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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Ice producer in sheets and method for assisting the detachment of the sheet from the evaporator of an ice producer**

(57) The ice producer has a frigorific circuit with an evaporator (1) on which a sheet of ice (2) is able to be formed, and providing a production phase of a sheet of ice (2) on said evaporator (1), in which in the suction line feeding the evaporator (1) a low pressure of the frigorific liquid is present, and with a defrosting phase for heating the evaporator (1) in order to permit the detachment of the sheet of ice (2), in which in the suction line feeding the evaporator (1) a high pressure of the frigorific liquid is present, actuation means further being provided which can be activated by a fluid (11, 19) for the generation on said sheet of ice (2) of a force able to assist its detachment from said evaporator (1) during said defrosting phase.

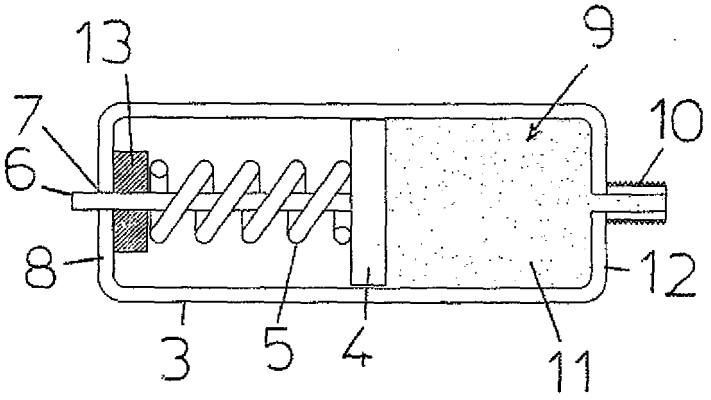

FIG1

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Description

[0001] The present invention refers to an ice producer on sheet and to a method for assisting the detachment of the sheet from the evaporator of an ice producer.

[0002] The field of application concerns a type of ice producing machines, which provides for the formation of a sheet of ice on an evaporating surface, (called evaporator), normally disposed in a vertical position.

[0003] Currently, once having finished the cycle of formation of the sheet of ice, the detachment of the sheet occurs through a defrosting cycle, which provides for the heating of the evaporating surface. This heating causes the subsequent detachment of the ice sheet. The rate of detachment of the ice sheet is relevant for the hourly production of the ice, as in fact the defrosting time (hot phase) subtracts time for the formation of the ice (cold phase). Furthermore in the defrosting phase part of the ice having been formed is melted, and this goes to detriment of the finale quantity of ice produced.

[0004] Technical task of the present invention is therefore to provide an ice producer in sheet and a method for assisting the detachment of the sheet of ice from the evaporator of an ice producer in sheet, permitting to eliminate the technical drawbacks lamented of the known art.

[0005] Within this technical task, an aim of the invention is to realize an ice producer in sheet having an improved productivity deriving both from the acceleration of the detachment process of the sheet of ice from the evaporator and from the reduction of the ice melting during the detachment from the evaporator.

[0006] Another aim of the invention is to realize a method for assisting the detachment of the sheet of ice from the evaporator of an ice producer in sheet that is extremely efficient, constructively simple and which does not require a distortion of the currently used technology for the realization of an ice producer in sheet.

[0007] The technical task, and also these and other aims according to the present invention are reached by realizing an ice producer of the type having a frigorific circuit, an evaporator on which a sheet of ice is able to be formed, and providing a production phase of a sheet of ice on said evaporator, in which in the suction line feeding the evaporator a low pressure of the frigorific liquid is present, and with a defrosting phase for heating the evaporator in order to permit the detachment of the sheet of ice, in which in the suction line feeding the evaporator a high pressure of the frigorific liquid is present, characterized in that it comprises actuation means which can be activated by a fluid for the generation on said sheet of ice of a force able to assist the detachment from said evaporator during said defrosting phase.

[0008] Preferably the actuation means comprise at least a pusher piloted by the variation of pressure of said actuation fluid, for the reversible commutation between an inactive state in which it does not exert said force and an active state in which it exerts said force. Preferably said pusher commutates from said inactive state to said active state following a positive variation of the pressure of said actuation fluid and from said active to said inactive state following a negative variation of the pressure of said actuation fluid. Preferably said pusher is positioned behind the rear side of the evaporator which in turn has a hole from which the pusher protrudes in order to reach its own active state in which it presses directly against rear side of the sheet of ice, and from which the pusher retracts in order to reach its own inactive state in which it is far from the rear side of the sheet of ice.

[0009] Preferably means for detecting the detachment of the sheet of ice are present, for habilitating a new production cycle of a new sheet of ice.

[0010] The actuation fluid, in a first preferred embodiment of the invention, is made by said frigorific fluid.

[0011] The actuation fluid, in a second preferred embodiment of the invention, is a part of a pressurized hydraulic circuit having an inlet electro-valve and an outlet electro-valve.

[0012] The actuation means, in a first preferred embodiment of the invention, comprise a cylinder inside which a piston is positioned, connected directly or through a force multiplier leverage, to said pusher, said piston delimiting in said cylinder an expansion chamber having an inlet of said actuation fluid.

[0013] The actuation means, in a second preferred embodiment of the invention, comprise a bellows connected, directly or through a force multiplier leverage, to said pusher, and having an inlet for said actuation fluid.

