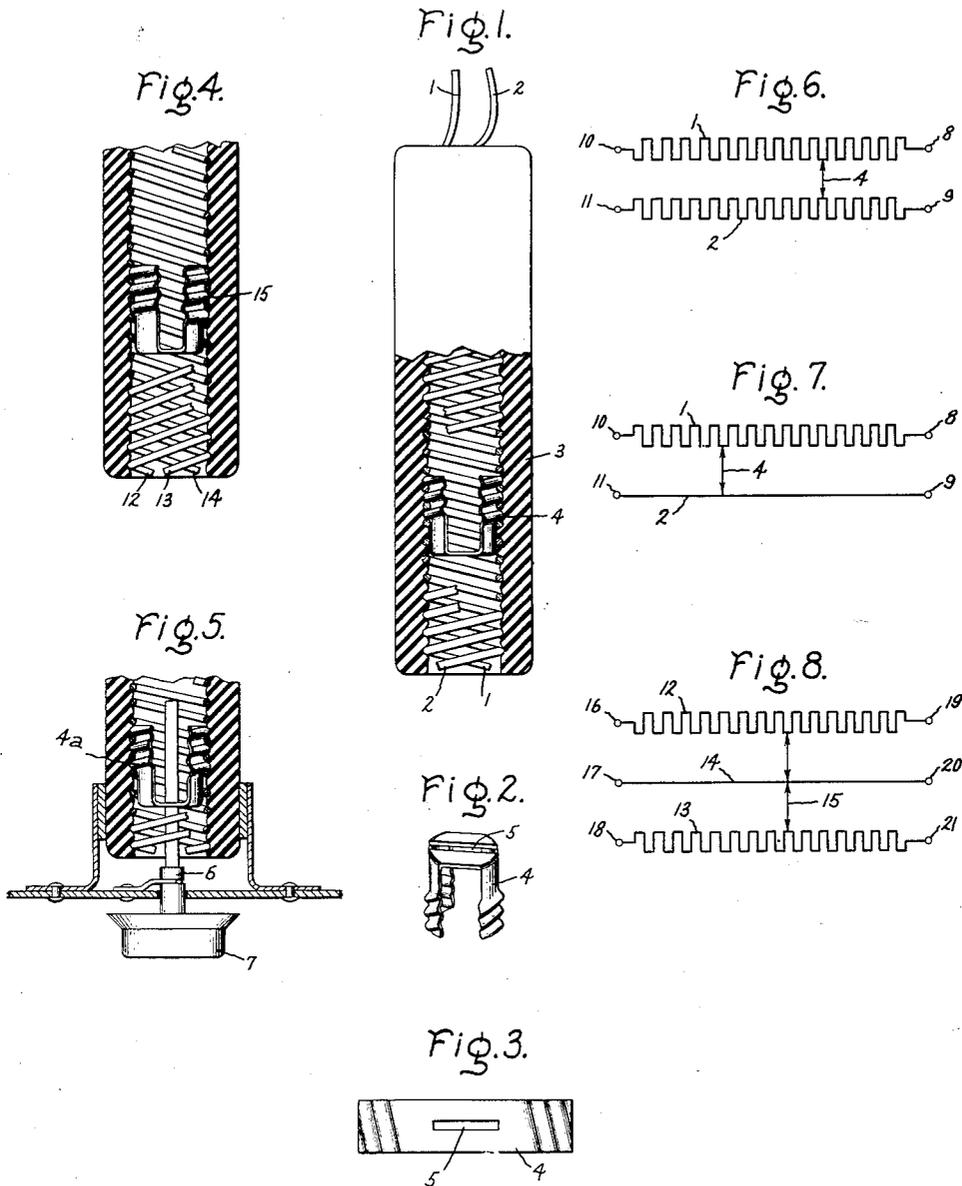


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WIRE WOUND RESISTOR

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WIRE WOUND RESISTOR

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The present invention relates to wire wound resistors as customarily used in radio and allied arts; and, more particularly, to adjustable or variable resistors or rheostats and potentiometer resistors.

