No. 667,421. Patented Feb. 5, 1901.

H. BLACKMAN.

MEANS FOR CONNECTING ELECTRODES.

(Application filed June 6, 1899.)

(No Model.)

FIG. 1.

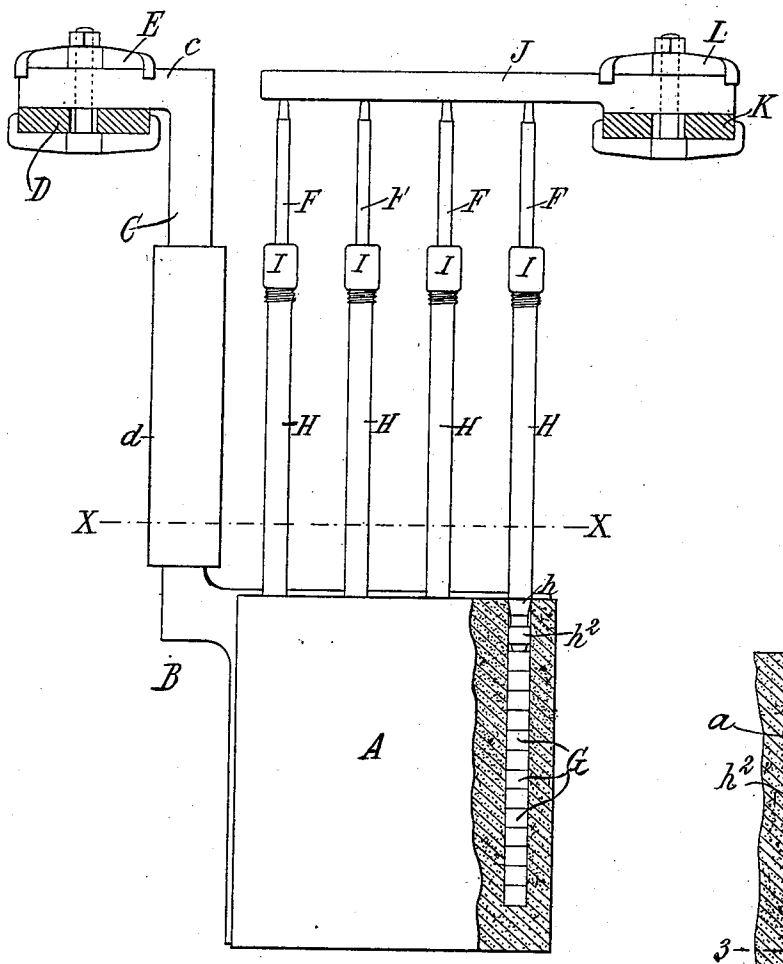


FIG. 2.

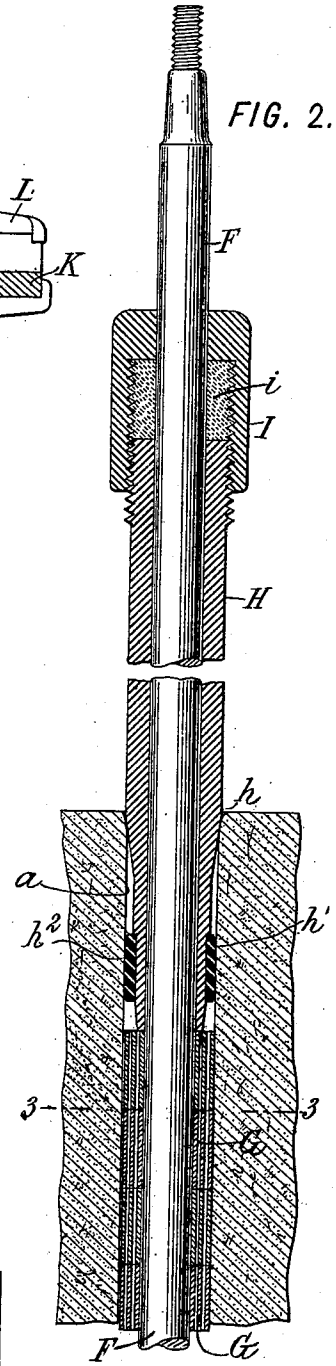


FIG. 4.

