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Tyler et al.

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[54] **COMPOSITE METAL ARTICLE**

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[52] **U.S. Cl.** **29/196.3,** 29/199

[51] **Int. Cl.** **B32b 15/00**

[58] **Field of Search** 29/199, 196.3

[56] **References Cited**

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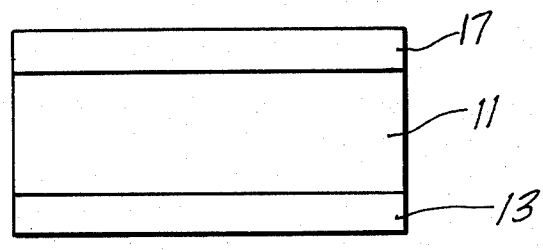
[57] **ABSTRACT**

The present disclosure teaches a composite metal article having a variety of uses, especially for the manufacture of jewelry. The composite of the present invention is a copper base alloy containing from 5 to 40 percent manganese bonded to nickel or a nickel base alloy or stainless steel. Additional layers may be bonded to this composite, such as a thin layer of a gold filled alloy or other decorative metal or alloy.

8 Claims, 3 Drawing Figures



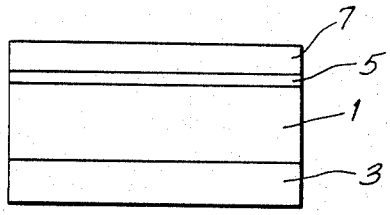


FIG-1

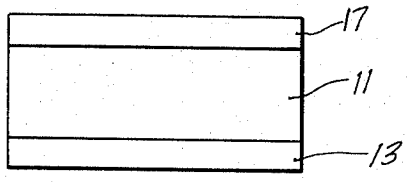


FIG-2

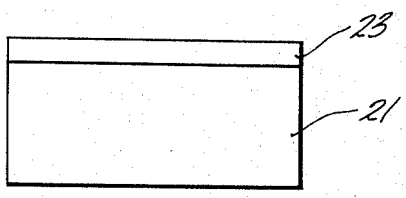


FIG-3

COMPOSITE METAL ARTICLE

BACKGROUND OF THE INVENTION

The present invention relates to the art of multicomponent composites particularly useful in the manufacture of jewelry.

It is highly desirable to develop relatively inexpensive composite materials which may be conveniently used in the manufacture of jewelry or ornamental articles, as well as for other uses. The copper base alloys are particularly desirable as a component thereof in view of their excellent physical properties. However, the copper base alloys are susceptible to tarnishing and often do not have suitable color characteristics for the desired use.

Accordingly, it is a particular object of the present invention to provide novel composite articles.

It is a further object of the present invention to provide composites as aforesaid which are particularly suitable for the manufacture of jewelry or ornamental articles.

It is a still further object of the present invention to provide relatively inexpensive composites which utilize a copper base alloy component which has an attractive white color and is relatively inexpensive.

It is a still further object of the present invention to provide novel composites as aforesaid which are readily compatible with a variety of other materials and which are suitable for a variety of uses.

SUMMARY OF THE INVENTION

In accordance with the present invention it has now been found that the foregoing objects and advantages are readily achieved. The composite of the present invention has a first component of a copper base alloy containing manganese in an amount from 5 to 40 percent balance essentially copper and a second component selected from the group consisting of nickel, nickel base alloys and stainless steel. The copper base alloy component may, if desired, contain a variety of other additives in order to achieve particular properties. Additional layers may be provided, if desired, in order to provide a still further improved composite. For example, one may utilize a thin layer of a decorative material, such as a gold filled alloy, bonded to either the copper component or the nickel or steel component.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a schematic drawing of a representative composite of the present invention;

FIG. 2 is a schematic drawing of an additional embodiment of the composite of the present invention; and

FIG. 3 is a schematic drawing of a still further embodiment of the composite of the present invention.

DETAILED DESCRIPTION

As indicated hereinabove, it is highly desirable to provide decorative and inexpensive composites which may be conveniently used in the manufacture of jewelry or ornamental articles.

