June 24, 1930. E. R. STOEKLE 1,767,715

ELECTRICAL RESISTANCE

Filed Feb. 19, 1927

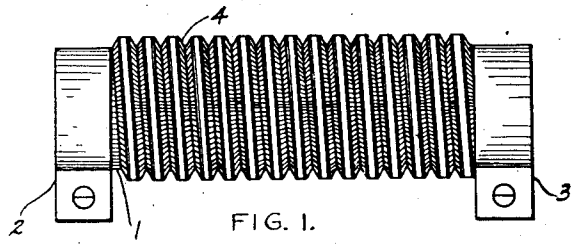


FIG. 1.

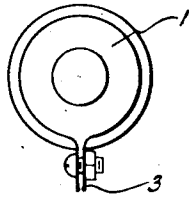


FIG. 2

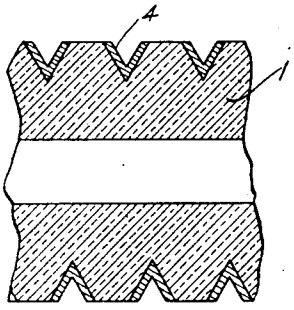


FIG. 3.

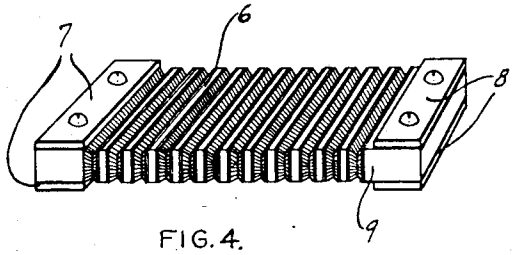


FIG. 4.

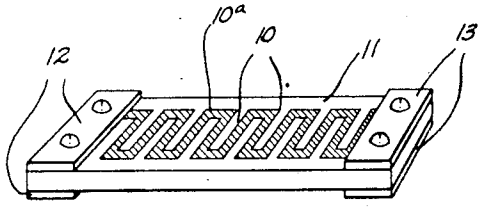


FIG. 5

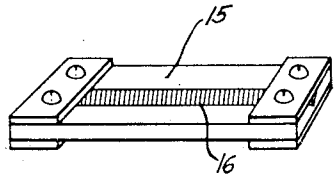


FIG. 6

FIG. 7.

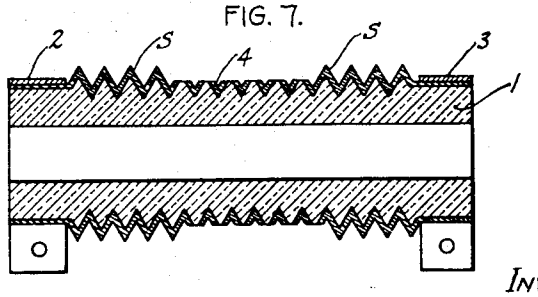
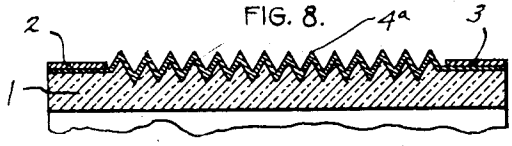


FIG. 8.



INVENTOR:
Erwin R. Stoekle

Patented June 24, 1930 1,767,715

UNITED STATES PATENT OFFICE

ERWIN R. STOEKLE, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO CENTRAL RADIO LABORATORIES, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN

ELECTRICAL RESISTANCE

Application filed February 19, 1927. Serial No. 169,425.

This invention relates to improvements in electrical resistances and methods of making the same. Although having wide adaptability, it is particularly applicable to making resistances of high value, having a minimum of electrical inductance, and is therefore especially adapted for use in the radio art.

One object of the invention is to provide an improved electrical resistance in which the conducting element consists of a thin conducting path deposited, sprayed, or otherwise applied upon an insulating core, and having in the final product a spiral or helical form, a reflex, that is, a sinuous or tortuous form, or such other form as may best adapt the electrical resistance to the particular use to which it is to be put.

Another object is to provide an improved and simple method of constructing a resistance having a high resistance compared to its inductance.

Another object is to provide a high electrical resistance without the use of a large number of turns of fine wire, thus simplifying the construction and also decreasing the amount of self induction.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawing forming a part of this specification, and in which;

Figure 1 is a view in elevation showing a preferred form of a resistance unit embodying the invention.

