

No. 669,440.

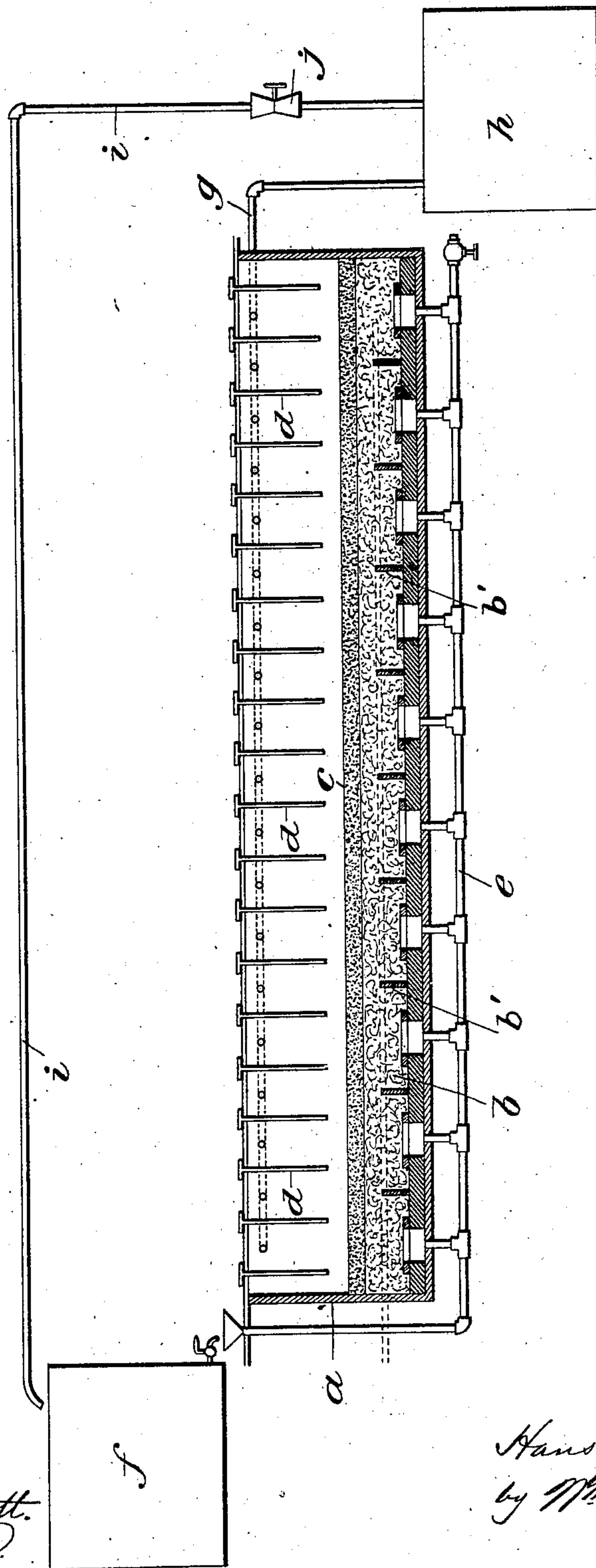
Patented Mar. 5, 1901.

H. A. FRASCH.

METHOD OF RECOVERING METALS BY ELECTROLYSIS.

(Application filed July 30, 1900.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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METHOD OF RECOVERING METALS BY ELECTROLYSIS.

SPECIFICATION forming part of Letters Patent No. 669,440, dated March 5, 1901.

Application filed July 30, 1900. Serial No. 25,293. (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 Recovering Metals by Electrolysis, of which the following is a full, clear, and exact description.

This invention relates to the electrolytic separation, recovery, or refining of metals, such as copper, nickel, cobalt, and others.

In the extraction of metals from matte or ores by the electric current the electrolytic solutions are obtained by the action of mineral or halogen acids upon matte or ores, either by direct chemical action or by means of an electric current, and the solutions of the sulfates or chlorids which constitute the electrolyte are more or less impure. In my invention I produce an electrolyte of greater purity and obtain the direct extraction and reduction of those metals whose hydroxids are soluble in alkalis or ammonia by the direct action of an electric current upon a salt of ammonium in presence of an anode containing the metal to be obtained, the ammonium salt being recovered and used over again. For example, if ammonium sulfate be used as the electrolyte in presence of a copper or nickel bearing anode, copper or nickel ammonium sulfate is formed and the metal is deposited on the cathode, whence it may be recovered, while the ammonium sulfate is re-formed. By this means all the metals and substances contained in the anode which are not soluble in ammonia remain undissolved and the copper or nickel is obtained without purification of the electrolyte.

