

June 10, 1930.

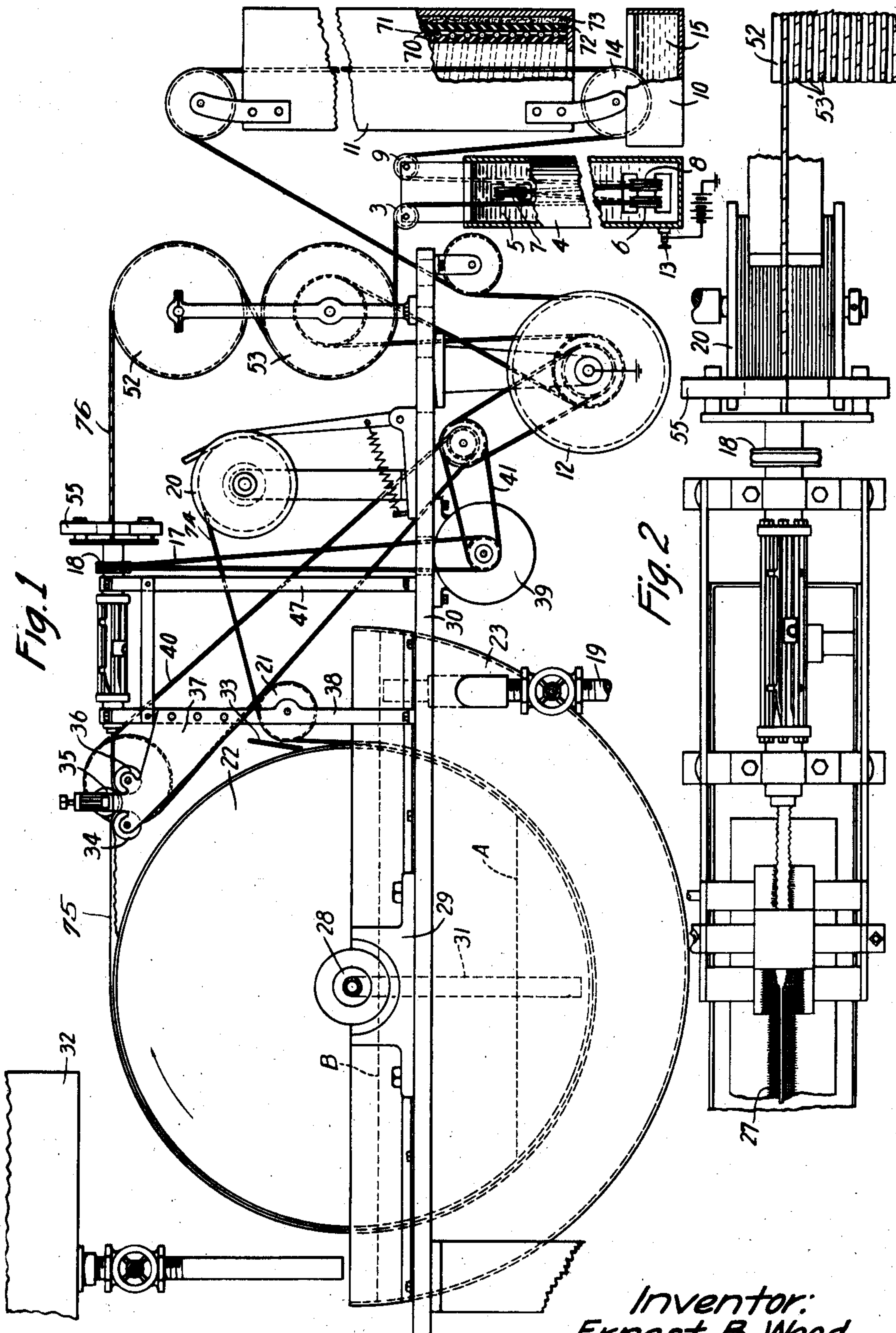
E. B. WOOD

1,762,941

PAPER INSULATED CONDUCTOR

Filed May 29, 1926

2 Sheets-Sheet 1



Inventor:
Ernest B. Wood

by J. E. Roberts Att'y

June 10, 1930.

