O. LIEBKNECHT.

PROCESS OF MAKING ALKALI PERBORATES.

APPLICATION FILED FEB. 29, 1916.

1,281,983. Patented Oct. 15, 1918.

Fig. 1

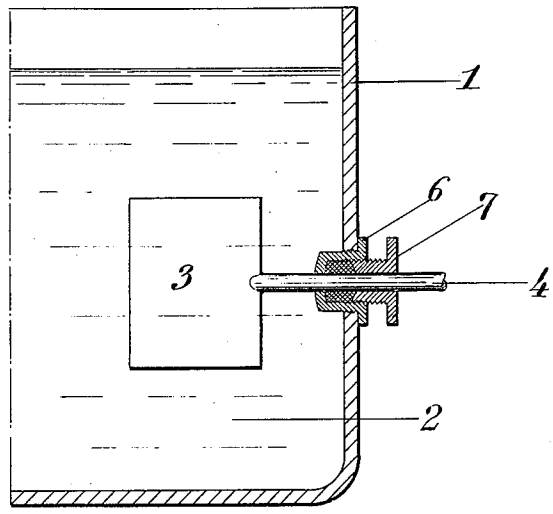
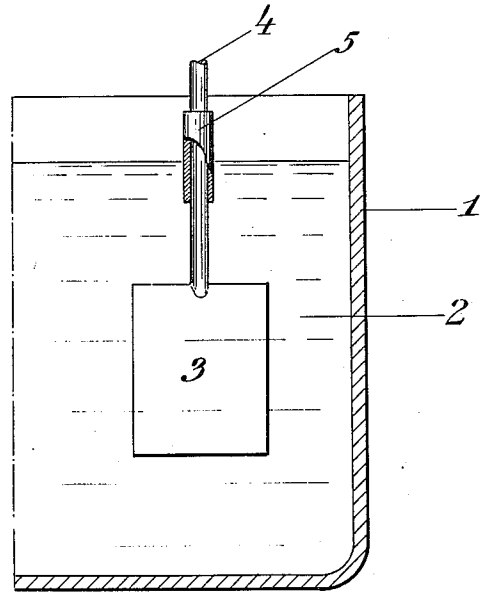


Fig. 2



Otto Liebknecht Inventor

By his Attorneys

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UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING ALKALI PERBORATES.

1,281,983. Specification of Letters Patent. Patented Oct. 15, 1918.

Application filed February 29, 1916. Serial No. 81,119.

To all whom it may concern:

Be it known that I, OTTO LIEBKNECHT, a citizen of Germany, residing at Frankfort-on-the-Main, Germany, have invented certain new and useful Improvements in Processes of Making Alkali Perborates; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to processes of making alkali perborates and it relates particularly to the electrolytic production of alkali perborates in the presence of certain electrodes possessing properties favorable for such electrolysis.

In the electrolytic production of alkali perborates, such as sodium perborate, from solutions of alkali borates and alkali carbonates as described in my applications filed January 6, 1916, under Serial Nos. 70,591 and 70,592, the material of which the anode is made is necessarily such as will not be attacked by oxygen. As to the cathode there arises the presumption that any material acting as a catalyzer to the sodium perborate should be excluded and that the metals not exerting this harmful function, as for instance zinc, tin, or aluminium, would be primarily suitable in the construction of such a cathode.

I have been astonished, however, to find that said metals, mentioned above, are unsuitable; aluminium for instance is strongly affected by the discharge of the alkali metal at the cathode, whereas tin is more or less covered with a thick layer of a brown powder, which is probably a finely divided metal mixed with the generated sodium perborate. Zinc displays a behavior similar to that of tin; none of these metals can therefore be considered for making a cathode for the production of alkali perborates.

Though this electrolytic process is extremely sensitive toward catalyzers, I have now made the surprising observation that the cathode may be made with great success of such conductors which themselves or the compounds of which, act as catalyzers, as for instance lead, iron, nickel, copper, silver or carbon.

The cathodes made from these latter materials do not change at all and give satisfactory yields; in the finished alkali perborate these materials cannot be found to be present.

I have found through experiments, that in working the process according to my invention, it is advantageous to use cathodes made of materials which are characterized by their hydrogen potential equaling zero, or a value which differs but slightly from zero. Or to express it with other words, it is advantageous to apply cathodes made of materials which display no cathodic excess potential, or but a slight cathodic excess potential. Such materials, for instance, are iron, silver, nickel, copper.