[0014] Preferably in this case said pusher and said inlet are present at the opposite bases of said bellows and are mutually aligned in the direction of deformation of said bellows.

[0015] The present invention reveals also a method for assisting the detachment of a sheet of ice from the evaporator o fan ice producer providing a production phase of a sheet of ice on said evaporator, in which in the suction line feeding the evaporator a low pressure of the frigorific fluid is present, and a defrosting phase for heating the evaporator in order to permit the detachment of the sheet of ice, in which in the suction line feeding the evaporator a high pressure of the frigorific fluid is present, characterized in that it exploits the pressure variation of a fluid for generating on said sheet of ice a force able to assist its detachment from said evaporator during said defrosting phase.

[0016] In a preferred embodiment of such method, the pressure variation is exploited to which the frigorific fluid is subjected in the suction line feeding the evaporator between the production phase of the sheet of ice and the defrosting phase for the generation of said force.

[0017] With such invention an actuation is proposed, which in the defrosting phase (hot phase), by acting on the sheet of ice, accelerates its detachment and so shortens the defrosting time, so increasing the hourly production of ice. The actuation is controlled by means of the pressure of an actuation fluid, in the shape of a liquid or gas. Therefore an actuation is not used employing an

energy source of electrical kind, more complex and expensive.

[0018] In particular, the actuation means can assume two states/position according to the pressure level of the actuation fluid. In the active state the actuation means are therefore able to apply a force to the sheet of ice, accelerating its detachment from the evaporator. Further features and advantages of the invention will be more evident from the description of a preferred but non exclusive embodiment of the ice producer in sheets according to the invention, which are illustrated in an indicative and non limitative way in the annexed drawings, in which:

- figure 1 shows a sectional view along a diametral plane of the actuation means according to a first embodiment, in the inactive or resting position;
- figure 2 shows the actuation means of figure 1 in an active position;
- figure 3 shows a sectional view along a diametral plane of the actuation means according to a second embodiment, in the inactive or resting position;
- figure 4 shows the actuation means of figure 3 in an active position;
- figure 5 shows the time course of the pressure of the frigorific fluid and the temporal correlation of the pressure of the frigorific fluid with the state of the actuation means of figures 1 and 2;
- figures 6 and respectively 7 show the actuation means of figures 1 and respectively 2 applied to the evaporator;
- figure 8 shows the actuation means of figure 1, in the case in which the actuation fluid is not the frigorific fluid but it is a part of a suitable pressure hydraulic circuit;
- figure 9 shows the time course of the pressure of the actuation fluid and the temporal correlation between the pressure of the actuation fluid, the aperture of the inlet valve and of the discharge valve of the hydraulic circuit of figure 8, and the state of the actuation means of figures 1 and 2;
- figures 10 and respectively 11 show the variation in which, between the pusher and the piston of the embodiments of figures 1 and respectively 2, a force multiplier leverage is interposed.

[0019] With reference to the cited figures, the ice producer has a frigorific circuit, having an evaporator 1 on which a sheet of ice 2 is able to be formed.

[0020] The ice producer has a production phase of the sheet of ice 2 on the evaporator 1, in which in the suction line feeding the evaporator 1 a low pressure of the frigorific fluid is present, and a defrosting phase for heating the evaporator 1 in order to permit the detachment of the sheet of ice 2, in which in the suction line feeding the evaporator 2 a high pressure of the frigorific fluid is present.

[0021] The ice producer advantageously comprises actuation means which can be actuated by a fluid for the generation on the sheet of ice 2 of a force able to assist its detachment from the evaporator 1 during the defrosting phase.

[0022] The actuation means, as illustrated in figures 1 and 2, can comprise a cylinder 3, inside which a piston 4 is inserted, which is contrasted by a spring 5.

[0023] The piston 4 is firmly connected with a rod-shaped pusher 6 which slides through a hole 7 provided centrally of a base 8 of the cylinder 3.

[0024] The piston 4 delimits in the cylinder 3, from the opposite side with respect to the rod 6, an expansion chamber 9 having an inlet 10 of the actuation fluid 11.

[0025] The inlet 10 is centrally positioned in the other base 12 of the cylinder 3.

[0026] The rod 6 has an inactive or resting position (figure 1), and proceeds at the outside of the hole 7 when the pressure of the actuation fluid exceeds the determined value from the resistances of the piston 4 and of the spring 5. Such value can vary according to the application. The cylinder 3 assures the tightness with respect to the losses of fluid 11 through the hole 7 by means of at least one seal 13.

[0027] With reference now to figures 3 and 4, the actuation means comprise a bellows 14, with on base 16 thereof a rod-shaped pusher 15 is centrally firmly connected.

[0028] The opposite base 17 of the bellows 14 has centrally an inlet 18 for the actuation fluid 19.

[0029] The rod 15 and the inlet 18 are mutually aligned in the direction of deformation of the bellows 14.

[0030] The bellows 14, similarly to the solution with piston 4 illustrated before, under the action of the pressure of the actuation fluid 19 is deformed, so causing the extension of the rod 15 which, from its resting position (figure 3), will extend (figure 4) until pushing the sheet of ice. Once having ceased the pressure of the actuation fluid 19, also in this case the rod 15 is retracted in its resting position. The control solution adopted, by means of a fluid, is different depending on whether the actuation means are controlled with a gas, or with a liquid.

