Feb. 23, 1971 KATSUMI ICHIKAWA ET AL 3,566,330

VARIABLE RESISTOR OF SLIDING TYPE

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FIG. 1

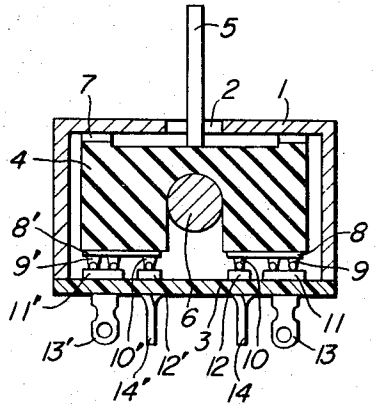


FIG. 2

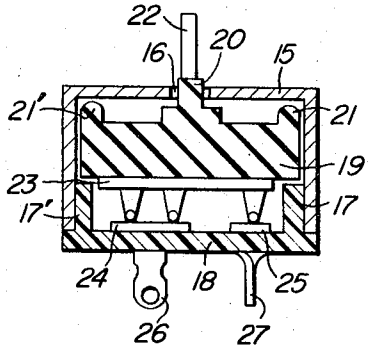
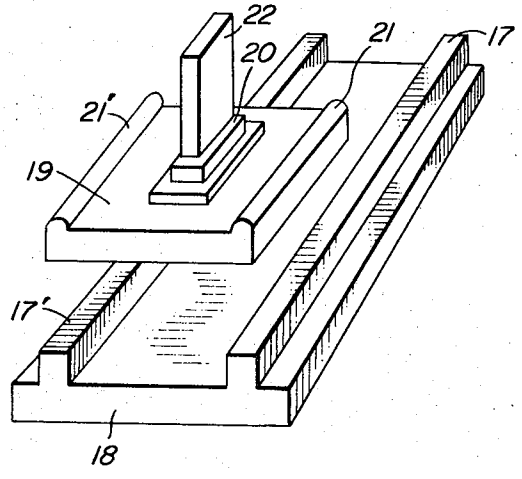


FIG. 3



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FIG. 4

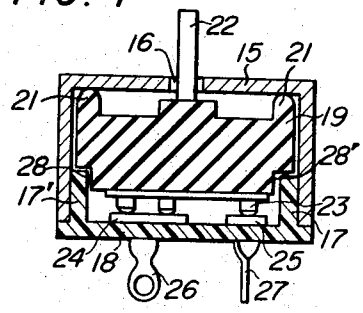


FIG. 5

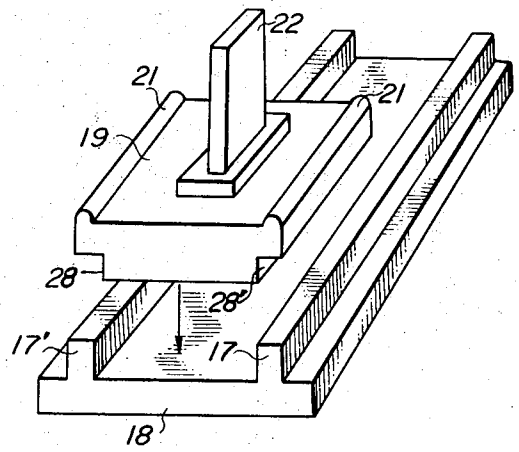


FIG. 9

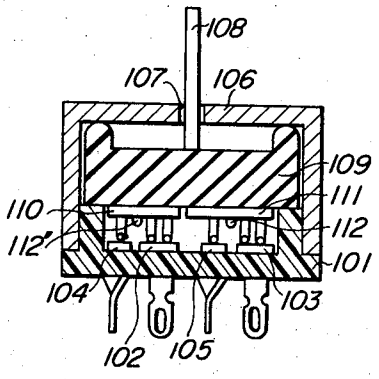
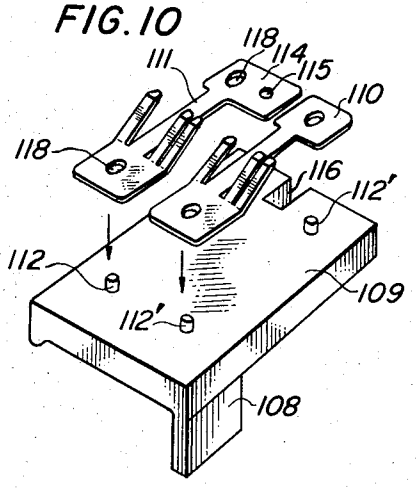


