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FACE PLATE FOR ELECTRICAL CONTACT

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This invention relates to an improved contact suitable for X-ray targets, radio targets, ignition contacts, spark plug points and contacts in general which, as a result of making and breaking a circuit, are subjected to an arcing effect. It relates to a contact of high melting material which is toughened, strengthened and made resistant to pitting and oxidation, and which has a great density and compactness and may be securely mounted in a metal backing.

Contacts heretofore used for the above mentioned purposes have usually employed a face plate of wrought or malleable tungsten, or of a platinum-iridium alloy. Contacts of pure, wrought tungsten, although they are refractory and have the advantage of a high melting point, are difficult to unite to a metal backing of copper or equivalent metal and lack compactness, toughness and resistance to pitting. As a result, they are subject to internal heating effects, particularly at the junction of the face plate and the metal backing and accordingly, to a rapid disintegration.

An object of my invention is to provide a refractory contact or face plate which avoids these deficiencies and has a relatively greater compactness and resistance to disintegration than a face plate of pure wrought tungsten.

Other objects of the invention are to provide a material for contacts which has the desirable refractory qualities but which may be readily and economically formed into the desired shape and securely joined to a suitable backing of a low melting point metal, and to provide a contact which may be more readily united in a uniform, intimate union with other metals.

With these and other objects, the invention comprises the contact and contact material described and set forth in the following specification and claims.

In producing my improved contact or face plate I employ an alloy composed of tungsten, vanadium and silicon. A small amount of thorium may also be added to the alloy. Although vanadium and silicon have lower melting points than tungsten, my alloy of tungsten, vanadium and silicon is harder, tougher and more compact than contacts or face plates of pure tungsten and are, therefore, more resistant to disintegration under the conditions to which such face plates are subjected. This alloy also has the advantage of being more easily worked and of providing a surface that may be superficially alloyed with materials for mounting on a metal backing.

I produce my alloy by first preparing a suitable tungsten base. This is done by starting with tungstic acid which has been purified so that it is chemically pure tungsten oxide containing not more than .25% mineral impurities. Two thousand grams of this tungstic acid are dissolved in a mixture of 2000 cc. of C. P. ammonium hydrate having a specific gravity of .900 and 5000 cc. of distilled water. After stirring for one-half hour, most of the WO_3 is dissolved and the ammonium tungstate solution is filtered. The filtrate should have but a slight tinge of yellow color and for convenience, this may be termed "solution A". Half of this ammonium tungstate solution is then placed in a porcelain evaporating dish and C. P. HCL is permitted to run into the same from fine constrictions with a constant stirring until the solution gets turbid and very fine crystals float around in the same, or reaches a point where the solution is almost neutral. This solution is then permitted to cool for at least ten hours and the crystals allowed to settle. After washing the crystals several times, they are filtered through a Buechner funnel and dried in a nickel pan in a furnace heated to about 300° C. to 400° C. long enough for most of the ammonia to be driven off. This may be called mixture "A".

The other half of solution "A" is heated to a temperature of about 70° to 80° C. and slowly introduced into a vessel containing a boiling mixture of about three parts nitric acid and four parts hydrochloric acid and four parts water. A current of steam is injected into this mixture while solution "A" is being introduced, and a precipitate of tungsten oxide is obtained which is finally removed and filtered and washed with hot distilled water and then dried out into the form

of a fine yellow powder of tungsten oxide. This may be called mixture "B".

Instead of using a solution of ammonium tungstate, in some cases I prefer to precipitate the tungsten oxide from the sodium tungstate solution.

