wound, carbon film, thick metal or metal oxide film or thin metal or metal oxide film.

4 Claims, 8 Drawing Figures

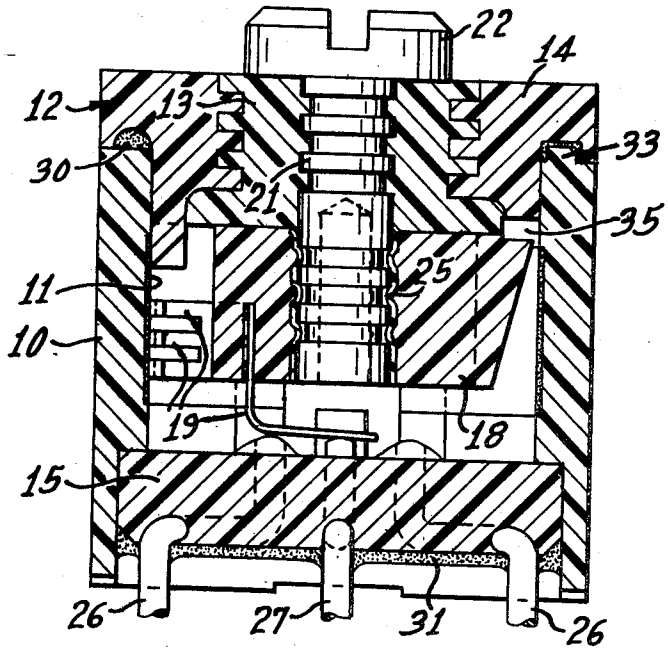


FIG. 1

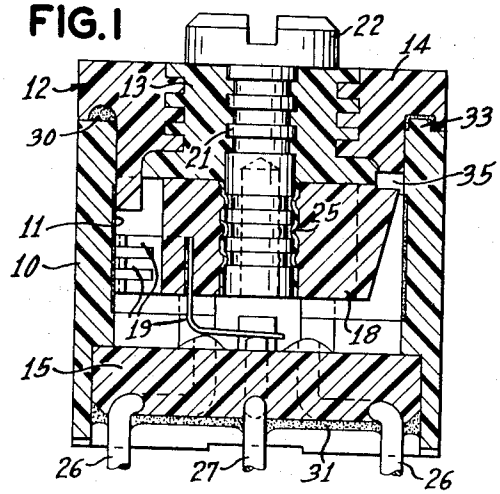


FIG. 2

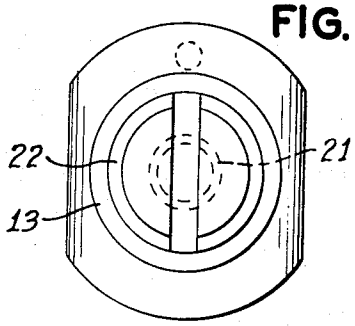


FIG. 4

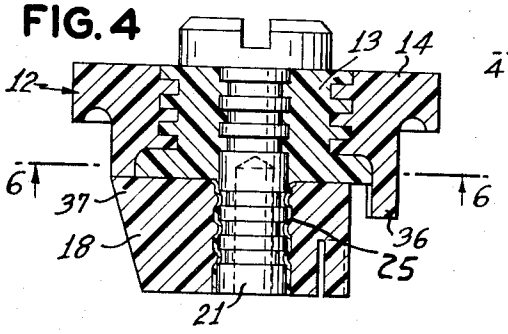


FIG. 5

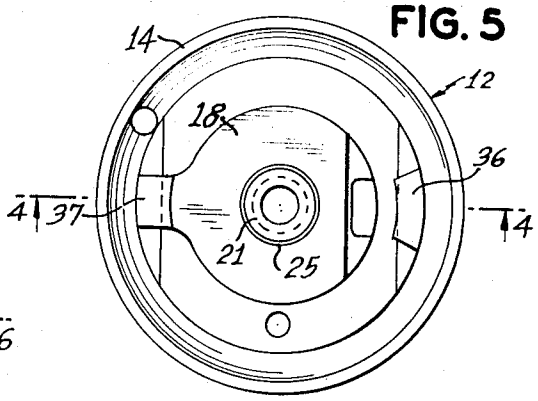


FIG. 3

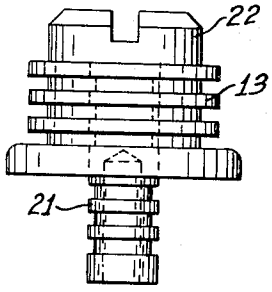


FIG. 6

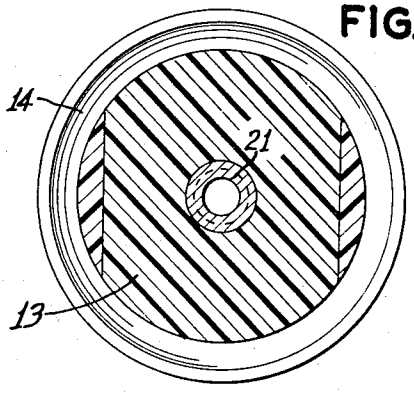


FIG. 7

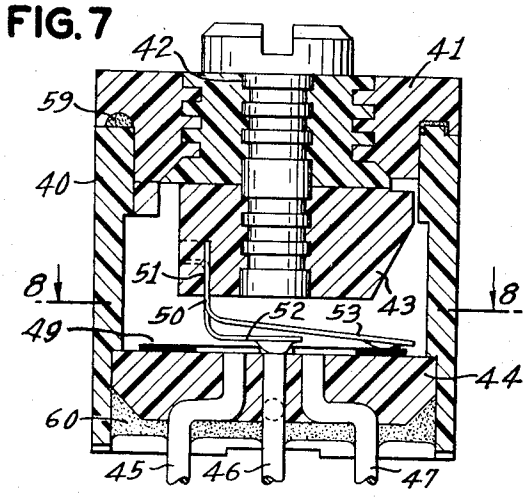
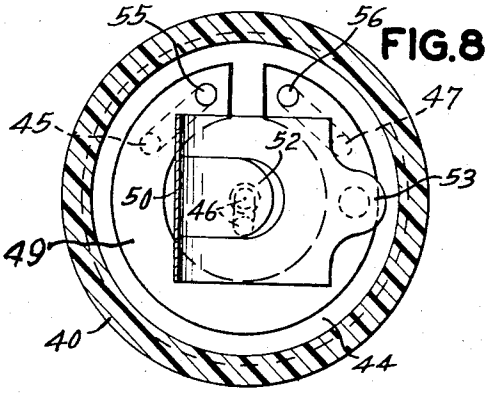


FIG. 8



TRIMMER POTENTIOMETERS

This is a divisional application of Ser. No. 774,682 filed Nov. 12, 1968, now U. S. Pat. No. 3,597,837.

BACKGROUND OF THE INVENTION

The invention relates to a potentiometer or variable resistor and to the method of making the same.

In the past, the manufacture of a potentiometer or variable resistor involved the machining and assembly of several accurately fitted components. This entailed considerable time and expense including the employment of skilled workers, and was particularly difficult in the production of subminiature trimmer potentiometers. This difficulty is overcome, in accordance with the invention, by co-molding the top plate with the bearing for the adjustable shaft and with the brush block on the shaft carrying the contact brush or wiper. The resistor element in the form of a film of carbon, metal oxide or the like may also be co-molded with the shell or bottom header of the trimmer. Thus the invention simplifies the assembly of the unit and makes possible the fabrication of a trimmer of reduced size.

SUMMARY

A potentiometer consists essentially of a resistor element, a contact brush or wiper engaging the resistor element, an insulating shell or casing, an adjustable or rotatable shaft member for positioning the contact brush, and terminals on the casing for providing electrical connection to the contact brush and resistor element. The adjustable shaft member being usually of metal, the contact brush is mounted on an insulating block attached to the shaft member. In accordance with the invention in a preferred embodiment, the insulating block carrying the contact brush is co-molded with the top or front plate of the casing through which the adjustable shaft member projects or with a part of the top plate assembly. In the molding operation, the brush block is attached to the shaft member by molding the block thereon. Similarly other elements of the potentiometer may be formed and assembled simultaneously, by co-molding, such as a bearing and seal in the top plate for the adjustable control shaft. It will be evident that this method greatly simplifies the production and assembly of the unit. Furthermore the component parts of the potentiometer may be reduced in size to an extent heretofore impracticable. This is important in the manufacture of so-called "trimmer" potentiometers, where the smallest possible physical dimensions are desired to reduce the size of the electronic assembly units in which they are generally used.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, which illustrates typical embodiments of the invention:

FIG. 1 is a cross-sectional view of an assembled trimmer potentiometer embodying the invention;

FIGS. 2 and 3 are top and side views, respectively, of the subassembly consisting of the adjusting shaft and plastic bearing;

FIG. 4 is a cross-sectional view, taken on the line 4—4 of FIG. 5, showing the top plate co-molded with the bearing and brush block;

FIG. 5 is a view of the underside of the subassembly shown in FIG. 4;

FIG. 6 is a cross-sectional view of the subassembly taken on the line 6—6 of FIG. 4;

FIG. 7 is a cross-sectional view of a modification; and

FIG. 8 is a transverse cross-section taken on the line 8—8 of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawing, a subminiature precision potentiometer embodying the invention comprises a cylindrical plastic insulating shell or casing **10** having a conductive plastic or film-type resistor element **11** on the inner surface thereof, preferably co-molded with the shell or casing. The potentiometer further comprises an insulating top plate assembly **12** consisting of two parts **13** and **14**, an insulating terminal plate or header **15**, and a rotatable brush block **18** supporting a contact brush or wiper **19** engaging the resistor element **11**. The brush block **18** is attached to a stainless-steel adjusting shaft **21** journalled in the top plate **12**, said shaft being provided with a slotted external head **22** adapted to receive a suitable tool for adjusting the angular position of the brush block and associated brush or wiper **19**. When the brush block **18** is molded around the shaft **21**, as will be explained below, a plastic "clutch" sleeve **25** is compressed between the block and the shaft to provide a driving connection for the brush block which will slip if the block is forced against the stop member at the end of its travel. The sleeve **25**, being slightly compressible, maintains a driving fit if the plastic block **18** shrinks or becomes deformed as a result of ambient temperature changes.

The potentiometer is shown as provided with the usual terminals **26** connected to the ends of the resistor element **11**, and terminal **27** connected to the brush or wiper **19**. While the terminals are shown as mounted in the bottom header, the arrangement of the terminals may be varied as required. In the embodiment shown by way of example the top header **12** is sealed and cemented to the shell **10** as indicated at **30**, and the bottom header **15** cemented and sealed in place by a locating pin **33** as indicated at **31**. The top header is lined properly by a locaing pi **33** in the top of the shell **10**, or in any other suitable manner.

The part **13** of the top plate **12** forms a bearing for the shaft **21**, and is preferably molded of a plastic such as a tetrafluoroethylene polymer made by E. I. du Pont de Nemours & Co. and sold under the trademark Teflon. The metallic shaft **21** may be grooved to effect a tight seal at the bearing and the characteristics of the Teflon material insure the desired smooth and positive low-friction adjustment of the shaft. FIGS. **2** and **3** illustrate the shaft with the Teflon bearing molded thereon, an initial step in the manufacturing process.

In accordance with another feature of the invention, the section **14** of the top plate or header **12** and the brush block **18** are co-molded around the bearing **13** and the lower end of the adjusting shaft **21**, as shown in FIGS. **4**, **5** and **6**. In order to lock the parts **13** and **14** of the top plate assembly together against relative movement as the adjusting shaft **21** is turned, they may be deeply grooved at their mating edges as shown. The insulating members **14** and **18** may be molded of any suitable material, preferably a thermosetting plastic such as a mineral-filled or glass fiber-filled epoxy, dial-

lyl phthalate or formaldehyde derivative. After the parts **14** and **18** have been co-molded on the bearing **13**, the brush block **18** is separated from the part **14** by slitting the material at the point **35** (FIG. **1**). After being severed from the part **14** in this manner, the brush block is free to turn as the shaft **21** is turned to adjust the unit. Since this is the only machining operation performed in the manufacture of the potentiometer during the final fabrication and assembly, the component parts of the unit may be of such small size as to provide a subminiature unit or trimmer having an outside diameter at least as small as one quarter of an inch. However the same manufacturing procedure may be utilized to make a variable resistor or potentiometer of larger size, with the same advantages of low manufacturing and assembly costs.