FIG. 10



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FIG. 6

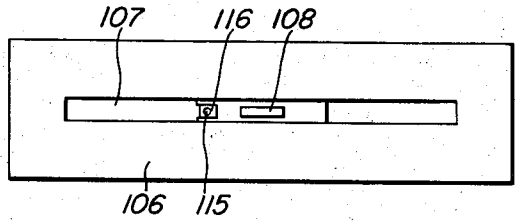


FIG. 7

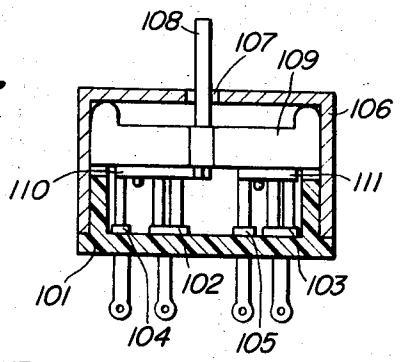
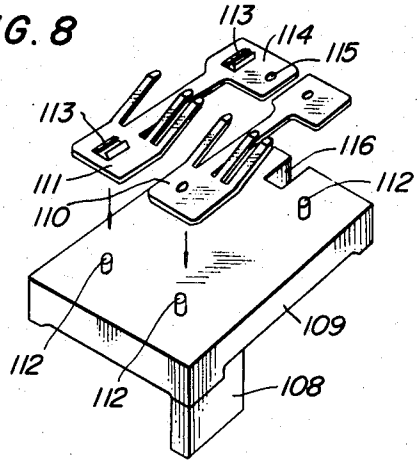


FIG. 8



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VARIABLE RESISTOR OF SLIDING TYPE

Katsumi Ichikawa, Osaka, Syunzo Oka, Hirakata-shi, and Tadasi Yano, Kadoma-shi, Japan, assignors to Matsushita Electric Industrial Co., Ltd., Osaka, Japan, a corporation of Japan

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Int. Cl. H01c 5/02
U.S. Cl. 338—133 8 Claims

ABSTRACT OF THE DISCLOSURE

Improvements on a variable resistor of the sliding type and more particularly the structure of fitting a slider and a contact element to a resistor is disclosed, preventing the lateral rolling of the slider and making the fitting position of the contact element adjustable to control the value of resistance simply.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates in general to a variable resistor of the sliding type and more particularly to a variable resistor of the sliding type in which the mechanism of a slider is improved and the position of a contact element fitted to the slider is made adjustable after assembling.

Description of the Prior Art

A prior art variable resistor of the sliding type has a structure in which slider riding on a guide rod provided in the center of a case is slided by manipulating an actuating lever. When a lateral force is applied to the actuating lever, it suffers a large deflection. A minute crack on the surface of the guide rod causes roughness or blockage during manipulation so that smooth sliding is not obtainable. Such a lateral deflection has made it impossible to give a constant pressure of contact element on the resistance element.

Generally, a variable resistor of the duplex sliding type is often used as volume or tone control of a stereo set. In this case, unless the resistances in both variable resistors vary equally, a true stereo is not obtained as the volume or the tone of the speakers on both sides differs. A certain unbalance is brought forth depending on the variation of resistance characteristic and the dimension of the resistance element. However, it is errors in assembling the variable resistor which mainly influence the unbalance. A defect of the conventional duplex type variable resistor is that the position of a contact element with respect to the resistor has a large influence on the value of resistance and causes a deviation between both resistors.

SUMMARY OF THE INVENTION

Therefore, one object of this invention is to provide a variable resistor of the sliding type obviating the above-mentioned roughness and blockage and applying a constant pressure of the contact element on the resistance element.

Another object of this invention is to provide a variable resistor of the sliding type in which the position of a contact element fitted to the slider is made adjustable after assembling so that any error that might occur during assembly is eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional front view of a prior art variable resistor of the sliding type.

FIG. 2 is a longitudinal sectional front view of a variable resistor of the sliding type according to one embodiment of this invention.

FIG. 3 is a perspective view showing the disassembled main portion of the above variable resistor of the sliding type.

FIG. 4 is a longitudinal sectional front view of a variable resistor of the sliding type according to another embodiment of this invention.

