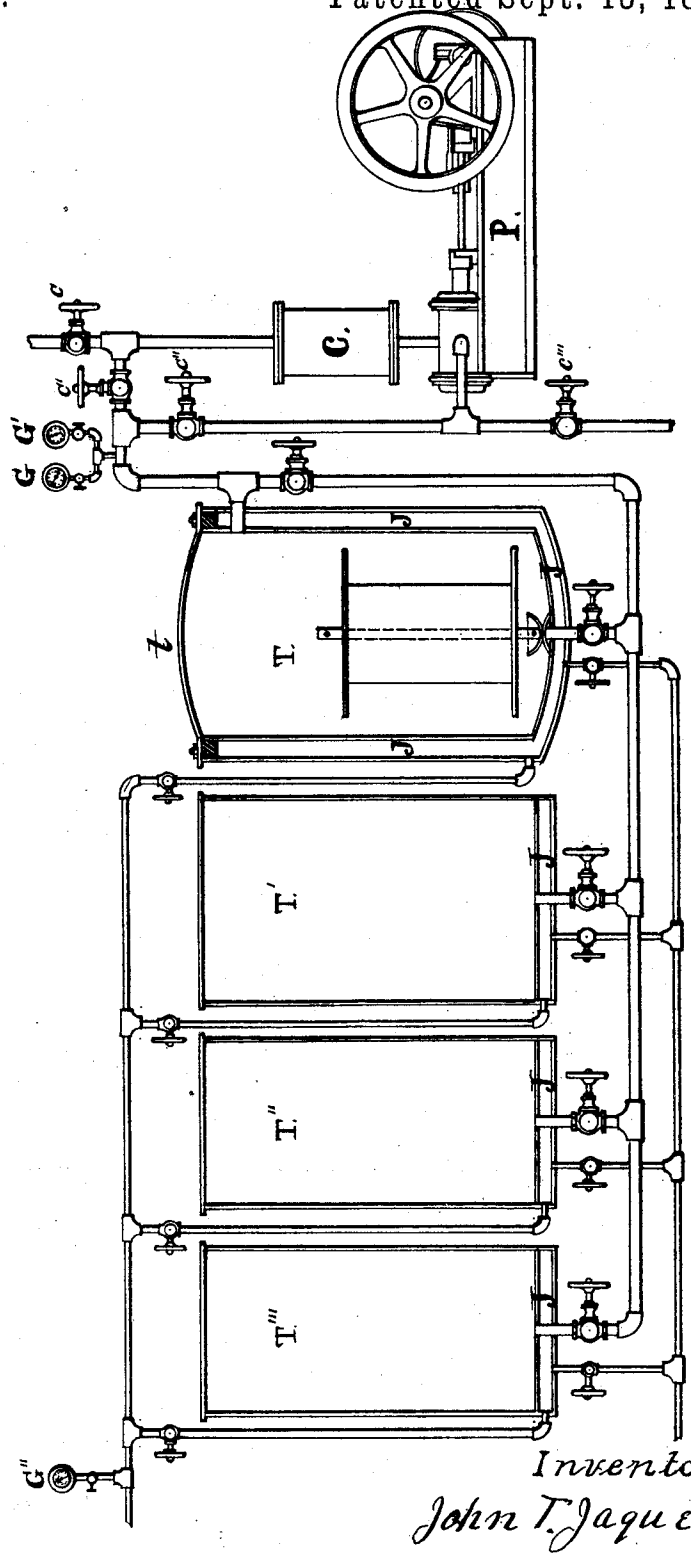
(No Model.)

J. T. JAQUES.

MANUFACTURE OF INSULATED ELECTRICAL CONDUCTORS.

No. 369,793. Patented Sept. 13, 1887.



Witnesses:
H. H. Eustis.
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UNITED STATES PATENT OFFICE.

JOHN T. JAQUES, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE FARADAY ELECTRIC CABLE COMPANY.

MANUFACTURE OF INSULATED ELECTRICAL CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 369,793, dated September 13, 1887.

Application filed March 14, 1885. Serial No. 158,774. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. JAQUES, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in the Manufacture of Insulated Electrical Conductors, of which the following is a specification.

My invention relates to the manufacture of insulated electrical conductors.

The object of my invention is to secure a higher insulation, a relatively lower inductive capacity, and greater durability in insulated electrical conductors or cables.

Insulated conductors as usually constructed consist of a core of copper or other good conductor having wrapped, braided, or twisted thereon a coating of fibrous material, as silk or cotton, which material, either before its application to the conductor or immediately afterward, is saturated with an insulating substance, such as paraffine, tar, or resin. The degree of perfection to which this form of insulation attains is, as I have found by experiment, in a great measure due to the exclusion of moisture from the fibrous and other insulating material used. Heat alone fails to completely remove moisture from the cellular structure of cotton, for instance, and the same is true of many other fibrous materials, and also of the resins, gums, &c., used for insulating conductors.

