Jan. 26, 1943. D. K. CRAMPTON ET AL 2,309,099

BRANCH FITTING

Filed July 31, 1940

Fig. 1.

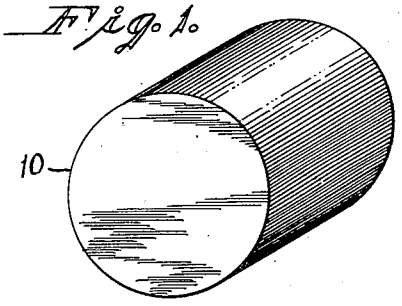


Fig. 4.

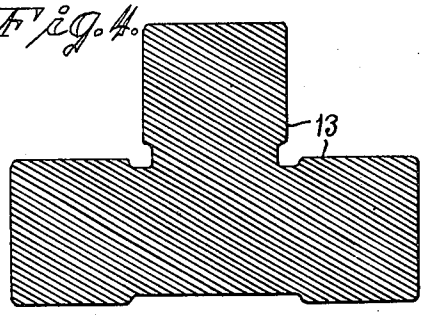


Fig. 2.

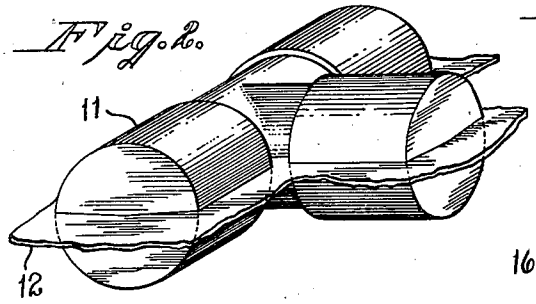


Fig. 5.

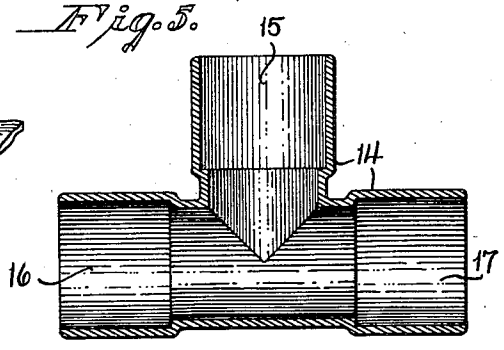


Fig. 3.

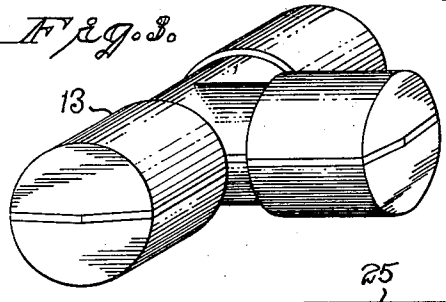


Fig. 6.

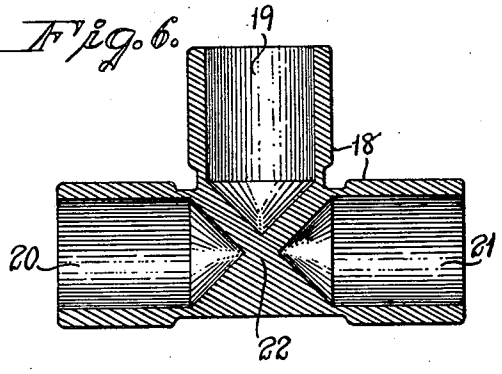
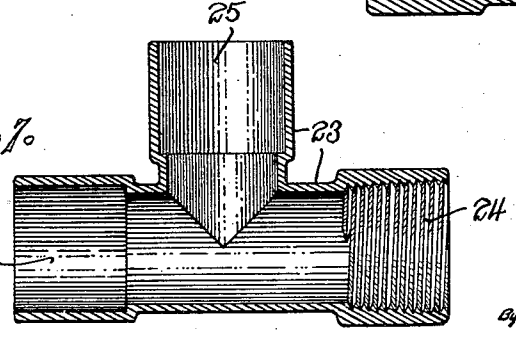


Fig. 7.



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UNITED STATES PATENT OFFICE

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BRANCH FITTING

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Application July 31, 1940, Serial No. 349,019

3 Claims. (Cl. 285—210)

This invention relates to improvements in sweat-solderable high-copper branch-fittings.