E. B. WOOD

1,762,941

PAPER INSULATED CONDUCTOR

Filed May 29, 1926

2 Sheets-Sheet 2

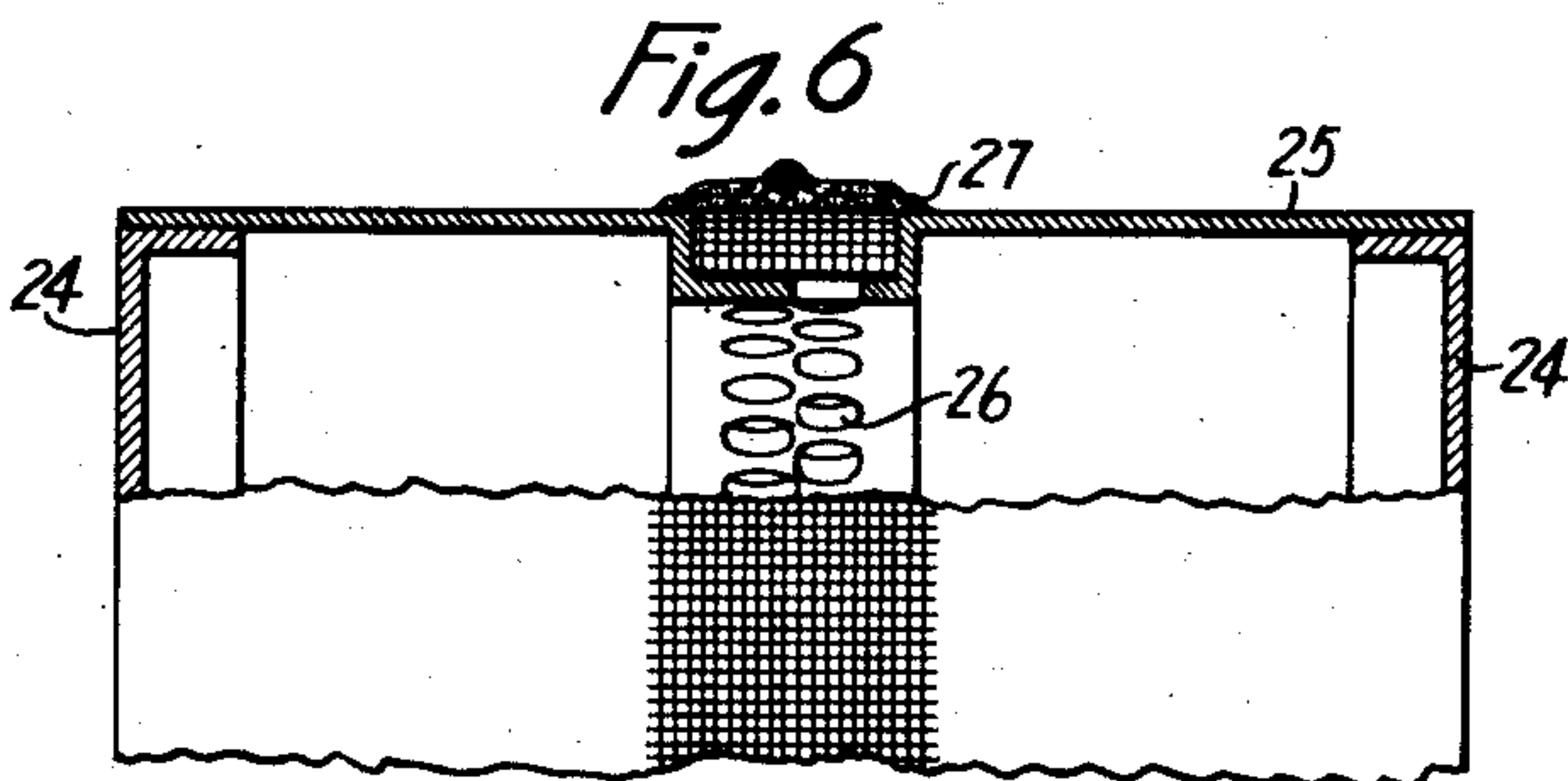
