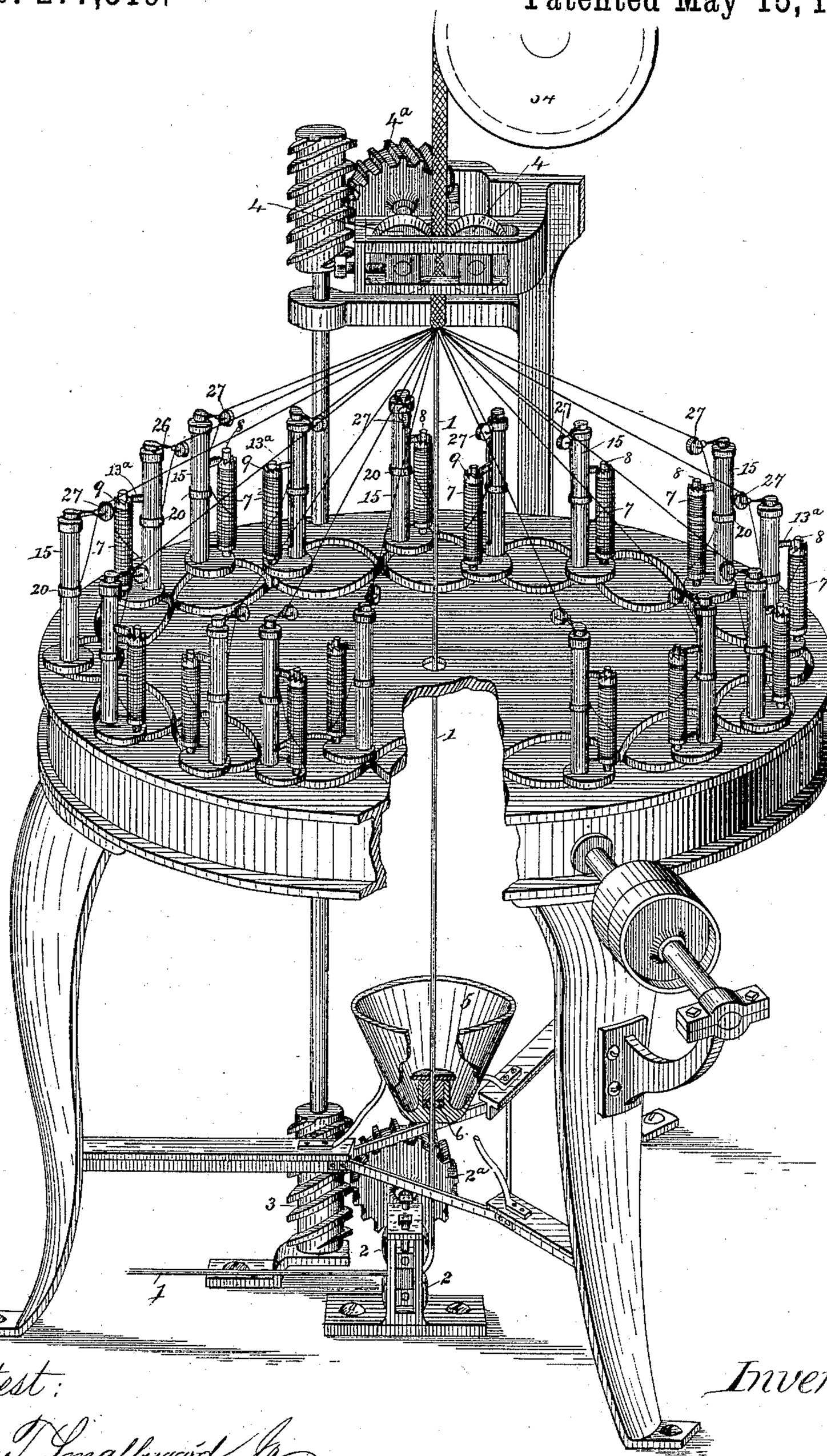
(No Model.)

J. J. C. SMITH.

INSULATING WIRE FOR ELECTRIC PURPOSES.

No. 277,519. Patented May 15, 1883.



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INSULATING WIRE FOR ELECTRIC PURPOSES.

SPECIFICATION forming part of Letters Patent No. 277,519, dated May 15, 1883.

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To all whom it may concern:

Be it known that I, JOHN JOSEPH CHARLES SMITH, a citizen of the United States, residing at College Point, in the county of Queens and State of New York, have invented certain new and useful Improvements in Insulating Wire for Electric Purposes, of which the following is a specification.

