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M. MORRISON

HIGH RESISTANCE CONDUCTOR AND METHOD OF MAKING THE SAME

Filed April 27, 1922

FIG. 1.

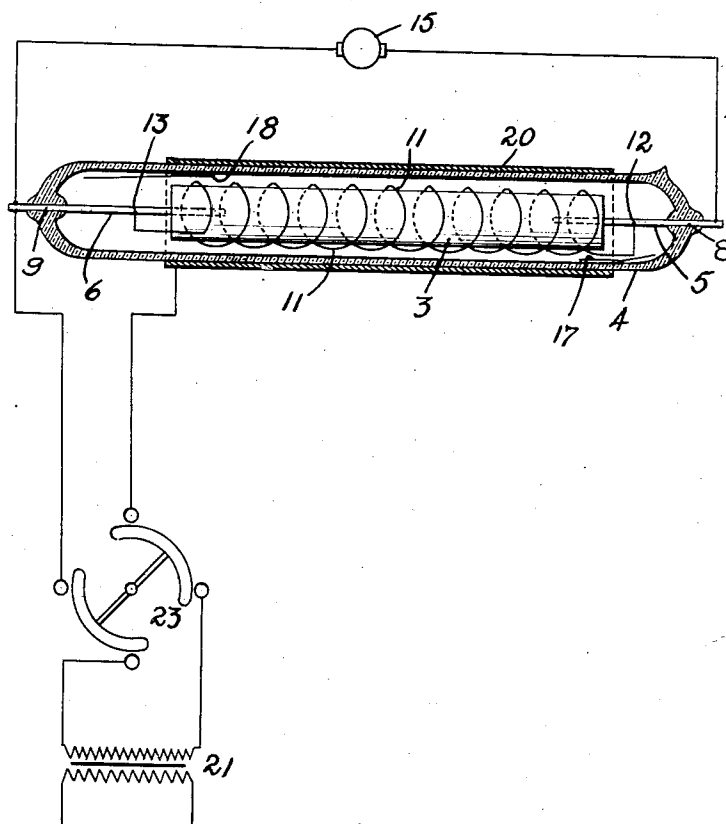
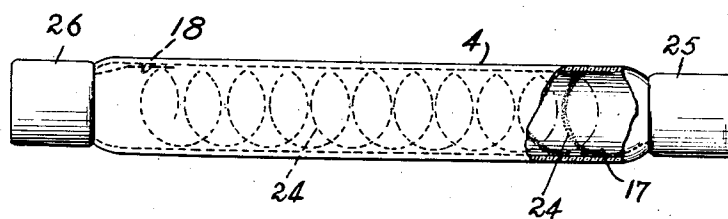


FIG 2



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HIGH-RESISTANCE CONDUCTOR AND METHOD OF MAKING THE SAME.

Application filed April 27, 1922. Serial No. 556,976.

To all whom it may concern:

Be it known that I, MONTFORD MORRISON, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented a new and useful Improvement in High-Resistance Conductors and Methods of Making the Same, of which the following is a specification.

This invention relates to a novel form of high-resistance conductor and a method of making the same.

The invention has for one of its objects the provision of a conductor of such form and size that its resistance within a given space may be made greater than that of the resistors now in use.

Another object of the invention is the provision of a novel method for depositing electrically conductive material.

A further object of the invention is the provision of a method whereby an electrically conductive material may be deposited in a predetermined configuration.

A still further object of the invention is the provision of a high-resistance unit, the properties of which will remain constant.

Other objects may be inferred from a reading of the following specification.

In making high-resistance conductors, the resistance of which is rated in megohms, it has been proposed to deposit a metallic film on the entire inner wall of a tube. The requisite thinness of the deposit may thereby be attained but, in effect, the conductor will be a broad band, the breadth of the band giving it a comparatively large cross section and, therefore, a comparatively high conductivity, which is contrary to the purpose.

According to my invention, a conductor of any degree of thinness and narrowness and, therefore, resistance may be produced. To this end, I form a resistor by depositing a film of material of filamentary form in a predetermined restricted path which may take the form of a helix or otherwise concentrated configuration adherent to the surface of a non-conducting material. It is obvious that a conductor of such form has a much higher resistance in a given space than resistors deposited over the entire inner surface of a tube.

In order to cause the particles of material to be deposited in the desired path, I employ, as an electrode, an element of the same

form as that which it is desired to deposit and place this in close proximity to, say within a few mms. of, the surface on which the material is to be deposited. I employ also high-tension, unidirectional current to cause electrostatic precipitation of the particles to be deposited.

A clearer understanding of my invention may be had by reading the following description taken in connection with the accompanying drawings, in which,

Fig. 1 is a diagrammatic representation of the apparatus used for depositing the high-resistance conductor; and,

Fig. 2 is a side elevation, partly in section, of the high-resistance unit mounted for use.

Fig. 1 of the drawing shows a cylindrical body 3 of refractory insulating material, the periphery of which is concentric with, and in close proximity to, the interior diameter of a cylindrical envelope 4 within which the cylinder 3 is suspended by means of leading-in conductors 5 and 6 which are sealed into the walls of the envelope 4 at 8 and 9, respectively, and embedded in the ends of the cylinder 3.

A filament 11 of conducting material, such for example, as carbon, is wound into a helix around the cylinder 3 and has its terminals secured to the leading-in conductors 5 and 6 at points 12 and 13, respectively. A source of power 15 is connected to the leading-in conductors 5 and 6 in order to heat the filament 11 to any desired temperature. The cylindrical envelope 4, which surrounds and encloses the cylinder 3 and the filament 11, consists of an insulating material, such as glass. The envelope 4 is preferably exhausted to avoid oxidation of the filament 11 when the latter is heated, after which an inert gas such, for example, as argon, may be introduced and the envelope then sealed from the atmosphere.

