

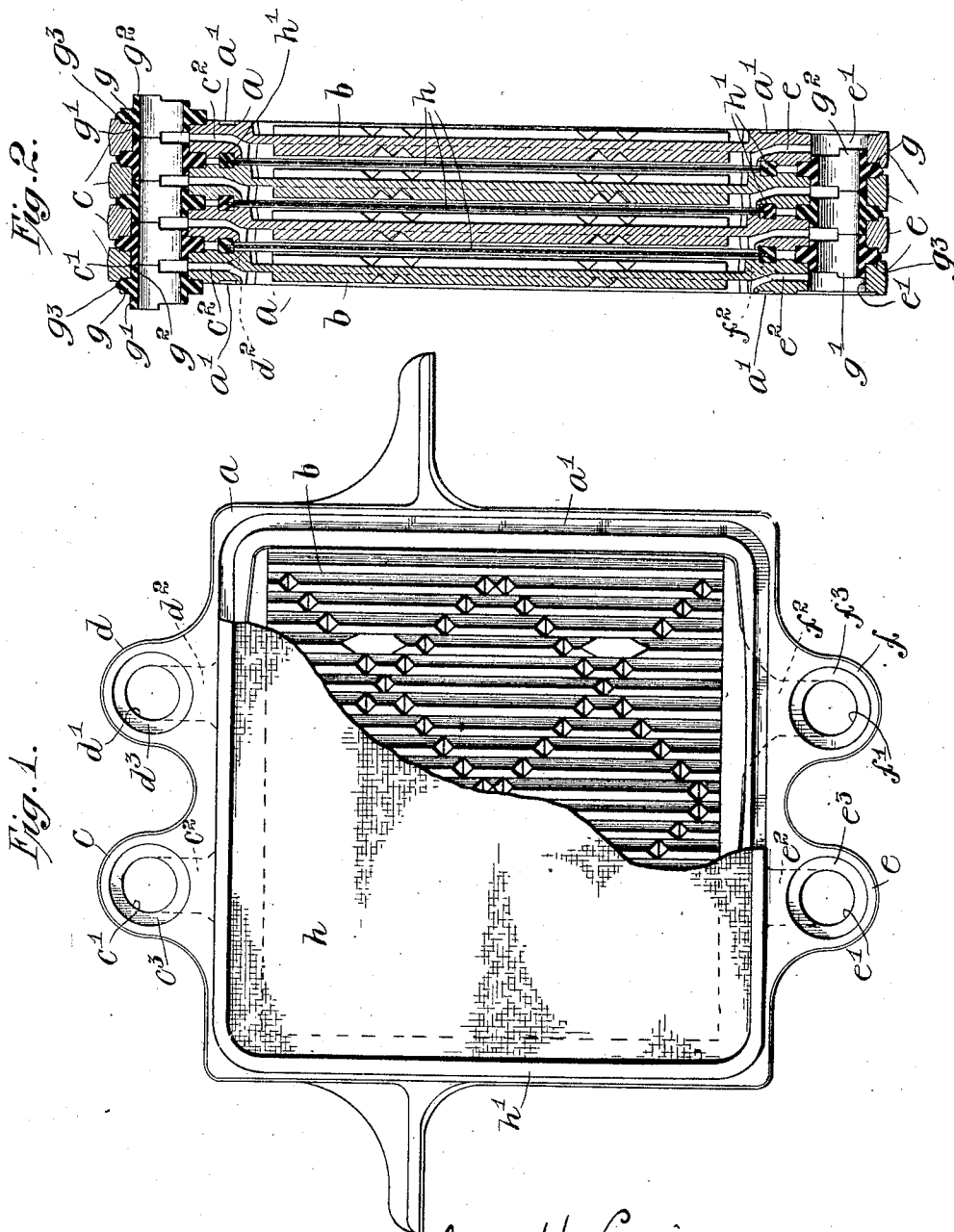
I. H. LEVIN.
ELECTROLYTIC APPARATUS.

APPLICATION FILED OCT. 25, 1915. RENEWED APR. 23, 1920.

