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G. W. VAN BARNEVELD KOOY
DEVICE FOR THE CONTINUOUS DIALYSIS IN COUNTER-CURRENT OF LIQUIDS CONTAINING SUBSTANCES IN A COLLOIDAL STATE
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Fig:1.

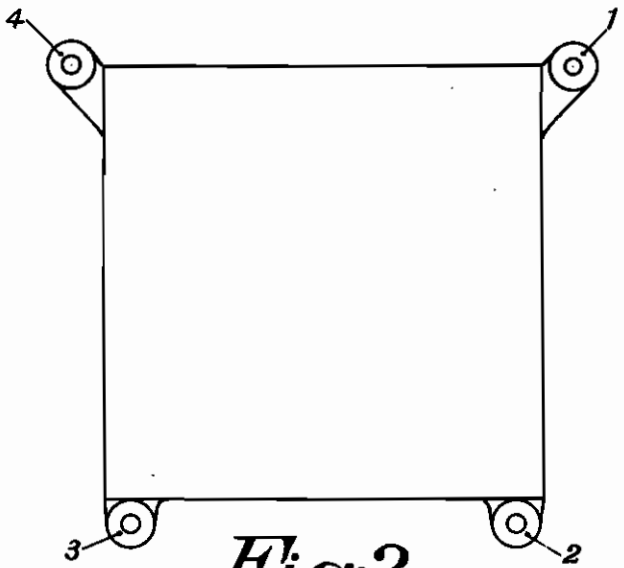
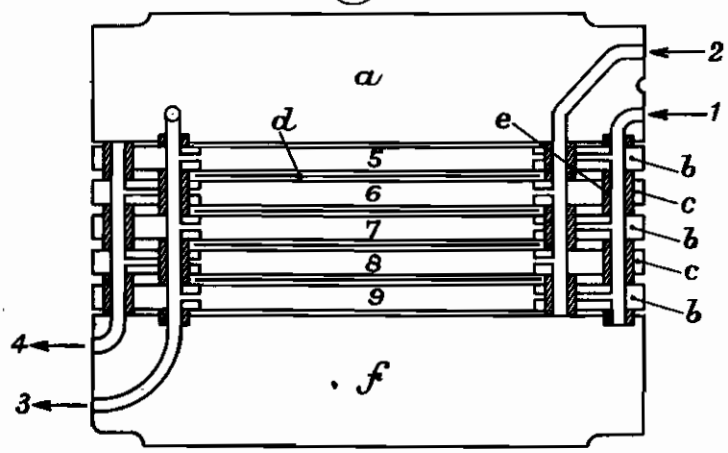


Fig:2.



Gerrit Willem Van Barneveld Kooy
INVENTOR
By
his ATT'Y.

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR THE CONTINUOUS DIALYSIS IN COUNTER-CURRENT OF LIQUIDS CONTAINING SUBSTANCES IN A COLLOIDAL STATE

Gerrit Willem van Barneveld Kooy, The Hague, Holland; vested in the Alien Property Custodian

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It is known that the caustic soda in the waste lyes of the industry of artificial silk, applying the viscose-process, and in the waste lyes which are formed during the manufacture of such products such as cellophan, woolly products obtained from artificial silk (Zellwolle) and the like can be recovered by dialysis. It is obvious that for this purpose devices, the construction of which resembles that of the so-called frame-filter-presses, can be used. In the filter presses just referred to there are provided on the one side a number of frames arranged in parallel and containing the impure liquid and on the other side a number of frames, also arranged in parallel, receiving the filtrate. The frames are always arranged in such a manner that the frames 1, 3, 5 and so on just as the frames 2, 4, 6 and so on communicate with each other. Between the frames the filter cloth is arranged. The frames receiving the impure liquid are all fed from a common inlet while each of the frames from which the filtrate flows away may have a special outlet, or a common outlet may be provided.

