

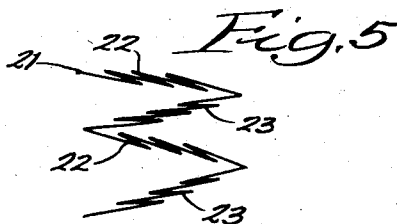
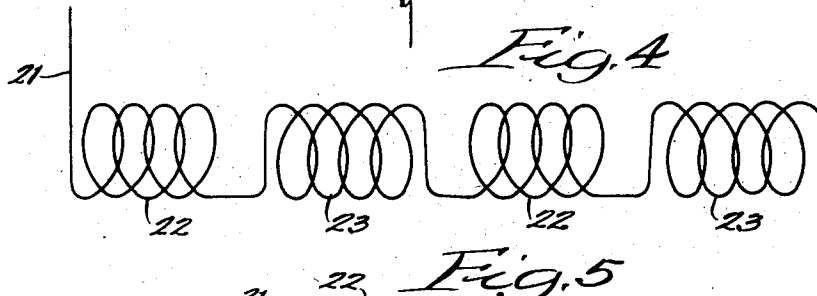
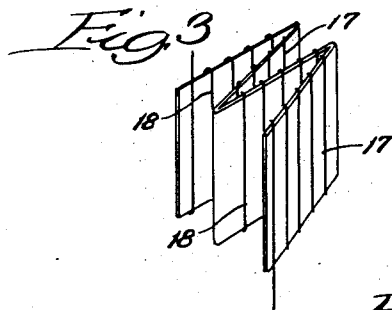
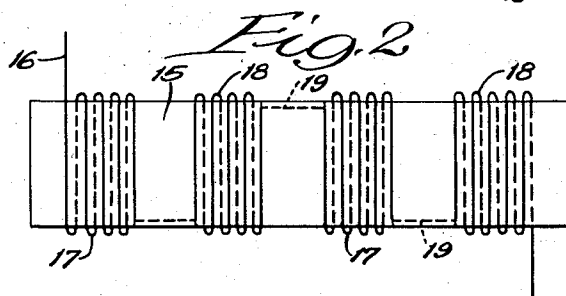
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WIRE TYPE PRECISION RESISTOR

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WIRE TYPE PRECISION RESISTOR

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6 Claims. (Cl. 338—62)

This invention relates to electrical resistors and more particularly to wire type precision resistors.

In wire type resistors it is highly important that inductance and capacitance effects be minimized and that the wire be so handled that resistance values can be uniformly controlled. It is also highly important that the resistor be so designed that it can be produced rapidly and inexpensively.

It is a primary object of the present invention to provide an electrical resistor which meets all of these requirements.

Another object is to provide a resistor in which the wire is wound into a plurality of separated sections with the wire being looped in opposite directions in adjacent sections.

It is another object to provide a resistor formed of a plurality of oppositely looped sections in which the sections are folded over into each other to be interleaved.

According to one feature of the invention, the wire is wound on a flat tape of insulating material with adjacent sections separated so that the tape can be folded between the sections.

In another desirable feature of the invention the sections are formed of flat loops with the wire held together by plastic or waxy adhesive material for convenient handling.

The above and other objects and features of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which:

Figure 1 is a sectional view with parts in elevation and a completed resistor embodying the invention;

Figure 2 is a view of a resistance element before folding;

Figure 3 is a partial perspective view illustrating the manner of folding the resistance element of Figure 2;

Figure 4 is a view similar to Figure 2 of an alternative construction; and

Figure 5 is an end view showing the resistor unit of Figure 4 in folded condition.

A completed resistor, according to the present invention, comprises a resistance unit 10 formed of an elongated piece of resistance wire mounted in a tubular insulating body 11 formed of ceramic material, plastic, glass, or the like. The ends of the wire forming the resistance unit preferably extend through the ends of the tubular body 11 and are engaged by enlarged end portions 12 on terminals 13. The terminals 13 may be formed by relatively large lengths of wire by which the resistor may be connected in circuit and may be physically supported and the enlarged ends 12 thereon are of a size to fit tightly into the ends of the tube and to complete a circuit with the ends of the wire which project from the tube. The complete unit may be sealed by wax, varnish, or the like, as shown at 14.

According to the present invention, the resistance unit itself is formed of a unitary wire wound into a plurality

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of separated sections with the adjacent sections wound in opposite directions and adapted to be folded over on each other. The unit, as shown in Figures 2 and 3, comprises a flat insulating tape or film 15 which may be formed of paper, woven glass fiber, or any other desired type of insulating material. The wire or resistance element, as indicated at 16, is wound around the tape to define alternate sections 17 which are wound in the same direction and which alternate with sections 18 wound in the opposite direction. Between the sections the tape may be slit at its edges and the wire may be passed through the slits, as indicated by the dotted lines 19 so that the direction of winding can be reversed. It will be noted that adjacent sections wound in this manner are similar in many respects to a pi filter in that the direction of the effective magnetic flux is opposite in adjacent sections.

