March 30, 1937. A. E. ZDANSKY 2,075,688

ELECTROLYTIC APPARATUS

Filed Jan. 10, 1935

Fig. 1

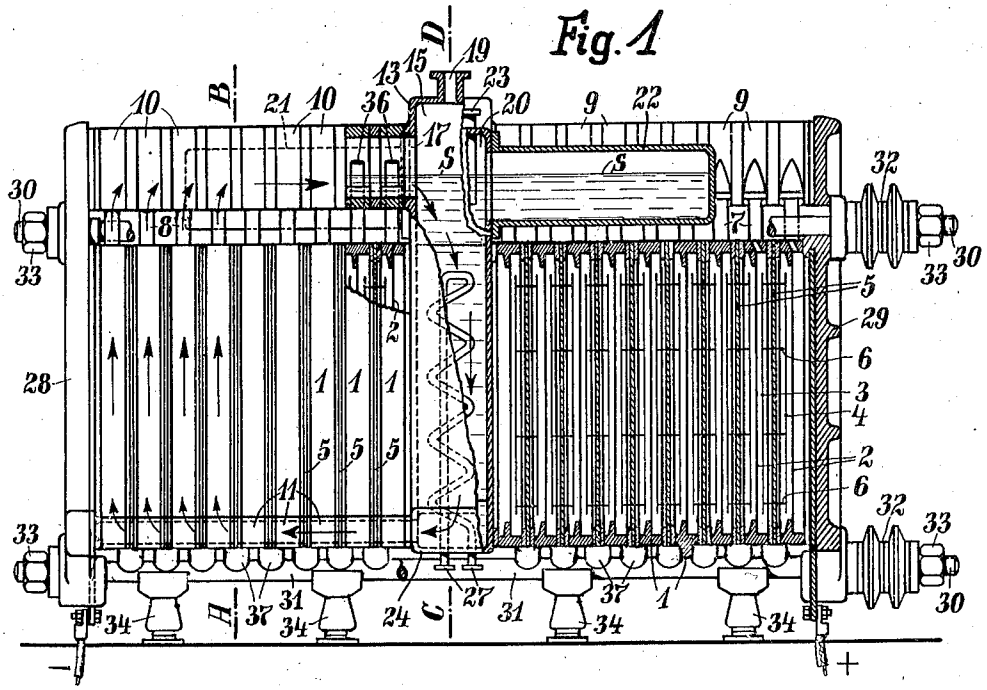


Fig. 2

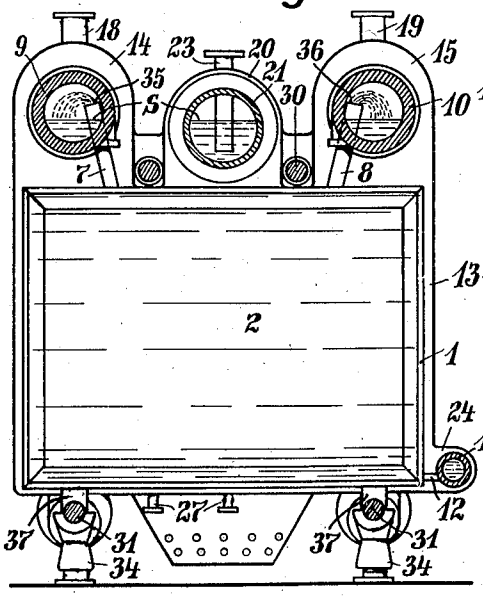
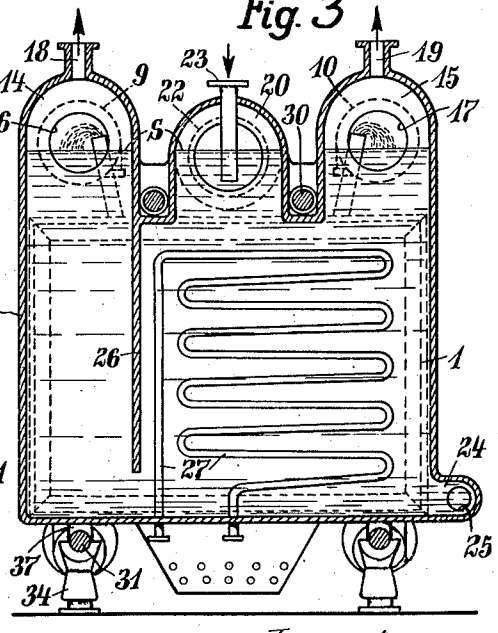