As in a dialyser two liquids are always flowing it was only necessary to provide both groups of frames each with a common inlet and also with a common outlet, while for a filter cloth between the frames membranes were employed. The arrangement was such that the membranes as in the case of the filter cloth of a filter press could be rapidly and easily replaced. As the membranes when building up the press could be clamped between rubber packings arranged on the frames, it was possible to apply membranes comprising sheets of parchment, which are not only cheap but also have a great permeability. Consequently in applying a great dialysing-speed per cm^2 of the membrane-surface a rather small surface is sufficient. As in the industries above mentioned large amounts of waste lyes must be dialysed, a large membrane-surface is necessary; plants with a total active membrane-surface of 1200 M^2 and more are therefore not uncommon. It is obvious that those surfaces will be distributed over as small a number of devices possible; consequently each of them must embody a large number of frames.

In addition to the foregoing the following factor plays an important part. In order to obtain a high efficiency the treated waste lye may not contain more sodium hydroxide than is necessary to prevent the separation at the flocculent state of the impurities, in this case the hemicellulose, which would obstruct the pipes of the devices and the pores of the membranes.

In order to meet those requirements it is necessary to distribute the liquids flowing into the device uniformly over the spaces arranged in parallel and bounded by the membranes. For if more lye is flowing through a certain space than the neighbouring membranes can deal with, the treated lye flowing out contains a high percentage of sodium hydroxide which means a loss. If, however, one space receives too much lye, the other space will receive too little lye; consequently the dialysis will be carried out too intensively and the colloids will be separated at the flocculent state. In this case the disadvantages above-mentioned arise. The same disadvantages arise if the distribution of water is unequal. If the amount of water flowing through a space is too little, the dialysis in the neighbouring spaces may not be carried out in an efficient manner, which means a loss. If this amount of water is too large, the dialysis in the neighboring spaces will be carried out too intensively, hence separation at the flocculent state. If the surface of the membranes is more increased than theoretically corresponds with the amount of lye to be treated, no advantage is obtained, because in this case the undesired separation of the colloids at the flocculent state is still more intensive.

It has been found that in a filter press such a uniform distribution of the liquids over the spaces arranged in parallel does not happen, which may be proved by providing those spaces with special outlet pipes for the filtrate. This uniform distribution of the liquids is not necessary when using a filter press as distinct from a device for the dialysis, in which the uniform distribution plays an important part. Such a uniform distribution could also be obtained with a device for the dialysis for the following reasons:

In a device for the dialysis the spaces arranged in parallel for the liquids which serve as a dialysing means as well as the spaces for the liquids to be dialysed form communicating vessels, which means that at the same level the pressure is the same. As in the liquid to be dialysed, e. g. the pressed lye, which flows from the bottom to the top, the percentage of sodium hydroxide decreases, also the specific weight of this liquid will decrease. If in this case the speed of the liquid in all spaces is not the same, the pressure at the same level will no longer be the same. If the speed in one space is too high, no sufficient dialysis takes place in this space; consequently the pressure in this space is higher than in a communicating space in which a lower speed prevails. Under these circumstances a regulating action

would arise providing for a uniform distribution of the lye over the spaces arranged in parallel. The same action takes place in the spaces in which the water flows from the top to the bottom, this water being converted into pure lye.

It has, however, been found that in practice this regulating action particularly, when using devices embodying a large number of spaces, results in nothing. As the inlet of each liquid is situated at the same side as the outlet, the path which must be covered by each particle of the liquid will be longer as it flows through a space situated at a greater distance from the head containing the inlet as well as the outlet for this liquid. The losses of pressure which are caused by the frictional resistance are consequently not the same. The regulating action above-mentioned is consequently in part nullified and the more so as the length of the device is increased and consequently the difference between the paths to be covered becomes larger. For example in using a device of great capacity containing 80 spaces arranged in parallel between the heads in which alternatively 40 spaces serve for the liquid to be dialysed and 40 spaces serve for the dialysing liquid, the path through the first space in a horizontal direction amounts only to a few cm; however, through the last space the way amounts to more than 5 m while the paths in a vertical direction are always the same.

