UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING ALLOYS.

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To all whom it may concern:

Be it known that I, HENRY L. DOHERTY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Processes of Making Alloys, of which the following is a specification.

This invention relates to processes of making alloys; and it comprises a method of making alloys of readily volatilizable metals, such as mercury, sodium, zinc, etc., with less fusible and less volatile metals wherein the metals of the two classes are combined together under pressure, as by heating them together in a closed casing adapted to withstand pressure at a temperature at which the less fusible metal melts, such casing being one adapted to withstand the pressure of the vapors of the more volatile metal at this temperature, and the alloy is then solidified; all as more fully hereinafter set forth and as claimed.

Most pairs of metals do not mix in all proportions. With metals of about the same melting point this offers no difficulty in securing mixtures of any desired proportion since by agitating the molten metals together and then casting, no time is permitted for segregation or separation. Further, where one metal is comparatively readily volatile it is in any event difficult to alloy it with another metal of high melting point to obtain a mixed metal of definite and exact composition for the reason that volatilization (always very active in any atmosphere containing furnace gases) changes the proportions. In making brass for example it is the practice to melt the copper and then add the zinc with the result that a variable proportion of the zinc always volatilizes away before the alloy can be formed.

Practically, it may be said that in compounding a volatile metal with a less volatile only two ways are open to the operator. Either he may use a temperature such as suffices to melt only the more volatile one (which is also always the more fusible) in which case he can only secure alloys up to the limit of solubility of the less volatile in the more volatile; or he can use higher temperatures; in which case there is always a loss of the volatile metal which must be allowed for in the proportioning.

It is an object of the present invention to provide a simple process wherein the noted difficulties may be obviated; and this I do by the simple expedient of performing the fusion or union of the two metals in a closed casing adapted to withstand pressure and to retain the vapors of the volatile metal. I may of course in many instances use externally heated casings, heated by fire heat or electrical resistance; but as a rule I find it better to rely upon internally developed heat; either resistance heating or an electric arc. The two metals may be placed together in such a casing and the assemblage heated till the desired alloy is made; or the less volatile may be melted therein and then the more volatile metal added. The casing may serve merely for fusion and the fused alloy be cast into a separate mold (which may also be under pressure); or it may serve also as the mold for making the final ingot. Very many methods of operating may be devised within the limits of my broad invention which consists in having sufficient pressure at the time of union of the two metals, to prevent to a substantial extent evolution of vapors of the more volatile metal.

In making copper amalgams for dental use I may, for example, place the desired amount of copper and of mercury in a closed steel casing lined with fireclay or fire brick and pass a current through one or both of the metals until the temperature is about the melting point of copper (1075° C.); and then mingle the two metals if they be not already in contact. An arc may of course be made in the casing for heating purposes. Mercury boils at 357° C. under atmospheric pressure and its vapor tension is considerable at lower temperatures; but heating it with copper in a closed casing there is no difficulty in retaining it until the alloying is completed. Operating in this manner, it is obvious that any desired ratio between the copper and the mercury can be attained in the final product. After union is effected, the molten alloy may be tapped to another casing to give an ingot; or it may be allowed to solidify in the casing in which it was made. Amalgams of mercury with other metals, such as silver, gold, lead, tin, etc., can be made in the same manner. In making brass, I proceed in exactly the same manner, charging the casing with the desired amounts of copper and of zinc (with or without deoxidants such as phosphorus)

and heating up to the melting point of copper.

The present process is particularly convenient in making alloys of sodium and potassium with other metals since not only are these metals freely fusible and volatile but they are also combustible. In making what I may term a sodium-copper couple for chemical reductions I may, for example, place about 90 per cent. of sodium and 10 per cent. of copper in a closed casing and heat internally until the temperature is around a thousand degrees centigrade, agitate the casing vigorously to produce good admixture and tap into a closed mold. In so doing I produce bars of an alloy which has a more energetic reducing action than sodium alone and which is susceptible of many uses in commercial organic chemistry. It is of course a stronger reducing agent than the ordinary copper zinc couple.

A copper zinc couple in convenient form may be produced by using 90–95 parts of zinc and 10–5 parts of copper in the same way.

Many other specific embodiments of the present invention may be made. I regard it as particularly useful in making alloys in any desired proportions, using sodium, potassium, mercury, cadmium and zinc together with another metal of less fusibility and volatility.

It is of course not necessary that both metals or either be heated under pressure prior to the moment of union. For example, copper may be melted in the ordinary way and cast into a mold adapted to withstand pressure. Zinc may be similarly melted and cast into the same casing. Or, a casing adapted to withstand pressure may be provided with a necessary quantity of solid zinc and molten copper tapped into it directly from a suitable melting furnace. A 2-compartment mold may be employed and the two molten metals cast into the compartments, the mold closed to hold back vapors and then the two metals united by tilting or otherwise.

The same expedients may be used in making alloys of other pairs of metals of widely different volatility.

What I claim is:—

1. The process of making alloys which comprises inclosing a relatively volatile metal and a relatively less volatile metal in a closed casing and heating under a high pressure of the vapors of the more volatile metal.

2. The process of making alloys which comprises inclosing a relatively volatile metal and a relatively less volatile metal in a closed casing and heating under a high pressure of the vapors of the more volatile metal to a temperature at which the less volatile metal fuses.

3. The process of making alloys of a highly volatile metal with a less volatile metal which comprises uniting the less volatile metal in a fused state with the more volatile metal at a relatively high pressure in a casing adapted to withstand such pressure and prevent substantial volatilization of the more volatile metal.

4. The process of making alloys of a highly volatile metal with a less volatile metal which comprises uniting the less volatile metal in a fused state with the more volatile metal at a relatively high pressure in a casing adapted to withstand such pressure and prevent substantial volatilization of the more volatile metal and casting under pressure.

5. In the manufacture of alloys of metals of widely different melting point the process which comprises uniting said metals at a temperature sufficient to melt the less fusible metal in a casing under sufficient pressure to restrain substantial evaporation of the more fusible and volatile metal and retain it in a liquid state at such temperature.

6. In the manufacture of alloys of metals of widely different melting point the process which comprises uniting said metals at a temperature sufficient to melt the less fusible metal in a casing under sufficient pressure to restrain substantial evaporation of the more fusible and volatile metal and retain it in a liquid state at such temperature and casting under pressure.

In testimony whereof, I affix my signature.

HENRY L. DOHERTY.