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(54) **EXCITATION BASED ICE DETECTION UNIT, REFRIGERATOR WITH ICE DETECTION UNIT AND METHOD FOR DEFROSTING OF A REFRIGERATOR**

ANREGUNGSBASIERTE DETEKTIONSEINHEIT, KÜHLSCHRANK MIT EISDETEKTIONSEINHEIT
UND VERFAHREN ZUM ABTAUEN EINES KÜHLSCHRANKS

UNITÉ DE DÉTECTION DE GLACE À BASE D'EXCITATION, RÉFRIGÉRATEUR AYANT UNE UNITÉ
DE DÉTECTION DE GLACE ET PROCÉDÉ DE DÉGIVRAGE D'UN RÉFRIGÉRATEUR

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(73) Proprietor: **Vestel Elektronik Sanayi ve Ticaret A.S.
45030 Manisa (TR)**

(72) Inventor: **ÖZKÜCÜK, Serhat
45030 Manisa (TR)**

(74) Representative: **Ascherl, Andreas et al
KEHL, ASCHERL, LIEBHOFF & ETTMAYR
Patentanwälte - Partnerschaft
Emil-Riedel-Strasse 18
80538 München (DE)**

(56) References cited:
**DE-A1- 2 020 311 JP-A- 2002 176 926
US-A- 3 641 781 US-A- 4 176 524**

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Description

[0001] The present invention refers to an ice detection unit according to claim 1, a refrigerator according to claim 12 and a method for operating a refrigerator according to claim 13.

Background of the Invention

[0002] In all no-frost refrigerators, there is a heater on the heat-exchanger for prevent icing. After starting of refrigerator, heat-exchanger starts cooling and icing. This is unwelcome situation by user and inefficient situation by cooling performance of refrigerator. So, there is located a heater on the heat-exchanger in all no-frost refrigerators to prevent icing. After a long certain time (8-12 hours) starting of the refrigerator, the heater works a small certain time (5-10 minutes) for the reason to melt the ice. This operation is called as defrost.

[0003] Document US4843830A discloses a differential ice sensing system and method for a cold drink beverage dispenser or the like. The beverage dispenser has an ice bath cooling tank containing a supply of water. A refrigerated cooling surface is provided within the tank so as to freeze a portion of the water into a body of ice. The beverage dispenser has a beverage flow path which is cooled by the liquid in the ice bath. The differential ice sensing system comprises a first conductivity (or impedance) probe which is disposed in the water of the ice bath at a position where it will sense the conductivity of the ice when the body of ice formed on the refrigerated surface attains a predetermined size. A second conductivity probe is disposed within the liquid so that it is maintained in conductivity sensing relationship with the liquid. Each of the probes is responsive to an electric current supplied thereto to measure the electrical conductivity in its vicinity. A system is provided for detecting conductivity differences between the first and second probes indicative of the presence of ice at the first probe and for generating a signal indicating presence of ice at the first probe. This signal may be utilized to block the flow of refrigerant to the refrigerated surface when the body of ice formed has reached a pre-determined size and to initiate the flow of refrigerant when the body of ice is less than a desired size.

[0004] Document WO0009960A2 discloses an apparatus and method that regulates the size of an ice bank and that prevents short cycling of the compressor therefor and operation thereof at undesired voltages. A microprocessor based control circuit includes a circuit for sensing line voltage combined with an ice bank sensing circuit. The ice bank sensing circuit is of the conductivity sensing type wherein the electrical conductivity between two probes is sensed. The microprocessor continually monitors the probes to determine if refrigeration is needed or not, and continually senses the line voltage to determine if that voltage is within the design limits of the refrigeration compressor. The voltage sensing circuit can also sense

if power has been interrupted where the voltage drops to zero.

[0005] Document US3782130A discloses a refrigerator, said refrigerator is arranged to cool part of an area for which an indication of the imminence of ice-formation is required. A first temperature sensitive circuit and a first conductivity probe are situated in that part of the area while a second temperature sensitive circuit and a second conductivity probe are situated outside it. A first differential amplifier compares the conductivities of the conductivity probes and a second differential amplifier compares the outputs of the temperature sensitive circuits. The outputs of one of the differential amplifiers controls the refrigerator while the output of the other differential amplifier provides the said indication.

[0006] Document DE2641600A1 discloses the initiator of a deicing system is used in an evaporator, especially in a heat pump. The initiator has electrode scanning the evaporator surface. The conductivity increased by ice formation switches the deicing device on by a discriminator circuit. The deicing device is started only if the evaporator is actually covered with ice. The deicer is not connected when the environment is cold but dry, nor when the electrode gap is subjected to droplets. The electrode is arranged in front of the end edge of the air baffle plates connected to the evaporator pipe. The effective length of the electrode is short in relation to the end edge. The discriminator circuit switches the deicer on only if the higher conductivity is still present after a delay time. The electrode consists of a head held on a rod fixed on an insulating support on the baffle plate. Thus, the main problem is that the presence and amount of ice on the heat-exchanger is not detected simultaneously without sensors. Defrost operation is done automatically with help of periodic programming. Existence of ice and need of heating to melt the ice is unknown. So this periodic defrost operation causes inefficient situation by energy consume and cooling performance of No-frost refrigerators.

[0007] The documents US 3 641 781 A and US 4 176 524 A both disclose ice detection devices.

Object of the Invention

[0008] Therefore, it is the object of the present invention to provide an advanced ice detection unit, a refrigerator with such an advanced ice detection unit and a method for operating such a refrigerator.

Description of the Invention

[0009] The before mentioned object is solved by an ice detection unit according to claim 1. The term ice preferably comprises besides ice also snow or the like, but it is possible to limit the term ice also to ice only.