My invention consists, first, in the process of insulating wire by applying a coating of vulcanizable cement directly to the surface thereof, then braiding strands of elastic vulcanized rubber around such coated wire, and subjecting such coated and enveloped wire to the action of vulcanizing-heat.

My invention consists, secondly, in coating the surface of wire with vulcanizable cement and then braiding around said coated wire an envelope of elastic vulcanized-rubber strands, as above stated, and applying a second coating of vulcanizable cement to said rubber envelope, then an envelope of braided fibrous material, and then subjecting said doubly coated and enveloped wire to the action of vulcanizing-heat.

My invention consists, thirdly, in applying a coating of vulcanizing-cement directly to the surface of the wire, then braiding strands of vulcanized rubber around such coated wire, then applying a second coating of vulcanizable cement to the rubber envelope, then braiding an envelope of fibrous material around said doubly coated and enveloped wire, as above stated, and then applying an external coating of vulcanizable cement and subjecting the wire thus coated and enveloped to the action of vulcanizing-heat.

My invention consists, fourthly, in an insulating-covering for telegraph and other wire, consisting of a coating of vulcanized-rubber composition next to the wire, an envelope of elastic vulcanized-rubber braiding around said coating, a second coating of vulcanized-rubber composition, an envelope of fibrous material, and an external coating of vulcanized-rubber composition, the whole forming a single adherent mass.

In order that my invention may be fully understood, I will proceed to describe the exact manner in which I have carried it into effect, reference being had to the accompanying drawing, forming part of this specification, in which the figure is a perspective view of a coating and braiding apparatus suitable for carrying my invention into effect.

The drawing, illustrating a machine employed by me for producing the insulating-covering hereinafter described, is furnished in order to a more perfect comprehension of the present invention, of which the said mechanism—which is to form the subject-matter of a separate application for Letters Patent—forms no part.

For my purpose I prefer to employ braiding-machines of that style in which the wire passes through the machine in a vertical direction, for reasons which will be seen. Such a machine is shown in the drawing filed herewith, in which the wire 1 passes from a supply-drum, (not shown,) located beneath or at one side of the machine, upward between two feed-rollers, 2 2, deriving motion from a worm-pinion, 2^a, actuated by a worm on the lower end of a worm-shaft, 3, which extends upward, and actuates through a worm on its upper end a worm-pinion, 4^a, revolving the take-up rollers 4. The wire 1 passes vertically upward to the said take-up rollers 4, (which are made of semi-hard rubber to prevent too great pressure upon the braided wire,) and is wound in a coil around a receiving-drum, 34. As the wire leaves the feed-rolls 2 it passes into a funnel-shaped reservoir, 5, through a stuffing-box, 6, in the bottom thereof. This vessel 5 contains the vulcanizable rubber cement or compound, a coating of which is imparted to the wire upon its passage through its containing-vessel to the point where it receives the braid, and thence between the take-up rolls 4 to the receiving-drum 34. The wire 1 having been brought to a proper tension by the two drums and the take-up rolls, the ends of the elastic-rubber fibers, which are wound upon from eight to sixteen winding-spools, 7, are properly fastened to said wire, and the machine is set in motion. The rubber threads are fed from spools 7, mounted each upon a shoe, 10, which also carries a tube, 15, within which is a mechanism (not shown) for regulating the tension of the rubber threads during the operation of wind-

ing. The top of the tube 15 carries a closely-fitting removable cap, 25, on which is a bracket, 26, provided with a pulley, 27. The bracket turns in a horizontal plane on the vertical pin 28. The spool 7 is filled with rubber thread spooled up to medium tension. The end of the thread is then passed up over the pulley 27, and thence to the wire 1, to which it is properly secured.

I have thus briefly described the construction of this machine and its operation, in order that the manner of producing the braided insulating cover may be apparent. It is my intention to make a separate application for Letters Patent for this mechanism and for the formation and application of braided insulating rubber coverings, and I hereby reserve the right so to do.

I will now proceed to describe the process involved in my present invention.

