United States Patent

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[54] **METHOD OF MAKING TRIMMER POTENTIOMETERS**
4 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **29/610,** 264/157, 338/162
[51] **Int. Cl.** **H01c 17/00**
[50] **Field of Search** 29/610, 613; 338/162, 164, 166, 168; 264/138, 145, 152, 157

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ABSTRACT: A potentiometer or variable resistor adapted to be fabricated in subminiature size, and the method of making the same. The potentiometer or resistor comprises a top assembly and bottom header, and an insulating shell or casing. The top plate assembly is comolded with a plastic bearing member for the adjustable shaft carrying the contact brush or wiper. The top plate is also comolded 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.

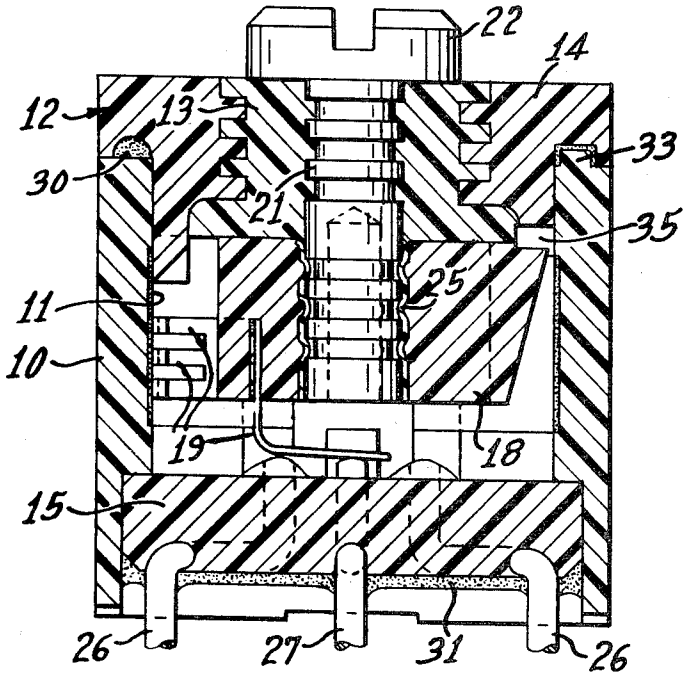


FIG. 1

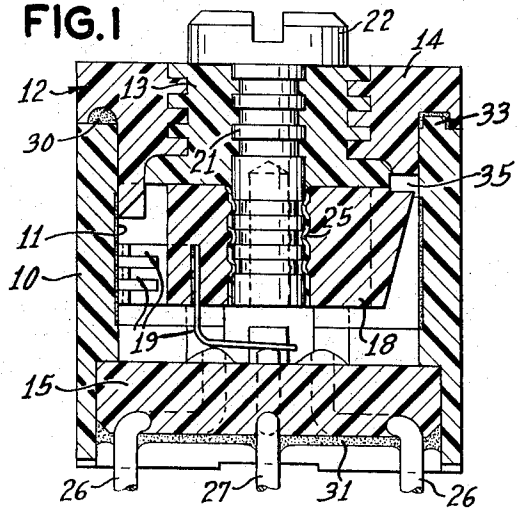


FIG. 2

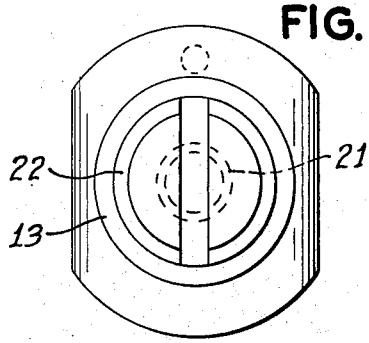


FIG. 5

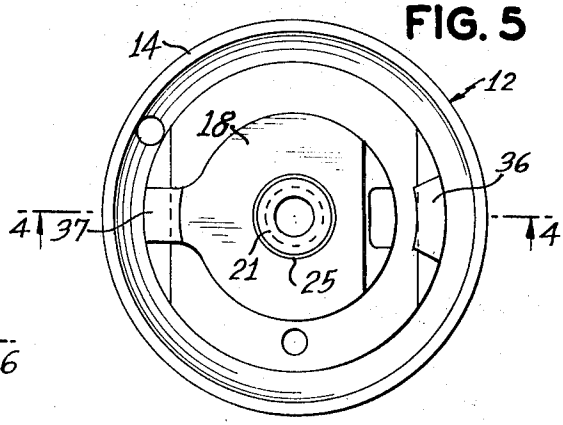


FIG. 4

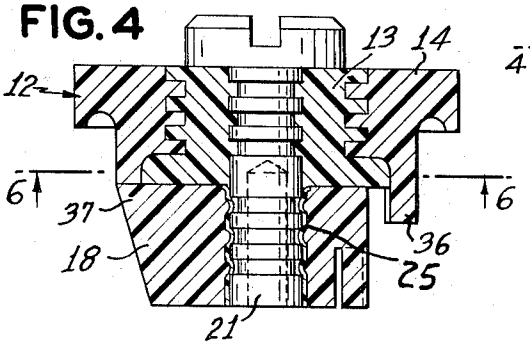


FIG. 3

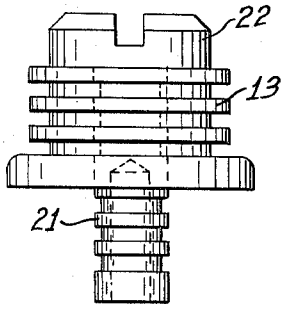


FIG. 6

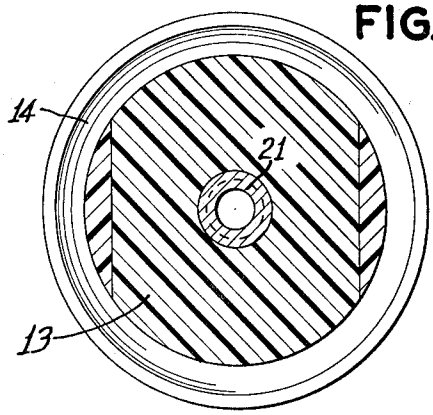


FIG. 7

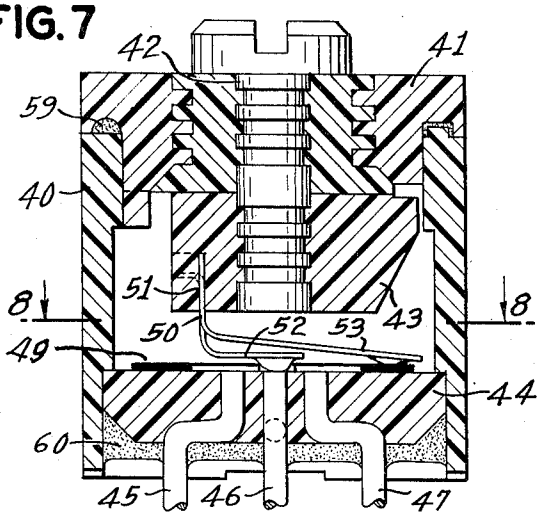
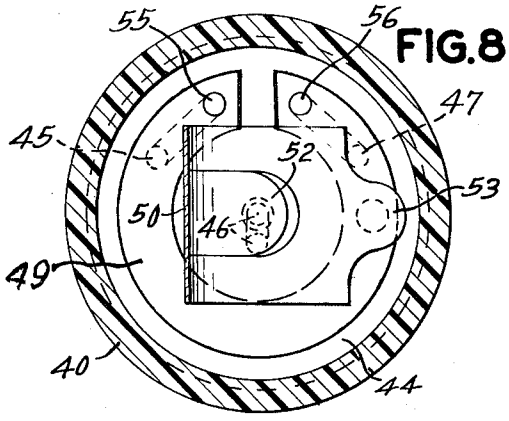


FIG. 8



METHOD OF MAKING TRIMMER POTENTIOMETERS

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 comolding 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 comolded 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 comolded 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 comolding, 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 comolded 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 comolded 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 journaled 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 as indicated at 31. The top header is aligned properly by a locating pin 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 comolded 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, diallyl phthalate or formaldehyde derivative. After the parts 14 and 18 have been comolded 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** comolded 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 comolded insulating components, while retaining the advantages of simplified and improved assembly.

