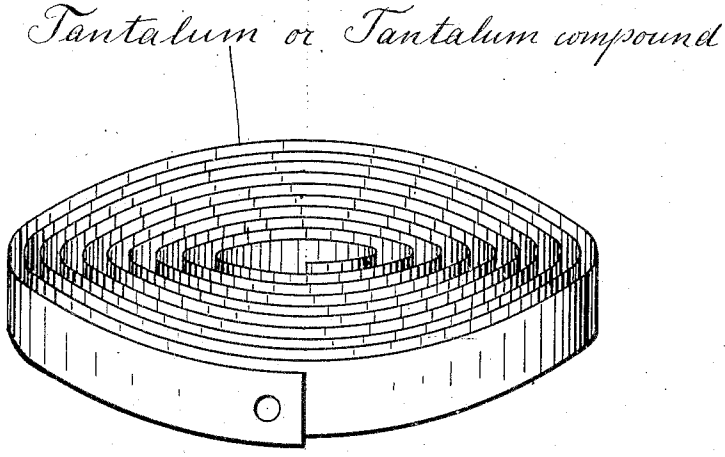
W. v. BOLTON.

SPRING FOR TIMEPIECES.

APPLICATION FILED FEB. 17, 1905.

946,993. Patented Jan. 18, 1910.



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UNITED STATES PATENT OFFICE.

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SPRING FOR TIMEPIECES.

946,993. Specification of Letters Patent. **Patented Jan. 18, 1910.**

Application filed February 17, 1905. Serial No. 246,189.

To all whom it may concern:

Be it known that I, WERNER VON BOLTON, a subject of the Czar of Russia, and resident of Charlottenburg, near Berlin, Germany, have invented certain new and useful Improvements in Springs for Timepieces, of which the following is a specification.

The present invention relates to an improved construction of springs and more particularly to springs which are employed in time pieces. Heretofore springs of this character have generally been made of steel, due to the fact that that material combines a great many advantageous properties, such as being capable of easy manufacture, considerable strength, resistance to wear and the like. There are, however, certain inherent objections to the use of steel in springs for time pieces. This material is not permanent under all conditions and being susceptible to magnetism, rust and wear, it often proves unsatisfactory. Prior to my invention, however, so far as I am aware, no efficient substitute for steel was suggested, and I therefore believe that I am the first to overcome these difficulties and to provide a spring for time pieces which is capable of answering the severe requirements which are demanded.

In accordance with my invention, the spring contains tantalum preferably combined with a hardening agent. In my application, Serial No. 278,023, filed June 8, 1907, I claim the construction of springs for time pieces composed of tantalum, and in my application Serial No. 278,024, filed June 8, 1907, I claim the construction of springs for time pieces containing tantalum and an element of the iron group. The elements of the iron group are hardening agents, and these come within the broader terms of the present application, which relates to the use of tantalum with hardening agents in general, while specifically the present application relates further to the use of tantalum with hardening agents whose atomic weights are less than thirty. This includes the employment of carbon, oxygen, hydrogen, silicon, boron and aluminum as the hardening agents.

Tantalum has been proposed for use in filaments, for electric lighting in which its high melting point is the chief property utilized. I have found, however, that tantalum possesses a great many properties which were not heretofore utilized, and which are of especial advantage in the springs of time pieces. It possesses, like steel, the property of being easily worked and hardened. It offers greater resistance to fracture than steel and it has great resiliency and elasticity. Its hardness can be increased to such a degree as to greatly exceeds that of the best steel, and it almost equals the diamond in its hardness. It has the further advantage over steel in being one of the precious metals which is not affected by the atmosphere and which at ordinary temperatures completely resists the action of most acids. A further important advantage which it possesses is that it is non-magnetic or substantially so. Being extremely hard, it has very great resistance to wear, and being resilient and elastic, while at the same time possessing great strength, it has the yielding property of steel with less liability to fracture; being non-magnetic and resistant to acids and to the atmosphere, it has a permanence which steel entirely lacks. Having a very high melting point, it is capable of use at temperatures beyond those at which steel would be of service.

In the accompanying drawing I have shown an example of my invention. Said drawing illustrates conventionally a clock spring composed of tantalum or a tantalum compound.

In order to work the metal satisfactorily, it must be previously well fused. This is preferably done by heating the metal in a vacuum by electrical means, such as electrical resistance or directly by passing an electric current through it. By the fusing process, the metal is freed from impurities, while at the same time it is rendered homogeneous. The metal which has been fused and thus rendered homogeneous can be readily worked mechanically in known manner. It can be hammered, rolled, drawn, filed and the like and thus brought into the desired form. When being mechanically worked, particularly if it contains a small quantity of carbon or other hardening medium, the metal readily assumes so great a degree of hardness that further working is rendered impossible, and it must then be carefully reheated or annealed in order to be rendered soft again. In this annealing process, care must be taken that the temperature does not rise too high as otherwise the

metal is more easily attacked by the oxygen of the atmosphere. Even in the form of the finest drawn wire or the thinnest rolled bands, however, the metal will stand a heating in the open air up to a dark red heat without being appreciably affected. When so heated, the metal shows a coloring similar to tempered steel. In order to prevent too great a heating, especially when working with fine parts of pure tantalum, it is preferable to effect the heating indirectly by bringing large plates or drums to the temperature to which the parts to be heated are required to be brought, and then to bring the objects of tantalum to be heated in contact with these plates or drums. If on the other hand, it is desired to raise the objects of tantalum to higher temperatures without their being materially affected on their surfaces, it is advantageous to effect the heating in a vacuum as at very high temperatures pure tantalum combines with almost all known substances.

For imparting great hardness to the tantalum, any of the hardening agents above mentioned or titanium and tin may be employed. Their employment may be in any of the ways well known to those skilled in this art, for example, the object of tantalum to be hardened may be embedded in carbon and then heated to redness. In the case of carbon, the tantalum becomes very hard and resistant as soon as a small per cent. is taken up. Also of the other named substances, only small quantities are required in order to produce great hardness. If the admixture of such hardening substances is increased materially beyond the small proportion, the tantalum generally becomes so brittle that no further working of the same is possible.

I claim:

1. As a new article of manufacture, a spring for time pieces, containing tantalum.

2. As a new article of manufacture, a spring for time pieces, containing tantalum and a hardening agent.

3. As a new article of manufacture, a spring for time pieces containing tantalum and a hardening agent whose atomic weight is less than 30.

4. As a new article of manufacture, a spring for time pieces composed of tantalum and a hardening agent.

5. As a new article of manufacture, a spring for time pieces composed of tantalum and a hardening agent whose atomic weight is less than 30.

6. As an article of manufacture, a spring for time pieces containing tantalum and carbon.

7. As an article of manufacture, a spring for time pieces composed of tantalum and carbon.

In witness whereof, I have hereunto subscribed my name this third day of February A. D., 1905.

WERNER V. BOLTON.

Witnesses:
WOLDEMAR HAUPT,
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