1,360,541.

Patented Nov. 30, 1920.

2 SHEETS—SHEET 1.



Attest:

James H. Levin
Judith Pardee.

James H. Levin Inventor:
by *Frank P. Wentworth*
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2 SHEETS—SHEET 2.

Fig. 3.

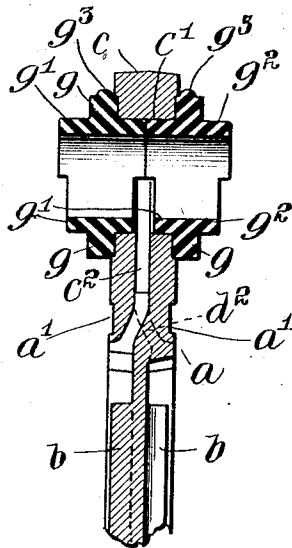


Fig. 4.

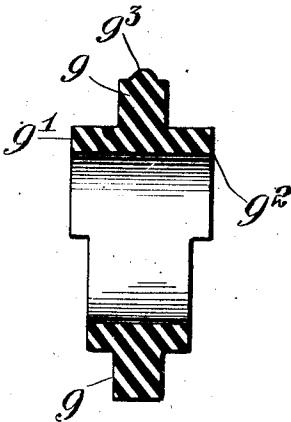
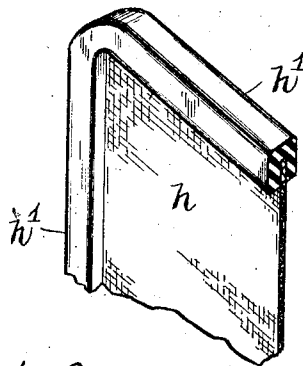


Fig. 5.



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UNITED STATES PATENT OFFICE.

ISAAC H. LEVIN, OF NEW YORK, N. Y.

ELECTROLYTIC APPARATUS.

1,360,541.

Specification of Letters Patent. Patented Nov. 30, 1920.

Application filed October 25, 1915, Serial No. 57,727. Renewed April 23, 1920. Serial No. 378,166.

To all whom it may concern:

Be it known that I, ISAAC H. LEVIN, a citizen of the United States, residing in the borough of Manhattan, in the city, county, and State of New York, have invented certain new and useful Improvements in Electrolytic Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to electrolytic apparatus and more particularly to improvements in such apparatus of the filter press type.

The filter press type of electrolytic apparatus has certain advantages as compared with the uni-polar type of apparatus, in that its structure is more compact; it may be more conveniently assembled; it is less liable to disarrangement of parts; and it has greater capacity for gas production with a given floor space. It may be more readily inspected and the electrolyte feed mechanism, and gas offtake mechanism, thereof, may be so constructed as to readily control the hydrostatic and the gas pressures throughout the apparatus. In this type of apparatus the electrolyte feed mechanism and the gas offtake mechanism usually include therein conduits formed by openings in the electrodes themselves and the electrodes are separated by a diaphragm, usually of asbestos which is absorbent while being practically impermeable to the gases generated upon the opposite sides thereof. The electrodes are usually made of iron, and I have discovered that the presence of a certain small percentage of impurities in the gases produced are traceable to the decomposition of electrolyte in the electrolyte feed and gas offtake conduit. By controlling the hydrostatic and gas pressures within the various cells, I have found that I am enabled to avoid the presence of electrolyte in the gas offtake ducts in sufficient quantity to avoid the formation of gases in these conduits in volume sufficient to result in any substantial percentage of impurities in the gases, but in the electrolyte feed ducts such decomposition does occur with a resultant admixture of gases showing impurities in the product of a sufficiently high percentage to be material. I have also discovered that irrespective of the degree of pressure applied to the edge of the diaphragm through adjacent electrodes, seepage of the electrolyte does

occur and I conceive that a certain percentage of impurities may be produced in the gas by reason of the decomposition of this electrolyte between the electrodes.

