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JP-A- 2007 107 731
JP-U- S 563 379
US-A1- 2003 084 675
US-A1- 2003 094 011
US-A1- 2007 028 631
US-A1- 2011 271 701

Description

The invention relates to a cooling unit, in particular for cooling foodstuffs.

Standard cooling units in the form of refrigerated display units such as the ones provided in supermarkets for cooling fresh foodstuffs such as sausage or cheese in the above-zero temperature range are known from the prior art.

Standard refrigerated display units have a rear wall, a bottom element and a ceiling element such that at least a partially open goods compartment to be refrigerated is spanned between these components.

In order to enable refrigeration at all, the respective cooling medium supply lines and cooling medium discharge lines provided with the respective throttle elements are disposed outside the cooling unit such that as a result of the heating of the refrigerant in the goods compartment, heat can be extracted from the latter.

Routing central supply lines and discharge lines of the cooling medium to and from the cooling unit always requires laborious and complex insulation of the pipelines. This insulation prevents condensate from forming on the supply lines and discharge lines through which a cooling medium is flowing, and also prevents the lines outside the goods compartment to be refrigerated from icing up.

Furthermore, throttle elements for controlling the mass flow and thus also for the extraction of heat from the goods compartment to be refrigerated are provided in the outside area of the cooling unit, for example on the outer surface of the top plate.

The disadvantage of this technology lies in the fact that moisture is continuously condensing on the throttle elements in particular, which consequently ice up, impairing their function or rendering them completely unusable. Furthermore, the liquid condensate on the throttle elements, which are not insulated, and/or in the area of the throttle elements, which is likewise not insulated due to the structural fixation measures between the cooling medium lines and the throttle element, is detrimental to the insulation adjoining this insulation-free area, as the insulation absorbs water like a sponge, which significantly accelerates the corrosion of the lines. In addition, the wetting of the cooling medium supply lines and cooling medium discharge lines also causes the latter to lose their insulating properties. Due to the design of known cooling units, it is always necessary, as mentioned above, to insulate the cooling medium lines. However, this insulation is interrupted by the throttle elements, which for example are flange-connected to the lines. As a consequence, it is impossible to insulate the throttle elements themselves. Nor is it possible to insulate the immediate area surrounding the throttle elements, hence the throttle elements and their surroundings are designed without insulation and it is precisely here where condensate precipitates and freezes. Due to the formation of ice and the associated functional impairment of the throttle elements, laborious defrosting steps and long defrosting times are required for defrosting the throttle elements in known cooling units. Obviously, it is not possible to cool the refrigerated goods during these defrosting steps, hence loss of goods is always a possibility to be reckoned with. Furthermore, the insulation is continuously being damaged as a result of wetting such that the insulating effect is lost and expensive and laborious re-insulation is required. A further disadvantage imposed by the prior art is that additional drip pans have to be fitted directly beneath the throttle elements in order to collect and drain the melt water.

JP S56 3379 U discloses relevant prior art.

The problem addressed by the present invention is therefore that of providing a cooling unit whose control unit prevents the formation of ice on the throttle elements and/or a wetting of the insulation as known from the prior art.

This problem is solved according to the features of claim 1.

An essential point of the invention according to claim 1 lies in the fact that the control unit is arranged within the cooling unit. Essentially, this has the advantage that icing up as in known throttle elements is prevented. The control unit of this invention is thus designed to be permanently ice-free. This arrangement is also advantageous in that the central cooling medium supply and/or discharge lines can be designed as completely insulated by the control units within the cooling unit without the throttle elements interrupting the insulation material as in known cooling units. During operation, the control unit further advantageously has an intrinsic temperature in the range of -20°C to 25°C, more advantageously in the range of 0.25 K to 20 K higher than the cold-storage room temperature (depending on the cold-storage room temperature) such that during the operation of the control unit, which also corresponds to the operation of the cooling unit, the temperature of the control unit is always equal to or higher than the temperature of the liquefied cooling medium and/or of the expanded cooling medium.

For the simplified discharge of condensation water of the control unit, which may still form in the event of extremely high humidity, there can be a free space between the control unit and the bottom element, which has no relevant, in particular electronic components of the cooling unit. This ensures that the condensate on the cooling medium lines or directly on the control unit itself can drip down toward the bottom element, thus entirely avoiding known corrosion, rust formation and electronic damage due to water (condensate/ice) in an advantageous manner. This is particularly advantageous in terms of the duration of the cooling unit and the resulting significantly reduced maintenance intervals. Furthermore, this arrangement turns out to be more economical because fewer components wear out.

Another advantage of the bottom element is that it is also suitable for collecting cooling medium and discharging the cooling medium via the drain during maintenance, thereby avoiding contamination of the cooling unit itself.

An essential point of the invention according to claim 1 lies in the fact that the control unit is arranged within the cooling unit, at least partially within an insulation unit. This arrangement has the advantage that the control unit in this case is arranged at least partially, advantageously completely, within an insulation unit. This is particularly advantageous for insulating the control unit from the humidity of the ambient air such that in addition, a way to prevent condensate and ice formation is created. The insulation unit is furthermore advantageously made of insulation material, for example expanded polypropylene or polystyrene, such that a temperature gradient arises between the inner volume of the insulation unit and the cooling unit itself. The inner volume of the insulation unit is advantageously heated to a higher temperature than the outside environment. Consequently, here too the control unit is designed to be ice-free and/or anti-icing.

The control units described here are advantageously arranged within a cooling unit, more advantageously at least partially, most advantageously in the goods compartment to be refrigerated of the cooling unit.

An advantage of both of the cooling units according to claim 1 or 2 described here lies in the fact that the cooling unit is optimally balanced hydraulically. The basis of the hydraulic balance is an appropriate design of the refrigeration network by means using pipe network calculation programs. To this end, the cooling capacity of the individual cooling units and the pressure losses of all components of the pipe network must be known. Hydraulic balancing is lacking in the prior art, hence certain cooling units in proximity to the cold generator are oversupplied and cooling units remote from the cold generator are undersupplied. In this case, a cold generator is advantageously understood to mean a device which conveys the cooling medium, for example a heat pump, whose cooling medium or refrigerant is brine. This means that the brine temperature must be lowered in order to cool the undersupplied cooling units so that the cold generator cycles more frequently. Furthermore, the lowering of the brine temperature also means that the brine concentration must be increased, thereby causing a deterioration in the value of the specific heat capacity and consequently also of the efficiency. With the control unit described here, precisely these disadvantages of the prior art are overcome and an optimum hydraulic balance is achieved.

Further advantageous embodiments are listed in the dependent claims.

According to the invention, the control unit is designed as a pump arrangement. An advantageous of the pump arrangement lies in the fact that the latter gives off heat energy during operation. This intrinsic heat prevents the pump arrangement itself from sweating or icing up. A further advantage is that the dew point temperature in electric control units, particularly of a pump arrangement, is elevated due to self-heating. This means that due to the self-heating of the control unit, the temperature, particularly in the housing of the pump arrangement, is raised to a temperature such that no moisture can precipitate within the housing of the pump. Consequently, the temperature in and/or on the housing of the pump arrangement is always higher than the dew point temperature in the goods compartment to be refrigerated during the operation of the pump arrangement, which also corresponds to the operation of the cooling unit.

