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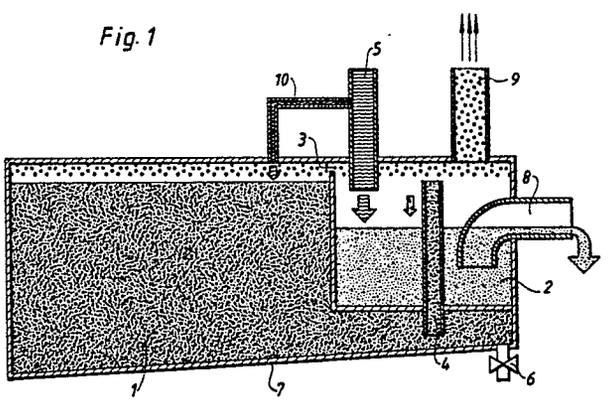
## (54) A method and an arrangement for the continuous diluting of a concentrated solution.

(57) The invention relates to a method and an arrangement for the continuous diluting of a concentrated solution. A main tank (1) for the concentrated solution and a partial tank (2) for diluting liquid are connected to one another by means of an overflow pipe (4), whose open end is on a level with the level of the concentrated solution in the main tank (1).

Diluting liquid is fed continuously by the feed line (5) to the partial tank (2), a small quantity of diluting liquid at the same time being diverted and fed to the main tank (1).

The quantity of diluting liquid which is fed to the concentrated solution is of the same magnitude as the quantity of concentrated solution which is fed at the same time to the diluting liquid via the overflow pipe (4).

Fig. 1

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# A METHOD AND AN ARRANGEMENT FOR THE CONTINUOUS DILUTING OF A CONCENTRATED SOLUTION

The present invention relates to a method for the continuous diluting of a concentrated solution by means of a continuous flow of diluting liquid. The invention also relates to an arrangement intended for the same.

Concentrated solutions of different types occur in many different branches of industry and the handling of these concentrated solutions always involves problems and risks of material damage and personal injuries. When the concentrated solutions have been used in production, a portion of the solutions can be drawn off via a drain and be dealt with in a conventional purifying works, if prior to drawing off they have been diluted to a very low concentration. Other solutions are not suitable for drawing off via a drain, but they may become easier and safer to handle after dilution. The diluting of concentrated solutions in batches is space-demanding as large mixing tanks are required.

In the industry where liquid foodstuffs are filled into non-returnable packages of an aseptic type hydrogen peroxide, $H_2O_2$, is used as a sterilizing agent. This peroxide occurs in concentrations of 30 - 50 per cent by weight in the production.

On a packing machine where the moving packing material web of plastic-coated paper passes through a peroxide bath for sterilization, a bath with at least 30 litres of peroxide solution is used. After approx. one week's production the peroxide bath has been polluted by particles from the packing material and with increased pollution the concentration of peroxide diminishes and the bath becomes unusable for sterilization.

When the peroxide solution has to be changed it may be drawn off either directly into the drain or onto the floor, which, above all owing to the vapours formed by this peroxide, is harmful to machine operators and any personnel present on the premises. Peroxide vapour which is inhaled exerts a corrosive action on mucuous membranes, and direct contact with peroxide corrodes skin and clothes. Alternatively the peroxide solution can be pumped over to kegs or drums for subsequent destruction. Such handling too may involve hazards to those handling the solution.

It is an object of the present invention to deal with concentrated solutions in a simple manner demanding little space and dilute them so as to minimize the risk of personal injuries.

It is a further object of the present invention to provide an arrangement for the continuous dilution of concentrated solutions.

These and other objects have been achieved in accordance with the invention in that the method of the type described in the introduction has been given the characteristic that the concentrated solution is fed continuously in small quantities to the diluting liquid owing to a small quantity being diverted from the inflowing diluting liquid and being fed to the concentrated solution, the amount of concentrated solution fed to the diluting liquid being of equal magnitude as the quantity of diluting liquid fed to the concentrated solution.

The invention will now be described in more detail with reference to the attached drawings, wherein

Fig. 1 shows schematically a preferred embodiment of the invention,

Fig. 2 shows a further preferred embodiment of the invention.