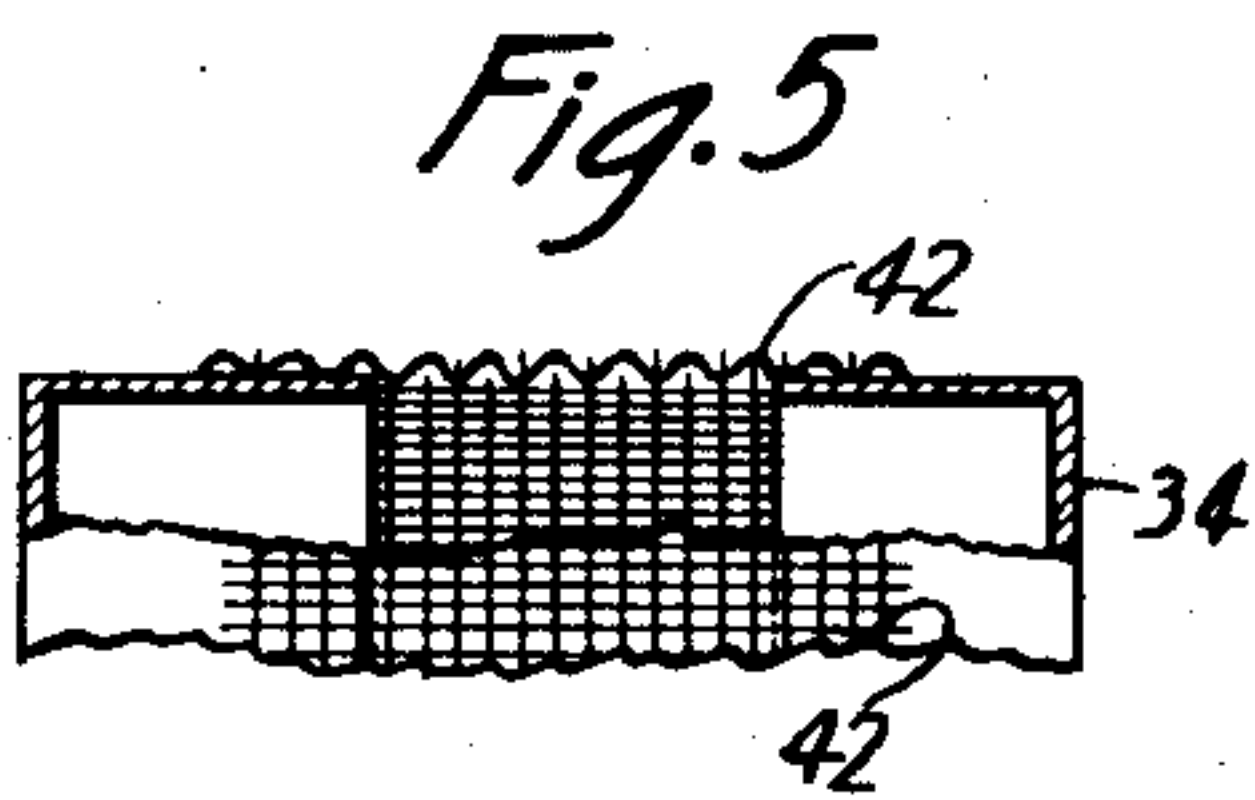
