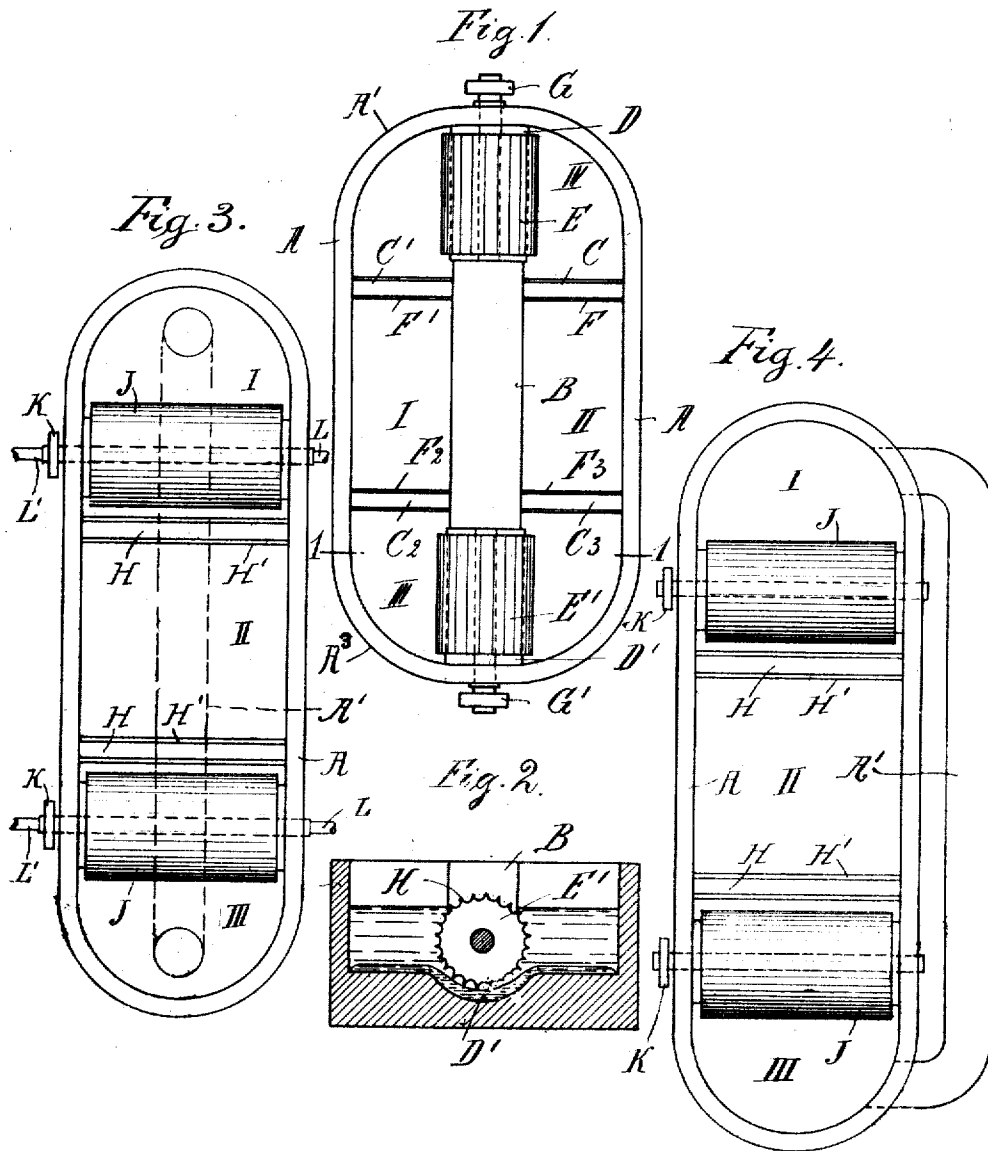


R. FRANK.
 APPARATUS FOR MERCURIAL DECOMPOSITION OF ALKALINE CHLORIDS.
 APPLICATION FILED JAN. 30, 1911.

1,009,061.

Patented Nov. 21, 1911.
 2 SHEETS—SHEET 1.