[0010] Said ice detection unit preferably comprises at least a channeling element for guiding water and/or for holding ice, said channeling element can be a tube or

hose and preferably extends straight in one direction. It is also conceivable that the channeling element has a varying diameter or a constant diameter, in particular the outer surface of the channeling element has a constant diameter. The channeling element has preferably a circular shape or a shape differing from a circular shape. The diameter of said channeling element is preferably between 0,5mm and 20cm, in particular between 5mm and 10cm or between 10 mm and 5cm or between 1mm and 20mm or between 5mm and 15mm. The channeling element preferably has a length of preferably between 0,5mm and 20cm, in particular between 5mm and 10cm or between 10 mm and 5cm or between 1mm and 20mm or between 5mm and 15mm. The ice detection unit further comprises an excitation means for exciting said channeling element. Excitations are preferably vibrations, in particular caused by a vibration source like an ultra sonic unit. An excitation detection means for detecting excitations of the channeling element is also provided, wherein a mechanical connection between the channeling element and at least the excitation means and/or the excitation detection means establishes due to a solidification of a fluid substance, in particular a liquid substance, in particular water, inside the channeling element. The mechanical connection preferably transfers excitations from the excitation means to the excitation detection means.

[0011] This solution is beneficial, since the mechanical connection represents the ice or snow situation in the environment of said ice detection unit. Thus, in case the ice detection unit is part of a cooling room of a refrigerator the growth or accumulation of ice and/or snow happens simultaneously. Since the mechanical connection appears in dependency of ice and/or snow growth respectively accumulation triggering of an counter effect, like switching on a heating unit, can be established in close relationship.

[0012] Further preferred embodiments of the present invention are subject-matter of the dependent claims and/or of the following parts of the specification.

[0013] According to the present invention the channeling element has at least to axial ends and at least in sections and preferably completely a tube-like shape. At least the excitation means has an excitation part reaching on one side of the channeling element into the inside of a tube-like shaped section without contacting said channeling element. Additionally, or alternatively at least the excitation detection means has an excitation detection part reaching on the other side of the channeling element into the inside of a tube-like shaped section without contacting said channeling element.

[0014] It is hereby conceivable that the excitation part or the excitation detection part is rigidly coupled with said channeling element.

[0015] Thus, it is important in case no ice or snow is present no mechanical connection between the excitation part and the excitation detection part is established.

[0016] The channeling element comprises according to the present invention at least a grid, in particular for

water flow, or a structured inner surface to allow solidified water (ice particles) to grow respectively to accumulate into radial direction. This is beneficial since an ice and/or snow growth or accumulation in radial direction is supported.

[0017] At least or exactly one holding means for holding said channeling element in a predefined position is provided, wherein said holding means comprises at least one and preferably at least or exactly two spring elements. Thus, the holding means comprises at least two spring elements, wherein one first spring element is preferably arranged on a topside of a tube-like shaped connection section of the channeling element and wherein one second spring element is preferably arranged on a bottom side of said tube-like shaped connection section, wherein the tube-like shaped connection section is positioned between the axial ends of said channeling element, wherein each of said spring elements has one further end to be coupled with a surrounding, in particular stationary, wall member, in particular of a refrigerator. This embodiment is beneficial since said channeling element is arranged movable, in particular in one direction respectively up and down or at least partially in a rotating direction. Thus, also very slight excitations can be detected, this allows or supports a stepwise actuation of further means, in particular a heater of a refrigerator.

[0018] According to a further preferred embodiment of the present invention the excitation means for exciting said channeling element comprises a vibration motor, wherein said excitation part is preferably a rotatable pivot, wherein said rotatable pivot is preferably actuated by means of an actuation of said vibration motor. Additionally or alternatively the excitation detection means for detecting excitations of the channeling element is preferably a vibration sensor, wherein the excitation detection part is preferably connected to said vibration sensor and transfers vibrations of the channeling element to the vibration sensor. Said pivot preferably has a spoon-like or scraper-like or stirrer-like shape and is preferably rotated in one direction. It is also conceivable that said pivot is rotated between a first and a second position and vice versa. Due to this embodiment and in dependency of the length of the time slots between each actuation of said excitation means different level excitation intensity can be determined.

[0019] A control unit is according to a further preferred embodiment also provided respectively also part of said ice detection unit. However, it is also conceivable that said control unit is a control unit of a refrigerator. Said control unit preferably operates the excitation means due to predefined rules, wherein the excitation detection means outputs excitation signals in dependency of detected excitations. The control unit preferably provides control signals in dependency of the detected excitation signals for operating of at least one further means. Thus, the excitation detection means preferably detects value changes in resistance and/or voltage and/or current. A first value range represents a low level excitation inten-

sity, wherein preferably no signals or a signal up to a threshold A for operating the further means is provided by the control means if a low level excitation intensity is determined. A second value range represents a mid level excitation intensity, in particular between threshold A and B, wherein threshold B represents more respectively stronger excitations than threshold A. Signals for operating the further means are preferably provided by the control means if a mid level excitation intensity is determined. Highly preferably also a third value range is present and represents a high level excitation intensity, in particular between threshold B and C, wherein threshold C represents more respectively stronger excitations than threshold B wherein signals for operating the further means are provided by the control means if a high level excitation intensity is determined. The signals for operating the further means are causing a longer operation of the further means in case a high level excitation intensity is determined in comparison to a case in which a mid level excitation intensity is determined. It is also conceivable that one two levels of excitation intensity are present, thus on one side of a specific threshold no actuation of a further means, in particular heater, takes place and on the other side of that threshold an actuation of said further means takes place. This embodiment is beneficial since the heating can be adapted due to the needs and/or requirements of a specific device or user or environment.

[0020] The excitation means and the excitation detection means are according to a preferred embodiment of the present invention electrically isolated from each other. This solution is beneficial since the detection of excitations is a very exact value for the detection of ice and/or snow. The fluid, in particular water, freezes below 5°, in particular below 1° or below 0°, and ambient pressure of 10.1 N/cm².