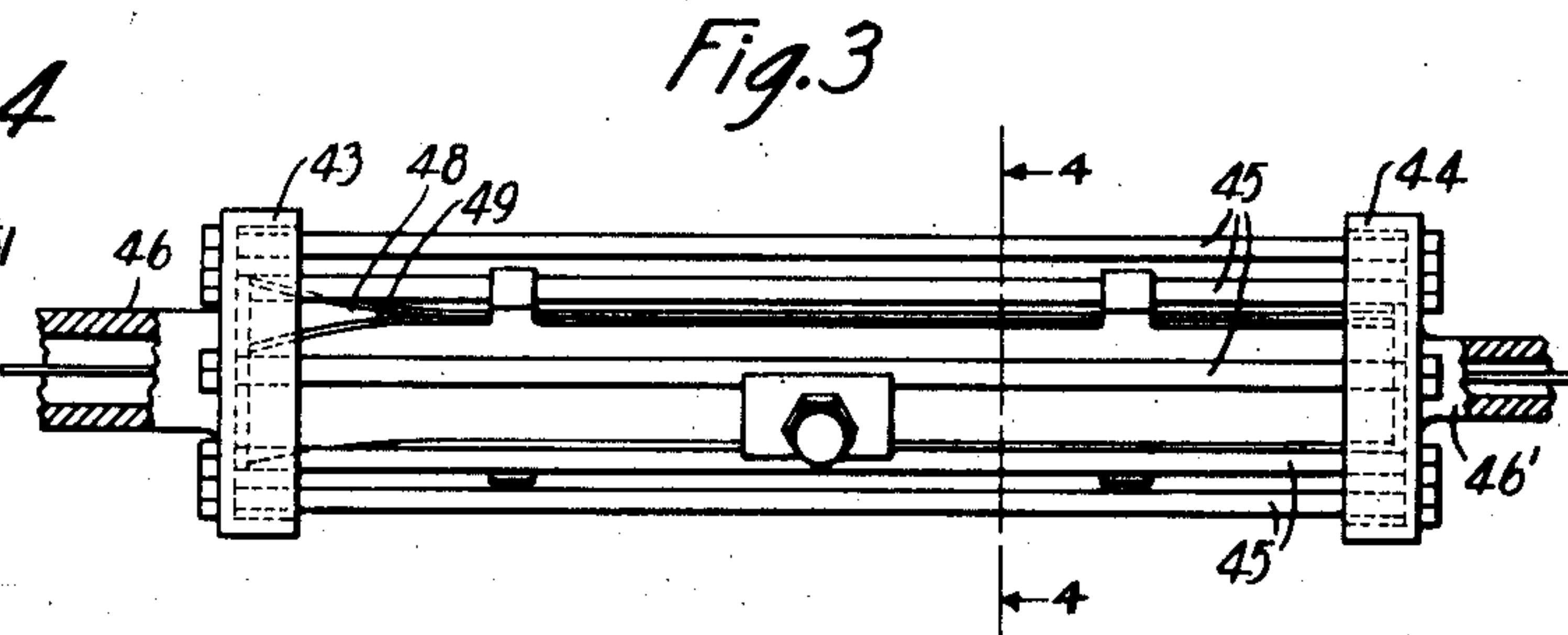
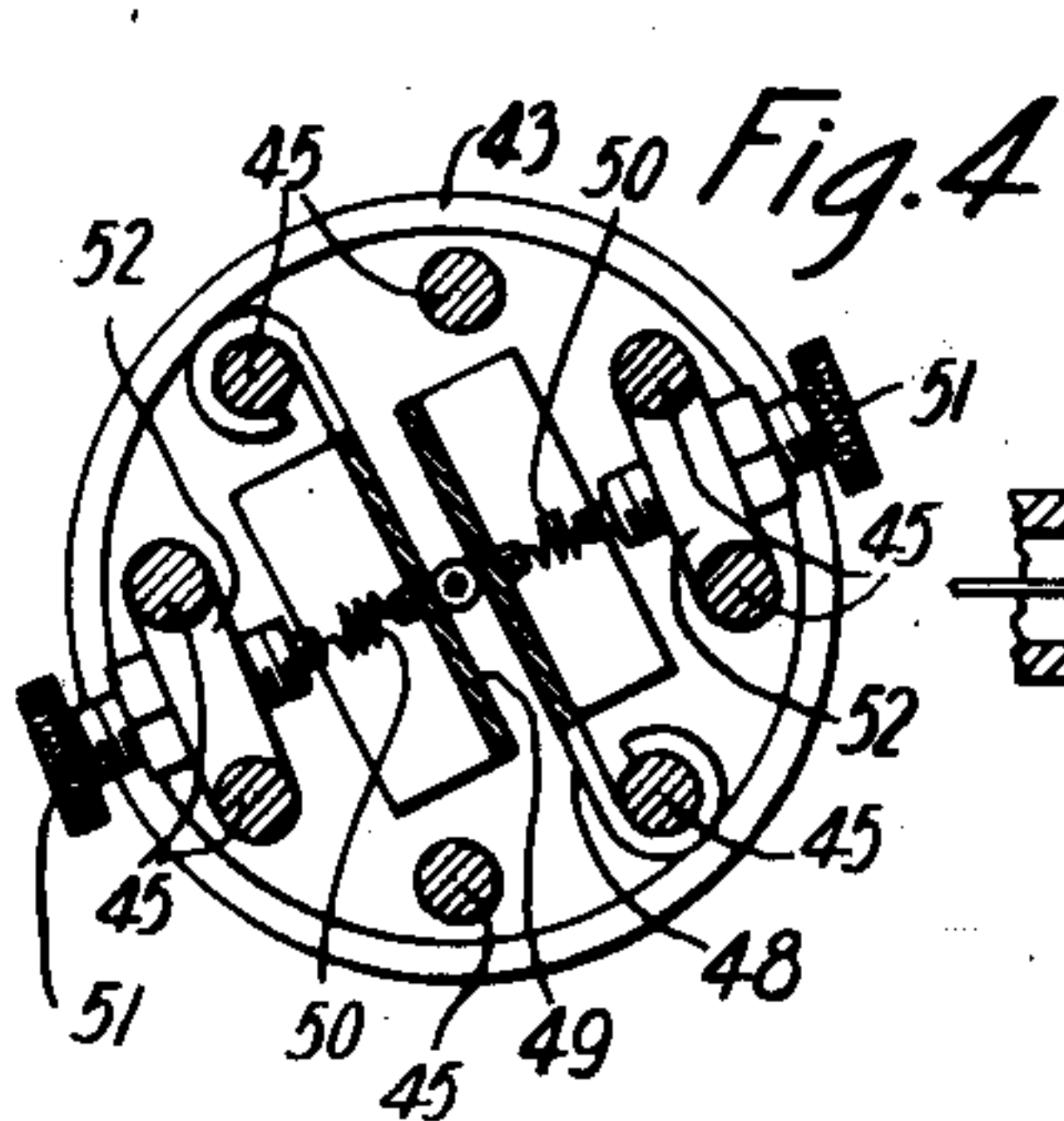


