April 9, 1963 C. S. DASH 3,085,218

VARIABLE RESISTOR

Filed Dec. 7, 1960

Fig. 1

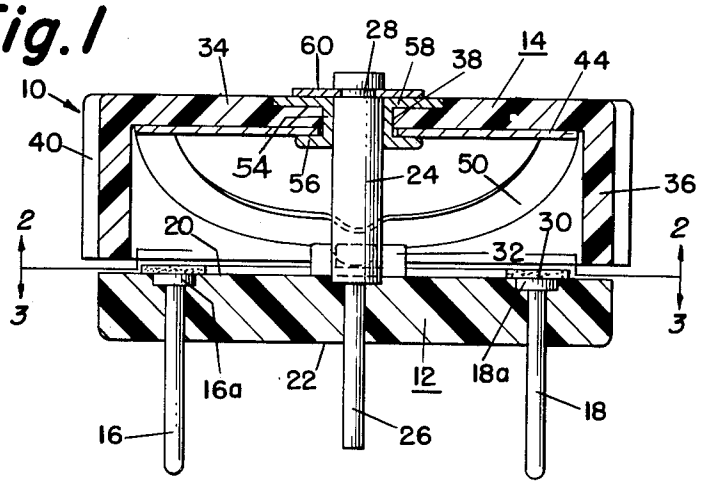


Fig. 2

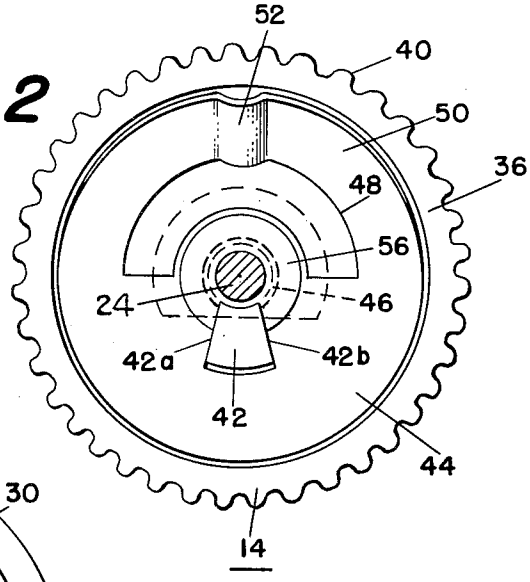
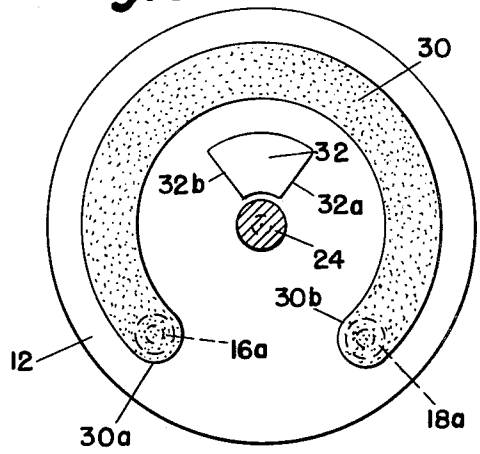


Fig. 3



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VARIABLE RESISTOR

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The present invention relates to a variable resistor, and more particularly to a miniature variable resistor for use as a volume control in such small, compact electrical devices as hearing aids, pocket radios and the like.

With the miniaturization of electronic tubes, and the increasing use of transistors, the trend has been to making such electrical devices as radios, hearing aids and the like smaller and more compact. Such small, compact electrical devices require a miniaturization of all of the components used therein including the variable resistors used as the volume control. In fact, for use in hearing aids which are completely assembled in the ear piece of the frame of eye glasses, it is necessary to provide a variable resistor which is as small as approximately one-quarter inch in diameter and three thirty-seconds of an inch in thickness. Since the standard, commercially available variable resistor comprises a large number of small parts, it has been found that it is impractical to merely reduce the size of such variable resistors to the small sized units required. Therefore, it has been found that a variable resistor of a size for use in the small, compact electrical devices must be constructed of a minimum number of parts for ease of manufacture of the small parts, and for ease of assembling the parts.

It is an object of the present invention to provide a novel variable resistor.

It is another object of the present invention to provide a miniature variable resistor for use as the volume control in small, compact electrical devices.

It is a further object of the present invention to provide a miniature variable resistor having a minimum number of parts for ease of manufacture of the resistor.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a sectional view of the variable resistor of the present invention.

FIGURE 2 is a view of the variable resistor of the present invention taken along line 2—2 of FIGURE 1.

FIGURE 3 is a view of the variable resistor of the present invention taken along line 3—3 of FIGURE 1.

Referring initially to FIGURE 1, the variable resistor of the present invention is generally designated as **10**.

Variable resistor **10** comprises a flat, circular base plate **12**, and a cup-shaped cover **14** mounted on the base plate **12** for rotation relative thereto. The base plate **12** and the cover **14** are each of an electrical insulating material, such as a plastic. For use in small, compact electrical devices, the assembly of the cover **14** and the base plate **12** can be made as small as approximately one-quarter of an inch in diameter, and three thirty-seconds of an inch in thickness.