Figure 1 of the drawings is a fragmentary sectional view showing one form of apparatus designed for use in connection with my invention and Fig. 2 is a similar view showing a modification.

Similar numerals of reference indicate similar parts throughout the several views.

1 indicates the wall of the electrolytic vessel. 2 the electrolyte. 3 the electrode and 4 the conductor. 5 indicates a protective coating on conductor 4 and 6 and 7 indicate suitable packing rings for holding the conductor in the wall of the electrolytic vessel in the form shown in Fig. 1.

Though I have found that generally no further precautions have to be observed in the application of cathodes made from these materials, I have found it suitable to protect the conducting rods of the cathodes, as far as they protrude from the electrolyte, against the action of the electrolyte and air which latter is noticeable on the surface of the former. To this end I am disposing the cathode in such a manner as to prevent the same from getting into contact with air; for instance, by providing for the cathode a conductor which enters the bath laterally, that is, below the surface of the electrolyte. Thereby, not only the cathode but the con-

ducting rod also is precluded from coming into contact with the air. An illustration of this novel feature is given in Fig. 1 of the drawings. This very effect may be attained in a modified manner by coating the conducting rods of the cathode, at those portions with which the rods enter the electrolyte, with a non-porous and non-corrosive material capable of resisting the effect of the combined action of the electrolyte and air.

Such a protective coating may be made by placing a layer of metal, resistant to the corrosive action, as for instance platinum, on the portions to be protected, or a coat of resistant paint may be applied, or, if the form of the cathode permits it, a rubber tubing may be slipped over the portion to be protected. An illustration of this latter modification is reproduced in Fig. 2 of the drawings.

Through experiments I have further discovered the surprising fact that among all the materials suitable for making cathodes, nickel occupies an exceptional position in as far as nickel is not liable to corrosion even within the contacting zone of the electrolyte and air. In consequence of this discovery, cathodes made of any materials otherwise than nickel, may be protected within the danger zone by means of nickel. Thus, electrodes made of iron and which in practical working on a manufacturing scale, have proved especially satisfactory may be provided with a nickel coating, or may consist of nickel in the threatened places. The applicability of nickel for these purposes could not be anticipated, all the less, as the rest of the base metals suitable for the purpose under consideration, are all liable to be affected by the combined action of the electrolyte and air.

What I claim as my invention is:

1. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer to an alkali perborate.

2. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode made of conductive material, the compounds of which act as a catalyzer to an alkali perborate.

3. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer to an alkali perborate and protecting the exposed parts of the cathode against the combined action of the electrolyte and air by covering said parts with a coat of material resistant to the corrosive action of the electrolyte and air.

4. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer to an alkali perborate, and displaying substantially no cathodic excess tension.

5. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode made of conductive material displaying substantially no cathodic excess potential and the compounds of which material act as a catalyzer to an alkali perborate.

6. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer to an alkali perborate and displaying but an inconsiderable excess potential.

7. The process of making alkali perborates, consisting in electrolyzing a solution of alkali borate and alkali carbonate in the presence of a cathode containing iron.

8. The process of making sodium perborate, consisting in electrolyzing a solution of a sodium borate and sodium carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer for an alkali perborate.

9. The process of making sodium perborates, consisting in electrolyzing a solution of a sodium borate and sodium carbonate in the presence of a cathode made of conductive material, the compounds of which act as a catalyzer to an alkali perborate.

10. The process of making sodium perborates, consisting in electrolyzing a solution of a sodium borate and sodium carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer to an alkali perborate and protecting the exposed parts of the cathode against the combined action of the electrolyte and air by covering said parts with a coat of material resistant to the corrosive action of the electrolyte and air.

11. The process of making sodium perborates, consisting in electrolyzing a solution of a sodium borate and sodium carbonate in the presence of a cathode containing iron.

12. The process of making sodium perborates, consisting in electrolyzing a solution of a sodium borate and sodium carbonate in the presence of a cathode made of conductive material acting *per se* as a catalyzer for an alkali perborate and displaying substantially no cathodic excess potential.

13. The process of making sodium perborates, consisting in electrolyzing a solution

of a sodium borate and sodium carbonate in the presence of a cathode made of conductive material displaying but an inconsiderable excess of cathodic potential and acting *per se* as a catalyzer to an alkali perborate and being protected against contact with air.

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

OTTO LIEBKNECHT.

Witnesses:
JEAN GRUND,
CARL GRUND.