Instead of ammonium sulfate the chlorid or any other ammonium salt or any salt of an alkali may be used which is capable of forming a double salt with the metal to be extracted.

The invention comprehends a method of producing an electrolyte of metals whose hydroxids are soluble in ammonia by percolating a solution of a salt of ammonia through an anode composed of disintegrated substance bearing the metal to be extracted and decomposing the salt of ammonia in the presence of a cathode by the action of an electric cur-

rent and successively circulating the solution through the anode and past the cathode, as I will proceed now more particularly to describe and finally claim.

In the accompanying drawing I have shown in vertical section one form of apparatus by which my method may be carried out, and in my concurrent case, Serial No. 25,292, filed July 30, 1900, is another and similar apparatus; but I do not limit the invention in this case to the kind of apparatus employed.

The tank or vessel *a*, of suitable construction, has the anode *b* in its bottom, and this anode is composed of a layer of disintegrated matte or ore bearing the metal or metals to be extracted, to which the current is conducted by means of carbon rods or other usual conductors *b'*. Above this layer is the diaphragm *c*, preferably sand, ground quartz, or other silicious or electrically neutral or inert material.

d represents the cathodes, suspended in any suitable and easily-removable manner within the tank. These cathodes, preferably, are made of the kind of metal to be extracted, but may be of iron, carbon, or other suitable material.

e is a pipe by which the electrolytic solution may be introduced beneath and through the permeable anode from a tank or holder *f*, and *g* is an overflow-pipe opening from the upper portion of the tank and between the cathodes and leading to a receiver *h*.

The electrolytic solution is placed in the vessel *f*, whence it is introduced into the pipe *e*, and thence discharged by hydrostatic or other pressure into and through the anode, permeating the matte and itself being saturated and depositing the metal on the cathodes. The overflowing electrolyte is conveyed by pipe *g* to the receiver *h* and is pumped or otherwise returned to the holder *f* through pipe *i* and a suitable forcing apparatus, pump, ejector, or other medium *j* and thence reused in the vessel.

Instead of conducting the electrolyte to a receiver or holder it may be made to circulate directly through the electrolyzing apparatus.

What I claim is—

1. The method of producing an electrolyte of metals whose hydroxids are soluble in ammonia, which consists in percolating a solu-

tion of a salt of ammonia through an anode composed of disintegrated substance bearing the metal to be extracted, and in presence of a cathode decomposing the salt of ammonia by the action of an electric current, and circulating the solution successively through the anode and past the cathode.

2. The method of recovering metals whose hydroxids are soluble in ammonia, from matte or ore, by electrolysis, which consists in disintegrating or pulverizing metal-bearing matte or ore, so as to render it freely permeable by an electrolyte capable of combining with the metal or metals to be extracted, distributing such mass over the bottom of the vessel in which the electrolysis is conducted in connection with electric conductors to constitute an anode, covering such anode with a granular, permeable, electrically-neutral substance, and passing an electric current between the anode and a suitable cathode.

3. The method of recovering metals whose hydroxids are soluble in ammonia, from matte or ore, by electrolysis, which consists in disintegrating or pulverizing metal-bearing matte or ore so as to render it freely permeable by an electrolyte capable of combining with the metal or metals to be extracted, distributing such mass over the bottom of the vessel in which the electrolysis is conducted and in connection with electric conductors to constitute an anode, covering said anode with a granular, permeable, electrically-neutral substance, circulating an electrolyte through the anode and the neutral substance and

in contact with the cathode, and passing an electric current between the anode and the cathode.

4. The method of recovering copper and nickel, from matte or ore, by electrolysis, which consists in disintegrating or pulverizing metal-bearing matte or ore so as to render it freely permeable by an electrolyte capable of combining with the metal or metals to be extracted, distributing such mass over the bottom of the vessel in which the electrolysis is conducted and in connection with electric conductors to constitute an anode, covering said anode with a granular, permeable, electrically-neutral substance, suspending in the electrolyte a number of cathode-plates by and upon which the metal is collected, and passing an electric current between anode and cathode.

5. The method of producing an electrolyte and recovering metals from ore or matte, which consists in circulating an electrolyte capable of combining with the metal or metals so extracted successively through disintegrated matte or ore bearing the metal or metals to be extracted, a permeable diaphragm, and past the cathodes and at the same time subjecting the electrolyte to an electric current.

In testimony whereof I have hereunto set my hand this 27th day of July, A. D. 1900.

HANS A. FRASCH.

Witnesses:

WM. H. FINCKEL,

C. A. NEALE.