

Jan. 31, 1939.

C. J. FUNK

2,145,651

COMPOSITE ARTICLE AND METHOD OF MAKING THE SAME

Original Filed March 11, 1935

Fig. 1.

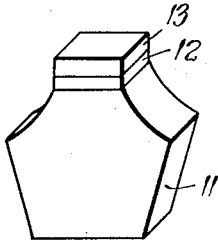


Fig. 2.

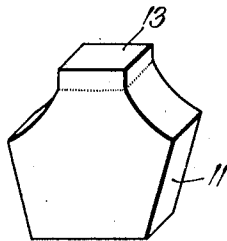


Fig. 3.

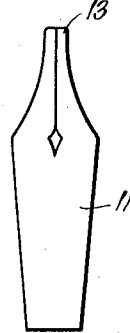


Fig. 4.

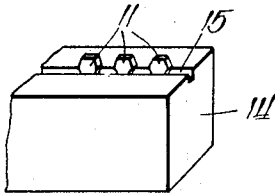


Fig. 6.

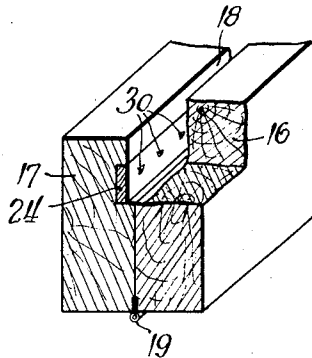


Fig. 5.

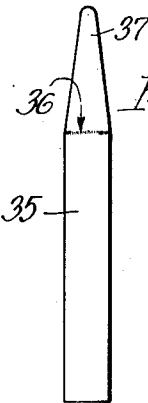
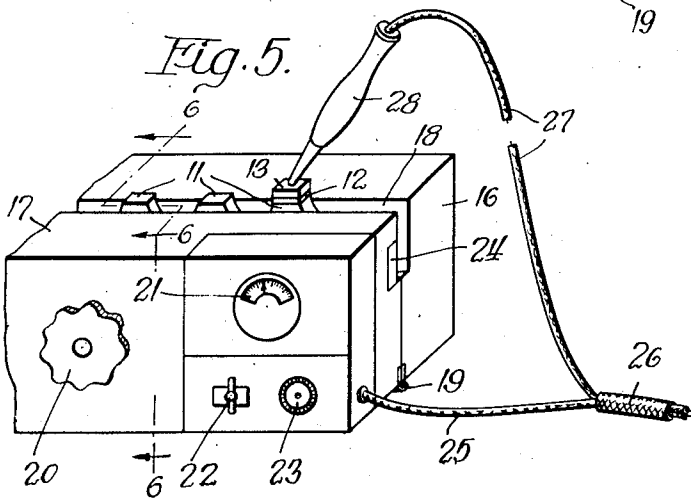


Fig. 7.

Inventor:
Charles J. Funk.
By John J. McLaughlin

UNITED STATES PATENT OFFICE

2,145,651

COMPOSITE ARTICLE AND METHOD OF
MAKING THE SAME

Charles J. Funk, Chicago, Ill., assignor, by mesne assignments, of one-half to Edward T. O'Brien, J. Glenn Shehee, and John J. McLaughlin, all of Chicago, Ill., and one-third to McLaughlin & Wallenstein, Chicago, Ill., a firm composed of John J. McLaughlin and Sidney Wallenstein

Application March 11, 1935, Serial No. 10,468
Renewed June 14, 1938

12 Claims. (Cl. 219—10)

This invention relates to composite articles and to a process of making the same, and is specifically concerned with articles such as pens, styli of various kinds, phonograph needles and the like.

In general, my invention may be successfully used in all such cases where heterogeneous metals are to be united to form physically homogeneous integral structures and the invention is particularly applicable for effecting the fusion of metals such as tantalum and iridium, or tantalum and stainless steel and the like. My novel process and the novel articles which I produce will be better understood if based on a brief review of the prior art, referring by way of example to articles such as writing pens and needles for sound reproducing devices or the like.