[0021] The above mentioned object is also solved by a refrigerator, in particular no frost refrigerator. Said refrigerator preferably comprises at least a cooling means for cooling down the atmosphere inside the refrigerator, a heater means for melting of accumulated ice or snow inside the refrigerator, an ice detection unit according to any of the before mentioned claims for detecting ice or snow inside the refrigerator and for actuating the heater means in dependency of detected ice or snow. This embodiment is beneficial since ice or snow can be detected and reduced respectively removed whenever detected and thus not just in dependency of a predefined time slot. The above mentioned object is solved by using properties of solidification of water and good transmission of vibration by solid materials. Generally speaking, the inventive system includes a solid pipe with grid surface for transmission of vibration (grid surface for liquid form of water flowing and solid form of water as ice standing), a vibration motor for excitation the system, a vibration sensor for sensing the excitation and two or more springs for flexible fixing the solid pipe.

[0022] The above mentioned object is also solved by a method for operating a refrigerator. Said method pref-

erably comprises at least the steps: Cooling down a food storage section by means of a cooling means, Detecting ice or snow inside the food storage section by means of operating an ice detection unit according to any of claims 1 to 9, Operating an ice reduction respectively removing means, in particular a heating means, in case the presence of ice or snow is detected. This embodiment is beneficial since ice or snow can be detected and reduced respectively removed whenever detected and thus not just in dependency of a predefined time slot. This method can be used in all cooler devices that include heat-exchanger part. The inventive method and unit, respectively system, can be used for all ice detection application.

[0023] According to a preferred embodiment of the present invention the heating means is operated as long as a mechanical coupling between the excitation means and the excitation detection means is present. Alternatively, the heating means is operated for a predetermined time, wherein the predetermined time depends on the determined level of excitation intensity.

[0024] The control unit further computes at least on further parameter, in particular an average number of door openings in dependency of daytime and/or calendar day, in particular in dependency of a day planner, and/or a moist sensor, inside and/or outside the refrigerator, and/or a selected temperature or cooling program.

[0025] Further benefits, goals and features of the present invention will be described by the following specification of the attached figures, in which exemplarily components of the invention is illustrated. Components of the systems and methods according to the inventions, which match at least essentially with respect to their function can be marked with the same reference sign, wherein such components do not have to be marked or described multiple times with respect to said figures.

[0026] In the following the invention is just exemplarily described with respect to the attached figures.

Brief Description of the Drawing

[0027]

Fig. 1 shows a schematic illustration of the ice detection unit according to the present invention and

Fig. 2 shows a schematic illustration of a refrigerator having an ice detection unit according to fig. 1.

[0028] Fig. 1 shows an ice detection unit 1 according to the present invention. Said ice detection unit 1 comprises at least a channeling element 2 for guiding water and for holding ice 4, an excitation means 6 for exciting said channeling element 2 and an excitation detection means 8 for detecting excitations of the channeling element 2, wherein a mechanical connection between the channeling element 2 and at least the excitation means 6 and/or the excitation detection means 8 establishes due to a solidification of fluid, in particular water, inside

the channeling element 2, wherein the mechanical connection transfers excitations from the excitation means 2 to the excitation detection means 8.

[0029] Excitation means 6 preferably comprises an excitation part 10, in particular a pivotable longitudinal element. The excitation detection means 8 preferably comprises an excitation detection part 12, which is preferably a longitudinal, in particular flat, element that extends into channeling element 2.

[0030] Reference number 16 indicates a holding means. Said holding means 16 comprises a first spring 18 and a second spring 20, wherein the first spring 16 is preferably coupled with the top side of channeling element 2 and wherein the second spring 18 is preferably coupled with the bottom side of channeling element 2. Both springs 16, 18 are preferably coupled with a wall member 22, in particular of a refrigerator 25 (cf. Fig. 2). Holding means 16 allows a defined positioning and excitation of channeling element 2.

[0031] Reference number 30 indicates an operation scheme for operating excitation means 6. Said operation scheme can be provided as data. Said operation scheme is preferably provided and executed respectively processed by control unit 24. Therefore, control unit 24 is preferably connected for signal and/or data exchange with excitation means 6 and/or excitation detection means 8. Excitation detection means 8 preferably directly actuates a further means, in particular heater means 26 (cf. fig. 2). It is also conceivable that excitation detection means 8 provides data and/or signals representative for detected excitation respectively vibration. Said data and/or signals can be processed or evaluated by control unit 24 and can be used for actuating said further means, in particular heater means 26 (cf. fig. 1).

[0032] As shown in fig. 2 the working principle is based on excitation and sensing. After starting of refrigerator 25, heat-exchanger respectively cooling means 26 starts cooling and icing. The vibration motor respectively excitation means 6 is excited by certain time intervals with excitation of ice control signal when heat-exchanger 26 starts cooling. Firstly, if there is no ice 4 or snow occurs inside of grid 14 surfaced solid pipe respectively channeling element 2, the excitations of vibration motor 6 cannot create any vibration on the solid pipe 2 and/or on vibration sensor respectively vibration detection means 8. Vibrator leg respectively excitation part 10 of motor 6 cannot hit the solid pipe 2. When icing occurs on heat-exchanger surface and after a certain time, thick layer of ice 4 fills the inside of the solid pipe 2 which preferably has a grid 14 surface. At this condition ice filled solid pipe 2 starts the vibration transfer from vibration motor 6 side to vibration sensor side respectively excitation detection means 8. Vibrator leg 10 of motor 6 hit the ice 4 that occurs inside of pipe 2. So excited vibration reaches the inside surface of pipe 2 with help of good transmission of vibration by solid materials (ice). When icing full filled inside of the solid pipe 2, excited vibration reaches perfectly to vibration sensor 8. There are different type vi-

bration sensor 8 that returns from vibration to voltage, current or resistance. The resistance, voltage or current of vibration sensor changes with respect to perceived vibration intensity.

