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CIRCULATION ELECTROLYZER FOR ALKALINE CHLORIDES

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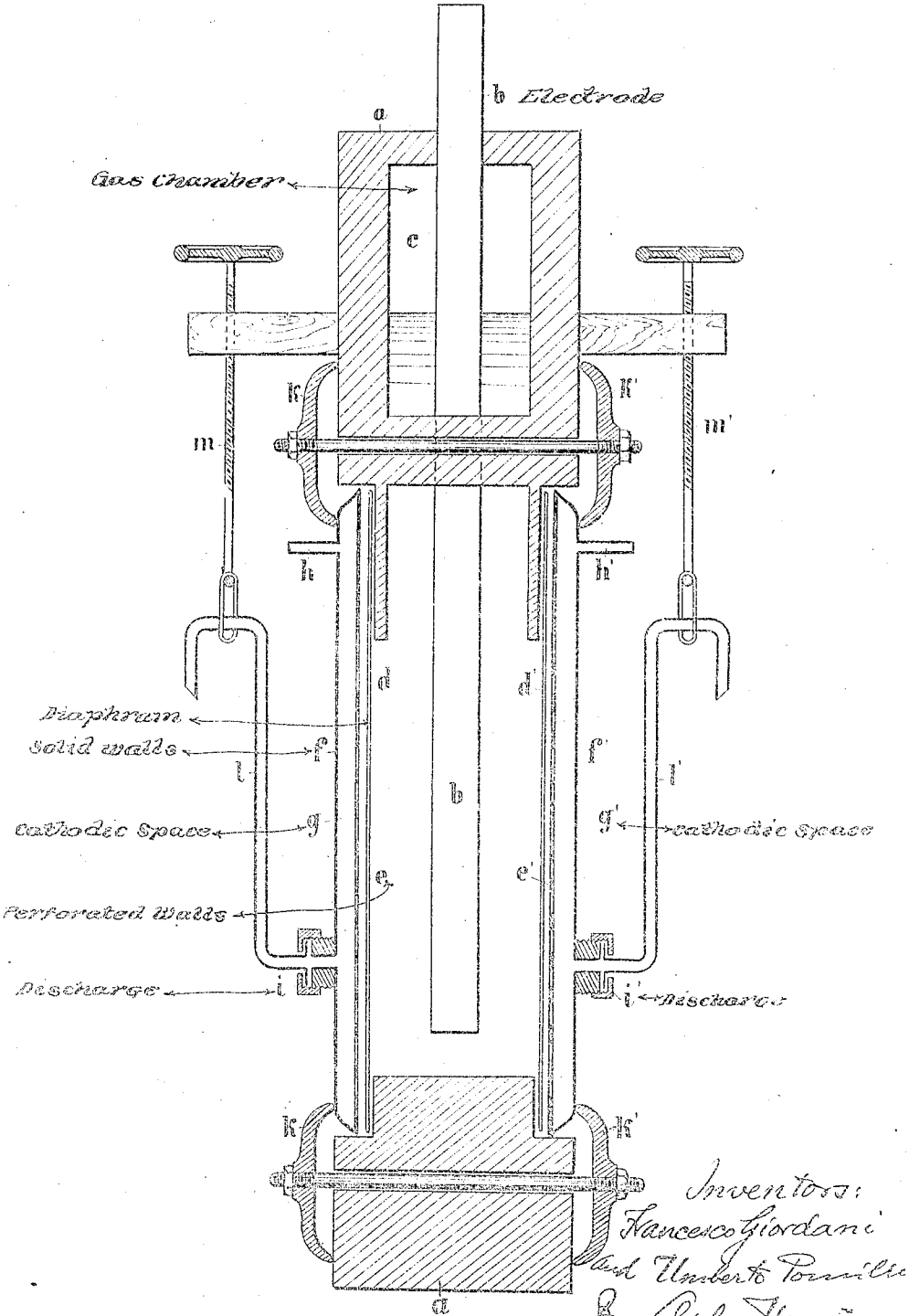

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CIRCULATION ELECTROLYZER FOR ALKALINE CHLORIDES.

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To all whom it may concern:

Be it known that I, FRANCESCO GIORDANI, a subject of the King of Italy, residing at Naples, in the Kingdom of Italy, and I, UMBERTO POMILIO, a subject of the King of Italy, residing at Naples, in the Kingdom of Italy, have invented certain new and useful Improvements in Circulation Electrolyzers for Alkaline Chlorides, of which the following is a specification.

The efficiency of diaphragm electrolyzers for alkali chlorides is limited by the migration of the ions OH' in the anodic section, a migration which becomes the more conspicuous the higher is the concentration of the alkali in the cathodic section.

In order to obtain a high efficiency while working with not too low concentrations it has already been proposed to cause a general movement of the liquid through the diaphragm on the anode towards the cathode, so as to reduce the speed of the said ions measured in respect of the separating diaphragm.

However when trying to practice this suggestion, which aims at effecting a filtration across the diaphragm, it has generally been lost sight of the fact that the porosity of the diaphragm itself cannot be increased beyond a certain value without the phenomena of physical diffusion assuming a considerable importance. Hence the necessity to obtain the circulation of the liquid through a not too small hydrostatic pressure.

If then the fact is taken into consideration that during the operation the physical characteristics of the diaphragm generally are altered in the direction of a diminution of its porosity, and therefore of its permeability, it may be seen how it is necessary to provide in a continuous and controllable way for the variation of the heights of the anodic liquid to be filtered.

