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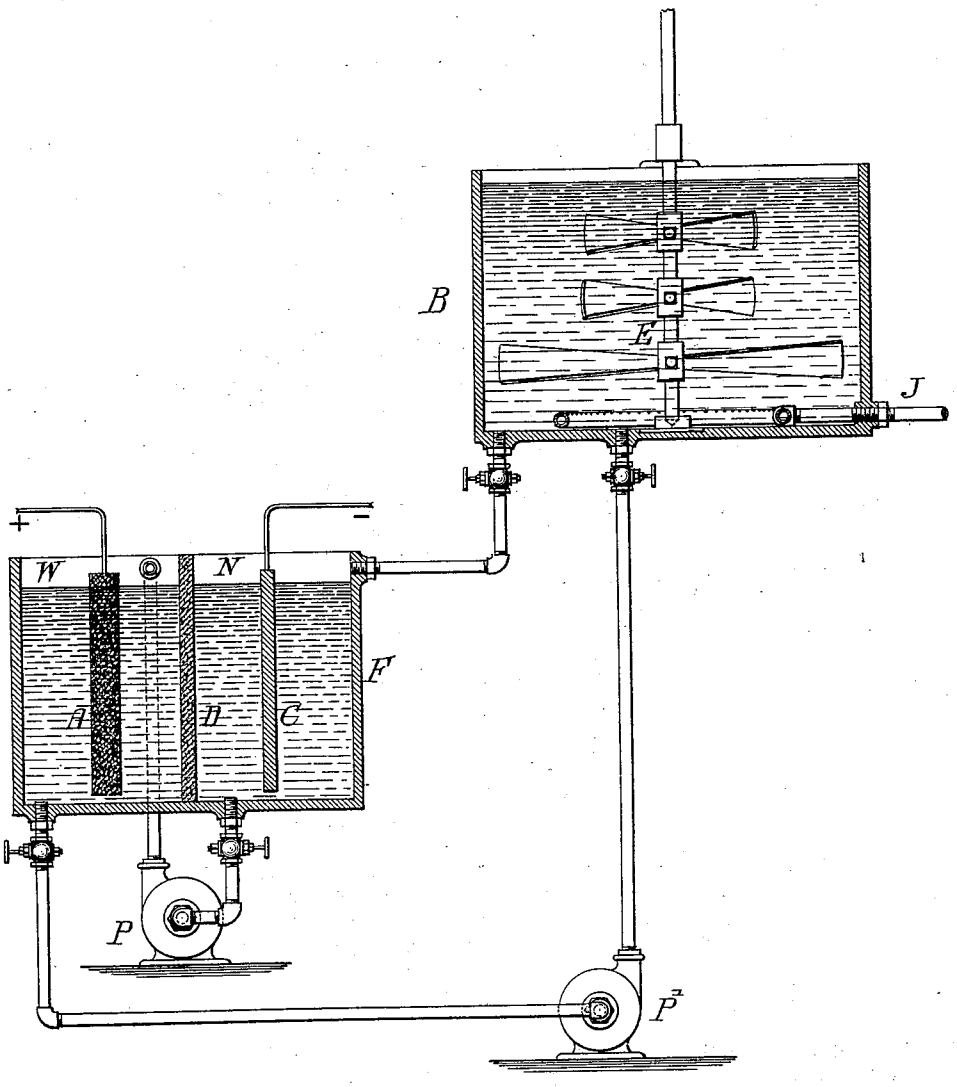
S. S. SADTLER.

PROCESS OF EXTRACTING METALS FROM ORES AND SCRAP CONTAINING SAME.

(Application filed July 10, 1900. Renewed Apr. 11, 1902.)

(No Model.)



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UNITED STATES PATENT OFFICE.

SAMUEL S. SADTLER, OF PHILADELPHIA, PENNSYLVANIA.

PROCESS OF EXTRACTING METALS FROM ORES AND SCRAP CONTAINING SAME.

SPECIFICATION forming part of Letters Patent No. 700,563, dated May 20, 1902.

Application filed July 10, 1900. Renewed April 11, 1902. Serial No. 102,457. (No specimens.)

To all whom it may concern:

Be it known that I, SAMUEL S. SADTLER, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Processes of Extracting Metals from Ores and Scrap Containing the Same, of which the following is a specification.

My invention relates to certain improvements in the process of extracting zinc and other metals from native sulfid ores, and has for its object the obtaining of the metals in a high state of purity, with sulfur as a by-product, at a comparatively small expense.

The accompanying figure shows one arrangement of apparatus for carrying out my improved process.

In the case of the native sulfid of zinc, known generally as "zinc-blende," the ore concentrate is ground to such a fineness that it will pass through a sieve of about two hundred mesh. It is then placed in a tank, preferably of the form shown at B, provided with means of agitation E, and a calculated amount of solution of caustic soda of about ten-per-cent. strength is run in. Chlorin gas is then caused to enter the tank from perforated pipe J, situated below the level of the alkaline solution, and hypochlorite of soda is thereby formed, the following reaction taking place:

$$2NaOH+2Cl=NaOCl+NaCl+H_2O.$$

This in turn causes a solution of the zinc of the ore with the formation of zincate of soda and the separation of sulfur, substantially as shown in the following reaction:

$$ZnS+NaOCl+2NaOH=Zn(ONa)_2+NaCl+H_2O+S.$$

The liquid rendered turbid by the separated sulfur is allowed to settle, preferably, in another tank, and when clear is run into the cathode-compartment N of the electrolyzer F.

