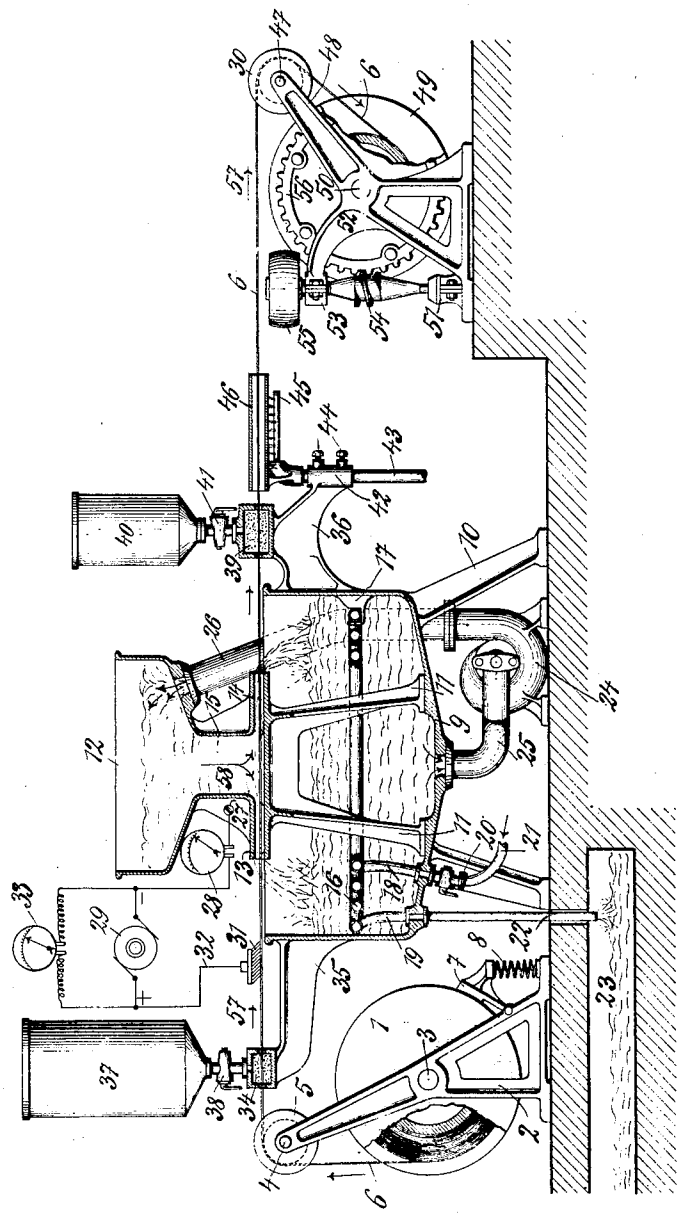
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METHOD OF INSULATING WIRE OF ALUMINIUM AND THE LIKE.

APPLICATION FILED MAY 31, 1911.

1,117,240. Patented Nov. 17, 1914.



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METHOD OF INSULATING WIRE OF ALUMINIUM AND THE LIKE.

1,117,240. Specification of Letters Patent. Patented Nov. 17, 1914.

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To all whom it may concern:

Be it known that I, ERNST PRESSER, a subject of the Grand Duke of Oldenburg, residing at Berlin, in the Empire of Germany, have invented a new and useful Method of Insulating Wire of Aluminium and the like, of which the following is a specification.

My invention relates to a novel method of insulating wire of aluminium and the like, which consists in passing the wire through an electrolyte while at the same time conducting through it a current of a high tension, so as to form from the metal an inorganic coat of metal combinations, which coat very strongly sticks to the wire and is an excellent electrical insulator and is capable of replacing the ordinary organic insulators, such as cotton, silk, etc. The novel insulating layer presents most important advantages, which will be hereinafter set forth.

