Feb. 6, 1934. P. SIMONS 1,945,709

METHOD AND MEANS FOR INSULATING ELECTRIC CONDUCTORS

Filed Sept. 17, 1931 2 Sheets-Sheet 1

Fig. 1.

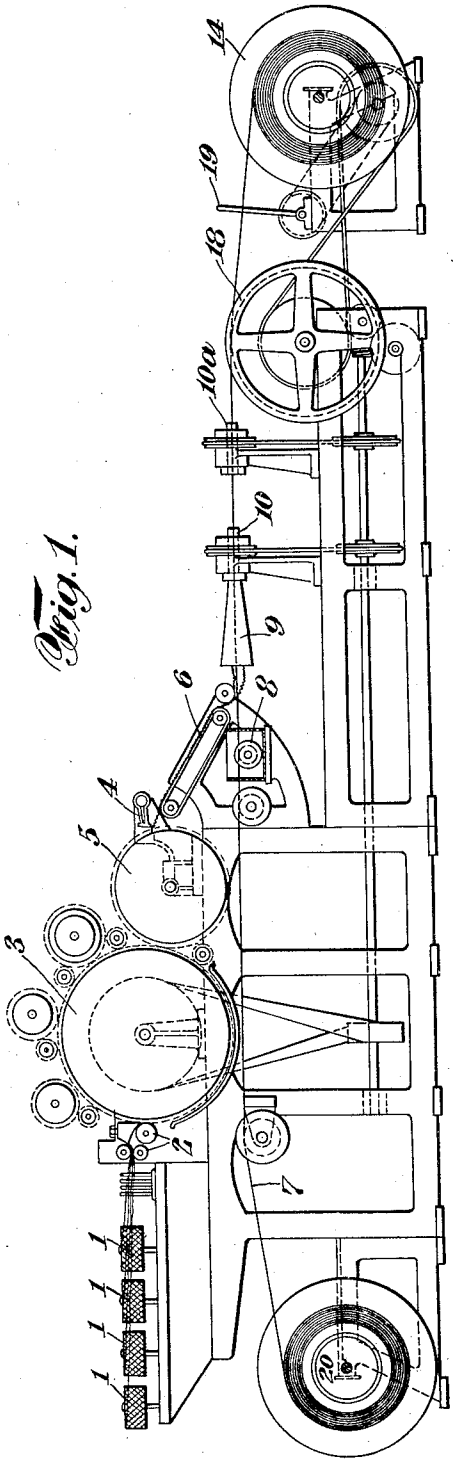


Fig. 3.

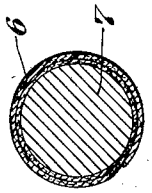
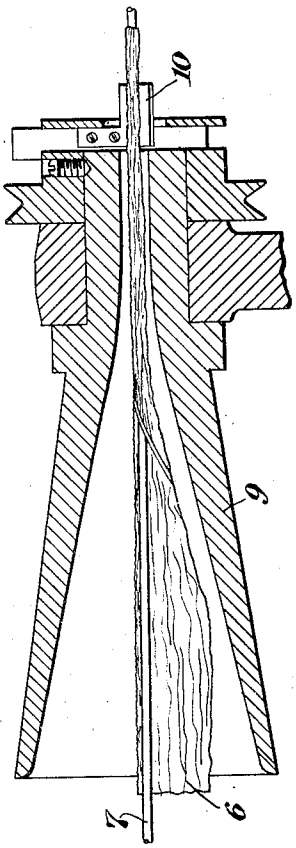


Fig. 2.



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Fig. 4.