Fig. 7



Fig. 8



Fig. 9



Fig. 11.



Fig. 10



Inventor:
Ernest B. Wood

by J. H. Roberts Att'y.

UNITED STATES PATENT OFFICE

ERNEST B. WOOD, OF CHATHAM, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

PAPER-INSULATED CONDUCTOR

Application filed May 29, 1926. Serial No. 112,532.

This invention relates to paper insulated conductors and a method of making them.

An object of this invention is an inexpensive, substantially moisture-proof paper insulated conductor capable of withstanding severe service strains.

The method of applying the paper insulation to the conducting core does not form a part of this invention since the method used is that disclosed in the copending application of H. G. Walker and A. T. March, Serial No. 547,924, filed March 29, 1922, Patent No. 1,615,417 dated Jan. 25, 1927. The moisture-proofing or impregnating process also is disclosed in the copending application of D. R. Brobst, Serial No. 68,058, filed November 10, 1925.

The conductor of this invention has its insulation reinforced by the application of a serving of yarn which partially embeds itself in the somewhat moist paper coating, previous to the moisture-proofing by impregnating with cellulose acetate lacquer.

The invention will be better understood from the following description together with the attached drawings forming a part thereof and in which,

Fig. 1 is a diagrammatic representation of the apparatus required for coating and impregnating the conductor;

Fig. 2 is a top view on an enlarged scale of a part of the pulp applying apparatus;

Fig. 3 is a side view of the pulp former;

Fig. 4 is a section of the same on line 4—4 of Fig. 3;

Fig. 5 is a view in section of a part of the squeezing roll;

Fig. 6 is a view in section of a part of the main drum;

Figs. 7, 8, 9 and 10 represent different steps in the formation of the pulp on the conductor; and Fig. 11 is a side view of the insulated conductor.

Referring now particularly to Fig. 1, the core 74 to be coated is fed from a supply reel 20, over an idler roll 21 and thence around a drum 22 which is partly submerged in liquid containing pulp within a semi-spherical trough 23. The drum 22 comprises a pair of sheet metal sides 24, (Fig. 6) and a peripheral

portion 25 secured thereto. The portion 25 is provided with a plurality of relatively large perforations 26 which are covered with a narrow strip of fine wire mesh 27. The core, in passing around the drum, lies upon the wire mesh 27. The drum 22 has a centrally disposed tubular axle 28 which is rotatably mounted in suitable bearings 29 carried by a framework 30 which supports all the elements of the apparatus.

In order to apply pulp to the core as it passes over the drum 22, the pulp mixture within the drum is maintained at a lower level than that of the level of the pulp mixture in the tank 23, as indicated by dotted lines A and B, respectively. This difference in levels is maintained by a siphon pipe 31 which has its inlet opening submerged in the pulp mixture within the drum 22 and its discharge through the tubular axle 28. A continuous circulation of the pulp mixture is maintained in the tank 23 by feeding the pulp mixture from a supply tank 32 into tank 23 and out of said tank through a pipe 19 into a receiving tank (not shown) from which it is pumped back into the supply tank 32, in any suitable manner. As the drum 22 carries the core thereon through the tank, the liquid in tank 23 will pass through the wire mesh 27 and perforations 26, due to the difference in levels of liquid within the drum and the tank 23, straining the pulp onto the outer surface of the wire mesh and applying the pulp to the core supported thereon. In order to keep the wire mesh clean prior to its reception of the core, and a new coating of pulp, it is washed by a jet of water, under pressure, which is supplied through a nozzle 33.

The drum 22 is rotated in the direction indicated by the arrow. The core 74, with a coating of pulp 75 thereon, leaves the drum at the top thereof and the force of gravity, the surface tension of the liquid in the pulp mixture, and the felting of the pulp fibres cause the pulp to surround the core and cling to it in substantially the form shown in Fig. 7.

From the drum 22, the core, with a pulp coating 75 thereon, is passed over an auxiliary roll 34 and then between a pair of squeezing rolls 35 and 36. These rolls are rotatably

mounted between a pair of brackets 37, secured to an upright standard 38 supported by the framework 30. The shaft carrying the roll 36 is driven through a pulley attached thereto which is actuated by a motor 39 in any suitable manner, as by means of belts 40 and 41. The core is drawn from the supply reel 20 over the drum 22, causing it to rotate, by the squeezing rolls 35 and 36.

