No. 663,719. Patented Dec. 11, 1900.

H. BECKER.

ELECTROLYTIC APPARATUS.

(Application filed June 26, 1899.)

(No Model.)

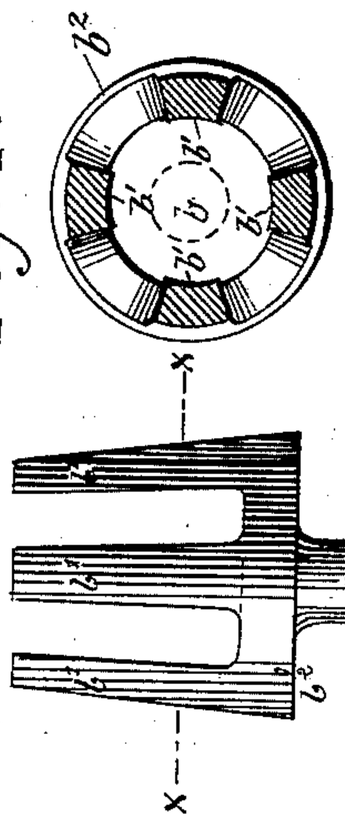

FIG. 2.

Fig. 4.

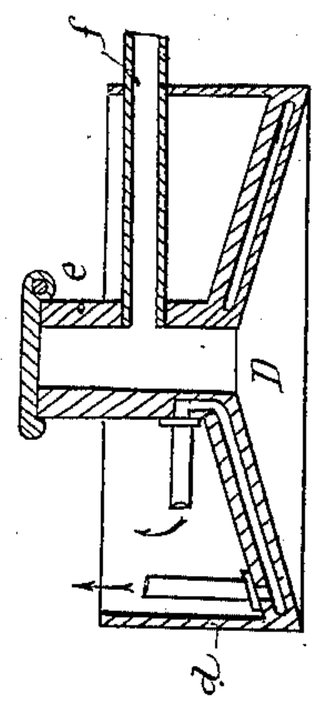

FIG. 3.

FIG. 1.

Witnesses

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HERMANN BECKER, OF PARIS, FRANCE.

ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 663,719, dated December 11, 1900.

Application filed June 26, 1899. Serial No. 721,883. (No model.)

To all whom it may concern:

Be it known that I, HERMANN BECKER, chemical engineer, a citizen of the Swiss Republic, residing at Paris, in the Republic of France, have invented certain new and useful Improvements in Electrolytic Apparatuses for Extracting Metals Lighter than the Electrolyte, (for which I have applied for Letters Patent in France, No. 284,125, dated December 17, 1898; in Germany, B. 24,129 IV/40, dated January 20, 1899; in Austria, No. 126, dated May 15, 1899, and in England, provisional protection, No. 11,678, filed June 5, 1899,) of which the following is a specification.

The present invention relates to an apparatus intended for the extraction of metals which in the electrolysis of their salts or oxids in fusion rise to the surface of the liquid mass; and it consists of an apparatus which enables the metals obtained to be easily collected, while preserving them from contact with air and preventing them from being redissolved in the electrolyte after having quitted the cathode. This result is obtained by means of a collecting-cone of metal suspended in the electrolyte above the cathode and which is in electric communication with the cathode.

In the accompanying drawings, Figure 1 is a vertical section of the apparatus; Fig. 2, an elevation showing a modification in the method of forming the cathode; Fig. 3, a vertical section of a modification in the method of forming the collecting-cone, and Fig. 4 a cross-section of the cathode on the line $x\ x$ of Fig. 2.

As may be seen in Fig. 1, the apparatus is composed of a metal vessel A, lined or otherwise, the bottom of which is provided with a large pipe a for giving passage to a rod b, on the end of which the cathode proper, B, is fixed. The lower end of the pipe a is closed by means of a cylindrical piece a' of insulating material—such as lava, porcelain, fireclay, or the like—perforated in the center with a hole, through which the rod b passes. The pipe a is surrounded or inclosed by a refrigerating jacket or sleeve having a double casing h or by any other suitable refrigerating arrangement. The refrigeration of the pipe a has for its object to render pasty and, if possible, solid the electrolyte contained therein, so as to avoid any leakage between the said tube and the plug or stopper a'.

The cathode B is formed of a metallic piece having a slightly-tapering shape, so as to facilitate the rise of globules of metal in a straight line to the surface of the bath, which globules of metal form on the surface of the said cathode; but it may assume any other suitable form answering the same purpose. Fig. 2 shows, for instance, a cathode of a special form comprising a certain number of rectangular, square, or round bars b', cast in one piece with the base b^2, which is fixed to the end of the rod b. This arrangement allows of the cathode-surface being considerably increased, and consequently of the metal produced being concentrated in a limited space at the surface of the bath.