[0031] The two cases will be exemplified by considering the solution with a piston actuation (figures 1 and 2), but the considerations will be the same by adopting the bellows solution (figures 3 and 4).

[0032] First of all the control solution with a gas will be analyzed.

[0033] The solution advantageously makes use directly of the frigorific fluid of the ice producer being in the state of a gas in the defrosting phase of the evaporator 1.

[0034] The frigorific circuit as said has, in the suction line feeding the evaporator 1, during the cold phase a low pressure, whereas the hot defrosting phase has a high pressure.

[0035] Therefore a point of the suction line is connected at the inlet 10 of the cylinder 3.

[0036] By determining, at the various ambient temperatures , the average value of the high and low pressures, the pressure value can be identified above

which the rod 6 extends, in order to contact a sheet of ice 2, and under which the rod 6 is retracted 6.

[0037] For the mechanical dynamics, the actuation means have a minimal hysteresis, so the rod 6 extends when the pressure during the transient rise, reaches a pressure value indicated by the upper dotted line in figure 5 and is retracted when, during the transient downwards, reaches a pressure value indicated by the lower dotted line in figure 5.

[0038] The operation of the actuation means is illustrated in figures 6 and 7.

[0039] The rod 6 is placed in the rear portion 20 of the evaporator 1, and is slidable through an aperture 21 provided in the rear portion 20 of the evaporator 1. The excursion of the rod 6 has a length greater than the distance existing between the tip of the rod 6 at rest and the rear side of the sheet of ice 2. In this way, in the ouput phase of the rod 6, a sufficient force is applied in the rear portion of the sheet of ice 2, so facilitating and accelerating its detachment (figure 7).

[0040] The ice producer has also means for the detection of the fall of the ice, in order to habilitate a new cold cycle.

[0041] The consequent lowering of the pressure permits the rod 6 be retracted in the resting position. Such cycle traditionally is repetitive and periodic, with times depending on the ice producer. Let us now analyze the control solution with a liquid (figure 8). The solution making use of the action of the pressure of a liquid in order to actuate the piston 4, is applied to machines in which one does not want to connect the piston actuation with the frigorific circuit.

[0042] In this case a hydraulic circuit 24 is provided (which arrives from the mains or a circuit connected with a pump) connected with the inlet 10 of the cylinder 3 and able to supply water with a pressure sufficient to act on the piston 4.

[0043] In practice the circuit 24 comprises a first electro-valve 22 at the inlet of the pressurized water and a second electro-valve 23 for discharging the water.

[0044] The first electro-valve 22 once open pressurizes the piston 4, advancing the rod 6.

[0045] The second electro-valve 23 conversely opens for discharging the water from the piston 4, by lowering its pressure, in order to retract the rod 6 in its resting position.

[0046] The two electro-valves 22 and 23 naturally are never actuated/opened at the same time.

[0047] The graphical representation of the operation phases of the liquid actuation means is shown in figure 9.

[0048] Also in this case the rod 6 advances when the pressure, in the transient rise, reaches a pressure value indicated by the upper dotted line in figure 9 and retracts when, in the transient fall, it reaches a pressure value indicated by the lower dotted line in figure 9.

[0049] The defrosting phase in which the water pressure exceeds the actuation threshold of the rod 6, occurs with the electro-valve of the water inlet 22 open, the discharge electro-valve 23 being closed and the rod 6 in an active position.

[0050] The production phase of the ice conversely occurs with the electro-valve of the water inlet 22 closed, the discharge electro-valve 23 being open (at least for the time necessary for discharging the expansion chamber 9), and the rod 6 being in an inactive position. The mechanical dynamics of actuation towards the evaporator 1 repeat those of the gas version, and therefore they will not be repeated.

[0051] With reference to figures 10 and 11 a variation of the invention is shown, in which equivalent parts with respect to those evidenced in the figures 1 and 2 are indicated with the same numerical reference. In this case, differently from the realization of figures 1 and 2, a force multiplier leverage 25 is present, interposed between the piston 4 and the pusher 6, in order to assure in any pressure conditions the correct value of the force.

[0052] The leverage 25 for example comprises a first connecting rod 26 hinged to a rod 27 movable together with the piston 4, and a second connecting rod 28 hinged from one side to the first connecting rod 26 and from the other side to the rod-shaped pusher 6, which in turn is bound during its axial translation between the inactive position and the active position.

[0053] It has to be stressed that the actuation means of the present invention are independent from the evaporator, in particular both for structure and functioning, and are provided as supplement of the ice producer to accelerate the detachment of the ice sheet when the evaporator itself is heated at the defrosting phase.

[0054] The ice producer so conceived is subject to numerous modifications and variations, all coming within the inventive concept; furthermore, all details can be substituted by technically equivalent elements.

[0055] In practice the used materials, and also the dimensions, can be of any kind according to the needs and the state of the art.

Claims

1. An ice producer of a type having a frigorific circuit, an evaporator (1) on which a sheet of ice (2) is able to be formed, and providing a production phase of a sheet of ice (2) on said evaporator (1), in which in the suction line feeding the evaporator (1) a low pressure of the frigorific liquid is present, and with a defrosting phase for heating the evaporator (1) in order to permit the detachment of the sheet of ice (2), in which in the suction line feeding the evaporator (1) a high pressure of the frigorific liquid is present, **characterized in that** it comprises actuation means which can be activated by a fluid (11, 19) for the generation on said sheet of ice (2) of a force able to assist its detachment from said evaporator (1) during said defrosting phase.