It is desirable to make sweat-solderable branch-fittings by a hot-forging process, as such procedure lends itself to bringing a simple slug of the metal to nearly the size and proportions of the finished article in a single forging operation. Prior to our invention, however, this has never been accomplished practically, because of certain difficulties of the procedure or shortcomings of the finished article. For instance, if such a branch-fitting were to be furnished from the ordinary forging brass alloys which are so readily shaped hot, the finished article would be found vulnerable to corrosion by aqueous solutions and, therefore, not commercially feasible. Other copper-base alloys designed to overcome this low resistance to corrosion are usually relatively more difficult to forge, and, in addition, difficult to machine, and in the as-forged condition are so soft as to be highly subject to damage in ordinary handling and shipping. Inasmuch as it is absolutely essential that such fittings must have cylindrical recesses for receiving tubes to be sweat-joined thereto, with the fit between the recess and tube of high precision, any distortion of the sweat-fitting due to handling or shipping would be fatal to their proper use.

We have found that improved satisfactory branch-fittings can be made from certain alloys which are relatively resistant to aqueous corrosion, which can be readily hot forged to shape, which can be readily sweat-soldered, and which after forging, and either before or after machining, can be markedly hardened by a simple heat treatment or what is known as age-hardening treatment, and it is an object of this invention to produce such improved branch-fittings.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawing forming part of the present disclosure, in which certain ways of carrying out the invention are shown for illustrative purposes:

Fig. 1 is a perspective view illustrating a slug of metal which has been sheared or cut from a bar of special high-copper alloy made in accordance with this invention;

Fig. 2 is a perspective view of a forged branch-fitting blank made by forging the slug shown in Fig. 1 in a suitable pair of forging dies;

Fig. 3 is a perspective view of the blank shown in Fig. 2 after the flash has been trimmed therefrom;

Fig. 4 is a longitudinal central sectional view through the blank shown in Fig. 3;

Fig. 5 is a sectional view similar to Fig. 4 after the interior machining operations have been completed;

Fig. 6 is a central longitudinal sectional view similar to Fig. 4 through a modified form of blank in which hollow end-openings are pressed in the blank at the time of forging the same, for economy of metal and machining; and

Fig. 7 is a longitudinal central sectional view similar to Fig. 5, of a modified form of branch-fitting.

In the description and claims, the various parts and steps are identified by specific names for convenience, but they are intended to be as generic in their application as the prior art will permit.

We have discovered that in order to make satisfactory sweat-solderable high-copper branch-fittings in accordance with the present invention, that it is essential that an alloy be employed containing a suitable age-hardening constituent in amount sufficient to render the alloy sufficiently age-hardenable, and at least about 95% of copper, with or without reasonable additions of certain other elements as, for instance, aluminum, tin, zinc, iron, cadmium, silver, etc., and where machinability is desired in the alloy, a suitable amount of machinability-imparting material is used. Expressions such as "the balance or remainder substantially of copper," etc., are intended to include such one or more additional elements in such substantially innocuous amounts as do not seriously impair the essential or desired properties of alloy, that is, in such amounts as do not essentially change the nature of the alloy.

Many age-hardening materials are not suitable for use in the present alloys for various reasons. Some are too expensive to use, others produce alloys which are difficult to cast, others result in alloys too difficult to forge in the sizes and shapes necessary, others result in alloys which do not have sufficient age-hardening properties with simple heat treatments, and others result in alloys which are not readily sweat-joined with soft solders.

We have found that age-hardening constituent selected from one or more of the group of the age-hardening materials, nickel plus phosphorus, cobalt, and nickel plus silicon used in alloys in accordance with this invention, provides alloys well suited to the use under consideration. All

these alloys cast well, can be wrought into rod at low cost, can be forged readily at reasonable temperatures, can be considerably hardened after forging by simple aging heat treatments, can be readily sweat soldered by ordinary soft solders, and can be modified by the addition of suitable material such as teliurium or selenium to render them reasonably machinable or free-cutting.

Where nickel plus phosphorus is used as the age-hardening constituent, it is present in the alloy from about 0.4% to about 2.5% with the phosphorus from about ⅓ to about 1/10 of the nickel, and at least about 95% of copper is present. A more to be preferred percentage of the nickel-phosphorus age-hardening constituent is from about ½% to about 1½% with the phosphorus from about ⅓ to about 1/7 of the nickel, and at least about 96% of copper is present. And the most preferred percentage of the nickel-phosphorus age-hardening constituent is about 1¼% with the phosphorus about 1/5 of the nickel.

