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# PROVISIONAL SPECIFICATION

## "IMPROVEMENTS IN OR RELATING TO IMPREGNATION OF BRAIDED LINEN THREADS WITH CONDUCTING CARBON"

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH, Rafi Marg, New Delhi-1 India, an Indian registered body incorporated under the Registration of Societies Act (Act XXI of 1860)

*The following specification describes the nature of this invention :—*

This is an invention by :

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This invention relates to improvements in or relating to impregnation of braided linen threads laid together with conducting carbon to give the required electrical resistance values.

Hitherto these threads were enclosed in a homogeneous sheath of rubber or neoprene and imported as such as suppressor cables from abroad. These cables are used as Insulated High Tension Distributed Resistance Ignition Cables for ingition systems of power units applicable to automative vehicles and allied installations particularly in the defence services and also as television and radio suppression cable. The reported method of preparation of these conducting linen threads is by impregnation with graphite solution.

This is open to the objection that graphite solution is to be imported. No details are available about the method of preparation and efforts to disperse graphite in solvents and impregantion of these linen threads has not given the required resistance values.

The object of this invention is to obviate these diadvantages by choosing an indigenously available carbon suitable for the purpose and evolve a method of impregnating it to get the desired resistance values.

To these ends, the invention broadly consists in dispersing the carbon black obtained by incomplete combustion of liquid naphtha obtained as a waste product in fertilizer factories in India in suitable solvents like trichloroethylene benzene, acetone, ether, ethanol and also in water to which some suitable wetting agents are added. Mixtures of some of these solvents with water may also be used. To the suspension of this carbon black, adhesives like PVC, purspex, gum acacia etc. need not be added in this process for adhesion, even though it is reported in literature for the process where in graphite solution has been used. Braided linen threads coiled loosely are dipped and kept for some time ranging from 15—30 minutes keeping the suspension stirred magnetically. After the treatment, the coil is taken out, dried and superficially pressed and dragged under pressure to remove the carbonacious material not adhering to the surface. Under optimum conditions of treatment, the desired resistance values could be obtained. The expected specifications for the suppressor cable when the braided linen is removed from the sheath corres ponds to 1000—2000 ohms per cm.

This could easily be achieved by the method and materials developed by us, sometimes by repeating the treatment until the desired resistance is obtained.

The following typical examples are given to illustrate the invention :

**Example 1**

Carbon black obtained by incomplete combustion of liquid naphtha supplied by EID PARRY (MADKAS) has been used, 25 gms of the material suspended in 100 ml of trichloroethylene at the room temperature of about 30—35° C was kept stirred magnetically. In the solution the braided linen coiled loosely is dipped and kept for about 15 minutes after which time the coil is removed and air dried. The carbonacious material not adhering to the surface of the fibres is removed by pressing it and dragging it along a few times. Then the electrical resistance was measured and found to be about 2000 ohms per cm. The process was repeated once more under identical conditions and the resistance was found to get lowered to 1000 ohms per cm. Dimensions of the braided linen used are 1 metre long and 1.5 mm dia.

**Example 2**

25 gms of the same carbon as used in example 1 was suspended in acetone and kept stirred at the room temperature of 30—35°C. The briaded linen thread of length 1 metre and dia meter 3 mm was introduced into the bath and kept for about 15 minutes. It was then

removed and air-dried. Carbonacious material not adhering to the surface is removed by pressing and dragging it a few times. The value of the resistance obtained was 2000 ohms per cm.

A repetition of the process for a second time reduced the resistance of the coil to 1100 ohms per cm.

The following are among the main advantages of the invention :

(1) The process of making braided linen coils used in suppressor cables involves a specific carbon black obtained indigenously by incomplete combustion of liquid naphtha, available in plenty as a waste material from the fertilizer factories of our country,as a substitute for the graphite solution to be obtained from abroad for processing the same.

(2) The process of impregnating this carbon is highly simplified as no adhesive is required by this method, whereas the process reported in literature requires an adhesive.

(3) The method of preparation is easy as it involves mechanical stirring of suspension of the carbon black dispersed in which the braided linen coil is kept dipped.

Dated this 27th day of September, 1967.

Sd.-
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## COMPLETE SPECIFICATION

### "IMPROVEMENTS IN OR RELATINC TO IMPREGNATION OF BRAIDED LINEN THREADS WITH CONDUCTING CARBONS"

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg, New Delhi-1, India, an Indian registered body incorporated under the Registration of Societies Act (Act XXI of 1860)

*The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed :—*

This is an invention by CHITTARI VENKATA SURYANARAYANA, Scientist, NARASIMHAN RANGARAJAN, Senior Scientific Assistant, KRISHNAMOORTHY NAGARAJA RAO, Senior Scientific Assistant and MARY JULIANA MANGALAM, Senior Scientific Assistant, all of the Central Electrochemical Research Institute, Karaikudi-3, Madras State, India, all Indian citizens.

