No. 657,012. Patented Aug. 28, 1900.

P. SCHOOP.

APPARATUS FOR ELECTROLYSIS.

(Application filed Aug. 17, 1899.)

(No Model.)

Fig. 1.

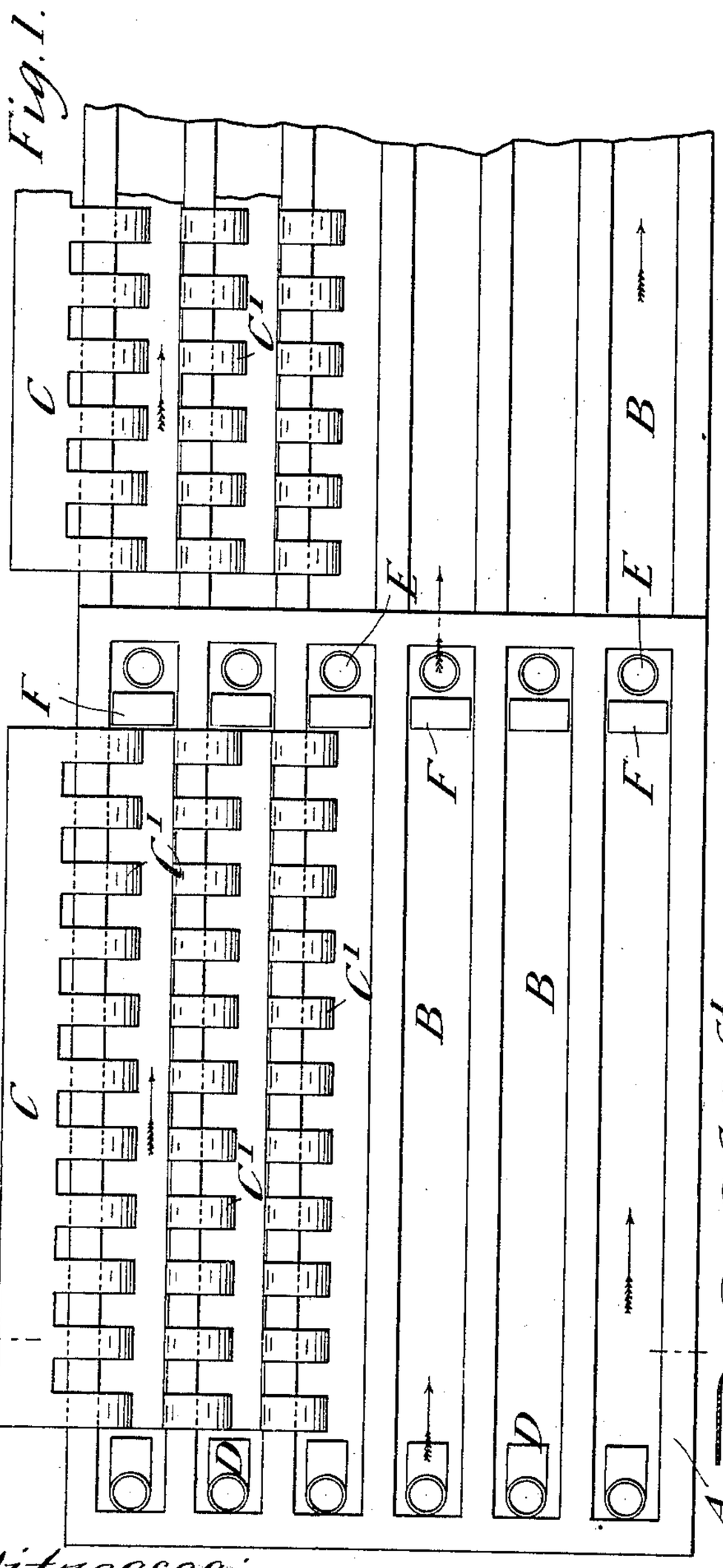


Fig. 2.

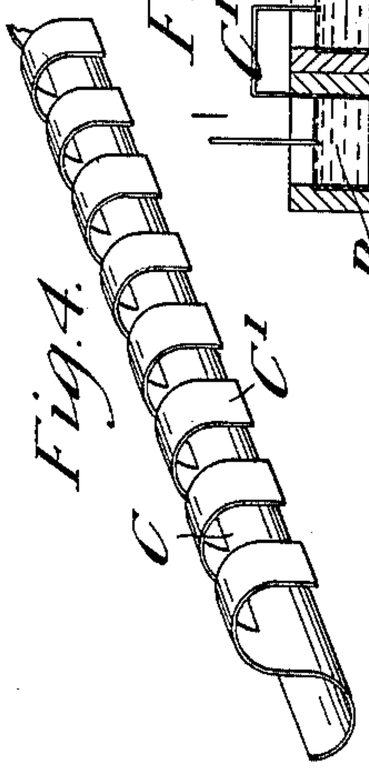


Fig. 3.