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Low level vibration intensity = Low level icing (no need defrost)

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Mid level vibration intensity = Mid level icing (need standard time defrost)

High level vibration intensity = High level icing (need long time defrost)

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[0033] This system can be used both with microcontroller respectively control unit 24 or directly hardware system with no microcontroller. This system is also perfectly isolated. There is highly preferably no electrical conductivity between excitation side and sensor side.

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[0034] The invention describes an ice detection unit 1, which at least comprises a channeling element 2 for guiding water and for holding ice 4, an excitation means 6 for exciting said channeling element 2 and an excitation detection means 8 for detecting excitations of the channeling element 2, wherein a mechanical connection between the channeling element 2 and at least the excitation means 6 and/or the excitation detection means 8 establishes due to a solidification of fluid, in particular water, inside the channeling element 2, wherein the mechanical connection transfers excitations from the excitation means 2 to the excitation detection means 8.

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List of reference numbers

35 **[0035]**

- 1 ice detection unit
- 2 channeling element
- 4 ice
- 40 6 excitation means
- 8 excitation detection means
- 10 excitation part
- 12 excitation detection part
- 14 grid
- 45 16 holding means
- 18 first spring element
- 20 second spring element
- 22 wall member
- 24 control unit
- 50 25 refrigerator
- 26 cooling means
- 28 heating means
- 30 data
- 32 output signal

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Claims

1. Ice detection unit (1),
at least comprising
a channeling element (2) for guiding water and for holding ice (4),
an excitation means (6) for exciting said channeling element (2) and
an excitation detection means (8) for detecting excitations of the channeling element (2),

wherein a mechanical connection between the channeling element (2) and at least the excitation means (6) and/or the excitation detection means (8) establishes due to a solidification of fluid, in particular water, inside the channeling element (2),
wherein the mechanical connection transfers excitations from the excitation means (2) to the excitation detection means (8),
characterized by

a holding means (16) for holding said channeling element (2) in a predefined position,
wherein said holding means (16) comprises at least one spring element (18) and
wherein the channeling element (2) comprises at least a grid (14) or structured inner surface to allow solidificated water to grow into radial direction and wherein the channeling element (2) has at least to axial ends and at least in sections a tube-like shape.
2. Ice detection unit according to claim 1,
characterized in that
at least the excitation means (6) has an excitation part (10) reaching on one side of the channeling element (2) into the inside of a tube-like shaped section without contacting said channeling element (2).
3. Ice detection unit according to claim 1 or 2,
characterized in that at least the excitation detection means (8) has an excitation detection part (12) reaching on the other side of the channeling element (2) into the inside of a tube-like shaped section without contacting said channeling element (2).
4. Ice detection unit according to claim 1,
characterized in that
the holding means (16) comprises at least two spring elements (18, 20), wherein one first spring element (18) is arranged on a topside of a tube-like shaped connection section of the channeling element (2) and wherein one second spring element (20) is arranged on a bottom side of said tube-like shaped connection section, wherein the tube-like shaped connection section is positioned between the axial ends of said channeling element (2), wherein each of said spring elements (18, 20) has one further end to be coupled with a surrounding, in particular stationary, wall member (22).
5. Ice detection unit according to any of claims 1 to 4,
characterized in that
the excitation means (6) for exciting said channeling element (2) comprises a vibration motor, wherein said excitation part (10) is a rotatable pivot, wherein said rotatable pivot is actuated by means of an actuation of said vibration motor, the excitation detection means (12) for detecting excitations of the channeling element (2) is a vibration sensor, wherein the excitation detection part (12) is connected to said vibration sensor and transfers vibrations of the channeling element (2) to the vibration sensor.
6. Ice detection unit according to any of the proceeding claims,
characterized by
a control unit (24),
wherein the control unit (24) operates the excitation means (6) due to predefined rules,
wherein the excitation detection means (8) outputs excitation signals in dependency of detected excitations,
wherein the control unit (24) provides control signals in dependency of the detected excitation signals for operating of at least one further means.
7. Ice detection unit according to claim 5,
characterized in that
the excitation detection means (8) detects value changes in resistance and/or voltage and/or current,

wherein a first value range represents a low level excitation intensity,
wherein no signals for operating the further means are provided by the control means (24) if a low level excitation intensity is determined
wherein a second value range represents a mid level excitation intensity,
wherein signals for operating the further means are provided by the control means (24) if a mid level excitation intensity is determined,
wherein a third value range represents a high level excitation intensity,
wherein signals for operating the further means are provided by the control means (24) if a high level excitation intensity is determined,
wherein the signals for operating the further means are causing a longer operation of the further means in case a high level excitation intensity is determined in comparison to a case in which a mid level excitation intensity is determined.
8. Ice detection unit according to any of the proceeding

claims,

characterized in that

the excitation means (6) and the excitation detection means (8) are electrically isolated from each other.

9. Ice detection unit according to any of the proceeding claims,

characterized in that

the fluid, in particular water, freezes below 5°, in particular below 1° or below 0°, and ambient pressure of 10.1 N/cm².

10. Refrigerator (25), in particular no frost refrigerator, at least comprising

a cooling means (26) for cooling down the atmosphere inside the refrigerator (25),

a heater means (28) for melting of accumulated ice or snow inside said refrigerator (25),

an ice detection unit (19) according to any of the before mentioned claims for detecting ice (4) or snow inside the refrigerator (25) and for actuating the heater means (28) in dependency of detected ice (4) or snow.

11. Method for operating a refrigerator (25), at least comprising the steps:

Cooling down a food storage section by means of a cooling means (26),

Detecting ice (4) or snow inside the food storage section by means of operating an ice detection unit (1) according to any of claims 1 to 9,

Operating a heating means (28) in case the presence of ice (4) or snow is detected.

