Dec. 23, 1958 G. RISK 2,866,061

TORTUOUS CONDUCTANCE PATH RESISTOR

Filed May 3, 1956

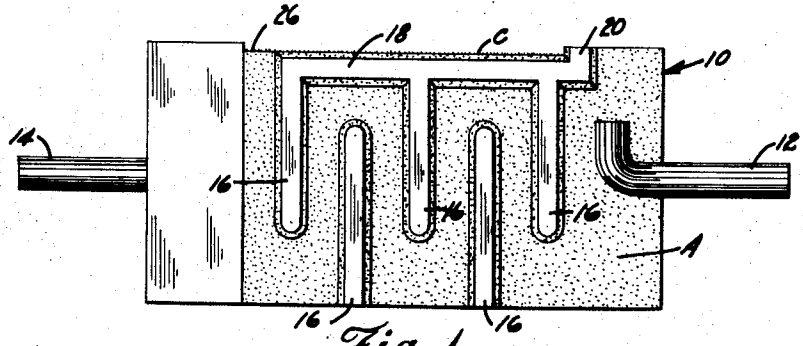


Fig. 1.

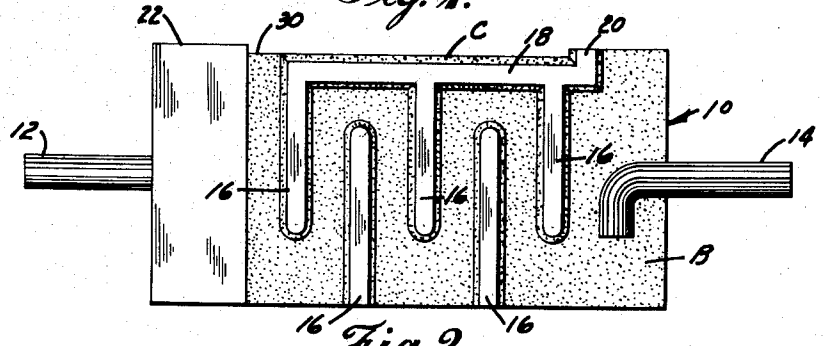


Fig. 2.

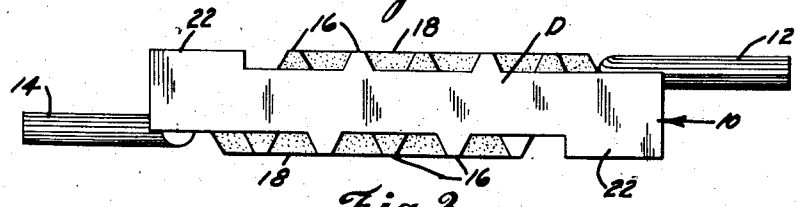


Fig. 3.

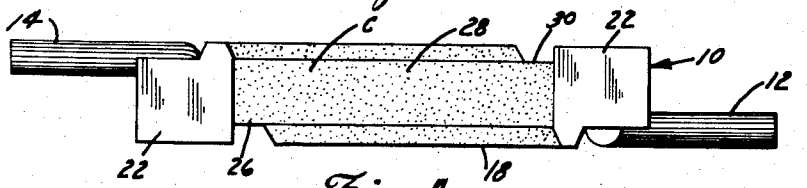


Fig. 4.

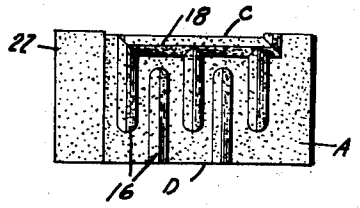


Fig. 5.

INVENTOR.
George Risk
BY A. Hirsch Agent

United States Patent Office 2,866,061
Patented Dec. 23, 1958

2,866,061

TORTUOUS CONDUCTANCE PATH RESISTOR

George Risk, Columbus, Nebr.

Application May 3, 1956, Serial No. 582,575

1 Claim. (Cl. 201—73)

This invention relates to resistors of the deposited carbon film type and more particularly it is an object of this invention to provide a resistor construction which lends itself to the mass production of great quantities of such resistors having uniform conductiveness characteristics to a high degree of accuracy.

In the past, resistors of this type were made by coating a cylindrical rod with a carbon film; then to obtain higher resistance values, it has been the practice to grind a helical groove along the length of the coated rod, thus multiplying the length and reducing the width of the conductive path between the ends of the resistor, and thus raising the resistance in ohms to desired values.