High grade pens are usually made of gold with a tip or point of iridium or similar substance. The disadvantages resulting from this structure are largely of a commercial and economic nature, although some objections might be raised against the use of gold on account of its softness. But the waste incurred by the use of gold and the cost of this material are the chief reasons for proposing substitutes. Nevertheless, gold is being used for high grade pens because it is least susceptible to the corrosive influences of the various inks, and because it offers the least difficulties in manufacture.

I propose to employ tantalum for the shank or body portion of a pen in order to eliminate the above intimated objections and to provide a tip or point of iridium or similar substance in order to furnish the required hardness where it is needed. Tantalum is insoluble in alkalis and acids with the exception of hydrofluoric acid and if used for a pen furnishes a non-corrosive body. It can be rolled to any point of resilience that may be desired in a pen. It is considerably cheaper than gold and furnishes all the desirable qualities of the latter. To provide high grade pens similar to the present iridium tipped gold pens which are in almost universal use, an iridium tip is provided on the tantalum shank or body.

Although it has previously been proposed to employ tantalum and tantalum-tungsten alloys for fountain pen nibs, as far as I am aware, tantalum pen nibs have never successfully been provided with an iridium tip, perhaps on account of the difficulties that arise when it is attempted to attach a point consisting of a substance like iridium to tantalum. However, I have discovered a practical and efficient way in which this problem can be solved cheaply and successfully without any undue difficulties.

The case of styli or needles for phonographs or the like offers problems which are in some respects similar to those mentioned previously. The stylus should be of a material and of a shape offering the least resistance to sound propagation and avoiding sound distortion, while the point or tip of the stylus should be of a substance capable of withstanding the wear to which it is subjected. The prior art suggests the use of materials ranging from wood or other fibrous substances to metals such as phosphor-bronze and others. It has also been suggested in the past to provide iridium tips or points and the like on the shank or body of such a stylus.

I propose to employ stainless steel for the shank portion of my novel stylus and to provide a head or tip portion of tantalum. This metal is unusually well adapted to furnish long-lived, high grade service, and stainless steel for the body portion furnishes all of the qualities that might be required and at the same time offers the advantages of utmost economy.

The process for joining tantalum and stainless steel as herein disclosed is, as far as I am aware, also new.

Some of the objects of my invention may be separately noted as follows:

One object resides in a process for joining tantalum and iridium.

Another object is concerned with a process for making articles, such as pen points, consisting of tantalum and iridium, and also covers the articles produced thereby.

A further object is realized by the novel process of uniting stainless steel and tantalum.

Still another object resides in producing styli of various kinds and particularly styli for sound producing devices which are composed of stainless steel and tantalum and also refers to the process of realizing this object.

Other objects and features not specifically mentioned above will appear from time to time throughout the following detailed description and the appended claims.

The invention will be described with reference to the accompanying drawing forming a part of this specification. In the drawing—

Figs. 1, 2 and 2 illustrate three distinct phases or steps in the process of realizing a certain embodiment of the invention;

Fig. 4 illustrates an intermediate step in this process and a tool for carrying out this step;

Fig. 5 illustrates another step in the process and a tool for carrying out this step;

Fig. 6 is a section along lines 6—6 of Fig. 5 and shows certain details; and

Fig. 7 is a diagrammatic illustration of another embodiment of my invention.

5 The process may be described in general terms with reference to Figs. 1, 2 and 3. Fig. 1 shows a blank 11 on an enlarged scale. This blank may be stamped or cut from tantalum. At certain stages during the process I place on the tip
10 of this tantalum blank a pellet 12 consisting of a noble metal such as gold, silver, platinum, etc., and another pellet 13 made of iridium. The intermediate layer of a noble metal is provided for facilitating the fusing of the iridium pellet
15 to the tip of the tantalum blank. The blank, as well as the intermediate metal and also the iridium tip are subjected prior to, during and after the assembly shown in Fig. 1 to a treatment which I shall describe later. The fusion
20 of the iridium tip 13 with the blank 11 is accomplished electrically in a manner which I also shall indicate in detail presently, and the result will be a structure which is diagrammatically indicated in Fig. 2. It will be seen from this figure
25 that the iridium pellet 13 is fused to the blank 11. The point of fusion (where the noble metal was disposed previously) is indicated by the dotted line. After the process has proceeded to a step maturing in the article shown in Fig. 2,
30 I subject this article to a rolling and shaping process so as to obtain the product shown in Fig. 3. The body or shank portion 11 of this product, which is assumed to be a pen, is firmly joined with the iridium tip 13 forming therewith an
35 integral and homogeneous structure. The finished pen after coming from the rolling process may be subjected to suitable tumbling and polishing operations. I desire to mention at this point that tantalum is very well adapted to be
40 integrally stained or colored according to one of many known metal coloring processes. Unusual and very pleasing color schemes may be devised. The article can also be colored in imitation of gold, if desired.