2. The ice producer according to preceding claim, **characterized in that** said actuation means are independent from the evaporator (1).

3. The ice producer according to preceding claim, **characterized in that** said actuation means comprise at least a pusher (6, 15) piloted by a variation of pressure of said actuation fluid (11, 19) for the reversible commutation between an inactive state in which it does not exert any force and an active state in which it exerts such force.

4. The ice producer according to preceding claim, **characterized in that** said pusher (6, 15) commutates from said inactive state to said active state following a positive variation of the pressure of said actuation fluid (11, 19) and from said active to said inactive state following a negative variation of the pressure of said actuation fluid (11, 19).

5. The ice producer according to any of preceding claims, **characterized in that** said pusher (6, 15) is positioned behind the rear side (20) of the evaporator (1) which in turn has a hole (21) from which the pusher (6, 15) protrudes in order to reach its active state in which it presses directly against the rear side of the sheet of ice (2), and from which the pusher (6, 15) retracts in order to reach its inactive state in which it is far from the rear side of the sheet of ice (2).

6. The ice producer according to any of preceding claims, **characterized in that** it presents means for detecting the detachment of the sheet of ice (2) for habilitating a new production cycle of a new sheet of ice (2).

7. The ice producer according to any of preceding claims, **characterized in that** said actuation fluid (11, 19) is made by said frigorific fluid.

8. The ice producer according to any of claims 1 to 6, **characterized in that** said actuation fluid (11, 19) is a part of a pressure hydraulic circuit (24) having an inlet electro-valve (22) and an outlet electro-valve (23).

9. The ice producer according to any of claims 7 and 8, **characterized in that** said actuation means comprise a cylinder (3) inside which a piston (4) is positioned, connected directly or through a force multiplier leverage, to said pusher (6), said piston (4) delimiting in said cylinder (3) an expansion chamber (9) having an inlet (10) of said actuation fluid (11).

10. The ice producer according to claim 7 and 8, **characterized in that** said actuation means comprise a bellows (14) connected, directly or through a force multiplier leverage, to said pusher (15), and having an inlet (18) for said actuation fluid (19).

11. The ice producer according to preceding claim, **characterized in that** said pusher (15) and said inlet (18) are present at the opposite bases (16, 17) of said bellows (14) and are mutually aligned in the direction of deformation of said bellows (14).

12. A method for assisting the detachment of a sheet of ice (2) from the evaporator (1) of an ice producer providing a production phase of a sheet of ice (2) on said evaporator (1), in which in the suction line feeding the evaporator (1) a low pressure of the frigorific fuel is present, and a defrosting phase for heating the evaporator (1) in order to permit the detachment of the sheet of ice (2), in which in the suction line feeding the evaporator (1) a high pressure of the frigorific fluid is present, **characterized in that** it exploits the pressure variation of a fluid (11, 19) for generating on said sheet of ice (2) a force able to assist its detachment from said evaporator (1) during said defrosting phase.

13. The method for assisting the detachment of a sheet of ice (2) from the evaporator (1) of an ice producer according to preceding claim, **characterized in that** it exploits the pressure variation to which the frigorific fluid (11, 19) is subjected in the suction line feeding the evaporator (1) between the production phase of the sheet of ice (2) and the defrosting phase for the generation of said force.

14. The method for assisting the detachment of a sheet of ice (2) from the evaporator (1) of an ice producer according to any preceding claims 12 and 13, **characterized in that** said force is generated by actuating means independent from the evaporator.

Amended claims in accordance with Rule 137(2) EPC.

1. An ice producer of a type having a frigorific circuit, an evaporator (1) on which a sheet of ice (2) is able to be formed, and providing a production phase of a sheet of ice (2) on said evaporator (1), in which in the suction line feeding the evaporator (1) a low pressure of the frigorific liquid is present, and with a defrosting phase for heating the evaporator (1) in order to permit the detachment of the sheet of ice (2), in which in the suction line feeding the evaporator (1) a high pressure of the frigorific liquid is present, **characterized in that** it comprises actuation means, independent from said evaporator (1), and which can be activated by a fluid (11, 19) for the generation on said sheet of ice (2) of a force able to assist its detachment from said evaporator (1) during said defrosting phase.

2. The ice producer according to preceding claim, **characterized in that** said actuation means comprise at least a pusher (6, 15) piloted by a variation of pressure of said actuation fluid (11, 19) for the reversible commutation between an inactive state in which it does not exert any force and an active state in which it exerts such force.

3. The ice producer according to preceding claim, **characterized in that** said pusher (6, 15) commutates from said inactive state to said active state following a positive variation of the pressure of said actuation fluid (11, 19) and from said active to said inactive state following a negative variation of the pressure of said actuation fluid (11, 19).

4. The ice producer according to any of preceding claims, **characterized in that** said pusher (6, 15) is positioned behind the rear side (20) of the evaporator (1) which in turn has a hole (21) from which the pusher (6, 15) protrudes in order to reach its active state in which it presses directly against the rear side of the sheet of ice (2), and from which the pusher (6, 15) retracts in order to reach its inactive state in which it is far from the rear side of the sheet of ice (2).