12. Method according to claim 11,

characterized in that

the heating means (28) is operated as long as a mechanical coupling between the excitation means (6) and the excitation detection means (8) is present.

13. Method according to claim 11,

characterized in that

the heating means (28) is operated for a predetermined time, wherein the predetermined time depends on the determined level of excitation intensity.

Patentansprüche

1. Eiserfassungseinheit (1),

mindestens umfassend

ein Kanalisierungselement (2) zum Leiten von Wasser und zum Enthalten von Eis (4),

ein Anregungsmittel (6) zum Anregen des Kanalisierungselements (2) und

ein Anregungserfassungsmittel (8) zum Erfassen von Anregungen des Kanalisierungselements (2),

wobei sich aufgrund einer Erstarrung von Fluid, insbesondere von Wasser, innerhalb des Kanalisierungselements (2) eine mechanische Verbindung zwischen dem Kanalisierungselement (2) und mindestens dem Anregungsmittel (6) und/oder dem Anregungserfassungsmittel (8) bildet,

wobei die mechanische Verbindung Anregungen von dem Anregungsmittel (2) an das Anregungserfassungsmittel (8) überträgt, **gekennzeichnet durch**

ein Haltemittel (16) zum Halten des Kanalisierungselements (2) in einer vorbestimmten Position,

wobei das Haltemittel (16) mindesten ein Federelement (18) umfasst, und

wobei das Kanalisierungselement (2) mindestens ein Gitter (14) oder eine strukturierte Innenoberfläche aufweist, um es erstarrtem Wasser zu erlauben, in einer radialen Richtung zu wachsen, und

wobei das Kanalisierungselement (2) mindestens zwei axiale Enden und mindestens in Abschnitten eine röhrenartige Form hat.

2. Eiserfassungseinheit gemäß Anspruch 1,

dadurch gekennzeichnet, dass

mindestens das Anregungsmittel (6) einen Anregungsteil (10) hat, der auf einer Seite des Kanalisierungselements (2) in das Innere eines röhrenartigen Abschnitts reicht, ohne das Kanalisierungselement (2) zu kontaktieren.

3. Eiserfassungseinheit gemäß Anspruch 1 oder 2,

dadurch gekennzeichnet, dass

mindestens das Anregungserfassungsmittel (8) einen Anregungserfassungsteil (12) hat, der auf der anderen Seite des Kanalisierungselements (2) in das Innere eines röhrenartigen Abschnitts reicht, ohne das Kanalisierungselement (2) zu kontaktieren.

4. Eiserfassungseinheit gemäß Anspruch 1,

dadurch gekennzeichnet, dass

das Halteelement (16) mindestens zwei Federelemente (18, 20) umfasst, wobei ein erstes Federelement (18) auf einer Oberseite eines röhrenartigen Verbindungsabschnitts des Kanalisierungselements (2) angeordnet ist und wobei ein zweites Federelement (20) auf einer Unter-

seite des röhrenartigen Verbindungsabschnitts angeordnet ist, wobei der röhrenartige Verbindungsabschnitt zwischen den axialen Enden des Kanalisierungselements (2) positioniert ist, wobei jedes der Federelemente (18, 20) ein weiteres Ende aufweist, das mit einem umgebenden, insbesondere stationären, Wandelement (22) zu koppeln ist.

5. Eiserfassungseinheit gemäß einem der Ansprüche 1 bis 4, 10

dadurch gekennzeichnet, dass

das Anregungsmittel (6) zum Anregen des Kanalisierungselements (2) einen Vibrationsmotor umfasst,

wobei der Anregungsteil (10) eine drehbare Schwenkeinrichtung ist,

wobei die drehbare Schwenkeinrichtung mittels einer Betätigung des Vibrationsmotors betätigt wird,

das Anregungserfassungsmittel (12) zum Erfassen von Anregungen des Kanalisierungselements (2) ein Vibrationssensor ist,

wobei der Anregungserfassungsteil (12) mit dem Vibrationssensor verbunden ist und Vibrationen des Kanalisierungselements (2) an den Vibrationssensor überträgt.

6. Eiserfassungseinheit gemäß einem der vorhergehenden Ansprüche, 30

gekennzeichnet durch

eine Steuerungseinheit (24),

wobei die Steuerungseinheit (24) das Anregungsmittel (6) aufgrund vorbestimmter Regeln betreibt,

wobei das Anregungserfassungsmittel (8) Anregungssignale in Abhängigkeit von erfassten Anregungen ausgibt,

wobei die Steuerungseinheit (24) Steuerungssignale in Abhängigkeit von den erfassten Anregungssignalen liefert, um mindestens ein weiteres Mittel zu betreiben.

7. Eiserfassungseinheit gemäß Anspruch 5, 45

dadurch gekennzeichnet, dass

das Anregungserfassungsmittel (8) Wertänderungen im Widerstand und/oder in der Spannung und/oder im Strom erfasst,

wobei ein erster Wertebereich eine Anregungsintensität eines niedrigen Pegels repräsentiert,

wobei keine Signale zum Betreiben des weiteren Mittels von dem Steuerungsmittel (24) geliefert werden, wenn eine Anre-

gungsintensität eines niedrigen Pegels festgestellt wird,

wobei ein zweiter Wertebereich eine Anregungsintensität eines mittleren Pegels repräsentiert,

wobei Signale zum Betreiben des weiteren Mittels von dem Steuerungsmittel (24) geliefert werden, wenn eine Anregungsintensität eines mittleren Pegels festgestellt wird, wobei ein dritter Wertebereich eine Anregungsintensität eines hohen Pegels repräsentiert,

wobei Signale zum Betreiben des weiteren Mittels von dem Steuerungsmittel (24) geliefert werden, wenn eine Anregungsintensität eines hohen Pegels festgestellt wird,

wobei die Signale zum Betreiben des weiteren Mittels einen längeren Betrieb des weiteren Mittels in einem Fall verursachen, in dem eine Anregungsintensität eines hohen Pegels festgestellt wird, im Vergleich mit einem Fall, in dem eine Anregungsintensität eines mittleren Pegels festgestellt wird.

