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C. SUTER & B. REDLICH.

PROCESS FOR THE ELECTROLYTIC PRODUCTION OF METALS OF THE EARTHY ALKALIES.

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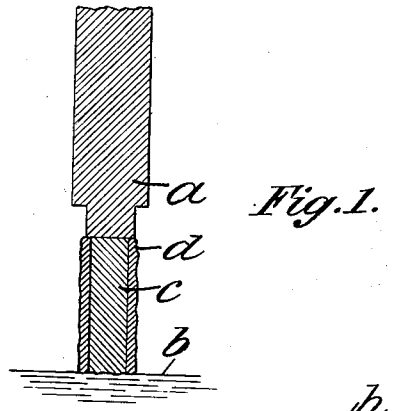

Fig. 1.

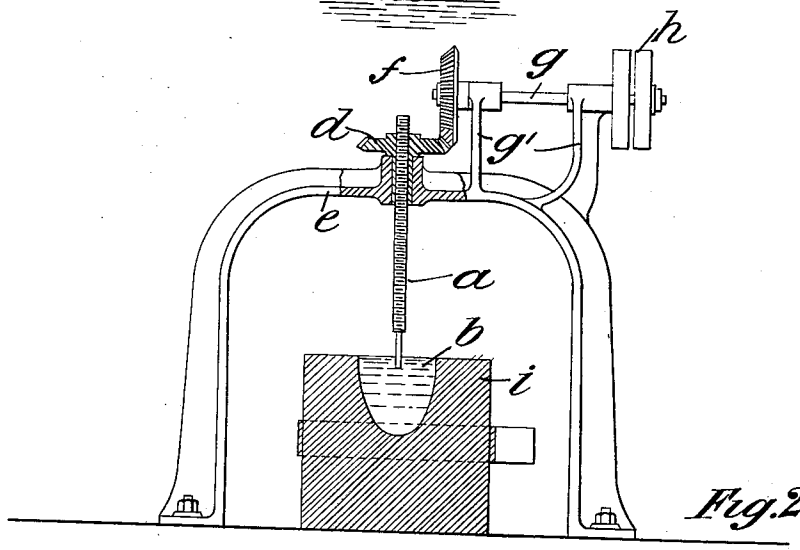

Fig. 2.

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CARL SUTER AND BERTHOLD REDLICH, OF RATIBOR, GERMANY.

PROCESS FOR THE ELECTROLYTIC PRODUCTION OF METALS OF THE EARTHY ALKALIES.

No. 813,532. Specification of Letters Patent. Patented Feb. 27, 1906.

Application filed January 2, 1904. Serial No. 187,560.

To all whom it may concern:

Be it known that we, CARL SUTER, a citizen of the Swiss Republic, and BERTHOLD REDLICH, a subject of the Emperor of Austria-Hungary, residents of Ratibor, Silesia, in the Empire of Germany, have invented a new and useful Process for the Electrolytic Production of Metals of the Earthy Alkalies, and more especially of metallic calcium, of which the following is a specification.

The electrolytic production of the metals of the earthy alkalies has hitherto been attended by difficulties which are entailed by the maintenance of the temperature and current conditions necessary for the separation of these metals. It is only successful, as is well known, when a high cathodic current density (say one ampere per one square millimeter) is employed, together with such a temperature in the immediate vicinity of the cathode as will cause the metal being produced to run or melt in spherical drops. When a smaller current density and a lower temperature are employed, there is produced a more or less voluminous spongy product of the metal of the earthy alkali, which is impregnated with the electrolyte; but as when high current densities and high temperatures are employed the solubility of the metals of the earthy alkalies in the molten anhydrous haloid salts is considerable the yield of the metal obtained under such conditions is so small that a systematic production of metal by these means would seem to be impracticable. This applies especially to the process ordinarily used hitherto for the electrolytic production of the metals of the earthy alkalies where the molten metal which is produced must be removed in the form of smaller or larger drops separately from the molten electrolyte. In this case it is necessary that the metal which is produced should remain in the melt, even if only for a short time, because on practical grounds the drops must always have first attained a certain size. Now the aforesaid losses occur through the metal becoming dissolved during this period of accumulation in the melt. A further loss of metal is entailed by remelting the lumps so obtained, which are rendered impure by adhering melt into bars or rods. These disadvantages are obviated according to the present invention, and the metal is at the same time produced directly in a form (rod form) which is especially suitable for further purposes of use. The metal produced at the cathode is by the aid of the latter removed continuously from the melt, the metal which is produced becoming gradually solid and then assuming in its turn the function of the cathode. At the same time the solidified metal becomes covered by adhesion with a thin coating of the electrolyte, whereby it is protected in a simple manner from all oxidation by the oxygen of the air.