45 The various steps in my process which should be observed are pointed out below:

The iridium pellets are furnished according to a desired size and are then thoroughly washed with spirits of ammonia and with soap. The
50 pellets are subsequently washed with a concentrated solution of iodine and alcohol. They are now practically ready for fusion with the tantalum body. However, in order to prevent any contamination of the pellets they should preferably be left in the iodine-alcohol solution until
55 such a time when they can be attached to the tantalum bodies.

The tantalum bodies are stamped or suitably shaped into a preliminary or preparatory form, for instance as shown at 11 in the drawing. It
60 is understood, of course, that the size and shape of the ultimate article will determine the size and shape of the preliminary stamping 11. The tantalum bodies 11 are then boiled in hydrochloric acid in a suitable container. In actual
65 practice I carried out the boiling operation in a copper kettle and obtained good results. One of the functions of boiling the tantalum bodies in hydrochloric acid is to remove impurities from the surface of the tantalum.

70 The tantalum bodies are then placed with their tips in a rack such, for example, as illustrated diagrammatically in Fig. 4. The rack may consist of a member 14 having a slot 15.
75 This slot may be continuous throughout the body

14, or may consist of a series of notches or grooves of predetermined size, each just large enough to receive and to hold the tips of the corresponding blanks in the position as indicated in Fig. 4. The tips of the blanks are thus protected from any contamination. The bodies of these blanks, as shown in Fig. 4, are then dipped into a substance such as hot bees-wax in order to provide thereon an acid resisting and protective coat. The points will be left entirely free and clean. The acid resisting coat may be provided on the blanks in any other suitable and desired manner. This step in the process largely concludes the preparation of the tantalum bodies 11 with the exception of certain etching steps to be noted later. The subsequent treatment will now be described particularly with reference to Figs. 5 and 6.

These figures indicate part of a vise or rack consisting of the portions 16 and 17, which may be movably hinged at 19. When closed, as shown, these portions 16 and 17 form a longitudinal slot 18. At 20 is indicated a knob to which may be attached a suitable internally extending spindle for securing the portions 16 and 17 in closed position and for opening the vise if desired. I have shown a knob such as 20, but it is understood, of course, that other clamping means may be provided. Shown on this vise is also an instrument 21 which may be a voltmeter or an ammeter, and a switch 22, as well as a knob 23, which may be part of a rheostat for regulating the current supply. A cord 26 branches out into the leads 25 and 27. To the latter may be attached a suitable stylus 28 which represents one electrode of the device. The cord 26 may contain the conductors leading to a suitable plug for insertion into a wall socket of a commercial current supply source. It is understood, of course, that I have shown only a single indicating instrument 21 and described the same as being a voltmeter or ammeter for the purpose of convenient description. Several instruments of any desired character may be provided if desired. Secured inside of the grooved portion of the member 17 is a conductive strip 24 carrying a number of spikes or pin-like projections such as indicated in Fig. 6 by the numeral 30. These projections extend transversely slightly into the channel or slot 18.

Returning now again to that part of the description when reference was made to the waxing of the tantalum bodies 11, and examining Fig. 5, it will be seen that these tantalum bodies 11 are placed in the channel or groove 18 in a row right side up. When the device is closed by means of the knob 20 operating a suitable spindle as described, the spikes or pin-points 30 forming a part of the electrode 24 will penetrate the wax coat on each of the tantalum bodies 11 and will thus establish contact with the tantalum bodies. The electrode 24 is, of course, internally connected to the current supply governed by the switch 22. The intensity of the current may be regulated by means of a suitable rheostat operable from the knob 23, as previously mentioned.