FIG. 5 is a perspective view showing the disassembled main portion of the above variable resistor of the sliding type.

FIG. 6 is a top view of a variable resistor of the sliding type according to a further embodiment of this invention.

FIG. 7 is a cross-sectional view of the above variable resistor of the sliding type.

FIG. 8 is a perspective view showing the disassembled main portion of the above variable resistor of the sliding type.

FIG. 9 is a longitudinal cross-sectional view of a variable resistor of the sliding type according to another embodiment of this invention.

FIG. 10 is a perspective view showing the disassembled main portion of the above variable resistor of the sliding type.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A prior art variable resistor of the sliding type will be explained hereinafter with reference to FIG. 1. **1** is a metal case made by metal plate processing, a guide window **2** being formed in one portion of the top surface and a base **3** being fitted on the bottom wall. **4** is a slider made of a rectangular insulating material with an actuating lever **5** on its top surface penetrating the guide window **2** and with a groove portion in the bottom surface riding on a guide rod **6** positioned in the center of the case. **7** shows mails provided in the corner of the top surface of the slider **4** to touch the inner top surface of the case **1**. **8** and **8'** are contact elements having contact portions **9**, **9'**, **10** and **10'** fitted to the bottom of the slider **4**. These contact portions are slid on the resistance elements **11** and **11'** and contact plates **12** and **12'** which are provided on the base **3** in parallel with one another. **13**, **13'**, **14** and **14'** are wiring terminals provided outside the base **3** and are connected to the ends of resistance elements **11** and **11'** and contact plates **12** and **12'** respectively.

In this structure, the slider **4** riding on the guide rod **6** is slid by manipulating the actuating lever **5**. So, when a lateral force is applied to the actuating lever **5**, it suffers a large deflection. Further, minute cracks existing on the surface of the guide rod **6** cause roughness or blockage during manipulation and prevent a smooth slide. The lateral deflection of the slider presses down the contact elements **8** and **8'** thereunder making it difficult to give a constant pressure of the contact element on the resistance element.

This invention eliminates the above-mentioned roughness and blockage and provides a structure in which a constant pressure is kept applied on the resistance element.

Explanation of one embodiment of this invention will be made hereunder with reference to FIGS. 2 and 3.

15 is a metal case made of metal plate with a guide window **16** on one portion of the top surface. A base **18** made of molded material with protrusions **17** and **17'** on both sides of the top surface is fitted to the bottom surface of the case **15**. **19** is a slider of insulating material, the bottom surface of which is disposed on the protrusions **17** and **17'**. **20** is a rectangular projection

provided on the top of the slider **19** and slidingly fitted into the guide window **16**. Protrusions **21** and **21'** on both sides of the slider **19** contact with the inner top surface of the case **15**. The bottom surface of the sliding body **19** is on the protrusions **17** and **17'** by manipulating an actuating lever **22** provided on the rectangular projection **20**. Contact elements **23** provided under the slider and having a contact portion is arranged to slide on a resistance element **24** and contact plate **25** which are provided in parallel with each other on the base **18**. **26** and **27** are wiring terminals provided outside the case **15** and connected to the end portions of the resistance element **24** and the contact plate **25** respectively.

As is seen in the above-mentioned structure of the inventive variable resistor of the sliding type, since the bottom surface of the slider **19** is positioned on the protrusions **17** and **17'** of the base **18**, a constant pressure is always applied on the resistance element **24**. Further, as these sliding portions are made of molded material, they provide for a very smooth slide action. Even if a lateral force is applied to the actuating lever **22**, the rectangular projection **20** provided on the slider **19** touches the guiding window thereby to prevent the rolling of the actuating lever **22**.

Next, explanation of another embodiment of this invention will be made with reference to FIGS. 4 and 5.

In these figures, **15** is a metal case made of sheet metal, a guide window **16** being formed in one portion of the top surface. A base **18** of molded material having protrusions **17** and **17'** on both sides of the top surface is provided under the case **15**. **19** is a slider of insulating material. An actuating lever **22** is provided on the top of the slider, penetrating the guide window **16**. Both sides of the bottom surface of the slider **19** are shaped into ridges **28** and **28'** which are made to contact with the protrusions **17** and **17'**. The protrusions **21** and **21'** provided on both sides of the top surface of the slider **19** contact with the inner top surface of the case **15**. The ride portions **28** and **28'** are slid by manipulating the actuating lever **22**. Contact elements **23** provided under the slider **19** and having a contact portion are arranged to slide on a resistance element **24** and a contact plate **25**. **26** and **27** are wiring terminals provided outside the base **18** and connected to the end portions of the resistance element **24** and the contact plate **25** respectively.