Within the cylinder 4, in contact with its interior wall, and preferably partially embedded therein, are two leading-in conductors 17 and 18 capable of making an airtight seal with the envelope 4. The function of these leading-in conductors will be hereinafter explained.

Surrounding at least a portion of the envelope 4 and in contact with the outer surface thereof is an electrode 20, the length of which should be equal to the length of the helical coil 11. The coil 11 and the cylindrical plate 20 constitute the electrodes of

a circuit which is supplied with power from a high-tension source 21 which may be the secondary of a transformer. A high-tension rectifier 23 is connected into the circuit in order to maintain the electrode 11 at a negative potential and the electrode 20 at a positive potential.

In practicing this invention, the filament 11, which is preferably carbon (because this element has comparatively high resistance), is heated by an electric current to a temperature at which it is partially vaporized. As soon as vaporization of the filament commences, the high tension existant between the filament 11 and the electrode 20 directs the particles of vaporized carbon to points on the interior surface of the envelope 4 substantially opposite the points of the carbon filament 11 from which they proceed. The deposition of carbon in this manner results in a conducting film of the same form or configuration as that of the filament 11. It will be appreciated that the conductivity of the deposited material will depend upon such factors as the length, diameter, pitch, circumference and temperature of the filament 11, and the length of time during which the deposition takes place.

After accomplishing the formation of the high-resistance element by deposition, the cylinder 3, the filament 11, and the leading-in conductors 5 and 6 may be removed from the envelope 4 by breaking off both ends of the tube 4 after which the ends of the latter may be sealed from the atmosphere to preclude contact with moisture, a variation in which is likely to change the conductivity of the high-resistance element.

Referring to Fig. 2, the deposited conductor is represented by the line 24, the ends of which are secured to the leading-in conductors 17 and 18 which are sealed into the ends of the tube 4 and secured, as by soldering, to the terminals 25 and 26, respectively. While I have herein described one embodiment of my invention and a method of producing the same, it is to be understood that many modifications may be made both in the article and the process but that it is desired to cover such of these modifications as come within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A high-resistance element comprising a filamentary body of electrically conductive material deposited upon a body of insulating material.

2. A high-resistance element comprising a filamentary body of carbon deposited upon a body of insulating material.

3. A high-resistance element comprising a filamentary body of electrically conductive material deposited upon an insulating material and sealed from the atmosphere.

4. A high-resistance element comprising a

filamentary body of carbon deposited upon an insulating material and sealed from the atmosphere.

5. A high-resistance conductor comprising a filamentary body of conductive material deposited on an electrically insulating body according to a predetermined configuration.

6. A high-resistance element consisting of a filamentary body of conductive material deposited in a concentrated configuration on an electrically insulating body and sealed from the atmosphere.

7. A high-resistance element consisting of a filamentary body of carbon deposited in the form of a coil on an electrically insulating body.

8. A high-resistance element consisting of a filamentary body of carbon deposited in the form of a helix on an electrically insulating body and sealed from the atmosphere.

9. A high-resistance device comprising an evacuated sealed envelope of insulating material and a body of conductive material of filamentary form deposited within said envelope.

10. A high resistance device comprising an evacuated sealed envelope of insulating material and a body of conductive material of filamentary form deposited within said envelope and leading-in conductors extending from the exterior to the interior of said envelope and making contact with the ends of the deposited material.

11. A high-resistance device comprising an evacuated sealed envelope of non-conducting material and a filamentary body of carbon deposited on the interior surface of said envelope and having a concentrated form.

12. A high-resistance device comprising an evacuated sealed envelope of non-conducting material and a filamentary body of carbon deposited in the form of a helix on the interior surface of said envelope.

13. An apparatus for forming a high-resistance conductor comprising an exhausted envelope of insulating material, an electrode surrounding said envelope, means for charging said electrode to a positive potential, a conductive filament within said envelope in close proximity to the surface thereof, means for vaporizing said filament and means for charging the same to a negative potential.

14. An apparatus for forming a high-resistance conductor comprising an evacuated sealed envelope of insulating material, an electrode surrounding said envelope, a carbon filament within said envelope in close proximity to the interior surface thereof, means for vaporizing said carbon filament and a source of high potential, the negative terminal of which is connected to said carbon filament, the positive terminal be-

ing connected to the electrode surrounding said envelope.

15. The method of forming a high-resistance conductor which consists in partially vaporizing an electrically conductive material and electrostatically depositing the resulting vapor on a non-conducting body.

16. The method of forming a high-resistance conductor which consists in partially vaporizing a body of refractory material and electrostatically depositing the resulting vapor in a predetermined path on an electrically non-conducting material.

17. The method of forming a high-resistance conductor which consists in vaporizing a conductive filament of predetermined form and electrostatically depositing the resulting vapor on a body of insulating material.

18. The method of forming a high-resistance conductor which consists in vaporizing a conductive filament of predetermined form and electrostatically depositing the resulting vapor on a body of insulating material placed in close proximity to said filament.

19. The method of forming a high-resistance conductor which consists in vaporizing electrically conductive material and electrostatically depositing the resulting vapor on a body of insulating material.

20. The method of forming a high-resistance conductor which consists in vaporizing a carbon filament of predetermined form in a vacuum and electrostatically depositing the resulting vapor on a body of insulating material placed in close proximity to said filament.

In testimony whereof, I have hereunto subscribed my name this 25 day of April, 1922.

MONTFORD MORRISON.