My invention consists in a process of insulating electrical conductors whereby all moisture is removed from the insulating material, and for this purpose I provide an air-tight tank and means for exhausting the air therefrom, as an air-pump operated by a steam-engine. I also provide one, two, or more tanks for the reception of the insulating material with which the fibrous coating is to be saturated, the number depending on the number of substances which are to be used in succession. All these tanks are connected with the air-tight tank first mentioned by pipes having cocks or valves controlling the passage therethrough. All the tanks are provided with steam-jackets, whereby the temperature of their contents may be raised to any desired point. If three insulating substances are to be successively applied, as is my custom, I place in each of three tanks, respectively, one species of insulating material. I then open the pipe connecting the first tank with the air-tight tank, and by creating a vacuum in said tank draw in the insulating substance from the first tank. I continue to exhaust from this tank till the gage indicates as nearly a perfect vacuum as is attainable, when, the air and moisture being removed from the insulating substance, I change the arrangement of valves and force the air into the air-tight tank. This forces the insulating material back into the tank from which it was drawn. Of course sufficient heat must be maintained in the steam-jackets to keep the substance under treatment in a fluid state. The same process is then applied to substances in the second, third, and remaining tanks. The cable, composed of a series of conductors wrapped or braided with cotton or other fibrous material upon a light skeleton reel, is now placed in the air-tight tank and a high vacuum produced therein, while the temperature is considerably increased. This causes expansion in the cellular structure of the fibrous covering, which finally bursts and discharges the contents of the cells. This, in the form of water, is now drawn off. The pipe-connection with the first tank containing an insulating substance is opened, a vacuum produced in the cable-tank, and the cable becomes submerged in the insulating material. Air-pressure is now applied until the fibrous coating of the conductors is thoroughly saturated or impregnated. The remaining material is driven back into the first tank and the operation last described pursued with the remaining substances in the second, third, and additional tanks. The cable is then ready to receive its armor of lead pipe or other appropriate protection.

The accompanying sheet of drawings illustrates the arrangement of means for practicing my process of insulation.

T is a tank having a cover, *t*, which must be bolted or otherwise securely fastened down to form an air-tight joint. Tank T is surrounded with a steam-jacket, J. Air-pump P, operated by a steam-engine, and the condenser C

are connected to tank T by a pipe having cocks or valves c' c'' c''', which are arranged for producing either a vacuum or pressure in the tank.

G G′ G″ are vacuum, pressure, and steam gages, respectively.

T′ T″ T‴ are three tanks of substantially the same capacity as tank T. I prefer to use for insulating substances two or three materials varying in viscosity, and to apply the most liquid substance first, following its application by that of a substance somewhat more viscous, and this by other substances of relatively greater viscosity. To this end I place spirits of turpentine, pine-tar oil, and heavy pine-tar in the three tanks, respectively. Steam-jackets J may be placed upon the under side of these tanks. The tops are preferably open. Pipes connecting the steam-jackets and steam-boiler are shown.

The tanks T′ T″ T‴ being supplied with the insulating substances, as stated, the first tank, T′, is opened into tank T through the connecting-pipe, and a vacuum is formed in T, which draws the spirits of turpentine into tank T. The inlet to T is then closed, and when the gage indicates as complete a vacuum as it is practicable to obtain the connection with tank T′ is again opened, air-pressure is applied to tank T, and the turpentine is driven back into T′, sufficient heat being applied to keep the turpentine in a semi-fluid state. The same operation is now gone through with respecting the contents of tanks T″ T‴. Tank T is now uncovered, and the cable, composed of a series of conductors wound, braided, or twisted with some fibrous material, as cotton, upon a light skeleton reel, is placed in tank T and the cover *t* placed in position. Steam is then caused to heat tank T to from 225° to 300° Fahrenheit, and while so heated a vacuum is produced in T, so that the moisture, vapors, and gases are entirely removed from the fibrous coating of the cable and the minute pores swell up, burst, and discharge their contents, as appears upon microscopic examination. After the moisture, vapor, and gases have been so completely removed from the fibrous coating that a vacuum can be maintained in T, tank T′ is connected with T and the turpentine drawn into tank T, submerging the cable. The outlet of T is now closed and air-pressure is applied of, say, four atmospheres, which causes the turpentine to impregnate the fibrous material, filling the minutest pores and interstices. The passage between T and T′ is again opened and the free turpentine is forced back into tank T′. This operation is applied to the insulating substances in the remaining tanks, which must be properly heated, after which the tank T is opened and the cable removed.

The cable is now ready to receive its lead pipe or other protecting-armor. I prefer to use lead pipe and to braid, weave, or wind over this a cover of cotton, hemp, or other fibrous material impregnated according to my process with some substance to prevent decay.

I do not confine myself to the insulating materials above described, nor to the use of any number of substances, and my process of treating fibrous substances is equally applicable to the treatment of material for ropes, cordage, sail-cloth, &c.

I do not herein claim the means shown and described for practicing my method of insulation, nor do I claim the product of such manufacture, as this forms the subject-matter of other applications.

What I claim is—

The process of insulating an electrical conductor herein described, which consists in covering the conductor with a fibrous insulating material, subjecting it to the combined action of heat and an air-pump operated to produce a vacuum until the combined action thereof bursts the cellular structure of the fibrous insulating material and dispels the moisture, and then applying insulating substance under pressure.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 11th day of March, 1885.

JOHN T. JAQUES.

Witnesses:

H. H. EUSTIS,

GEO. K. LITTLEFIELD.