With this method of proceeding, as will be clearly understood, the resulting metal as it is being produced is removed from the melt and cooled, so that the losses by its dissolving in the electrolyte are practically avoided. With this process, therefore, the theoretical yield is almost obtained from the current.

When it is desired to produce metallic calcium, for example, according to this process, calcium chlorid or another suitable calcium salt is freed from water and is melted and the molten mass is poured into an electrolyzing vessel. The cathode is preferably made horizontal at its lower end and is arranged to dip only with this level surface into the level of the melt as a contact-electrode. The size of the operative cathode-surface is determined by the known density of the current. A short time after the circuit is closed there is formed at the contact-cathode a drop of molten calcium. As soon as this is observed the cathode is removed slowly and uniformly from the surface of the melt, whereby the calcium which is being produced follows on in the shape of a column of metal.

In order to facilitate the first adhesion of the metal and the solidifying of the latter on the cathode, it is advisable not to allow the temperature at the operative cathode-surface to rise too high. This may be effected both by a suitable choice of form and material of the cathode; but this is, however, not absolutely necessary for carrying out the present process.

As soon as the metallic calcium is formed in the shape of a small column solidified onto the cathode it takes over the function of the said cathode, and the conductor which served to start the process now serves merely as a conductor for the current and as a mechanical attachment for the calcium electrode now produced.

The accompanying drawings illustrate the process.

Figure 1 is a diagrammatic sectional elevation illustrating the process, while Fig. 2 is an elevation, partially in section, of an apparatus suitable for carrying the process into effect.

Fig. 1 shows the conditions obtaining a short time after the commencement of the electrolytic process. The electrode *a*, which was originally in contact with the surface *b* of the melt, has already become removed therefrom by the height of the calcium column *c*, and this latter is enveloped by a thin protective coating *d* of solidified electrolyte.

As illustrated in Fig. 2, the rod *a*, serving as the cathode, is screw-threaded and passes through a bevel-wheel *d*, suitably mounted in the frame *e*, the bevel-wheel *d* being geared with the bevel-wheel *f*, mounted upon a counter-shaft *g*, carried within bearings *g'*, provided on the frame *e*, and power is communicated to the shaft *g* by belting passing over one of the pulleys *h* or by any suitable means.

For carrying the process into effect it is most advantageous to employ dephlegmated molten chlorid of calcium as the electrolyte. A charcoal pan or crucible *i* serves as the anode, while a round iron rod *a* serves as the cathode, the latter being provided at its lower end with a horizontal surface of such size that on each millimeter of it there is one ampere, while the anodic strength is about forty amperes per sqdm and the voltage of the bath between twelve and fifteen volts.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. A process for the electrolytic production of metals of the earthy alkalies, consisting in melting the salt, effecting the electrolysis thereof, and causing the relative movement of the cathode with reference to the electrolyte substantially as described.

2. A process for the electrolytic production of metals of the earthy alkalies, consisting in melting the salt effecting the electrolysis thereof, and causing the slow movement of the cathode from the surface of the electrolyte during the electrolysis substantially as described.

3. A process for the electrolytic production of calcium consisting in the melting of a calcium salt, the electrolysis thereof, and causing the slow movement of the cathode with reference to the electrolyte during the electrolysis substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CARL SUTER.
BERTHOLD REDLICH.

Witnesses:
LOUIS KLATZ,
ALBERT SCHENK.