In addition, the provision of one pump arrangement per refrigeration point turns out to be advantageous in that pump arrangements with lower outputs can also be used. This decentralized individual arrangement is also advantageous in that each cooling unit is designed to be individually controllable so that the refrigeration temperature, for example, of each cooling unit can be adjusted in accordance with the goods to be refrigerated.

The provision of at least one pump arrangement per cooling unit also results in an ideal hydraulic balancing, as stated above, such that each pump arrangement only provides as much delivery head as is actually needed by the corresponding cooling unit.

The pump arrangement is designed in such a way that it continuously overcomes the pressure loss of the heat extraction transfer element and of the supply line or discharge line through which the cooling medium is flowing.

Additionally or alternatively, it is also possible to arrange the control unit, advantageously the pump arrangement, in the ventilation flow of the heat exchanger of the cooling unit such that the control unit is also kept sweat-free and/or ice-free, at least during operation, by means the ventilation flow of the heat exchanger.

Furthermore, it is also possible to keep the pump arrangement free of condensate and/or ice by insulating the control unit within the cooling unit. This can be accomplished with, for example, a simple insulation unit that encloses the control unit. In the simplest case, the insulation unit can merely be designed as temperature-insulating. Alternatively, a diffusion-tight design of the insulation unit would also be conceivable.

Furthermore, in another advantageous embodiment, the pump arrangement is designed as a high-efficiency pump. This is advantageous due to the fact that a needs-appropriate mass flow of the cooling medium is delivered by the controlled high-efficiency pump, which makes a uniform, continuous flow velocity of the cooling medium within the cooling unit possible with high energy efficiency.

Obviously, this is not to be construed as limiting, as provision of several pump arrangements per cooling unit is also conceivable.

In particular, the design of the control unit as a pump arrangement is advantageous in that the pressure loss of the cooling medium network of a cooling unit can be reduced significantly. For example, the provision of a central cooling medium delivery pump and throttle elements arranged in a manner known from the prior art requires that a significantly higher delivery pressure be provided due to the requirement for an effective valve authority (P_{Veff}) in the cooling medium network with a central cooling medium delivery pump. Consequently, for an effective valve authority of at least 0.4, the total pressure to be provided would have to be increased by 67 % in comparison to a cooling medium network in which the mass flow per cooling unit is controlled by one pump arrangement in each case.

According to an example that is not part of the claimed invention, the control unit is designed as a control element advantageously comprising multiple throttle elements and at least one pump arrangement. Accordingly, the throttle elements can be selected from, for example, the group of 2-point valves, 2-way valves, 3-way valves and/or balancing valves.

Alternatively or additionally, it is also possible to arrange the throttle element in the ventilation flow of the heat exchanger of the cooling unit such that the throttle element is also kept sweat-free and/or ice-free by means of the ventilation flow of the heat exchanger, at least during the operation of the cooling unit.

The control unit can thus advantageously be designed as a pump arrangement and/or as a throttle element with a central cooling medium delivery pump in the goods compartment to be refrigerated. For example, it is thus conceivable for pump arrangements and/or throttle elements and/or combinations thereof to be arranged within the cooling unit, more advantageously within the goods compartment to be refrigerated, wherein the throttle elements are advantageously selected from the group of 2-point valves, 2-way valves, 3-way valves and/or balancing valves. In particular, the pump arrangement within each cooling unit, more advantageously within each cold-storage room, has proven to be effective and reliable because the pump arrangement always remains ice-free.

It is furthermore conceivable that the cooling units described here also comprise at least one local control device, which for example regulates and/or controls the flow rate of the pump arrangement or the mass flow of the throttle element. This control device can be integrated in the pump arrangement and/or in the throttle element and/or be arranged separately in the cooling unit and/or outside the cooling unit. Furthermore, the control device is advantageously designed in such a way that it controls the local control units within the cooling unit and also increases or reduces the delivery head, as needed, of the central cooling medium delivery pump and/or decentralized pump arrangement.

In a further advantageous embodiment, the control unit is designed to be controllable via at least one sensor element. This is advantageous because the control unit, in particular the pump arrangement, can be controlled individually, depending on the cooling medium, the supplying of the cooling medium, the temperature thereof and/or the pressure thereof, in order to make a pressure compensation and/or a temperature compensation/equalization. The sensor is advantageously designed as a probe and connected via at least one interface to the control unit, advantageously to the pump arrangement, and/or to the control device. The interface is advantageously designed as a bus, more advantageously as a Modbus and/or as a PWM signal and/or as a 0- to 10-volt interface.

In particular, it has proven to be advantageous to provide two sensor elements in the flow direction of the cooling medium, i.e., of the refrigerant, upstream of and downstream of the control unit, wherein both sensor elements are advantageously disposed at the same distance from the control unit. This enables reliable control of the mass flow of the cooling medium. Both sensors are each advantageously connected via an interface to the control unit. This connection can be wired and/or wireless, for example via radio or RFID. For example, it is thus conceivable for the data acquired by the sensor elements to be transmitted wirelessly to the control unit and/or to the control device and processed there. Alternatively, it would also be conceivable for the control unit and/or the control device to retrieve the data acquired by the sensor elements in predeterminable time intervals from the latter for further processing.

According to the invention, the insulation unit comprises at least one first opening for passing the cooling medium supply line into the insulation unit and at least one other opening for passing the cooling medium discharge line out of the insulation unit, wherein the insulation unit additionally comprises at least one condensate collecting duct. The provision of an insulation unit is advantageous for maintaining the control unit nearly ice-free and/or condensate-free also during reduced operation of the pump arrangement or in the case in which the control unit is designed as a throttle element with a central cooling medium delivery pump.

The insulation unit advantageously spans a closed space around the control unit such that the insulating effect of insulation unit is exploited. In the simplest case, the insulation unit is designed as a rectangular solid, a cube, or also as a sphere. Obviously, this is not to be construed as limiting, hence any other polygonal shapes and bodies are also conceivable.

However, should condensate still form on the control unit, the insulation unit, which is advantageously formed from at least one insulating material, comprises at least one condensate collection duct. In the simplest case, this condensate collection duct is designed as a depression, for example an inclined channel, such that the condensate is collected in at least one collection area of the insulation unit, advantageously at the bottom thereof, and can then be easily discharged.

The passage opening of the cooling medium supply and discharge lines are advantageously designed as moisture- and/or gas-tight with suitable sealing elements.

The condensate collection duct also advantageously opens into the collection area, which comprises a further opening within the wall of the insulation device. In order to ensure the moisture-and/or gas-tightness of this opening as well, it has proven to be advantageous to open the opening suddenly by means of a valve, for example a solenoid valve, in order to drain the condensate quickly and completely from the insulation unit. The solenoid valve is advantageously controlled in accordance with the amount of condensate and/or of the condensate weight. Corresponding sensor elements are provided for this detection. Additionally, providing a heating device within the insulation unit in order to prevent condensate formation and to regulate the temperature of the control unit would be conceivable.