By my present invention, I am enabled to secure a highly effective insulation of the adjacent electrodes to prevent the seepage of the electrolyte between the electrodes through the absorptive properties of the edge of the diaphragm; and to raise the percentage of purity of the gases produced, by preventing the decomposition of the electrolyte while in the ducts formed by the openings in the various electrodes. I also am enabled to form both a fluid and a gas-tight joint between adjacent electrodes, thus preventing not only the escape of the electrolyte, but also the escape of gases. The escape of gases is a matter of considerable importance, not because of waste of the gases, but because apparatus of this character are usually employed in manufacturing plants and the escape of the gases is generally considered a substantial fire risk.

The invention consists in the novel features of construction and combination of parts hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

Referring to the drawings:—

Figure 1 is a front elevation of a bi-polar electrode showing a diaphragm in relation thereto, the diaphragm being broken away;

Fig. 2 is a vertical section of a group of electrodes;

Fig. 3 is an enlarged view of one of the lugs of the electrode with the insulating lining positioned therein;

Fig. 4 is a detail of one of the sections of the insulating lining; and

Fig. 5 is a perspective view of a corner of the diaphragm.

Like letters refer to like parts throughout the several views.

In the filter press type of electrolytic apparatus, the cells are formed by a series of bi-polar electrodes, the gases passing from the top of these electrodes, and the electrolyte being delivered adjacent the bottom thereof. This type of electrode, at this time, is old in the arts, the present invention relating more particularly to certain definite characteristics of the apparatus, the effect of which is to secure a higher percentage of purity than was possible with the old apparatus of the filter press type.

In the accompanying drawings, I have illustrated merely those portions of the apparatus, the operative effect of which is modified by my present invention.

5 Each of the electrodes used in this type of apparatus is the same as every other and a description of but one of them will be entered into. In this electrode *a* indicates a frame, having within it a metallic plate *b*.
 10 Gas offtake ducts are provided above the metallic plate *b* and electrolyte feed ducts, toward the bottom of said plate, are also provided. Ordinarily to avoid the escape
 15 of gas from one gas offtake duct to the other, or the flow of electrolyte from one electrolyte feed duct to the other, the ducts are formed in lugs projecting from the frame *a* and spaced away from each other
 20 so that any flow of the gas or electrolyte from the ducts would be to atmosphere. In the accompanying drawings, the lugs having the openings forming the gas offtake
 25 ducts are shown at *c—d* and the lugs having the openings forming the electrolyte feed ducts are shown at *e—f*. Each lug *c* has therein an opening *c'* communicating by a
 30 short duct *c²* with the interior of the frame *a* upon one side of the plate *b*. The lug *d* has an opening *d'* communicating with the other side of the plate *b* through the short
 35 duct *d²*. The lug *e* has an opening *e'* therein communicating through the short duct *e²* with the space within the frame *a* upon one side of the plate *b*, and the lug *f* has a
 40 similar opening *f'* which communicates through a similar short duct *f²* with the other side of said plate. This construction and arrangement is old in this art.

By grouping a plurality of such bi-polar electrodes face to face, a series of cells is
 45 formed, one face of the plate *b* of one electrode forming the anode for a cell and the face of the plate *b* of the adjacent electrode presented toward said anode, forming the
 50 cathode.

Each of the lugs *c—d—e—f* about the opening therethrough, is countersunk as at
 55 *c³—d³—e³—f³*, each side of the lug being provided with such a countersink.

Mounted in each of said openings is a nipple, having the two-fold function of
 60 forming a fluid proof connection between adjacent electrodes and of insulating said ducts in a manner to prevent decomposition of any electrolyte therein. This nipple is preferably made of soft vulcanized, highly
 65 elastic rubber, although other substances having insulating properties capable of forming a tight seal between adjacent electrodes may be substituted therefor, without departing from the spirit and scope of the invention.

