No. 669,441. Patented Mar. 5, 1901.

H. A. FRASCH.

METHOD OF PRODUCING ALKALI BY ELECTROLYSIS.

(Application filed Aug. 16, 1900.)

(No Model.)

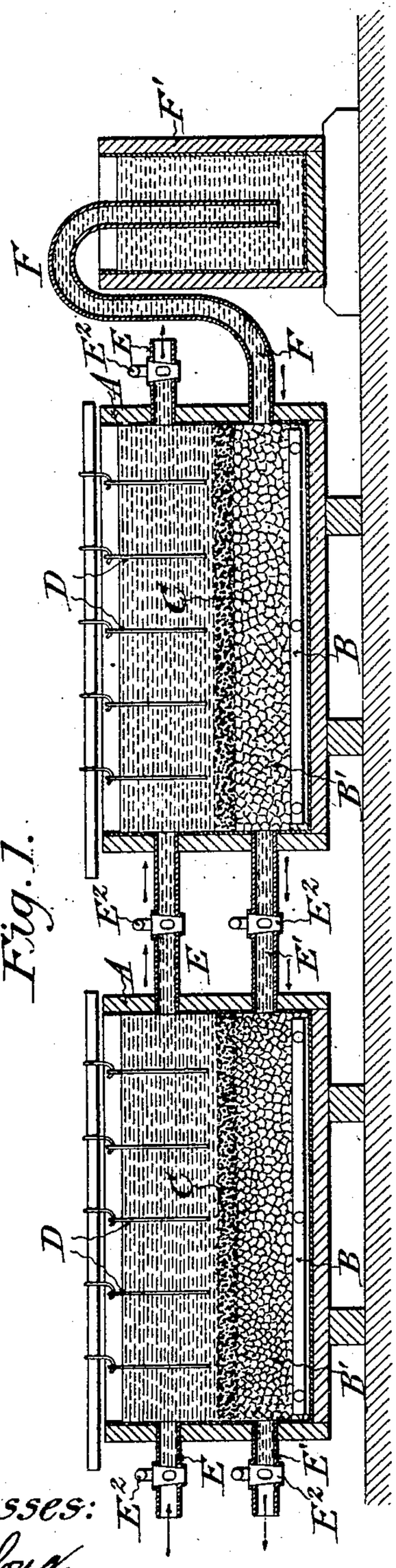

Fig. 1.

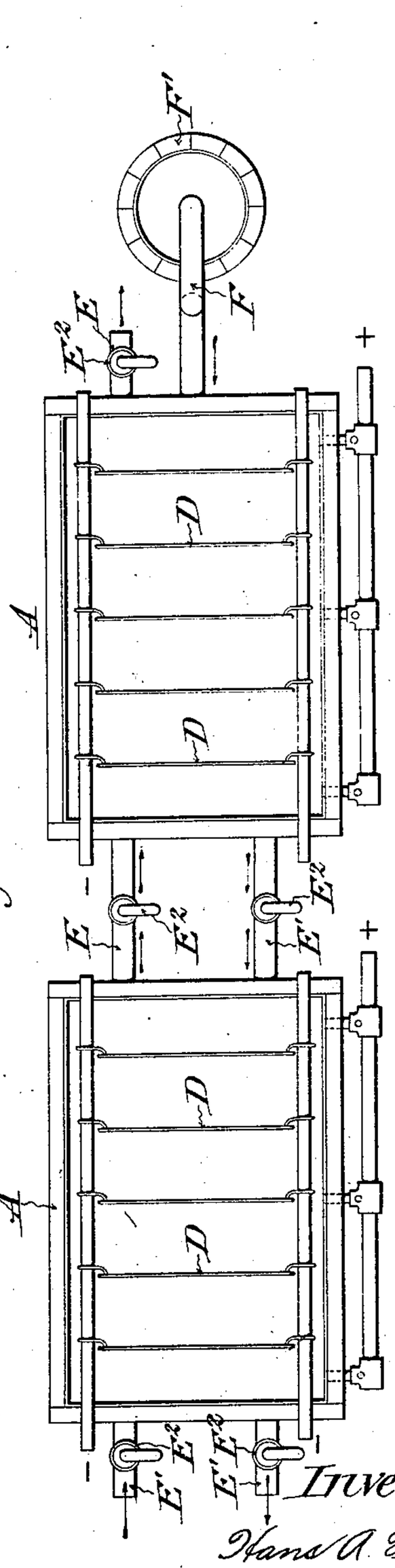

Fig. 2.

