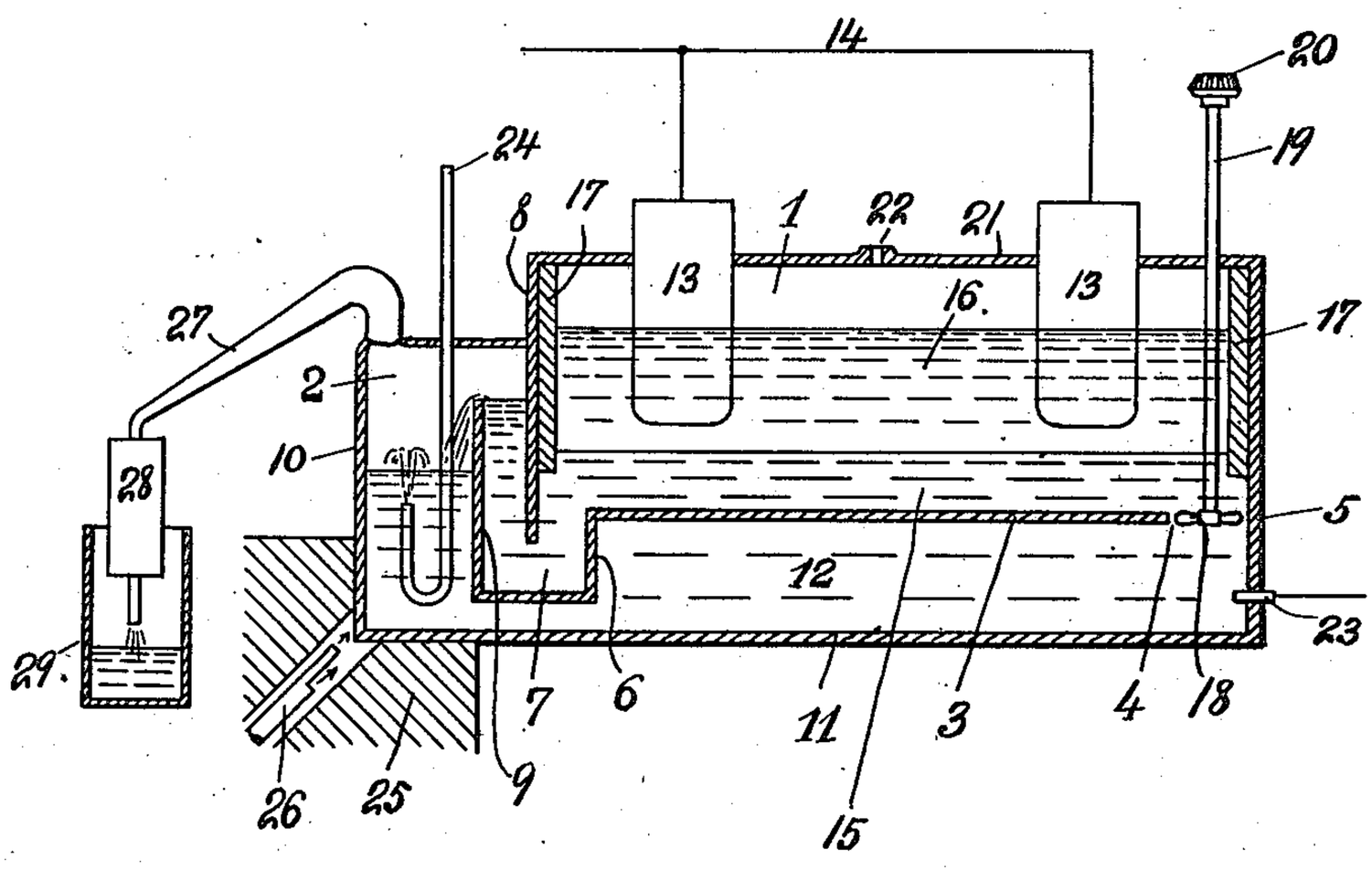
R. J. McNITT.

METHOD FOR REDUCING METALS.

APPLICATION FILED OCT. 8, 1909.

993,391. Patented May 30, 1911.



Witnesses
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UNITED STATES PATENT OFFICE.

ROBERT J. McNITT, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO ROESSLER & HASSLACHER CHEMICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD FOR REDUCING METALS.