The anode-compartment W is separated from that containing the cathode by a porous diaphragm (shown at D) and is preferably filled with a solution from which the zinc has been previously deposited in the cathode-compartment. This may, however, be a fresh alkaline solution containing sodium chlorid with an excess of caustic soda. A current of electricity from any suitable source of electrical energy is passed through the two solutions, entering at the anode A and leaving at the cathode C, and zinc is deposited on the cathode until the maximum amount of chlorin that can be dissolved by the solution has been formed at the anode. The following shows the double decomposition which takes place:

$$Zn(ONa)_2+2NaCl+2H_2O=Zn+2Cl+4NaOH.$$

As the metal to be obtained by the use of my process is deposited from double salts it is readily obtained as a smooth coherent deposit, in the case of zinc capable of being rolled into sheets or melted into spelter. This is due to the generally-admitted fact that the real cathion in this reaction is the alkali metal, (in the above-described process sodium,) which acts as soon as formed in a purely chemical way on the double salt in contact with the cathode-surface, thereby depositing the less positive metal, (zinc.)

The solution found at the end of the process in the anode-compartment, consisting, as it does, of sodium hypochlorite and sodium chlorid formed by the chlorin set free, with preferably an excess of sodium hydrate, is conveyed by suitable means to the dissolving-tank and is ready to be used on another charge of ore. The solution of sodium hydrate found in the cathode-compartment is similarly conveyed to the anode-compartment. It will be seen from the above description that my process is cyclic in its operation, the same solutions being used repeatedly.

In preparing the original hypochlorite solution and in carrying out the electrolytic deposition care must be taken to provide for the formation of hypochlorite instead of hypochlorate, it being understood by those skilled in the art that the formation of one or the other of these is largely dependent upon the temperature and concentration of the solutions.

It will be understood that I do not confine myself to the use of but single units in my arrangement of apparatus for the above process, since I may employ a number of dissolving tanks or vats and a battery of any convenient number of electrolyzers, each having one or more sets of anode and cathode compartments.

It will be noted that the metal obtained by my process is very pure, because only those metals whose oxids in the nascent state are soluble in caustic alkali can be in the solution.

While I prefer to use sodium hydrate as my alkali, it is obvious that a hydrate of any of the alkali metals may be used, and instead of chlorin being employed to form a hypochlorite bromin or other halogen may be used to form a hypobromite, &c., in the same way. Furthermore, I do not confine myself to forming my solutions by adding a halogen to a caustic alkali, but may obtain the same by direct electrolysis of a salt of a halogen with any particular alkali or mixtures of salts of halogens and alkali metals.

It will be seen that the above-described method of treating ore, which depends on a combined action of alkali and hypochlorite, is radically different from those processes in which the roasted ores are dissolved in acid solutions or by neutral and acid solutions with the help of oxidizing agents. In these zinc is dissolved by a simple salt and cannot for obvious reasons be deposited in a coherent smooth film, as is the case when it is formed in alkaline solutions from double salts.

This process is not confined to the treatment of zinc ore alone, as it may be used with similar advantages upon any ore of a metal whose oxid is capable of forming soluble compounds with the alkali-metal hydroxids. It will also be understood that the process is not confined to the extraction of these metals from their ores, as it may be applied with advantage to recovering them from galvanized iron, tin-scrap, zinc-crust, and from other similar combinations where the metal has been deposited as a film or covering over the surface of another metal.

I claim as my invention—

1. The process of obtaining the metals, whose oxids form soluble compounds with the alkali-metal hydroxids, from any material in which these metals are present, said process consisting in treating said material with a solution formed by treating a caustic alkali with one of the halogens and decomposing the resulting solution in an electrolytic cell, the metal being deposited on a suitable cathode, substantially as described.

2. The process of obtaining from their sulfid ores metals whose oxids form soluble compounds with the alkali-metal hydroxids, said process consisting in dissolving the ore in a solution formed by treating a solution of a caustic alkali with any one of the halogens, and decomposing the resulting solution in an electrolytic cell, substantially as described.

3. The process of extracting from their sulfid ores metals whose oxids form soluble compounds with the alkali-metal hydroxids, said process consisting in dissolving said ore in a solution formed by treating a solution of a caustic alkali with a halogen and decomposing the resulting solution in the cathode-compartment of an electrolytic cell, the anode-compartment being separated therefrom, and containing a solution of caustic alkali, substantially as described.

4. The process of extracting from their ores metals whose oxids are soluble in the alkali-metal hydroxids, said process consisting in dissolving said ore in a solution formed by treating a solution of caustic alkali with a halogen, decomposing the resulting solution in the cathode-compartment of an electrolytic cell, and in the anode-compartment of said cell simultaneously regenerating a solution from which metal has previously been separated, said solution having been transferred from the cathode to the anode compartment before beginning the operation, substantially as described.

5. The herein-described process of extracting from their sulfid ores metals whose oxids form soluble compounds with the alkali-metal hydroxids, said process consisting in dissolving said ore in a solution of sodium hypochlorite and sodium hydrate, separating the sulfur therein formed, and decomposing the remaining solution in the cathode-compartment of an electrolytic cell, substantially as described.

6. The process of extracting zinc from the sulfid ore of the same, said process consisting in dissolving said ore in a solution containing sodium hypochlorite and sodium hydrate, separating the sulfur formed therein, decomposing the remaining solution in the cathode-compartment of an electrolytic cell, and simultaneously regenerating, in the anode-compartment of said cell, a solution of sodium hydrate left in the cathode-compartment and transferred therefrom to the anode-compartment after a previous operation of the same cell, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAML. S. SADTLER.

Witnesses:

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