It is furthermore also conceivable to drain the condensate from the insulation unit via a control flap and/or tilting flap, provision of which is then made instead of the solenoid valve. These two flaps are advantageously mechanically and/or electronically controllable such that an automatic opening and/or closing of the control flap and/or tilting flap takes place depending on the amount of condensate and/or of the condensate weight.

It is furthermore conceivable to arrange a further conveying device, for example an additional pump, within the insulation unit, which pumps out the condensate in the collection area of the insulation unit. The pump is advantageously arranged within the insulation unit. Alternatively, suctioning the condensate in the collection area from the outside is also conceivable. In this case the suction device, for example a pump, is advantageously arranged outside the insulation unit. Both pumps are preset in such a way that, depending on the amount of condensate and/or the condensate weight, they directly produce the corresponding output and actively remove the condensate from the insulation unit. To this end, probes or other sensor elements could advantageously be arranged within the insulation unit, advantageously in and/or at the collection area of the insulation unit and/or on and/or in the condensate collection duct.

Insulation unit and insulation device can advantageously be used synonymously here. It has furthermore been shown to be particularly advantageous to form the insulation unit from expanded polypropylene. This material is particularly lightweight and can be made in any shape.

It is furthermore advantageous to provide the insulation unit at least partially on and/or in the upper ceiling element of the cooling unit. This is advantageous in that the condensate can then be removed from the insulation device via the cooling unit. It is thus possible to dispense with complex line systems. The insulation unit is advantageously provided as a component of the cooling unit and can also be formed integrally with the latter, for example.

In a further advantageous embodiment, it is conceivable to arrange the control unit in a further, additional housing section within the cooling unit, wherein this housing section can be provided alternatively or in addition to the insulation unit. This is advantageous because an additional fixing of the control unit is provided by the housing section, which is advantageously designed as open downwards toward the bottom element. In addition, the housing section also reduces noise. The housing section is advantageously arranged on, for example bolted to, the rear wall of the cooling unit. The housing can furthermore also be designed as a screen such that it advantageously completely spans the control unit arranged on the rear wall of the cooling unit, wherein the screen can be designed as plate-shaped or also as a C-profile, for example. This does not affect the function of the control unit.

It is furthermore conceivable to provide further control or monitoring devices within the housing section such that the further housing section is designed as a decentralized control unit. Advantageously, the cooling unit is controlled entirely via this control unit. Advantageously, each cooling unit further comprises at least one power supply.

If no corresponding housing section is provided in a cooling unit, then the control unit is advantageously firmly affixed to the cooling unit such that it is not damaged during transport, for example.

It has also been proven to be advantageous to arrange the control unit on the rear wall, more advantageously in the lower third of the rear wall of the cooling unit oriented toward the cold-storage room. This is advantageous because this significantly reduces the influence of the turbulence of the air flow generated by the control unit designed as a pump arrangement. If the control unit, more advantageously the pump arrangement, is disposed too far up in the cooling unit, this can give rise to the disadvantage, particularly in open cooling units, that the cooling curtain is interrupted, causing non-uniformities in the cooling of the goods.

In a further advantageous embodiment, the bottom element is designed to be fixed or detachable as part of the racks. If the bottom element is firmly attached to the cooling unit, this is advantageous because the stability of the entire cooling unit is increased. Furthermore, it is also advantageous because further components of the cooling unit, such as fans or heat extraction transfer elements, for example, can be arranged in and/or on the bottom unit.

If the bottom element is designed detachably with the cooling unit, it is advantageous if the bottom element has a trough-shaped section whose opening which is oriented toward the interior of the cooling unit. The condensate that forms on the lines and/or on the pump arrangement within the cooling unit, for example, can thus be easily and expediently removed from the cooling unit.

In a further advantageous embodiment, the cooling unit is designed as a cold-storage room and/or as a refrigerated cabinet and/or as a refrigerated display unit. This is advantageous because the cooling unit described here can thus be used in diverse ways. Depending on the embodiment, it is advantageous to design the cooling unit to be open, at least partially closed and/or also completely closed. For example, it is thus also conceivable for the cooling units described here to be designed as cold-storage rooms and/or as mobile refrigerated containers.

In a further advantageous embodiment, it has proven to be advantageous if the cooling medium supply line, which has a lower temperature than the cooling medium discharge line, is designed as longer in its longitudinal extension within the cooling unit than the cooling medium discharge line for conducting the cooling medium out of the cooling unit. An insulating of the lines can thus be dispensed with almost entirely, advantageously entirely.

In a further advantageous embodiment, the cooling unit is designed as a cooling module unit. This is advantageously understood to mean a modular unit such that, depending on the local conditions, a plurality of such modular cooling units are designed to be connected with one another in series or in parallel. Consequently, it is advantageous to provide a plurality of the cooling units connected to one another described here, which are even more advantageously designed as cooling module units. The advantage of the cooling module units lies in the fact that each unit can be controlled and/or actuated separately and in each case comprises at least one separate control unit, in particular a pump arrangement.

Obviously, this is not to be construed as limiting, hence it is also conceivable that central control processes such as the supplying of cooling medium, for example, can be regulated and/or controlled via central control devices.

Accordingly, the cooling module units can be controlled/actuated and/or regulated and/or monitored jointly as well as controlled/actuated and/or regulated and/or monitored individually, separately from one another, such that when, for example, multiple cooling module units are connected to one another in series, each cooling module unit can have, for example, a different refrigeration temperature. For example, the requirements of the foodstuffs to be refrigerated can thus be met in an expedient and power-saving manner.

In addition, the fact that the cooling units described here each advantageously also comprise a power supply unit and/or a control unit is also advantageous. For example, even if a single cooling module fails, this ensures that the other cooling units will continue to function and that the whole system does not have to be shut down in order to make repairs or replace parts.

In a further advantageous embodiment, the cooling units, advantageously the cooling module units, each have at least one coupling element for rapid assembly. The coupling element can be designed as, for example, a latching connection and/or clip connection and/or bayonet-type connection. The advantage of providing at least one coupling element, advantageously two coupling elements, on the cooling medium supply line and/or on the cooling medium discharge line lies in the fact that assembly of the cooling units on site is simplified considerably. Depending on the local conditions, any number of cooling units can be arranged against one another quickly and easily in that two cooling units are brought into operative engagement with each other via the corresponding coupling elements such that the cooling medium network is expanded by one cooling unit, wherein the cooling medium networks are designed to be individually regulatable and/or controllable/actuatable and/or monitorable, in particular by the pump arrangement provided in each case.

This invention also discloses a cooling system with at least two cooling module units according to at least one of the above-mentioned features, whose cooling medium networks are connected to one another in a cooling medium-tight manner via coupling elements. In this case it has also proven to be advantageous if the coupling elements also have at least one sealing element so that the leakage of cooling medium is prevented. Depending on the embodiment, it is advantageous if the cooling medium supply lines and the cooling medium discharge lines run in and/or on the cooling unit in such a way that two cooling units arranged adjacently to one another can be easily connected.