8. Eiserfassungseinheit gemäß einem der vorhergehenden Ansprüche,

dadurch gekennzeichnet, dass

das Anregungsmittel (6) und das Anregungserfassungsmittel (8) elektrisch gegeneinander isoliert sind.

9. Eiserfassungseinheit gemäß einem der vorhergehenden Ansprüche, 35

dadurch gekennzeichnet, dass

das Fluid, insbesondere Wasser, unter 5°, insbesondere unter 1° oder unter 0° und einem Umgebungsdruck von 1,01 bar (10.1 N/cm²) einfriert.

10. Kühlschrank (25), insbesondere selbstenteisender Kühlschrank, 45

mindestens umfassend

eine Kühleinrichtung (26) zum Herunterkühlen der Atmosphäre innerhalb des Kühlschranks (25),

eine Heizeinrichtung (28) zum Schmelzen angesammelten Eises oder Schnees innerhalb des Kühlschranks (25),

eine Eiserfassungseinheit (19) gemäß einem der vorhergehenden Ansprüche zum Erfassen von Eis (4) oder Schnee innerhalb des Kühlschranks (25) und zum Betätigen der Heizeinrichtung (28) in Abhängigkeit von erfasstem Eis (4) oder Schnee.

11. Verfahren zum Betreiben eines Kühlschranks (25), mindestens umfassend die folgenden Schritte:

Herunterkühlen eines Lebensmittelaufbewahrungsabschnitts mittels einer Kühleinrichtung (26),
Erfassen von Eis (4) oder Schnee innerhalb des Lebensmittelaufbewahrungsabschnitts durch Betreiben einer Eiserfassungseinheit (1) gemäß einem der Ansprüche 1 bis 9,
Betreiben einer Heizeinrichtung (28) für den Fall, dass die Anwesenheit von Eis (4) oder Schnee erfasst wird.

12. Verfahren gemäß Anspruch 11,

dadurch gekennzeichnet, dass die Heizeinrichtung (28) so lange betrieben wird, wie eine mechanische Kopplung zwischen dem Anregungsmittel (6) und dem Anregungserfassungsmittel (8) vorhanden ist.

13. Verfahren gemäß Anspruch 11,

dadurch gekennzeichnet, dass die Heizeinrichtung (28) für eine vorbestimmte Zeit betrieben wird, wobei die vorbestimmte Zeit von dem bestimmten Pegel einer Anregungsintensität abhängt.

Revendications

1. Unité de détection de glace (1), comprenant au moins un élément de canalisation (2) pour guider de l'eau et pour maintenir de la glace (4), un moyen d'excitation (6) pour exciter ledit élément de canalisation (2) et un moyen de détection d'excitation (8) pour détecter des excitations de l'élément de canalisation (2), dans laquelle une connexion mécanique entre l'élément de canalisation (2) et au moins le moyen d'excitation (6) et/ou le moyen de détection d'excitation (8) s'établit en raison d'une solidification du fluide, en particulier de l'eau, à l'intérieur de l'élément de canalisation (2), dans laquelle la connexion mécanique transfère les excitations du moyen d'excitation (2) au moyen de détection d'excitation (8),
caractérisée par un moyen de maintien (16) pour le maintien dudit élément de canalisation (2) dans une position prédéfinie, dans laquelle ledit moyen de maintien (16) comprend au moins un élément à ressort (18) et dans laquelle l'élément de canalisation (2) comprend au moins une grille (14) ou une surface interne struc-

turée pour permettre à l'eau solidifiée de se développer dans une direction radiale et dans laquelle l'élément de canalisation (2) a au moins vers les extrémités axiales et au moins dans des sections une forme tubulaire.

2. Unité de détection de glace selon la revendication 1, **caractérisée en ce qu'**au moins le moyen d'excitation (6) a une partie d'excitation (10) arrivant d'un côté de l'élément de canalisation (2) à l'intérieur d'une section de forme tubulaire sans entrer en contact avec ledit élément de canalisation (2).

3. Unité de détection de glace selon la revendication 1 ou 2, **caractérisée en ce qu'**au moins le moyen de détection d'excitation (8) a une partie de détection d'excitation (12) arrivant de l'autre côté de l'élément de canalisation (2) à l'intérieur d'une section de forme tubulaire sans entrer en contact avec ledit élément de canalisation (2).

4. Unité de détection de glace selon la revendication 1, **caractérisée en ce que** le moyen de maintien (16) comprend au moins deux éléments à ressort (18, 20), dans laquelle un premier élément à ressort (18) est agencé sur un côté supérieur d'une section de connexion de forme tubulaire de l'élément de canalisation (2) et dans laquelle un second élément à ressort (20) est agencé sur un côté inférieur de ladite section de connexion de forme tubulaire, dans laquelle la section de connexion de forme tubulaire est positionnée entre les extrémités axiales dudit élément de canalisation (2), dans laquelle chacun desdits éléments à ressort (18, 20) a une extrémité supplémentaire devant être couplée à une pièce de paroi (22) environnante, en particulier stationnaire.

5. Unité de détection de glace selon l'une quelconque des revendications 1 à 4, **caractérisée en ce que** le moyen d'excitation (6) pour exciter ledit élément de canalisation (2) comprend un moteur à vibrations, dans laquelle ladite partie d'excitation (10) est un pivot rotatif, dans laquelle ledit pivot rotatif est actionné au moyen d'un actionnement dudit moteur à vibrations, le moyen de détection d'excitation (12) pour détecter des excitations de l'élément de canalisation (2) est un capteur de vibrations, dans laquelle la partie de détection d'excitation (12) est connectée audit capteur de vibrations et transfère les vibrations de l'élément de canalisation (2) au capteur de vibrations.

