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PROCESS OF MANUFACTURING AN ALUMINUM ALLOY

Ernest W. Westhoff, Detroit, Mich.

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8 Claims. (Cl. 75—1)

The invention relates to metals and it has particular relation to a metal alloy and a process for manufacturing it.

One object of the invention is to provide a method of producing an aluminum chromium alloy, which enables combining a substantial amount of chromium with the aluminum.

Another object of the invention is to provide a method of producing an aluminum chromium alloy which enables introduction of the chromium without raising the temperature of the aluminum undesirably above its melting point.

Another object of the invention is to provide a method of producing an alloy including aluminum, copper and chromium.

Another object of the invention is to provide an improved method of introducing one metal into another to produce an alloy.

Another object of the invention is to provide an improved aluminum and chromium alloy.

Other objects of the invention will become apparent from the following description relating to a particular application thereof, and from the claims hereinafter set forth.

The introduction of chromium into aluminum alloys is advantageous in that it increases the strength, hardness, resistance to corrosion and wear, and decreases the coefficient of thermal expansion of the alloy. These characteristics are retained at higher working temperatures and are important advantages particularly in the use of the alloy in pistons for internal combustion engines as the piston is subjected to fairly high temperatures, and such characteristics naturally are to be desired to increase the life and efficiency of the piston.

As an example of the alloy, it may comprise approximately

	Percent
Copper	9 to 12
Chromium	1½ to 3
Silicon	1
Magnesium	0.3
Iron	0.8 to 1
Remainder—aluminum	

It has been determined, however, that the process hereinafter to be described enables incorporating a much larger percentage of chromium into the aluminum, but the percentage above set forth probably would be satisfactory for most alloys, and particularly for pistons for the reasons previously mentioned. The magnesium and iron have additive value in increasing the hardness of the alloy, and it is to be understood that while it is preferred to use magnesium and iron, desirable alloys may be made without adding these metals.

In preparing the alloy, aluminum is reduced to its molten state by increasing its temperature to its melting point of 1217° F. and preferably the temperature will be further increased to approximately 1300° F. This temperature, while above the melting point, is not sufficient to appreciably harm the physical properties of the aluminum, whereas if the temperature is further increased the physical properties of the aluminum become more appreciably harmed and this in turn would more appreciably injure the alloy. While the temperature of 1300° F. is satisfactory, it may be varied, although it is not desired to increase the temperature of the aluminum to a point where its structure or physical properties would be injured undesirably.

The chromium and copper are added as follows. Copper is formed in strips and by well known electrolytic processes, chromium is electroplated on the copper. The size and thickness of the copper may be varied according to the proportion of chromium desired, as it is desirable to have a thin plating of chromium. Thin strips of copper .010 to .012 of an inch in thickness have been used with very satisfactory results.

After plating the copper with chromium, with the amount of copper and chromium predetermined, so as to add the proper amount of copper and chromium to the aluminum, the plated strips are introduced into the aluminum, and usually it is better to then agitate the molten mass. The copper and chromium become disintegrated and are absorbed in the molten aluminum and may uniformly be distributed by the agitating process.

Silicon is added in the form of a silicate, such as sodium silicate, and its addition may result in the formation of aluminum oxide, which may be skimmed from the top of the molten mass.

The silicon when added in the form of silicate tends to improve the physical properties of the alloy by refining its grain structure and micro structure, as it seems to settle in the grain boundaries of the metal and acts as a binding agent between grains. Silicon so added as a silicate increases the affinity of chromium for aluminum and is helpful in the process of disintegrating or absorbing the chromium.

Instead of first melting the aluminum and then adding the chromium, copper and silicate, the chromium plated copper and silicate may be placed in the melting pot along with the unmelt-

ed aluminum. If magnesium or iron are to be added, they may be added in any well known and conventional manner.

The resulting alloy is extremely hard and resistant to wear. Moreover, it is extremely strong. These properties render the alloy very suitable in cases where metal is subjected to wearing conditions and strength is required. The alloy also has a decreased thermal coefficient of expansion and this is especially desirable where the alloy is subjected to temperature changes and changes in size and dimensions must be maintained at a minimum. Particularly, the alloy is very desirable for pistons, as strength, hardness, wear and corrosion resistance and lower coefficient of heat expansion are important factors in the life and satisfactory operation of the piston, and it is important that these properties be retained at high working temperatures. This alloy used for pistons, has the advantages of both the well known iron and light metal pistons, while being substantially free of the disadvantages thereof.

Although only one form of the invention has been described, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the appended claims.

I claim:

1. The process of making an aluminum and chromium alloy, which comprises reducing the aluminum to a molten state, and adding chromium in the form of an electroplated deposit.

2. The process of making an alloy of aluminum, chromium and copper, which comprises reducing the aluminum to a molten state, and adding the chromium and copper in the form of a strip of copper upon which chromium is electroplated.

3. The process of making an alloy of aluminum, chromium and copper which comprises reducing the aluminum to a molten state, adding chromium is electroplated and maintaining the aluminum in a molten state and at a temperature in proximity to its melting point until the chromium and copper are absorbed.

4. The process of making an alloy of alumium, chromium and copper, which comprises reducing the aluminum to a molten state, adding chromium and copper in the form of copper electroplated with chromium, and agitating the molten mass until the copper and chromium are absorbed.

5. The process of making an alloy of alumium, chromium and copper, which comprises reducing the aluminum to a molten state, adding a small quantity of silicon in the form of a silicate to the aluminum, and adding chromium and copper in the form of copper electroplated with chromium.

6. The process of making an alloy comprising aluminum and chromium, which includes reducing the aluminum to a molten state and adding the cnromium in the form of chromium thinly electroplated upon the exterior of another metal plate.

7. The process of making an alloy comprising aluminum, chromium and silicon which comprises reducing the aluminum to a molten state, adding a small quantity of silicon in the form of silicate and adding chromium in the form of chromium electroplated on another metal while maintaining the temperature of the aluminum at a degree sufficient to reduce it to a molten state but insufficient to injure its physical properties.

8. The process of making an alloy of aluminum and chromium which comprises reducing the aluminum to a molten state and adding chromium in the form of a thin electroplated deposit to the molten aluminum while maintaining the temperature of the latter sufficiently low to prevent injury to its physical properties.

