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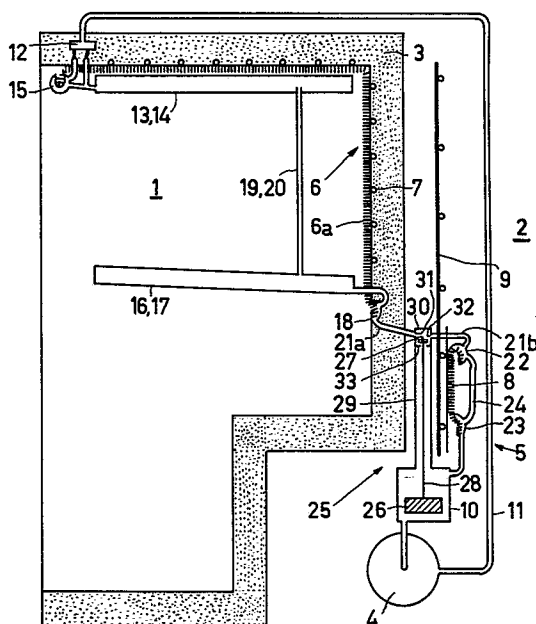
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⑤④ **A device for extracting moisture from a space.**

⑤⑦ The invention relates to a device for extracting moisture from a space (1) and transferring it to a second space (2) by means of a loop circuit (5) containing a hygroscopic liquid. In the first space (1) moisture is absorbed in the hygroscopic liquid and in the second space (2) the moisture is evaporated from said liquid. Sometimes the evaporation process is so intensive that the hygroscopic liquid becomes overconcentrated, so that the flow in the circuit (5) is impeded by crystallization of the dissolved substance. According to the invention this problem is solved by the use of a concentration controller (25), which maintains the concentration below a specific desired value.



A device for extracting moisture from a space.

The invention relates to a device for extracting moisture from a space, which device comprises a loop circuit in which a hygroscopic liquid is circulated by means of a pump and in which a first moisture-absorbing
5 element is included, arranged in said space whereby moisture is absorbed by the hygroscopic liquid, which circuit includes a reservoir for the hygroscopic liquid and a second moisture-absorbing element, arranged in a second space, whereby the absorbed moisture is evaporated
10 from the hygroscopic liquid.

Such a device is known from Netherlands Patent Application no. 7 701 242 (PHN 8669).

A problem associated with said known device is that the evaporation process is so intensive that the hy-
15 groscopic liquid becomes overconcentrated, so that in the first space where the moisture is absorbed by the hygroscopic liquid problems arise because the dissolved liquid may crystallize in the hygroscopic liquid, especially when the temperature in the first space is low. As a result of
20 this, the first moisture-absorbing element may become blocked, so that the device no longer functions correctly.

It is an object of the invention to solve this problem. To this end the invention is characterized in that the circuit includes a concentration controller
25 comprising a body arranged to float in the liquid in the reservoir in the equilibrium state at a level which depends on the concentration of the hygroscopic liquid in the reservoir, and by a valve which is controlled by the body, which valve controls the rate of liquid flow to the
30 second moisture-absorbing element.

By means of this controller the concentration of the hygroscopic liquid in the reservoir can be maintained below a certain value.

A preferred embodiment of the device in accordance with the invention is characterized in that a by-pass duct is arranged across the second moisture-absorbing element, the liquid flow rate through which duct is controllable by the valve.

The by-pass duct is constituted by a tube which extends vertically from the reservoir, which tube has a chamber at the upper end, which chamber has one inlet opening and two outlet openings, of which a first outlet opening communicates with the second moisture-absorbing element and of which a second outlet opening communicates with said tube, which first outlet opening is situated at a higher level than the second outlet opening, the valve being arranged to the body by means of a rod which extends through the tube.

The invention will be described in more detail with reference to the drawing, which schematically represents an embodiment, and in which:

Fig. 1 is a side view of a refrigerator incorporating the device with the concentration controller, and

Fig. 2 is a rear view of the refrigerator of Fig. 1.

The refrigerator has an insulated housing 3, which encloses a first space 1, the refrigerating space, from which moisture is to be extracted. Outside the housing is a second space 2 in which the moisture is evaporated and discharged.