It is an object of the present invention to provide an externally insulated resistor, the resistance value of which can be adjusted closely irrespective of the manufacturing tolerance. A further object is to provide a resistor whose resistance value can easily be changed after installation in a chassis or circuit arrangement. A still further object is to provide a novel variable potentiometer resistance. A still further object is to provide a resistance element of low manufacturing cost which is continuously variable over a relatively wide range, whereby the number of sizes of resistors which need be used or carried in stock can be reduced. A still further object of my invention is to provide a continuously variable resistor whose resistance is variable in a non-linear fashion.

The above and other objects of my invention as well as the method of carrying out the same will best be understood from the following description taken in connection with the accompanying drawing in which Fig. 1 is an elevation partly in section of a wire wound resistor in accordance with my invention; Fig. 2 is a perspective view of the adjusting screw used in Fig. 1; Fig. 3 is a development of Fig. 2; Fig. 4 shows a modification of my invention; Fig. 5 shows a further modification; and Figs. 6, 7, and 8 are schematic circuit diagrams of my resistors. As shown in the drawing my resistor comprises two conductors 1 and 2 formed of any desired similar or dissimilar metallic wires. The two wires 1 and 2 are helically wound spaced side by side on a mandrel, thus forming in effect a double threaded helix. The mandrel may be smooth or threaded as desired. After the wire has been wound and before it is removed from the mandrel, the helix is coated with a suitable insulating material 3 as, for example, a thermosetting plastic or preferably a ceramic. Where required, the insulated helix is then subjected to heat to cure the plastic or to fire the ceramic, whereby a solid support for the helix is produced. The mandrel is then removed, or, if desired, it may be removed after winding the resistance wire or prior to the heat treating operation.

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A double threaded screw 4, having threads formed on its exterior surface of the same pitch as the pitch of the wires forming the helix, is then inserted in one end of the hollow resistor, whereby the two resistance wires are interconnected, the point of connection depending upon the position of the screw within the helix.

The resistance circuit is thus completed between the conductors 1 and 2 through the screw 4. The resistance element is preferably connected into a circuit by means of conductors 1 and 2 as they extend from one end of the resistor. For many purposes it is immaterial whether the conductors at the other end of the resistor are interconnected or not. If desired, a single wire doubled into a loop may be used, starting the winding of the helix with the loop and terminating with the wire ends.

The adjusting screw 4 may be made of any desired conducting material having double threads adapted to engage the two wires 1 and 2 of the helix at various points as the screw is threaded into the resistor. The threaded portion of the screw is preferably axially slotted and slightly spread apart to tension the threaded portion against the wires. I prefer, however, as illustrated, to form the screw 4 from a thin spring material such as Phosphor bronze. I am thereby readily able to obtain a substantially constant contact pressure. The screw can, moreover, conveniently be made from strip stock by punching and forming operations as will be evident from the development of the screw as shown in Fig. 3. A slot 5 is punched in the head portion of the screw so that the screw may be turned by a screw-driver.

It will be understood that my resistor can be made in other ways than that described. For example, where low dielectric loss is essential the multiple wire helix may be supported within a frame or cage formed of narrow strips of low loss material. However, it is preferred to mold insulating material 3 around the formed wire helix so that the wire conductors are rigidly supported and maintained in spaced relation.

Figure 6 is a schematic circuit diagram of the resistance element shown in Fig. 1. If the wires 1 and 2 are resistance wires of equal resistivities, the element may be connected in a desired circuit by either end as represented, for example, by the terminals 8, 9 or by the terminals 10, 11. A

simple variable resistor is thus obtained when the screw 4 is turned.

On the other hand, as indicated in the schematic circuit diagram of Fig. 7, if only the wire 1 is a resistance wire of relatively high resistivity and the wire 2 is of low resistance so that it acts merely as a conductor, the element can be used as a potentiometer resistance or voltage divider. The resistance wire 1 is then connected, for example, across a potential source by terminals 8 and 10 and the third connection is made to the movable contact 4 at either terminal 9 or 11 of the wire 2.

More than two wires can be used in forming resistor elements according to my invention. Fig. 4 shows, by way of example, a resistor element using three wires 12, 13, and 14 wound into a triple threaded helix and contacted by a triple threaded screw contact member 15.