The usual gold filled composite for the manufacture of jewelry preferably has a substantially pure nickel base and bonded thereto is a thin layer of decorative gold filled alloy. However, from time to time attempts have been made to provide a substitute for the nickel

base. This is due to the high cost of nickel and the fluctuating supply thereof. Stainless steel has been only partially successful as a replacement, for example, due to a frequent reaction between the stainless steel and the wearer of the jewelry. It has been suggested to use composites having a core of a nickel-silver alloy (a copper base alloy containing about 10 to 18 percent nickel and about 25 to 30 percent zinc). Composites of this type would have a thin nickel layer on one side and a gold filled alloy on the other side, with or without an intermediate layer of nickel. However, these alloys tend to be expensive and do not entirely serve the present needs.

In accordance with the present invention one may provide a highly decorative composite by simply utilizing as a first component a copper base alloy containing from 5 to 40 percent manganese and as a second component either nickel, a nickel alloy or a stainless steel. This composite may, if desired, be the finished article or preferably a thin layer of a decorative material, such as a gold filled alloy, may be bonded thereto either adjacent the copper layer or adjacent the nickel or steel layer. When the decorative material is bonded directly to the copper base alloy, a thin layer of substantially pure nickel may be interposed between the copper component and the decorative component. This interlayer beneficially influences the reflectivity and surface appearance of the finished article.

The first component of the composite of the present invention is a copper base alloy containing from 5 to 40 percent manganese. This material is particularly useful in the composite of the present invention in view of its highly desirable physical characteristics. This component, particularly as modified hereinafter, has a highly desirable white color which is particularly useful in decorative applications. Furthermore, it has a relatively low cost and is readily and conveniently processed.

Suitable alloying additions to the copper component include the following and mixtures thereof: nickel from 0.5 to 30 percent; zinc up to 35 percent and preferably from 20 to 35 percent; aluminum from 0.01 to 5 percent. Representative and typical alloys which may be readily used include the following:

Alloy 1
- manganese - 5 – 35 percent
- copper - essentially balance

Alloy 2
- manganese - 8 – 16 percent
- zinc - 21 – 34 percent
- copper - essentially balance

Alloy 3
- manganese - 5 – 30 percent
- nickel - 5 – 30 percent
- copper - essentially balance

Alloy 4
- manganese - 3 – 10 percent
- nickel - 0.5 – 10 percent
- zinc - 21 – 34 percent
- copper - essentially balance

Alloy 5
- manganese - 5 – 40 percent
- aluminum - 0.5 – 5 percent
- copper - essentially balance

Alloy 6
- manganese - 5 – 40 percent
- aluminum - 0.5 – 5 percent
- zinc - 0.5 – 10 percent

copper - essentially balance

Alloy 7

manganese - 5 – 35 percent

aluminum - 0.5 – 5 percent

nickel - 0.5 – 15 percent

copper - essentially balance

Naturally, in addition to the foregoing, it is contemplated that the copper base alloys used herein may contain small additions of other elements either as normal commercial impurities or as intentional additions in order to improve their fabrication or performance. Such other elements may be present in amounts as low as 0.01 percent, but may be intentionally added in amounts from 0.1 to 5 percent. Such additions may consist of one or more of the following elements: iron, cobalt, phosphorus, tin, zinc, titanium, zirconium, silicon, boron, magnesium, chromium, arsenic and antimony.

The copper base alloys which are utilized in the composite of the present invention are substantially less expensive than both pure nickel and the nickel-silver alloys. They are readily processed to thin gage by hot rolling and cold rolling, with or without intermediate or terminal anneals, and are exceedingly amenable to being incorporated into an article of jewelry or an ornamental material.

The second component of the composite of the present invention may be either a nickel base alloy, nickel or a stainless steel. The nickel or nickel base alloy may be high purity nickel, commercial purity nickel or a nickel alloy containing one or more additives as desired, such as aluminum from 1 to 8 percent. Other additives are naturally contemplated, for example, in amounts of at least 0.001 percent, generally less than 5 percent and preferably less than 1 percent, such as cobalt, iron, copper, manganese, silicon, carbon, sulfur and/or chromium. Naturally, impurities may also be present.

Any of the stainless steels may be used as the second component, for example, the austenitic stainless steels containing from 16 to 26 percent chromium and 3 to 22 percent nickel. Typical additional alloying constituents include but are not limited to the following: carbon, aluminum, manganese, titanium, silicon, phosphorus, sulfur, chromium, nickel, zirconium and/or zinc. Generally up to 5 percent may be used, preferably up to 2 percent and as low as 0.001 percent. Naturally, normal impurities may be present.

