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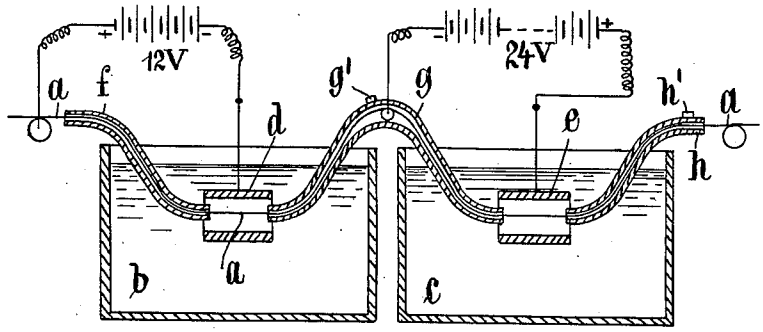
PROCESS FOR THE PRODUCTION OF AN INSULATING COATING ON ELECTRICAL CONDUCTORS.

APPLICATION FILED DEC. 16, 1912.

1,069,151. Patented Aug. 5, 1913.



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PROCESS FOR THE PRODUCTION OF AN INSULATING-COATING ON ELECTRICAL CONDUCTORS.

1,069,151. Specification of Letters Patent. Patented Aug. 5, 1913.

Application filed December 16, 1912. Serial No. 737,097.

To all whom it may concern:

Be it known that I, JACQUES LOEWENTHAL, citizen of Germany, subject of the King of Prussia and Emperor of Germany, residing at 137 Grosse Frankfurterstrasse, Berlin, in the Kingdom of Prussia and Empire of Germany, have invented new and useful Improvements in Processes for the Production of an Insulating-Coating on Electrical Conductors, of which the following is a specification.

As is well known solutions of aluminium salts cannot in a cool state be used for depositing metallic aluminium electro-chemically, but compounds of aluminium and particularly aluminium oxid can be produced in that manner. According to the present invention this fact is utilized for coating conductors of any desired form or property such as copper wire with an electrically insulating layer. To this end the conductor is treated electrolytically as negative electrode in a bath containing aluminium salt. By suitably selecting the composition of the bath and the current used a firmly adhering coating of aluminium compounds particularly of aluminium hydroxid and forming a sound and fire proof insulator is obtained on the conductor. The aluminium hydroxid can be converted into aluminium oxid by the action of heat.

The accompanying drawing represents a diagrammatic view of a device for carrying out the process according to this invention.

For the purpose of carrying the process into effect solutions of aluminium salts may be used such as are for instance described in the scientific literature more especially in connection with the analytical separation of aluminium in the form of hydroxid. A suitable bath is for example that suggested by A. Classen and consisting of a solution of aluminium-ammonium oxalate with an excess of ammonium oxalate. From this bath the aluminium is precipitated on the cathode in the form of hydroxid under the action of the current to the extent to which the ammonium oxalate is converted into ammonium carbonate. For practical purposes for example an aqueous or slightly acidulated solution of aluminium sulfate neutralized if desired by means of ammonia is treated with an excess of ammonium oxalate, adding with the application of heat, if desired, solid ammonium oxalate so that two to three grams ammonium oxalate are used for each 0.1 gr. of the metal. The strength of the current is so chosen as to produce a violent decomposition of the oxalic double salt. The conductor thoroughly cleaned is immersed in this bath and used as a cathode, the anode consisting of any desired conductive substance which is not attacked by the liquid of the bath such as platinum. The shape of the anode is by preference as nearly as possible that of the conductor so that the distance between all points of the surface of the conductor and the nearest point of the anode is the same as nearly as possible. From this bath the aluminium is precipitated in the form of hydroxid which very firmly adheres to the conductor.

An exceedingly suitable example for treating sheet metal or metal wire such as copper wire or copper band, is as follows: The metal such as copper sheet or copper wire to be coated with aluminium oxid is first of all carefully cleaned by the removal of the fatty layer adhering to it. This is effected by means of benzol, ammonia, spirit or the like and subsequently etching it with acid or other corrosives. By preference the etching is effected electrolytically by placing the copper body for instance in a bath of sodium acetate to which a little free acetic acid has been added and connecting it to the positive pole of a source of current, the negative pole being attached to a copper sheet acting as cathode and annularly surrounding the copper body to be etched. After the etching operation the copper body is brought into a second solution without previous rinsing. This second solution consists of aluminium acetate (for example 8%) to which nitrate of mercury has been added. The quantity of nitrate of mercury added may for instance be such that the contents thereof in the solution amount to about 0.1%, fresh mercury salt being added from time to time. In this bath the copper body forms the cathode and the anode is made to annularly surround the same. For the anode lead with lead-peroxid is preferably used. This may be obtained by treating lead sheets as anode in sulfuric acid of about 25% with moderately strong current for some time. In the bath of the aluminium salt the aluminium oxid or hydroxid is now precipitated

on the copper. Good results can be obtained with a terminal tension of 24 volts and with a current density at the cathode of at least 0.1 to 0.5 amperes per square centimeter surface. In order to increase the firm adhesion of the precipitate the liquid is strongly agitated during the action. This may conveniently be effected by blowing in air between the anode and cathode for instance with the aid of a pipe extending into the interior of the annular anode. This pipe may consist of nonconductive material and for the treatment of wire or band may simultaneously serve as a guide for these bodies. After the electrolytic treatment which may be completed in about half a minute the copper body is rinsed and then heated to drying without glowing. If after one treatment there are still places to which the precipitate does not firmly adhere the treatment can be repeated with absolute success, the cause for the non-adhesion being in most cases due to the copper not having been entirely freed from fat or like layers at the outset.

