Patented July 26, 1927. 1,636,763

UNITED STATES PATENT OFFICE.

HENRIK BOVING, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METALLIC COMPOSITION.

No Drawing. Application filed May 26, 1920. Serial No. 384,264.

This invention relates to a method of producing alloys and metallic compositions when one of the constituents of the alloy or compound is a metal having a relatively low volatilization point.

It has been found heretofore that, in attempting to form alloys or metallic compositions where one of the elements of the product was a metal which possessed a comparatively low volatilization point such as, for example, the metals which are commonly known as the alkaline earth metals, considerable difficulty was encountered in securing the desired chemical composition in the final product. When an alloy is desired of nickel and barium and the barium added directly to the molten nickel, allowance has had to be made heretofore for the barium which was usually lost through sudden volatilization when heated suddenly to the temperature of the nickel. In fact, where only a small amount of the barium is required, it is practically impossible to obtain even an approximation of the desired constitution. Methods have been suggested in the past, such as enclosing the more volatile metal in a sheath of the other constituent previous to being added to the molten metal, or adding the volatile metal at some point beneath the surface of the molten metal; but these methods have not proven to be of any great value, and do not reduce to any appreciable extent the loss of the volatile metal which is usually incurred.

It is an object of this invention to provide a more efficient process by which alloys and metallic compositions may be made when one or more of the constituents of the desired product has a comparatively low volatilization point.

Briefly, the process consists in reducing the constituents initially to a finely divided state, and then uniting these minute particles to form a unitary mass. In effecting a union between the materials which are to form the composition various agencies may be employed. Those which have been found to be well suited for the carrying out of this invention are pressure, heat and a combination of both pressure and heat. These methods will be hereinafter more fully considered. For the purpose of illustration an alloy composed of barium and nickel will be referred to.

The desired amount of barium and nickel is first weighed out and reduced to a finely divided state. Since the volatile metal, barium, is likely to become oxidized during this operation due to its affinity for oxygen, it has been found desirable to carry out this reduction in such a manner that the formation of any compound on the surface of the metallic particles may be avoided. Thus, for example, a vacuum may be used, or the material may be disintegrated in an oil bath. These two finely divided materials are mixed thoroughly, either by hand or by the more efficient method of mechanical mixing. A homogeneous composition having been obtained, it is placed in a mold of any desired shape, which is composed, preferably, of a material which is chemically inert to nickel and barium. The next step is to cause the barium to assume a partially molten state, without allowing the metal to flow freely. This may be accomplished by exerting a sufficient pressure on the mixed material, or by increasing the temperature, or both. Where pressure alone is utilized, no great care is required in carrying out the process; the pressure being increased until a point is reached where the two metals tend to run together, and form a unitary mass. It will be readily seen that the amount of pressure will determine whether or not a true alloy is formed. Thus, for example, it is conceivable that in proceeding in this manner a fraction of the mass might be converted into an alloy, while the remainder would be merely a homogeneous physical mixture of the two elements.

Where the temperature is increased either with or without employing additional pressure, greater care must be taken in order that the desired alloy or composition will result, and no loss be sustained by the volatilization of one or both of the metallic constituents. In such a case the vapor tension of the two materials, barium and nickel must be taken into account, and an external vapor pressure created which will retard any tendency toward a passage of either of the materials from the liquid or solid state to the vapor state. It has been found desirable to employ for this purpose an external phase composed of the vapor of the low volatilization point element at a pressure at least equal to the vapor pressure

of said element at the temperature employed; in the case cited herein for example this external phase might consist of barium vapor.

While nickel and barium have been more particularly referred to herein, it is to be understood that this invention is applicable to other metals, and alloys as well, which lend themselves readily to such a process. Although barium has been specifically chosen as the volatile material, the remainder of the alkaline earth metals—calcium and strontium, as well as magnesium—may be very readily alloyed or combined with metals having higher volatilization points in accordance with this invention.

What is claimed is:

1. The method of forming an alloy comprising a plurality of metallic elements, one or more of said metallic elements having a comparatively low volatilization point which consists in reducing said metallic elements to a finely divided state, molding the mixture of the resulting particles in the presence of gas under sufficient pressure to blanket the volatilization of the low volatilization point element at the temperature employed and increasing the temperature to form an alloy.

2. The method of forming an alloy comprising a plurality of metallic elements, one or more of said metallic elements having a comparatively low volatilization point which consists in reducing said metallic elements to a finely divided state, molding the mixture of the resulting particles in the presence of a gas under sufficient pressure to blanket the volatilization of the low volatilization point element at the temperature employed, increasing the temperature and exerting mechanical pressure to form an alloy.

3. The method of forming an alloy from one or more metals of the alkaline earth group and nickel, which consists in reducing said elements to a finely divided state, mixing the resultant particles, and molding said particles under heat and pressure so as to cause said elements to form an alloy.

4. The method of forming an alloy of nickel and barium, which consists in reducing the barium to a finely divided state under conditions in which it will not oxidize, reducing the nickel to a finely divided state, mixing the resultant particles, molding the mixture under a pressure sufficient to blanket the volatilization of the barium.

In witness whereof, I hereunto subscribe my name this 24th day of May, A. D., 1920.

HENRIK BOVING.