5. The ice producer according to any of preceding claims, **characterized in that** it presents means for detecting the detachment of the sheet of ice (2) for habilitating a new production cycle of a new sheet of ice (2).

6. The ice producer according to any of preceding claims, **characterized in that** said actuation fluid (11, 19) is made by said frigorific fluid.

7. The ice producer according to any of claims 1 to 5, **characterized in that** said actuation fluid (11, 19) is a part of a pressure hydraulic circuit (24) having an inlet electro-valve (22) and an outlet electro-valve (23).

8. The ice producer according to any of claims 6 and 7, **characterized in that** said actuation means comprise a cylinder (3) inside which a piston (4) is positioned, connected directly or through a force multiplier leverage, to said pusher (6), said piston (4) delimiting in said cylinder (3) an expansion chamber (9) having an inlet (10) of said actuation fluid (11).

9. The ice producer according to claim 6 and 7, **characterized in that** said actuation means comprise a bellows (14) connected, directly or through a force multiplier leverage, to said pusher (15), and having an inlet (18) for said actuation fluid (19).

10. The ice producer according to preceding claim, **characterized in that** said pusher (15) and said inlet (18) are present at the opposite bases (16, 17) of said bellows (14) and are mutually aligned in the direction of deformation of said bellows (14).

11. A method for assisting the detachment of a sheet of ice (2) from the evaporator (1) of an ice producer providing a production phase of a sheet of ice (2) on said evaporator (1), in which in the suction line feeding the evaporator (1) a low pressure of the frigorific fuel is present, and a defrosting phase for heating the evaporator (1) in order to permit the detachment of the sheet of ice (2), in which in the suction line feeding the evaporator (1) a high pressure of the frigorific fluid is present, **characterized in that** it exploits the pressure variation of a fluid (11, 19) for generating on said sheet of ice (2) a force able to assist its detachment from said evaporator (1) during said defrosting phase, said force being generating by actuating means independent from said evaporator.

12. The method for assisting the detachment of a sheet of ice (2) from the evaporator (1) of an ice producer according to preceding claim, **characterized in that** it exploits the pressure variation to which the frigorific fluid (11, 19) is subjected in the suction line feeding the evaporator (1) between the production phase of the sheet of ice (2) and the defrosting phase for the generation of said force.