In order to produce a perfectly irreproachable insulating coat on the wire, it is necessary to protect the wire from contact with any foreign body during its passage through the electrolyte, that is during the formation of the coat. For this reason it is preferable to conduct the wire in a straight line through a current of electrolyte. For this purpose means are provided for constantly raising the electrolyte from a lower vessel to an upper vessel and for permitting it to flow out from the upper vessel through a tube surrounding the wire to be coated into the lower vessel. It is further important to employ a tension of the electric current far higher than that used in ordinary electrolytical processes, where in general pressures of but from one to four volts per cell are employed. In opposition to such baths the tension of the current employed in the new method varies between 100 and 500 volts, so as to enable the electric current to break through the layer of oxid on the surface of the metal, which layer is formed in a known manner, for example like the layer of polarization in the electric aluminium condenser. Under the high tension a comparatively strong current will pass through the liquid and produce a great heat at the layer of polarization on the surface of the wire, in which layer the greatest part of the electric resistance is located. The heat so developed may be so great as to make fire appear on the dipped surface of the wire.

In order to prevent the heat of the wire from exceeding a certain limit the wire requires to be passed at a suitable speed (such as for example three meters per minute) through the liquid. Means are provided for cooling the liquid say in the lower vessel. Preferably means are provided for cleaning the wire before its passage through the electrolyte. Where so preferred, the insulated wire may be afterward covered with a protecting layer of lacquer, tar, or the like.

I will now proceed to describe my invention with reference to the accompanying drawings which diagrammatically illustrate partly in vertical longitudinal sections, partly in elevation an apparatus that may be employed for carrying the method into effect.

A drum 1 charged with bright aluminium wire is placed between two parallel supports 2 on a pin 3 which can be withdrawn and reintroduced. The two supports 2 are upward lengthened for carrying on a pin 4 a grooved guiding pulley 5, over which the wire 6 unwound from the drum 1 passes. Preferably a suitable brake, such as 7, is disposed on the supports 2 for bearing against the periphery of one side disk of the drum 1 under the action of a helical spring 8. A lower vessel 9 on suitable legs 10 is disposed and carries on its bottom the legs 11 of an upper vessel 12, which is made in one with a horizontal tube 13, 14 and a tubular connection 15. A cooling coil 16 is shown to be supported in the lower vessel 9 by means of brackets 17 on the walls and tube ends 18 and 19 on the bottom. The inner tube end 18 is connected with a cock 20 or its equivalent beneath the bottom and the cock 20 or the like is in turn connected by a tube 21 with a source of cold water. The outer tube end 19 is connected with a tube 22 fastened on the bottom of the vessel 9 and leading downward into a channel 23, which goes to without. A centrifugal pump 24 is provided, which is driven from without in any known manner and is connected with the bottom of the lower vessel 9 by a suction tube 25 and with the upper vessel 12 by a delivery tube 26. On the upper vessel 12 or its tubular connection 15 a binding post 27 is provided, which is electrically connected by a line over an amperemeter 28 with the negative pole of a direct current generator 29. The aluminium wire 6 is made to pass from the guiding pulley 5 through the tube 13, 14 to another guiding

pulley 30 to be mentioned later on. A contact brush 31 of any known construction is supported by the lower vessel 9 in any known manner (not shown) and is made to rub the wire 6. The contact brush 31 is connected by a line 32 with the positive pole of the generator 29. A voltmeter 33 is shown to be connected with the two poles of the generator. The lower vessel 9 is shown to be provided with brackets 35 and 36. The bracket 35 contains a chamber 34 for a sponge or the like, which surrounds the wire 6. The bracket 35 carries a vessel 37 with a cock 38 or the like at its bottom communicating with the chamber 34. The vessel 37 is to be filled with a washing liquid capable of cleaning the surface of the wire 6. The other bracket 36 contains a chamber 39 for a sponge or the like surrounding the wire 6 and carries a vessel 40 with a cock 41 or the like at its bottom. The vessel 40 is to be filled with liquid lacquer, tar, oil, or the like. The bracket 36 has an arm 42, in which a gas tube 43 can be vertically adjusted by means of a screw 44. The upper end of the gas tube 43 is connected with a suitable burner 45 and supports a horizontal drying tube 46, which surrounds the wire 6.

The grooved guiding pulley 30 already mentioned above turns on a pin 47 carried by the upper ends of two parallel supports 48. A drum 49 for winding on the insulated aluminium wire 6 can be placed between the two supports 48 on a pin 50, which can be withdrawn and reintroduced. The front support 48 has a foot step 51 and an arm 52 with a bearing 53. The shaft of a worm 54 is mounted to turn in the foot step 51 and in the bearing 53 and carries at its upper end a driving pulley 55, which is arranged to be driven from without in any known manner. The worm 54 meshes with a worm wheel 56 connected in any known manner with one side disk of the drum 49.

