Oct. 15, 1935. A. RHEINER 2,017,607

INSULATED ELECTRICAL CONDUCTOR

Filed June 30, 1931

Fig. 1.

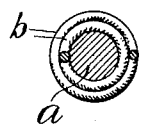


Fig. 1a.

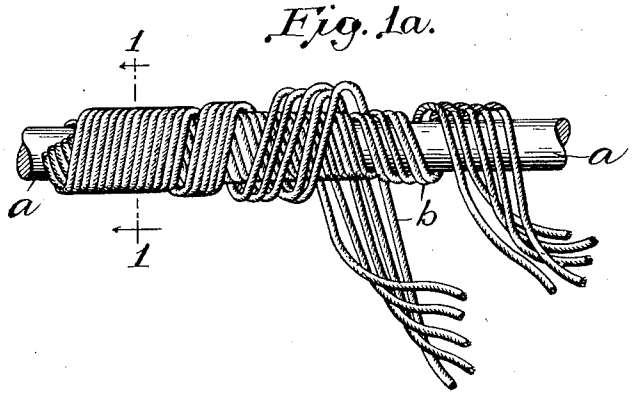


Fig. 2.

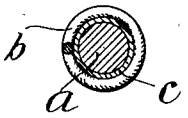


Fig. 2a.

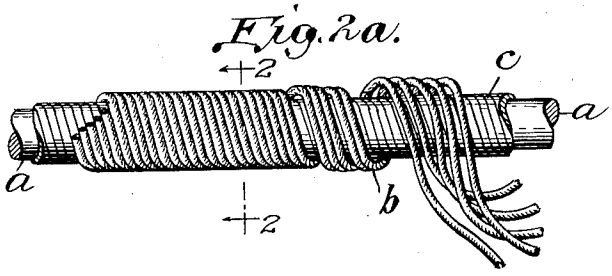


Fig. 3.

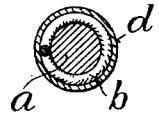
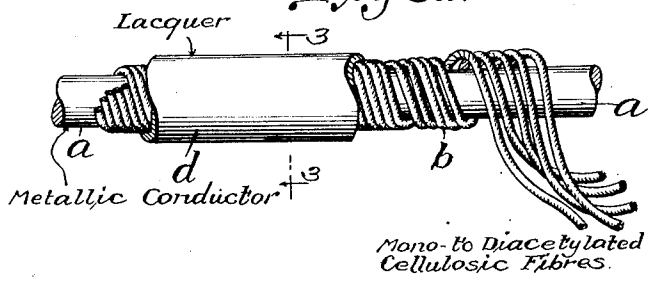


Fig 3a.



Inventor

A. Rheiner,

By E. F. Neuderoth

Attorney

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2,017,607

INSULATED ELECTRICAL CONDUCTOR

Alfred Rheiner, Basel, Switzerland, assignor to the firm of Chemical Works Formerly Sandoz, Basel, Switzerland

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In Germany July 8, 1930

3 Claims. (Cl. 173—264)

This invention relates to insulated electrical conductors, such as bars, plates, strips, wires and the like.

It is known that cotton yarn can be used for the insulation of electrical conductors. Cotton, however, has various drawbacks in such use, as for example, a close dependence on the moisture of the atmosphere as well as on the pressure which is exerted on the insulating layer. This is evident particularly in the case of conductor wires which are wrapped together.

It has now been found that the mono- to diacetylated cellulose fibres in which the original structure is maintained without alteration can advantageously be used as insulating material for electrical conductors of any kind.

The superiority of these fibres as electrically insulating material in comparison with unaltered cellulose fibres is determined by their better specific insulating properties, their much less hygroscopicity and their great independence of the pressure to which the insulating material is subjected.

According to the present invention therefore it is proposed to use as an insulating material the mono- to diacetylated cellulose fibres in which the original structure is maintained without alteration, prepared for example by the processes described in the British Patents Nos. 5,016/1907, 280,493, 314,913, 323,500, 324,680, 323,548, 323,515 and in the German Patents Nos. 224,330, 347,130, 380,994 or by any other process.

Further according to the present invention an electrical conductor can be prepared by covering a metal wire, strip, plate or the like with layers or fibres of cellulose mono- to -diacetate, prepared according to any acetylation process which causes no structural alteration of the fibres.

The invention may be applied to any electrical apparatus, such as condensers and other apparatus where electrical insulation is required.

The following numerical data were found in the determination of the continuous current resistance of such an insulation, for example, with a voltage of 120 and an insulating layer of 0.2 mm. thickness which was rolled on a cylinder and which had a total surface area of 0.6314 sq. dm.

Ohmic resistance

(1) Bleached cotton yarn 50/1 = $505.5 \cdot 10^6\ \Omega$

(2) Mono acetylated cellulose obtained according to the British Patent No. 280,493 = $9821.7 \cdot 10^6\ \Omega$

These figures show the great superiority of the new insulating material in comparison with cotton.