The intermediate metal which is used for effecting the fusion of the iridium points 13 with the tantalum bodies 11 may be made of a suitable noble metal of which platinum, gold, and silver may be noted as examples. Other substances may be used if desired. The metal is cut or stamped in pellets approximately of a shape and size fitting the tip of the corresponding tantalum blanks which are to be joined with iridium
75

points. In Fig. 1 is indicated such an intermediate metal layer by the reference numeral 12. These metal layers or pellets should be thin and the exact size will be obviously determined by the size of the bodies to be fused, as well as by the current intensity employed for fusing.

I consider it important to avoid any contamination whatsoever of any part during any step of my process. Attention must therefore be paid not only to clean all parts, but to retain them in as clean a condition as possible until the fusion is established. The intermediate layer 12 of noble metal may be cleaned with aqua regia.

The tantalum blanks are placed in the tool illustrated in Fig. 5 with the clean tips exposed and ready for receiving the final treatment preceding the fusing. This final treatment consists in brushing hydrofluoric acid over the clean exposed tips of the tantalum bodies. The tips will thus be etched in order to facilitate the adhesion of the iridium point to be fused thereto. The intermediate layer of noble metal previously prepared in pellets of suitable size, as described, is now placed on the cleaned and etched exposed tips of the tantalum bodies 11. The previously prepared and treated iridium tips are then taken out of the concentrated iodine solution and are washed with carbon tetrachloride in order to clean them finally. They are placed in position on the intermediate layers. This condition is illustrated in Fig. 5 in connection with one of the tantalum members 11. It will be seen that on this particular member 11 contained in the channel 18 is placed the intermediate layer of a noble metal 12 and on the latter is placed the previously prepared and finally cleaned iridium pellet point 13. The various tantalum bodies secured in the device shown in Fig. 5 are assembled with their respective fusing metal pellets and are provided with their corresponding iridium points. They are then ready for the fusion or welding treatment. It should be recalled that each of the tantalum bodies in the device shown in Fig. 5 is in electrical contact with the internal electrode 24 due to the spikes or pin points projecting from the internal electrode and piercing through the protective wax layer to contact the metal of the bodies 11.

The current may now be turned on by means of the switch 22 and adjusted to the desired intensity by means of the knob 23 actuating a suitable rheostat. The welding stylus 28 is then operated to effect the electric fusion of the intermediate metal 12, which is accomplished by simply touching each assembly by means of the stylus point, as is indicated in the drawing, Fig. 5, in connection with the right hand assembly of a tantalum body 11, intermediate layer 12 and the corresponding iridium point 13.

The bodies thus treated and processed are removed from the device shown in Fig. 5 after the welding or fusing steps are completed. The individual bodies will then approximately correspond to the one indicated diagrammatically in Fig. 2. These bodies may now be subjected to rolling and pressing operations after which they may be formed into the final shape such as indicated in Fig. 3. Tumbling and polishing operations will complete the process and furnish the desired article which, in the assumed case, is a pen point. Coloring may be applied, if desired, as previously mentioned.

Substantially the same process as above described may be employed for the manufacture of styli, such as the one diagrammatically indi-

cated in Fig. 7. This particular stylus may be provided for a sound reproducing device and may consist of a body portion 35 made of stainless steel and a tip portion 37 which may consist of tantalum. Numeral 36 indicates an intermediate layer of noble metal such as gold, platinum, silver, etc. which is inserted at a step in the process of making the stylus in a manner similar to the one described in connection with producing the pen points illustrated in the remaining figures. The process of welding the tantalum point 37 to the stainless steel body 35 may also be similar to the one described. Cleaning operations and preliminary treatment of the stainless steel body, as well as the intermediate layer of noble metal and also the tantalum point 37, may likewise correspond in general outline to the previously described procedure.