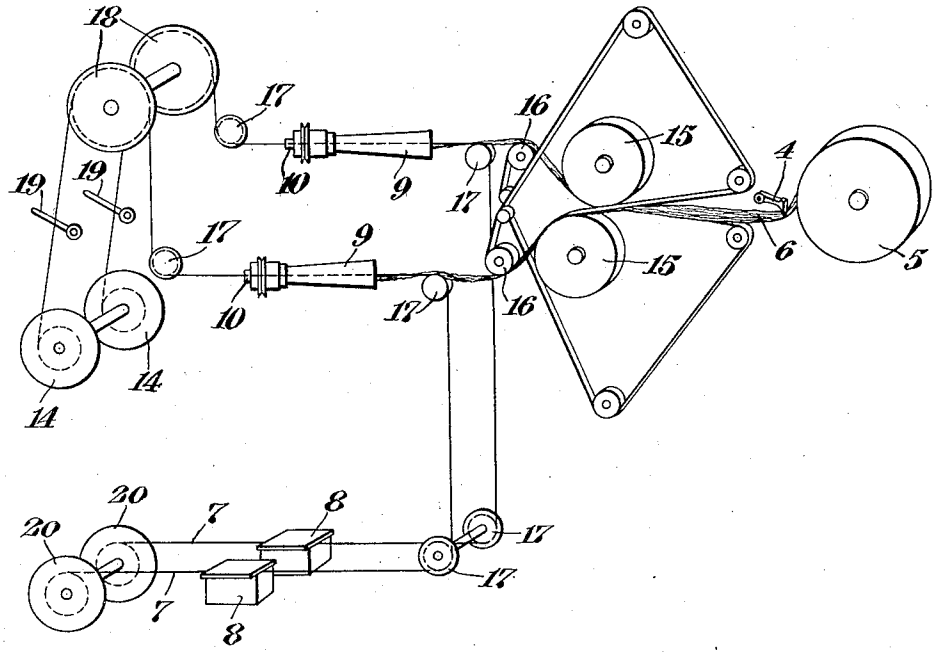
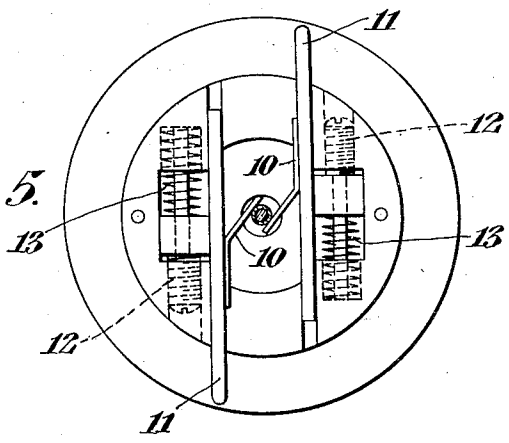


Fig. 5.



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METHOD AND MEANS FOR INSULATING ELECTRIC CONDUCTORS

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Application September 17, 1931, Serial No. 563,310, and in Germany September 26, 1930

8 Claims. (Cl. 173—244)

My invention has the purpose of insulating electric conductors with fibrous material in the form of a delicate web which is coherent but still contains the fibers of the material in substantially parallel relation. I propose to card sliver, roving or similar raw material in a carding device of conventional construction, until it assumes a very delicate, fleecy or gauzy structure, usually called a "web" in the art, and to apply the web thus delivered by the carding device at one of its edges longitudinally to the conductor and to subsequently wrap the web, hanging on the conductor, around the conductor so that if, for instance, the web should have a width greater than the conductor circumference, it would be spirally wound around the conductor. The conductor is preferably coated with an adhesive before the web is applied to it.

The twisting of the web around the conductor is performed according to the invention by leading the conductor and the web together past a rotating surface whose distance from the conductor gradually diminishes until it substantially touches the conductor. Best suited for this purpose is a rotating funnel through the central axis of which the conductor and the web are guided. When the conductor and web first enter the funnel, only one longitudinal edge of the web adheres to the conductor, while the other edge of the web, hanging straight down, will drag along the inner surface of the rotating funnel, and in being taken along by the funnel and being pulled into the interior of the funnel is wrapped loosely around the conductor, whereby the web edges remain substantially parallel to the conductor. The largest and the smallest inner diameter of the funnel are dimensioned in accordance with the cross-section of the conductor and the width of the web ribbon used. After the conductor with the loosely wrapped web has left the funnel, the web is pressed tightly against the conductor and smoothened by means of leaf springs rotating around the conductor in well known manner. The thus insulated conductor may subsequently be impregnated with any suitable material desired, and be subsequently again smoothened. This impregnation and smoothing process may be repeated any number of times required, and the conductor may then be led through a drying chamber in well known manner. This novel manner of insulating an electric conductor by means of a web of fibrous material has the advantage that the conductor is surrounded with certainty on all sides with the fibrous material. Further, the thickness of the insulation can be very easily controlled, because it only depends upon the width and the density of the web strip. Furthermore, conductors of different diameters can be insulated in this manner without changing the construction or the gearing of the machine by which the insulation is applied, since the only change necessary is in the width of the sliver.