Base plate **12** has a pair of terminal pins **16** and **18** extending therethrough. Each of the terminal pins **16** and **18** has a flat head **16***a* and **18***a* respectively at one end. The heads **16***a* and **18***a* of the terminal pins **16** and **18** are embedded in the inner surface **20** of the base plate **12** with the top surfaces of the heads **16***a* and **18***a* being flush with the inner surface **20**. As shown in FIGURE 3, the terminal pins **16** and **18** are positioned adjacent the peripheral edge of the base plate **12**, and are circumferentially spaced apart approximately 60°.

The terminal pins **16** and **18** are made of an electrically conductive metal, and project beyond the outer surface **22** of the base plate **12**.

A shaft **24** is mounted on the center of the base plate **12**, and projects upwardly from the inner surface **20** of the base plate. A terminal pin **26** is integral with and projects axially from the end of the shaft **24** which is mounted on the base plate **12**. The shaft terminal pin **26** extends through the base plate **12**, and projects beyond the outer surface **22** of the base plate. Shaft **24** has an annular groove **28** in its outer surface adjacent the free end thereof. The shaft **24** and its terminal pin **26** are made of an electrically conductive metal. The shaft **24** with its terminal pin **26**, and the terminal pins **16** and **18** are secured to the base plate **12** such as by molding the base plate **12** directly to and around the shaft **24** and the terminal pins **16**, **18** and **26**.

An arcuate stripe **30** of an electrical resistance material is coated on the inner surface **20** of the base plate **12**. The resistance stripe **30** extends circumferentially for approximately 300° around the inner surface **20** of the base plate **12** adjacent the outer periphery of the base plate. As shown in FIGURE 3, the ends **30***a* and **30***b* of the resistance stripe **30** are spaced apart, with one end **30***a* extending over and contacting the head **16***a* of the terminal pin **16**, and the other end **30***b* extending over and contacting the head **18***a* of the terminal pin **18**. Thus, the terminal pins **16** and **18** provide the terminals for the resistance stripe **30**. The resistance value of the resistance stripe **30** is dependent on the width, length and thickness of the resistance stripe **30** as well as the particular composition of the resistance stripe. The resistance stripe **30** may be coated on the base plate **12** by painting, spraying or the like.

The base plate **12** is provided with an integral stop lug **32** projecting upwardly from the inner surface **20** thereof. Stop lug **32** is positioned on the inner surface **20** of the base plate **12** adjacent the shaft **24**, and on the side of the shaft **24** diametrically opposite the gap between the ends **30***a* and **30***b* of the resistance stripe **30**. The stop lug **32** is of a circumferential length such that its end **32***a* is on the same diameter of the base plate **12** as the end **30***a* of the resistance stripe **30**, and the end **32***b* of the stop lug **32** is on the same diameter of the base plate **12** as the end **30***b* of the resistance stripe **30**.

The cover **14** has a flat top **34**, and a cylindrical side **36** extending from the periphery of the top **34**. The top **34** of the cover **14** has a central hole **38** therethrough. The cylindrical side **36** of the cover **14** is provided with serrations **40** on its outer surface to permit ease of rotating the cover **14**. A stop lug **42** is integral with and projects downwardly from the inner surface of the top **34** of the cover **14**. The stop lug **42** is substantially the same length as the side **36**, and as shown in FIGURE 2 is positioned on the inner surface of the top **34** of the cover **14** adjacent the hole **38** through the top **34**.

A contact **44** is secured to the inner surface of the top **34** of the cover **14**. The contact **44** comprises a circular disc of a suitable electrically conductive spring metal, such as beryllium or copper. Contact **44** has a central hole **46** therethrough of a diameter corresponding to the diameter of the hole **38** through the top **34** of the cover **14**. As shown in FIGURE 2, the contact **44** has an arcuate opening **48** therethrough which extends around approximately 180° of the hole **46**. The opening **48** provides the contact **44** with an arcuate contact arm **50** of a circumferential length of approximately 180°. The contact arm **50** has a rounded contact point **52** bent therefrom. The contact point **52** is circumferentially positioned intermediate the ends of the contact arm **50**. As shown in FIGURE 1, the contact **44** is bent along a diameter adjacent the ends of the contact arm **50** so that

the contact arm 50 is at an angle with respect to the remaining portion of the contact 44.