Where cobalt is used alone as the age-hardening constituent, it can be present from about 1% to about 3%. Where nickel plus silicon is used alone as the age-hardening constituent, the nickel can be present from about 1½% to about 4% and the silicon from about 0.4% to about 1%, with the silicon preferably about ¼ of the nickel.

Where material is added to the alloy to improve its machinability, material from the group consisting of tellurium and selenium from about 1/10% to about 1% is used. A more preferred range for the tellurium and/or selenium is from about 0.2% to about 0.6%. And a still more preferred amount of tellurium and/or selenium is about 0.5%.

The most preferred alloy has about 1¼% of nickel-phosphorus with the phosphorus about 1/5 of the nickel, tellurium about 0.5%, and the balance substantially of copper.

When an alloy in accordance with the present invention is to be made into branch-fittings, it is preferably wrought into the form of a bar from which slugs **10**, such as shown in Fig. 1, are sheared or otherwise cut from the bar. Such a slug **10** is heated and forged between a pair of forging dies to produce a blank **11** as shown in Fig. 2, having a flash **12** as shown. When this flash **12** is sheared off, the complete blank **13** is produced as shown in Fig. 3. In order to convert the blank **13** shown in Figs. 3 and 4, into the finished branch-fitting or T **14** shown in longitudinal central section in Fig. 5, it is necessary to perform certain interior machining operations on the blank **13**. And the machining operations should produce well-formed cylindrical sweat-solderable tube-receiving sockets **15**, **16** and **17**, inasmuch as it is highly important that the surfaces of the tube-receiving sockets shall be both cylindrical and smooth so as to be true and free from burrs to thus permit of making a close fit with small tolerances, for insertion of copper tubes or the like into the sockets **15**, **16** and **17**, so that they can be joined thereto by sweat-soldering.

Fig. 6 shows a sectional view similar to Fig. 4, of a modified form of forged blank **18** which is exteriorly the same in form as the blank **13** of Figs. 3 and 4, the interior of the blank **18** being formed with pressed-in sockets **19**, **20** and **21** at the time the blank **18** is forged, by means of suitable plungers, the solid interior **22** of the blank being afterward bored to provide passages, and the cylindrical surfaces of the sockets **19**, **20** and **21** being machine finished to form a T similar to that shown in Fig. 5.

Fig. 7 illustrates a sectional view similar to Fig. 5, of a modified form of branch-fitting **23** having an interiorly-threaded pipe-receiving socket **24**, and two smooth cylindrical sweat-solderable tube-receiving sockets **25** and **26**.

Branch-fittings made of alloys in accordance with the present invention, are characterized by satisfactory age-hardenability, sweat-solderability, good forging quality, high corrosion resistance to water, and, where machinability-imparting material has been added to improve the machinability thereof, by good machinability.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

We claim:

1. An age-hardened sweat-solderable high-copper branch-fitting hot-forged from an alloy and having good corrosion resistance and consisting substantially of: nickel plus phosphorus age-hardening material from about 0.4% to about 2.5% with the phosphorus from about ⅓ to about 1/10 of the nickel in amount sufficient to render the alloy age-hardenable; material from the group consisting of selenium and tellurium from about 1/10% to about 1% in amount sufficient to render the alloy freely machinable; and copper at least about 95%.

2. An age-hardened sweat-solderable high-copper branch-fitting hot-forged from an alloy and having a good corrosion resistance and consisting substantially of: nickel plus phosphorus age-hardening material from about ½% to about 1½% with the phosphorus from about ⅓ to about 1/7 of the nickel in amount sufficient to render the alloy age-hardenable; material from the group consisting of selenium and tellurium from about 0.2% to about 0.6% in amount sufficient to render the alloy freely machinable; and copper at least about 96%.

3. An age-hardened sweat-solderable high-copper branch-fitting hot-forged from an alloy and having good corrosion resistance and consisting substantially of: nickel plus phosphorus age-hardening material about 1¼% with the phosphorus about 1/5 of the nickel in amount sufficient to render the alloy age-hardenable; tellurium about 0.5%; and the balance substantially of copper.

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