If, in accordance with the present invention, a web with tapered edges is used, for instance in case the web ribbon edges overlap one another on the conductor, it is only necessary to change the density of the web near the edges. Moreover, according to this invention, the insulation can be applied in a continuous way without interruption such as occurs for instance in case insulating threads are spun around the conductor, and where the ends of the threads have to be connected when new spools are inserted into the spinner. In the present case not only the heavy rotating spinners are done away with entirely, but the supply of the web can be made continuous, since it is in loose form when it enters the machine, and the ends of raw material can be connected before it enters the carding device without knots, such as occur in threads in the present day manner of insulation.

The web used according to my invention can be produced in any suitable way. For instance roving may be fed into a carding machine, where it is carded and attenuated in well-known manner, until it assumes the character of a delicate gauzy ribbon or web. The number of threads at the web edges may be diminished so that when the web leaves the carding machine it is provided with tapered edges. I may also produce first a web of considerably greater width than required, and by suitable means, for instance by a web divider, longitudinally split the web into ribbons of the required width which are then individually fed directly into several wrapping funnels so that from one carding device a number of conductors can be insulated at the same time.

If it is desirable to store such a gauzy web before it is applied to the conductor, it must be carried on a paper strip, or else in order to avoid the paper strip, I might apply to one side of the web a very thin adhesive which, when dry, will give the fibrous material sufficient self support to roll it up and store it in cans the same as sliver and roving for spinning is stored until it is required for use.

According to the present method wires, or the

like, may be provided with a coating of fibrous material which are used for other than electric purposes.

In insulating electric conductors, my invention is of particular advantage for more thoroughly insulating ordinary cotton thread insulated conductors, by applying first a web wrapping according to my invention, consisting of fibrous material of much higher insulating qualities than cotton, before the cotton thread is spun around the conductor in the ordinary present day manner. For instance, the web material may consist of asbestos or silk. It is also possible according to my invention to insulate conductors by applying several layers of web wrappings of different fibrous materials, each in the manner shown and described. For instance, first a web of asbestos fiber may be wrapped upon the conductor, thereupon a web of cotton fiber, and so forth in accordance with the requirements of insulation. It is also possible in this manner to produce a suitable mixture of fibers in one web. For instance, the fibers of the web may consist of a mixture of cotton and silk which can be thoroughly mixed in the carding device, so that they form a substantially uniform material when the web is applied to the conductor.

In the drawings I have illustrated in more or less diagrammatic fashion means suitable for carrying out my novel method.

In these drawings—

Fig. 1 shows in side elevation a machine for carding, applying and wrapping the web around the conductor;

Fig. 2 shows in longitudinal section and in larger section the wrapping funnel and the manner in which the web is first applied and laid around the conductor;

Fig. 3 shows a cross-section of the conductor and the web laid around it;

Fig. 4 shows diagrammatically the manner of dividing a wide web into narrow ribbons of suitable width to be applied to several individual conductors, and

Fig. 5 shows in end view the smoothing device 10 of Fig. 1 in larger scale.

Referring first to Fig. 1, the raw material which may be wound on the supply rollers 1 and which may consist of very loosely assembled fibers or of roving, is fed by means of the feeding rollers 2 into the carding device 3. From roller 5 of this device the material is taken off in the form of a web ribbon by the doffing device 4 so that it emerges in fluffy loose form as shown at 6 ready to be applied to the conductor 7, which is supplied from a drum 20. Previous to meeting the web ribbon, conductor 7 is coated with a suitable adhesive by means of coating roller 8. The ribbon is conducted onto this coated wire so that it meets the latter and first adheres to it at or close to one of the ribbon edges, and in this condition the two enter together the funnel 9 which is rotated from a suitable gearing only diagrammatically indicated. This funnel is shown in detail in Fig. 2 from which it will be noted that the web ribbon 6, at first attached only at one of its longitudinal edges (see left hand end) to conductor 7 is gradually wrapped around the conductor as both proceed toward the throat of the funnel, until the conductor emerges from the funnel with the material tightly wound around it, whereby the web edges remain practically parallel to the wire axis. Fig. 3 very distinctly shows how the web is spirally wound in several layers around the conductor. Before the insulated conductor leaves the wrapping funnel the fibers hanging loosely at the outside of the insulation, are pressed tightly against the conductor, and the whole fibrous structure is condensed and smoothened by means of leaf springs 10. The right hand end view of the funnel shown in Fig. 5 clearly illustrates these leaf springs 10. These springs may for instance be mounted on slides 11, which in turn are adjustable by means of screws 12. They are tensioned by means of spiral springs 13. This smoothing and densifying of the insulation may be repeated in a second smoothing device 10ª shown in Fig. 1.