It is thus conceivable to provide these lines on the outside of the cooling units, for example on the outside of the ceiling element, or also in the bottom area and/or on the back wall of the cooling unit, where the control unit is also advantageously situated. It is thus possible to achieve a further simplification constructionally because the corresponding lines are arranged within the base area of the cooling unit or along the inside of the back wall and any condensate that forms can be discharged directly downward and out of the cooling unit via the bottom trough.

A further advantageous point of the cooling units described here lies in the fact that the cooling system formed by coupling the individual cooling units comprises a line network, which can be used for cooling goods compartments, for example refrigerated display units in supermarkets. By providing the control units within the goods compartments to be refrigerated and/or in the cold generator, throttle elements outside the cooling units are dispensed with completely. The superordinate line network of the cooling system, which consists of the central cooling medium supply and discharge lines which run to and from the individual cooling units, is designed without control units, more advantageously without control elements, such that in particular no control elements are integrated for controlling the mass flow of the cooling medium. This essentially has the advantage that an icing-up as in arrangements known from the prior art is prevented such that the control unit of this invention is designed to be permanently free of ice. Furthermore, loss of functionality of the control unit due to icing-up is effectively prevented.

Furthermore, providing a central pump arrangement with local throttle elements within each cooling unit in addition to the decentralized control unit would also be conceivable. In this case it has proven to be advantageous if the central pump arrangement is likewise arranged within the goods compartment to be refrigerated.

A further arrangement of the invention is a variant in which the central pump arrangement is part of the refrigeration unit. In this variant, the central pump arrangement is situated within the housing of a heat pump, for example.

The cooling units and cooling module units described here are advantageously part of a refrigeration circuit, in which the transport of the cooling medium designed to be a refrigerant is controlled via at least one heat pump, in particular a brine pump. The terms cooling medium and refrigerant can therefore be used synonymously.

Advantages and expediencies can be inferred from the following description in conjunction with the drawing. Shown are:

Fig. 1 a schematic illustration of one embodiment of a cooling unit;

Fig. 2 a schematic section of a cooling system;

Fig. 3 a schematic view of a system with multiple cooling units;

Fig. 4 a further schematic illustration of a cooling unit;

Fig. 5 a further schematic illustration of a cooling unit;

Fig. 6 a further schematic illustration of a cooling unit;

Fig. 7 a further schematic illustration of a cooling unit;

Figs. 8a to c a lateral sectional view of a cooling unit;

Fig. 9 a further schematic illustration of a cooling unit; and

Fig. 10 a further schematic illustration of a cooling unit.

Fig. 1 shows a cooling unit 1, which comprises a compartment W to be refrigerated. The compartment W to be refrigerated is characterized in that the compartment is delimited by a ceiling element 2, a rear wall 4 and a bottom element 6. The ceiling element 2 upwardly encloses the goods compartment W to be refrigerated. The bottom element 6 downwardly delimits the cooling unit 1, wherein the waste water can be discharged from the goods compartment to be refrigerated via openings in the bottom element. Stand elements 8, which can be adjusted depending on the local conditions, can advantageously be provided on the bottom element 6. In the simplest case, the stand elements 8 are provided as feet, which are designed as adjustable in their height. Furthermore, it is also conceivable to design the cooling unit 1 as closed and, for example, capable of being closed with a glass door.

The cooling unit 1 shown here in this embodiment further comprises vertical struts 10, which are provided for additional stabilization of the rear wall 4 and which also support the ceiling element 2. These struts 10 are also used to hold shelves for the foodstuffs to be refrigerated (not shown).

In addition, a line section 12 is shown schematically as an example on the outer surface of the ceiling element 2. In this case the line section 12 constitutes a part of the cooling medium supply line 16. The line section 12 runs in the longitudinal direction of the cooling unit 1 and can comprise coupling elements (not shown) or also closure elements (not shown) on the respective ends E, depending on whether further cooling units are provided for attachment thereto. The cooling units 1 are supplied with cooling medium via the line sections 12.

Also situated in the compartment W to be refrigerated is a unit via which heat is extracted from the compartment W to be refrigerated. Parts of this unit include a heat exchanger 34 or a heat transfer element 20, a control device 24 and sensor elements (not shown).

In this embodiment of the cooling unit 1, a cooling medium is supplied to the compartment W to be refrigerated via a line section 12. The pump arrangement 14 of the cooling unit 1 conveys the cooling medium within the cooling unit 1 as needed such that the cooling medium flows via the heat exchanger 34 into the line section 13 and is then conducted via the same out of the cooling unit 1. Both line sections are advantageously part of the central line network of a cooling system 22. The cooling system 22 further comprises at least one cold generator, for example a brine heat pump (not shown).

The directions of the arrows depicted in Figures 1 to 10 represent the flow or flowing direction of the cooling medium within a cooling unit 1 or within the cooling system 22 (not shown).

An advantage of the local, decentralized pump arrangement 14 lies in the fact that the delivery pressure of the pump arrangement is such that the pressure loss of the respective line sections 12 and 13 and of the heat exchanger 34 can be overcome. For regulating the necessary mass flow of the cooling medium, sensor elements (not shown) enable the demand for the refrigeration capacity of each cooling unit 1 to be determined. An advantageous variant of the demand determination is the recording of the temperature in the compartment W to be refrigerated. For example, if this temperature in the compartment W to be refrigerated rises, then the mass flow of the cooling medium is increased by the control unit 14, 15. If the temperature in the compartment W to be refrigerated drops, then the mass flow of the cooling medium is reduced.

The line section 13 of the cooling medium discharge line 18 advantageously runs parallel to the line section 12. This is not to be construed as limiting, and thus it is also conceivable for the two line sections 12, 13 to extend within the cooling unit, in the longitudinal direction thereof, for example along the rear wall 4. The arrangement of the two sections 12, 13 or the diameter thereof can be freely chosen and can either be established at the outset by the production technology or later on the job site, depending on the local conditions. For example, it is thus conceivable for the cooling medium to be supplied near the bottom by the bottom element 6 of the cooling unit 1, whereas it is discharged at the opposite end of the cooling unit 1 via the ceiling element 2.

The control device 14 here is designed as a pump arrangement, for example as a high-efficiency pump, which regulates and/or controls and/or monitors the cooling medium pressure and/or the cooling medium temperature. To this end, the control unit 14 is connected to the cooling medium supply line 16. The cooling medium supply line 16 in turn opens downstream of the pump arrangement 14 into a heat exchanger 34, which is advantageously designed as a brine heat transfer element 20. In this embodiment, the illustrated cooling unit 1 comprises multiple subsections, wherein only one pump arrangement 14 is provided. The cooling medium supply line 16 extends in the longitudinal direction of the cooling unit 1.

The heat exchanger 34; 20 is connected to the cooling medium discharge line 18. It is also the case that the cooling medium supply line 16 and the cooling medium discharge line 18 are connected to or are integrally formed with the line section 12 and the line section 13, respectively. The cooling medium flows into the cooling unit 1 in the direction of the arrows Z and back out of the cooling unit 1 in the direction of the arrows.

The cooling medium supply line 16 is advantageously positioned, with the pump arrangement 14, in the longitudinal extension of the cooling unit 1 upstream of the heat transfer element 20 of the cold-storage room W. This is advantageous in that the control unit 14, 15 does not sweat and/or cannot ice up due to the continuous flow around it. The reason for this is that the air which flows via the heat exchanger 34;20 can absorb significantly more moisture than air which does not flow.