For want of space I have drawn the drum 1 for the unwinding wire 6 near the lower vessel 9, but it will be understood, that this drum may be placed at any convenient distance from the vessel 9.

My novel method of insulating aluminium wire is as follows: A drum 1 charged with bright aluminium wire is placed on the pin 3 and the free end of the wire 6 is passed over the guiding pulley 5 through the sponge or the like in the chamber 34, under the contact brush 31 through the tube 13, 14, the sponge or the like in the chamber 39 and through the drying tube 46, then over the guiding pulley 30 and is fastened on the drum 49. The lower vessel 9 is filled up with an electrolyte, which may be a solution of any of very many salts. I have for example found that a solution of sodium carbonate or of bicarbonate of soda in water answers well the purpose. Gas is supplied through the tube 43 to the burner 45 and is here lighted, so that the flames heat the tube 46. The cock 20 is opened for admitting the cooling water to the coil 16. The cock 38 or the like is conveniently opened for admitting the necessary quantity of washing liquid to the sponge or the like in the chamber 34. In a similar manner by opening a little the cock 41 or the like a convenient quantity of lacquer, tar, oil, or the like is admitted from the vessel 40 to the sponge or the like in the chamber 39. Then the generator 29, the centrifugal pump 24 and the driving pulley 55 are started. Now the drum 49 will wind the wire 6 on, which passes at the convenient speed (for example 2 to 3 meters per minute) in the direction of the arrows 57, 57 from the drum 1 on the left to the other drum 49 on the right. The centrifugal pump 24 sucks in the electrolyte from the lower vessel 9 through the tube 25 and raises it through the delivery pipe 26 to the upper vessel 12, from which the liquid flows in the direction of the arrows 58 through the tubular connection 15 and the tube 13, 14 in both directions into the lower vessel 9. The direct current passes from the positive pole of the generator 29 through the line 32, the contact brush 31 and the wire 6 in contact with the electrolyte, from which portion of the wire the current passes through the electrolyte, the walls of the tubular connection 15, the binding post 27 over the amperemeter back to the negative pole of the generator. The electrolyte becomes heated in the tube 13, 14 by the current of high tension, but is constantly cooled in the lower vessel 9 by means of the cold water passing through the coil 16 and escaping through the tube end 19 and the tube 22 into the channel 23. An insulating coat will be formed on the surface of the wire 6, which during the passage through the chamber 39 is covered with liquid lacquer, tar, oil, or the like, whereupon this covering layer is dried up during the passage of the wire 6 through the drying tube 46. The finished insulated wire is then wound on the drum 49.

On the drawing I have for example illustrated an apparatus for carrying my method into effect, but I desire it to be expressly understood, that I do not bind myself in any way to the construction shown, but reserve to myself the right of varying the apparatus in any known manner. For example wire guides similar to the known yarn guides in winding machines may be employed for unwinding the wire from the drum 1 and for winding it in regular turns on the drum 49. The tension of the electric current employed may be for example 220 or 440 volts, the essential point being that the current be capable of breaking through the layer of polarization on the surface of the wire. In other words, the tension of the electric current must be greater

than the counter tension generated in the electrolyte on the surface of the wire. The speed of the wire 6 should be so regulated, that its heat during the passage through the electrolyte is prevented from exceeding a convenient limit.

The inorganic insulating layer formed on the surface of aluminium wire by the described electrolytic process with the assistance of the heat looks like a neutral tint, is hard and tough and offers a great resistance to friction, pressure and shocks. It possesses properties similar to porcelain. It sticks very strongly to the wire and proves to be an excellent electric insulator. For example, a tension of 220 volts may take place between two superposed insulated aluminium wires without any passage of the current from one wire to the other one. The insulating layer is moreover incombustible, so that for example coils made from such wires will suffer no damage even at a very high temperature, which of course is a most important advantage over the organic insulations (such as cotton, silk, etc.,) hitherto employed. A further essential advantage of this inorganic insulating layer over the known organic insulators consists in that in spite of its high insulating capacity it is so very thin, that it can be nearly completely neglected in the calculation of the space required by a coil to be produced. Thus it is possible to better utilize any given space with the novel insulated aluminium wire than hitherto.

