

# UNITED STATES PATENT OFFICE.

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## PROCESS FOR HARDENING TANTALUM.

No. 896,705.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, WERNER VON BOLTON, a subject of the Emperor of Russia, and residing in Charlottenburg, near Berlin, Germany, have invented a certain new and useful Process for Hardening Tantalum, of which the following is a specification.

My invention relates to the treatment of tantalum for various purposes, and is more especially concerned with a process for the hardening of tantalum.

Tantalum has been found useful for very many purposes, in some of which it should be very hard and resistant, while in other uses it must be comparatively soft and malleable.

The process I have discovered has for its object to give to tantalum the particular degree of hardness required by it in the use to which it is to be put.

I have ascertained that tantalum possesses, in many respects, properties which are similar to those of iron. For example, when iron has added to it a small proportion of carbon, we find that the iron becomes very much harder. In the same way, if one adds to tantalum a very slight proportion of carbon the tantalum also becomes very much harder. Tantalum bodies may be hardened in this way by heating them to glowing in the presence of carbon. I have also found that slight traces of silicon and boron have a similar effect upon tantalum. Further, traces of hydrogen and oxygen, which are probably present in the form of hydrides and oxides will produce this hardening effect in the same manner. Many metals, such as aluminum, tin and titanium are also applicable for this purpose.

The process forming the subject matter of the present invention consists then in adding to the tantalum slight traces of hardening agents, such as those mentioned above. I do not wish to restrict my process to any particular method of performing this mixture or addition. The mixture may be made in different proportions, varying from an extremely small proportion of the added substance, up to 1% or more of the same, ac-

ording to the degree of hardness required. In the case of carbon, for instance, the tantalum becomes very hard and resistant as soon as a very small fraction of 1% is added. If the proportion is greater than this, the tantalum soon becomes very brittle, so that it can no longer be used for most of its purposes.

By changing the quantity of the added material, the degree of hardness and also the degree of tensile strength of the metal may be altered within very wide bounds. If, for example, the tantalum is to be made into wire, especially into fine, drawn out wire, then the degree of hardness must be selected which will allow the metal to be drawn out in the usual manner without becoming broken or receiving fissures upon its outer surface. Adapting tantalum in this way to the manufacture of drawn out wire need not, however, be the only application given consideration here. If, on the other hand, it is to be used for the construction of tools for wood working, stone working, metal working or the like, or for the construction of bearings, wheels and the like for machines or clock works, etc., one must give the tantalum a very much higher degree of hardness and the malleability and tensile strength need not be given so much consideration. For this latter purpose, the proportion of the added material would be higher than it would be for the manufacture of drawn out wires and such uses.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The herein described process for hardening tantalum, which consists in adding carbon to tantalum.

2. The herein described process for hardening tantalum which consists in adding to tantalum a small percentage of carbon.

3. The process of hardening tantalum, which consists in heating tantalum to glowing in the presence of carbon.

WERNER VON BOLTON.

Witnesses:

HENRY HASPER,  
WOLDEMAR HAUPT.