This operation, commonly referred to in the art as spiralling, is costly since each single resistor must be chucked in a lathe type machine that rotates and advances the coated rod across a high speed diamond abrasive cutting wheel.

It is one of the objects of this invention, therefore, to provide a resistor of the type described, having such irregular surface characteristics that make possible lengthening of the conductive path by mass production methods.

It is an object of this invention to provide a resistor formed on a blank having ribs preferably a triangular shape in cross section. It is my conception to coat such a blank with carbon and then to grind away the apex of each triangular rib simultaneously in a lapping process leaving a very long conductive pathway extending along the sides of the ribs where the carbon deposit has not been ground away.

A further object is to provide a carbon coated resistor having ribs the apex of which may be lapped or ground away to varying degrees whereby different degrees of conductiveness may be obtained.

A further object is to provide, in a resistor as described, a configuration of ribs in which two groups of ribs are disposed opposite each other with ribs of one group overlapping ribs of the second group and being spaced apart from ribs of the second group for providing a tortuous conducting pathway between, but not over, the ribs.

I am aware that there exists in the prior art a certain patent to Glynn 2,622,178 in which an electric heating element is formed in a somewhat similar way to the resistor of my invention. However, the heating element of the Glynn patent has ribs which are not formed of a frustro-triangular shape.

Also, the Glynn patent is from the electrical heater field, a field much different from the resistor field and in which a metal conductive coating rather than a carbon conductive coating is used.

Further differences between the resistor of my invention and the electric heater of Glynn reside in the provision in my resistor of ribs on both on a top and a bottom side rather than on one side only and in the use of one of the vertical sides as a carbon deposited conductive area forming a part of the tortuous conductive pathway.

This application is a continuation in part of the applicant's co-pending Patent Application No. 374,179, filed August 13, 1953, now abandoned.

Other and further objects and advantages of the present invention will be apparent from the following detailed description, drawings and claim, the scope of the invention not being limited to the drawings themselves as the drawings are only for the purpose of illustrating a way in which the principles of this invention can be applied.

Other embodiments of the invention utilizing the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claim.

In the drawings:

Fig. 1 is an elevational view of a completed resistor;

Fig. 2 is an elevational view of the same resistor shown in Fig. 1, but from the opposite side, i. e., simply turned over end for end;

Fig. 3 is a bottom view of a completed resistor;

Fig. 4 is a top plan view of a completed resistor; and

Fig. 5 is an elevational view of the resistor after completion of the carbon deposit process, and before the process of lapping.

Throughout the drawings, a body upon which the resistor is formed is generally indicated by the numeral **10**.

Incoming and outgoing electric cables **12** and **14** are shown connectably secured one at each of the ends of the resistor body.

The body **10** of the resistor is generally in the shape of an elongated rectangular prism having a plurality of laterally and alternately disposed ribs **16** on each of its broad sides. These broad sides will be referred to as A and B. The opposite edges will be referred to as C and D. The ribs **16** do not extend the full lateral length of the sides but end in a distance from the edge of said sides.

A longitudinally disposed rib member **18** is provided adjacent the upper edge of the side and connects the upwardly extended ends of the upper positioned ribs and has a right angle upwardly extended portion **20**.

The ribs **16** and **18** are of a triangular shape in cross-section the apex of which is upwardly extended.

The ribs **16** and **18** are of known and exact shape and size in cross section as is important because when this is accurate then a certain amount of lapping or grinding away of the outermost portion of the ribs, as later described, will cause dozens and dozens of resistors all being lapped at the same time to have the same conductance characteristics within a high degree of accuracy. This would not be true if the ribs were of haphazard shape and size with no attention to accuracy.

As presented in the drawings, the upper rib **16** combined with the longitudinal member **18** form an "E"-like configuration and the lower ribs are equally disposed between the spaced apart upper ribs.

On each end of the resistor body **10** a thickened end portion **22** is provided and extends outwardly from the body **10** opposite from the connections of the cables **12** and **14** a distance equal to the height of the ribs **16**.

As best seen in the side elevations of Fig. 1 and Fig. 2, the end portions **22** extend a short distance above the top surface of the body, the purpose of which is later described.