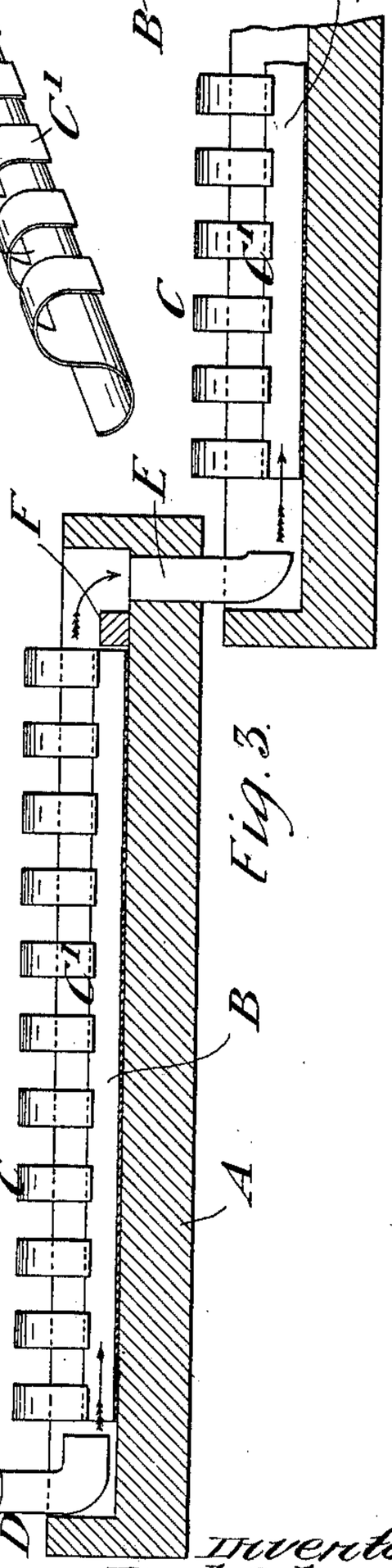
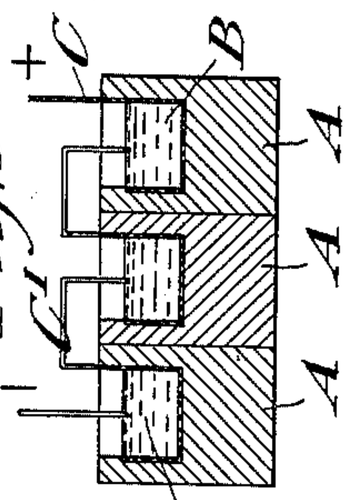


Fig. 4.

Fig. 5.



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APPARATUS FOR ELECTROLYSIS.

SPECIFICATION forming part of Letters Patent No. 657,012, dated August 28, 1900.

Application filed August 17, 1899. Serial No. 727,586. (No model.)

To all whom it may concern:

Be it known that I, PAUL SCHOOP, electrochemist, a citizen of Switzerland, residing at Wildegg, canton of Argaü, Switzerland, have invented certain new and useful Improvements in Apparatus for Electrolysis, (for which I have made application for patent in Great Britain, dated June 23, 1899, No. 13,074; in Switzerland, dated July 3, 1899, No. 21,579; in France, dated July 15, 1899, No. 278,851; in Germany, dated July 17, 1899, No. 14,989, and in Italy, dated July 15, 1899, No. 605,) of which the following is a specification.

This invention consists in an improved arrangement and construction of electrolytic decomposing apparatus—that is, vessels and electrodes—which enables the electrical resistance to be reduced to a minimum, so as to obtain an exceedingly favorable useful effect for the electrolytic process. Furthermore, my invention also enables precious metals, such as platinum, to be used as the material for the electrodes, as these can be made very thin in consequence of the conditions and proportions of my construction, while the necessary strength and conductivity of the electrodes are nevertheless afforded. In carrying out the process also the mixture of the separated products at the electrodes, which is for some purposes necessary, is effected automatically in a very perfect manner. I will exemplify the attainment of these several advantages by describing the application of my invention to the electrolysis of a somewhat-dilute solution of common salt. As is well known, the electrolyzed solution undergoes such a change that vegetable fibers can be bleached thereby.

On the accompanying drawings, Figures 1 to 5 show the construction of my improved apparatus. Fig. 1 shows a plan view; Fig. 2, a cross-section at right angles to the longitudinal direction of the apparatus; Fig. 3, a section taken parallel to the longitudinal direction. Fig. 4 is a detail perspective view of one of the double electrodes, and Fig. 5 a cross-section of a modified form.