Witnesses:
 Corinne Myers.
 Eva Paulsen

Inventor:
 Rudolf Frank
 by L. K. Böhm,
 Attorney

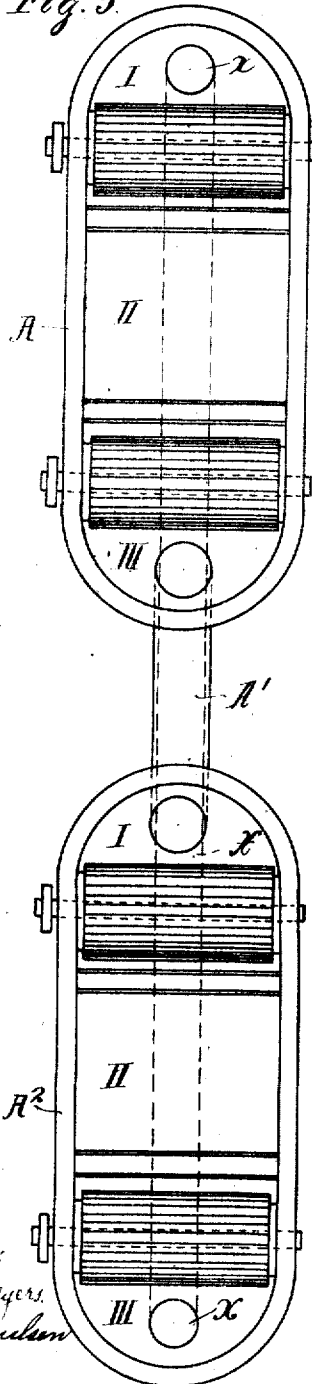
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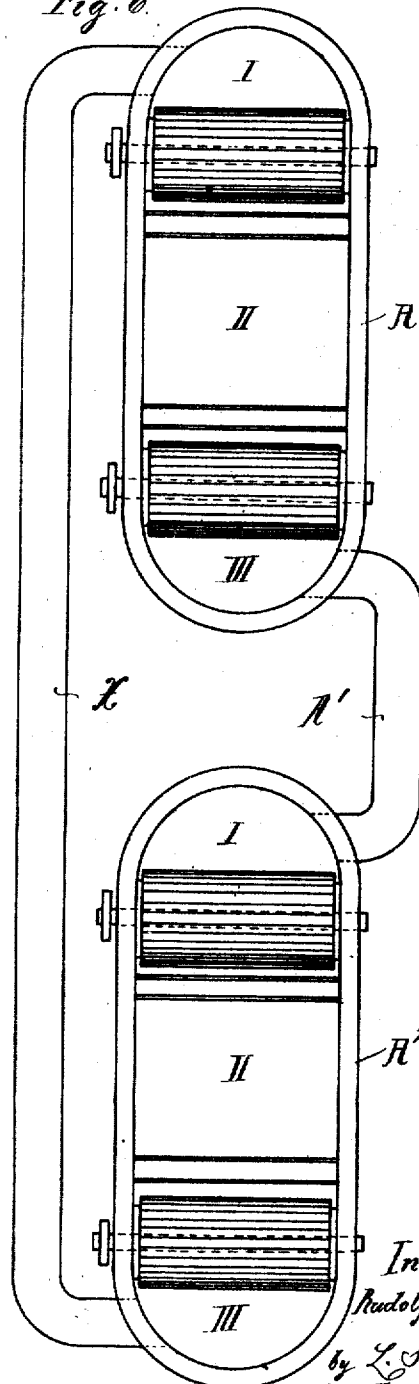
2 SHEETS-SHEET 2.

Fig. 5.



Witnesses:
 Corinne Myers,
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Fig. 6.



Inventor:
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 Attorney

UNITED STATES PATENT OFFICE.

RUDOLF FRANK, OF GRUNEWALD, NEAR BERLIN, GERMANY.

APPARATUS FOR MERCURIAL DECOMPOSITION OF ALKALINE CHLORIDS.

1,009,061.

Specification of Letters Patent. Patented Nov. 21, 1911.

Application filed January 30, 1911. Serial No. 605,416.

To all whom it may concern:

Be it known that I, RUDOLF FRANK, a subject of the Emperor of Austria-Hungary, and resident of 48 Hubertus-Allee, Grunewald, near Berlin, German Empire, doctor of chemical science, have invented Improvements in Apparatus for Mercurial Decomposition of Alkaline Chlorids, of which the following is a specification.

This invention relates to an improved electrolytic apparatus for the mercurial decomposition of alkaline chlorids. The mercurial decomposition of alkaline chlorids is one of the simplest and best methods of electrolysis which have been devised for, and taken up by, large manufacturing plants. There are two principal kinds of such apparatus viz: those having immovable mercurial cathodes and those having movable mercurial cathodes.

