UNITED STATES PATENT OFFICE.

HUGH S. COOPER, OF CLEVELAND, OHIO, ASSIGNOR TO THE COOPER COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ALUMINUM-CALCIUM ALLOY AND PROCESS OF MAKING THE SAME.

1,224,362. Specification of Letters Patent. Patented May 1, 1917.

No Drawing. Application filed September 29, 1916. Serial No. 122,932.

To all whom it may concern:

Be it known that I, HUGH S. COOPER, citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in an Aluminum-Calcium Alloy and Process of Making the Same, of which the following is a specification.

This invention relates to an alloying process and an alloy in which calcium is used, all as hereinafter shown and described and more particularly pointed out in the claims. The alloy consists of the metals calcium and aluminum with or without the addition of other metals, and where the proportion of calcium approximates ten per cent. the alloy is harder and more durable and easily machined than aluminum alone and also of less specific gravity, which makes this specific alloy particularly valuable in the metal industries, notably in the manufacture of light castings for automobile and air-ship uses, which castings should possess low specific gravity, good machining properties, freedom from brittleness, and capable of taking the finest impressions from the mold. Pure aluminum is tetratomic metal which is entirely too soft to produce satisfactory castings for most commercial uses; therefore it has been the practice to add a hardener such as copper, zinc, or tin. In using these hardeners the objections which are encountered are that, they greatly increase the specific gravity of the alloy, show a strong tendency to cause brittleness, and in most cases the alloys are less resistant to corrosion than the component metals. These objections are overcome in my alloy as the addition of calcium to aluminum produces an alloy which is from five to twenty per cent. lighter in weight than aluminum, much harder and more resistant to corrosion, and machines easily. The calcium also acts as a purifier and prevents the formation of oxid while the castings are being made, the alloy pouring in a silvery stream with great ease, and the most intricate castings take the finest impressions from the mold.

In the manufacture of light alloys calcium has heretofore been overlooked to a great extent probably because known methods are too expensive or difficult for alloying this dyad metallic element and because it is oxidized readily by the atmosphere, and also because it readily decomposes water, either hot or cold. However, I have discovered by repeated experiments and tests that calcium mixed with aluminum produces an alloy which is not affected by the air, and which does not decompose water, and that fifteen per cent. of calcium mixed with aluminum without the addition of another metal makes an alloy which is slightly brittle. Less than eight per cent. of calcium mixed with aluminum makes a strong durable alloy which is easier to machine than aluminum alone, but an alloy containing eight to ten per cent. of calcium and approximately ninety per cent. of aluminum is preferred as this proportion produces a ductile alloy of lower specific gravity than where a smaller amount of calcium is used. This alloy can also be remelted without taking any more precaution than in remelting aluminum, and compared with the commercial aluminum-copper and aluminum-zinc alloys, my alloy is about twenty-five to thirty-five per cent. lighter in weight but can be used wherever such alloys are used.

In view of the fact that calcium burns, even when heated to a low temperature, the alloy cannot be made by simple fusion of the mixed metals. Consequently, the steps practised by me in making these alloys is to melt the aluminum first and heat to about 800 C. The melted product is then removed from the fire and calcium in the form of small pieces pushed under the surface of the melted aluminum and held there until melted. Upon the introduction of each piece of calcium a slight reaction takes place with a rise in temperature of the melt, and when the proper amount has been added the alloy is stirred rapidly and immediately poured into molds. Care must be taken that the calcium does not float on the surface of the aluminum as in this case it would rapidly burn to the oxid without formation of alloys. After the melted aluminum has been removed from the fire, the introduction of each calcium piece produces a reaction which generates sufficient heat to keep the alloy in a melted condition until all the needed calcium has been added.

What I claim is:

1. A ductile alloy of relatively low specific gravity for casting uses, consisting of a preponderating amount of aluminum and eight per cent. or less of calcium mixed together in their elementary form and uniform in

structure and possessed of good machining properties without brittleness.

2. A ductile alloy of light weight for casting uses, consisting of aluminum and calcium mixed in metallic form in the proportion of approximately eight per cent. calcium and a preponderating amount of aluminum.

3. A ductile alloy of lighter weight than aluminum for casting uses, consisting of the metals calcium and aluminum mixed in elemental form in the proportion of substantially eight per cent. calcium and approximately ninety-two per cent. of aluminum.

Signed at Cleveland in the county of Cuyahoga, and State of Ohio.

HUGH S. COOPER.