Fig. 3



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ELECTROLYTIC APPARATUS

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2 Claims. (Cl. 204—5)

This invention relates to electrolytic apparatus for the decomposition of water (or other liquids) of the type comprising a plurality of cell units assembled to a unitary structure after the fashion of a filter-press.

The invention is particularly concerned with the circulation of the electrolyte in such an apparatus. This circulation is essential in order to cool the electrolyte, and to mix the water that is to be decomposed uniformly with the electrolyte. The more intensively the circulation of the electrolyte proceeds, the more favourable is its effect on the electrolytic process, since it has been ascertained that too weak a circulation is accompanied by a rapid separation of the electrolyte in the cathode, or anode, space. In general, the circulation is produced by means of circulation pumps, but this method has the drawback of intefering with the reliability of the working operations and of increasing the expense of the process by the cost of running the pumps.

An attempt has therefore been made to set the electrolyte in motion by the dynamic action of the effluent gases, and in order to bring about such a movement of the electrolyte, there has been provided, in addition to the conduits leading the gases to the receivers, other pipes leading from the receivers to the bottoms of the cells. The entire system, receivers included, is filled with liquor. In operation, the liquor is set in motion, by the effluent gases, in such a manner that it is carried, with the gas, into the receivers, and led back to the bottom of the apparatus through the additional pipes. The circulatory movement of the electrolyte thereby obtained is far too small for the electrolytic process and considerable separation still takes place; moreover, the circulation ceases entirely as soon as the specific gravity of the liquor in the individual cells prevents the entrance of the oncoming electrolyte, as the result of increased back pressure.

The present invention brings about a particularly intensive circulation of the electrolyte sufficient for completely preventing separation of the electrolyte in the individual cells. Owing to the large quantities put into circulation by the application of the invention, adequate cooling and uniform mixing of the water used are also rendered possible.

According to the invention, the increased circulation is obtained by leading the electrolyte from each separate cell into collecting mains common to all the cells and disposed directly above them through exceedingly short pipes provided for each cell, the pipes opening into the collecting mains at a higher level than that of the electrolyte in the mains. The arrangement is such that the dynamic action of the gases expels the liquor and gases freely into the collecting mains, and the electrolyte falls down on to the surface of the liquid. The gases, which are thus instantaneously separated from the electrolyte, can be led away direct. From the collecting mains, the electrolyte is led back to the cells through return pipes.

The amount of electrolyte in circulation can be controlled, at convenience, by suitably increasing or lessening the difference between the level of the liquid in the battery of cell units and the outlets of the projecting pipes.

In returning the liquor, this may be passed through a chamber located in the centre of the battery and provided with cooling means. The mixing of the distilled water used can also be effected in said chamber.

A typical embodiment of the invention is illustrated on the accompanying drawing, whereon:—

Fig. 1 shows the apparatus in part-sectional elevation;

Fig. 2 represents a section through a single cell, on the line A—B of Fig. 1; and

Fig. 3 represents a section through the central chamber of the apparatus on the line C—D of Fig. 1.