The new insulating layer can be equally well produced on square aluminium wire as on round wire, which is not the case with the other known insulators. As is well known, the employment of square wire permits any given space to be better utilized than is possible with round wire. This advantage can be obtained, it is true, by coils formed from ordinary bright square aluminium wire, however, such coils even when subsequently treated in any manner do not possess so high an electrical insulating capacity as coils formed from my insulated square aluminium wires.

In most cases it is possible to completely save the insulators between the several layers of wires in the coils made from my new insulated aluminium wires, which insulators are absolutely necessary in coils made from bright aluminium wire.

As already mentioned above, the insulated aluminium wire may, if so desired, be covered in a known manner with a protecting layer made from lacquer, tar, oil, or the like. Such protecting layers stick very well to the somewhat porous insulating layer.

I have already indicated above, that during the passage of the aluminium wire through the electrolyte the wire should be protected from coming in contact with any foreign body. The reason for this resides in the fact, that the insulating layer commenced to be formed may be damaged on the places of contact, so that the strong current generated on these places may very strongly attack the insulating layer and under circumstances may burn it through. This drawback is particularly to be found with comparatively thin wires conducted within the electrolyte over guiding rollers.

The method described may also be applied to wires made from other metals similar to aluminium, such as magnesium, alloys of aluminium, etc. Then the tension of the direct current should be chosen between 100 and 500 volts, the essential point being, that this tension be in all cases greater than the counter tension generated in the electrolyte on the surface of the wire.

I claim:

1. The method of insulating wire of aluminium and the like, which consists in passing the wire through an electrolyte while protecting it from contact with solid bodies and at the same time conducting through the wire and the electrolyte an electric current of a tension greater than the highest counter tension due to the polarization generated in the electrolyte on the surface of the wire, so that the layer of polarization upon the wire is electrically broken through with a development of great heat and the presence of fire on the dipped surface of the wire, whereby a high resistant insulating coat is produced on the wire.

2. The method of insulating wire of aluminium and the like, which consists in passing the wire first through a cleaning medium and then through an electrolyte while protecting it from contact with solid bodies and at the same time sending through the wire and the electrolyte an electric current of a tension greater than the maximum value of the counter tension generated in the electrolyte on the surface of the wire, so that the layer of polarization upon the wire is electrically broken through with a development of great heat and the presence of fire on the dipped surface of the wire, whereby a high resistant insulating coat is produced on the wire.

3. The method of insulating wire of aluminium and the like, which consists in passing the wire through an electrolyte while protecting it from contact with solid bodies and at the same time sending through the wire and the electrolyte an electric current of a tension greater than the counter tension generated in the electrolyte on the surface of the wire, so as to produce an insulating coat on the wire, next in passing the wire through a liquid so as to form on it a protecting coat, and in drying the protecting coat.

4. The method of insulating wire of alu-

minium and the like, which consists in passing the wire first through a cleaning medium and then through an electrolyte while protecting it from contact with solid bodies and at the same time sending through the wire and the electrolyte an electric current of a tension greater than the counter tension generated in the electrolyte on the surface of the wire, so as to produce an insulating coat on the wire, next in passing the wire through a liquid so as to form on it a protecting coat, and in drying the protecting coat.

5. The method of insulating wire of aluminium and the like, which consists in passing the wire through an electrolyte formed of a solution of the carbonate of an alkali while protecting said wire from contact with solid bodies and at the same time sending through the wire and the electrolyte an electric current of a tension greater than the maximum value of the counter tension generated in the electrolyte on the surface of the wire, so that the layer of polarization upon the wire is electrically broken through with a development of great heat and the presence of fire on the dipped surface of the wire, whereby a high resistant insulating coat is produced on the wire.

6. The method of insulating wire of aluminium and the like, which consists in passing the wire through an electrolyte formed of a solution of sodium carbonate while protecting said wire from contact with solid bodies and at the time sending through the wire and the electrolyte an electric current of a tension greater than the maximum value of the counter tension generated on the surface of the wire, so that the layer of polarization upon the wire is electrically broken through with a development of great heat and the presence of fire on the dipped surface of the wire, whereby a high resistant insulation is produced on the wire.

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Witnesses:
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