The form of nipple shown in the drawings, which is that form which I have found
 70 to be most satisfactory in use, has a central

annular flange *g* adapted to seat in the countersink about the duct openings of adjacent electrodes. On each side of this flange, are
 75 tubular extensions *g'—g²* the lower portion of each of which is cut away to register with the short duct leading from said lug opening to the interior of the electrode frame. The end of each of the extensions *g'—g²* is adapted to abut against a similar extension
 80 of the nipple carried by the adjacent electrode, thus forming a continuous insulating lining for each of the ducts *c'—d'—e'—f'*.

The nipples *g* have their field of greatest utility in connection with the electrolyte
 85 feed ducts inasmuch as the likelihood of decomposition of the electrolyte while in these ducts, is greater than with the gas offtake ducts wherein after the apparatus is in operation there may be little or no electrolyte. In that form of electrolytic apparatus of the
 90 filter press type wherein there is a continuous circulation of the electrolyte through the electrolyte feed ducts, the cells and the gas offtake ducts, decomposition of the electrolyte will occur in all of said ducts. The
 95 result of such decomposition in these ducts is the presence of both gases produced in the apparatus, in each of the products thereof or a material increase in the percentage of impurities in each of these gases. Ordinarily the gases produced in this type of
 100 apparatus are oxygen and hydrogen, and where decomposition of the electrolyte occurs in the ducts, there will be a measurable quantity of hydrogen in the oxygen produced and a measurable quantity of oxygen
 105 in the hydrogen produced. I have determined by the actual operation of apparatus employing insulated ducts, that the percentage of impurities in the gases produced may be reduced to a point where these gases will be approximately 99.8 pure.

For the purpose of aiding in the accurate positioning of the nipples, I provide the
 110 flange *g* with a nub *g³* visible exteriorly of the apparatus.

By using a soft rubber nipple, the pressure applied to the electrode when assembling the device will form a seal at four
 115 points of each nipple; the abutting edges will be forced together in a manner to form a tight joint at this point: the edge of the opening in the conduit will form a tight seal, the outer edge of the flange *g* will form a tight seal with the inner edge of the
 120 countersink and the top of said flange will be bulged outwardly so as to form a seal against the outer edge of said countersink. The nipple *g*, spanning as it does the space between the lugs of adjacent electrodes will
 125 prevent the closing of the circuit through said lug from one electrode to the other in a manner to eliminate or minimize likelihood of decomposition of the electrolyte while in the duct.

Each side of the frame *a* is provided with a channel *a'* extending entirely about same. A diaphragm *h* is positioned between adjacent electrodes. This diaphragm heretofore has consisted of an absorbent sheet, impervious to gases, asbestos generally being used. This sheet had its edges clamped between the frames *a'* adjacent the electrodes, and it was found impossible to prevent the escape of electrolyte through capillary attraction to the outer side of the rim. By my invention, I avoid the presence of electrolyte between the frames *a* by preventing contact of the diaphragm with said frames, and by forming a gas and liquid tight seal completely surrounding the plate *b* within said frame. I also form a more perfect insulation between adjacent frames, and restrict the path of the current to the space within said frames occupied by the electrolyte and divided by the diaphragm.

In securing this result, I provide the diaphragm *h* with an enlarged rim *h'* completely enveloping the edge of said diaphragm, as shown more particularly in Fig. 5 of the drawings. This rim is made of insulating material, preferably of soft rubber. To facilitate the mounting of the diaphragm; it is molded directly upon said diaphragm so as to form a single unitary structure therewith. This rim is seated in the channels *a'* of adjacent electrodes and when pressure is applied to these electrodes in assembling the structure a tight joint is secured through the distortion of the material of said rim and the angularity of the top edges and the bottom corners of said channel.

I have found in actual practice that a diaphragm and electrode made as described prevents the escape of the electrolyte or gases at any point about the electrode and that an apparatus provided with the form of insulating packing, both as to the frames *a* and as to the various ducts carried thereby, produces gas having a higher percentage of purity than it was possible to produce by apparatus not having these characteristics.