6. Unité de détection de glace selon l'une quelconque

- des revendications précédentes,
caractérisée par
 une unité de commande (24),
 dans laquelle l'unité de commande (24) fait fonctionner le moyen d'excitation (6) en raison de règles prédéfinies,
 dans laquelle le moyen de détection d'excitation (8) délivre en sortie des signaux d'excitation en fonction des excitations détectées,
 dans laquelle l'unité de commande (24) fournit des signaux de commande en fonction des signaux d'excitation détectés pour le fonctionnement d'au moins un moyen supplémentaire.
7. Unité de détection de glace selon la revendication 5,
caractérisée en ce que
 le moyen de détection d'excitation (8) détecte des changements de valeur de résistance et/ou de tension et/ou de courant,
 dans laquelle une première plage de valeurs représente une intensité d'excitation de bas niveau,
 dans laquelle aucun signal pour le fonctionnement du moyen supplémentaire n'est fourni par le moyen de commande (24) si une intensité d'excitation de bas niveau est déterminée
 dans laquelle une deuxième plage de valeurs représente une intensité d'excitation de niveau moyen,
 dans laquelle des signaux pour le fonctionnement du moyen supplémentaire sont fournis par le moyen de commande (24) si une intensité d'excitation de niveau moyen est déterminée,
 dans laquelle une troisième plage de valeurs représente une intensité d'excitation de haut niveau,
 dans laquelle des signaux pour le fonctionnement du moyen supplémentaire sont fournis par le moyen de commande (24) si une intensité d'excitation de haut niveau est déterminée,
 dans laquelle les signaux pour le fonctionnement du moyen supplémentaire entraînent un fonctionnement plus long du moyen supplémentaire dans le cas où une intensité d'excitation de haut niveau est déterminée en comparaison à un cas dans lequel une intensité d'excitation de niveau moyen est déterminée.
8. Unité de détection de glace selon l'une quelconque des revendications précédentes,
caractérisée en ce que
 le moyen d'excitation (6) et le moyen de détection d'excitation (8) sont isolés électriquement l'un de l'autre.
9. Unité de détection de glace selon l'une quelconque des revendications précédentes,
caractérisée en ce que
 le fluide, en particulier l'eau, gèle en dessous de 5°, en particulier en dessous de 1° ou en dessous de 0°, et à une pression ambiante de 10,1 N/cm².
10. Réfrigérateur (25), en particulier réfrigérateur sans givre,
 comprenant au moins
 un moyen de refroidissement (26) pour le refroidissement de l'atmosphère à l'intérieur du réfrigérateur (25),
 un moyen de chauffage (28) pour la fusion de la glace ou de la neige accumulée à l'intérieur dudit réfrigérateur (25),
 une unité de détection de glace (19) selon l'une quelconque des revendications mentionnées précédemment pour détecter de la glace (4) ou de la neige à l'intérieur du réfrigérateur (25) et pour actionner le moyen de chauffage (28) en fonction de la glace (4) ou de la neige détectée.
11. Procédé de fonctionnement d'un réfrigérateur (25), comprenant au moins les étapes :
 refroidissement d'une section de stockage d'aliments au moyen d'un moyen de refroidissement (26),
 détection de glace (4) ou de neige à l'intérieur de la section de stockage d'aliments au moyen du fonctionnement d'une unité de détection de glace (1) selon l'une quelconque des revendications 1 à 9,
 fonctionnement d'un moyen de chauffage (28) dans le cas où la présence de glace (4) ou de neige est détectée.
12. Procédé selon la revendication 11,
caractérisé en ce que
 le moyen de chauffage (28) fonctionne tant qu'un couplage mécanique entre le moyen d'excitation (6) et le moyen de détection d'excitation (8) est présent.
13. Procédé selon la revendication 11,
caractérisé en ce que
 le moyen de chauffage (28) fonctionne pendant une durée prédéterminée,
 dans lequel la durée prédéterminée dépend du niveau déterminé de l'intensité d'excitation.