The arrangement in Figure 1 consists of a substantially closed main tank 1 holding at least the quantity of concentrated solution which is to be diluted. There must also be space for possible vapour formation. In this main tank 1 is enclosed a small partial tank 2 intended for the diluting liquid. The main tank and the partial tank 2 are connected with one another on the one hand via an air gap 3 for vapours discharged in the upper part of the tanks, on the other hand via an overflow pipe 4, preferably placed vertically with its bottom end immersed in the main tank 1 below the lower boundary surface of the partial tank 2. The top end of the overflow pipe 4 is on a level with the level of the concentrated solution in the main tank 1.

In the upper part of the partial tank 2 opens up a feed pipe 5 for diluting liquid. This feed pipe 5 is forked so that a small amount of diluting liquid is diverted from the feed flow and is supplied to the main tank 1.

The main tank 1 is provided with an openable drainage line 6 suitably placed at the bottom 7. The bottom 7 may be made sloping with the drainage line 6 being in the upper part. Hence, on changing of the concentrated solution which is to be diluted, a certain amount of diluting liquid will be allowed to remain in the tank 1. This amount of liquid contributes to an immediate dilution.

The outlet line 8 of the partial tank 2 is constituted of an overflow pipe whose one end opens below the liquid surface in the partial tank 2. The arrangement is provided, moreover, with a ventilating pipe 9 for the discharge of vapours and for reducting the danger of excess pressure in the tanks.

The concentrated solution which is to be diluted is fed to the main tank 1, where it occupies almost the whole space. The supply of the con-

centrated solution to the main tank 1 should be arranged in a safe manner so that the solution does not need to be handled manually. The upper part of the arrangement might then be filled with vapours which are discharged via a ventilating pipe 9 which may be connected to the central ventilation and conducted away from the production premises.

The diluting liquid, which e.g. may be water, is supplied to the arrangement through an inlet line 5. In the event of the arrangement being used on aseptic packing machines, the waste water from the water ring compressor of the machine, which is used for scrubbing the air containing hydrogen peroxide circulating in the machine can serve excellently as diluting liquid. The greater part of the diluting liquid supplied is fed to the partial tank 2. A small amount is branched off and is fed to the main tank 1. The liquid level in the main tank 1 rises and thus also the level in the overflow pipe 4 which connects the main tank 1 to the partial tank 2. A small quantity of concentrated solution, corresponding to the diluting liquid fed to the main tank 1, passes via the overflow pipe 4 out into the diluting liquid of the partial tank 2.

The partial tank 2 is drained continuously via its outlet 8 which is constituted of an overflow pipe. This overflow pipe 8 opens below the liquid surface, so that the vapours should not be able to pass this way. If the diluted solution is allowed to be drawn off directly into the drain, the outlet 8 can be connected directly to this. Otherwise an appropriate arrangement is present to take charge of the liquid after the outlet pipe 8.

A small portion of diluting liquid is fed continuously into the main tank 1 at the same time as the concentrated solution passes via the overflow pipe 4 out into the partial tank 2. This small quantity of diluting liquid thus will gradually cause the contents of the main tank 1 too to be diluted to a harmless concentration. By keeping constant the diluting liquid fed to the concentrated solution it is possible to control the dilution process and calculate the ultimate concentration. The diluting liquid can be kept constant, for example, by giving the branch line 10 from the inlet line 5 of diluting liquid a certain dimension or, as is shown in Fig.2, by providing a vessel with constant water head and a bottom outlet opening of a defined dimension at the inlet 5 of the diluting liquid.

With a main tank of 50 litre and with an inflow and outflow of 3.7 litre per minute it takes approx. 20 hours until the concentrated solution in the main tank 1 too has been diluted to a concentration of below 1 per cent by weight, when the peroxide may be considered harmless and be drawn off into the drain. With other quantities and other inlet and outlet flows respectively other diluting times are obtained in corresponding manner.

After the time which is required for the desired dilution of the content of the main tank 1, the openable draining line 6 may be opened and the main tank 1 emptied. The main tank 1 now is ready to accept a new quantity of concentrated solution and the diluting process is repeated.

As is evident from the aforegoing description a method and an arrangement are provided by means of the present invention for the continuous diluting of a concentrated solution without any risk of personal injuries and where the procedure can take place in a wholly enclosed manner, since no manual handling is required before the solution has been diluted to a harmless concentration which can be easily handled.

