UNITED STATES PATENT OFFICE.

FRANK A. FAHRENWALD, OF CLEVELAND, OHIO, DEDICATED, BY MESNE ASSIGNMENTS, TO THE GOVERNMENT OF THE UNITED STATES OF AMERICA, AND TO THE PEOPLE OF THE UNITED STATES OF AMERICA.

COMPOSITE METAL ARTICLE.

1,228,194. Specification of Letters Patent. Patented May 29, 1917.

Application filed May 31, 1916. Serial No. 100,996.

(DEDICATED TO THE PUBLIC.)

To all whom it may concern:

Be it known that I, FRANK A. FAHRENWALD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Composite Metal Articles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This application is made under the act of March 3, 1883, chapter 143 (22 Stat. 625), and the invention herein described and claimed may be used by the Government of the United States, or any of its officers or employees in the prosecution of work for the Government or by any person in the United States without the payment of any royalty thereon.

The invention comprises a metal body consisting of tungsten or molybdenum or an alloy thereof and a layer of precious metal intimately united therewith, which is useful for various purposes of the art, as, for example, in dentistry, as dental pins or the like.

Tungsten, particularly in its malleable and ductile form as described in the Letters Patent of William D. Coolidge, No. 1,082,933 dated December 30, 1913, and tungsten-molybdenum alloys as described in my application filed June 3, 1916, Serial No. 101,502, possess many physical and chemical characteristics which adapt them preëminently for certain uses in the arts, chief among these being their practical insolubility, their extremely high melting point, their extraordinary stiffness and tensile strength and their high specific gravity. However their liability to oxidation at high temperatures (say anywhere above 600° C.) and the hitherto impossibility of soldering, welding, or otherwise joining two articles made of any of these metals, have seriously interfered with their use. However I have discovered that if a piece of ductile and malleable tungsten, molybdenum, or an alloy thereof, be covered with an adherent layer of some non-oxidizable metal such as gold or containing a large proportion of gold, both of the above objections are overcome and the material is adapted for uses to which it is otherwise denied.

Pure gold, alone, forms a suitably adherent coating when applied to the tungsten under suitable non-oxidizing and cleansing conditions, as under the surface of a suitable flux or in an inert or reducing atmosphere, and this coating will serve in ordinary cases. By adding small amounts of palladium to the coating its melting point is raised and at the same time a better bond between the tungsten and this protective layer is obtained. Silver alone has practically no affinity for tungsten, and in addition its presence appears to have a deleterious influence upon the tungsten in that it seems to accelerate crystallization. Palladium, also, when used pure or in preponderance seems to have the same effect as regards crystallization, although it adheres very tenaciously to the tungsten and even alloys therewith. Platinum, and certain other metals such as iridium, adhere very tenaciously to the tungsten, but their use is attended with considerable difficulty because of their high melting point which greatly endangers the crystalline nature of the tungsten. However, when alloyed with other less refractory metals their melting point may be lowered sufficiently so as not to injure the metal structure during the length of time necessary for the coating operation. Gold alone, or gold alloyed with five to ten per cent. of palladium, if applied to the tungsten article at a temperature of not more than about 1,350° C., and within a time interval of not more than from 10 to 30 seconds, has no appreciable effect upon the crystalline character of the tungsten and effects a very perfect coating. For a flux I prefer an oxygen salt of one of the alkali metals, such as the carbonate or borate of sodium, which in combination with the oxid of tungsten or molybdenum will afford a tungstate or molybdate of the alkali metal. I do not in this patent claim the process of applying this coating since this is covered in my copending application filed of even date herewith Serial No. 100,997.

In the accompanying drawing I have illustrated a dental pin made in accordance

with my invention, the article being shown partly in section. 1 represents a rod or wire of tungsten, molybdenum, or an alloy thereof together, or an alloy thereof with some other substance. 2 represents the coating which is preferably of an alloy of gold and palladium in the proportion of 90 to 95% of gold with 10 to 5% of palladium. However this coating metal may be pure gold within the purview of my invention, or it may be an alloy of gold with platinum, iridium, silver, copper, etc.; or, instead of gold, other noble metals may be employed depending upon the work to be done or the expense to be incurred. It will be understood that this coating is not restricted to wire alone but may be applied to other forms and articles.

Inasmuch as the properties of tungsten and molybdenum are very similar, the above specification relates to one as much as to the other, and also to alloys thereof as described and claimed in my copending application of even date herewith Ser. No. 101,502, and I desire my specification and claims read with this in view.

Having thus described my invention, what I claim is:—

1. A composite metal article comprising one or more metals of the tungsten group and a coating of pure gold metallically united to or wetting the same.

2. A metal article consisting of a ductile metallic substance consisting of one or more metals of the tungsten group and an adherent layer of an incorrodible alloy consisting largely of gold.

3. A composite metal article comprising a body part consisting of one or more metals of the tungsten group and a coating comprising an alloy of gold and palladium metallically united to or wetting the same.

4. A composite metal article consisting of a ductile, mechanically strong and resilient metal retaining said properties at a temperature of at least about 1,000° C., and a coating of incorrodible alloy adhering to the surface of said metal and consisting largely or wholly of gold.

In testimony whereof, I hereunto affix my signature.

FRANK A. FAHRENWALD.