METHOD OF ADDING ALUMINUM TO ALUMINUM-CONTAINING ALLOYS.

No Drawing. Application filed June 16, 1925. Serial No. 37,433.

In the manufacture of aluminum-copper-nickel alloys it has been common practice to add aluminum to a molten copper-nickel alloy such, for example, as Monel metal. In such practice there have been certain difficulties, particularly as regards the malleability of the alloy while hot.

The object of my invention is to overcome this difficulty and also make the process easier for the operator in preparing and pouring the alloy.

I have discovered that if the aluminum to be added to the copper-nickel alloy is made into an alloy prior to its introduction into the copper-aluminum alloy the product is improved particularly in its hot forging and rolling properties. I have also found that the preliminary aluminum alloy made should not contain materially more than 85% of aluminum in order to give the best results, and should preferably contain from 60% to 70% of aluminum.

I believe that this improvement is due to the fact that when a substantially pure aluminum is added to a bath of copper-nickel alloy there is a rise in temperature probably due to the formation and possibly decomposition of certain compounds; and with the use of an aluminum alloy such as I have employed this rise in temperature is greatly reduced and may be practically done away with. However, I do not wish to be limited to this theory of action.

As an example of carrying out my invention, in making an aluminum-copper-nickel alloy containing aluminum up to 17% (about 2 to 7% preferred) copper from about 1 to 90% (preferably over 10%) and the remainder mainly nickel (the nickel being preferably over 40%), I have added to a bath of Monel metal an aluminum alloy containing 60 to 70% of aluminum, 25 to 30% of nickel and 15 to 10% of copper.

The composition of the preformed aluminum alloy may vary widely but the aluminum should run from 35% to not materially over 85%, and for the material desired in my tests the nickel should run from 45 to 10% and the copper from 20 to 5%.

I have also found that if magnesium is added to the preliminary aluminum alloy in amounts as low as 20%, no further addition of magnesium in the furnace or in the ladle is necessary in order to give complete deoxidation and good malleability. In my opinion, the aluminum in the added alloy under my invention itself acts as a deoxidizer; and as there is no material temperature rise in the bath when added there is probably no reoxidation resulting.

A large number of test runs made by adding an aluminum alloy of varying proportions to Monel metal has given excellent results in reducing difficulties in hot rolling and forging of the aluminum-copper-nickel alloy.

The alloy may be added in the furnace or in the ladle, but is preferably added in the furnace as this insures better distribution. I have also found that by adding this alloy of aluminum in connection with the use of a furnace lining of zirkite brick instead of silica brick the silicon in the final alloy is reduced so that any rolling difficulties which have occurred from the effect of silicon in the final alloy have been reduced to a considerable extent.

If the preliminary alloy contains 85% of aluminum there will be some temperature increase in the bath when it is added, although not sufficient to ruin the heat.

The use of my invention also enables the operator to make the addition more rapidly and also avoids the need of holding the metal before teeming in order to avoid pouring at too high a temperature.

The advantages of my invention will be obvious to those skilled in the art since hot working difficulties of the final alloy are greatly reduced or eliminated, less additional deoxidizer is required, and certain operating advantages are also given.

A small amount of magnesium may be added with advantage to the preliminary aluminum alloy as above recited, and the alloy may also contain calcium, zinc, tungsten or other deoxidizing elements. The other alloying ingredients of the preliminary aluminum alloy may, of course, vary in accordance with the final alloy desired.

I claim:

1. In the manufacture of aluminum-copper-nickel alloys, the step consisting of adding an aluminum alloy to a molten bath consisting mainly of copper and nickel.

2. In the manufacture of aluminum-copper-nickel alloys, the step consisting of adding to a molten bath consisting mainly of copper and nickel an alloy containing not materially over 85% of aluminum.
3. In the manufacture of aluminum-copper-nickel alloys, the step consisting in adding to a molten bath consisting mainly of nickel and copper an aluminum alloy containing aluminum and at least one other constituent of the metal bath.

4. In the manufacture of aluminum-copper-nickel alloys, the step consisting in adding to a bath consisting mainly of molten nickel and copper an aluminum alloy containing aluminum and at least one other constituent of the bath and a deoxidizer.

5. In the manufacture of aluminum-copper-nickel alloys, the step consisting of adding to a molten bath consisting mainly of copper and nickel an alloy containing from 35 to 85% of aluminum.

6. In the manufacture of aluminum-copper-nickel alloys, the step consisting of adding to a molten bath consisting mainly of copper and nickel an alloy containing from 35 to 85% of aluminum, the remainder of said added alloy consisting mainly of copper and nickel.

7. In the manufacture of aluminum-copper-nickel alloys, the steps consisting of forming a molten bath consisting mainly of copper and nickel within a furnace having a lining containing no more than a small percentage of silicon, and adding to said bath an alloy containing aluminum.

8. In the manufacture of aluminum-copper-nickel alloys, the step consisting in adding to a molten bath consisting mainly of copper and nickel an alloy containing aluminum, nickel and copper.

In testimony whereof I have hereunto set my hand.

WILLIAM A. MUDGE.