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UNITED STATES PATENT OFFICE.

HANS A. FRASCH, OF HAMILTON, CANADA.

METHOD OF PRODUCING ALKALI BY ELECTROLYSIS.

SPECIFICATION forming part of Letters Patent No. 669,441, dated March 5, 1901.

Application filed August 16, 1900. Serial No. 27,099. (No specimens.)

To all whom it may concern:

Be it known that I, HANS A. FRASCH, a citizen of the United States, residing at Hamilton, in the county of Wentworth and Province of Ontario, Canada, have invented a certain new and useful Improvement in Methods of Producing Alkali by Electrolysis, of which the following is a full, clear, and exact description.

This invention relates to the electrolytic production of alkali from common salt or any other salt of an alkali.

The customary method of producing alkali from the salts of alkalies consists in decomposing the salt, such as common salt, (sodium chlorid,) by the electric current in such a manner that caustic soda is formed at the cathode and free chlorin is formed at the anode. Various methods are employed to keep the chlorin separate from the alkali, diaphragms being mostly used. In some instances the alkali is obtained by the use of a mercury cathode, whereby an amalgam of sodium and mercury is obtained, while free chlorin is separated.

In carrying out my invention I separate halogen or mineral acids from the corresponding alkali salts by binding the acids or chlorin *in statu nascendi* to metals which form a part or the whole of an anode in an electrolytic bath. If, for instance, a solution such as sodium chlorid is subjected to an electric current in presence of an anode consisting of a metal-bearing substance, such as copper and nickel matte, the cathode, consisting of any substance conducting the electric current—chlorid of copper, nickel, iron, &c.—is formed at the anode, while caustic soda is produced at the cathode. In this way two valuable products are obtained in one and the same operation—viz., the chlorid of copper and nickel, which may be subjected to an electric current and the metals separated and refined, and caustic soda, which in itself forms a valuable marketable product.

One of the advantages of my invention consists in recovering simultaneously caustic alkali and the salts of metals from ores or matte.

Having thus stated the principle of my invention, I will proceed now to describe the same in detail and then will particularly point out and distinctly claim the part or improvement which I claim as my invention.

In the accompanying drawings, illustrating my invention, in the two figures of which like parts are similarly designated, Figure 1 is a sectional elevation of one form of apparatus for carrying out my invention, and Fig. 2 is a plan view thereof.

To carry out my invention—for instance, to obtain caustic soda by the decomposition of common salt—the apparatus as shown in the accompanying drawings may be used, though I do not limit the invention to the kind of apparatus shown and described.

The tank or vessel A, of suitable construction, has an electric conductor B extending over its bottom, which conductor may be a layer of carbon plates or simply a number of conductors composed of a material capable of conducting the electric current and which is not affected by chlorin. This conductor of carbon plates or other conductive substance is covered with or embedded in a layer of disintegrated matte or ore B′, bearing the metal or metals to be extracted and the chlorids of which should be obtained. This layer of matte or ore, being an electric conductor in itself, takes the current and forms an anode extending over the whole bottom of the vessel A, and above this layer of matte, which may be of any desired fineness, the diaphragm C, preferably sand, ground quartz, or other silicious or electrically neutral or inert material, is located. While this diaphragm is not an absolute necessity to carry out my process, I prefer the use of it, as otherwise the electrolyte is easily disturbed.

D are cathodes suspended in any suitable and easily-removable manner within the tank. They may consist of carbon, copper, or any other suitable substance.

E E′ are pipes provided with suitable stopcocks or valves E^2, by which the electrolytic solution may be withdrawn or replaced from either beneath or above the diaphragm.

In carrying out my invention the vessel A is filled with salt brine, previously purified, and the whole is subjected to electrolysis, when the chlorin liberated at and within the anode B reacts with the metals contained in the anode, forming the corresponding chlorids, while caustic soda is obtained above the dia-

phragm at the cathode. The electrolysis is conducted until the sodium has been decomposed, when the caustic-soda solution is withdrawn from above the diaphragm by the pipe E and replaced by fresh salt solution. This is repeated until the metals represented in the anode are transformed to chlorids. When the solution is drawn off and the chlorids removed, the tank may be recharged with fresh matte or ore. At any time during the procedure of the process the solution of the chlorids may be withdrawn from beneath the diaphragm through the pipe E', while the corresponding amount of fresh sodium solution is automatically supplied by the siphon F from a suitable supply tank or vessel F'. In carrying out this process a series of tanks may be connected and arranged in such a manner that the electrolyte flows from one tank to and through the next in series, and I have herein shown two tanks connected up in series. The solution of the metals may be made to flow in one direction, as shown in Fig. 1, below the diaphragm C, while the alkali solution may flow in opposite direction above the diaphragm C, as indicated by the arrows. In this manner in one operation caustic soda and the chlorids of metals which are desired to be extracted from ores or matte may be obtained to be subjected to electrolysis in any approved manner. Sulfate of soda or any other salt of sodium or potassium may be used for the electrolyte in place of sodium chlorid.