993,391. Specification of Letters Patent. Patented May 30, 1911.

Application filed October 8, 1909. Serial No. 521,735.

To all whom it may concern:

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

My invention relates to a new and useful method for reducing metals from compounds containing the same and the object of the invention is to provide a method for more economically and effectively carrying on such reduction.

My invention 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 is volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor. The solution, alloy or chemical compound thus prepared is then brought to a suitable temperature and an inert gas passed through the same, said gas carrying over with itself the vapors of the more volatile metal or metals. These vapors may be separated from the gas by any suitable means and collected as desired.

In the following I have described, in connection with the accompanying drawing, one means of carrying out my invention, the features thereof being more particularly pointed out hereinafter in the claims.

The drawing is a sectional elevation of one form of device for carrying out my invention, the view being largely diagrammatical.

I have illustrated my invention in connection with a continuous process for the reduction of metallic sodium from its compounds, for example, sodium chlorid, in which illustration the sodium is alloyed with a suitable cathode metal such as lead through the action of electrolysis, lead being volatile only at a higher temperature and lower pressure than sodium.

The drawing illustrates an electrolytic cell, preferably of cast iron, having an electrolytic chamber 1 and a furnace chamber 2.

3 is a transverse partition extending from side to side of the chamber 1, an opening 4 being left between one end of the partition 3 and the end wall 5 of the chamber 1, the other end 6 of partition 3 being turned downward to form a seal 7 into which depends end wall 8 of chamber 1.

9 is the upturned portion of partition 3 forming one wall of furnace chamber 2. 10 is one of the end walls of the electrolytic cell and is adapted to form the other wall of furnace chamber 2.

11 is the bottom of the cell connecting walls 5 and 10.

It is seen that the relation of the parts is such that there is a free means of communication through channel 12 from furnace chamber 2 through opening 4 into the electrolytic chamber 1 and from electrolytic chamber 1 through seal 7 over wall 9 into the furnace chamber 2.

13, 13 indicate the anodes which may be of any suitable substance, such as carbon or graphite, and connected by wire 14 to a source of suitable electric current (not shown).

15 represents the cathode metal, which in the illustration chosen, is molten lead.

16 indicates the compound from which the metal desired is to be reduced, which in the illustration chosen, is sodium chlorid.

17, 17 represent a suitable magnesia lining protecting the walls of the electrolytic chamber 1 and extending down below the surface of the cathode metal 15, as shown.

18 represents a stirrer blade on shaft 19 suitably supported and driven by gear 20 actuated by any suitable means. The object of the stirrer blade 18 is to circulate the molten metal from channel 12 through opening 4 into chamber 1.

21 is a cover forming an air-tight connection with chamber 1 and is preferably of asbestos.

22 is an opening in cover 21, which in the illustration chosen, is adapted to permit the chlorin, one of the products of electrolysis of sodium chlorid, to escape. The chlorin may be conducted to a suitable receiver (not shown) for any purpose desired. Cover 21 is also provided with suitable means (not shown) for charging the chamber 1.

23 is an electric contact to the cathode.

24 is a pipe conducting an inert gas, such as hydrogen or nitrogen, for example, to a point beneath the surface of the contents of furnace chamber 2, the inner end of the pipe being suitably perforated (perforations not shown) for the passage of gas therethrough

into the contents of furnace chamber 2, said gas being forced under suitable pressure through pipe 24 from any convenient source (not shown).

25 represents a furnace for heating furnace chamber 2, so that the contents will be maintained at a temperature suitable for driving off the more volatile metal or metals. In the illustration the heating means is shown as a gas burner 26.

27 is a gooseneck connection from furnace chamber 2 to condenser 28, condenser 28 discharging into receptacle 29.

30 is a suitable air-tight cover for furnace chamber 2.

In the operation of the device described and in connection with the reduction of metallic sodium from sodium chlorid, the sodium is separated from the chlorin and alloyed with the cathode metal, which as stated above may be lead, or tin, or a mixture of these or other suitable metals, the chlorin passing off through opening 22 in cover 21 as described. The alloy is caused to circulate out of electrolytic chamber 1 through seal 7 under wall 8 and over wall 9 into furnace chamber 2 by the pressure exerted upon it by the superincumbent sodium chlorid, which must be renewed as fast as decomposed, in connection with circulating device 18, as described. In furnace chamber 2 the alloy is maintained at a suitable temperature by means of furnace 25 and subjected to the action of the inert gas which passes through the same, the gas carrying the vapor of the more volatile metal, in the illustration chosen, sodium, with it, through connection 27 into condenser 28, the remaining portion of the molten alloy, freed from some or all of the metal which is sought, being drawn through chanel 12 and opening 4 into chamber 1 by means of the circulating device described. In chamber 1 the residual metal again serves as the cathode becoming recharged or further charged with the sodium.

