UNITED STATES PATENT OFFICE.

GUY DUNSTAN BENGOUGH AND OSWALD FREEMAN HUDSON, OF LONDON, ENGLAND, ASSIGNORS TO THEMSELVES, TO THE IMPERIAL TRUST FOR THE ENCOURAGEMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND TO THE INSTITUTE OF METALS, BOTH OF WESTMINSTER, ENGLAND.

PROCESS FOR PROTECTING COPPER AND ITS ALLOYS FROM ATTACK BY ATMOSPHERES OR LIQUIDS.

1,319,508. Specification of Letters Patent. Patented Oct. 21, 1919.

No Drawing. Application filed February 15, 1918. Serial No. 217,418.

To all whom it may concern:

Be it known that we, GUY DUNSTAN BENGOUGH and OSWALD FREEMAN HUDSON, both subjects of the King of Great Britain, both residing in London, England, have jointly invented certain new and useful Improved Processes for Protecting Copper and Its Alloys from Attack by Atmospheres or Liquids, of which the following is a specification.

It is known that under favorable conditions copper or an alloy of copper exposed to the atmosphere becomes coated with a patina consisting mainly of oxid and basic carbonate of copper, which hinders the decay of the metal, and attempts have been made to produce this patina artificially.

By the present invention, copper or its alloys, more particularly copper-zinc alloys, may be protected from atmospheric influence or attack by water or saline solutions by heating the metal under such conditions that there is formed on its surface an adherent layer of oxid, which may be subsequently or immediately converted wholly or partially into an oxy-salt by natural or artificial agency. This oxy-salt varies in composition with the nature of the metal surface and the mode adopted in producing it, but it is mainly a mixture of a basic chlorid and a basic carbonate.

It is essential to the invention that the metal heated for oxidizing its surface should have that surface in smooth and finished condition, such as the surface of a drawn brass tube; it is furthermore essential that the layer of oxid formed on the surface should be of the maximum thickness which will adhere to the metal when the surface is deformed in use.

The invention is particularly useful for protecting copper or brass from the attack of sea water, for instance for avoiding the pitting and consequent destruction of condenser tubes for marine engines.

According to the invention, the sheet, tube or other fashioned article to be protected is heated in contact with an oxidizing fluid, such as in air or an oxidizing atmosphere or liquid until there is formed a layer of oxid which has no tendency to leave the surface in the form of flakes or otherwise.

When heating in air is the mode adopted the temperature should be within limits such that the lower limit insures sufficient oxidation while the upper avoids a degree of oxidation inimical to the proper adhesion of the layer. For instance, in the case of brass condenser tubes a temperature between 200° C. and 400° C. has so far been found suitable. In the foregoing statement "sufficient oxidation" is to be defined as the greatest degree of oxidation that can be obtained without impairing the adherence of the film of oxid. This is to be judged by the color of the film which will vary with different alloys, and is to be ascertained by experience. The condition of this oxid film may be improved by subjecting the tube to a final light drawing operation, or by forming the film before the ordinary last drawing operation.

When a liquid agent is to produce the requisite oxidation, this may be a solution of a well-known oxidizing agent, such as a solution of a permanganate. We have found that solutions of carbonates containing also dissolved air, such as a saturated solution of calcium bicarbonate in ordinary water, are also useful for producing the required oxidation.

The oxid on the surface may be allowed to become more or less converted into an oxy-salt by exposure to the atmosphere, saline solution or water in contact with which it is used, or it may be treated with an atmosphere or solution adapted directly to produce the oxy-salt; for example, the metal may be immersed in cold or heated brine. Heating the metal in a saline solution containing air or other suitable oxidizing agent may suffice to produce the layer of oxy-salt in a single operation.

When a copper-zinc alloy is under treatment it is advisable first to enrich the surface in copper by removing zinc from the surface; for instance, the surface may be heated sufficiently to volatilize zinc, or it may be treated with an acid or a solution of a copper salt to dissolve zinc, the equivalent of copper being deposited in the latter case, or a combination of these methods may be applied.

As an example of the invention, a brass

condenser tube (70 per cent. copper, 28 per cent. zinc and 2 per cent. lead) is examined for flaws before or after the last drawing operation. If free from these it is heated in a muffle to a uniform temperature of 250° C. for half-an-hour. It is then withdrawn and allowed to cool slowly. This (unless the tube is to be subjected to a final drawing operation) may complete the operation, since the conversion of the oxid into an oxy-salt, which is the truly protective layer, will follow in the use of the condenser tube. If, however, it is desired that the finished layer shall be produced forthwith the tube may be laid away in saturated brine at ordinary temperature for a week.

Tubes of brass containing a lower content of copper than 70 per cent. may be heated as described above and then placed in a vat containing a saturated solution of calcium bicarbonate. Steam is passed into the vat for three or four days, after which the tubes are withdrawn and dried at ordinary temperature.

Having thus fully described the nature of our invention and the best means we know of carrying the same into practical effect, we claim:—

1. A process of coating a smooth finished surface of copper or its alloys in order to prepare such surface upon further exposure with a protecting layer of an oxy-salt which process consists in heating the smooth finished surface in contact with an oxidizing fluid until there has been formed on the surface a layer of oxid of the maximum thickness which will adhere to the surface when deformed in use.

2. A process of coating a smooth finished surface of copper or its alloys in order to prepare such surface upon further exposure with a protecting layer of an oxy-salt which process consists in heating the smooth finished surface in contact with air until there has been formed on the surface a layer of oxid of the maximum thickness which will adhere to the surface when deformed in use.

3. A process of coating a smooth finished surface of copper or its alloys in order to prepare such surface upon further exposure with a protecting layer of an oxy-salt which process consists in heating the smooth finished surface in contact with air at a temperature between 200° C. and 400° C. until there has been formed on the surface a layer of oxid of the maximum thickness which will adhere to the surface when deformed in use.

4. A process for protecting copper or its alloys from attack by atmospheres or liquids which process consists in heating the object made of copper or alloy in contact with an oxidizing fluid until there has been formed on its surface an adherent layer of oxid and then exposing the object to a fluid adapted to convert the said oxid into an oxy-salt.

5. A process for protecting copper or its alloys from attack by atmospheres or liquids which process consists in heating the object made of copper or alloy in contact with air until there has been formed on its surface an adherent layer of oxid and then exposing the object to a fluid adapted to convert the said oxid into an oxy-salt.

6. A process for protecting brass condenser tubes from attack by atmospheres or liquids, which process consists in heating the tube in contact with air to a temperature between 200° C. and 400° C. until its surface has become covered with an adherent layer of oxid and then exposing the object to a fluid adapted to convert the said oxid into an oxy-salt.

7. A process for protecting brass condenser tubes from attack by atmospheres or liquids, which process consists in heating the tube in contact with air to a temperature between 200° C. and 400° C. until its surface has become covered with an adherent layer of oxid and then immersing the object in brine until the said oxid has been converted into an oxy-salt.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GUY DUNSTAN BENGOUGH.
OSWALD FREEMAN HUDSON.

Witnesses:
WALTER J. SKERTEN,
H. C. CARPENTER.