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UNITED STATES PATENT OFFICE.

ERNST WOLFGANG KÜTTNER, OF BERLIN, GERMANY, ASSIGNEE, BY MESNE ASSIGNMENTS, TO THE CHEMICAL FOUNDATION, INC., A CORPORATION OF DELAWARE.

MANUFACTURING ELECTRIC COILS OF ALUMINUM.

No Drawing.

Application filed September 5, 1916. Serial No. 252,796.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, Dr. ERNST WOLFGANG KÜTTNER, citizen of Germany, subject of the King of Prussia and Emperor of Germany, residing at 26 Schlesischestrasse, Berlin, in the Kingdom of Prussia and Empire of Germany, have invented new and useful Improvements in Manufacturing Electric Coils of Aluminum, of which the following is a specification.

It is known to manufacture electric coils of aluminum in which the individual windings are insulated from each other by the selfformed oxide of the aluminum. It has been suggested to reinforce the said oxide covering, which is easily injured in winding the coils by heating the finished coil and treating the same with an oxidizing agent in such a manner, that the whole coil is penetrated with the oxidizing agent. Such treating of the finished coils with hot oxidizing fluids, or the soaking of the heated coils in such oxidizing liquids may, in certain cases be disadvantageous, in particular when the coils are wound on parts which are sensitive to heat and the use of strong oxidizing liquids. It is however necessary to use such strong and concentrated oxidizing liquids, as it was found that it is unreliable to produce a reinforcement of the oxide film by exposing aluminum wire to the influence of moist air. As a rule it is necessary to heat the metal and to employ strong oxidizing liquids.

It has been found that the oxidation may be obtained in a rapid and reliable manner when the wires have been previously artificially oxidized. Wire, which has been oxidized is far more sensitive toward oxidizing agents, even when the oxide covering formed by the first oxidation has been injured or almost completely removed.

The method forming the subject matter of the present invention is based on this fact. The method consists in the coil being wound, without any precaution against damage to the oxide covering, of a wire, band or the like, which has been previously oxidized, whereupon the finished coil is subsequently treated with weaker oxidizing agents. Under the circumstances even water will suffice as a second oxidizing agent. Neither is it necessary to employ the oxidiz-

ing agent hot or to heat the coil. The method described affords the advantage that residues from the first oxidizing process, such as soda or alkali salts, which, if allowed to remain on the surface of the metal, might have a detrimental effect will be washed away by the subsequent treatment with the weaker oxidizing solutions or water. This washing out may be further increased by employing as the second oxidizing agent a substance which will have a neutralizing effect on any residues remaining from the first oxidizing process.

The method according to the present invention may be carried out, for example, in the following manner: The wire, band or the like, to be wound to a coil, consisting of aluminum or an aluminum alloy, is treated before or while being wound to a coil with a sufficiently strong oxidizing agent such as a solution of caustic soda or the like. After the coil has been wound, which may be performed without any special precaution in the usual manner, the coil is treated with a weaker oxidizing agent or with water. This second treatment may also be performed during the winding process, for example by each completed layer of windings being wetted with the liquid. After the whole coil has then been completed, it is dried in any suitable manner.

The method may, however, also be carried out in such a manner that the wires or bands treated with the oxidizing agent are wound in a wetted state to the coil. In such cases preferably an alkaline solution, such as a solution of caustic soda or the like is employed. It has been found that the slimy coat of liquid on the surface of the coil will reduce the effects of the friction and the pressure in winding to such an extent or entirely remove the same, that the coat of oxide formed will not be injured at all. It is therefore not necessary to apply a special coating to the surface of the wire for reducing the friction and protecting the coat of oxide. When the said method is employed it is furthermore unnecessary to subsequently treat the finished coils with oxidizing agents. A simple manner of employing the said method consists in the wires of aluminum or an aluminum alloy being continuously drawn through the preferably

heated liquid capable of producing the desired oxidation, and immediately thereafter reaching the winding machine, where they are, without having been previously dried, 5 wound to a coil. Another mode of procedure consists in the wires being dipped in bundles or rings into the oxidizing liquid or painted, wetted or otherwise treated therewith, whereupon they are allowed to dry; 10 the thus oxidized wires or bands are then again wetted immediately before or while they are being wound to a coil. This second wetting may be carried out with water, but preferably again an oxidizing liquid, such 15 as a solution of caustic soda is employed. The coil is then dried whereby the oxidizing liquid still adhering to the wires will have a further oxidizing effect, so that such portions of the surface of the wire which 20 had been previously not fully oxidized, or from which the oxide coating had been removed by a mechanical injury, will be covered with a sufficiently strong oxide coating without any special treatment being necessary. 25

I claim:

1. Method of manufacturing electric coils from wires or bands of aluminum or aluminum alloys consisting in treating said 30 wires or bands with an oxidizing agent prior to winding the coil and subsequently treating with an oxidizing agent.
2. Method of manufacturing electric coils from wires or bands of aluminum or aluminum alloys consisting in treating said 35 wires or bands with an oxidizing agent prior to winding the coil and subsequently treating with water during the winding.
3. Method of manufacturing electric coils from wires or bands of aluminum or aluminum alloys consisting in treating said 40 wires or bands with an oxidizing agent prior to winding the coil and subsequently treating with an oxidizing agent, said second 45 oxidizing agent being adapted to remove that portion of the first oxidizing agent remaining upon the wires or bands.
4. Method of manufacturing electric coils

from wires or bands of aluminum or aluminum alloys consisting in treating said 50 wires or bands with an oxidizing agent prior to winding the coil and subsequently treating with an oxidizing agent, said second oxidizing agent being adapted to wash out any portions of the first oxidizing agent remaining upon the wires or bands. 55

5. Method of manufacturing electric coils from wires or bands of aluminum or aluminum alloys consisting in treating said 60 wires or bands with an oxidizing agent prior to winding the coil, and subsequently wetting each layer with an oxidizing agent during the winding operation.

6. Method of manufacturing electric coils of oxy-insulated wires or bands of aluminum 65 or aluminum alloys consisting in treating the conductor prior to winding with an oxidizing agent, and subsequently winding while the wires or bands are in a wet condition. 70

7. Method of manufacturing electric coils of oxy-insulated wires or bands of aluminum or aluminum alloys consisting in treating said 75 wires or bands with an oxidizing liquid and continuously drawing said treated wires or bands through a second preferably heated oxidizing liquid prior to winding into a coil.

8. Method of manufacturing electric coils of oxy-insulated wires or bands of aluminum or aluminum alloys consisting in treating 80 said wires or bands with an oxidizing liquid, drying, and subsequently wetting immediately before winding to a coil.

9. Method of manufacturing electric coils of oxy-insulated wires or bands of aluminum 85 or aluminum alloys consisting in treating said wires or bands with an oxidizing liquid, then drying and again wetting during the winding operation.

In testimony whereof I have hereunto set 90 my hand in presence of two subscribing witnesses.

Dr. ERNST WOLFGANG KÜTTNER.

Witnesses:

ANTON LEVY,
MARGARETHE SCHWARZ.