The auxiliary roll 34, as shown in Fig. 5, is a hollow sheet metal drum having a peripheral slot covered with a strip of fine wire mesh 42. It has been found preferable to employ the auxiliary roll 34 and to make it foraminous where it engages the core and pulp coating thereon in order that the "free liquid", so to speak, may be strained off away from the core and coating. If such a roll were not provided, the excess liquid would tend to wash off the pulp coating, since at this stage the pulp coating is very soft and easily removed from the core. With the free liquid removed, the coating has greater strength due to a closer felting of the fibres so that when the core and coating are passed through the squeezing rolls, the coating will not be torn from the core.

The squeezing rolls may be formed of rubber and forced together by any suitable adjustable means to place the proper pressure on the core and pulp coating as they pass between the rolls. These rolls remove the greater portion of liquid from the pulp mixture and form the pulp into a thin ribbon which extends laterally from each side of the core as shown in Fig. 8. This squeezing operation also mats or felts the fibres into more intimate relation thereby increasing the strength of the covering and securing it more firmly to the core.

From the squeezing rolls, the core with its ribbon pulp coating, is drawn through a former, which wraps the projecting edges of the ribbon around the core and around each other. The appearance of the coating after it is first acted on by the former and after the forming action is completed is shown in Figs. 9 and 10. The former causes a thorough intermingling of the pulp fibres and molds the coating to conform to the shape of the core.

The former, shown in detail in Figs. 3 and 4, comprises two cup-shaped collars 43 and 44 held together and in spaced relation by means of rods 45. Integral with said collars 43 and 44 are sleeves 46 and 46' respectively, which are rotatably mounted within suitable bearings in the standards 38 and another pair of standards 47 supported by the framework 30. Two plates 48 and 49 have projecting tongues which are bent around two of the rods 45 to pivotally support the plates in opposed relation to each other. Compression springs 50 engage the rear faces of plates 48 and 49 and tend to force them to-

gether. The springs 50 are put under the requisite compression by means of adjusting screws 51 which are mounted in brackets 52 secured to the rods 45. The ends of the plates 48 and 49, adjacent the squeezing rolls 35 and 36, are flared outwardly so as to present a smooth surface to the core and pulp coating as they pass from these rolls through the sleeve 46 and between the forming plates 48 and 49. The core passes from the forming plates through the sleeve 46'.

The plates 48 and 49 are rapidly rotated around the core having the pulp coating thereon, through the medium of a pulley 18 secured to the sleeve 46', the pulley being driven by the motor 39 through a belt 17.

The forming plates 48 and 49 wrap the projecting edges of the pulp ribbon about each other and around the core in much the same manner as though the core and pulp ribbon were rolled on a tabletop with the palm of the hand.

As the coated core leaves the former, a serving-head 55 wraps a layer of yarn 76 over the pulp coating. Since the pulp coating is still soft and moist this yarn as shown in Fig. 11 will partially embed itself in the coating thereby greatly strengthening it. This yarn may be of any suitable material and of any convenient size and is served so that there is no overlapping or portions of unprotected pulp coating. The serving usually consists of about seven or nine strands.

If desired, strands of distinct colors may be introduced into the yarn to act as markers.

The core with its formed coating passes from the serving-head to a mechanism for drying out the coating. The means shown for this operation is a pair of wide hollow drums 52 and 53 heated internally and having a plurality of grooves 53' formed thereon (Fig. 2) which receive the core. Guides (not shown) are provided for drawing the core over first one drum and then the other until the coated core has traversed all of the grooves on both drums, after which it is drawn over a suitable pulley or other guiding means 3 to an impregnating tank 4 containing a cellulose acetate bath 5. The impregnating tank 4 is preferably composed of a suitable electrically conducting, cellulose acetate-inert material such, for example, as brass.

From the pulley 3, the conductor passes under pulley 6, up and over pulley 7, down and under pulley 8, up and out of the bath and tank and over pulley 9. From the tank 4 the conductor passes to a second impregnating tank 10 and drying chamber 11 and then to a suitable take-up reel 12.