The hygroscopic liquid, for example a calcium bromide solution, is circulated in a loop circuit 5 by means of a pump 4. The circuit includes a first moisture-absorbing element 6 arranged in the refrigerating space 1 of the refrigerator against evaporator tubes 7. The first moisture-absorbing element in fact comprises three portions, namely one portion 6a for the top and rear and two portions 6b and 6c for the two sides. In the second space outside the housing, a second moisture-absorbing

element 8 is included in the circuit, which element is arranged against condenser 9, forming part of the refrigeration circuit. The moisture-absorbing element may for example be made of cellulose, such as blotting paper, or may be of nylon or glass-fibres. Furthermore, the circuit includes a reservoir 10 for the hygroscopic liquid.

By means of the pump 4 the hygroscopic liquid is pumped from the reservoir 10 to a distributor element 12 through a duct 11 and thence to three tubes 13, 14 and 15, of which the tube 15 is divided into two chambers. Under the influence of gravity the hygroscopic liquid flows from the tubes 13, 14 and 15 through the moisture-absorbing elements 6a, 6b and 6c. The ends of the moisture-absorbing elements each project through a slot (not shown) into the relevant tube. The moisture-absorbing elements are fitted closely against the evaporator tubes 7.

In order to prevent that the upper tubes 13, 14 and 15 contain so much liquid that they would overflow, overflow ducts 19 and 20 arranged between the tubes 13-16 and 14-17 respectively. Between the tubes 15-18 no overflow duct is necessary because the tube 15 communicates with the tubes 13 and 14.

The hygroscopic liquid in the tubes 16 and 17 flows to the tube 18 and thence through ducts 21a and 21b to the space 2 outside the housing, to the tube 22 and subsequently through the second moisture-absorbing element 8 to the tube 23. The ends of said element each project from a slot of the relevant tube in the same way as the ends of the first elements. The second moisture absorbing element 8 is fixed closely against the condenser 9. Again an overflow duct 24 is provided. From the tube 23 the liquid flows back to the reservoir 10.

In the first space 1, the refrigerating space, the moisture is absorbed by the hygroscopic liquid at the location of the first moisture-absorbing elements 6a, 6b and 6c. In the second space 2 outside the housing the absorbed moisture is evaporated from the hygroscopic liquid

at the location of the second moisture-absorbing element 8. Sometimes this evaporation process is so intensive that the hygroscopic liquid becomes overconcentrated, which gives rise to the said problem of crystallization. In accordance with the invention this is solved by the use of a concentration controller 25. This concentration controller is constituted by an immersion body 26 arranged in the reservoir 10, to which a valve 27 is connected by means of a rod 28. This rod extends through a tube 29, which extends vertically from the reservoir 10 and which has a chamber 30 at its upper end. The chamber is located in the duct between the tubes 18 and 23 and for this purpose has an inlet opening 31 to which the duct 21a is connected and a first outlet opening 32 to which the duct 21b is connected. Between the chamber 30 and the tube 29 there is provided a second outlet opening 33, whose passage can be controlled by the valve 27.

The hygroscopic liquid in the chamber 30 can either flow through the first outlet opening 32 to the second moisture-absorbing element 8 and thence back to the reservoir 10 or flow directly to the reservoir 10 through the second outlet opening 33 and the tube 29. By means of the valve 27 the rate of flow of the liquid through the tube 29 can be controlled and thereby the rate of flow of the liquid through the second moisture-absorbing element. The tube 29 thus functions as a kind of by-pass duct which bypasses the second moisture-absorbing element 8.

When the weight of the immersion body 26 is selected so that the immersion body floats in equilibrium in the second liquid when the liquid has the desired concentration, it is ensured that the concentration cannot become too high. If the concentration of the liquid in the reservoir exceeds the desired value because too much water has evaporated, the density of the liquid will increase. The immersion body 26 will then move upwards, so that the valve 27 opens and liquid of a lower concentration flows back directly to the reservoir 10 and is not further

evaporated. If the concentration increases again, the valve will again close and all the liquid will flow to the evaporation section near the warm condenser.

The use of the invention is not limited to refrigerators. The invention may equally be used in conjunction with air-conditioning equipment.

