No. 647,217. Patented Apr. 10, 1900.

A. J. O. CHALANDRE, L. J. B. A. COLAS & C. J. GÉRARD.

ELECTROLYZING APPARATUS.

(Application filed Mar. 21, 1899.)

(No Model.) 3 Sheets—Sheet 1.

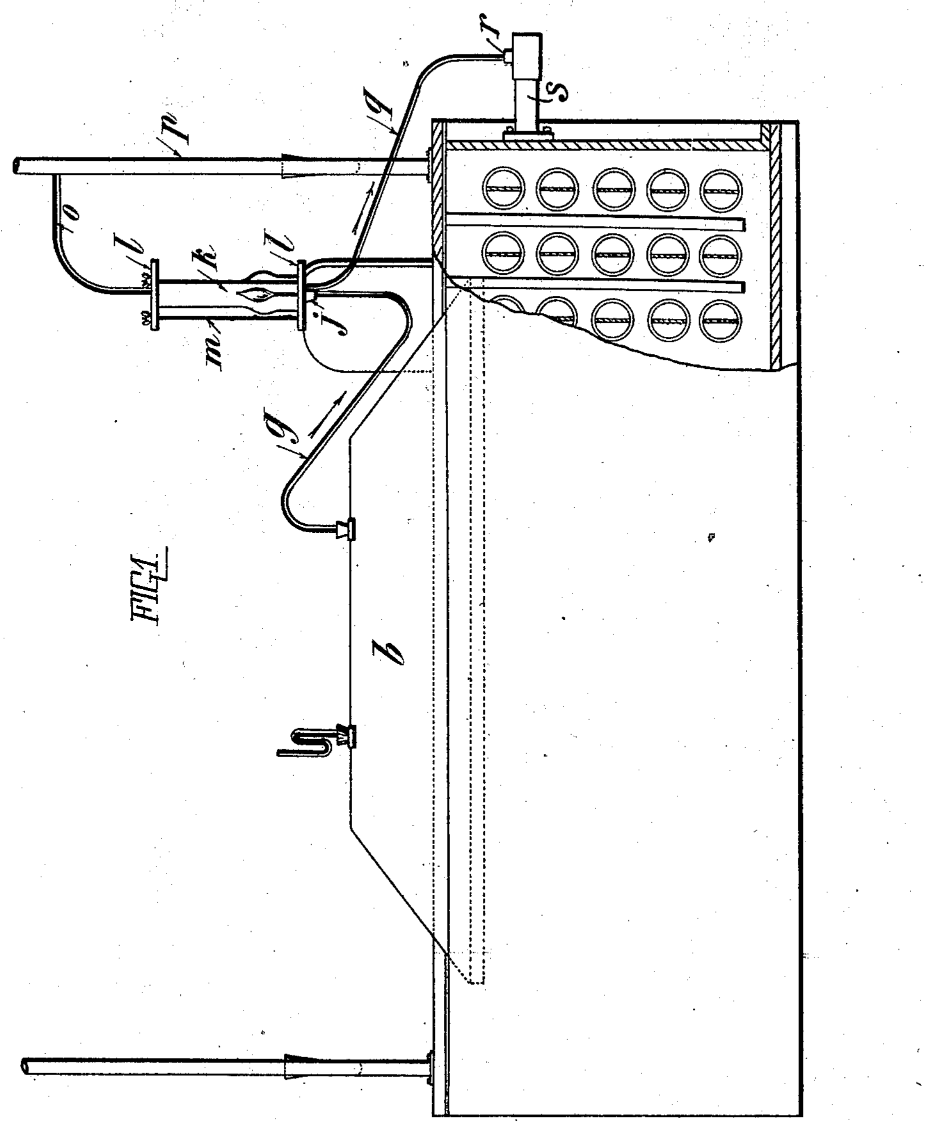

FIG. 1.