The anode C, of annular form, entirely surrounds the cathode. It may be in one or more pieces. It is made of agglomerated retort-carbon or of metal, according to the nature of the electrolyte. This anode is suspended by one or more rods c, which serve as conductors and which are fixed to the outer surface of the anode or the constituent parts of the anode in such a way that there is a greater space between the rod of the anode and the cathode than between the anode itself and the cathode. The anode must not be immersed down to the bottom of the vat. It must be, at the most, at the same height as the cathode. Above this cathode there is suspended a metallic piece of conical form, insulated from the apparatus, and which is designed to collect the globules of metal which rise to the surface of the electrolyte. This collecting-cone D has the form of a very wide recessed shade or reflector and is provided with a vertical or approximately-vertical flange or raised edge d. It has a center tube e of sufficiently large diameter and having a thick wall. This tube e is closed by a heavy hinged lid, forming a valve, or in any other suitable manner, and is provided with a discharge-pipe f, slightly inclined, which passes through the wall of the electrolytic vessel. At the point where the discharge-pipe passes through the wall of the vessel it is insulated by means of a little tube or collar f', of asbestos or porcelain. The diameter of the collecting-cone must be a little greater than that of the cathode B and smaller than the diameter of the annular anode, so that the globules of metal which are detached from the cathode

all come under the collecting-cone, and the gases which are released at the anode can pass outside this cone. The collecting-cone must not be immersed too deeply in the electrolyte, so that the latter cannot extend above the edge *d* and cover the collecting-cone, the upper face of which is always in contact with the air, thus preventing any abnormal increase in the temperature. When the temperature of the electrolyte with which the operation is carried out is too high, the collecting-cone may be chilled by causing cold air to arrive therein or by allowing water to drop therein, which water is immediately volatilized, or even by any other suitable system of refrigeration.

Fig. 3 represents a conical collector, in the wall of which a refrigerating gas or liquid may be caused to circulate. This refrigeration of the collecting-cone has for its object to lower the temperature of the liberated metal sufficiently to prevent its distillation and its oxidation on its exit from the discharge-pipe. The collecting-cone is connected in shunt with the negative conductor *g* by means of a resistance calculated in such a way that only a very small fraction of the total current can pass through it. It therefore plays the part of an auxiliary cathode, so that the metal liberated at the principal cathode and which rises into the collecting-cone becomes again negative during the time that it occupies in sliding over the lower face of the collecting-cone and rising in the pipe which conveys it to the discharge-opening. The passage of the metal from the principal cathode to the auxiliary cathode is so rapid that it cannot be redissolved in the electrolyte, and once it comes against the auxiliary cathode the metal forms part of the latter, so that it cannot be attacked by the bath. It must also be understood that the particular form of the collecting-cone shown in the drawings is not indispensable, as this part may assume any other suitable form fulfilling the same object.

If it be desired to collect the gas which is liberated at the anode, it is sufficient to cover the apparatus with a suitable lid or cover provided with a discharge-pipe.

The apparatus is mounted on a frame or foundation of cast metal, bricks, or the like of any suitable form.

In this electrolytic apparatus the electrolyte is maintained in fusion by the heat developed by the passage of the current, which enables only the central part of the mass to be kept liquid and insures great durability for the apparatus. The metal which emerges by the discharge-pipe having been brought to a suitable temperature by one of the systems of refrigeration hereinbefore described may, if not very oxidizable, be received in an ingot-mold of any suitable form placed beneath the end of the discharge-pipe. If the metal is too oxidizable, an ingot-mold is employed which is almost hermetically closed and provided at its upper part with an opening in which the end of the discharge-pipe can enter.

This apparatus is intended for the extraction by electrolysis of metals lighter than their electrolyte, and, for instance, for its application to the extraction of sodium I proceed as follows: Soda, soda carbonate, or sodium chlorid is taken as electrolyte. The pipe of the electrolytic vessel is cooled by means of a suitable refrigerating-sleeve, while the tapered collector on the other side is cooled by contact with the air. As sodium is very likely to oxidize, a closed ingot-mold adapted to the end of the pipe is used for collecting it.

I claim as my invention—

1. In an electrolytic apparatus for the separation of metals lighter than the electrolyte from which they are extracted, a collecting device D of metal of a recessed conical form having its internal face in position to be immersed in the electrolyte in fusion above the cathode with its upper face uncovered by the electrolyte, in combination with a vessel A having a contracted part *a* at its lower end, means for cooling said contracted part, an insulating-stopper *a'* traversed by a support for the cathode B said cathode having a tapering external surface for facilitating the rise of the globules of metal, an anode C surrounding the cathode B suitable electric conductors for connecting the anode and the cathode with the means for producing the electricity, and a conductor for connecting in shunt the collector D, substantially as hereinbefore described and for the purpose set forth.

2. In an electrolytic apparatus for the separation of metals lighter than the electrolyte from which they are extracted, a collecting device D of metal of a recessed conical form having its internal face in position to be immersed in the electrolyte in fusion above the cathode, with its upper face uncovered by the electrolyte and having a chamber for receiving a current of cooling-water, in combination with a vessel A having a contracted part *a* at its lower end, means for cooling said contracted part, an insulating-stopper *a'* traversed by a support for the cathode B, a cathode B having a tapering external surface for facilitating the rise of the globules of metal, an anode C surrounding the cathode B, suitable electric conductors for connecting the anode and the cathode with the means for producing the electricity, and a conductor for connecting in shunt the collector D to the current-conductor feeding the cathode B substantially as hereinbefore described and for the purpose set forth.

In witness whereof I have hereunto signed my name, this 12th day of June, 1899, in the presence of two subscribing witnesses.

HERMANN BECKER.

Witnesses:

LOUIS CHAVUNEZ,

HENRI WALDVOGEL.