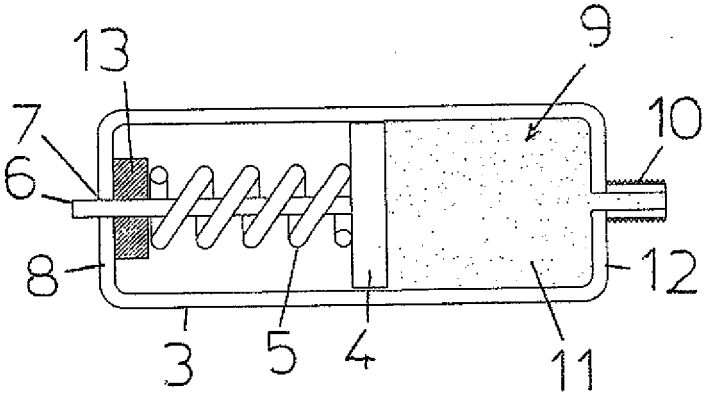

FIG1

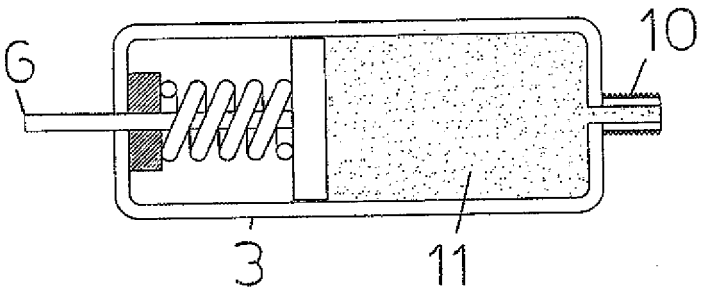

FIG2

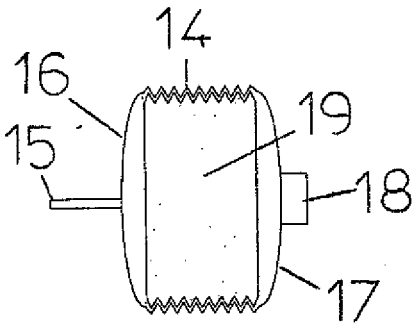

FIG3

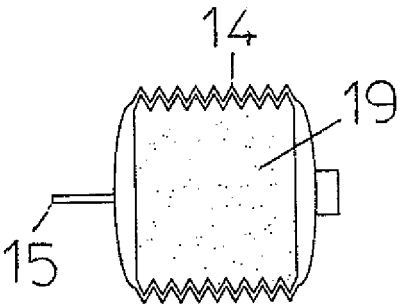

FIG4

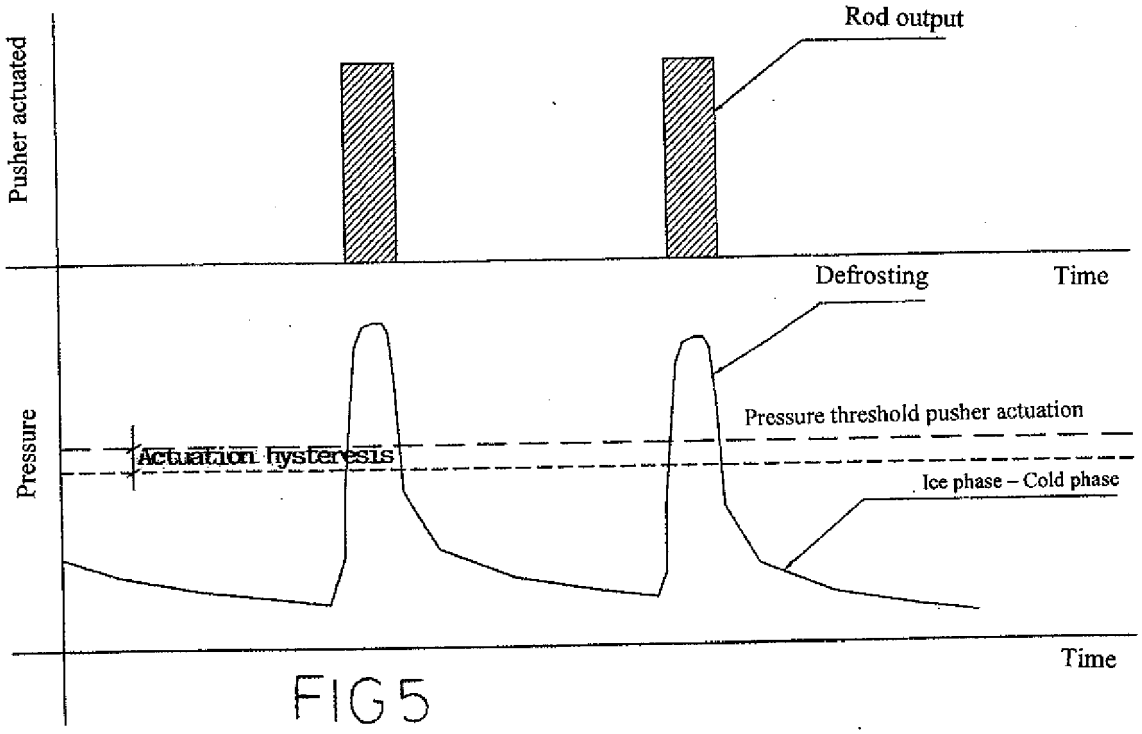

FIG 5

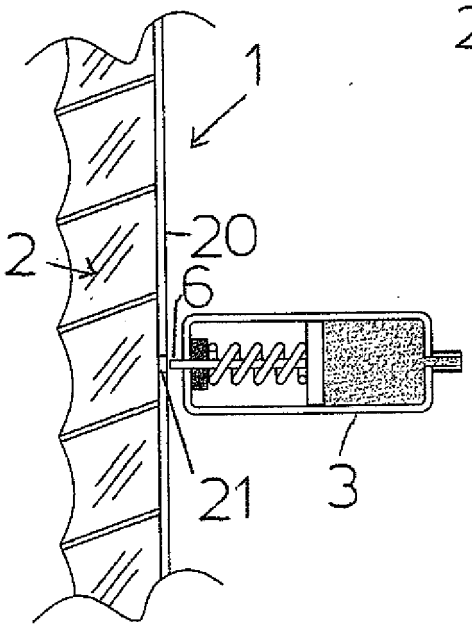

FIG 6

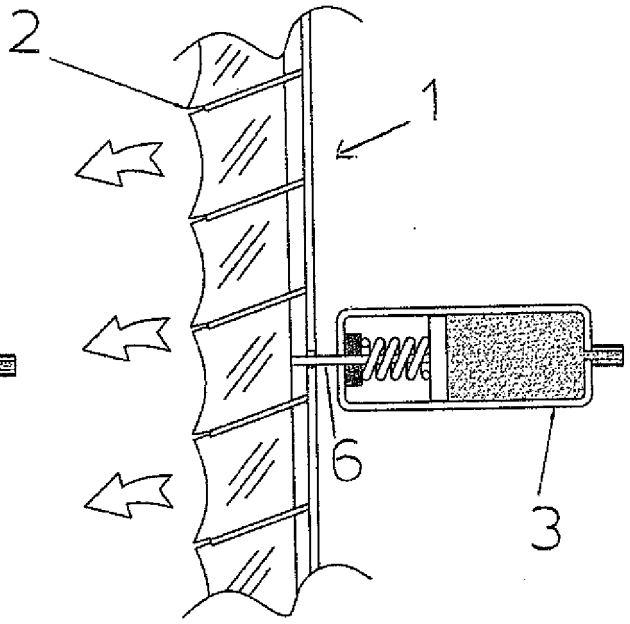

FIG 7