## Claims

1. A method for the continuous diluting of a concentrated solution by means of a continuous flow of diluting liquid,
**characterized in that** the concentrated solution is fed continuously in small quantities to the diluting liquid, owing to a small quantity of the inflowing diluting liquid being diverted and fed to the concentrated solution, the quantity of concentrated solution which is fed to the diluting solution being of the same magnitude as the quantity of diluting liquid which is fed to the concentrated solution.

2. A method for the continuous diluting of a concentrated solution in accordance with claim 1,
**characterized in that** the quantity of diluting liquid which is fed to the concentrated solution is kept constant.

3. An arrangement for the continuous diluting of a concentrated solution, comprising a main tank (1) for the concentrated solution and a partial tank (2) for the diluting liquid,
**characterised in that** the partial tank (2) is connected to the main tank (1) by means of an overflow pipe (4) whose top end is on a level with the liquid level of the concentrated solution in the main tank (1) and whose bottom end opens below the lower boundary surface of the partial tank (2), an inlet line (5) for diluting liquid, arranged so that a small quantity of diluting liquid is fed to the main tank (1) and the remaining quantity is fed to the partial tank (2), and that the outlet (8) of the partial tank (2) is constituted of a spillway.

4. An arrangement for the continuous diluting of a concentrated solution in accordance with claim 3,
**characterized in that** the feed line (5) for diluting liquid has a branch line (10) of a defined diameter.

5. An arrangement for the continuous diluting of a concentrated solution in accordance with claim 3,

**characterized in that** the feed line (5) of diluting liquid opens into a separate metering container (11) which with a spillway (12) is connected to the partial tank (2) and to a bottom outlet (13), of a defined diameter, connected to the main tank (1)

6. An arrangement for the continuous diluting of a concentrated solution in accordance with claim 2,
**characterized in that** the main tank (1) is provided with a ventilating pipe (9) and an openable drainage line (6).

7. An arrangement for the continuous diluting of a concentrated solution in accordance with claim 2,
**characterized in that** the outlet (8) of the partial tank (2) is constituted of an overflow pipe which opens out below the liquid surface in the said partial tank (2)