The invention has for its object to remove the detrimental influences exerted by the difference in the losses by friction between the paths which each lead through one of the spaces arranged in parallel by the uniform distribution of the liquid over these spaces.

The device according to the present invention, which, in accordance with the construction of a filter press, contains frames or plates provided with membranes which are arranged in a replaceable manner between a fixed head or one or more movable heads, the spaces bounded by those membranes being arranged in parallel and being alternatively passed in counter-current by the liquid to be dialysed and the dialysing liquid, is characterized by the fact that the outlet for each of the liquid is always arranged at the end of the device opposite to that at which the inlet for this liquid is arranged.

According to this construction the paths which are followed by the liquids have always the same length no matter through which spaces those liquids pass, as the paths which are followed by the liquids in the spaces bounded by the membranes have always the same length. It is true that now the path of inlet which must be covered by a particle of the liquid is longer as the space which must be passed is situated at a greater distance from the head; however, the path of outlet for the particle of the liquid decreases in the same degree; consequently the whole path always has the same length.

With a device constructed according to the invention it is quite immaterial whether both inlets for the two liquids are arranged at one side and both outlets at the other side of the device or whether the inlet for one liquid and the outlet for the other liquid is at one end of the device and the outlet for the first liquid and the inlet for the second liquid at the other end. The main point is that the inlet and the outlet for the same liquid is always arranged at opposite ends of the device. Preferably both inlets for the two liquids are arranged at the same side of the device on the fixed head, on which the controlling means for the inlets are also mounted. In this case the movable head only carries the outlets through which the liquids flow freely away.

As an example of a form of the invention, the device consists of a double filter press with a fixed head in the middle of the press. On both sides of this head **80** spaces separated the one from the other by membranes of parchment are arranged, those spaces being arranged in parallel and being alternatively traversed by the lye to be treated and by water. On both sides of the fixed head movable heads are arranged at both ends of the device. On the centre part four inlets are arranged for the inlet of the lye and of the water. Each of the movable heads has an outlet for the treated lye and an outlet for the pure lye. On each side of the middle part the water flows from the top to the bottom through the frames **2**, **4**, **6** . . . **80** and is converted on its way into pure lye. The impure lye (pressed lye) which flows through the frames **1**, **3**, **5** . . . **79** from the bottom to the top, leaves the device at the upper side of the movable head. In order to prevent the device from emptying itself, the collected pure lye, flowing at the bottom from the movable head, is guided in a upward direction by means of a pipe fixed to the head, this pipe being bent at the upper side.

In order that the invention may be the better understood reference is made to the accompanying drawings in which:

Fig. 1 is a view.

Fig. 2 is a plan view of the device.

The water enters the device at **1** and flows through a pipe into the spaces **5**, **7** and **9** leaving those spaces through a common pipe at **3**. The path which is covered by this liquid in passing the several spaces is always the same. For the path of inlet for this liquid, passing the space **5** is short, however, the path of the outlet is long. The path of the inlet for the liquid passing the space **9** is long, while the path of outlet is short. As the path of inlet increases, the path of outlet decreases and conversely; the total path, however, remain the same, thus yielding the advantages above-mentioned. The explanation given in connection with the water or the pure lye also applies to the impure lye or the waste lye. For the impure lye enters the device at **2** and flows from the pipes as indicated through the spaces **6** and **8**, leaving the device at **4** through the common pipe in the form of waste lye. Also in this case the phenomenon arises that as the length of path of the inlet for the impure lye increases, the length of path of outlet for the liquid in the form of waste lye decreases and conversely. The total length of the path covered by this liquid, however, always remains the same.

The invention is not limited to the application to pressed lyes as described, as it may be applied to all liquids containing substances in a colloidal state.

GERRIT WILLEM VAN BARNEVELD KOOY.