In carrying out my invention I first cover or coat the wire with a vulcanizable-rubber cement or solution composed preferably of three parts of caoutchouc, one part of sulphur, and two parts of asphaltum or roofing compound, all held in solution by bisulphide of carbon. (Benzine or naphtha should not be used to make the required cement, for the reason that such oils will destroy the strength of the soft rubber threads of which the braiding is composed, causing them to snap asunder almost as quickly as they come in contact with it. The bisulphide of carbon, on the contrary, has no such detrimental action.) This cement is applied directly to the surface of the wire in the manner stated above. By the time the wire reaches the point where the elastic threads encircle it from the place of application of the cement, the bisulphide of carbon will have partly evaporated, leaving a heavy semi-fluid cement. As the braiding progresses the rubber threads, crossing each other at a strong tension, squeeze this semi-fluid cement between their joints and laps and become thereby united and cemented. By the time which it takes to braid over a piece of wire reaching from the point of braiding to the receiving-drum, which should be a distance of from ten to twenty feet, the cement has become dry, owing to the evaporation of the bisulphide of carbon, and the covered part of the wire may be coiled up on the receiving-drum without sticking the coils together, especially if powdered soapstone is dusted over each layer. The thickness of the rubber covering may be varied according to requirements by using thicker or thinner threads and increasing or decreasing the tension of the threads during the braiding operation. Fine threads braided under high tension produce a uniform perfect insulating-covering not more than one sixty-fourth part of an inch in thickness, and such covering will be equally uniform and perfect when applied to the finest wire as when applied to the coarsest wire. If the braiding-machine acts well and if the tension is properly regulated, every spot of the wire will be perfectly covered, while the braiding in of the semi-fluid cement renders the continuity of the coating still more certain. Should defects occur, they are quickly discovered, as any irregularity shows immediately in the different appearance of the braiding.

In coiling the covered part of the wire on the receiving-drum another great advantage is apparent in my use of vulcanized-rubber threads in this way: If unvulcanized-rubber threads or ribbons were used, it would be found that the wire while coiled up, especially if coiled up under tension, which is indispensable in order to save labor and trouble, would cut a raw-rubber covering and expose itself, or it would at least become dislocated from the center of the covering, which is equally as bad as, if not worse than, exposure, as in case of dislocation there is no means of ascertaining the extent to which the covering is cut. The vulcanized covering applied according to my method cannot be cut by the wire, it will resist great pressure, and when the pressure is relieved it returns to its normal state as when applied; hence the wire cannot be dislocated from its central position. Any length of wire covered according to my method may be reeled up in a continuous piece without injury before its final finishing and while it passes through the several manipulations incident to its manufacture.

When the rubber or actual insulating-covering is applied to a given length of wire, as I have thus far described it, then the protective fibrous covering is added, if so desired, by means of the braiding-machine. It is not necessary to describe this operation minutely, as the braiding of fibrous material over wire is well known. In the present instance, however, I pass the rubber-covered wire through the above-mentioned vessel containing the vulcanizable cement, which is prepared in a more liquid form than that originally applied, to impart a second coating in a similar manner to the first application to the bare wire. The fibrous material is then braided around the doubly coated and enveloped wire. The adhering cement is then absorbed by the fibrous threads in the same manner as by the rubber threads in the previous operation, the fibrous threads becoming saturated with the solution and cemented together and to the rubber covering in the braiding operation. In order to insure the perfect coating of the fibrous covering in every part, I pass the doubly-covered wire through a second vessel similar to that previously used and containing the same kind of cement. This vessel is placed under the braiding-machine, so that the wire passes through it on its way to the receiving-drum. The wire is now ready for the vulcanizing process, by which the coverings and coatings of rubber and fiber are permanently united together and to the wire, and by which it has imparted to it all those highly valuable prop-

erties of good unadulterated india-rubber. The manner of conducting this vulcanizing process is as follows: I use a circular vulcanizing-vessel standing upright, into which I coil the wire, layer above layer, dusting powdered soapstone over each layer, and leaving enough space between each layer for the passage of steam to produce the required heat. I apply a heat of from 280° to 300° Fahrenheit for about six hours, which results in vulcanizing the cement and re-vulcanizing the rubber threads, shrinking and uniting the latter firmly and perfectly to the wire, and bringing the stretched threads to a normal and unchangeable condition, just the same as if the rubber had been applied in the raw state and then vulcanized. The cement, which contains a good portion of sulphur, becomes semi-hard, and imparts some of that property to the more elastic rubber covering, rendering the fibrous covering perfectly tight and of durable resisting qualities against the action of heat and cold, of water, or of moisture in the atmosphere, the soil, or damp places. The braided fibrous covering also adds greatly to the strength of the wire, in which respect it possesses great advantages over the ordinary tape coverings, which do not impart strength or even form a durable protective covering, being very easily unraveled.

The elastic rubber threads used by me in forming the braided covering above described I obtain from thin vulcanized-rubber sheets cut into threads of the required length in the same manner as such threads are cut for elastic woven fabrics.