Fig. 1

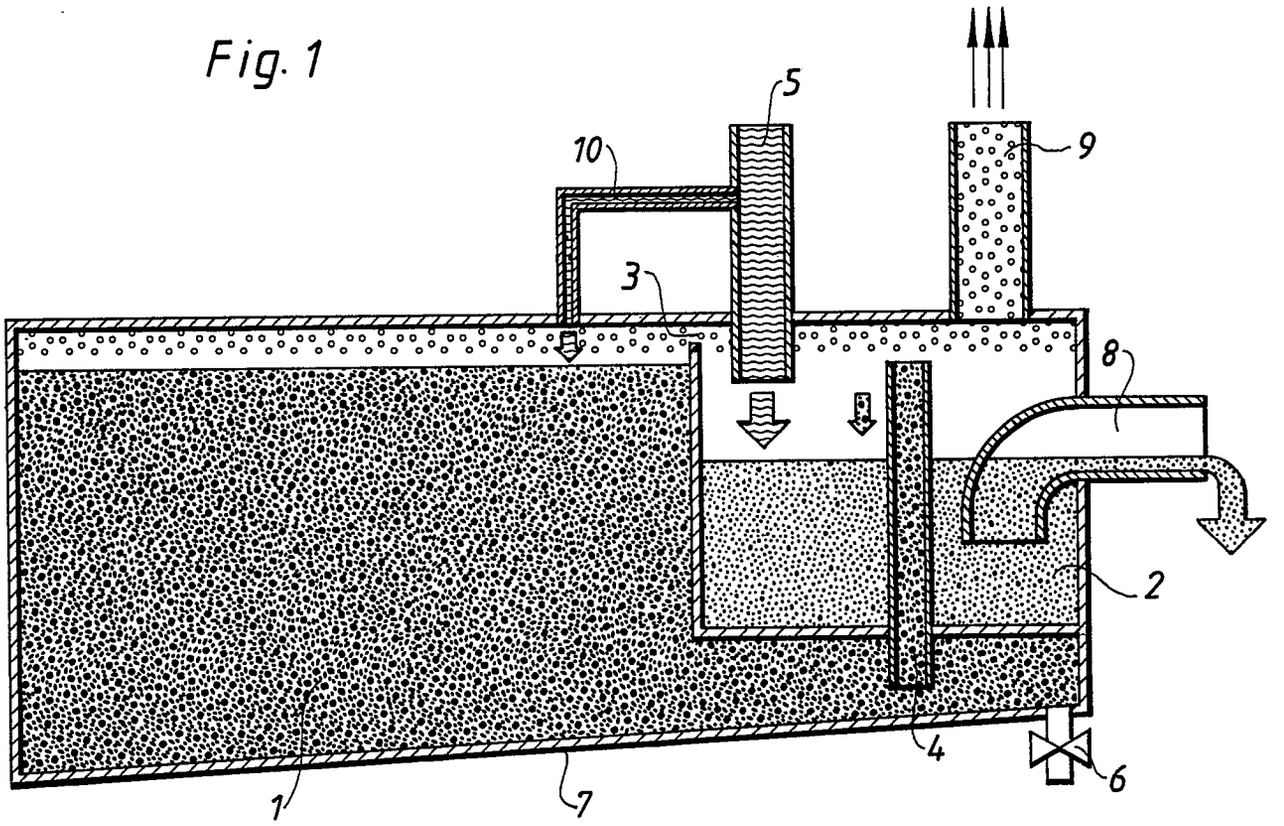
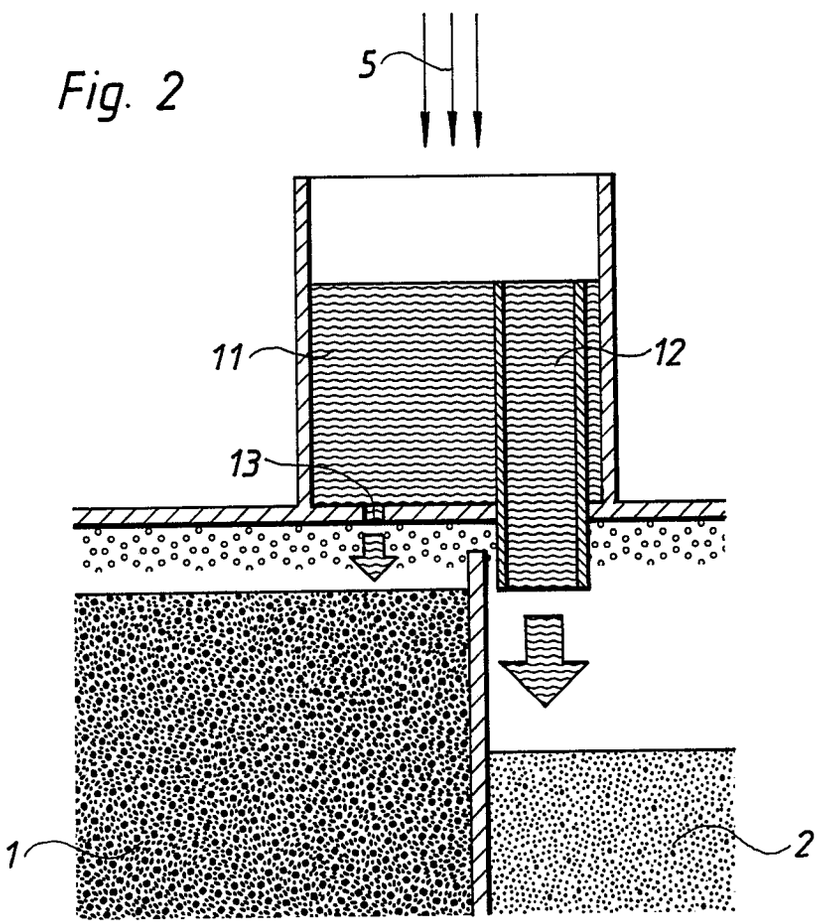



Fig. 2



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# EUROPEAN SEARCH REPORT

Application number
EP 89 11 8969.8

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int Cl 4) |
|---|---|---|---|
| | No relevant documents have been disclosed.<br>----- | | B 01 F 3/08<br>B 01 F 5/00 |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl.4)<br>B 01 F<br>B 01 J<br>B 67 D<br>C 02 F |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| STOCKHOLM | 22-01-1990 | ASPLUND W. |

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