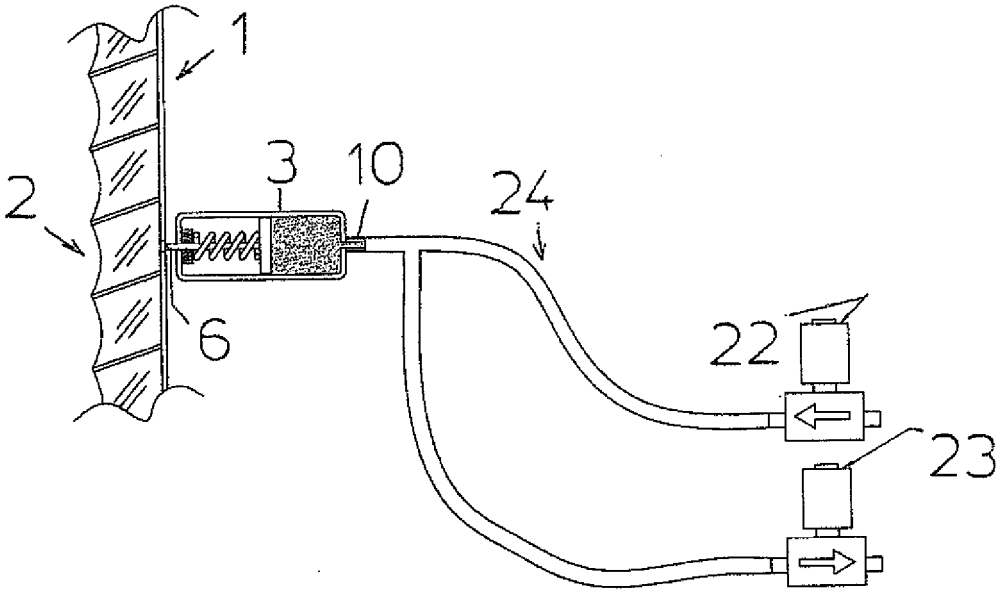

FIG 8

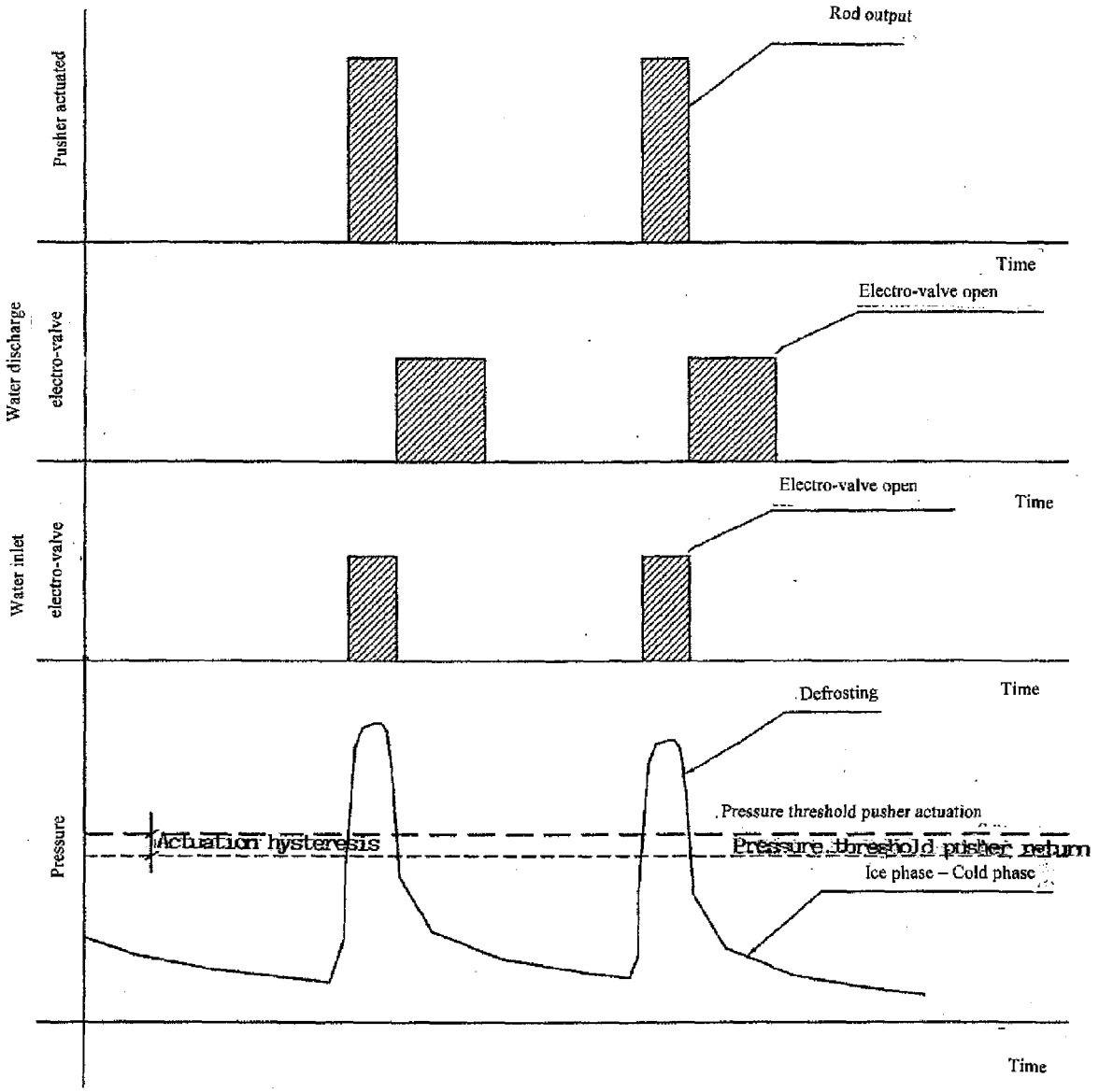
Pusher actuated
Rod output
Time
Water discharge electro-valve
Electro-valve open
Time
Water inlet electro-valve
Electro-valve open
Time
Pressure
Defrosting
Time
Pressure threshold pusher actuation
Actuation hysteresis
Pressure threshold pusher return
Ice phase – Cold phase
Time