This invention relates to improvements in or relating to impregnation with conducting carbon of braided linen threads laid together to give the required resistance values for use as suppressor cable in television and radio circuits.

**Prior Knowledge :**

So far these threads were enclosed in a homogeneous sheath of rubber or neoprene and imported as such from abroad as suppressor cables. These cables are used as Insulated High Tension-Distributed Resistance-Ignition Cables for ignition systems of power units applicable to automative vehicles and allied installations particularly in the defence services and also as television and radio suppressor cables.

The reported method of preparation of these conducting linen threads is by impregnation with a carbonaceous material which is done by passing it through a solution comprising water, a comminuted graphite with a binder comprising starchy material and protein material for adhesive purposes and a wetting agent like dioctyl sodium sulfosuccinate in suitable proportions with subsequent drying.

**Drawbacks connected with hitherto known process/Devices :**

The hitherto known method is open to the objection that graphite solution is to be imported, no sufficient details are available about the method of preparation and techniques of dispersing graphite in solvents. The reported method, being scanty in detail either did not give good impregnation of these linen threads even with the imported graphite solution and in case of occasional success, it is difficult to adjust the required resistance values. The required resistance values lie in a range of 1000—2000 ohms per cm.

**The main object of the invention :**

The main object of the present invention is to obviate these disadvantages (i) by choosing an indigenously available carbon suitable for the purpose and (ii) to evolve a process of impregnating it to get the desired resistance values.

**The main finding (the new principle) underlying the invention :**

The Fertilizer Factories in India have a waste by-product in the incompletely burnt liquid naphtha existing as an oily paste. With this as starting material, this is fired in an open pan at a suitable temperature till it burns for about 48 hours when the oil is used up and the process comes to a stop. Globules of carbon are obtained by this method. A mass of this is ballmilled for about two days to a fineness of not less than 200 mesh.

With the carbon powder obtained above as a starting material, a dispersion of it is made in suitable solvents like trichloroethylene, benzene, acetone, ether, ethanol (and also in water to which some suitable wetting agents are added). Mixtures of some of these suitable solvents with water may also be used.

To the suspension of this carbon black, adhesive like PVC, perspex, gum acacia etc.

need not be added for adhesion in our process even though it is reported in literature for the process wherein graphite solution has been used.

Braided linen threads coiled loosely are dipped and kept for some time ranging from 15—30 minutes, keeping the suspension stirred. After the treatment, the coil is taken out, dried and superficially pressed and drawn under pressure.

**The new result flowing from the new finding (defined in quantitative terms) :**

As given in the above, the braided linen cords are very effectively impregnated with the carbonaceous material and the desired resistance values could be obtained. The expected specification for the suppressor cable when the braided linen is removed from the sheath corresponds to 1000—2000 ohms per cm. These specifications have been achieved easily by the method and materials developed by us, sometimes if necessary by repeating the treatment until the desired resistance is obtained. In any case at least two treatments are necessary. The conducting quality of the processed braided linen is durable, unaffected by humidity and temperature upto 150°C and the adhesion of carbon particle is good.

In non-aqueous media, even without binders, we have been able to achieve a good and lasting adhesion of stable carbonaceous material available in India thus avoiding the import of graphite solution or acetylene black from abroad. etting agents used in hitherto known process require to be imported for this purpose. Hence the present invention gives an easier process and completely avoids import of either the wetting agents or the graphite solution.

**Other new findings :**

In the hitherto known process done only in aqueous media subsequent drying after impregnation was an essential step requiring the use of an oven. In our process, using non-aqueous media air drying at 30—35°C is enough and effective. As such this has reduced one step of heating in oven for the production of suppressor cables.

**A statement of invention :**

According to the present invention, the process for impregnation of braided linen threads with conducting carbons by dipping the linen cord coil in a bath containing the carbonaceous material is characterised in that the dipping is done in a bath containing the carbonaceous material and a non-aqueous solvent, swirling the solvent using a magnetic stirrer whereby adhesives and wetting agents used hitherto in aqueous solutions are dispensed with.

Thus, by using a suspension of a suitable carbonaceous material, namely, indgeneously available carbonaceous paste made out of incompletely burnt liquid naptha available in our country as a waste-product in fertiliser industries, the use of imported graphite suspension and/or acetylene black is dispensed with.

The magnetic stirring is continued till a satisfactory impregnation occurs only to be subsequently air dried, drawn under pressure and tested.

Thus, the impregnation of briaded linen threads with conducting carbon is done by a new method using non-aqueous solvents and dispensing with adhesives and wetting agents used hitherto in aqueous solutions, and replacing the imported graphite suspension and/or acetylene black by a suitable indigeneously available carbonaceous material obtained by processing of the cabonaceous paste of incompletely burnt liquid naptha available in our country as a waste by-product in fertilizer industries.

