

UNITED STATES PATENT OFFICE.

WILLIAM R. VEAZEY, OF CLEVELAND, OHIO, ASSIGNOR TO THE DOW CHEMICAL COMPANY, OF MIDLAND, MICHIGAN, A CORPORATION OF MICHIGAN.

METHOD OF MAKING LIGHT METAL ALLOYS.

No Drawing.

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To all whom it may concern:

Be it known that I, WILLIAM R. VEAZEY, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Methods of Making Light Metal Alloys, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The present improved alloy relates to the class in which magnesium is the predominant metal, so that the term "light metal alloy" may be appropriately applied thereto. The alloying metal in the present case is beryllium, (or glucinum as it is also called) and the invention involves not only the product consisting of an admixture of the two metals in question in varying proportions, but also in the steps for making such alloy, all as hereinafter fully described and pointed out in the claims. The following description, it will be understood, thus sets forth but several of the various ways in which the invention may be carried out.

It is recognized that metallic beryllium is very difficult to obtain; accordingly I do not attempt to obtain such metal in isolated form for use in preparing my improved alloy, but rely on the reducing action of metallic magnesium on available compounds of beryllium. By proper proportioning of the amounts of magnesium and such beryllium compound, and by properly controlling the rate of reaction, the metallic beryllium as formed will go into solution in the magnesium, or vice versa, so that the beryllium does not require to be segregated at all. Magnesium metal is of course available, being commercially manufactured on an increasing scale from year to year.

As already indicated, my improved method of making an alloy of beryllium and magnesium, briefly stated, consists in admixing, while in molten condition, a suitable quantity of a mixture of halide of beryllium and another metal and metallic magnesium. The most readily available compound of beryllium is the double fluoride with the sodium, ($\text{BeF}_2 \cdot 2\text{NaF}$ or $\text{BeF}_2 \cdot \text{NaF}$). Other halogen salts of beryllium may be used, but not as satisfactorily.

I have found the preferred method of pro-

cedure to be, first to melt metallic magnesium in a suitable, e. g. iron, crucible, under a flux consisting of a mixture of magnesium and sodium chlorides in order to prevent burning; then the double fluoride referred to above is added in such amounts and at such intervals as will prevent the resulting reaction from becoming too violent. The molten magnesium, in other words, reacts almost instantly with the beryllium fluoride, reducing the same to metallic beryllium with corresponding formation of magnesium fluoride. The latter with the sodium fluoride form additions to the flux while the metallic beryllium goes directly into solution with the molten magnesium forming an alloy therewith. So far as I have been able to determine the reaction in question may be continued by adding more of the double fluoride so as to secure any desired proportion of beryllium to magnesium in the residual metallic mass. The amount of magnesium required is of course in excess of that present in the final alloy by an amount at least equal to that required to reduce the beryllium in such final product.

Instead of adding the double fluoride of beryllium and sodium to molten magnesium I have found it entirely feasible to reverse the process by adding metallic magnesium to such fluoride, the latter being in molten state. In other words, I fuse a quantity of beryllium sodium fluoride in an iron vessel and then add pieces of magnesium thereto, such pieces being of a size, and added at such a rate, as to permit effective control of the reaction as before. Presumably magnesium fluoride is formed and metallic beryllium, the sodium fluoride remaining and forming, with the magnesium fluoride, a thick pasty mass, out of which ultimately collects the molten alloy in which the proportion of beryllium to magnesium is determined as before.

I have succeeded in making alloys of the metals in question by the methods just described containing as high as 16 per cent of beryllium, so far as can be determined by available methods of analysis. It should be explained that not only is it extremely difficult accurately to determine the percentage of beryllium, but, as is well known, the quantitative determination of magnesium even in well-known alloys, such as those formed with

aluminum, is a matter of extreme difficulty, with a corresponding degree of uncertainty in the result.

One of the striking characteristics of the alloy in question which I have noted incidentally to the production of the same by the general process just described is that such alloy tends to stick to the surface of the iron vessel in which the fusion is conducted. In other words, whereas magnesium by itself will not adhere to iron so as to coat the same, by mixing even a small amount of beryllium therewith this difficulty is overcome, and a firm and apparently permanent bond secured between the two metals. The importance of this discovery, where it is desired to provide an iron wearing surface for articles composed chiefly of magnesium will be readily understood.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the method herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. The method of causing magnesium to adhere to iron, which consists in applying an admixture of beryllium with such magnesium while in molten state in contact with the iron article to be coated.

2. The method of making an alloy of beryllium and magnesium, which consists in admixing while in molten condition a suitable quantity of a mixed halide of beryllium and another metal, the halide of which

is not reduced by magnesium, and metallic magnesium.

3. The method of making an alloy of beryllium and magnesium, which consists in admixing while in molten condition a suitable quantity of a double fluoride of beryllium and an alkali metal and metallic magnesium.

4. The method of making an alloy of beryllium and magnesium, which consists in admixing while in molten condition a suitable quantity of a double fluoride of beryllium and sodium and metallic magnesium.

5. The method of making an alloy of beryllium and magnesium, which consists in adding to molten magnesium a mixed halide of beryllium and another metal, the halide of which is not reduced by magnesium.

6. The method of making an alloy of beryllium and magnesium, which consists in adding a double fluoride of beryllium and an alkali metal to molten magnesium.

7. The method of making an alloy of beryllium and magnesium, which consists in adding a double fluoride of beryllium and sodium to molten magnesium.

8. In a method of making an alloy of beryllium and magnesium, the steps which consists in melting a quantity of magnesium under a suitable flux and then gradually adding a double fluoride of beryllium and another metal producing a compound not reduced by magnesium until the desired proportion of such beryllium is secured.

Signed by me, this 6th day of May, 1920.

WILLIAM R. VEAZEY.