

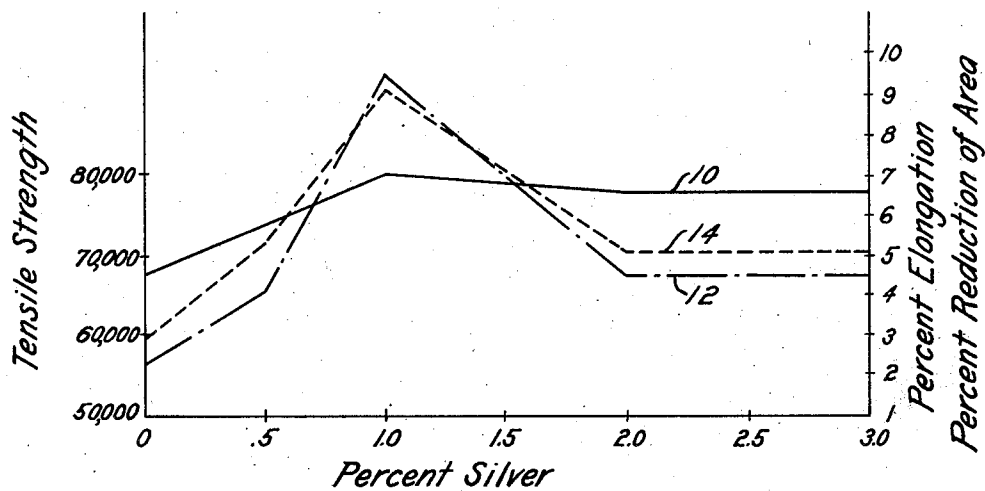
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BRAZING ALLOYS

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WITNESSES:

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BRAZING ALLOYS

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This invention relates to alloys and in particular to copper base brazing alloys.

An object of this invention is to produce a copper base brazing alloy having high strength and good ductility.

Other objects of this invention will become apparent from the following description when taken in conjunction with the accompanying drawing, the single figure of which is a graph the curves of which illustrate the effect of changes in the alloying content on the tensile strength, elongation and reduction of area of the alloy of this invention.

The alloy of this invention consists of 0.25% to 2.5% silver, 1% to 3% tin, 6% to 7.5% phosphorus and the balance copper with not more than .5% incidental impurities. The alloys within this range have low melting ranges and good ductility combined with excellent flow, wetting and self-fluxing characteristics. The alloys containing from .5% to 2% silver, 1% to 3% tin, 6.5% to 7.5% phosphorus and the balance copper with not more than .5% incidental impurities and falling within the foregoing broad range are preferred as having excellent strength and ductility, together with an exceptionally low melting range of from 650° to 790° C.

The copper base brazing alloy containing 2% tin and 6.5% phosphorus with the silver content ranging between .5% and 1.5% has unusual characteristics as is illustrated by reference to the following table:

Table I

Ag.	Tensile strength, p. s. i.	Elongation in 1 1/4 inches	Reduction of area
0	67,497	2.3	2.9
.50	73,596	4.1	5.3
1.00	80,004	9.5	9.1
2.00	77,600	4.5	5.1

In the foregoing table the silver and copper contents are the only variables, the tin and phosphorus contents being held constant with the alloy containing not over .5% incidental impurities. The data given in the table is the average of a number of tests conducted for each of the alloys containing the silver content as given in the table.

Examining the data given in the table and referring to the curves of the accompanying drawing, it is evident that the maximum characteristics of the alloy within the range given is ob-

tained where the silver content is about 1% and the tin content about 2%. In the drawing, curve 10 is illustrative of the tensile strength, curve 12 is illustrative of the elongation, and curve 14 is illustrative of the reduction in area obtained and recorded in the foregoing table. As clearly illustrated in the drawing the addition of more than 2% silver does not have any beneficial effect on the alloy. However, silver contents of up to 2.5% do not have any detrimental effect upon the resulting alloy and are contemplated within the scope of this invention.

By utilizing both tin and silver within the ranges given, a copper base brazing alloy containing phosphorus is produced which has unusual properties. The tin content of the alloy has the effect of lowering the melting point and improving the ductility. However, 1% is given as the lower limit of the tin content, as the effect of tin on the ductility is negligible if less than 1% tin is utilized. The tin has the effect of increasing the ductility if up to 3% of tin is employed, but beyond 3% tin the brittleness of the alloy increases to a detrimental degree. The silver content further lowers the melting range, improving the ductility and facilitating the manufacture of the alloy by decreasing the hot shortness of the alloy. The effect of the silver content on the physical characteristics of the resulting alloy is apparent from the foregoing table and the accompanying drawing.

The phosphorus content of the alloy of this invention has a definite effect on the ductility of the resulting alloy in that the lower the phosphorus content the more ductile the resulting alloy. Referring to the following table, the effect of the phosphorus on the ductility and tensile strength of the alloy is readily apparent, the results recorded therein being obtained with copper base brazing alloys having a 1% silver and a 2% tin content with the phosphorus varying as indicated in the table:

Table II

P	Tensile strength, p. s. i.	Elongation in 1 1/4 inches	Reduction of area	Melting Range, °C.
6.0	78,550	10.4	11.1	650-867
6.5	80,269	9.5	9.1	680-790
7.0	80,250	6.1	7.65	680-744

By lowering the phosphorus content of the alloy, improved ductility is obtained. However the melting range of the alloys having the lower

phosphorus content is wider. Thus, while it is contemplated to include alloys having a phosphorus content as low as 6% as given in the broad range hereinbefore referred to, it is preferred that the lower limit of the phosphorus content be not less than 6.5%, as with such a lower limit a melting range within the limits of 680° to 790° C. is obtained.

In practice, it is found that alloys of this invention can be readily duplicated. Further, the alloys can be extruded where desired and have such good ductility that if they are in rod or wire form such rod or wire can be bent to any desired shape for preplacing of the brazing alloy on assemblies which are to be furnace-brazed. The resulting joints are exceptionally strong and ductile.

As stated hereinbefore, the alloy of this invention may contain up to .5% of incidental impurities without detrimental effect on the resulting alloy. In practice, it is found that these impurities may comprise cadmium, zinc, antimony, bismuth, nickel, iron, arsenic, lead and tellerium which are sometimes present in the alloying ingredients. In the claims where the term "balance copper" is employed, it is intended that this

term include as a maximum not more than .5% of such incidental impurities as are referred to hereinbefore and which may be present in the resulting alloy without changing the desirable characteristics of the alloy referred to hereinbefore.

While this invention has been described with reference to a particular embodiment thereof, it is, of course, not to be limited thereto except in so far as is necessitated by the scope of the appended claims.

I claim as my invention:

1. A brazing alloy consisting of, 0.5% to 2% silver, 1% to 3% tin, 6.5% to 7.5% phosphorus, and the balance copper.
2. A brazing alloy consisting of, about 1% silver, about 2% tin, from 6.5% to 7% phosphorus, and the balance copper.
3. A brazing alloy consisting of, about 1% silver, about 2% tin, about 6.75% phosphorus, and the balance copper.
4. A brazing alloy consisting of, about 1.5% silver, about 2% tin, about 6.75% phosphorus, and the balance copper.

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