As shown more clearly in FIGS. **4** and **5**, during the molding operations, the top plate **14** is formed with a projection or stop lug **36**, and the brush block **18** with an offset portion **37** intersecting the stop **36** as the brush block is turned to either end of its travel. In this or any other suitable manner the angular adjustment of the brush block and associated contact or wiper is limited to the working area of the resistor element.

FIGS. **7** and **8** illustrate a modified form of potentiometer in which the bottom header becomes the insulating support for the resistor element, which may be for instance in the form of a wire-wound coil, a carbon film, a thick metal film or a thin metal film. In this modification the cylindrical shell **40**, the top or front plate assembly **41**, the adjusting shaft **42**, the brush block **43** and the bottom header **44** in which are embedded the terminals **45**, **46** and **47** may be similar to the corresponding parts of the trimmer shown in FIG. **1**, and the parts **41** and **43** co-molded as described above. The resistor element **49** is applied to the header **44** in the usual manner. As shown, the brush block **43** carries a spring contact member **50** secured in a slot **51** in the block. The contact member **50** includes projecting fingers or brushes **52** and **53** engaging the terminal **46** and resistor element **49** respectively. The terminals **45** and **47** are conductively connected to the opposed ends of the resistor element **49** at the points **55** and **56**. The top or front plate **41** and the header **44** are cemented and sealed to the shell **40** as indicated at **59** and **60**, using a strong adherent adhesive with adequate sealing characteristics, such as epoxy adhesive.

The important advantages of the described construction are evident, particularly in connection with subminiature trimmer potentiometers. While illustrative embodiments of the invention have been described in detail for the purpose of explaining the underlying principles thereof, it will be apparent that the form and arrangement of the component parts may be varied without departing from the scope of the invention. Thus not only the conventional resistor element, wiper and wiper adjusting means shown may be modified but also the co-molded insulating components, while retaining the advantages of simplified and improved assembly.

What is claimed is:

1. A potentiometer, comprising:
- an insulating shell,
- a resistor element,
- a top plate on said shell formed from moldable insulating material,
- a brush block formed from the same moldable insulating material as said top plate and formed as an integral part thereof,
- an adjusting shaft journalled in said top plate and said brush block,
- said top plate and said brush block having a separation plane therebetween for separating said top plate and said brush block such that said brush block is rotatably adjustable with respect to said top plate upon said adjusting shaft,
- a contact brush engaging said resistor element and mounted on said brush block,
- a stop for limiting the rotational adjustment of said brush block and contact brush,
- friction-clutch means between said adjusting shaft and said brush block for effecting non-positive rotational adjustment of said brush block as said shaft is turned, and
- terminals for said resistor element and contact brush.

2. A potentiometer according to claim **1**, in which said resistor element is formed as an integral part on said insulating shell.

3. A potentiometer, comprising:
- an insulating shell,
- a resistor element,
- an adjusting shaft,
- a bearing formed of moldable material contiguously about said adjusting shaft,
- a friction-clutch below said bearing mounted contiguously about said adjusting shaft,
- a top plate mounted on said shell formed of moldable insulating material contiguously about said bearing,
- said top plate including a lower portion formed of moldable insulating material as an integral part of said top plate contiguously about said friction-clutch on said adjusting shaft,
- said top plate having a separation plane at a point between said bearing and said friction-clutch for separating said top plate and said lower portion thereof to form a brush block such that said brush block is free to rotate with respect to said top plate upon said adjusting shaft while said friction-clutch effects said rotation,
- a contact brush engaging said resistor element and mounted on said brush block, and
- terminals for said resistor element and contact brush.

4. A potentiometer comprising
- a resistor element,
- an insulating shell,
- an adjusting shaft journalled in said shell,
- a brush block attached to said shaft,
- a contact brush mounted on said brush block and engaging said resistor element, and
- a plastic sleeve interposed between said shaft and said brush block to provide a friction-clutch drive for said block as said adjusting shaft is turned to vary the position of said contact brush.

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