The components of the composite of the present invention may be readily bonded by any desired method. It is preferred in accordance with the present invention that the bonding take place at some intermediate gage in sheet form by rolling the components together. Naturally, heat and pressure may be used and the composite would then be rolled to the desired final gage. Alternatively, the nickel and gold layers could be deposited onto the copper component by electrolytic means. After fabrication the composite may, if necessary, be heat treated by normal procedures to render it in a condition suitable for subsequent forming, pressing, or coining operations in order to produce a desired article of jewelry or the like.

A preferred embodiment of the present invention utilizes a decorative material as a third component, as indicated hereinabove. Any decorative alloy may be utilized, for example, a gold rich alloy, a silver rich alloy, a platinum rich alloy, a palladium rich alloy, a rhodium rich alloy or a chromium rich alloy, or mixtures thereof. In fact, a plurality of layers of decorative materials may be readily used depending upon the particular finish desired.

When a gold rich material is utilized, either pure gold or preferably an alloy may be used. For example, a common material is an alloy containing gold, silver and copper for a rolled gold finish of about 10 karats, with a composition of 41.7 percent gold, 15–47 percent silver, balance essentially copper. Alternatively, a filled gold layer of typically 14 karats has a composition of 58.3 percent gold, 10–32 percent silver, balance essentially copper. The exact composition tends to depend on desired color. The high silver materials are white in color. The color goes through yellow to red with decreasing silver content.

The white gold alloys are commonly used as a substitute for platinum and are commonly gold-nickel-copper-zinc alloys. For example, a representative material of 10 karats has a composition of 41.7 percent gold, 32.8 percent copper, 17.1 percent nickel and 8.4 percent zinc. A representative material of 14 karats has a composition of 58.3 percent gold, 23.5 percent copper, 12.2 percent nickel and 6.0 percent zinc.

Naturally, additional elements may be utilized, generally in small amounts up to 1 percent, such as zirconium, iridium, rhodium, ruthenium, cobalt, iron and/or nickel. The gold material is normally rolled on, but may be electrolytically deposited.

Rhodium is generally utilized as the pure metal and is normally electroplated.

Palladium may be electroplated or rolled and may be used in pure form or as a palladium-ruthenium alloy containing up to 10 percent ruthenium and generally up to about 5 percent.

Platinum may be used in pure form, or in an alloy containing up to about 20 percent palladium, or in an alloy containing up to about 20 percent iridium, or in an alloy containing up to about 10 percent ruthenium. Generally binary alloys are used. The material may be either electroplated or rolled.

The silver is generally used in pure form or as sterling silver which contains 92.5 percent minimum silver, balance copper, and may be electroplated or rolled.

Chromium is generally utilized as the pure metal and is normally electroplated. The chromium is generally applied over nickel for better appearance.

The total thickness of the composite is naturally variable. In finished form applicable for use in jewelry or other decorative uses, the total thickness is preferably between 0.008 inch to 0.025 inch. For other uses, one may contemplate a wider range of thicknesses from 0.008 inch to 0.1 inch. Naturally, individual components may have a thickness as small as 0.0001 inch.

The drawings which form a part of the present specification show representative composites.

FIG. **1** illustrates one form of the invention, consisting, for example, of an alloy core **1** of a 12.5 percent manganese, 24.5 percent zinc, balance copper alloy. Bonded to one (the bottom) side of the core **1**, is a backing layer **3**, which may have a minimum thickness of about 0.001 inch. This backing layer may consist of substantially pure nickel, or a stainless steel alloy, typically 304 alloy. On the other side (the top) of the core **1**, is bonded a substantially pure nickel layer **5** which also may have a minimum thickness of about 0.001 inch. Bonded to the top of this nickel layer **5** is a layer

of gold 7, the thickness of which is preferably about 0.001 inch. The gold may be of any desired karat, such as, for example, an alloy consisting of 41.65 percent gold, 38.45 percent copper, 9.55 percent silver, 1.50 percent nickel and 9.95 percent zinc.