The contact 44 is mounted flat against the inner surface of the top 34 of the cover 14 with the contact arm 50 extending away from the inner surface of the top 34. The contact 44 is positioned so that the contact point 52 is on the side of the hole 38 through the top 34 of the cover 14 diametrically opposite the stop lug 42, as shown in FIGURE 2. The contact 44 is secured to the cover 14 by a hollow rivet 54 of an electrically conductive metal. The rivet 54 extends through the hole 38 in the top 34 of the cover 14, and through the hole 46 in the contact 44. The rivet 54 has an annular flange 56 extending radially outwardly from its inner end, and an annular flange 58 extending radially outwardly from its outer end. The inner flange 56 of the rivet 54 overlaps the portion of the contact 44 around the hole 46 in the contact to clamp the contact 44 to the top 34 of the cover 14. The outer flange 58 of the rivet 54 extends across and is embedded in the portion of the outer surface of the top 34 of the cover 14 around the hole 38. The inner flange 56 of the rivet 54 has a portion cut away to permit the stop lug 42 of the cover 14 to project therethrough. The contact 44 also has a portion adjacent the central hole 46 cut away to permit the stop lug 42 to project therethrough.

The assembly of the cover 14 and the contact 44 is mounted on the base plate 12 with the shaft 24 extending through the rivet 54. A C-washer 60 fits tightly within the groove 28 in the shaft 24 to secure the cover 14 on the shaft 24. The shaft 24 is of a length so that when the cover 14 is mounted on the shaft, the base plate 12 is within and extends across the open end of the cover 14, and the contact point 52 of the contact arm 50 slidably engages the resistance stripe 30. The contact arm 50 of the contact 44 extends from the contact 44 a distance such that when the cover 14 is assembled on the shaft 24, the engagement between the resistance stripe 30 and the contact point 52 pushes the contact arm 50 back toward the top 34 of the cover 14 slightly. Since the contact arm 50 is of a spring metal and is pushed back slightly, the contact arm 50 acts as a spring to maintain proper engagement between the contact point 52 and the resistance stripe 30. The spring action of the contact arm 50 also urges the top 34 of the cover 14 away from the base plate 12 to hold the outer flange 58 of the rivet 54 in engagement with the C-washer 60.

In the assembled condition of the variable resistor 10 of the present invention, the shaft terminal pin 26 is electrically connected to the contact point 52 through the shaft 24, the rivet 54, and the contact 44. Thus, in the use of the variable resistor 10 of the present invention, a varying resistance is obtained between the shaft terminal pin 26 and either of the terminal pins 16 and 18 by rotating the cover 14 on the shaft 24 with respect to the base plate 12. The serrated edge 40 of the cover 14 permits ease of rotating the cover 14. In fact, the serrated edge 40 of the cover 14 permits the cover 14 to be rotated with respect to the base plate 12 even when the variable resistor 10 is mounted with only a portion of the periphery of the cover 14 exposed.

The stop lugs 32 and 42 project from the base plate 12 and the top 34 of the cover 14 respectively a distance such that the stop lugs 32 and 42 are in overlapping relation longitudinally of the shaft 24. Thus, upon rotation of the cover 14 with respect to the base plate 12, the stop lugs 32 and 42 will come into mating engagement to limit such rotation. The stop lug 42 on the cover 14 is of a circumferential length that when the end 42*a* of the stop lug 42 engages the end 32*a* of the stop lug 32 on the base plate 12, the contact point 52 is at the end 30*a* of the resistance stripe 30, and when the end 42*b* of the stop lug 42 engages the end 32*b* of the stop lug 32, the contact point 52 is at the end 30*b* of the resistance stripe 30. Thus, the stop lugs 32 and 42 limit the rotation of the contact point 52 to the length of the resistance stripe 30.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A variable resistor comprising a base plate of an electrical insulating material, an arcuate resistance stripe on one surface of said base plate, terminals extending from the ends of said resistance stripe, a cover of an electrical insulating material extending over the one surface of said base plate and the resistance stripe, a shaft mounted on the base plate at the center of the arcuate path of the resistance stripe and projecting from the one surface of the base plate, said cover having a hole therethrough through which the shaft extends to support said cover for rotation with respect to said base plate, a contact of an electrically conductive metal seated against the surface of said cover facing said base plate, said contact having a contact point slidably engaging said resistance stripe, a hollow rivet of an electrically conductive metal extending through the hole in the cover and surrounding the shaft, said rivet fixedly securing the contact to the cover and slidably engaging the shaft so as to electrically connect said contact to said shaft, and a terminal for said contact secured to said shaft and extending through the base plate.

2. A variable resistor in accordance with claim 1 in which the cover is cup-shaped, and the base plate is circular with the base plate extending across the open end of the cover.

3. A variable resistor in accordance with claim 2 including a separate stop lug on each of the base plate and the cover, said stop lugs being in overlapping relation longitudinally of the shaft and being positioned so that they are engageable to limit the rotation of the contact point to the length of the resistance stripe.

4. A variable resistor in accordance with claim 3 in which the contact comprises a disc of an electrically conductive spring metal, said disc having a central hole therethrough through which the shaft extends, and an arcuate opening therethrough around a portion of said central hole, said arcuate opening providing an arcuate contact arm, said contact arm being bent adjacent its ends to extend away from the cover and toward the base plate, and the contact point being formed on said contact arm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,451,241 Rosentreter ---------- Oct. 12, 1948

FOREIGN PATENTS

783,782 Great Britain ---------- Oct. 2, 1957
796,931 Great Britain ---------- June 25, 1958