

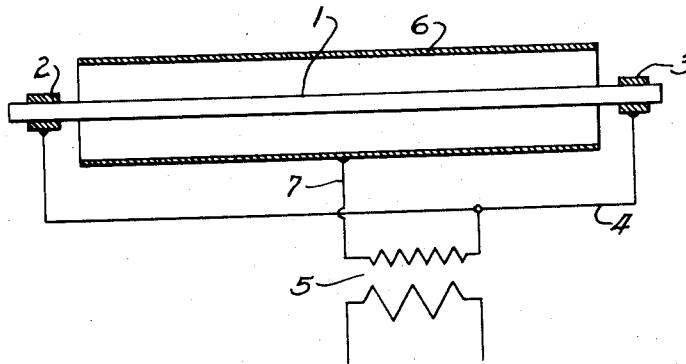
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METHOD OF TREATING METALS

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METHOD OF TREATING METALS

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4 Claims. (Cl. 148—10)

This invention relates to a method of treating metals, and more particularly to a method wherein a metal is subjected to the action of an electric current to harden the metal and improve its mechanical properties.

An object of the invention is to provide an improved method whereby metal may be hardened without heat treatment and without cold or hot working.

In general terms, the invention contemplates a process wherein the metal is made an electrode in a circuit which includes an arc or spark, a corona discharge, a cathode sputtering discharge, a high-frequency discharge, or any similar discharge from the metal through an insulating medium such as air, the process preferably carried out without substantially raising the temperature of the metal.

The invention will be more fully understood from the following description, taken in connection with the accompanying drawing in which the single figure illustrates an apparatus whereby the method may be performed.

It has been determined experimentally that when an electric current passes from a metal through an insulating material, as in the case of an electric arc or spark, a hardening effect is produced in the metal independently of the heating effects of the current. The present invention utilizes this hardening effect by making the metal to be hardened the electrode in a circuit which includes an arc or other discharge through an insulating medium such as air. The discharge may be the ordinary spark or arc in atmosphere, or it may be a corona discharge obtained by raising the potential of the electrode to the point where corona discharge occurs. The discharge may also take the form of cathode sputtering, in which case the metal to be hardened forms the cathode of the apparatus. Any other suitable arrangement may be used whereby the current is caused to pass from the electrode being treated through an insulating material.

Where a corona discharge is to be produced, the apparatus used may be similar to that shown in the drawing, wherein the reference numeral 1 designates a metallic member to be treated, the member being connected by means of contacts 2 and 3, and lead 4 to the secondary winding of a transformer 5. The metallic member 1 is surrounded by a tube 6, formed of brass or other suitable conducting material, which is connected by a lead 7 to the secondary winding of transformer 5. Upon the transformer being energized at a suitably high voltage, a corona discharge will pass between member 1 and tube 6, and this process may be continued, without substantially heating the member 1, until the desired degree of hardening has been produced.

Heretofore the only known methods of hard-

ening nonferrous metals have been by heat-treating, cold-working, and alloying with other ingredients. In practicing the present invention and using a piece of gold strip $\frac{1}{2}$ of an inch in thickness, the strip, without substantially raising its temperature or deforming it, was hardened on both sides from what is known as dead soft to 23 Rockwell ($\frac{1}{2}$ inch ball). In another test, gold was hardened from final hardness 18 Rockwell, produced by cold-rolling from $\frac{1}{4}$ inch to $\frac{1}{2}$ inch in thickness, to a hardness of 26 Rockwell.

An examination of microphotographs of specimens, treated according to the invention, disclosed a crystal change from an even crystalline arrangement to a diversified crystalline arrangement, indicating a hardening of the specimens similar to that obtained from cold-working.

The method as applied to arc or spark discharge and cathode sputtering is analogous to that just described, and since the apparatus for maintaining such discharge is well known, a detailed description thereof is considered unnecessary.

The method constituting this invention may be applied to any metal or alloy, but is particularly advantageous when applied to the hardening of copper, gold, and other non-ferrous metals which cannot otherwise be hardened except by cold or hot working or by introducing an alloy ingredient.

Various changes may be made in the form of apparatus employed as well as in the specific steps of the method without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. A process of hardening non-ferrous metal which comprises making the metal an electrode, and applying a high voltage thereto to produce a corona discharge.

2. A process of hardening non-ferrous metal which comprises making the metal an electrode in a cathode sputtering device, and applying a high voltage thereto.

3. A process of hardening a non-ferrous metal which comprises subjecting the metal to high voltage stresses and passing a current to the metal through an insulating medium.

4. A process of hardening non-ferrous metal which comprises making the metal an electrode, subjecting it to high alternating voltage stresses and passing a current to the metal through an insulating medium.

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