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FIG. 2

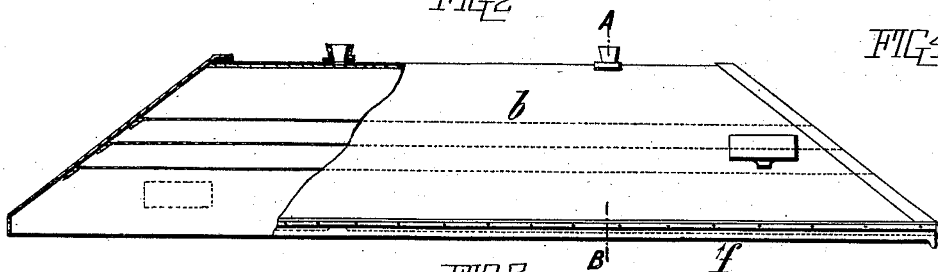


FIG. 4

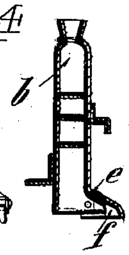


FIG. 3.

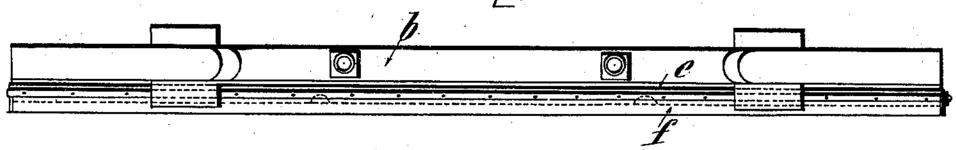
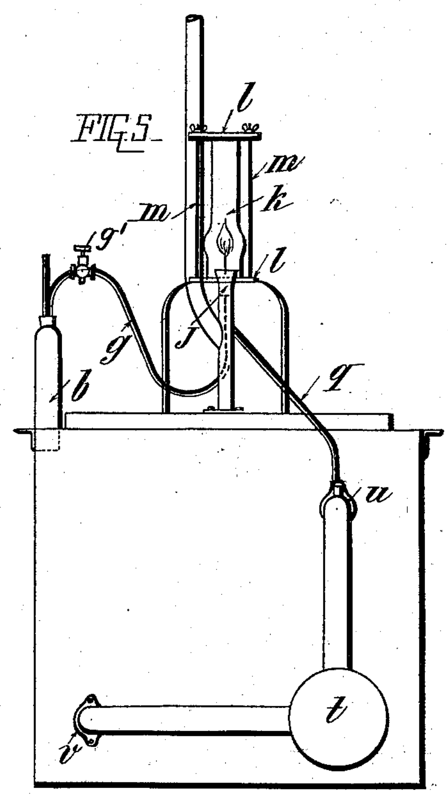


FIG. 5.



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(No Model.) 3 Sheets—Sheet 3.

