

UNITED STATES PATENT OFFICE

2,489,529

METHOD OF HEAT TREATING A CAST
ALUMINUM-BRONZE ALLOYHoward L. Grange, Detroit, Mich., assignor to
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corporation of DelawareNo Drawing. Application March 3, 1948,
Serial No. 12,887

8 Claims. (Cl. 148—13.2)

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This invention has to do with the heat treatment of cast aluminum-bronze alloys of the class which contains, in addition to aluminum and copper, small percentages of iron and nickel. A typical aluminum-bronze alloy of this type is one composed substantially as follows: 12.4% aluminum, 3.5% iron, 3.5% nickel, and the balance copper.

The primary object of the present invention is to provide an improved method of heat treating a cast aluminum-bronze alloy of the type described herein to increase its hardness materially.

Other objects and advantages of the invention will become more apparent from the detailed description which follows:

I have found that conventional temperatures for solution and homogenization (about 1500°–1600° F.) are too low for an aluminum-bronze alloy of the type described herein to harden fully. For example, I have found that a cast aluminum-bronze alloy as above described, having a hardness as cast of 140 Brinell does not attain hardnesses greater than about 250 Brinell when heated and quenched according to the usual practice for aluminum-bronze alloys. I have discovered that by heating a cast aluminum-bronze alloy of the composition above described to a temperature appreciably higher than that normally employed for heat treating aluminum-bronzes, that is, heating to a temperature of about 1800° to 1825° F., and then rapidly quenching the heated alloy, that the hardness of the aluminum-bronze alloy is increased to a Brinell hardness of about 304 to 320. I have discovered also that the hardness may be further increased to as high as 400 Brinell by reheating the aluminum-bronze alloy, after the quench from 1800°–1825° F., to temperatures as high as 800° F. and then cooling to normal room temperature. Maximum hardness is obtained after reheating at 800° F. and then cooling. Reheating to temperatures higher than 800° F. and up to 1550° F. causes coalescence of the microstructural constituents with accompanying softening that can be controlled so as to obtain any desired hardness from 400 Brinell to as low as 200 Brinell.

The following heat treatments of a cast aluminum-bronze alloy composed of 12.4% aluminum, 3.5% iron, 3.5% nickel and the balance copper are typical.

Heat the alloy to 1800° F. for ½ hour; longer times are necessary as the size of the article exceeds ½" in thickness. Then quench by immersing in a rapid quenching bath to cool the alloy to normal room temperature. Water, brine, and a

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caustic soda solution are suitable quenching mediums. A hardness of Brinell 302 to 320 is obtained after quenching. Reheating after quenching, at temperatures ranging from room temperature up to 800° F. will increase the hardness progressively. Reheating to 800° F. for about one to two hours will, after cooling to room temperature, result in a maximum hardness of 400 Brinell. The time of reheating is not particularly critical. Reheating to temperatures from 800° F. to 1550° F. will result in hardnesses between 400 and 200 Brinell, the hardness becoming less and less within this range as the reheating temperature is increased from 800° F. up to 1550° F.

The Brinell numbers referred to in this specification are those obtained with 500 kg. load and a standard 10 mm. ball.

Various changes and modifications in the specific embodiments of the invention described herein may be made by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A method of heat treating a cast aluminum-bronze alloy composed substantially as follows: 12.4% aluminum, 3.5% iron, 3.5% nickel and the balance copper, which comprises heating said cast alloy to a temperature within the range of 1800° F.–1825° F., and thereafter rapidly cooling the same to substantially room temperature.

2. A method as in claim 1 which includes the further step of reheating the alloy after the rapid cooling, to a temperature ranging from room temperature up to about 1550° F.

3. A method as in claim 2 in which the reheating temperature is 800° F.

4. A method as in claim 1 in which the heated cast alloy is rapidly cooled by immersing the same in a quenching medium of the class consisting of water, brine and caustic soda solution.

5. A cast aluminum-bronze alloy composed substantially as follows: 12.4% aluminum, 3.5% iron, 3.5% nickel and the balance copper and heat treated according to the process of claim 1, said alloy having high hardness.

6. A cast aluminum-bronze alloy composed substantially as follows: 12.4% aluminum, 3.5% iron, 3.5% nickel and the balance copper and heat treated according to the process of claim 2, said alloy having high hardness.

7. A cast aluminum-bronze alloy composed substantially as follows: 12.4% aluminum, 3.5% iron, 3.5% nickel and the balance copper and heat treated according to the process of claim 3, said alloy having high hardness.

8. A cast aluminum-bronze alloy composed substantially as follows: 12.4% aluminum, 3.5% iron, 3.5% nickel and the balance copper and heat treated according to the process of claim 4, said alloy having high hardness.

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REFERENCES CITED

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