Obviously, the cooling unit 1 described here can also have known components (not shown here) and is connected to the refrigeration circuit and/or to the central line network of a cold generator such as a heat pump, for example, by the superordinate line sections 12, 13.

Fig. 2 shows a section of two cooling units 1 coupled to one another, which are connected to each other via a coupling element 32. The same reference signs as before correspond to the same components and they will not be explained again here. The coupling element 32 forms an operative connection between the two cooling units 1. The two line sections 12 arranged adjacently to one another of each cooling unit 1 are advantageously connected to one another in a cooling medium-tight manner via coupling elements 32, for example plastic or metal tees. The routing of the cooling medium supply/discharge lines 16, 18 is only indicated schematically here and can be determined on the basis of the actual local conditions.

For low pressure and/or temperature loss, advantageously the cooling medium supply line 16 is designed as longer in its longitudinal extension within the cooling unit 1 than the cooling medium discharge line 18. In comparison to the former, the latter is designed as significantly shortened. The ratio of the cooling medium supply line 16 to the length of the cooling medium discharge line 18 is advantageously from 5:1 to 1.1:1. Obviously, the cooling unit 1 described here can also have known components (not shown here) and is connected to the refrigeration circuit of the heat pump (not shown) by the superordinate line sections 12, 13.

A further embodiment is shown in Fig. 3. Here, three cooling units 1 arranged at a distance from one another form a cooling system 22. The same reference signs as before correspond to the same components and they will not be explained again here. Each of the cooling units 1 comprises cooling medium supply and discharge lines 16, 18 as well as a pump arrangement 14 and a control device 24. The medium lines 16, 18 are connected without control units to the central line sections 12, 13. The line sections 12, 13 in turn form the line network with a cold generator, e.g., a heat pump 11. The individual control of the pump turns out to be advantageous with this arrangement of one pump 14 per cooling unit in each case. All three cooling units 1 can thus be variably actuated according to the requirements of, for example, the goods to be refrigerated such that, for example, each cooling unit has a different temperature.

Each cooling unit 1 comprises an interior cooling medium network and a control device 24, which advantageously regulates and/or controls the output of the pump arrangement 14. The cooling medium entering the cooling unit 1 first flows through the pump assembly 14, in order to be conducted subsequently to the heat transfer element 20. After passing through the heat transfer element 20, the cooling medium is transported via the cooling medium discharge line 18 to the line section 13 and exits the cooling unit 1 again. The two central line sections 12 and 13, together with the heat pump 11 which is designed as, for example, a heat pump, form the line network outside the cooling units 1. Owing to the exceptionally advantageous arrangement of the pump arrangements 14 in each cooling unit 1, the line network to the heat pump 11 is designed without control units. This increases the efficiency.

A modification is shown in Fig. 4, in which here too the same reference signs as above correspond to the same components. The cooling unit 1 shown here further comprises power electronics 14a in addition to the pump arrangement 14. Furthermore, check valves 25, which control the cooling medium flow, are also provided within the cooling unit 1. Fig. 5 differs from this in that in addition, provision is made of throttle elements 15, e.g., throttle elements with associated power electronics 15a. The power electronics 15a here are advantageously designed as servomotors. The servomotor which is assigned to each throttle element 15 is responsible for adjusting the throttle element 15, for example in order to adjust the cooling medium flow.

Fig. 6 corresponds to the design from Fig. 3, wherein according to one example which is not part of the claimed invention, throttle elements 15 are arranged in each cooling unit 1 instead of the pump arrangement 14. These elements are used for fine tuning the demand. The cooling system 22 shown in Fig. 6 further comprises a single pump arrangement 14, which is arranged within a cooling unit.

A further embodiment with throttle elements 15, in which here the pump arrangement is arranged within the heat pump, is shown in Fig. 7. This is likewise advantageous for keeping the pump arrangement free of ice and/or free of condensate.

Fig. 8a - c shows a schematic lateral view of a cooling unit 1, in which the same reference signs as in Fig. 1 correspond to the same components and will not be explained again here.

The bottom element 6 here is trough-shaped in the front region, advantageously formed opposite the rear wall 4. The depression serves as a condensate collection trap and/or as a refrigerant collection trap during maintenance work.

It is also conceivable to make the rear wall 4 out of different materials such that, for example, an upper rear wall portion 4a has a different insulating property than the lower rear wall portion 4b. The arrangement of the control element 14, advantageously a high-efficiency pump, in the lower third of the cooling unit 1 has proven to be advantageous due to the controlling of the control and/or monitoring function. The two cooling medium lines 16, 18 run within the cooling unit 1 and occur in medium-tight connection with the line sections 12, 13 only on the outside of the ceiling element 2. It is thus ensured within the entire cooling system 22, which comprises multiple cooling units 1, that the continuous cooling medium flow is ensured between the cooling units 1.

The cooling unit 1 shown in Fig. 8a further comprises shelves 26 and an outlet area 30, from which the cold air flow exits like a curtain and descends under the effect of gravity.

Figures 8b, c show further exemplary embodiments of the cooling unit 1, in which the cooling medium lines 12 and 13 are integral components of the cold-storage room. This means that the line sections 12 and 13 are incorporated into the insulation of the rear wall 4 or of the ceiling element 2.

Fig. 9 shows yet another embodiment. Here the cooling units are designed as cold storage rooms. In this case the arrangements of the individual components within the cold-storage rooms are different from the above-mentioned examples of refrigerated cabinets. In addition to a pumping arrangement 14 and a control device 24, each cooling unit, in this case each cold-storage room, also comprises at least one sensor element 38, advantageously for recording the temperature. The cooling system 22 illustrated here is also hooked up to a heat pump 11 via the line network.

Fig. 10 shows a further advantageous embodiment of the cooling unit 1. As in the preceding figures, the cooling unit 1 here is designed as a cooling unit module, which can be arranged individually and/or in combination with other cooling module units 1. In the latter case, multiple cooling units 1 form components of a cooling system 22.

The same reference signs as in the preceding figures correspond to the same components and will not be explained again here.

In the embodiment of the cooling unit 1 illustrated in Fig. 10, the latter comprises an insulation unit 36, which is arranged on the top of the cooling unit 1. This can be a fixed and/or detachable arrangement such that an easy replacement of the insulation unit 36 is also possible. On the other hand, it is also advantageous to provide the insulation unit 36 as a fixed component of the cooling unit 1 during production, as by doing so expensive assembly costs can be saved.

The insulation unit 36 is fix-connected to the ceiling element 2.

The pump arrangement 14 is arranged within the insulation unit 36, which is advantageously formed from insulation material 40, more advantageously from at least one polymer foam, even more advantageously from at least one expanded polypropylene. A check valve 25 is disposed upstream of the pump arrangement 14 in the flow direction of the cooling medium. This valve controls the flow of the cooling medium and can also stop it completely, for example during repairs or transport. A further check valve 25 is likewise arranged in the insulation unit 36 in the outflow direction of the cooling medium.