It is in this form, as described above, that the resistor body is originally molded, the apex of the ribs being pointed. The resistor body is then coated with a deposit of carbon as illustrated in Fig. 5 of the drawings.

Portions of the carbon deposit are removed from the resistor body **10** by means of the process of lapping or grinding away the pointed tips of the ribs **16** and **18** and the flat surfaces of the thickened end portions **20**, the flat surfaces of the ends of the body, and the full length

of the bottom surfaces of the body. Referring to Fig. 4 which is a top view of the finished resistor, it will be seen that the upwardly extended top portions of the thickened end portions **20** are the only surfaces ground away or lapped due to the lowered center portion of the top.

The shape of the ceramic body **10** lends itself easily and readily to the lapping process in mass production quantities. The resistor appears as illustrated in Figures 1, 2 and 3 after the process of lapping.

The maze-like configuration formed by the ribs **16** and **18** in combination with other carbonless portions of the body **10** is such that after lapping, a tortuous path of carbon deposit forms a most irregular and lengthy conductance circuit.

Electricity enters at the electric inlet **12** and travels up and down one side as shown in Fig. 1 to the top at **26**, across the top **28** to the point **30** at the opposite end of the top **28** and down in a similar configuration on the other side of the body **10** to the electric outlet **14**.

The essence of the production of resistors of exact and extremely accurate resistance by the process described in this invention is in having the ribs **16** of a known cross-sectional size and shape so that the lapping way of the apex of each rib to a certain extent leaves a certain and known area of carbon on each side of each rib available for electrical conduction.

For this reason it is preferable that the ribs be of a frustro-triangular shape before and after lapping with the outwardly extending side of the ribs protruding outwardly uniform and known distances. Expressed in another way each hypotenuse of the cross-sectional frustro-triangular configuration of each rib is of a known length and is of a constant length in each of many resistor blanks whereby a uniform amount of lapping of each of many hundreds of resistors will result in a substantially uniform resistance in each of the resistors.

It will be further seen that the cross-sectional area need not necessarily be frustro-triangular and that the side of the ribs can be of arcuate or other shape and yet with the same results provided the sides are of uniform and known types or in other words if the sides protrude away from the body **10** known distances, which are uniform from resistor blank to resistor blank among a group of coated resistor blanks which are to be made into substantially identical resistors by uniform amounts of lapping.

When a group of resistors are in this way uniform in shape a great quantity can be lapped at one time and uniform results will be obtainable.

It will thus be seen that on the small body, a conductance path is formed of relatively very great length, and that by reason of the flat surfaces presented lapping can be accomplished easily and in great quantities simultaneously.

From the foregoing description it is thought to be obvious that a resistor constructed in accordance with my invention is particularly well adapted for use by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification without departing from the principles and spirit thereof, and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice, except as claimed.

I claim:

A resistor body for use in electronic circuits of substantially prismatic shape including two parallel sides hereinafter referred to as sides A and B, and two opposite edges hereinafter referred to as C and D, side A having an electrical inlet and side B having an electrical outlet, said inlet and outlet being substantially positioned at opposite ends of sides A and B, said resistor body being provided with ribs positioned as follows, an E-shaped rib positioned on surface A, all portions of which are spaced from the edges of surface A except one point which contacts surface C, a raised portion throughout the width of surface A and disposed on the end thereof opposite the electrical inlet, two rib members extending from the edge of surface D and interposed between the bars of the figure E but contacting no part thereof; surface B being provided with parts similar and analogous to those on surface A but bearing the relationship of mirror images; surface C having a raised portion throughout its width at each end thereof; all of said before mentioned ribs being of accurate and precisely known shape and size in cross-section and being lapped away at the outermost portions as seen in cross-section whereby a group of such resistors can be simultaneously lapped for removing the outermost portions of said ribs to produce a group of resistors having conductance characteristics which are substantially the same, all of said raised portions and the whole of surface D being lapped, a carbon deposit on all unlapped portions of said resistor whereby a tortuous conductive pathway is formed from side to side progressively along surface A from the inlet, backward along surface C, progressively forward and from side to side on surface B to outlet thereon.

References Cited in the file of this patent

UNITED STATES PATENTS

1,767,715	Stoekle	June 24, 1930
2,119,680	Long	June 7, 1938
2,416,347	Rector	Feb. 25, 1947
2,622,178	Glynn	Dec. 16, 1952