I desire here to point out briefly the several important and valuable features and advantages possessed by my method, and which distinguish it from others which have preceded it.

It is well known that caoutchouc or rubber compounds are only made a practically useful material for insulation of wire by the process of vulcanization, which imparts to the gum its durability, strength, and the capacity to resist the action of heat and cold and of moisture in the atmosphere or in the form of bodies of water. Rubber has been applied to the surface of wire by winding it spirally thereon in one or more layers running in the same or in opposite directions, and such vulcanized rubber has been applied to the surface of the wire, also, in longitudinal position. In these methods the insulating-cover has been strengthened and bound by fibrous material, and cement has also been used to render the insulating-covering firm and more homogeneous. Wire insulated by some of the above processes has also been treated to the action of heat in order to cause the cement to adhere the more closely to the rubber strips composing the insulating-covering, and thereby unite them more firmly together. In cases where vulcanized rubber has been wound spirally around the wire this serious defect has ensued, that such elastic strips being wound under tension seek to relieve themselves of such tension, thereby exerting a constant and powerful resistance, which results in a tendency to unravel, even when cement is employed, and also a fibrous binding envelope, and finally in rupture of the rubber covering and consequent destruction of insulation. At least wire thus covered is very liable to become dislocated from its central position—a result quite as damaging as actual rupture, since the latter almost inevitably ensues thereupon. It will become evident that no such twisting, distortion, or unraveling can occur with my braided rubber covering, the tension of each fiber of which acts not upon the wire, but is borne by the other fibers of the envelope, and as a result all hug the wire with a uniform direction of pressure. When raw rubber is employed it has generally been applied by drawing the wire through dies, and the results as to evenness of coating have been quite unsatisfactory. It is here, however, that the difficulties of subsequent vulcanization ensue. With wire in short lengths these difficulties are reduced to a minimum; but with a body of wire several thousand feet in length, weighing many hundreds of pounds, and covered with a heavy, soft, and sticky body of unvulcanized rubber, which is to be vulcanized, the operation becomes beset with great difficulty, especially in view not alone of the necessary handling, coiling, and placing in proper receptacles for vulcanizing, but also of the fact that the vulcanizing process, during a part of its action, renders this coating almost semi-fluid before it assumes the harder elastic nature of vulcanized rubber. As results of this method the wire is almost certain of dislocation, and the covering is perforated with innumerable small holes and blisters—a serious injury to its insulating qualities. By my method all of these difficulties are avoided, and I produce a light, perfect, uniform, durable, and perfectly-insulating covering, which is fit for submarine and subterranean purposes, and such method secures a saving of costly material and the avoidance of difficulty in vulcanizing.

The process of vulcanization may be introduced and a serviceable insulating-cover will be produced at the following stages of the process: first, after the application of the first coating of vulcanizable cement and the braided rubber covering; second, after the application of the fibrous covering; and, third, after the application of the final external coatings of vulcanizable cement, the latter being the complete process.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The process of insulating telegraph and other wire, consisting in applying a coating of vulcanizable cement directly to the surface of the wire, then braiding around such coated wire an envelope of elastic vulcanized-rubber threads, strands, or strips, and finally in uniting said coating and envelope by vulcanization, as herein set forth.

2. The process of insulating telegraph and

other wire, consisting in applying a coating of vulcanizable cement directly to the surface of the wire, then braiding around such coated wire an envelope of elastic vulcanized-rubber threads, strands, or strips, then covering such coated and enveloped wire with a second coating of vulcanizable cement, then braiding around such doubly coated and enveloped wire an envelope of fibrous material, and finally uniting said coatings and envelopes by vulcanization, as herein set forth.

3. The process of insulating telegraph and other wire, consisting in applying a coating of vulcanizable cement directly to the surface of the wire, then braiding around such coated wire an envelope of elastic vulcanized-rubber threads, strands, or strips, then covering such coated and enveloped wire with a second coating of vulcanizable cement, then braiding around such doubly coated and enveloped wire an envelope of fibrous material, then covering such doubly-coated and doubly-enveloped wire with one or more coatings of vulcanizable cement, and finally uniting said coatings and envelopes by vulcanization, as herein set forth.

4. An insulating-covering for telegraph and other wire, consisting of a coating of vulcanized-rubber composition next to the wire, an envelope of elastic vulcanized-rubber braiding around said coating, a second coating of vulcanized-rubber composition, an envelope of fibrous material, and an external coating of vulcanized-rubber composition, the whole forming a single adherent mass, as herein set forth.

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Witnesses:
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