The means described is illustrative of but one manner of carrying out my invention, as it is obvious that an alloy might be prepared in other ways than by electrolysis, that solutions or chemical compounds having the characteristics desired may be used in place of alloys and that other metals than sodium may be reduced. It is further obvious that the metal desired may remain in the furnace as the residual metal, the vapors driven off being those of the metal or metals with which the metal desired has been alloyed or otherwise combined, although I prefer to drive off the metal desired as described herein in connection with sodium. It is further obvious that the metal driven off may be recovered in other ways than by condensation or may be acted upon in an uncondensed state by suitable reagents allowing the inert gas to pass on and be used over again as described. The process may be continuous or intermittent and the inert gas may be used over again by means of suitable connections.

The practice of my invention is especially advantageous in connection with metals which are attacked by atmospheric gases and also in connection with the reduction and separation of metals under reduced pressures. In this latter case the pressure in chamber 2, for example, may be reduced by any suitable means, as a vacuum pump (not shown), placed in connection with condenser 28 in the usual maner.

I do not restrict myself to any of the details of operation shown or described, as they may be considerably varied without departing from the spirit of my invention.

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 volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature and passing an inert gas through the same.

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 volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature, passing an inert gas through the same and condensing the metal driven off.

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 volatile only at higher temperatures and lower pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature and passing through the same an inert gas.

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 volatile only at higher temperatures and lower pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature, passing through the same an inert gas and condensing the metal.

5. 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 volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature, passing through the same an inert gas, separating the metal driven off from said gas and again passing the gas through the solution, alloy or compound.

6. 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 volatile only at higher temperatures and lower pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature, passing through the same an inert gas, separating the metal driven off from said gas and again passing the gas through the solution, alloy or compound.

7. The method of reducing sodium from sodium chlorid which consists in alloying the sodium with another metal or mixture of metals volatile only at higher temperatures and lower pressures than sodium, maintaining said alloy at a suitable temperature and passing through the same an inert gas.

8. The method of reducing sodium from sodium chlorid which consists in alloying the sodium with another metal or mixture of metals volatile only at higher temperatures and lower pressures than sodium, maintaining said alloy at a suitable temperature, passing through the same an inert gas and condensing the sodium.

9. The method of reducing sodium from its compounds which consists in dissolving, alloying or chemically combining the sodium with another metal or mixture of metals volatile only at different temperatures and pressures than sodium, maintaining said solution, alloy or compound at a suitable temperature and passing through the same an inert gas.

10. The method of reducing sodium from its compounds which consists in dissolving, alloying or chemically combining the sodium with another metal or mixture of metals volatile only at different temperatures and pressures than sodium, maintaining said solution, alloy or compound at a suitable temperature, passing through the same an inert gas and condensing the sodium.

11. 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 volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature, submitting the same to a pressure lower than that due to the atmosphere and passing an inert gas through the same.

12. 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 volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor, maintaining said solution, alloy or compound at a suitable temperature, submitting the same to a pressure lower than that due to the atmosphere, passing an inert gas through the same and condensing the metal driven off.

13. The method of reducing sodium from its compounds which consists in dissolving, alloying or chemically combining the sodium with another metal or mixture of metals volatile only at different temperatures and pressures than sodium, maintaining said solution, alloy or compound at a suitable temperature, submitting the same to a pressure lower than that due to the atmosphere and passing through the same an inert gas.

14. The method of reducing sodium from its compounds which consists in dissolving, alloying or chemically combining the sodium with another metal or mixture of metals volatile only at different temperatures and pressures than sodium, maintaining said solution, alloy or compound at a suitable temperature, submitting the same to a pressure lower than that due to the atmosphere, passing through the same an inert gas and condensing the sodium.

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

ROBERT J. McNITT.

Witnesses:
HOWARD E. BATSFORD,
J. CLOYD DOWNS.