FIG. 7

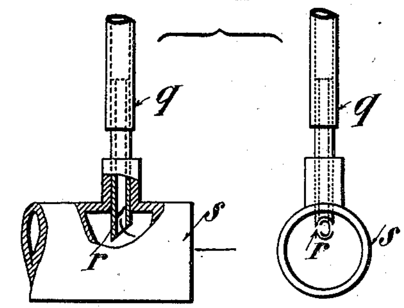


FIG. 8

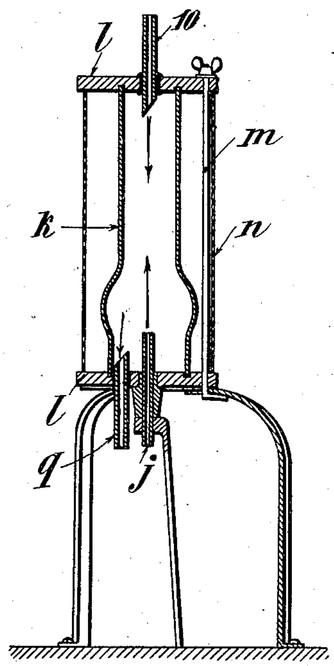


FIG. 6

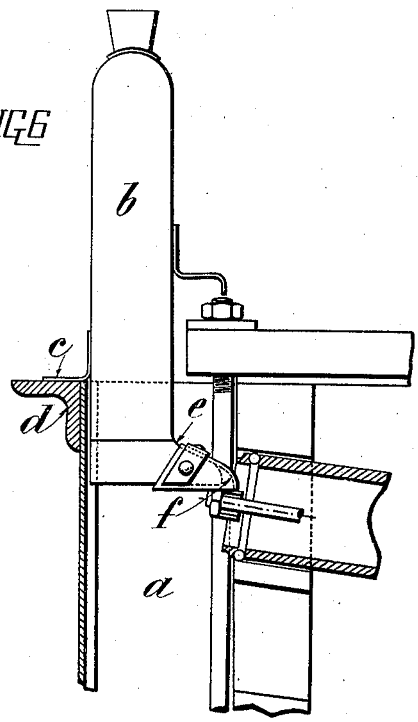
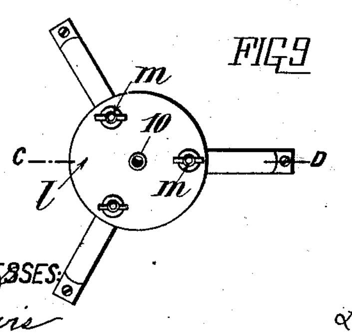


FIG. 9



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UNITED STATES PATENT OFFICE.

ANTOINE JOSEPH OUTHENIN CHALANDRE, LOUIS JEAN BAPTISTE AUGUSTIN COLAS, AND CHARLES JULES GÉRARD, OF PARIS, FRANCE.

ELECTROLYZING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 647,217, dated April 10, 1900.

Application filed March 21, 1899. Serial No. 709,939. (No model.)

To all whom it may concern:

Be it known that we, ANTOINE JOSEPH OUTHENIN CHALANDRE, LOUIS JEAN BAPTISTE AUGUSTIN COLAS, and CHARLES JULES GÉRARD, residents of Paris, in the Republic of France, have invented a new and useful Improvement in Electrolyzing Apparatus, which is fully set forth in the following specification.

In the electrolysis of soluble salts, and especially of alkaline chlorids, it is a well-known fact that the electric current will have the effect, in cases when the electrolyte consists of a liquid solution of, for example, chlorid of sodium, of forming—

First. At the cathode: (*a*) a solution of caustic soda produced by the sodium of the salt combining with oxygen which is furnished by the water of the electrolyte, while the corresponding hydrogen is set free; (*b*) the liberation of oxygen in consequence of the decomposition of part of the water of the electrolyte.

Second. At the anode: (*c*) the liberation of chlorin caused by the decomposition of the salt; (*d*) the liberation of oxygen corresponding to the hydrogen liberated, as stated in (*b*).

It will be seen, therefore, that there takes place in particular a liberation of chlorin and of hydrogen.

With the object of obtaining soda, on the one hand, and pure chlorin gas, on the other hand, in maximum quantities, or, in other words, in in quantities substantially the same as these products are combined in the chlorid of sodium the present invention relates to an apparatus whereby a portion of the gas liberated at the anode is combined with hydrogen liberated at the cathode to form hydrochloric acid, which is then introduced into the apparatus (into the anode-compartment, where the apparatus is provided with a porous diaphragm) to counteract the secondary reactions arising from chlorin-oxygen compounds which form in the electrolyzer. The hydrochloric acid is formed in quantity just sufficient to effect this purpose, so as to avoid any accumulation of the acid in the apparatus and the consequent tying up or loss of a portion of the chlorin.

In order to render the following description perfectly clear, in the accompanying drawings an electrolyzer such as illustrated and described in the patent to Chalandre *et al.*, No. 511,682, provided with the present improvements, is illustrated.

Figure 1 is a general view of the apparatus in elevation. Fig. 2 is an elevation, partly in section, of the hydrogen-receiver for collecting the hydrogen generated in the cathode-compartment of the apparatus. Fig. 3 is a plan of the same, and Fig. 4 a cross-section on the lines A B. Fig. 5 is a side view of the electrolyzer. Fig. 6 is a cross-section showing the connection between the hydrogen-receiver and the cathode-compartment. Fig. 7 illustrates the connection between the admission-tube of the hydrochloric acid into the circulating-tube of the anode liquid. Fig. 8 is an elevation of the hydrogen-gas burner, in which the hydrochloric acid is formed destined for the anode liquid. Fig. 9 is a plan of the device illustrated in Fig. 8.