The various countersinks *c*³—*d*³—*e*³—*f*³ and channels *a'* may be formed when casting the electrode itself, the construction heretofore described not requiring such accuracy in the formation of these countersinks or channels as to require a machine finish.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawings, it being apparent that such may be varied to adapt the invention to different designs of apparatus of the filter press type without departing from the spirit and scope of the invention.

Having described the invention what I

claim as new and desire to have protected by Letters Patent is:—

1. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes, each having therein openings adapted to form independent electrolyte feed ducts, a diaphragm between adjacent electrodes, and a substantially continuous lining of insulating material for said electrolyte feed ducts.

2. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes each having therein openings adapted to form independent gas off-take ducts, a diaphragm between adjacent electrodes and a substantially continuous lining of insulating material for said gas off-take ducts.

3. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes each having therein adjacent the bottom thereof openings adapted to form independent electrolyte feed ducts and openings adjacent the top thereof adapted to form gas off-take ducts, a diaphragm between adjacent electrodes and a substantially continuous lining of insulating material for said electrolyte feed ducts and said gas off-take ducts.

4. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes, each having therein openings adapted to form independent electrolyte feed ducts, a diaphragm between adjacent electrodes, and a nipple formed of insulating material having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

5. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes, each having therein openings adapted to form independent electrolyte feed ducts, a diaphragm between adjacent electrodes, and a soft rubber nipple having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

6. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes each comprising a frame having a plate within same, a plurality of lugs projecting from the bottom of said frame, said lugs having openings therethrough countersinks about each end of said openings, short ducts extending from the openings of said lugs respectively to within said frames upon opposite sides of said plate, a diaphragm between adjacent electrodes, a nipple formed of insulating material having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

7. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes, each having therein openings adapted to form independent gas offtake ducts, a diaphragm between adjacent electrodes, and a nipple formed of insulating material having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

8. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes, each having therein openings adapted to form independent gas offtake ducts, a diaphragm between adjacent electrodes, and a soft rubber nipple having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

9. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes each comprising a frame having a plate within same, a plurality of lugs projecting from the top of said frame, said lugs having openings therethrough and counter-sinks about each end of said opening, short ducts extending from the openings of said lugs respectively to within said frames upon opposite sides of said plate, a diaphragm between adjacent electrodes, a nipple formed of insulating material having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

10. An electrolytic apparatus of the filter press type embodying therein a plurality of electrodes, each comprising a frame having a plate within same, a plurality of lugs projecting from the top and from the bottom of said frame each of said lugs having openings therein adapted to form with openings of adjacent lugs a continuous duct, short ducts extending from each of said top lugs and each of said bottom lugs respectively to within said frame upon opposite sides of

said plate, a diaphragm between adjacent electrodes, and a nipple formed of insulating material having a flange centrally thereof and extensions upon opposite sides of said flange adapted to enter said openings to form an insulating lining therefor.

11. An electrolytic apparatus embodying therein a plurality of bi-polar electrodes each comprising a frame, and a plate within said frame, said frame having upon each side thereof a continuous channel extending thereabout and a diaphragm having upon the edge thereof an elastic rim adapted to enter said channel whereby contact of the diaphragm with said rim is prevented.

12. An electrolytic apparatus embodying therein a plurality of bi-polar electrodes each comprising a frame, and a plate within said frame, said frame having upon each side thereof a continuous channel extending thereabout and a diaphragm having upon the edge thereof an elastic rim completely enveloping the edge of the diaphragm and adapted to enter said channel whereby contact of the diaphragm with said rim is prevented.

13. An electrolytic apparatus embodying therein a diaphragm consisting of an absorbent, gas impervious sheet having molded about the edge thereof so as to completely envelop said edge, a bead of soft vulcanized rubber.

14. In an electrolytic apparatus a nipple for insulating the ducts leading to and from the cells consisting of a central flange of soft rubber having tubular extensions upon each side thereof, one side of said extension being shorter than the other.

In witness whereof I have hereunto affixed my signature in the presence of two subscribing witnesses, this 22nd day of October 1915.

ISAAC H. LEVIN.

Witnesses:

CLARICE FRANCK,
JUDITH PARDEE.