The connection of the insulation unit 36 to the cooling unit 1 has proven to be advantageous in that both components have a common opening 42. The opening 42 can advantageously be designed as a connection between the interior volume of the insulation unit 36 and the interior space of the cooling unit 1. In this case, any condensate can flow directly out of the insulation unit 36, via the inclined bottom surface 44 thereof, and be removed via the cooling unit 1.

Another alternative is, for example, to design the inclined bottom surface 44 of the insulation unit 36 as a condensate collection duct such that the condensate can be drained even more easily and quickly out of the insulation unit 36. The condensate collection duct advantageously comprises at least one depression, which is advantageously designed as a groove in which the condensate collects.

It has furthermore proven to be advantageous if the opening is designed to be reversibly closeable with a sealing cap, for example with a solenoid valve, a tilting flap or a control flap (not shown) such that, depending on the condensate amount and/or the condensate weight, the flap automatically opens in order to allow the condensate to drain away and then automatically closes and seals again. Here it is advantageous if the condensate is discharged offset with respect to the cooling medium lines in order to prevent the corrosion thereof. The cooling medium lines in the inlet and/or outlet area(s) on the insulation unit 36 are advantageously provided with sealing elements (not shown), which seal them in a liquid-tight and/or gas-tight manner.

The condensate collection duct and/or the inclined bottom area 44 can advantageously be formed from a further material, for example from a water-resistant and/or water-repelling organic and/or inorganic coating, for example from at least one polymer, at least one block copolymer, at least one surfactant, at least one sol or at least one sol-gel composition and/or a mixture thereof. The organic coating can also advantageously comprise at least one halogen, for example fluorine. The at least one coating material is advantageously designed to be hydrophobic, more advantageously superhydrophobic, such that a large contact angle greater than and/or equal to 90° is defined and consequently only small wetting surfaces are formed between the condensate and the coating material. This is for a much easier discharge of the condensate. In addition to the chemical modification of the inclined bottom area 44, a physical treatment is also conceivable such that the surface properties of the inclined bottom area 44 and in particular of the condensate collection duct are negated by means of plasma, laser or the like such that the aqueous condensate tends to be repelled and drains away more easily.

All features disclosed in the application documents are claimed as essential to the invention, provided that they are novel, individually or in combination, over the prior art.

List of reference signs

1	Cooling unit
2	Ceiling element
4	Rear wall
4a	Upper rear wall portion
4b	Lower rear wall portion
6	Bottom element
8	Stand element
10	Vertical strut
11	Heat pump
12, 13	Line section
14	Pump arrangement
14a	Power electronics
15	Control element/throttle element
15a	Power electronics
16	Cooling medium supply line
18	Cooling medium discharge line
20	Heat transfer element
22	Cooling system
24	Control device
26	Shelves
30	Outlet area
32	Coupling element
34	Heat exchanger
36	Insulation unit
38	Sensor element
40	Insulation material
42	Opening
44	Inclined bottom surface
W	Goods compartment
Z	Supply flow direction
A	Discharge flow direction
Arrow	Cooling medium flow direction

Patentkrav

1. Køleenhed (1), især til køling af levnedsmidler, omfattende i det mindste

a. et varerum (W) og begrænsningselementer, som i det mindste delvist omspænder varerummet (W), og som omfatter i det mindste et loftselement (2), i det mindste en bagvæg (4) samt i det mindste et bundelement (6),

b. i det mindste en kølemediumtilførselsledning (16) til tilførsel af et kølemedium ind i køleenheden (1) og i det mindste en kølemediumbortførselsledning (18), der er anbragt adskilt fra kølemediumtilførselsledningen (16), til bortledning af kølemediet ud af køleenheden (1) med henblik på udformning af et kølemediumsnet inde i køleenheden (1),

c. i det mindste en reguleringsenhed (14;15) til regulering af temperaturen og/eller trykket i det kølemedium, der i det mindste delvist gennemstrømmer køleenheden,

en isoleringsenhed (36),

hvor isoleringsenheden (36) omfatter i det mindste en første åbning til gennemføring af kølemediumtilførselsledningen (16) ind i isoleringsenheden (36) og i det mindste en yderligere åbning til gennemføring af kølemediumbortførselsledningen (18) ud fra isoleringsenheden (36), hvor reguleringsenheden er udformet som pumpeanordning (14),

kendetegnet ved, at

reguleringsenheden (14;15) er anbragt inde i køleenheden (1), hvor reguleringsenheden (14;15) inde i køleenheden (1) i det mindste delvist er anbragt inde i isoleringsenheden (36), og hvor isoleringsenheden yderligere omfatter i det mindste en kondensvandopsamlingskanal.

2. Køleenhed ifølge krav 1,

kendetegnet ved, at

pumpeanordningen (14) er udformet som højeffektivitetspumpe, fordelagtigt omdrejningstalstyret.

3. Køleenhed ifølge krav 1,

kendetegnet ved, at

pumpeanordningen (14) er anbragt i et husafsnit inde i køleenheden (1).

4. Køleenhed ifølge krav 1,
kendetegnet ved, at
denne hver gang har i det mindste et koblingselement (32) til hurtigmontage.

5. Køleenhed ifølge i det mindste et af de foregående krav
kendetegnet ved, at
køleenheden (1) er udformet som kølerum og/eller kølemøbel og/eller som kølereol.

6. Køleanlæg (22) med i det mindste to, i det mindste delvist ved siden af hinanden anbragte kølemodulenheder (1) ifølge i det mindste et af de foregående krav, hvor kølemodulenhederne (1) er udformet kølemediumstæt forbundet med hinanden, hvor der reguleringsenhedsfrit er udformet et overordnet ledningsnet i køleanlægget, hvilket ledningsnet består af de centrale kølemediumtilførsels- og bortførselsledninger (12;13), som forløber henholdsvis hen til og væk fra de enkelte køleenheder (1).