As stated at the beginning the insulated conductor may be impregnated with any suitable insulating liquid and be again smoothened. This is not shown in the drawings since it does not relate directly to the present invention and to the manner in which it may be reduced to practice.

The insulated conductor finally leaves the machine shown in Fig. 1 by means of the pulling drum 18, whence it passes over the guide 19 onto drum 14 on which it is wound.

If originally a web of considerably greater width than required for the insulation of a single conductor is used for the purpose of simultaneously insulating several conductors, such as is for instance shown in Fig. 4, the full width web 6 is fed from the discharge drum 5 of the carding device over the doffing device 4 onto the web divider. This device consists of a number of narrow belts which run in parallel and close to one another between two rollers 15, and which after they leave the rollers gradually diverge from one another in opposite direction, taking along between themselves and the roller 15 over which they leave the divider, a web ribbon equal to the width of the belt. These individual narrow ribbons, sufficient in width to be used for insulating a conductor, then pass by way of roller 16 toward the wire feeding rollers 17, beyond which they are applied to the pertaining wire, and whence the wire and the applied web pass into the pertaining wrapping funnel 9. The same as shown in Fig. 1, the wires before they meet the web ribbons are coated at 8 with a suitable adhesive. From the individual wrapping funnels the insulated wires pass by way of rollers 17 to the pulling drum or drums 18 and by way of guide 19 to the individual drums 14 on which they are coiled up.

I claim:

1. Method of insulating electric, conductors consisting in applying fibrous insulating material in web form longitudinally near one of its edges to an adhesive-coated conductor, and in subsequently wrapping the loosely hanging web portion around the conductor with the web edges remaining substantially parallel to the conductor.

2. Method of insulating electric conductors, consisting in applying fibrous insulating material in web form, of a width at least equal to the conductor circumference, longitudinally near one of its edges to the conductor, and in subsequently wrapping the loosely hanging web portion around the conductor.

3. Method of insulating electric conductors, consisting in applying fibrous insulating material in web form longitudinally near one of its edges to a conductor and in subsequently wrapping the loosely hanging web portion around the conductor by a funnel-shaped guide surface.

4. Method of insulating electric conductors, consisting in applying fibrous insulating material in the form of a web with tapered edges and

of a width greater than the conductor circumference, longitudinally near one of its edges to an adhesive-coated conductor, and in subsequently wrapping the loosely hanging web portion around the conductor.

5. Method of insulating electric conductors, consisting in carding fine roving of fibrous insulating material to form a web ribbon of a width at least equal to the conductor circumference, applying the web longitudinally near one of its edges to an adhesive-coated conductor, and in subsequently wrapping the loosely hanging web portion around the conductor, whereby the web-edges remain substantially parallel to the conductor.

6. Method of insulating electric conductors, consisting in carding fine roving of fibrous insulating material to form a web with tapered edges and of a width greater than the conductor circumference, applying the web longitudinally near one of its edges to an adhesive-coated conductor, and in subsequently wrapping the loosely hanging web portion around the conductor, whereby the web-edges remain substantially parallel to the conductor.

7. Method of insulating electric conductors, consisting in carding fine roving of fibrous insulating material to form a web, dividing the web long tudinally into ribbons of a width at least equal to the circumference of the conductors to be insulated, applying the individual ribbons near one of their edges to the conductors, and subsequently wrapping the free hanging web ribbon portions around the individual conductors by funnel-shaped guide surfaces.

8. Arrangement for insulating electric conductors, comprising means for carding fibrous insulating material to form a web of a width at least equal to the conductor circumference, means for feeding the conductor to be insulated, means for coating said conductor with an adhesive, means for applying the web longitudinally near one of its edges to the coated conductor, and a funnel-shaped guide, rotatable around said conductor and applied web, for wrapping the loose web portion around the conductor, with its edges in parallel to the conductor.

PAUL SIMONS.