In place of disintegrating the matte the latter may be used in shape of sheets or bars or in any other form.

So much of the process or method herein described as relates to the extracting or recovering of metals forms the subject of my application for patent entitled "Method of recovering metals by electrolysis," filed July 30, 1900, Serial No. 25,293.

What I claim is—

1. The process of producing alkali and extracting metals from ores and metal-bearing mineral substances, consisting in electrolyzing a solution of the salt of an alkali in presence of an anode composed of the disintegrated ores or metal-bearing mineral substance containing the metal to be extracted, and a suitable cathode, conducting a supply of solution of a salt of an alkali both to the anode and the cathode and displacing the metallic solution obtained at the anode and the solution of caustic alkali produced at the cathode, substantially as described.

2. The method of decomposing by an electric current a salt of an alkali and producing caustic alkali while extracting metals from mineral substances, consisting in electrolyzing in one and the same vessel a solution of a salt of an alkali in presence of an anode composed of a disintegrated metal-bearing mineral substance above which a cathode is arranged, delivering into the upper section of the vessel to the cathode the solution of the salt of the alkali, withdrawing the alkali there produced above the anode, and delivering below the cathode an independent supply of the solution of the salt of the alkali to the anode in the lower section of the vessel and withdrawing therefrom the metallic solution obtained at the anode, substantially as described.

3. The method of producing alkali and extracting metals from matte or ore, by electrolysis, which consists in disintegrating or pulverizing the metal-bearing matte or ore so as to render it freely permeable by the electrolyte, distributing such mass over the bottom of the vessel in which the electrolysis is conducted and utilizing it as an anode, covering it with a granular electrically-neutral substance, and circulating an electrolyte of a salt of an alkali through the mass of the anode below the neutral substance and in contact with the cathode above the neutral substance and electrolyzing the solution of the salt of an alkali, and thereby producing free alkali about the cathode.

4. The method of extracting metals from metal-bearing mineral substances and simultaneously producing alkali by electrolysis, which consists in electrolyzing a solution of a salt of an alkali, in presence of an anode of the mineral substance containing the metals to be extracted, covered with a granular, permeable electrically-neutral substance, and a cathode suspended in the electrolyte, and circulating the electrolyte at will below and above the electrically-neutral substance.

5. In the process of producing alkali and extracting metals from matte or ore by electrolysis, disintegrating or pulverizing the metal-bearing matte or ore so as to render it freely permeable, distributing such substance over the bottom of the vessel in which the electrolysis is conducted, utilizing it as an anode covering it with a permeable granular electrically-neutral substance and electrolyzing a solution of a salt of an alkali in said vessel.

6. In the process of producing alkali and extracting metals from matte or ore, by electrolysis, disintegrating or pulverizing the metal-bearing matte or ore so as to render it freely permeable by the electrolyte, distributing such mass over the bottom of the vessel in which the electrolysis is conducted and utilizing it as an anode, covering it with a granular permeable electrically-neutral substance and circulating an electrolyte capable of combining with the metals to be extracted through the anode below the neutral substance and in contact with the cathode above the neutral substance and subjecting it to the action of an electric current.

7. In the process of producing alkali and extracting metals from matte or ore, by electrolysis, disintegrating or pulverizing the metal-bearing matte or ore so as to render it freely permeable by the electrotyte, distributing such mass over the bottom of the vessel in which the electrolysis is conducted and

utilizing it as an anode, covering it with a granular, permeable, electrically-neutral substance and circulating an electrolyte capable of combining with the metals to be extracted through the anode below the neutral substance and electrolyzing a solution of the salt of an alkali in contact with the cathode above the neutral substance.

In testimony whereof I have hereunto set my hand this 14th day of August, A. D. 1900.

HANS A. FRASCH.

Witnesses:
E. A. FINCKEL,
CHAS. H. BAKER.