PROCESS OF MAKING POTASSIUM METAL OR SODIUM POTASSIUM METAL ALLOY

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PROCESS OF MAKING POTASSIUM METAL OR SODIUM-POTASSIUM METAL ALLOY

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This invention relates to a process to make sodium potassium metal alloy or potassium metal.

The problem of heat storage and heat transfer has held the interest of engineers and chemists to the extent that the use of materials, other than water is being investigated in order to reduce fuel cost and increase heating efficiencies, particularly where high temperatures are required.

I have discovered that an alloy of sodium metal and potassium metal, when used in a closed circuit heating system, will increase heat efficiency, particularly where very high temperatures are required, without decomposition, or undue pressures in the system.

The principal drawback to a more extensive use of this alloy has been the cost of the potassium metal which heretofore has been very difficult and expensive to manufacture; consequently, the high market price of this metal has limited its commercial possibilities.

The object of my invention is to provide a process whereby potassium metal or sodium-potassium metal alloy may be quickly and easily produced in commercial quantities and at a price which will permit its general use.

In carrying out the object of my invention, I provide a process in which the vapors of molten sodium metal are brought into interaction with a molten potassium compound, such as potassium hydroxide, potassium chloride, bromide or iodide, and whereby the vapors of the sodium metal are exchanged into vapors of potassium metal and are then condensed into an alloy of liquid sodium potassium metal, or if preferred, the potassium metal and sodium metal may be separated by fraction distillation.

With this and certain other objects in view, which will appear later in the specification, my invention comprises the process and apparatus described and claimed and the equivalents thereof.

In the drawings Fig. 1 is a diagrammatic view showing the method of making sodium potassium metal alloy.

Figure 2 is a diagrammatic view showing the parts in Fig. 1 connected to a fractionating tower for separating the sodium potassium metal alloy vapors into sodium and potassium metals.

Referring to Fig. 1 of the drawings, a quantity of a potassium compound such as potassium hydroxide, is melted in a heated container or retort at a temperature of about 300°C.

The molten potassium hydroxide is then fed in regulated quantities into the top of a countercflow reaction tower 2.

The reaction tower 2 is preferably constructed with a plurality of vertically spaced horizontal partitions, which divide the tower into a plurality of compartments. Each partition has a plurality of upwardly projecting tubes 4, which provide inter-communication with the adjacent compartments according to the usual practice of constructing such towers.

These upwardly projecting tubes are covered with bubble caps 5, which are spaced from the top edges of the tubes 4, and whose lower edges extend below the top of the tubes and slightly above the floor of the partition 3, thus forming a tortuous path through which the vapors must pass as they travel from one compartment to the next.

Each partition 3 also has a plurality of discharge pipes 6 communicating with the next lower compartment. These discharge pipes project above the partitions 3 at a height somewhat less than the height of the upwardly projecting tubes 4 so that a liquid level may be maintained in each compartment at a height equal to the top of the discharge pipes and somewhat below the top of the upwardly projecting tubes. Thus, when the liquid is fed into the top compartment, it will rise to a level with the top of the discharge pipe 6 and will then flow through the discharge pipe into the next lower compartment and so on until the lowermost compartment is reached. From the lower compartment the liquid is discharged from the tower into a waste receptacle 7.

In order to maintain the temperature in the tower sufficiently high enough to prevent the vapors from condensing, the tower is
heated to about 450° C, preferably by electric heating elements 8 which surround the tower, and in order to further conserve heat, the entire system may be heat insulated as at 9 in any well known manner.

A quantity of sodium metal is then placed in a heated container or retort 10 which communicates with the lowermost compartment of the reaction tower which is evacuated to a pressure of 0.5–0.1 millimeters.

The temperature of the sodium metal is then raised to about 450° C. Under high vacuum at which temperature the metal is converted into vapors which are fed into the lowermost compartment of the tower. From the lowermost compartment the sodium metal vapors pass upwardly through the projecting tubes 4, where they encounter the bubble caps 5 and are forced downwardly through the molten potassium hydroxide.