**Subsidiary novel features :**

This new process avoids one step in the hitherto known process of drying in the oven after impregnation. In the present invented process air drying at ordinary temperature at 30°—35°C is enough.

**Detailed description :**

Braided linen cords of varying diameters, for example, 1.5mm to 3mm are used. The carbon obtained by processing incompletely burnt naptha is kept suspended in one of the non-aqueous solvents mentioned by stirring for about 15—30 minutes. Then a suitable length of the braided linen made into a coil is introduced into the suspension and the stirring is continued at laboratory temperature for about half-an-hour. Later the coil is taken out, air dried at the laboratory temperature and drawn while pressing laterally. The resistance of this coil is tested at different places to see if it conforms to the specifications. A further reduction of resistance, if necessary, is done by repeating the process over again. Every repetition cumulatively reduces the resistance. In any case the process is repeated at least twice.

**A few typical examples :**

**Example 1**

The carbonaceous paste obtained by incomplete combustion of liquid naphtha supplied by the E.I.D. Parry, Madras was further processed as stated previously to obtain a powdery material. 25 grams of the material suspended in 100 ml of trichlorothylene at the room temperature of about 30—35°C was kept stirred. The braided linen coiled loosely is dipped into the solution and kept for about 15 minutes after which time the coil is removed and air dried. The carbonaceous material not adhering to the surface of the fibres is removed and pressed and drawn laterally a few times. Then the electrical resistance was measured and found to be about 2000 ohms per cm. The process was repeated once more under identical conditions and the resistance was found to get lowered to 1000 ohms per cm. Dimensions of the braided linen used are 1 metre long and 1.5 mm dia.

**Example 2**

25 grams of the same carbon as used in example 1 was suspended in acetone and kept stirred at the room temperature of 30—35° C. The braided linen thread of length 1 metre and diameter 3 mm was introduced into the bath and kept for about 15 minutes. It was then removed and air dried. Carbonaceous material not adhering to the surface is removed by pressing and drawing it a few times. The value of the resistance obtained was 2000 ohms per cm. A repetition of the process for a second time reduced the resistance of the coil to 1100 ohms per cm.

**The main advantages of the invention :**

The main advantages of the invention are as follows:

(1) The process of making braided linen coils used in suppressor cables involves a specific carbon black obtained indigenously from the incompletely burnt liquid naphtha available in plenty as a waste material from the fertilizer factories of our country as a substitute for the graphite solution and/or acetylene black to be obtained from abroad for processing the same.

(2) The process of impregnating this carbon is highly simplified as no adhesive is required by this method, whereas the process reported in literature requires adhesives and wetting agents in large quantities all requiring to be imported.

(3) One step in the hitherto known process, namely, that of oven drying after impregnation is avoided in our process.

**Summary and Critical Discussion :**

Linen threads braided into a coil and enclosed in a homogeneous sheath, of rubber or neoprene is being imported as such as suppressor cables. These are used as radio frequency suppressor cables. The reported process of preparation of these conducting linen threads consists (1) in using a suspension of graphite (2) a process which involves use of special adhesives and wetting agents for coating the same. After coating the coil, the hitherto known process involves the important step of oven drying at a high temperature. The presen invention relates to substitution of the graphite solution and/or acetylene black used for this purpose in the hitherto known process by an indigenously available material as a carbonaceous paste of incompletely burnt liguid naphtha accumulated so far as a waste by-product in the fertilizer industries in India. This obviates the necessity of import of graphite or acetylene black. Secondly, the processing contained in the present invention involves the use of non-aqueous solvents and mere contact of the braided linen cord with the suspended carbonaceous material in the non-aqueous suspension without addition of any wetting agents or adhesives. After sufficient impregnation of the linen cord, it is taken out and air dried at the laboratory temperature and then pressed and drawn to remove non-adhesive carbonaceous particles. The process is repeated sometimes till the electrical characteristics of the linen cord reach the required specification. The organic solvents used herein are the ones easily available in our country.

WE CLAIM :

1. A process for impregnation of braided linen threads with conducting carbons by dipping the linen cord coil in a bath containing the carbonaceous material which is characterised in that the dipping is done in a bath containing the carbonaceous material and a non-aqueous solvent, swirling the solvent using a magnetic stirrer whereby adhesives and wetting agents used hitherto in aqueous solutions are dispensed with.

2. A process as claimed in claim 1 wherein is used a suspension of a suitable carbonaceous material, namely, indigenously available carbonaceous paste made out of incompletely burnt liquid naphtha available in our country as a waste-product in fertiliser industries, whereby the use of imported graphite suspension and/or acetylene black is dispensed with.

3. A process as claimed in claims 1 or 2 wherein the magnetic stirring is continued till a satisfactory impregnation occurs only to be subsequently air dried, drawn under pressure and tested.

4. A process for the impregnation of braided linen threads with indigenous conducting carbon substantially as hereins-before described.

Dated this 25th day of June, 1968.

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