

UNITED STATES PATENT OFFICE

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PROTECTIVE COATING FOR METAL SURFACES

No Drawing.

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This invention relates to the art of coating metal surfaces and more particularly relates to the art of rendering said metal surfaces impervious to atmospheric corrosion when said coated metal surfaces are subjected to elevated temperatures. It is specifically directed toward providing a process to protect from oxidation stranded conducting lead wires of copper when they are heated at temperatures approximating 475° C. over prolonged periods of time during the exhaust process of the lamp or electron discharge device of which they are an incorporated part. This stranded copper cable is usually used in the lamp industry as the flexible portion of the metal component of the metal to glass seal of the lamp or power tube device.

In lamp and radio tube manufacture it is customary to place the completely assembled lamp or electron discharge device in an oven prior to sealing off and "bake" the device over a period of time sufficient to effect substantial drying and vaporizing of surface occluded gas, moisture, and heat decomposable or dissociable compounds. The entire baking process is done while the lamp or electron device is being subjected to the exhaust process. In the larger types of lamps or electron discharge devices this drying or baking process, during exhaust, extends over a long period of time, sometimes over a period of 18 to 20 hours.

In these larger types of lamps or electron discharge devices it is also necessary to employ as a lead-in conductor a stranded cable of copper wires, each wire of which has a diameter of approximately .005 inches. This is for the purpose of providing current carrying capacity and to provide flexibility as it is appreciated that were a solid conductor employed it would normally offer sufficient resistance to large currents to substantially heat up to near redness, and moreover would be characterized by great rigidity, both of which factors are undesirable.

During the baking process it is also necessary to effect substantial degasifying of the metal parts of the device by heating to redness. This is often done by passing a current

through the lead wires which often are substantially heated thereby to near redness.

It is found that during the baking process of these larger lamp or electron discharge devices at these elevated temperatures, the stranded copper lead-ins are subjected to corrosion and oxidation and are frequently sufficiently oxidized to substantially crumble up and become detached from the tungsten, molybdenum or nickel component of the lead-in which forms the metal portion of the metal to glass seal through the press of the device. This is especially prevalent when during this baking procedure a heating current is passed through the lead wires to assist in the baking and degasification of the internal metal parts of the device.

One of the objects of this invention is to provide a coating on the stranded copper lead wires which will be substantially impervious to atmospheric gases at the temperature of baking of these electrical devices so as to prevent oxidation and premature burn-out or disintegration of the lead wire during this high temperature baking process.

Another object of this invention is to provide a process whereby these metal leads may be coated with a substance which will substantially protect the stranded metal surfaces from oxidation and corrosion during this baking process.

Another object of this invention is to provide the metal surface with a coating impervious to atmospheric penetration at the temperature of baking and which may be subsequently removed easily and conveniently such as by solution in water or in a weak alkaline solution.

Another object of this invention is to provide a process of coating stranded metal wires with a coating impervious to atmospheric gases and which will have a melting point substantially above the temperature of baking and which may be subsequently easily removed.

Other objects will appear as the process is more fully disclosed.

Boron oxide or as commonly called boric anhydride, has been found to be the most suitable material for the coating of these

stranded copper lead wires. It has a melting point of 577° C. and may be heated to a much higher temperature without appreciable decomposition. At temperatures above 577° C. and approximating 750° C., the fused oxide becomes extremely fluid and tends to run thin but appears to be tenaciously retained as a thin surface coating upon a metal surface, when once placed thereupon. It also does not evidence appreciable shrinking on cooling and maintains an unbroken impervious coating at the required temperatures when once applied. At the temperature of baking the boric anhydride coating tends to soften and flow in a downward direction but a thin film is always retained to seal the surface. Moreover, the composition of the film is unaffected by atmospheric gases.

Other materials may be used to coat the surface of metal bodies to substantially increase the resistance to surface oxidation, such as any of the glasses or similar low melting vitreous materials, heat resistant enamels, and some types of metal coatings, none of which combined the particular advantages derived through the use of boric anhydride as a surfacing material, and this latter material is therefore preferred as a protective surfacing material.