I claim:

1. The method of making a potentiometer having an adjusting shaft, a contact brush turned by said shaft, a supporting member in which said shaft is journaled and a brush block attached to said shaft and carrying said contact brush, said method comprising the steps of

comolding the supporting member and brush block, and

severing said block from said supporting member to free it for rotation with said adjusting shaft.

2. The method of making a potentiometer or variable resistor having an insulating support member, an adjusting shaft a bearing for said shaft, a contact brush, a resistor element engaged by said brush, and an insulating block attached to said shaft and carrying said contact brush, comprising the steps of

comolding said support member, said bearing, and said insulating block, and

severing said insulating block from said insulating support member to free it for rotation with said adjusting shaft.

3. The method of making a potentiometer or variable resistor having an adjusting shaft, a contact brush, an insulating block for supporting said contact brush, and a sleeve interposed between said shaft and said insulating block, comprising the step of

molding said insulating block around said shaft and sleeve to form a friction-clutch drive connection between said shaft and said insulating block.

4. The method of making a potentiometer or variable resistor having an insulating casing, a resistor element, a contact brush engaging said resistor element, a rotatable brush block for supporting and positioning said contact brush, and a top plate carrying said brush block and contact brush, comprising the steps of

comolding said top plate and said rotatable brush block,

severing the brush block from said top plate, and

securing said top plate on said casing with the contact brush engaging the resistor element.