On the other hand the speed of the efflux ought to be equal in every part of the diaphragm in order to always keep it in the best working conditions. To this would indeed answer an apparatus with horizontal diaphragms, if a very high anodic chamber could be provided, so as to enable a variation of the level of the liquid by a suitable adjustment. However these apparatus, being already very bulky, would become much more so and would involve the use of enormous volumes of liquid, without taking into account the fact that in these apparatus all the deposits which are formed (precipitates, graphite disintegration products, etc.) inevitably settle upon the diaphragm, thus greatly quickening the alteration process of its physical features.

It remains then to consider the apparatus with vertical diaphragms whereof there are two main types:

The first (the McDonnald's for instance) provides for the adjustment by causing the level of the cathodic liquid to vary during the operation, beginning from a very small level difference between anolyte and catholyte on starting the operation. The adjustment process gradually uncovers a part of the diaphragm dividing it into a zone (submerged part which is gradually reduced) in every part of which is obtained an equal speed of efflux and in another (the part emerging on the cathodic side and gradually increasing) wherein the efflux speed varies continually at the different heights. Said apparatus further, either in simple units or in aggregate units, have but one level adjustment for all the diaphragms.

The electrolyzers of the second type, called by Americans "Percolation cell" (Nelson, Allen-Moore, etc.) have always their cathodic liquid chamber empty.

The different efflux speed at the different heights compels the constructors to limit the total height of the diaphragm, thus developing the electrolyzer in the direction only of its length every time they wish to increase its power. Thus there is a limit imposed by the concentration of the anolyte, beyond which it is not easy to go without recurring to an independent circulation of the anodic liquids for the purpose of completely resaturating them, which is not without inconvenience (chlorine exhalations, progressive enrichment of the liquid in chlorates, etc.).

In these apparatuses are not provided means to adjust the anolyte level within wide limits so as to keep constant the working conditions of the electrolyzer during its operation.

The apparatus which is the object of our invention comprises a central structure suitably arranged and combined on two of its faces by two diaphragms of a suitable material having a very limited porosity to reduce to the least possible quantity the phenomenon of the diffusion of the anodic and cathodic liquids.

This limited porosity, which is the true essential element of a high efficiency in this kind of apparatus, for the filtering of the liquid in a suitable measure, requires a pronounced difference of level between the anolyte and the catholyte said difference being obtained by suitably lifting the anodic chamber above the upper limit of the diaphragms.

By means of a suitable feeding device (not shown in the drawing) the level of the brine in the anodic section may be varied during the operation in order to be able to vary at will the efflux speed of the liquid through the diaphragm not only in relation to the working conditions but also for maintaining said efflux speed constant when the permeability of the diaphragm changes, which generally diminishes when the diaphragm gets old.

The cathodic chambers are kept constantly full up to the upper limit of the diaphragms, thereby obtaining the constant efflux speed in every part of them, differently from what occurs in the cells provided with filtering diaphragms not completely submerged on the cathodic side.

The catholyte is continuously withdrawn from the cathodic chambers through articulated siphons which can be controlled separately, and which allow to secure, with the exact determination of each level, an equal speed of efflux on both diaphragms even when they have not the same perfect structure, as it happens in practice.

The articulation of the discharge siphons allows also to wholly or partially empty the cathodic chambers, in order to increase the level difference between the anolyte and the catholyte; in this way it will be possible to work with diaphragms, the porosity of which has been greatly reduced by use, that is to say it will be possible to lengthen the duration of the diaphragm.

The annexed drawing shows by way of example in a diagrammatic section an embodiment of the electrolyzer according to our invention.

The frames —*a*— of unattachable material bears the electrodes —*b*— of anodic graphite and forms in the upper part a gas chamber —*c*— high enough to allow a variation of the anolyte level within wide limits.

The cathodic spaces —*g*—*g'*— consist of two sheet metal chambers having solid walls —*f*—*f'*— opposite to the perforated walls —*e*—*e'*—, these latter resting against to suitable porous diaphragms —*d*—*d'*— fitted on both sides of frame —*a*—.

The spaces —*g*—*g'*— are provided with hydrogen outlets —*h*—*h'*—, the lower portion of said spaces being connected with siphons —*l*—*l'*— by means of articulated discharges —*i*—*i'*—.

The lowering screws —*m*—*m'*— allow of the siphons —*l*—*l'*— to be adjusted independently one from the other, in order that the level of the catholyte may be varied at will. Two boltscrews —*k*—*k'*— connect the cathodic chambers with the frame —*a*—.

We claim as our invention:

1. A circulation electrolyzer for alkali chlorides, comprising an anodic chamber, cathodic chambers, vertical diaphragms separating the said anodic chamber from the cathodic chambers provided at their upper ends with hydrogen outlets, a feeding device for admitting the electrolyte to the anodic chamber, means for discharging the liquid arriving in the cathodic chambers, and means for regulating the speed of the liquid passing through the said diaphragms, irrespective of the changes of the porosity of the said diaphragms.

2. A circulation electrolyzer as specified in claim 1, in which the anodic chamber extends above the upper limit of the said diaphragms, the said feeding device allowing to regulate the level of the liquid fed to the said anodic chamber, and which comprises means for regulating the level of the liquid in the cathodic chambers, for the purpose of regulating the flow of the liquid through the said diaphragms by conveniently arranging the levels in the anodic and in the cathodic chambers.

3. A circulation electrolyzer as specified in claim 1, comprising means for regulating the level of the liquid in the cathodic chambers, the said means consisting in articulated siphons through which the catholyte is discharged.

4. A circulation electrolyzer as specified in claim 1, comprising articulated siphons in combination with the cathodic chambers, and means for adjusting the said siphons independently of each other.

In testimony whereof we have affixed our signatures this 21st day of September, 1922.

FRANCESCO GIORDANI.
UMBERTO POMILIO.