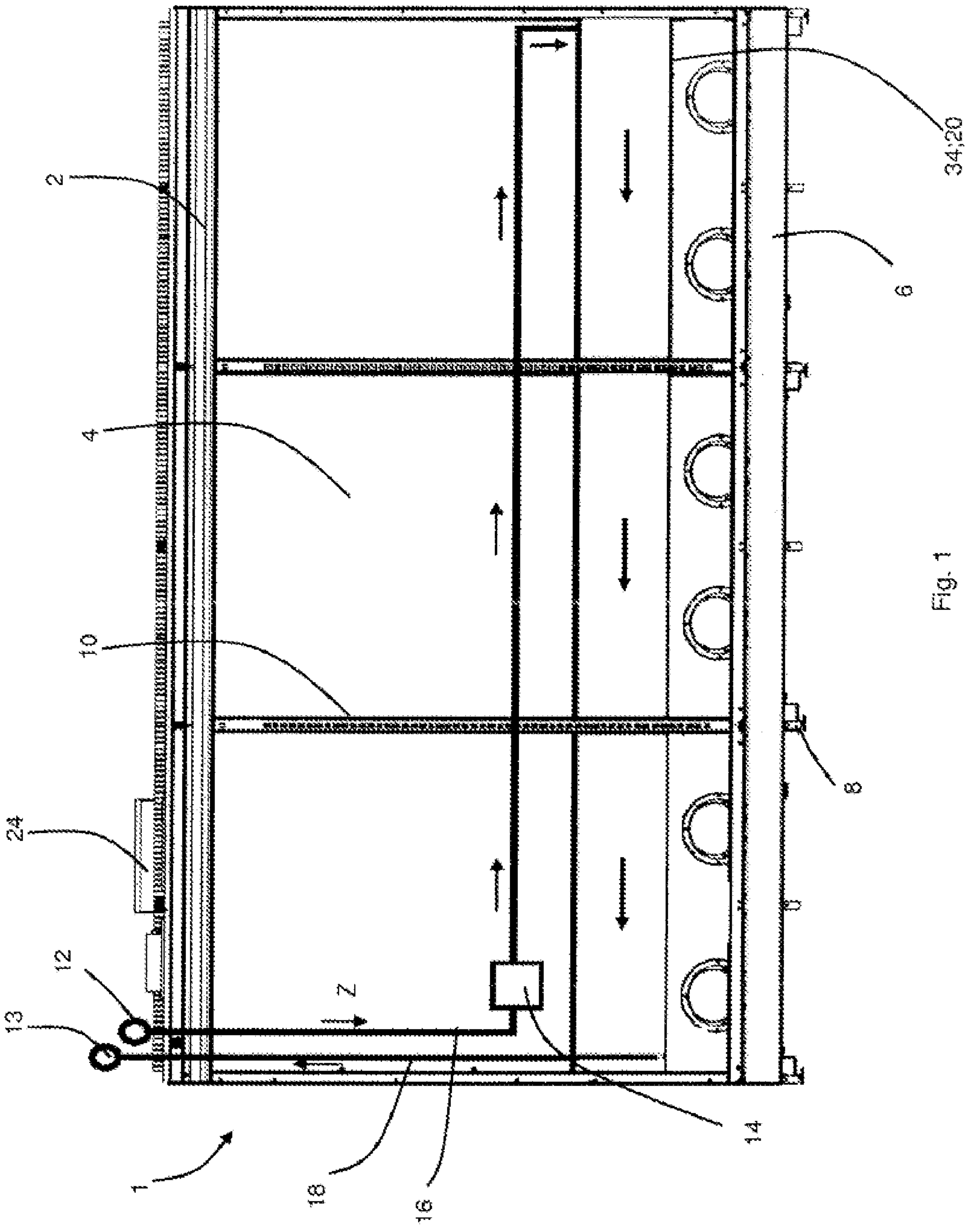

Fig. 1

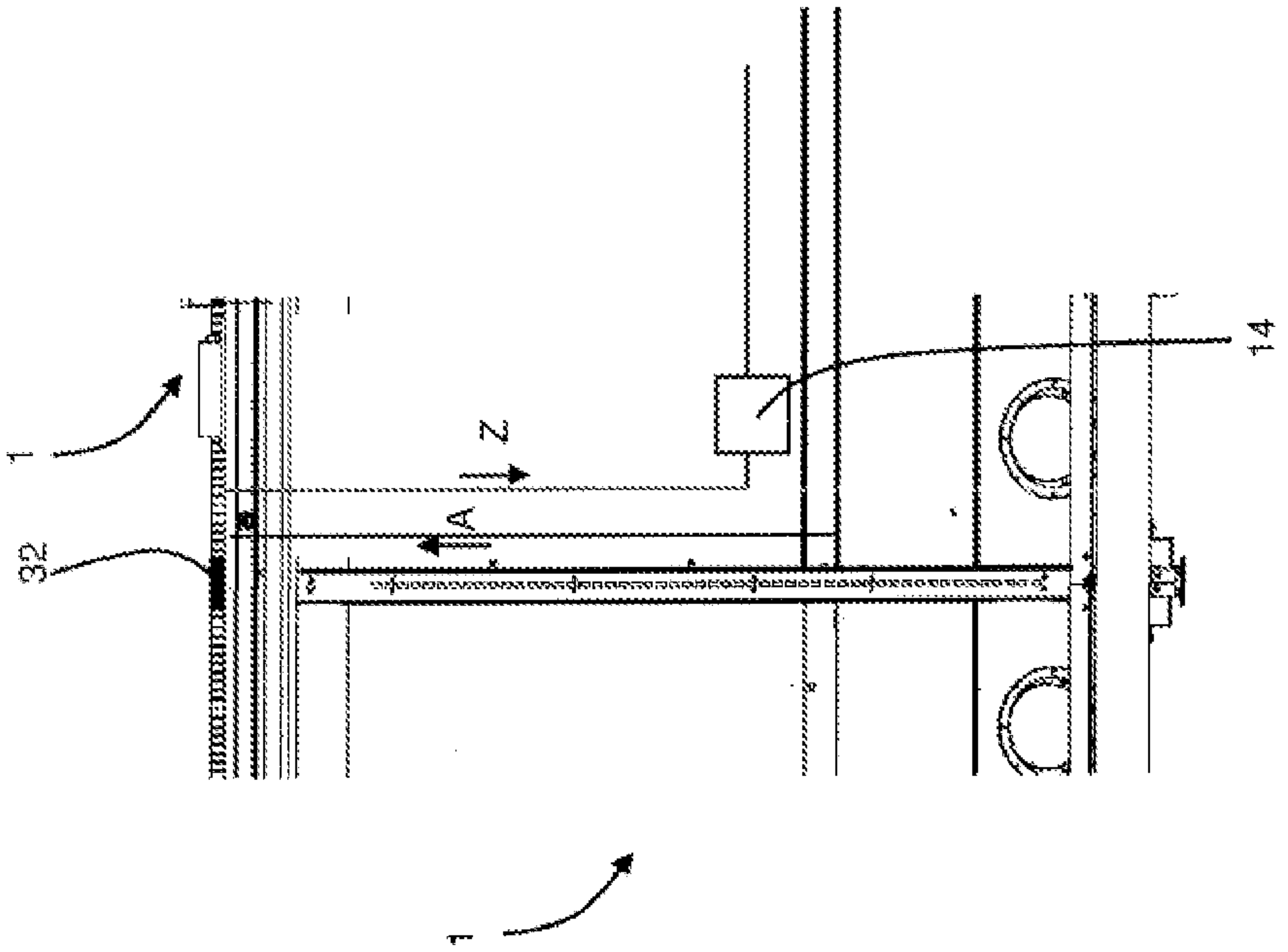

Fig. 2