My invention relates to apparatus of the movable mercurial cathode type and to the means for giving a continuous uniform movement thereto and also to provide an apparatus which particularly enables the employment of currents of high intensities.

In the drawings several constructional forms of the invention are illustrated by way of example.

Figure 1 is a plan view of one constructional form of apparatus according to the invention, with the cover and anodes removed. Fig. 2 is a vertical section according to the line 1-1 in Fig. 1. Fig. 3 is a view similar to Fig. 1 showing a modified form of my invention in which only one amalgamating cell is provided. Fig. 4 is a similar view to Fig. 3 showing a slightly modified construction of the same. Fig. 5 is a plan view similar to Fig. 3 showing two such electrolytic apparatus connected together. Fig. 6 is a view similar to Fig. 5 showing a slightly modified construction of same.

Referring to Figs. 1 and 2 of the drawings: A is the electrolytic receptacle which is preferably approximately rectangular in shape but has rounded ends A^a , the bottom of the receptacle being preferably horizontal. A vertical partition B is arranged longitudinally therein but does not extend to the circular ends A^a , and by means of transverse partitions c , c^1 , c^2 and c^3 arranged in proximity to the ends of the partition B, the vessel A is divided into four compartments or cells I, II, III and IV. In the

bottom of the receptacle A four grooves F , F^1 , F^2 , F^3 are provided, into which the partitions C , C^1 , C^2 and C^3 are so inserted that they do not engage the bottom of the grooves. Four slots are thus provided, which form traps between the different compartments but allow the passage of the mercury. The electrolysis of the alkaline-chlorid is effected in the cells I and II and the amalgam formed therein at the cathode is decomposed by water in the cells III and IV and alkaline hydrate generated. The bottom of the receptacle A is covered with mercury which also fills the grooves F beneath the partitions C , C^1 , C^2 and C^3 . During the electrolytic action the whole layer of mercury must be uniformly moved through all the compartments or cells in order to convey the amalgam formed in the compartments I and II into the compartments III and IV for decomposition, as well as to return the regenerated mercury from the compartments III and IV to the amalgamating or electrolytic compartments I and II. This movement of the mercury is attained in a very simple and perfect manner by providing the compartments or cells III and IV with cavities D , D^1 in which fluted, ribbed or like drums E , E^1 revolve, their ribs H (see Fig. 2) uniformly propelling the mercury in the cavities D . The drums are driven in opposite directions by means of pulleys G , G^1 . The vessel A is closed by means of an air-tight cover provided with outlet pipes for the chlorine and hydrogen gases generated, and the compartments or cells I and II are provided with suitable anodes dipping into the alkaline chlorid therein and arranged opposite the layer of mercury which forms the cathode.

The electrolytical decomposition takes place in the following manner: The cells I and II are, *e. g.*, filled with a solution of sodium chlorid which may be renewed in any suitable manner. The cells III and IV are provided with water or a solution of a sodium salt. In the cells III and IV, and above the mercury, so-called secondary electrodes may also be provided, short circuited with the mercury therein, for the purpose of quicker decomposition of the amalgam. The drums E , E^1 are caused to revolve and thereby the layer of mercury in the whole apparatus is propelled uniformly and thus caused to circulate through the cells. The velocity of this movement may be controlled

by varying the speed of the drums E, E'. When the drums E, E' are uniformly rotated the movement of the mercury is continuous and uniform, and an interruption of the movement or an unequal distribution of the mercury is avoided. For this movement only a minimum of power is required. The mercury from the cell IV flows through the slot beneath the partition C' into the electrolytic amalgamating compartment I where it is enriched with the cathion, the generated amalgam being conveyed through the slot under the partition C' into the decomposing compartment III. In this compartment or cell the amalgam is decomposed by the water contained therein and sodium hydrate generated thereby. This action may be aided by the use of short-circuited secondary electrodes, such as hereinbefore described. The regenerated mercury flows through the slot under the partition C' into the electrolytic cell or amalgamating compartment II where it is again enriched with amalgam which enters into the compartment IV through the slot under the partition C, where the amalgam is decomposed as in the compartment or cell III. The chlorine gas generated during the decomposition in the compartments I and II as well as the hydrogen generated in the compartments III and IV are led away by any suitable conduits.