The take-up reel 12 is preferably formed of an electrically conducting material so that it may be employed as one of the electrodes for applying potential between the conductor and the bath containing the conductor dur-

ing the impregnation treatment. When used in this manner, the conducting core of the conductor being treated is attached to the metallic core of the take-up reel 12. A suitable binding post is attached to the impregnating chamber 4 such as shown at 13.

During the passage of the conductor through the impregnating tank 4, a potential is applied, as set forth in the above mentioned Brobst application, between suitable electrodes, such as the metallic reel 12, to which the conducting core of the conductor is electrically attached, and the binding post 13; the reel 12, being preferably made the anode or positive electrode. With the application of such a potential between the conductor and the container holding the conductor during the impregnating treatment, it has been found that the cellulose acetate solution penetrates through the fibrous insulation to the conducting core. In this way, a substantially uniform structure is produced.

The insulated conductor is passed through the tank 4 containing the cellulose acetate solution as many times as desired to insure thorough impregnation. In the drawings, the conductor is shown as being given four passes through the bath in the tank 4.

It has been found that while the conductor covering is thoroughly impregnated with cellulose acetate in the above process, a better finish is produced if the conductor is passed through a plurality of additional impregnation steps without the application of a potential. Therefore after leaving the tank 4, the conductor is drawn under a suitable guide pulley 14 and through a cellulose acetate bath 15 contained in the tank 10. The distance traveled by the conductor after leaving tank 4 and before entering the bath 15 should be so short that there will be no deposition of moisture on the conductor.

The conductor then passes through the drying chamber 11 which may be, for example, an electric furnace comprising a refractory core 70 wound with suitable resistance wire 71 and enclosed within a second refractory tube 72 over which suitable heat insulating material 73 is placed.

The insulation of the conductor after passing through the chamber 11 should be thoroughly dry. This may be accomplished by maintaining a high temperature in the furnace or by giving the conductor several passes in the furnace.

What is claimed is:

1. An electrical conductor comprising a metallic core, a coating of loose fibrous material thereon and a layer of textile material enclosing said fibrous material coating, said coating and said layer of textile material being impregnated with cellulose acetate.

2. An electrical conductor comprising a conducting core, a coating of paper pulp thereon and a serving of yarn enclosing said

coating, said coating and said serving being impregnated with cellulose acetate.

3. An electrical conductor comprising a conducting core, a coating of paper pulp thereon and a layer of textile material enclosing said paper pulp and partially embedded therein, said pulp and said layer of textile material being impregnated with cellulose acetate.

4. An electrical conductor comprising a conducting core, a coating of paper pulp thereon and a serving of cotton yarn enclosing said pulp and partially embedded therein, said coating and said serving being impregnated with cellulose acetate.

5. A method of coating a core which consists in applying wet pulp to the core and causing it to conform to the shape of the core, enclosing said pulp, while moist, with a serving of textile material, drying said pulp and textile material, impregnating said pulp and said textile material with cellulose acetate and again drying the combined core covering.

6. A method of coating a core which consists in applying wet pulp thereto and molding it to conform to the shape of the core, wrapping a serving comprising a plurality of strands of textile material around said pulp with sufficient force to cause the strands to be partially embedded therein, drying the pulp and textile material, impregnating said pulp and strands with cellulose acetate and again drying the combined core covering.

7. A method of insulating an electrical conductor which consists in applying wet paper pulp to the conductor core and molding the pulp to conform to the shape of the core, wrapping a serving comprising a plurality of strands of cotton yarn around the pulp, while it is still moist, with sufficient force to cause the strands to be partially embedded therein, drying the pulp and yarn, subjecting the conductor and covering to a bath of cellulose acetate while maintaining a potential difference between the bath and the core and thoroughly drying the combined core covering.

In witness whereof, I hereunto subscribe my name this 25th day of May, A. D. 1926.

ERNEST B. WOOD.