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1. A device for extracting moisture from a space (1), which device comprises a loop circuit (5) in which a hygroscopic liquid is circulated by means of a pump (4) and in which a first moisture-absorbing element (6) is
5 arranged in the said space whereby moisture is absorbed by the hygroscopic liquid, which circuit includes a reservoir (10) for the hygroscopic liquid and a second moisture-absorbing element (8), arranged in a second space (2), whereby the absorbed moisture is evaporated from the
10 hygroscopic liquid, characterized in that the circuit (5) includes a concentration controller (25) comprising a body (26) arranged to float in the liquid in the reservoir (10) in the equilibrium state at a level which depends on the concentration of the hygroscopic liquid in the
15 reservoir and by a valve (27) which is controlled by the immersion body (26), which valve controls the rate of liquid flow to the second moisture-absorbing element (8).
2. A device as claimed in Claim 1, characterized in that a by-pass duct (29), whose passage is controllable
20 by the valve (27), is arranged across the second moisture-absorbing element (8).
3. A device as claimed in Claim 2, characterized in that the by-pass duct is a tube (29) which extends
25 vertically from the reservoir (10), which tube has a chamber (30) at the upper end, which chamber has one inlet opening and two outlet openings, of which a first outlet opening (32) communicates with the second moisture-absorbing element (8) and of which a second outlet opening (33) communicates with said tube (29), which first outlet
30 opening (31) is situated at a higher level than the second outlet opening (33), the valve (27) being arranged in the second outlet opening (33) and being connected to the

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immersion body (26) by means of a rod (28) which extends through the tube (29).

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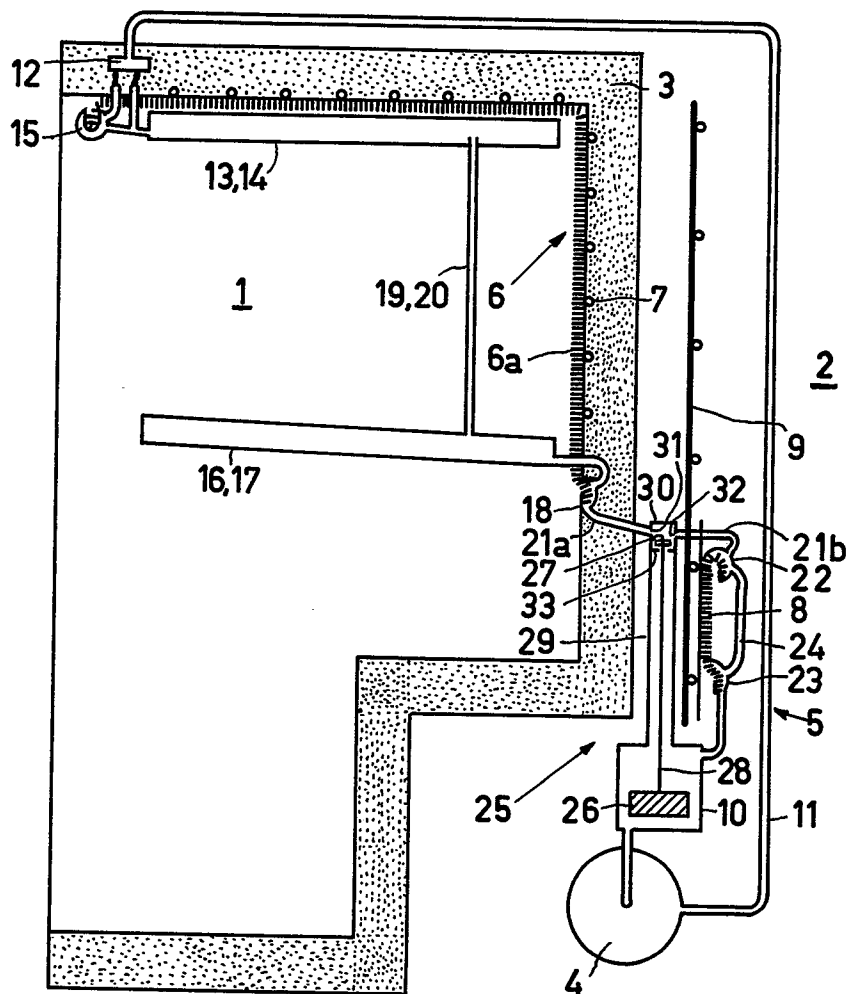


FIG.1





European Patent
Office

EUROPEAN SEARCH REPORT

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Application number

EP 81 20 1206

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 2 156 293 (KAUFMAN)</u> * page 2, right-hand column, lines 6-41; figure 1 * --	1	F 24 F 3/14 F 25 D 17/04
	<u>US - A - 2 498 008 (SCHMITZ)</u> * column 3, line 42 - column 4, line 29; figures 1,2 * --	1	
A	<u>US - A - 4 163 373 (VAN DER SLUIJS)</u>		TECHNICAL FIELDS SEARCHED (Int. Cl.)
D	& NL - 77 01 242 -----		F 24 F F 25 D F 26 B
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	16-12-1981	BURKHART	