Figure 2 is a view in end elevation over the resistance unit shown in Figure 1.

Figure 3 is an enlarged longitudinal sectional view of a portion of the resistance unit shown in Figures 1 and 2.

Figure 4 is a perspective view showing another form of the resistance unit.

Figure 5 is a similar view of still another form of the resistance unit.

Figure 6 is a perspective view illustrating an elemental form of the resistance unit.

Figure 7 is a longitudinal sectional view showing a variation of a form of the resistance unit illustrated in Figures 1 to 3, and

Figure 8 shows another embodiment of the invention.

Referring to Figure 1, the cylindrical core 1 is made of an insulating material such as Lavite or porcelain. The surface of this core is spirally grooved or threaded, except for the ends which are left with a plain cylindrical surface. The surface of this core is coated with a thin layer of conducting material in such a manner that the walls of the groove formed by the thread, are also coated. This may be accomplished by first coating the core with a thin layer of graphite and then electro-plating it with nickel or other suitable metal. A metallic coating may be applied by spraying the surface of the core with finely divided molten metal, in accordance with the Schoop process. The thickness of the coating will determine partly the resistance which it is desired to obtain. After the core is coated, it is provided with suitable terminals 2 and 3, which are pressed into intimate contact with the conducting coating or soldered thereto.

The unit is then mounted in a lathe and the surface cut down or ground down so that the sharp outer diameters of the threads are completely removed. This will leave a spiral conducting layer in the groove formed by the thread, as shown at 4 (Figure 1) and will result in increasing the resistance a great many times. The conducting coating remaining inside the groove is better shown in the Figure 3 wherein it is exaggerated and enlarged for purposes of illustration.

Referring to Figure 3, the conducting coating 4 is shown lying in the convolutions of the groove on the insulating core. It will be observed that the V-shaped cross section of this conducting coating will be decreased in proportion as the outside diameter of the thread is cut down. In this manner the resistance of the unit may be increased to any desired value by varying the amount to which the threads are cut down. A further control of the resistance may be obtained by cutting down only a portion of the threads and leaving the remainder of

the surface in its initial condition as indicated at S in Figure 7 so that the current on this un-cut surface will not pass in a spiral path along the groove but will pass directly from the groove to groove over the tops of the threads. In this manner a threaded core, which has been coated, may be used to make a large number of desired values of resistance greater than the initial resistance of the coated core.

By giving the core a very thin coating and then cutting the threads down rather close to their root diameter, it is possible to obtain a very high resistance with relatively few convolutions of the conducting path as compared with a wire wound resistance of the same value. This results in a resistance having a very much smaller value of electrical inductance than a wire wound unit of the same resistance value.

In the unit shown in Figure 4 the ratio of the inductance to the resistance is further decreased by making the core 9 of a rectangular transverse section. In this form of the device the spiral grooves 6 are preferably moulded on the core 9. Terminal blocks 7 and 8 are in electrical contact with the conducting surface which carries the current to the conducting layer in the grooves. The inductance of this construction is decreased because of the fact that the ratio of the cross sectional area of the core to the length of one turn of the spiral is greatly decreased.

Figure 5 shows a flat form of the resistance in which the grooves 10 are reflexed back and forth on the surface of the insulating base 11. These grooves are preferably moulded on the base. After coating the entire surface including the surface of the grooves, the flat surface of the base is held against a grinding wheel. This operation removes the coating on the ridges separating the grooves and leaves a reflexed, that is, a tortuous or sinuous conducting coating in the grooves as shown at 10^a. Adjustment of the resistance is again made by the degree to which the surface is ground down. Terminal blocks 12 and 13 are provided for leading the current into the conducting surface in the grooves. The construction shown in Figure 5 will give a ratio of inductance to resistance of practically zero value, which in certain radio applications is of considerable advantage.

In Figure 6 an elemental form of the invention is shown and as illustrated comprises an insulating base 15 having longitudinal grooves 16 therein. The groove 16 may be of any suitable cross sectional shape and in the embodiment illustrated is a V-shape in cross section. As in the other forms of the invention a metallic coating is applied to the walls of the groove and to at least the portions of the upper surface of the base which are contiguous to the groove 16. The upper surface of the base is then ground away to remove the portions of the metallic coating lying on the upper surface of the base and such portions of the base and of the conductor in the groove as may be necessary to obtain a resistance of the desirable value.