In the case of FIG. 2, the core 11 consists, for example, essentially of 7 percent manganese, 5 percent nickel, 29 percent zinc, balance copper. In this instance, the pure nickel interlayer is omitted. The outer layers 13 and 17, and their dimensions are substantially as layers 3 and 7 in the case of FIG. 1. Thus, layer 13 may be nickel of a nickel alloy or stainless steel and layer 17 may be a decorative material.

In the case of FIG. 3, the first component 21 may be any of the copper-manganese alloys described above, such as layer 1 in FIG. 1 or layer 11 in FIG. 2, and the second component 23 may be nickel or a nickel alloy or stainless steel, as in layer 3 in FIG. 1 or layer 13 in FIG. 2.

Naturally, the copper core material may consist of a plurality of the copper-manganese alloys described above. Similarly, the nickel or stainless layers and the gold filled layers may be combinations of materials.

The present invention will be more readily understood from a consideration of the following illustrative examples.

EXAMPLE I

A copper base alloy containing 12 percent manganese and 24.5 percent zinc was clad upon one side with nickel in the following manner.

A sample of annealed copper base alloy sheet, 0.200 inch gauge, and annealed nickel foil, 0.005 inch gauge, were sandwiched together and then rolled together in a single pass with a reduction of about 50 percent.

Subsequent cold rolling with an interanneal at 600°C was performed. In the resultant composite the copper base alloy layer was approximately 0.020 inch thick and the nickel layer approximately 0.0005 inch thick. A firm metallurgical bond was present between the two constituent layers. The composite so formed exhibited a highly polished and attractive bright white colored finish on both sides.

EXAMPLE II

A copper base alloy containing 30 percent manganese, 4 percent zinc, 1.2 percent iron and 0.5 percent aluminum alloy was clad on one side with nickel and gold fill and the other side with 304 stainless steel in the following manner.

A sample of the annealed copper base alloy at 0.200 inch gauge was sandwiched between annealed nickel foil of 0.005 inch gauge, and annealed 304 stainless steel foil of 0.005 inch gauge. This sandwich was reduced about 50 percent by rolling in one pass. The resultant composite was then annealed at 650°C for 30 minutes. Ten karat gold alloy foil of 0.0025 inch gauge was then placed adjacent to the nickel layer and the four component composite cold rolled to a final thickness of 0.010 inch. The resultant composite consisted of a copper-manganese alloy core with a stainless steel backing on one side. The other side had a nickel layer and an attractive gold fill upper layer.

This invention may be embodied in other forms or carried out in other ways without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered as in all respects illustrative and not restrictive, the scope of the invention being indicated by the appended claims, and all changes which come within the meaning and range of equivalency are intended to be embraced therein.

What is claimed is:

1. A composite article having a first component of a copper base alloy consisting essentially of manganese in an amount from 5 to 40 percent, balance copper and bonded thereto a second component selected from the group consisting of nickel, a nickel base alloy and stainless steel.

2. A composite according to claim 1 including a decorative layer as a third component bonded to said composite.

3. A composite according to claim 2 wherein said decorative layer is a gold alloy.

4. A composite according to claim 2 including as a fourth component an alloy consisting of nickel bonded to said first component, with the third component bonded to said fourth component.

5. A composite according to claim 1 wherein said first component contains a material selected from the group consisting of nickel from 0.5 to 30 percent, zinc from 20 to 35 percent, aluminum from 0.01 to 5 percent and mixtures thereof.

6. A composite according to claim 1 wherein said first component contains from 0.01 to 5 percent of a material selected from the group consisting of iron, cobalt, phosphorus, tin, zinc, titanium, zirconium, silicon, boron, magnesium, chromium, arsenic, antimony and mixtures thereof.

7. A composite according to claim 1 having a thickness of from 0.008 inch to 0.1 inch.

8. A composite according to claim 2 having a thickness of from 0.008 inch to 0.025 inch.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,778,238 Dated December 11, 1973

Inventor(s) Derek E. Tyler et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading, after "Inventors: Derek E. Tyler, 53 Elmwood Dr., Cheshire; Stanley Shapiro, 1860 Boulevard, New Haven, both of Conn." insert ---Assignee: Olin Corporation, New Haven, Conn.---.

Signed and sealed this 7th day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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