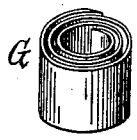
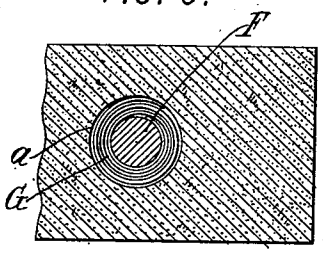


FIG. 3.



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MEANS FOR CONNECTING ELECTRODES.

SPECIFICATION forming part of Letters Patent No. 667,421, dated February 5, 1901.

Application filed June 6, 1899. Serial No. 719,530. (No model.)

To all whom it may concern:

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

This invention relates to electrodes for electrolytic decomposition, of which the electrolysis of sodium chlorid is a type.

My invention provides improvements in the electrical and mechanical connections of the electrodes, whereby better results are obtained than with the connections now in use at less cost.

My invention is particularly applicable to anodes of iron oxid—such, for instance, as magnetite, (Fe_3O_4.)

One feature of my invention is directed to obtaining a connection of the anode with the bus-bar or other conductor, which will have sufficient electrical conductivity and which will be permanent and substantially proof against the corrosive action of the electrolyte.

My invention also provides an efficient mechanical connection of the anode with the conductor or bus-bar.

Referring to the drawings, Figure 1 is an elevation of an electrode embodying my invention. Fig. 2 is an enlarged fragmentary vertical section of one of the connecting devices. Fig. 3 is a horizontal section taken on the line 3 3 in Fig. 2, and Fig. 4 is a perspective view of a detail.

In the drawings, A is the anode, and B is the cathode, the level of the electrolyte being indicated by the line x x. The electrodes may be of any desired shape, that shown being commonly employed.

The cathode B is constructed of any suitable material, as iron, steel, zinc, &c., and has an arm C at its upper left-hand corner, which terminates in the elbow c, the latter engaging the negative conductor or bus-bar D and being held firmly thereto by a suitable clamp E. I prefer to protect the arm C of the cathode B from corrosion by a sleeve d, of glass, hard rubber, or other suitable material.

The anode A may be of iron oxid (Fe_3O_4) or other suitable material, and has formed in its upper end a number of vertical holes or bores a, which may be of any suitable depth, depending upon the size and weight of the plate. In each of the holes a is inserted a conducting and supporting rod F, which is electrically connected thereto by the connectors or rings G. These connectors are formed, preferably, by coiling or winding a flat strip of metal upon itself, as shown in perspective in Fig. 4, although they may be otherwise made in such manner as to afford ample contact between the connector and the surface of the rod on the one hand and the surface of the hole on the other. I prefer to employ two or more such connectors for each rod F and to arrange them in the holes close together, as shown; but one only may be employed, and in this case it should preferably be of greater length than those shown. The rods F are forced through the center of the connectors G, the coils of the latter binding tightly about the rods on the one hand and closely engaging the walls of the holes on the other. I have found that when the rods are thus crowded into the plate A a firm and durable electrical connection is made. The connectors G are made of any suitable conducting material, zinc being suitable for this purpose. The rods F are also preferably made of zinc and may be solid or hollow; but I prefer that they should be solid to obtain the requisite strength and conductivity, their diameter being necessarily somewhat limited by the thickness of the electrode. Having thus produced a superior electrical connection, it is highly important that it should be protected against corrosion, the metal of the rods and connectors being readily attacked by the electrolyte. It is necessary that those parts of the rods which extend into the anode should be fully protected from the destructive action of the electrolyte and the gases resulting from the decomposition of the chlorid, as corrosion at this point would speedily destroy the connection. In carrying out this feature of my improvements I provide for each of the rods F a tube or sheath H, of hard rubber or other material which is proof against corrosion, which extends from above the level x x into the anode and at this

point makes a liquid and gas tight joint with the walls of the hole *a*. The lower part of the tube H is preferably beveled, as shown at *h* in Fig. 2, and at its end is formed with a reduced beveled portion *h'*, upon which is placed a packing-ring h^2. This ring is preferably made of soft rubber and its outer surface extends somewhat beyond the outer surface of the tube. As the tube is forced down into the hole in the anode this ring is compressed, so that it makes a tight packing between the hole and the tube. At its upper end the tube is screw-threaded to take a cap or follower I, and between the end of the tube and the follower is placed a packing *i*, of asbestos or other suitable material, which is compressed by screwing down the follower to make an air-tight stuffing-box.