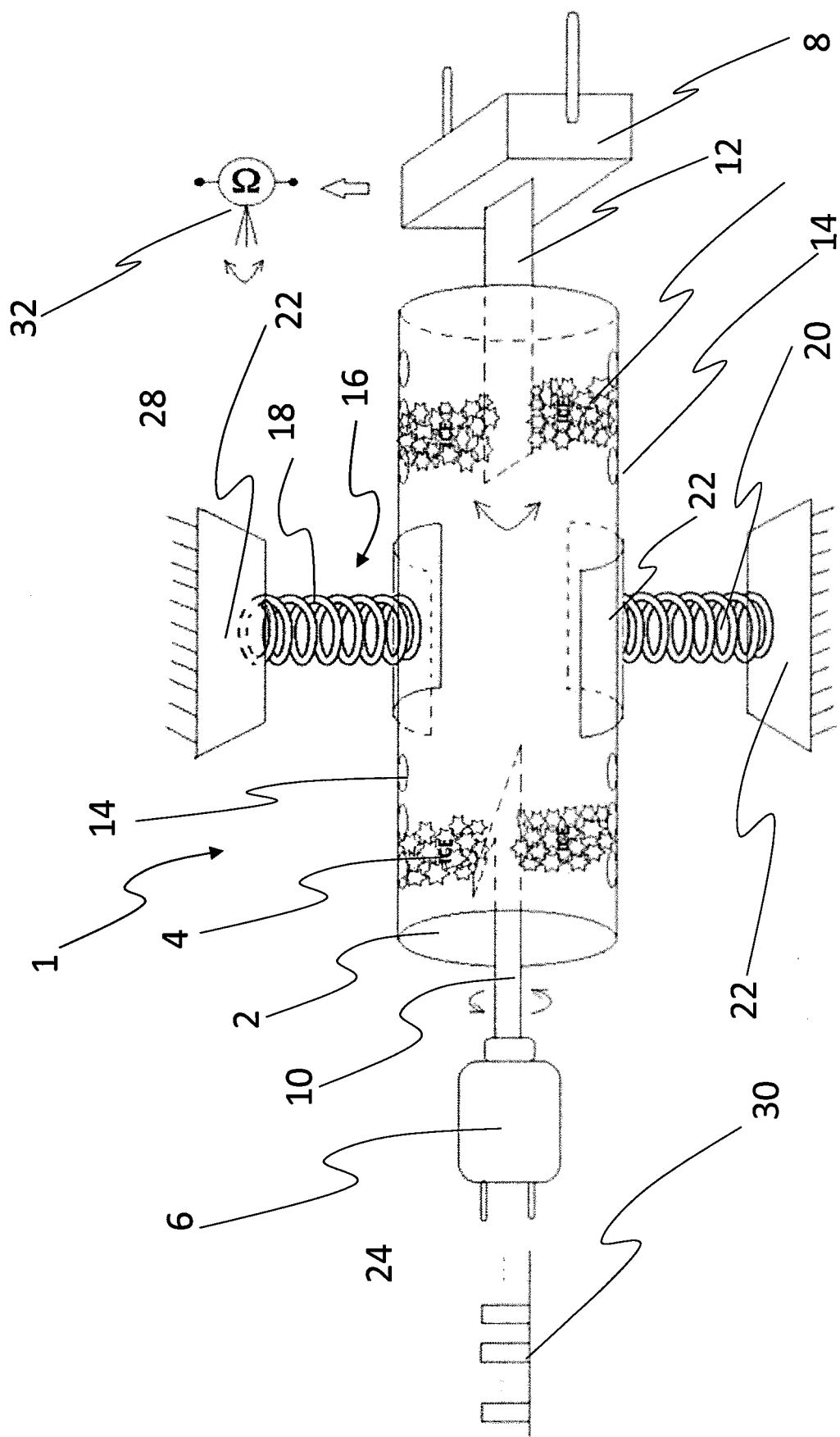


Fig. 1

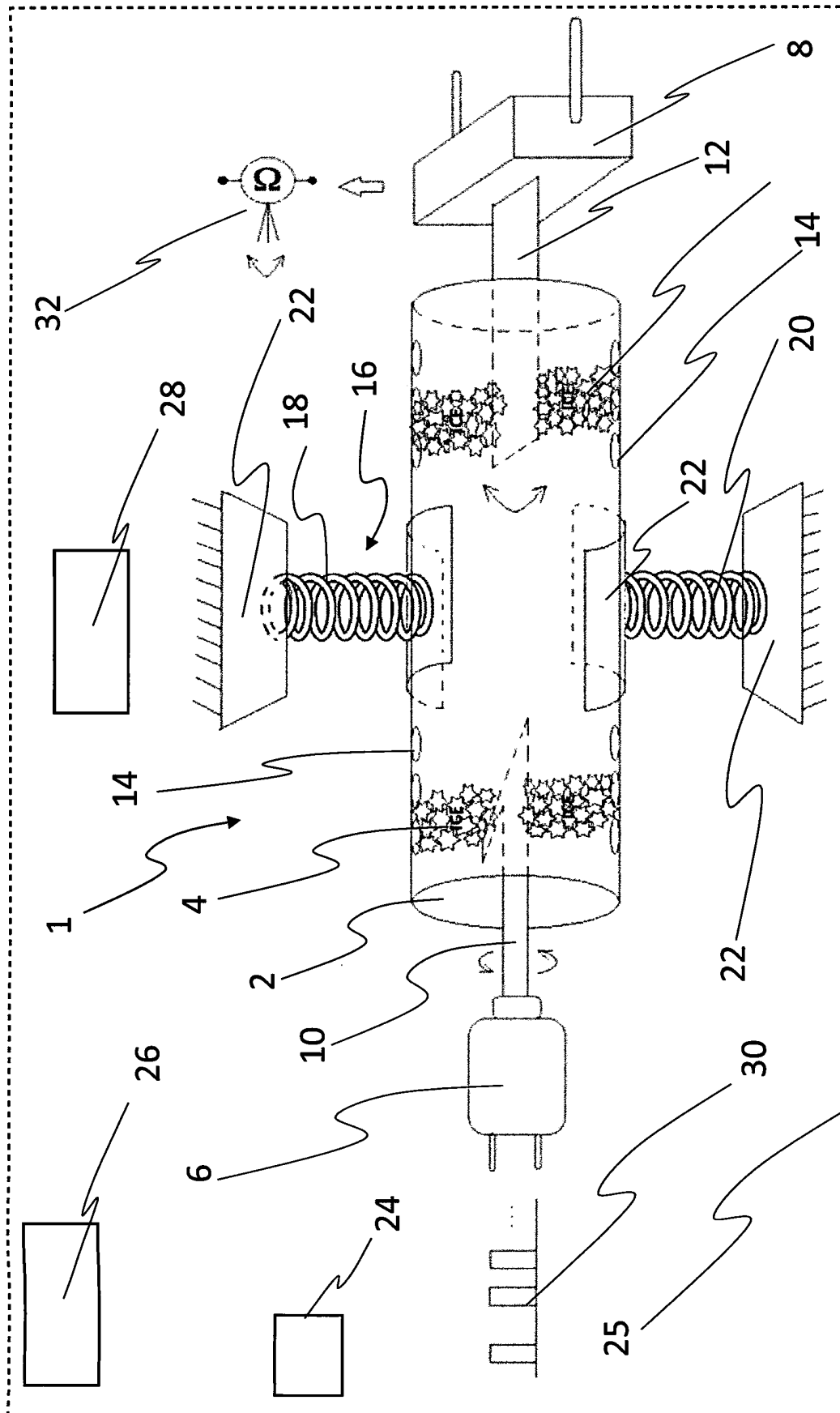


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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