After completion of the winding to form any desired number of sections so that the desired length of wire to produce the correct wire value is present, the complete winding just as shown in Figure 2, may be encapsulated in suitable insulating material, and this would result in a substantially rectangular shaped resistor unit; but where small overall size is a major consideration the tape may be folded between the sections to superimpose the sections upon one another, as shown in Figure 3, with the ends of the wire projecting from opposite ends of the folded body. After folding, the unit can be enclosed in any desired type of enclosure as, for example, a flat tubular body or enclosure formed by dipping the unit in wax, varnish, or similar coating material. For mounting in a small cylindrical tube, as shown in Figure 1, the folded body may be rolled for insertion in the tube, the superimposed sections thus being bent or folded about a common axis.

In any case, the completed unit is formed of a plurality of separate sections wound in opposite directions so that any inductance effect produced by the winding of the wire will be cancelled. Winding of the wire on the tape even though it is relatively closely wound will hold adjacent runs of wire slightly spaced so that the capacitance effect is minimized. Resistance units of this type can be formed rapidly and inexpensively through suitable automatic winding machinery and are easily reproducible so that uniformity of product can be obtained.

Figures 4 and 5 illustrate an alternative construction of a resistance unit in which a length of wire, as shown at 21, is wound into a plurality of alternate sections 22 and 23. Each section is in the form of a series of flat overlapping loops with the wire being looped in opposite directions in adjacent sections. The wire may be held in position by coating or covering it with a film of adhesive material, such as a wax, which will adhere to itself, a varnish, a plastic material, or the like. Thus after the sections are wound, they tend to remain in the form of self-supporting units and can be folded upon themselves, as shown in Figure 5. The folded assembly may be covered or placed in an enclosing casing in the same manner as the unit of Figures 2 and 3 to form a completed resistor.

In this construction, each of the sections is non-inductive since the current flows in opposite directions in opposite portions of each loop and since there is no circular flow of current around a center or axis to produce inductance. Thus a single section formed of flat loops can be used effectively as a resistor. When a plurality of oppositely wound sections are used, as shown, any inductive effect present in the sections will cancel. Capacitance is also minimized because the wires are relatively well separated as compared to a conventional wound resistor.

While two embodiments of the invention have been shown and described herein, it will be understood that they are illustrative only and not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. An electrical resistor comprising an elongated resistance element formed into a plurality of connected but separate sections, each section comprising a series of loops all wound in the same direction but with the loops of adjacent sections wound oppositely those of its adjacent section or sections so that while each section has a definite magnetic axis with an effective magnetic flux in one direction along said axis, such flux is substantially cancelled, said loops each comprising a first length portion of curved configuration and a second length portion of oppositely curved configuration and a reverse bend portion connecting said first and second length portions, the respective first and second length portions of each section lying generally in parallel planes.

2. An electrical resistor comprising an elongated resistance element formed into a series of loops connected to form a generally helical configuration with each loop forming a turn of said helical configuration, said loops each comprising a first length portion of curved configuration lying in a first plane and a second length portion of oppositely curved configuration lying substantially in a second plane and a reverse bend portion connecting said first and second length portions, the first and second planes of successive loops lying generally parallel to the length dimension of the configuration, and the loops being disposed to have current flow through the first length portions thereof in a first general direction and to have current flow through the second length portions thereof in a second general direction substantially opposite to said first direction, and said loops being disposed to have the first length portion of one loop in closely adjacent relation to the second length portion of an adjacent loop in comparison with the maximum spacing between the first and second length portions of each loop.

3. In a resistor assembly, a wire type precision resistance unit comprising an elongated piece of resistance wire formed into groups of turns of substantially uniformly spaced regular disposition with opposite sides of the respective turns lying in a pair of closely spaced generally parallel planes, and insulating means in intimate contact with all of said turns sustaining said groups of turns in said substantially uniformly spaced regular disposition, the successive groups of turns being oppositely wound along the length of said unit.

4. An electrical resistor comprising an elongated wire formed into a plurality of separate sections, the wire in each section being in the form of a flattened helix with the successive turns of the helix lying substantially in planes extending generally parallel to the length of the helix, and successive portions of the helix overlapping to place portions of said wire which are adapted to receive current flow in opposite directions in closely adjacent relation for substantial cancellation of the associated magnetic fields.

5. An electrical resistor comprising an elongated wire formed into a plurality of separate sections, the wire in each section being in the form of a flattened helix with the successive turns of the helix lying substantially in planes extending generally parallel to the length of the helix, and successive portions of the helix overlapping to place portions of said wire which are adapted to receive current flow in opposite directions in closely adjacent relation for substantial cancellation of the associated magnetic fields, the sections being folded upon each other in pleated relationship.

6. An electrical resistor comprising a length of wire formed into a flattened helix comprising a series of turns each lying in a plane extending generally parallel to the length of the helix, the successive flattened turns being disposed in overlapping relation lengthwise of the helix, to place portions of said wire which are adapted to have current flow therein in opposite directions in closely adjacent relation so that the associated magnetic fields substantially cancel one another.

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