FIG9

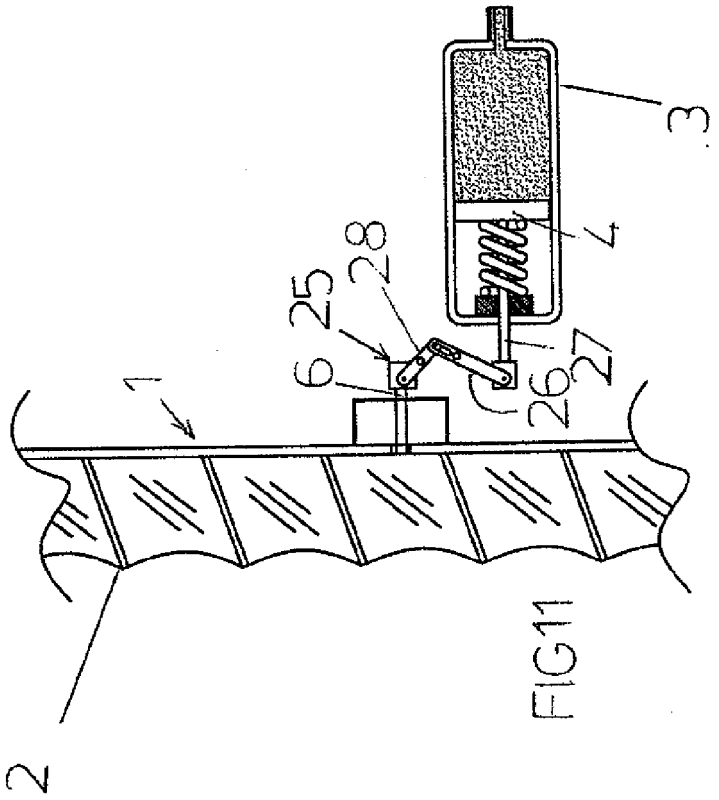

FIG11

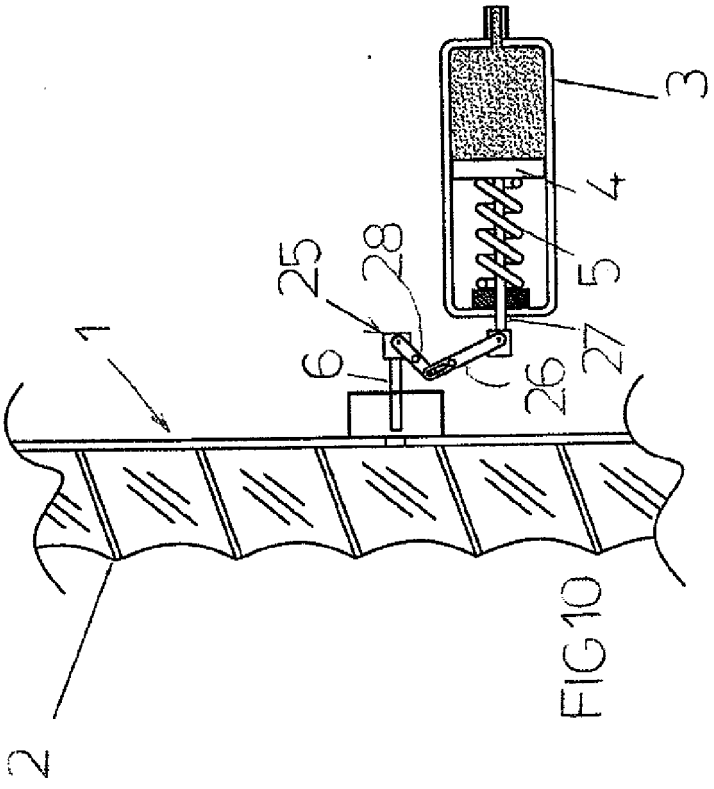

FIG10

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 3715

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 318 106 A (LITMAN ALAN L) 9 May 1967 (1967-05-09) * column 3, paragraph 4 - paragraph 5; figures 1,2,5,7 * -----	1,3,4,7, 12,13	INV. F25C5/06
X	US 4 412 429 A (KOHL VANCE L [US]) 1 November 1983 (1983-11-01) * the whole document * -----	1,12	
X	US 5 329 780 A (BROADBENT JOHN A [US]) 19 July 1994 (1994-07-19) * column 7, line 23 - column 8, line 8; figures 1-4 * -----	1,12	
			TECHNICAL FIELDS SEARCHED (IPC) F25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 August 2011	Jessen, Flemming

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12-08-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3318106 A	09-05-1967	NONE	
US 4412429 A	01-11-1983	NONE	
US 5329780 A	19-07-1994	NONE	

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