In passing countercurrently through the molten potassium hydroxide, the sodium metal vapors, through an interaction with the potassium hydroxide, are converted into a mixture of sodium metals and potassium metal vapors, and as these vapors pass into the next compartment through the molten potassium hydroxide they are gradually enriched with potassium metal until they reach the top compartment from which they pass into a condenser 11. The depth of the molten potassium hydroxide and the number of compartments through which it passes determines the percentage of potassium metal in the alloy.

The condenser 11 is preferably constructed as a counter-flow condenser which comprises a water jacket 12 surrounding a vapor tube leading from the reaction tower. Water, preferably at a boiling temperature, is led into the condenser at the feed end 13 and countercflowing to the vapors is discharged at the other end 14. In the condenser the metal vapors are condensed into a liquid consisting of an alloy of potassium and sodium metal and which will remain liquid at a temperature ranging from -10° to +6° C = 14° to 43° F. depending on the percentage of potassium metal in the alloy.

The alloy then enters a container 15, and from there into a storage tank or the containers from which it will be used or marketed.

The entire system is operated under a vacuum of from 0.5 to 0.1 millimeters, the vacuum pump 16 preferably being connected to the container 15 and pulling through the condenser 11, reaction tower 2, and retorts 10 and 1.

When it is preferred to separate the potassium metal from the alloy, the alloy may be removed from the container 15 and placed in a fractionating still, or the sodium potassium metal alloy vapors may be separated as shown diagrammatically in Figure 2 of the drawings.

In this arrangement the vapors from the reaction tower 2 are led directly into a fractionating tower 17, where sufficient temperature is maintained to allow part of the vapors to condense so that the column 17, acts as a dephlegmator to enrich the uprisings of potassium while the downflowing condensed liquid is rich in sodium metal.

To further increase the sodium metal content of the down flowing alloy, vapors of pure sodium metal from retort 10 are led into the fractionating tower through pipe 21. These vapors crowd out the potassium metal vapors which are liquified in condenser 19, and then are solidified in mold 20.

The liquid sodium metal passes from the bottom of the fractionating tower to the molds 22.

By the above described means, I have invented a process to make potassium metal or a sodium potassium metal alloy at a price far below the present known methods and which will place either the metal or the alloy within the reach of a number of commercial possibilities such as the use where high temperatures are to be maintained in bake ovens, cracking stills, and other heating processes using a closed circulating heating system.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The process of producing a sodium potassium metal alloy which consists in passing the vapors of sodium metal counter currently through a molten potassium compound under vacuum and condensing the resultant sodium and potassium vapors into a sodium potassium alloy.

2. The process of producing sodium potassium metal alloy which consists in passing the vapors of sodium metal counter currently through molten potassium hydroxide under vacuum and condensing the resultant sodium and potassium vapors into a sodium-potassium alloy.

3. The process of producing potassium metal which consists in passing the vapors of sodium metal counter currently through a molten potassium compound under vacuum and separating the resultant sodium and potassium vapors by fractional distillation.

4. The process of producing potassium metal which consists in passing the vapors of sodium metal counter currently through molten potassium hydroxide while under vacuum and separating the resultant sodium and potassium vapors by fractional distillation.

5. The process of producing sodium potassium metal alloy which consists in melting a quantity of potassium compound, vaporizing a quantity of sodium metal, passing the vapors of the sodium metal counter currently through the molten potassium com-
pound and condensing the resultant vapors into a sodium potassium alloy, the process being performed under vacuum.

6. The process of producing sodium potassium metal alloy which consists in melting a quantity of sodium hydroxide, vaporizing a quantity of sodium metal and passing the sodium metal vapors countercurrently through the molten potassium hydroxide and condensing the resultant vapors into a sodium potassium alloy, the process being performed under vacuum.

7. A process of producing potassium metal which consists in melting a quantity of a potassium compound vaporizing a quantity of sodium metal and passing the sodium metal vapors countercurrently through the potassium compound and separating the sodium metal vapors from the potassium metal vapors by fractional distillation, the process being performed under vacuum.

8. The process of producing potassium metal which consists in melting a quantity of potassium hydroxide vaporizing a quantity of sodium metal and passing the sodium metal vapors countercurrently through the molten potassium hydroxide separating the potassium metal vapors from the sodium metal vapors by fractional distillation, the process being performed under vacuum.

In testimony whereof I affix my signature.

RICHARD THURM.