The process I prefer to use in applying the boron oxide to the metal surface is to substantially overheat, to obtain great fluidity, the fused oxide to temperatures approximating 700° C. to 800° C. depending in part upon the size of the object to be coated and in part upon the nature of the coating desired. The metal object or stranded lead wire is then immersed in the fusion over the entire length and held there for a sufficient period of time to bring the object or stranded lead wire to approximately the same temperature as the bath, or at least to a temperature closely approximating the melting point of the boric oxide. This is to permit uniform distribution of the fused boric oxide over the entire surface area and an establishment of surface tension bonds thereon so as to promote effectual sealing from the atmospheric gases. If desired and to shorten the time interval of the process the metal may be preheated before immersing in the fused boric anhydride.

The object is then slowly withdrawn from the fused bath and the excess boron oxide allowed to drain back into the bath. The fusion of the boron oxide may be conducted in a cast iron pot.

If desired, a still thinner coating may be obtained by suspending the already coated articles in an oven heated to from 500° C. to 550° C. whereupon the excess boric anhydride softens and flows down and off of the article leaving, however, a thin, adherent film which is sufficient to effectually prevent oxidation of the metal surface during the sub-

sequent drying or baking process at temperatures below the fusion point of the boric anhydride.

Care must be taken that the coated article, after cooling, be protected from bending or from sharp blows at low or room temperature as the film is brittle although adherent and will be chipped or broken off from the metal surface. At elevated temperature, even below the true melting point, the material tends to become plastic like glasses and flows to fill up or heal cracks which may have been developed by previous rough handling.

The film of boric anhydride or the metal article may be removed from the metal surface when desired by soaking in water or in dilute caustic alkaline solutions in which it is soluble.

It will also be noted that the fused boric anhydride not only protects the surface from additional oxidation but substantially effects a cleaning action on the original metal surface by dissolving the adherent surface oxides. When the boric glass has been removed by solution in water the metal surface will be found to be bright and shiny.

Having specifically outlined and described the nature of my invention and the advantages to be gained from the practicing thereof, it is apparent that there are many substances which would substantially effect the same general result but as such are anticipated as being within the scope of this invention.

What is claimed is:

1. The method of protecting metal surfaces from corrosion by atmospheric gases which comprises coating the surface with a film of fused boron anhydride.

2. The process of applying an impervious adherent surface film of boric anhydride on a metal body comprising dipping said body in a fused bath of the oxide, holding therein until the temperature of the object is approximately at least the melting point of the boron oxide, removing said object from said bath and draining off the excess boron oxide by maintaining the metal object in a suspended position at a temperature sufficient to effect substantial flowing of the material in a downward direction.

3. The process of coating metal surfaces with an adherent impervious surface film of boric anhydride comprising heating said oxide to a temperature of maximum fluidity, dipping therein the metal object to be coated, withdrawing the coated object and removing the excess of the coating by suspending the coated object in a temperature zone sufficient to cause softening and flowing of the boric oxide from off the metal object.

4. The process of coating metal surfaces with an adherent impervious surface film of boric anhydride comprising heating said oxide to a temperature of maximum fluidity,

dipping therein the preheated metal object to be coated, withdrawing the coated object and removing the excess of the coating by suspending the coated object in a temperature zone sufficient to cause softening and flowing of the boric oxide from off the preheated metal object.

5 5. The process of coating metal objects with an impervious adherent protective film
10 to prevent surface corrosion which comprises preheating a metal object to a temperature approximating the fusion temperature of boric anhydride, dipping the heated metal
15 object in a fused bath of boric anhydride, removing said dipped metal object and draining off the excess of the adherent boron oxide by heating the metal object at a temperature sufficient to cause softening and flow of the boron oxide off from the metal object
20 while said object is in a suspended position.

6. An article of manufacture, a metal object surfaced with a non-oxidizing impervious heat resisting film of boric anhydride.

25 7. An article of manufacture, a metal object substantially resistant to surface oxidation at elevated temperatures characterized by being coated with a film of boric anhydride.

30 8. An article of manufacture substantially non-oxidizing heat resisting stranded metal objects characterized by being coated with an adherent impervious film of boric anhydride.

35 In testimony whereof, I have hereunto subscribed my name this 18th day of April, 1928.

CHARLES V. IREDELL.

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