Referring now to Figs. 3 and 4 of the drawings: In these constructions the vessel A is divided into only three compartments I, II and III by means of transverse partitions H, the bottom of the vessel A having grooves H' below the partitions H in the manner described with reference to Figs. 1 and 2. The compartments I and III are connected together by a pipe or conduit A' which may either pass below the vessel A (Fig. 3) or be arranged laterally thereof (Fig. 4). The layer of mercury in the vessel A is propelled from the compartment I through the compartment II to the compartment III and from thence returned to the compartment I by way of the conduit A' (or vice-versa) by means of ribbed or fluted drums J rotatably mounted in the compartments I and III and working in cavities therein in the manner described with reference to Figs. 1 and 2, the drums J being rotated in the same direction by means of a belt passing over pulleys K on the axles of the drums J. In order to accelerate the decomposition of the amalgam, the drums J may be hollow and heated by steam, steam inlet-pipes and outlet pipes L' being provided for this purpose.

As shown at Figs. 5 and 6 two such vessels A and A' may be connected together, the compartment III of one vessel A communicating with the compartment I of the vessel A' by way of a pipe or conduit A' and the

compartment III of the vessel A' communicating with the compartment I of the vessel A by way of a pipe or conduit X said pipes or conduits A' and X being either arranged below (Fig. 5), or laterally of (Fig. 6), the vessels A and A', the vessels A and A' being arranged with their bottom surfaces in the same horizontal plane. In these constructions the mercury from the compartment III of the vessel A will be delivered to the compartment I of the vessel A' while the mercury from the compartment III of the vessel A' will be delivered to the compartment I of the vessel A.

It will thus be seen that in all these constructions the mercury is not lifted from one level to another but is propelled in a closed circuit in a horizontal plane.

Apparatus according to the invention have the great advantage that the mercury does not flow over any oblique surface but forms a single very thin horizontal layer which is not raised by any complicated lifting device, but is uniformly propelled by rotating drums. The individual compartments or cells may have any desired size. It will be evident that the compartments or cells III and IV may be employed as amalgamating compartments and the compartments I and II as mercury regenerating cells. It is also evident that any desired number of compartments or cells may be used provided that between each two electrolytic cells there is a mercury regenerating cell, in which the rotating drum E for propelling the mercury may be arranged.

I claim:—

1. In an apparatus for the mercurial decomposition of alkaline chlorides, a vessel containing the mercury and having a horizontal bottom, partitions in said vessel dividing the same into amalgamating and dealamalgamating compartments which alternate with and are in communication with one another below said partitions, a cavity in the bottom of said vessel and mechanical means for propelling the mercury over the bottom of said vessel through said compartments in a horizontal plane and in a closed circuit without lifting the mercury, said means comprising a ribbed drum fitting in said cavity and adapted to be rotated.

2. In an apparatus for the mercurial decomposition of alkaline chlorides, a vessel containing the mercury and having a horizontal bottom, partitions in said vessel dividing the same into amalgamating and dealamalgamating compartments which alternate with and are in communication with one another below said partitions, a cavity in the bottom of said vessel and in said dealamalgamating compartment, and mechanical means for propelling the mercury over the bottom of said vessel through said compartments in a horizontal plane and in a

closed circuit without lifting the mercury, said means comprising a ribbed drum fitting in said cavity and adapted to be rotated.

3. In an apparatus for the mercurial decomposition of alkaline chlorids, a vessel containing the mercury and having a horizontal bottom, partitions in said vessel dividing the same into amalgamating and deamalgamating compartments which alternate with and are in communication with one another below said partitions, a cavity in the bottom of said vessel and in said deamalgamating compartment, mechanical means for propelling the mercury over the bottom of said vessel through said compartments in a horizontal plane without lifting the mercury, said means comprising a ribbed drum fitting in said cavity and adapted to be rotated, and a conduit for returning the mercury to the cavity so as to form a closed circuit for the mercury.

4. In an apparatus for the mercurial de-

composition of alkaline chlorids, a series of amalgamating and deamalgamating compartments alternating with and in communication with one another and each having a horizontal bottom arranged in the same horizontal plane, cavities in the bottom of said deamalgamating compartments, mechanical means for propelling the mercury over the bottom of said compartments in a horizontal plane, without lifting the mercury, said means comprising a series of ribbed drums fitting in said cavities and adapted to be rotated, and a conduit for returning the mercury from the last compartment of the series to the first cavity of the series so as to form a closed circuit for the mercury.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

RUDOLF FRANK.

Witnesses:

WOLDEMAR HAUPT,
HENRY HASPER.