As has been remarked above, the electrolyzer itself may be of any construction, but the one illustrated is especially adapted for this invention and has been chosen for the purpose of explaining the invention.

The cathode-compartment *a*, which is opened at its upper end, is provided with a gas receiver or collector *b*, Figs. 1, 2, and 3, which may rest simply, as shown in Fig. 6, by means of an angle-bar *c*, on another angle-bar *d* on the casing of the electrolyzer. This gas-receiver *b*, which is opened at its lower end, has at one side a beak or projection *e*, on which is fixed a rubber band *f*, forming a joint along the front wall of the tubes of the electrolyser, in order to insure all the hydrogen rising from the compartment *a* to enter the receiver *b*, from which it is allowed to pass through the pipe *g* to the burner *j*. This burner *j* is completely surrounded by a glass cylinder *k*, like an ordinary lamp-glass, but closed at both ends by plates *l l*, which are connected together by bars *m*, the whole being preferably surrounded by a close wire-netting *n*. At the upper part of this combustion-chamber a tube *o* is introduced, extending from another tube p, for collecting the chlorin gas liberated in the anode-compartment. A pipe q enters the bottom plate l of the burner-chamber, by which the hydrochloric acid formed by the combustion of the hydrogen in the chlorin is carried off and which discharges its contents at r into the circulation-tube of the anode liquid.

Having now described all the parts constituting the improved apparatus for the automatic production of hydrochloric acid necessary for the suppression of secondary chemical reactions, the actual working of such an apparatus will be described.

The tube g is provided with a stop cock or valve g' of any suitable kind, which is opened on starting the process. The hydrogen gas passes through this tube into the receiver k, where it ignites on coming in contact with the chlorin coming from the anode-compartment by way of the tube p. The flow of hydrogen is then regulated by means of the said cock on the tube g, so as to correspond to the production of so much hydrochloric acid as will completely stop secondary reactions. The hydrochloric acid escaping through the tube q will mix with the anode liquid at r, which is then taken by means of a pump t back to the electrolyzer.

As is well known, the production as regards quantity of hydrogen varies with the progress or action in the electrolyzer, and the pressure of hydrogen in the gas-receiver regulates the yield of the beak, and consequently the quantity of hydrochloric acid produced. The apparatus therefore regulates itself within certain limits.

The receiver can of course be of any convenient form as long as it can collect and keep the evolved gas.

Instead of arranging a generator of hydrochloric acid for every electrolyzer it would be possible to have a combination in which a single generator of hydrochloric acid may supply several electrolyzers.

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

1. The combination with the cathode and anode compartments of an electrolyzing apparatus, of a receiver for collecting the gases liberated in the cathode-compartment, a mixing-chamber, a pipe or passage leading from the receiver to said mixing-chamber, a pipe or passage leading from the anode-compartment to the mixing-chamber, and a pipe or passage leading from the mixing-chamber back into the electrolyzing apparatus, whereby the electrolyte therein may be recharged with the gases in their combined state to prevent secondary reactions in said apparatus.

2. The combination with the cathode and anode compartments of an electrolyzing apparatus, of a receiver for collecting the gases liberated in the cathode-compartment, a mixing-chamber, a burner therein, a pipe or passage leading from the receiver to said burner, a pipe or passage leading from the anode-compartment to the mixing-chamber, and a pipe or passage leading from the mixing-chamber back into the electrolyzing apparatus, whereby the electrolyte therein may be recharged with the gases in their combined state to prevent secondary reactions in said apparatus.

3. The combination with the cathode and anode compartment of an electrolyzing apparatus, of a receiver for collecting the gases liberated in the cathode-compartment, a mixing-chamber, a burner therein, a pipe or passage leading from the receiver to said burner, a valve in said passage for opening and closing the same.

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

ANTOINE JOSEPH OUTHENIN CHALANDRE.
LOUIS JEAN BAPTISTE AUGUSTIN COLAS.
CHARLES JULES GÉRARD.

Witnesses:
EDWARD P. MACLEAN,
JULES ALPHONSE GUSTAVE CUSSET.