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HIGH STRENGTH BRASS

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6 Claims. (Cl. 75—155)

The invention relates to high strength brass containing, as essential constituents, copper, zinc, manganese, and aluminum. This application is, in part, a continuation of my application Serial Number 702,035, filed December 12, 1933.

The high strength brasses heretofore known usually contain in addition to copper, about 33% to 46% zinc, and substantial amounts of aluminum, manganese, iron and tin. Some also contain nickel, and still others, lead. A typical composition contains 38% zinc, 1.5% aluminum, 2% manganese, 1.5% iron, 1% nickel, remainder copper. Such an alloy, when suitably wrought and heat treated, will have a yield point of about 45,000 pounds per square inch, a tensile strength of about 95,000 pounds per square inch, an elongation (ratio of gage length to diameter being 4) of about 25%, and a Brinell hardness (500 kg. load) of about 160. It has been claimed that some high strength brasses attain a tensile strength as great as 110,000 pounds per square inch; but such great strength is rare.

It is an object of the invention to provide a high strength brass having a tensile strength above 100,000, and preferably above 110,000 pounds per square inch; a yield point above 55,000, and preferably above 80,000 pounds per square inch; an elongation under tension (standard test specimen having ratio of gage length to diameter of 4) of at least 5%, and preferably at least 10%; and a Brinell hardness (500 kg. load) of about 200 or higher. Another object of the invention is to provide a high strength brass which retains a relatively high strength at elevated temperatures up to about 450° C. A further object is to provide a high strength brass having a relatively great resistance to corrosion.

I have discovered that the above, and other, objects of the invention are attained in a brass having a composition within the following limits:

Table A

Percent metal	Broad range	Preferred range
Zinc	10 to 20	11 to 18
Manganese	8 to 13	9 to 12
Aluminum	5 to 7.5	5.5 to 7
Copper	63 to 75	65 to 70

Preferably, no metals other than copper, zinc, manganese, and aluminum are present in significant amounts; but small amounts of other metals, for instance, not exceeding 2% nickel, 1% cobalt, 5% iron, or 0.5% each of chromium or vanadium, may be added without utterly destroying the desirable properties of the alloy.

My discovery has been verified by the making and testing of over one hundred alloy compositions within and outside the ranges of composition specified above in table A. Typical results of these tests on compositions within the said range are set forth in table B.

Table B

Analysis				Yield point thousands of lbs. per sq. in.	Ultimate strength thousands of lbs. per sq. in.	Percent elongation, $\frac{L}{d}=4$
Percent Zn	Percent Mn	Percent Al	Percent Cu			
17.0	8.0	6.0	69.0	77.9	101.4	5.3
16.6	8.9	6.8	67.7	81.4	115	12.0
16.0	9.9	6.9	67.2	85.1	108.6	8.6
12.2	12.1	7.3	68.4	81.4	114.5	6.7
11.1	12.1	7.0	69.8	85.2	120.3	12.0
15.7	11.8	5.5	67.0	94.2	110.4	8.0
18.5	11.5	5.7	64.3	94.2	121.3	5.3
17.6	11.9	5.8	64.7	87.3	114.5	10.0
17.5	12.2	5.3	65.0	74.2	110.4	7.3

As disclosed in my prior application Serial Number 702,035, especially useful compositions are those comprised within the limits of 15% to 20% zinc, 5% to 9% aluminum, 4.5% to 12% manganese, and the remainder copper; the copper being more than 65%; the sum of the aluminum and manganese percentages being between 13% and 18%; and the aluminum constituting at least one-third and not over one-half of said sum.

I claim:

1. High strength brass having in the as-rolled and annealed condition a tensile strength above 100,000 pounds per square inch and an elongation under tension of at least 5%, which brass has a composition within the limits: 10% to 20% zinc, 8% to 13% manganese, 5% to 7.5% aluminum, remainder substantially all copper, the copper content being 63% to 75% of the brass.

2. High strength brass having in the as-rolled and annealed condition a tensile strength above 100,000 pounds per square inch and an elongation under tension of at least 5%, which brass has a composition within the limits: 11% to 18% zinc, 9% to 12% manganese, 5.5% to 7% aluminum, remainder substantially all copper, the copper content being 65% to 70% of the brass.

3. High strength brass having approximately the composition: 11% zinc, 12% manganese, 7% aluminum, and 70% copper.

4. High strength brass having approximately the composition: 18.5% zinc, 11.5% manganese, 6% aluminum, and 64% copper.

5. A copper base alloy which has an elastic limit of at least about 55,000 pounds per square inch and a tensile strength of at least about 100,000 pounds per square inch, an elongation under tension of at least 5%, a metallographic structure substantially that of pure beta brass, and a composition within the limits: 15% to 20% zinc, 5% to 9% aluminum, 4.5% to 12% manganese, and the remainder copper; the sum of the aluminum and manganese percentages being between 13% and 18%; and the aluminum constituting at least one-third and not over one-half of said sum; and the copper amounting to more than 65% of the alloy.

6. A copper base alloy which has a tensile strength above 100,000 pounds per square inch, an elongation under tension of at least 5%, and a composition within the limits: 10% to 20% zinc, 5% to 9% aluminum, 4.5% to 13% manganese, and the remainder substantially all copper, the copper amounting to at least 63% of the brass.

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