The triple wire resistor of Fig. 4 may be used in a wide variety of circuit arrangements; for example, one of the wires may be a low resistance conductor and the other two wires may be resistance elements. Such an arrangement is indicated in the schematic circuit diagram of Fig. 8. The terminals of the three wires at one end of the element are here designated by the reference numerals 16, 17, and 18 while those at the opposite end are designated by the numerals 19, 20, and 21 respectively.

If the wire 14 be of high conductivity material so that it acts merely as a conductor, and the wires 12 and 13 be resistance wires of equal resistivities, a tapped resistor of variable overall magnitude is obtained by using the three terminals at either end of the element, since the screw contact 15 interconnects all three wires. On the other hand, a potentiometer resistance is obtained by connecting terminals 16 and 21, for example, across a potential source and making the third connection to the movable contact 15 at either terminal 17 or 20.

If the wires 12 and 13 be made of resistance wires of different resistivities and the wire 14 is still a conductor of low resistance, a non-linear resistance element can be obtained. For this purpose, terminals 16 and 18, for example, are connected together to form one circuit connection while the other circuit connection is made to either terminal 17 or 20. Thus the wires 12 and 13 are connected in parallel with each other producing a non-linear resistance variation when the screw threaded contact member 15 is turned.

It will be evident that since my resistor is externally fully insulated, it can readily be mounted by means of a simple metal strap encircling the resistor, or in small sizes it can be supported by the ends of the conductors. Or if desired, the resistor may be panel mounted using the modification shown in Fig. 5. Here the screw threaded element 4a is slidably engaged by the flat portion of a shaft 6 which may be rotated by a knob 7. With this arrangement the resistor may be mounted, if desired, behind a panel and resistance variations can be obtained by turning the knob 7.

It will also be evident that by the use of my adjusting screw, resistors can readily be manufactured to any specified resistance value without prescribing or adhering to close manufacturing tolerances since the desired correct value of resistance can readily be obtained by turning the adjusting screw in or out as required. Moreover, a considerable range of resistance can be obtained with a given element without seriously

affecting its heat dissipation ability. Whenever the resistor's maximum heat dissipation ability is not required, a still greater range of resistance can be obtained with a given element.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A resistance element comprising a plurality of wire resistance conductors formed into a multiple threaded helix, the multiple of the threads corresponding to the number of conductors, each conductor being electrically separated from adjacent conductors, insulating material molded about the outer surface of said helix, an end terminal for each of said conductors, and an independent U-shaped sheet metal member having threads formed on the arms of the U of the same pitch and multiple as said helix for engagement with the inside of the conductors making up said helix for electrically interconnecting said conductors, the base of said U-shaped member including means by which it may be rotated to change its relative position within said helix.

2. A resistance element comprising a pair of wire resistance conductors formed into a double threaded helix, each conductor being electrically separated from adjacent conductors, insulating material molded about the outer surface of said helix, an end terminal for each of said conductors, and an independent U-shaped sheet metal member having double threads formed on the arms of the U of the same pitch as said helix for engagement with the inside of the conductors making up said helix for electrically interconnecting said conductors, the base of said U-shaped member including means by which it may be rotated to change its relative position within said helix.

3. A variable resistance element comprising three uniformly spaced wire conductors wound into a triple-threaded helix, each conductor being electrically separated from adjacent conductors, and insulating compound molded on the outer surface of said helix, two of said conductors having relatively high resistivities and the third conductor having relatively high conductivity, at least one terminal for each of said conductors, and an independent U-shaped resilient member of conducting material with a triple thread formed on the arms of the U of the same pitch as the thread of said helix, said member being threaded into said helix for interconnecting said conductors at points along the helix, the base of said U-shaped member including means by which it may be rotated to change its relative position within said helix.

4. A non-linear variable resistance element comprising three uniformly spaced wire conductors wound into a triple-threaded helix, each conductor being electrically separated from adjacent conductors, an insulating compound molded on the outer surface of said helix, two of said conductors having relatively high resistivities different from each other and the third conductor having relatively high conductivity, at least one terminal for each of said conductors,

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and an independent U-shaped resilient member of conducting material formed with a triple thread on the arms of the U of the same pitch as the thread of said helix, said member being threaded into said helix for inter-connecting said conductors at points along the helix, the base of said U-shaped member including means by which it may be rotated to change its relative position within said helix.

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