The important steps in my process include the thorough cleaning of each individual part; precautions against any contamination of any part while carrying out the process; etching of certain parts prior to the joining of the same with others; and finally, the application of a suitable electric charge for accomplishing the fusion of the assembled metal members. The remaining steps which may be termed the finishing steps refer to the rolling, to the shaping, polishing and, if desired, the coloring of the article.

Individual steps and/or provisions in my above described process may be varied, if desired, or if required in any particular case. Materials may be substituted for the ones I have mentioned and apparatus and tools may be employed which differ structurally from the ones I have shown. With reference to the etching of the parts prior to fusing them into an integral unit, I wish to mention that I have noted a chemical etching operation but that the same may be also accompanied by mechanical means if desired. The essential meaning of the etching step is that the surface is suitably roughened or grooved so as to facilitate and insure the adhesion of the different parts upon fusing. I wish to have it distinctly understood that any and all such changes are comprehended in my invention as may be carried out within the spirit and scope of the following claims.

What we claim as new and desire to protect by Letters Patent of the United States is:

1. The process of joining a tantalum member and an iridium member to form a substantially integral body comprising thoroughly cleaning and etching the tantalum member, thoroughly cleaning the iridium member, arranging the thus treated tantalum and iridium members together with a cleaned body of a noble metal therebetween, and then fusing said members to form said integral, compact body.

2. The process of joining a tantalum member and an iridium member to form a structurally integral body comprising cleaning said iridium member, cleaning and etching said tantalum member, arranging said iridium and tantalum members together with a noble metal member therebetween, and electrically fusing said members.

3. The process of joining a tantalum member and an iridium member to form a structurally integral body, comprising the steps of cleaning said iridium member successively with spirits of ammonia, iodine and carbon tetrachloride, treating said tantalum member with hydrochloric acid, etching said tantalum member with hydrofluoric acid, arranging said iridium and tantalum mem-

bers together with a noble metal member therebetween, and electrically fusing said members.

4. In a process of joining tantalum and iridium members to form a structurally integral and compact structure, the steps comprising, subjecting said tantalum successively to the action of hydrochloric acid and hydrofluoric acid, placing on said member a noble metal, subjecting said iridium member successively to the action of spirits of ammonia, iodine and carbon tetrachloride and placing said iridium member on said noble metal, and then electrically fusing said members to form said integral compact body.

5. In the manufacture of pen points, the steps comprising, forming a blank of tantalum, cleaning and etching said blank, placing on said etched blank a layer of noble metal, forming a tip of iridium to be attached to said blank, cleaning said tip, placing said tip on said noble metal disposed on said etched blank, electrically fusing said blank, said noble metal and said tip to form a compact structure, and forming a pen from said structure.

6. A pen point comprising a cleaned and etched tantalum body portion, a binder comprising an intermediate layer of a cleaned noble metal, and a cleaned iridium point fused by said binder to said tantalum body portion and forming a substantially integral structure therewith.

7. The pen point set forth in claim 6 wherein the noble metal is gold.

8. A process of making pen points comprising

cleaning and etching a pen body or shank consisting substantially of tantalum, cleaning a noble metal member, cleaning a tip portion consisting substantially of iridium, placing the noble metal on the pen body or shank, placing the tip portion on the noble metal, and then fusing said metals to obtain an integral structure.

9. The process of claim 8 wherein the cleaning of the iridium is effected by successive treatments with ammonia, a solution of iodine and an organic solvent.

10. The process of claim 8 wherein the cleaning of the pen body or shank is effected by hydrochloric acid, the etching of the pen body or shank is effected with hydrofluoric acid, the cleaning of the iridium is effected by successive treatments with ammonia, a solution of iodine and an organic solvent, and the fusion is accomplished by electricity.

11. A compact integral body in the form of a stylus comprising a cleaned member consisting substantially of tantalum united to a member consisting substantially of iridium through an intermediate layer of a cleaned noble metal, the union being effected by fusion of the metals.

12. The process of making a pen point including the steps of joining a cleaned and etched tantalum body or shank to a cleaned iridium tip by disposing a layer of a cleaned noble metal therebetween and fusing the metals whereby a structurally integral pen body is formed.

CHARLES J. FUNK.