UNITED STATES PATENT OFFICE.

MAURICE MESLANS, OF PARIS, FRANCE.

PROCESS OF PRODUCING AN ALLOY FOR USE IN STEEL-CASTING.

No. 875,668. Specification of Letters Patent. Patented Dec. 31, 1907.

Original application filed July 7, 1902, Serial No. 114,651. Divided and this application filed May 3, 1904. Serial No. 206,161.

To all whom it may concern:

Be it known that I, MAURICE MESLANS, a resident of Paris, France, and a citizen of the Republic of France, have invented an Improved Process of Producing an Alloy for Use in Steel-Casting, of which the following is a specification.

It is known that the bubbles which occur in greater or less quantity in the pieces of ingots of cast steel are due principally to the presence of three gases: oxid of carbon, hydrogen and nitrogen, which are dissolved in the mass, and which separate out at the moment of solidification of the metal. This drawback has been removed in a certain degree by the addition to the metallic bath at the moment of casting of a small quantity of aluminium. The action of this metal is to decompose the oxid of carbon, and it thus causes one of the three objectionable gases to disappear. But it has no action on the hydrogen and on the nitrogen, and further when the gaseous mixture evolved from steel cast with the addition of aluminium is analyzed, only a small percentage of oxid of carbon is found, while from 50 to 80 % of hydrogen and 15 to 45 % of nitrogen occur. Consequently in order to remove the hydrogen and nitrogen from the steel, it is necessary to employ some metal capable of forming with these gases stable compounds at a high temperature. The metals such as calcium, barium, strontium and lithium possess this property, but their use in the state of the pure metals is impossible in practice because of their high price and of the difficulty of obtaining them in sufficient quantities. I have discovered, however, that these very metals are capable of uniting with aluminium in proportions which may be varied as desired, in such a way that in an aluminium calcium alloy for example, the calcium adds its action to that of the aluminium to eliminate the dissolved gases, forming with the hydrogen and nitrogen fixed or stable hydrids and nitrids. The reaction will take place after the following formulas:

$$M + H_2 = MH_2.$$
$$3M + N_2 = M_3N_2.$$
$$M = Ca, Ba, Sr.$$
$$\text{For lithium } M = 2Li.$$

By the use of these compounds, I obtain a new, practical and efficacious process, by which it is possible to produce steel cleared from bubbles.

The addition of a small quantity of alloy to a bath of molten steel takes its effect at the moment of casting in the same manner as has previously been done when using aluminium. The proportion to be used naturally varies with the composition of the alloy in which the proportion of calcium may range between 5 and 95%. It varies also according as the steel is produced in a reverberatory furnace or by the Bessemer process. Further, in order to effect the thorough contact of the alloy with the bath of metal it is only necessary to follow the course of action employed hitherto with pure aluminium. It is hardly necessary to state that the example which I am about to give for the employment of the alloy of aluminium and calcium applies equally to the alloys of aluminium with the other metals which I have mentioned.

To manufacture alloy of aluminium and of calcium, I employ a metallic crucible having its sides covered with a refractory and insulating material. The bottom of the crucible is exposed. In the receiver a quantity of aluminium is fused and it should cover all the exposed bottom. Above the aluminium there is fused a layer of anhydrous chlorid of calcium; this layer constitutes the electrolyte. The bottom of the crucible serves as conductor for the current; it is connected with the negative pole of the source of electricity, and therefore, the aluminium, which is in contact with the bottom of the crucible, constitutes the cathode. The anode may be of one or several carbon rods which depend into the fused chlorid of calcium. The voltage employed may be from 7 to 10 volts with a density of current varying from 100 to 150 amperes per square decimeter of the anode surface.

The electrolysis is effected very easily, and the calcium liberated at the molten cathode combines directly with the aluminium. The proportion of calcium in the alloy may be regulated at will by continuing the electrolytic action for a greater or less time. It is quite easy to make the action continuous. Aluminium-calcium alloys are thus obtained according to the time occupied in the electrolysis, of anything up to 95% of calcium. When the alloy becomes very rich in calcium, it detaches itself in large pieces and comes up and floats upon the surface of the electrolyte from which it is removed. By the same electrolytic processes the alloys of barium,

strontium and lithium with aluminium can also be obtained.

A process is described in *Richards' Aluminum*, Phila. 1896, 3rd Ed. p. 498 and ff. by which an alloy having as high as 8.6% calcium is said to be obtainable. An alloy having a percentage of calcium higher than this has never been previously secured. By my process, as I have previously stated, the per cent. of calcium may be brought as high as 95%.

Although I have described the production of this alloy with direct reference to its use in steel casting I do not intend to limit myself in its uses, neither do I relinquish my rights to the invention herein described with reference to the casting of steel, which I have claimed in my application Serial No. 114,651, filed July 7, 1902, and of which this application is a division.

I claim as my invention:

1. The herein described process of preparing an alloy of aluminium and a metal which has the property of combining with hydrogen and nitrogen to form products which are stable at the temperature of fused steel, said process consisting in electrolytically treating a salt of said metal in the presence of a cathode of fused aluminium and subsequently removing the alloy formed.

2. The herein described process of preparing an alloy of aluminium and calcium, consisting in electrolytically treating fused chlorid of calcium in contact with a cathode of fused aluminium, and continuing the operation until the alloy formed rises to and floats upon the surface of the bath, from which it is then removed.

3. The herein described process of preparing an alloy of aluminium and calcium consisting in electrolytically treating a calcium salt in the presence of a cathode of fused aluminium and subsequently removing alloy formed.

4. As a new product, an alloy of aluminium and calcium containing more than 8.6 per cent. calcium.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

MAURICE MESLANS.

Witnesses:

ANTONIO MARSHEVILLE,

ALPHOUSE MEJEAU.