UNITED STATES PATENT OFFICE.

HENRY BLACKMAN, OF NEW YORK, N. Y.

ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 568,229, dated September 22, 1896.

Application filed February 9, 1895. Serial No. 537,805. (No specimens.)

To all whom it may concern:

Be it known that I, HENRY BLACKMAN, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Electrodes, of which the following is a specification.

This invention relates to electrodes for use in electrolytic processes, as, for example, in the electrolysis of sodium chlorid to form sodium hypochlorite for use in the bleaching of paper-pulp and other substances. In such electrolysis much disadvantage is experienced by reason of the rapid destruction of the electrodes, particularly the anode, during the electrolytic action. In some instances the anode is disintegrated, and the particles resulting form specks in the electrolyte and in the products of electrolysis, and in other instances it dissolves or is decomposed, impairing the color of the electrolyte and of the solution resulting from the electrolytic action. When such resulting solutions are subsequently employed for certain uses, as, for example, for bleaching paper-pulp, the particles are liable to speck the pulp, and the discoloration of the solution tints or discolors the resulting pulp, to that extent impairing the bleaching operation.

According to my present invention I provide an electrode which possesses sufficient conductivity and is not to any material extent disintegrated, dissolved, or decomposed either by the electrolyte or during the electrolytic action.

My invention consists in employing for the electrode a composition of any oxid of iron or mixture of oxids of iron possessing suitable conductivity with the addition of a binding or fluxing material or materials. The oxid is preferably a magnetic oxid, such as forge-scales, or the native magnetic oxid (magnetite) may be used. In practice I prefer to use the residue from pig-iron furnaces known as "black slag." This slag is a good conductor and is to be distinguished from gray or glassy slag, which is largely composed of silicates and is a poor conductor.

An analysis of the black slag gives the following proportions:

Iron (as metallic)....	72.18	
Oxygen	24.02	
		96.20
Alumina	1.12	
Silica	1.62	
Lime.....	.56	
Magnesia.....	.24	
Sulfur.....	.17	
Phosphoric acid.....	.09	
		3.80
		100.00

This analysis shows the iron to exist almost entirely as an oxid, nearly approaching in composition the mean of the inner and outer layers of forge-scales. Like them, it possesses magnetic properties. The other elements present are insignificant in amount, but perform the valuable function of rendering the otherwise refractory iron oxid capable of being melted. Hence the slag is fusible and may be cast into any desired form for the electrode. It may, however, be used in the form in which it comes from the furnace.

As applied to electrolytic bleaching my improved electrode has important and valuable properties. It is a good conductor, does not speck or discolor the electrolyte, and has great durability against corrosion or disintegration by electrolytic action. In fact, it is found that the longer it is used the less it is affected. In electrolytic bleaching as ordinarily practiced, that is, by decomposing sodium chlorid, using carbon as the anode, it is found that even with the most refractory carbon there is a continual disintegration of the carbon, disengaging in the resulting sodium hypochlorite solution fine particles or specks of carbon, which it has been found exceedingly difficult and in fact almost impossible to remove by filtration or otherwise, so that when the solution is employed for bleaching paper-pulp, for example, the pulp is found to be slightly discolored by the minute specks of carbon which are deposited upon it.

With an anode of black slag instead of carbon the specking or discoloration of the solution is reduced to such an extent as to be practically insignificant, even at the outset, when the disintegration is greatest.

Three successive tests of my improved electrode used as an anode in decomposing a solution of sodium chlorid under a suitable electric current, continued for six hours in each test, showed the loss to be on the first test .037 of one per centum, on the second test .001 of one per centum, and on the third test .0005 of one per centum. These tests show that at the outset the corrodible portions of the slag are rapidly dissolved, quickly reducing the amount of corrosion to practically nothing. If desired, the almost infinitesimal amount of hydroxid of iron as it is disengaged is readily removable by the most simple filtration, (as by filtering through two inches of sand,) being thus far easier of separation from the liquid than is the finely-divided carbon which results when a carbon electrode is used.

The solution of sodium hypochlorite resulting from electrolysis of common salt has no perceptible corrosive or dissolving effect upon the black slag, even after immersion of the latter therein for several days.

My invention is susceptible of modification by mixing the black slag with other materials or substances in varying proportions as circumstances or experience may dictate, such as with pulverized carbon and a binding agent; also by substituting other oxids of iron than that found in the black slag, any magnetic oxid being suitable, such as forge-scale or magnetite; or my invention may be further modified by mixing two or more oxids together and adding sufficient of any fluxing material to enable the mixture to be fused and run into a solid body or cake.

In my application filed May 21, 1895, Serial No. 550,104, I have made the following generic claims:

"1. An anode for use in electrolytic decomposition consisting of electroconductive oxid of iron in a dense impermeable mass, substantially as set forth.

"3. The combination in an electrolytic apparatus, with a receptacle for the electrolyte and a cathode, of an anode consisting of dense impermeable magnetic iron oxid."

These claims are in issue in an interference, No. 17,641, in which my said application is involved. I hereby disclaim in and for my present application the invention defined in said claims and limit the claims in the present application specifically to the composition of an electroconductive iron oxid with a flux adapted to promote the fusion of the oxid to constitute the material for the electrode, or at least for the exposed surface thereof.

What I claim is—

1. An anode for use in electrolytic decomposition consisting of a dense impermeable mass of combined electroconductive iron oxid and a flux capable of acting to promote the fusion of the oxid.

2. An anode for use in electrolytic decomposition consisting of the dense impermeable composition of iron oxid and fluxing materials known as "black slag."

3. The combination in an electrolytic apparatus, with a receptacle for the electrolyte and a cathode, of an anode the exposed surface of which consists of combined electroconductive iron oxid and a flux, in a dense impermeable condition.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY BLACKMAN.

Witnesses:

ARTHUR C. FRASER,

GEORGE H. FRASER.