The apparatus consists of a number of adjacently disposed cells, each composed of the cell frame 1 with built-in diaphragm 2 and the electrode 5 faced by the cathode 3 and anode 4. The latter are secured to the main electrode 5 by means of bolts 6. Each cell carries, at the upper end, a pipe 7 on the oxygen side, and a pipe 8 on the hydrogen side which pipes open to mains sections 9 and 10. Each cell also has a lower section 11 (Fig. 2) communicating with the cell frame by means of a nozzle pipe 12. In the middle of the apparatus, between the cells, is an isolated central chamber 13, the cross section of which is shown in Fig. 3. It is provided with two gas-collecting chambers 14 and 15, having lateral bores 16 and 17 and gas-outlet pipes 18 and 19. The central chamber 13 is also provided with a central structure 20, to which (on the right and left) are attached two liquor-compensating tanks 21 and 22. These tanks serve as expansion tanks for the electrolyte displaced in the apparatus by the gases. The distilled water used is admitted through the feed pipe 23. The central chamber 13 is provided with a lower bay 24, having side openings 25. The central chamber also

contains a partition 26, extending nearly to the bottom, and a cooling coil 27.

Assembly is effected by setting the chamber 13 in the centre, and then the several adjoining electrodes and cells, on the bottom tie rods 31, insulators 37 being interposed. The complete block is pressed together between heavy end plates 28, 29, by means of the nuts 33 and the additional tie rods 30. Dished springs 32 are provided to take up expansion. The end plates are provided with insulated bores, and the entire battery of units is mounted on insulators 34.

Through the juxtaposition of the several cell frames 1, and therefore of the sections 9, 10, two tubular passages or mains closed by the end walls 28, 29, are formed above the cell frames and communicate with the central chamber 13 through the openings 16 and 17. The juxtaposition of the pipe sections 11 forms a passage which communicates with the central chamber 13, by way of the openings 25, and is also closed, at the ends, by the plates 28, 29.

The space 14 of the central chamber 13, and the laterally adjoining passage or main formed by the sections 9, serve for collecting the oxygen. In a corresponding manner, the space 15 of the central chamber 13 and the laterally adjoining passage or main formed by the sections 10 serve for collecting the hydrogen. The oxygen is led away through the branch 18, and the hydrogen through the branch 19. The passage formed by the sections 11 serves for the return of the electrolyte, and the supply of the water used from the central chamber 13 to the various cells of the apparatus, by way of the small pipes 12 belonging one to each cell. The effective apertures of these small pipes are varied (preferably by means of stops) according to their distance from the central chamber, thereby enabling equal quantities of electrolyte to be suplied to all the cells.

In operating the apparatus, the central chamber and the several cells are filled with electrolyte to the level S. The mouths 35 of the pipes 7, and the mouths 36 of the pipes 8, opening into the mains sections 9 and 10 respectively, are on a higher level than the surface S of the electrolyte. Consequently, the gases formed during the electrolysis and issuing through the pipes 7 and 8, carry the electrolyte with them and allow it to fall, after the manner of a gushing spring, on to the surface S of the liquid in the mains 9, 10. The electrolyte flows thence to the central chamber 13, is cooled by the coil 27 and returns to the several cells through the passage formed by the pipe sections 11, and through the small pipes 12. Thus, as indicated by the arrows, the electrolyte circulates through each half of the apparatus, and the circulation is assured by the higher level of the outlets 35, 36 from each cell, as compared with the surface S of the liquid.

I claim:—

1. In electrolytic apparatus, for the decomposition of water or other liquid, the combination of a plurality of individual cell units assembled together and presenting collector mains for the evolved gases, conduits leading from the cells and opening into said mains above the level of the electrolyte therein, said collecting mains being located immediately above the cells and said conduits being accordingly very short to ensure substantially unhindered expulsion of the electrolyte from the cells with the evolved gases, a cooling chamber in communication with said mains, cooling means in said chamber, and conduits leading from said cooling chamber to the cells.

2. Apparatus as claimed in claim 1, wherein said cooling chamber is disposed centrally between the assembled cell units and has an inlet branch for the water or liquid to be decomposed.

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