In the investigations of the independence of the resistance of such insulating layer to the outer pressure exerted thereonto, the following figures were obtained:

Pressure per square cm.	Ohmic resistance with bleached cotton yarn 50/1	Ohmic resistance of mono-acetylated cellulose obtained according to the British Patent No. 280,493
0.1850 kg.	$218 \cdot 10^6\ \Omega$	$4050 \cdot 10^6\ \Omega$
0.5555 kg.	$172 \cdot 10^6\ \Omega$	$4037 \cdot 10^6\ \Omega$
0.9259 kg.	$135 \cdot 10^6\ \Omega$	$3915 \cdot 10^6\ \Omega$
1.2963 kg.	$118 \cdot 10^6\ \Omega$	$3915 \cdot 10^6\ \Omega$

The results obtained show that with an increase of 1.11 kg./cm² the ohmic resistance of the cotton decreased by 45.87%, whereas mono-acetylated cellulose showed a decrease of only 3.58%.

The following table shows results obtained by the National Physical Laboratory in Teddington, Middlesex, England, in testing samples of acetylated fibres manufactured according to the process of the British Patent No. 280,493.

Resistance between copper and brass cylinder (100 turns)

Wire insulated with one covering of:	(1) Dry	(2) Normal atmosphere		(3) Saturated (by Megger)
		(a) 47% rel. moisture	(b) 56% rel. moisture	
	Megohms	*Megohms*	*Megohms*	
1. Acetylated fibre according to the British Patent No. 280,493, Sample A.	0.25 million	60 thousand	33 thousand	0.4 megohms.
2. Acetylated fibre according to the British Patent No. 280,493, Sample B.	0.18 million	41 thousand	26 thousand	0.4 megohms.
3. Acetylated fibre according to the British Patent No. 280,493, Sample C.	0.40 million	25 thousand	18 thousand	0.3 megohms.
4. 66's cellulose triacetate silk	0.03 million	7 thousand	5 thousand	2.2 megohms.
5. Natural silk	0.09 million	6 hundred	4.5 hundred	<2 thousand ohms.
6. Tussah silk	0.10 million	1 hundred	1 hundred	<2 thousand ohms.
7. 80's cotton	0.7 thousand	1.8	1.7	<2 thousand ohms.

The present invention is therefore of great technical value and shows a great advance in the insulation of electrical conductors, as it permits of the use of a new fibrous material which, on account of its cheapness and its properties, can be used as a substitute for silk.

The mono- to diacetate cellulose fibres may be used for the purpose claimed alone or in conjunction with other insulating materials. They can for instance be wound directly on a metallic wire and then be covered with a suitable lacquer or they can be wound on the wire previously covered with a known insulating layer.

A number of illustrative embodiments of the present invention are shown, by way of example, on the accompanying sheet of drawing, whereon

Fig. 1 is a section along line 1—1 of Fig. 1*a*.

Fig. 1*a* is a side elevation of a portion of a metallic conductor provided with an insulation according to the present invention, parts being broken away and unraveled for the sake of clearness;

Fig. 2 is a sectional view along line 2—2 of Fig. 2*a*;

Fig. 2*a* is a view similar to Fig. 1*a*, but showing a second embodiment of the invention;

Fig. 3 is a section taken on line 3—3 of Fig. 3*a*;

Fig. 3*a* is a view similar to Fig. 1*a*, showing still another embodiment of the invention.

Referring to the form shown in Figs. 1 and 1*a*, reference character *a* designates a conventional metallic conductor of electricity surrounded with an insulating layer or layers *b* which consists of helically wound threads of mono- to diacetylated cellulose made in accordance with the present invention. The superposed layers may be wound in different directions, as shown.

In the form shown in Figs. 2 and 2*a*, a conventional insulating layer *c* has been substituted for one of the layers *b* of the embodiment aforedescribed. Layer *c* may preferably contain some of the lower acetylated cellulose acetate, according to the invention as hereinbefore set forth.

In the embodiment of Figs. 3 and 3*a*, the insulating layer *b*, of mono- to diacetylated cellulose fibers, is encompassed by an outer layer of lacquer.

It is evident that details of the constructions described may be changed without departing from the spirit of the invention.

What I claim is:—

1. A metallic conductor for electrical purposes provided with an insulation containing a cellulose acetate of the group consisting of the mono- and di-acetates prepared from natural cellulose material without alteration of the original fibrous structure of the latter.

2. A metallic conductor for electrical purposes provided with an insulation containing cellulose mono- and di-acetates prepared from natural cellulose material without alteration of the original fibrous structure of the latter.

3. A metallic conductor for electrical purposes provided with an insulation containing monoacetylated cellulose prepared from natural cellulose material without alteration of the original fibrous structure of the latter, the ohmic resistance of the said insulation being relatively independent of external pressure which may be exerted thereon.

ALFRED RHEINER.