As is seen in the structure of the above inventive variable resistor of the sliding type, even if a lateral force is applied to the actuating lever **22**, the contact between the ridge portions **28** and **28'** on both sides of the bottom surface of the slider **19** and the protrusions **17** and **17'** provided on both sides of the top surface of base **18** can prevent the lateral rolling of the actuating lever **22**. Further, since these sliding portions are made of molded material, the sliding action becomes extremely smooth.

As is evident from the above description, the lateral movement of the actuating lever can be prevented by a simple structure, and a smooth sliding action is obtained. Therefore, the practical merit of this invention is very large.

Generally, a variable resistor of the duplex sliding type is often used for the volume or tone control in a stereo set. In this case, unless the resistances of the two variable resistors vary equally during adjustment, both speakers differ in volume or tone so that any true stereo is not obtained. The variation of resistance characteristic and the dimension of the resistance element cause a certain unbalance. However, it is the errors in the step of assembling that have a large influence on such an unbalance. Namely, the position of a contact element with respect to the resistance element occasionally suffers a large deviation.

This invention eliminates such a defect using a simple structure, whereby the contact position is adjustable after the resistors are assembled.

Explanation of another embodiment of this invention will be made hereunder with reference to FIGS. 6 to 8.

In these figures, **101** is a base made of an insulator, on which two resistance elements **102** and **103** and two contact plates **104** and **105** are provided. Pairs of resistance elements and contact plates **102** and **104**, and **103** and **105**, constitute individual resistors. The base **101** is covered with a case **106** made of metal sheet bending processing. An elongated hole **107** is formed in the top surface of the case **106**. A slider **109** with an actuating lever **108** penetrating the elongated hole **107** is disposed in the case **106**. Two contact elements **110** and **111** are fitted on the bottom surface of the slider **109** to be in contact with the resistance elements **102** and **103** and the contact plates **104** and **105**. As shown in FIG. 8, these contact elements **110** and **111** are fixed into protrusions **112** provided on the bottom surface of the slider **109**. One of them **110** is perfectly fixed by the protrusions **112** while the other element **111** is held by a cut-and-raised opening **113** slightly larger than the size of the protrusions **112**. A through hole **115** is perforated in the extended portion **114** of the contact element **111** and positioned on a cutaway portion **116** which is to be aligned with the elongated hole **107**. Therefore, the through hole **115** can be seen through from outside by way of the elongated hole **107**. A slender rod is inserted through the hole **115** and moved in the lateral direction so that the position of the contact element **111** with respect to the resistance element **103** may shift and the resistances of both contact elements **110** and **111** will be equal.

Lastly, a further embodiment of this invention will be explained with reference to FIGS. 9 and 10, in which **101** is a base made of an insulating material. Two resistive elements **102** and **103** and two contact plates **104** and **105** are fitted on the base **101**. Pairs of resistance elements and contact plates **102** and **104**, and **103** and **105** constitute individual resistors. The base **101** is covered with a case **106** made of metal sheet bending processing. An elongated hole **107** is formed in the top surface of the case **106**. A slider **109** with an actuating lever **108** penetrating the elongated hole **107** is disposed in the case **106**. Two contact elements **110** and **111** are fitted on the bottom surface of the slider **109** and contact with the resistance elements **102** and **103** and the contact plates **104** and **105**. As shown in FIG. 10, these contact elements **110** and **111** are fixed into the protrusions **112** provided on the bottom surface of the slider **109**. One of them **110** is perfectly fixed by the protrusion **112** while the other **111** is held by an elliptic fitting hole **118** having a slightly larger size than that of the protrusion **112**. Namely, the contact element **111** is fixed into the protrusion **112** but can be slid. A through hole **115** is perforated in the extended portion **114** of the contact element **111** and positioned on a cutaway portion **116** which is to be aligned with the elongated hole **107**. Therefore, the through hole **115** can be seen through from the outside by way of the elongated hole **107**. A slender rod is inserted through the hole **115** and moved in the lateral direction so that the position of the contact element **111** with respect to the resistance element **103** may shift and the resistances of both contact elements **110** and **111** will be equal.