The upper ends of the rods F are connected to the conducting-bar J in any suitable manner, as by threading into said bar, riveting, or otherwise, to make a good electrical connection and also to secure the necessary strength. The conducting-bar J may be clamped to the positive bus-bar K by a clamp L in a well-known manner.

In assembling, the connectors G may be first placed in each hole *a* and forced down tightly against each other, when the packing-ring h^2 may be inserted and the tube H then forced into place, so that the beveled portion *h'* passes through the ring h^2 and compresses it in the upper part of the hole *a*. The upper beveled portion *h* of the tube fits closely into the hole and serves to protect the ring h^2. A durable gas and liquid tight joint is thus made with the surface of the holes, so that the connections cannot be attacked by the electrolyte or gases. This having been done with each of the tubes H H, the rods F, which have been previously fixed to the conducting-bar J, are then passed through the tubes H H and forced down into the connectors G, expanding the latter into close contact with the surface of the holes *a*, and thereby making a good electrical connection between the rods F and the anode-plate A. The followers I are then tightened to compress the packings *i* closely around the rods F.

The connection herein described is exceedingly efficient and cheap, is fully protected from corrosion, and is well adapted to support the electrode.

I do not wish to be limited to the particular form of connector shown, as other forms may be used with good results. I may, for instance, use powdered or granulated conducting material (in the form, for example, of so-called "sand" or "shot") to make the connection between the conducting-rods and the electrode; but I prefer that shown because of its convenience.

While I have described my invention in connection with an anode for use in electrolytic decomposition, it is obvious that it may be applied with good results to the plates or elements of batteries in general.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. The combination with an electrode having a hole, and a rod extending into the same, of a separable conducting-connector of solid material inserted in said hole and pressed into contact with the surface of said rod and the wall of said hole.

2. The combination with an electrode having a hole, and a rod extending into the same, of a separable conducting-connector of yielding sheet metal shaped to press into contact with the surface of said rod and the wall of said hole.

3. The combination with an electrode having a hole formed in it, of a conducting-rod extending into said hole, and a conducting-ring of coiled metal in contact with both said rod and electrode.

4. The combination with an electrode formed with holes at its upper end, of conducting-rods extending into said holes, and separable conducting-rings surrounding said rods, and in contact with the walls of said holes.

5. The combination with an electrode formed with holes at its upper end, of conducting-rods extending into said holes, and rings of coiled metal surrounding said rod, and in contact with the walls of said holes.

6. The combination with an electrode having a hole of a rod extending into the same, a conducting-connector for connecting said rod with the electrode, and a packing surrounding the rod and engaging the walls of said hole for preventing the ingress of corrosive fluids to said connection.

7. The combination with an electrode of a rod extending into the same, a conducting-ring for connecting said rod with the electrode, a protecting-tube sheathing said rod, and a packing on said tube for preventing the ingress of corrosive fluids to said connection.

8. The combination with an electrode, formed with holes at its upper end, of conducting-rods extending into said holes, conducting-rings in contact with the rod and electrode, protecting-tubes surrounding said rods, and compressible packing-rings on said tubes in close contact with the walls of said holes.

9. The combination with an electrode, and an independent conductor having an electrical connection therewith, of a protecting tube or sheath inclosing such conductor adjacent to said connection, and a packing surrounding such conductor and adapted to prevent the passage of fluids between such tube and conductor to said electrical connection.

10. The combination with an electrode, and an independent conductor having an electrical connection therewith, of a protecting

tube or sheath inclosing such conductor, and a packing at the upper part of said tube surrounding such conductor, and forming a seal to prevent passage of fluids past said seal into the space between such tube and conductor.

11. The combination with an electrode having a hole formed in it, and a conductor entering said hole, of the tube H, surrounding said conductor and having a compressible packing-ring at its lower part, in contact with the wall of said hole.

12. The combination with an electrode having a hole formed in it, and a conductor entering said hole, of the tube H surrounding such conductor and having a compressible packing-ring at its lower part in contact with the walls of said hole, and having a packing at its upper part, and a follower for compressing said packing.

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

HENRY BLACKMAN.

Witnesses:

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O. F. RAYMOND.