

UNITED STATES PATENT OFFICE.

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METHOD OF REDUCING METALS.

959,785.

Specification of Letters Patent.

Patented May 31, 1910.

No Drawing.

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To all whom it may concern:

Be it known that I, ROBERT J. McNITT, a citizen of the United States, and a resident of Niagara Falls, county of Niagara, and State of New York, have invented certain new and useful Improvements in Methods for Reducing Metals, of which the following is a specification.

My invention relates to a new method for reducing metals and consists in dissolving, alloying or chemically combining the metal which it is desired to reduce, with another metal or mixture of metals, which latter metal or mixture of metals shall be volatile only at higher temperatures and lower pressures than the metal it is desired to reduce, subjecting the resulting solution alloy or chemical compound to the action of heat under a low pressure as *in vacuo* or under reduced pressure in the presence of inert gases, driving off the more volatile metal and condensing the same as desired. The heat may drive off all or part of the metal desired leaving behind the less volatile parts which may be used over and over again. The metallic vapors distilled over may be condensed and collected in that physical state and at that temperature most favorable for future application or use. By this method many metals may be profitably separated which under normal atmospheric or higher pressures can not be obtained at all or only with great difficulty.

As an illustration showing one way of practicing this method I shall describe the reduction of metallic sodium from its compounds, such as sodium chlorid, although of course, the method is not restricted in its application to use in connection with any particular metal.

The sodium is first separated from the chlorid and alloyed with lead, tin or a mixture of these or other suitable metals, in any convenient manner such as by electrolyzing the sodium chlorid, using the alloying metal as a cathode, as is shown in the Acker Patent. No. 623,692, dated April 25, 1899 for example. The alloy in such case is conveyed to or placed in any suitable receiver, subjected to reduced pressure by means of a suitable pump in the well known manner, and heated by any convenient means to a degree sufficient to drive off the more volatile sodium which may be condensed and drawn off in any state or condition desired, the lead

or other alloyed metal remaining behind, being returned to the electrolytic furnace if desired, to take up a fresh charge of sodium and to repeat the process indefinitely. The process may be made continuous by conveying the molten alloy from the electrolytic furnace to the receiver, distilling off the sodium and returning the remaining less volatile metal or metals to the furnace. In this case but little heat will have to be supplied to the receiver as the temperature of the alloy in the furnace is usually about 800° C. while sodium *in vacuo* boils off readily below 800° C., it being necessary simply to maintain the temperature while reducing the pressure.

The advantage of the method is apparent when it is recalled that from alloys of such concentration as can conveniently be made, sodium, by simple distillation, can be driven off at an appreciable rate only at temperatures well above the point of fusion of cast iron. Hence in the practice of my new method not only is there a saving from the fuel standpoint but also from the standpoint of effecting the separation by the use of simple apparatus of cheap material.

By properly selecting the temperature of distillation not merely the pure metal but any desired mixture or alloy can be distilled over.

In some cases it is obvious that the impurities might be removed by distillation, leaving the metal desired behind and I do not restrict myself to the practice of the method as described, the reverse of the method also coming within the scope of my invention.

I am aware that metals have been separated from alloys, etc. by distillation and do not claim such, my invention residing in separating the metals by distillation at reduced pressure either *in vacuo* or in presence of inert gases.

What I claim and desire to secure by Letters Patent is:—

1. The method of reducing a metal from its compounds which consists in dissolving, alloying or chemically combining said metal with another metal or mixture of metals less volatile than the metal desired, submitting the resultant solution, alloy or compound to a pressure lower than that due to the atmosphere and to a temperature suitable for the distillation of the metal desired.

2. The method of reducing a metal from its compounds which consists in dissolving, alloying or chemically combining said metal with another metal or mixture of metals less volatile than the metal desired, submitting the resultant solution, alloy or compound to a pressure lower than that due to the atmosphere and maintaining the same at a temperature suitable for the distillation of the metal desired.

3. The method of reducing a metal from its compounds which consists in dissolving, alloying or chemically combining said metal with another metal or mixture of metals less volatile than the metal desired, submitting the resultant solution, alloy or compound to a pressure lower than that due to the atmosphere, maintaining the same at a temperature suitable for the distillation of the metal desired, redissolving, realloying or chemically recombining a fresh supply of the

metal desired with the residual metal and indefinitely repeating the operation substantially as described.

4. The method of reducing a metal from its compounds which consists in dissolving, alloying or chemically combining said metal with another metal or mixture of metals of different volatility from that of the metal desired, submitting the resultant solution, alloy or compound to a pressure lower than that due to the atmosphere and maintaining the same at a temperature suitable for the separation of the metals from each other by distillation.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ROBERT J. McNITT.

Witnesses:

J. CLOYD DOWNS,

HOWARD E. BATSFORD.