In all embodiments of the invention, after the unit has been adjusted to the desired value of resistance, the surface may be coated with a suitable cement or with a vitreous enamel in order to protect the resistor lying in the grooves.

In Figure 8 a spirally grooved core 1 is shown as having a continuous coating 4^a thereon. By having a spirally grooved or a grooved core with a thin coating of this character thereon the effective length of the coating and consequently the value of the resistance is markedly increased without having an unduly long unit.

It will be apparent to those skilled in the art, that other forms of the insulating core may be used to meet the conditions required without departing from the scope or spirit of my invention as defined in the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. The method of making an electrical resistance which comprises coating a spirally grooved insulating core with a thin layer of conducting material and then removing said coating from the spiral ridges on said core to leave a helical conducting coating in said grooves and providing suitable terminals for making electrical connections to said conducting coating.

2. The method of making an electrical resistance which comprises coating with an electrically conducting layer, the entire peripheral surface of an insulating base having communicating adjacent grooves, removing said layer from the ridges separating said adjacent grooves, so that the conducting layer remaining in said grooves forms a tortuous path on the surface of said base thereby forming a high resistance path for electrical current.

3. The method of making an electrically conducting helix which comprises coating a helically grooved insulating core with a layer of conducting material, and then removing said coating from the helical ridges separating said grooves.

4. The method of making and adjusting an electrical resistance which comprises forming adjacent communicating V-shaped grooves on the surface of an insulating base, coating said surface and grooves with a layer of conducting material, and then removing the ridges separating said adjacent grooves until the electrical resistance of the

conducting path remaining in said grooves has the desired value.

5. A method of making an electrical resistance which consists in applying a coating of conducting material to an entire surface of an insulating body having a groove which traverses and advances along the same and then removing the portions of the coating that occurs between the traversing portions of the groove.

6. The method of making and varying an electrical resistance to a desired value which consists in applying a coating of conducting material to a body of insulating material having a groove therein which winds around and along the same and which has a sloping wall, and then removing portions of the coating and portions of the insulating body to laterally separate the portions of the conducting material that occupy adjacent portions of the groove to the desired extent and to reduce the cross sectional area of the coating to the desired extent.

7. In the art of making electrical resistances having insulating bodies provided with grooves narrowing toward their bottom and having conducting coatings applied to the grooves the step of varying the value of the resistance which consists in simultaneously removing portions of the conducting coatings applied to the groove and portions of the insulating body forming the walls of said grooves.

8. A method of making an electrical resistance which consists in applying a coating of conducting material to an entire surface of a grooved insulating body and grinding away all of the conducting material outside of the groove.

9. The method of making an electrical resistance which consists in coating an interrupted or uneven surface of an insulating body with a thin layer of conducting material and removing a continuous strip of the conducting material from high portions of the coated body whereby to expose a continuous strip of said insulating body to increase the length of the conducting path of the conducting material.

10. The method of making an electrical resistance of a definite value which consists in providing an insulating body with a groove so that the body has an interrupted surface, placing a thin layer of conducting material in the groove so that only thin edges thereof project from the groove into the interrupted surface of the insulating body and removing a portion of the conducting material along such an edge until the desired value of resistance is obtained.

11. The method of making an electrical resistance of a definite value which consists in providing an insulating body with a groove so that the body has an interrupted surface, placing conducting material in said groove so that the main portion thereof is beneath the interrupted surface of the body and a thin edge thereof is arranged in line with said interrupted surface and removing a portion of the conducting material along said thin edge.

12. The method of making an electrical resistance which comprises applying a coating of conducting material to an insulating body of irregular shape so that a thin portion of the conducting material projects outwardly from the insulating body and from the main portion of the conducting material, and removing some of the conducting material along said thin outwardly projecting portion.

13. An electrical resistance unit including an insulating supporting member having a groove therein and a thin layer of comminuted conducting material mounted in the groove and having an interrupted edge in line with the interrupted surface of said supporting member.

14. An electrical resistance unit including an insulating supporting member having a groove therein so as to provide an interrupted surface and a thin layer of conducting material having a graphite base mounted in the groove and having an interrupted edge in line with the interrupted surface of said supporting member.

In witness whereof, I hereto affix my signature.

ERWIN R. STOEKLE.