As is seen from the above-mentioned structure of the inventive slide type variable resistor, a contact element is fixed into a protrusion provided under the slider by either a cut-and-raised opening or in elliptic hole which has a slightly larger size than that of the protrusions. The through hole formed in one portion of the contact element is transparent. So, the position of the contact element with respect to the resistance element can be varied through this hole. In the case of a variable resistor of the duplex sliding type the resistances of the two contact elements can be adjusted to be equal. Therefore, this variable resistor of the duplex sliding type is very effective if employed in a stereo set. Also, a variable resistor of the single sliding type though not shown in the above embodiments is useful as a minute adjustment of the resistance is possible. Due

to such a simple structure with only holes in the contact elements these variable resistors of the sliding type can be manufactured cheaply. Therefore, the practical advantage of this invention is very large.

What is claimed is:

1. A variable resistor of the sliding type comprising a case having a guide window in one portion thereof; a base of molded material provided on the bottom surface of said case and having protrusions on both sides of the top surface; a slider of insulating material arranged in said case so that the bottom surface is positioned on said protrusions of said base; a protrusion located on the bottom surface of said slider disposed between said case and said base on which resistance elements and contact plates are provided; a contact element having a cut-and-raised opening with a slightly larger dimension than that of said protrusion fixed into said protrusion, one portion of said contact element being provided with a through hole which can be seen through by way of an elongated hole formed in said case; and a rectangular projection provided on the top surface of said slider to be slidingly fitted into said guide window.

2. A variable resistor of the sliding type comprising a case having a guide window in one portion thereof; a base of moulded material provided on the bottom surface of said case and having protrusions on both sides of the top surface; a slider of insulating material arranged in said case so that the bottom surface is positioned on said protrusions of said base; a protrusion located on the bottom surface of said slider disposed between said case and said base on which resistance elements and contact plates are provided; a contact element having an elliptic hole with a slightly larger dimension than that of said protrusion fixed into said protrusion, one portion of said contact element being provided with a through hole which can be seen through by way of an elongated hole formed in said case; and a rectangular projector provided on the top surface of said slider to be slidingly fitted into said guide window.

3. A variable resistor of the sliding type according to claim 2, wherein a cutaway portion is formed in one portion of said contact element so as to be seen through by way of said elongated hole formed in said case.

4. A variable resistor of the sliding type according to claim 1 wherein a cutaway portion is formed in one portion of said contact element so as to be seen through by way of said elongated hole formed in said case.

5. A variable resistor of the sliding type comprising a case having a guide window in one portion thereof, a base of molded material provided on the bottom surface of said case and having molded protrusions on both sides of the top surface, a slider of insulating material having cutaway portions on both sides of the bottom surface of

said slider, said slider being arranged in said case in such a manner that said cutaway portions may engage slidably with said protrusions provided on said base; further comprising a protrusion on the bottom surface of said slider disposed between said case and said base on which resistance elements and contact plates are provided, and a contact element having a cut-and-raised opening with a slightly larger dimension than that of said protrusion fixed into said protrusion, one portion of said contact element being provided with a through hole which can be seen through by way of an elongated hole formed in said case.

6. A variable resistor of the sliding type comprising a case having a guide window in one portion thereof, a base of molded material provided on the bottom surface of said case and having molded protrusions on both sides of the top surface, a slider of insulating material having cutaway portions on both sides of the bottom surface of said slider, said slider being arranged in said case in such a manner that said cutaway portions may engage slidably with said protrusions provided on said base; further comprising a protrusion on the bottom surface of said slider disposed between said case and said base on which resistance elements and contact plates are provided, and a contact element having an elliptical hole with a slightly larger dimension than that of said protrusion fixed onto said protrusion, one portion of said contact element being provided with a through hole which can be seen through by way of an elongated hole formed in said case.

7. A variable resistor of sliding type according to claim 5, wherein a cutaway portion is formed in one portion of said contact element so as to be seen through by way of said elongated hole formed in said case.

8. A variable resistor of sliding type according to claim 6, wherein a cutaway portion is formed in one portion of said contact element so as to be seen through by way of said elongated hole formed in said case.

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THOMAS J. KOZMA, Primary Examiner

U.S. Cl. X.R.

338—183; 202