UNITED STATES PATENT OFFICE.

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PRODUCTION OF ALLOYS OF ALKALI-EARTH METALS, &c.

944,826. Specification of Letters Patent. Patented Dec. 28, 1909.

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To all whom it may concern:

Be it known that we, GEORGE O. SEWARD, a citizen of the United States, and FRANZ VON KÜGELGEN, a subject of the German Emperor, both residing at Holcombs Rock, in the county of Bedford and State of Virginia, have jointly invented certain new and useful Improvements in the Production of Alloys of Alkali-Earth Metals, &c., of which the following is a specification.

The alloying of metals of the alkali-earth group with metals of other groups is accomplished at present by melting together the metals it is desired to form into an alloy. This method possesses the disadvantage that metals like aluminum and magnesium burn when heated to the temperature at which the alkali-earth metals melt, and loss of material results.

The present invention provides for obtaining the desired alloy of an alkali-earth metal with another metal by simultaneously producing the constituent metals in the electrolysis of a mixture of a salt of the alkali-earth metal with a small proportion of a salt of the less electro-positive metal with which it is desired to alloy the alkali-earth metal.

The deposition of the less electro-positive metal in preference to the alkali-earth metal is prevented by keeping the proportion of the salt of the former to the salt of the latter low. The ions of the latter are, therefore, much more numerous than the ions of the former, and the alkali-earth metal is deposited along with the less electro-positive metal. The degree to which the alkali-earth metal is deposited depends entirely on the relative concentration of its ions, and by regulating this concentration and maintaining the proper current density at the cathode, alloys of varying proportions of the alkali-earth metal are obtained. The current density is kept so high that the alkali-earth metal is produced in a molten state.

As an example of the application of this invention, we will describe the production of zinc-calcium alloys. An electrolyte of fused calcium chlorid is used, with a carbon or graphite anode, and an iron cathode of such dimension relatively to the current employed that the calcium is obtained in a molten condition. A current density of about 60 amperes per square inch is suitable, although this may be varied considerably. Upon commencing the electrolysis, we introduce a small proportion (from one to five per cent.) of zinc chlorid, and add from time to time zinc chlorid as is necessary to keep the concentration of zinc in the electrolyte constant. Calcium chlorid is also fed to replace that decomposed, but the electrolyte is always kept so that the proportion between the zinc and the calcium salt remains constant or approximately so. The tendency of the current would be to separate first only zinc, but, as the proportion of the zinc ions to the calcium ions is very small, and as we keep the current density at the cathode high enough to decompose the calcium chlorid, both zinc and calcium are deposited, and we get an alloy of these two metals. By varying the concentration of the zinc in the electrolyte, we can vary at will the proportion of zinc in the resultant alloy.

In an analogous manner we produce alloys of calcium and aluminum, calcium and magnesium, barium and aluminum, barium and magnesium, etc.

These alkali-earth-metal alloys are much more easily obtained than the alkali-earth metals alone, for the reason that their melting points are lower, and also for the reason that there is not so much tendency for redissolution as with the alkali-earth metals alone.

By regulating the concentration of ions in an electrolyte of two or more fused salts, alloys of varying percentages of the various metals can be obtained.

Our invention is not necessarily limited to the production of alloys of alkali-earth metals with less electro-positive metals, since it may in certain cases be availed of for the production of alloys of other metals from their salts. In all such cases the salt which is the more readily decomposable is maintained of such low concentration that the metal of the other salt is separated jointly therewith. Its principal utility, however, is in the production of alloys of which at least one component is an alkali-earth metal.

What we claim is:—

1. The production of alloys of alkali-earth metals with less electro-positive metals by electrolyzing a mixture of their fused compounds in which the concentration of the less electro-positive metal is maintained so

low that the alkali-earth metal is separated jointly with the less electro-positive metal.

2. The production of alloys of calcium with less electro-positive metals by subjecting a fused mixture of a calcium salt with a small proportion of a salt of the metal it is desired to alloy with calcium to electrolysis, and maintaining the concentration of the less electro-positive metal so low that calcium is separated jointly with the less electro-positive metal.

3. The electrolytic production of alloys of alkali-earth metals with less electro-positive metals by electrolyzing a mixture of their fused salts while maintaining the concentration of the less electro-positive metal constant, and so low that the alkali-earth metal is separated jointly with the less electro-positive metal.

4. The production of an alloy of an alkali-earth metal with a less electro-positive metal by subjecting a fused mixture of the chlorid of such alkali-earth metal with a small proportion of a salt of such other metal to electrolysis, and maintaining the concentration of such other metal so low that the alkali-earth metal is separated jointly therewith.

5. The electrolytic production of alloys by electrolyzing a mixture of fused salts of the metals to be alloyed, the salt of the less electro-positive metal being maintained of such low concentration that the other metal is separated jointly therewith.

In witness whereof, we have hereunto signed our names in the presence of two subscribing witnesses.

GEORGE O. SEWARD.
FRANZ VON KÜGELGEN.

Witnesses:
F. V. BIDDER,
J. H. WEBB.