A device by means of which for instance copper wire may be coated with hydroxid of aluminium in a continuous manner is diagrammatically illustrated in the accompanying drawing. The copper wire *a* is first drawn through the caustic bath *b* and then through the electrolytic bath *c*. In the former bath the wire *a* forms the anode and in the latter it is used as cathode. In the caustic bath the wire is surrounded by the annular cathode *d* consisting for instance of copper and in the electrolytic bath it is surrounded by the anode *e* consisting for instance of lead with lead-peroxid. For guiding the wire a tube *f g h* is used which may simultaneously serve as a means for blowing in air into the space between the anode and cathode in the bath. The admission of air may be effected for instance at the points *g' h'* by way of suitable nozzles or the like. In the rear of the electrolytic bath *c* the wire is brought into suitable washing devices in which it is freed from the adhering bath liquid and then into drying apparatus consisting for instance of a gas oven in which the wire is heated without being caused to glow, and finally on to winding apparatus for the formation of spools or the like.

Mercury salts are employed because it has been found that the aluminium oxid is precipitated in a more complete and in a much quicker manner from the bath when the mercury salt is added than when the bath is used without it. The use of lead with lead peroxid as an anode is advantageous as this material is not affected by the solutions applied and is cheaper than any other resistant conducting material such as the noble metals.

Having now described my invention what I claim and desire to secure by Letters Patent of the United States is:

1. A process for the production of an insulating coating on electrical conductors consisting in the precipitation electrolytically on the conductor used as a cathode of strongly adhering aluminium compounds from a suitable solution of aluminium salts.

2. A process for the production of an insulating coating on electrical conductors consisting in the precipitation electrolytically on the conductor used as a cathode of strongly adhering aluminium compounds from a suitable solution of aluminium salts with an addition of mercury salts.

3. A process for the production of an insulating coating on electrical conductors consisting in the precipitation electrolytically on the conductor used as a cathode of strongly adhering aluminium compounds from a suitable solution of aluminium salts, the anode consisting of lead with lead-peroxid.

4. A process for the production of an insulating coating on electrical conductors consisting in cleaning the said conductor by removing the fatty layer adhering to it and subsequently etching it then bringing it as cathode into an electrolytic bath consisting of a solution of aluminium acetate containing nitrate of mercury and subjecting it to an electrical current, the anode consisting of lead with lead-peroxid and finally rinsing and drying said conductor.

5. A process for the production of an insulating coating on electrical conductors consisting in the precipitation electrolytically on the conductor used as a cathode of strongly adhering aluminium compounds from a suitable solution of aluminium salts subjecting the liquid to strong agitation during the precipitation of the aluminium compounds preferably by blowing in air between the anode and cathode.

6. A process for the production of an insulating coating on electrical conductors consisting in the precipitation electrolytically on the conductor used as a cathode of strongly adhering aluminium compounds from a suitable solution of aluminium salts subjecting the liquid to strong agitation during the precipitation of the aluminium compounds preferably by blowing in air between the anode and cathode through a pipe, which is simultaneously used as a guide for the conductor such as copper wire to be coated with aluminium hydroxid.

7. A process of producing an insulating coating on electrical conductors which consists in applying aluminium oxid directly to a copper wire thereby producing an insulating conductor consisting only of the inner layer of copper and the outer layer of the aluminium oxid.

8. A process of insulating electrical con-

ductors which consists in electrolytically depositing on said conductors aluminium oxid from a solution containing aluminium salt.

9. A process of insulating electrical conductors which consists in electrolytically depositing on said conductors aluminium oxid from a solution containing aluminium salt, said solution being free of other metals which are electrolytically deposited in a metallic state.

10. A process of insulating electrical conductors which consists in electrolytically depositing on said conductors aluminium oxid from a solution containing aluminium salt, said solution being free of iron.

11. A process of insulating electrical conductors consisting in electrolytically depositing aluminium oxid from a solution containing aluminium salt on said conductors and employing a current of a strength sufficient to cause the aluminium oxid precipitated to firmly adhere to the conductor.

12. A process of insulating electrical conductors consisting in electrolytically depositing aluminium oxid from a solution containing aluminium salt on said conductors and employing a current of a strength sufficient to cause the aluminium oxid precipitated to firmly adhere to the conductor, said current having a terminal tension of more than twenty volts.

13. A process of insulating electrical conductors which consists in electrolytically depositing on said conductors aluminium oxid from a solution containing aluminium salt and moving said conductor through the bath during the electrolytical treatment.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JACQUES LOEWENTHAL.

Witnesses:

WALDEMAR HAUPT,

HENRY HASPER.