Equal portions of the crystalline mixture "A" and the amorphous mixture "B" are weighed out and the two thoroughly mixed for at least two hours in a porcelain ball-mill. The mixture is then placed into a large porcelain evaporating dish and a solution of sodium vanadate added of such a strength as to introduce about .25% to 2.0% of vanadium into the tungsten oxide. Also a solution of potassium silicate is added of such a strength so as to introduce about .50% silicon into the oxides. I then add carbon, or a caramel solution of specific gravity 1.1 in such amounts as to contain a carbon equivalent sufficiently large to reduce the above vanadium and silicon. This mixture is then thoroughly slurried and mixed so as to make a thoroughly homogeneous mass after which the same is dried out in a silicate dish and thoroughly heated in a furnace, either gas or electric, for a period of about half an hour, at about 1000° C. In some cases I also introduce thorium nitrate of such an amount as to give one to two percent thorium content in the tungsten oxide. If I do this, the amount of caramel solution must be increased so that its carbon content will take care of the reduction of the amount of thorium nitrate introduced.

The dried mixture of tungsten oxides, carbon, vanadium oxide, silica and thoria is screened through an eighty-mesh sieve and is then ready for reduction. This mixture is then reduced in a convenient way in a gas or electric furnace by first heating the same in nickel boats at a temperature of about 600° to 650° C. for two to three hours, and then at a temperature of 900° to 950° C. for five to six hours in hydrogen. This will produce a metal of a dark gray color, having a weight of thirty to forty grams per cubic inch. The material may also be reduced in other ways, such for example as with carbon. I prefer, however, to use hydrogen bubbled through aqua ammonia. Instead of introducing the silicon and thorium into the oxide as a nitrate, I may also introduce the silicon and thorium in elementary form after the tungsten oxide has been reduced to tungsten metal. The resultant mixture of the above elements in fine powder form, after being sifted through a 200-mesh sieve and thoroughly mixed, is converted into adherent and coherent bodies by processes well known in the art, such as by pressing the mixture in a suitable mould on a hydraulic press, into the form of a slug, and then baking or sintering the body in hydrogen or in an inert atmosphere. After sintering these slugs at about 85% to 90% of their fusing current, they may be worked down into the form of rod or sheet, either by swaging or rolling. The mechanical process of rolling and swaging is carried out at a yellow heat at first, and at a red heat after the bars have been reduced to the smaller sizes. After the alloy has been formed into sheet or rod or any desired shape, face plates are punched from the same, or if round rod is produced, discs may be sliced off the rod by means of a carborundum or alundum cutting wheel revolving at high speeds.

One side of the face plate thus formed is then coated with a thin, uniform layer of copper-nickel alloy. This is accomplished by placing the face plate upon a suitable nichrome form or plate and then placing a thin sheet of copper-nickel alloy of the same form as the face plate and of about 0.003 to 0.004 in thickness, upon the face plate. The nichrome holders are then placed in an electric or gas furnace in a hydrogen atmosphere, and heated to a temperature of about 1250 to 1350° C. After the holders, together with the face plates, attain the above temperature, the thin discs soften and alloy with the particular composition of which the face plates are composed and uniformly spread over the surface, forming a thin layer. The face plates with the thin layer of copper-nickel alloy are then placed in a cooling chamber and permitted to cool.

Because of the particular composition that I have produced, the nickel alloy penetrates the face plates and spreads uniformly over the surface without drawing up into globules. The composition of the copper-nickel alloy is about 90% copper and 10% nickel.

The resultant product, consisting of a face plate of the above alloy which has been coated with copper-nickel as outlined above, may now be welded or joined to any base metal backing material by the well known brazing operations, using any suitable intermediate layer of brazing material, depending upon the particular composition of the backing.

As changes of operation could be made within the scope of my invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A face plate of a hard, compact alloy of tungsten, vanadium, silicon and thorium, said vanadium, silicon and thorium constituting but a small part of said alloy.

2. A face plate comprising a disc of hard, compact alloy of tungsten, vanadium and silicon, the tungsten comprising 90 per cent or more of the alloy.

3. A face plate comprising a disc of a hard, compact alloy of tungsten, vanadium and silicon, the tungsten content being 75 per cent or more of the alloy containing a greater proportion of vanadium than of silicon.

In testimony whereof I hereunto affix my signature.

CLEMENS A. LAISE.