In a slab A of insulating material that will also resist the action of the solution—such as glass, marble, porcelain, ebonite, and solid hydrocarbons, such as paraffin, &c.—are formed channels B, running parallel to each other, which are closed at both ends. These channels are suitably made of a rectangular cross-section, as at Fig. 5, or they may be semi-circular, as at Fig. 2, and in the present case they are about one centimeter wide, one centimeter deep, and thirty centimeters long. The dimensions may, however, vary without materially affecting the results. The main points are that the section of the channels should be taken as small as possible, and that the distance of the channels from each other, which in the present case is one-half centimeter, should also be small. In these long narrow channels lying closely side by side are introduced the double electrodes C, which in the present case are made of platinum-iridium sheet metal of only one-twentieth millimeter in thickness, but which may be made of other material, such as carbon. Fig. 4 shows a perspective view of a double electrode C, while Fig. 2 shows a cross-section through the same, and Fig. 1 a plan view thereof. This electrode is formed like the letter **S** and is formed with notched parts C′ along the one edge. The electrode is situated with its unnotched part in one of the semicircular channels, while its other part first rises up out of the channel and then bends over into the next channel, so that the serrations thereof reach down to the level of the liquid in such channel. Each channel has a separate supply-pipe D for the solution to be electrolyzed and also a discharge-pipe E for the electrolyzed solution. The direction of the flow of the liquid is indicated by arrows in Figs. 1 and 3. In order that the level of liquid may be maintained constantly at the same height in all the channels, each of these is provided with a small weir F just before the discharge-orifice, so that the liquid has to overflow such weir before escaping. When all these channels have been provided with double electrodes, as above described, (there being any desired number of the channels, such as six, as shown at Fig. 1,) and these channels having been filled with the solution to be electrolyzed, the apparatus is connected to the circuit of a current-generator of sufficient voltage. The electric current then enters, for example, the first electrode C, passes from the notched parts C′ into the liquid of the first channel, and through this to the electrode

C, from which the current again issues through the notched part into the solution in the second channel, and so on until the current has passed through all the electrodes and channels, returning from the last of these to the positive pole of the generator. By a suitable regulation of the supply of liquid and of the strength of the electric current the electrolysis can be carried out within the desired limits.

If several such apparatus are to be employed in combination, they can advantageously be arranged in step form, one beside the other. Figs. 1 and 3 show part of a second apparatus arranged in this manner, the solution passing from the channels of the first one into those of the second, as indicated by the arrows. By this means the solution can be enriched to a corresponding degree instead of requiring to pass it repeatedly through one and the same apparatus for this purpose. For example, a solution of common salt having six per cent., by weight, of solid salt was passed through the above-described apparatus (about forty liters of the solution being passed through the apparatus in one hour) and electrolyzed until the contents of active chlorin in the solution had risen to one per cent. The voltage amounted to thirty volts and the strength of current to five amperes. It was found that the useful effect relatively to the quantity of current consumed was about seventy per cent. This constitutes the great advantage of the present invention, as with apparatus of known construction bleaching solutions of such strength could not even be obtained at all, and the useful effect already with the production of one-half per cent. of active chlorin is prohibitively low, or concentrated-salt solutions have to be used, which again increases the cost. If the present invention were worked with solution containing ten per cent. of salt for obtaining solutions with one-half per cent. active chlorin, the useful effect relatively to the quantity of current would be eighty-five per cent.

The useful effect when using graphite-carbon for the electrodes will, under the same conditions as in the first-described construction, (electrode-surface, concentration of the solution, strength of current, speed of flow, and distance apart of the electrodes,) always be less than with platinum electrodes, and will depend on the quality of the carbon used; but even graphite, such as is obtained by means of the electrical furnace, will not give such favorable results as platinum.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. An apparatus for electrolyzing solutions, comprising a base of insulating material having a series of long narrow channels therein through which the solution to be electrolyzed is caused to flow, the said channels being arranged parallel to each other and close together, double electrodes each extending from one channel into the next adjacent one and electrical connections with the electrodes at the ends of the apparatus from opposite poles of an electric generator.

2. An apparatus for electrolyzing solutions, comprising a base of insulating material having a series of long narrow channels B therein arranged parallel to each other and close together, means for supplying and discharging liquid to and from opposite ends of each of said channels, double electrodes C, **S**-shaped in cross-section, and provided with a notched part C′, one part of each of said electrodes being located in one of said channels, while the other notched part C′ projects over into the next adjacent channel, and electrical connections with the electrodes at the ends of the apparatus from opposite poles of an electric generator.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

PAUL SCHOOP.

Witnesses:
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A. LIEBERKNECHT.