UNITED STATES PATENT OFFICE.

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CONVERTING CHROMATES INTO BICHROMATES.

No. 838,757. Specification of Letters Patent. Patented Dec. 18, 1906.

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To all whom it may concern:

Be it known that I, ROBERT SUCHY, a subject of the Emperor of Austria-Hungary, residing and having my post-office address at 1 Jahnstrasse, Griesheim-on-the-Main, Germany, have invented certain new and useful Improvements in Converting Chromates into Bichromates, of which the following is a specification.

It has been found that chromates can be split up quantitatively into bichromates and alkali in accordance with the equation

$$2K_2CrO_4+H_2O=K_2Cr_2O_7+2K.O.H.$$

when a neutral solution of chromate is subjected in both compartments of an electrolytic cell to the action of electricity, the compartments being separated from each other by a diaphragm and the anode being of a material not attacked by the solution, while the cathode is of a material which does not reduce the alkali chromate. Bichromate and oxygen are formed in the anode-compartment in accordance with the following equation:

$$K_2CrO_4+CrO_4=K_2Cr_2O_7+O,$$

while the action taking place in the cathode-compartment results in the formation of caustic alkali and hydrogen in accordance with the following equation:

$$K_2+2H_2O=2KOH+H_2.$$

The yield is from eighty to ninety per cent. of the theoretical when the amount of alkali contained in the cathode solution is not too high. Haussermann has already proposed to convert by electrolysis neutral chromate into bichromate by placing the chromate in the anode-compartment and charging the cathode-compartment with water, (*Dingler's Polytechnisches Journal*, 288, 161.) This process has the disadvantage of requiring at the beginning of the electrolytic process an electric current of very high voltage on account of the resistance offered to the current by the cathode liquid, and the yield in alkali and bichromate is very poor on account of the passage of OH ions into the anode-compartment. If, however, in accordance with this invention a chromate solution be introduced into the cathode-compartment, a good yield can be obtained with an electric current of low voltage, because the transference of the negative electricity to the anode is effected solely by the CrO_4 ions.

The following examples will show how this invention can be carried out in practice:

In an iron trough connected to the negative pole of a source of electricity is placed a cell made of a material capable of acting like a diaphragm and dividing the trough into two compartments.

Into both the outer (the cathode) compartment and the inner (the anode) compartment a saturated solution of chromate is introduced, and the anode-compartment is provided with an insoluble anode—such as lead or platinum—for example. The current is then passed through the electrolytic apparatus until the chromate is converted into bichromate. The capacity of the cathode-compartment should be such that the amount of alkali is about one hundred grams per liter after the conversion of the chromate into bichromate is completed. It is also possible to work independently of the duration of the action going on at the anode by causing a circulation of the solutions in the cathode-compartment. To keep the voltage low, it is advisable to heat the bath to a temperature of from 80° to 90° centigrade.

A saturated or concentrated chromate solution is used to give to the cathode liquid a good conducting quality and to make the yield of the caustic alkali and of bichromate so great as to practically attain the theoretical one. The transference of the negative electricity to the anode is effected at the beginning of the electrolysis only by the CrO_4 ions, and only at or near the end of the process when the alkali has been generated by electrolysis do the OH ions also participate in the conduction of electricity. Only the CrO_4 ions go through the diaphragm into the anode-space, so that in the anode-space only CrO_4 and Cr_2O_7 ions are present, and as there is no other kind of ions added the yield can only be reduced at the end of the process when in the cathode-space the concentration of the OH ions has become so strong that said ions participate in the conduction of the current and enter into the anode-space.

When the alkaline contents of the cathode solution are sufficiently high, the said solution can be concentrated by evaporation, the chromate still present in the solution being

thereby precipitated quantitatively while the alkali lye that remains has a strength of 50° Baumé.

The anode solution can after the chromate has been wholly transformed into bichromate be discharged directly into the crystallizing vessel.

Having now particularly described and ascertained the nature of this invention and in what manner the same is to be performed, I declare that what I claim is—

The method substantially as hereinbefore set forth of converting chromate into bichromate and the simultaneous production of an alkali which consists in introducing a saturated neutral solution of alkali chromate into the anode and cathode compartments of an electrolytic cell separated from each other by a diaphragm, employing as electrodes an anode not attacked by the solution and a cathode which will not reduce the chromate, and electrolyzing the solution, whereby at the beginning the transference of the negative electricity to the anode is effected solely by the CrO_4 ions and caustic alkali is obtained in the cathode-compartment and a pure solution of bichromate is obtained in the anode-compartment.

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

ROBERT SUCHY.

Witnesses:
FRANZ HASSLACHER,
MICHAEL POLK.