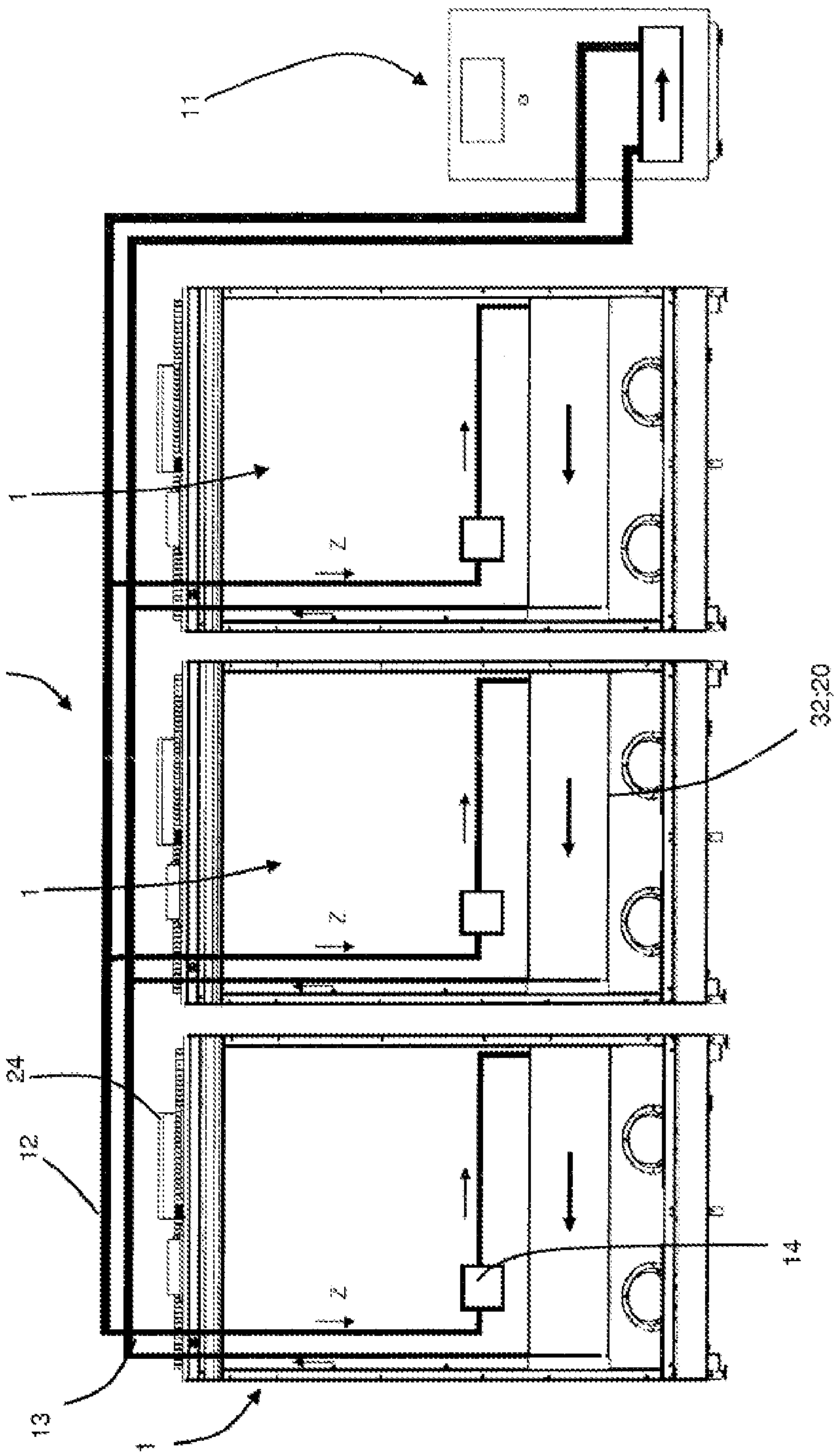

Fig. 3

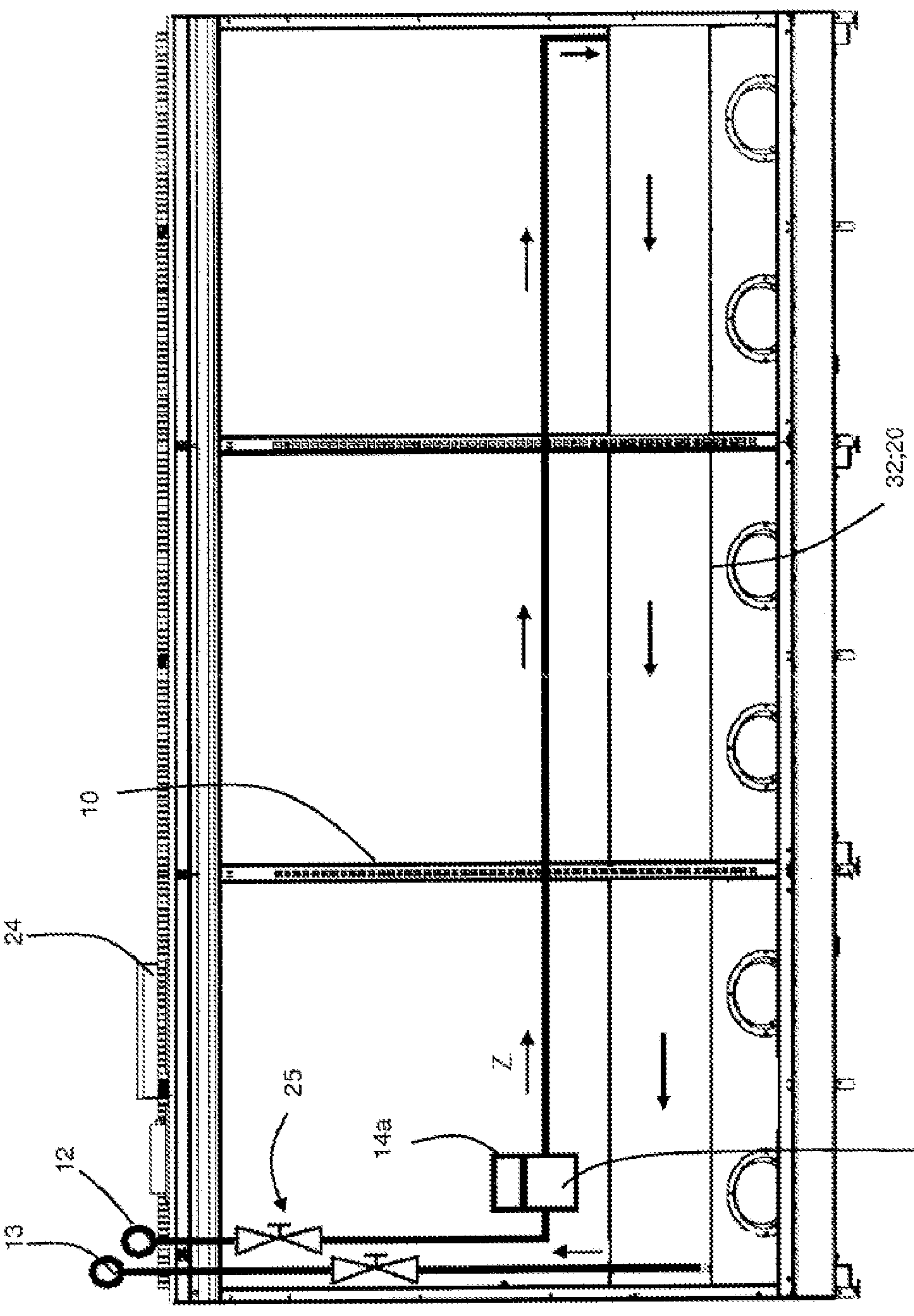

Fig. 4

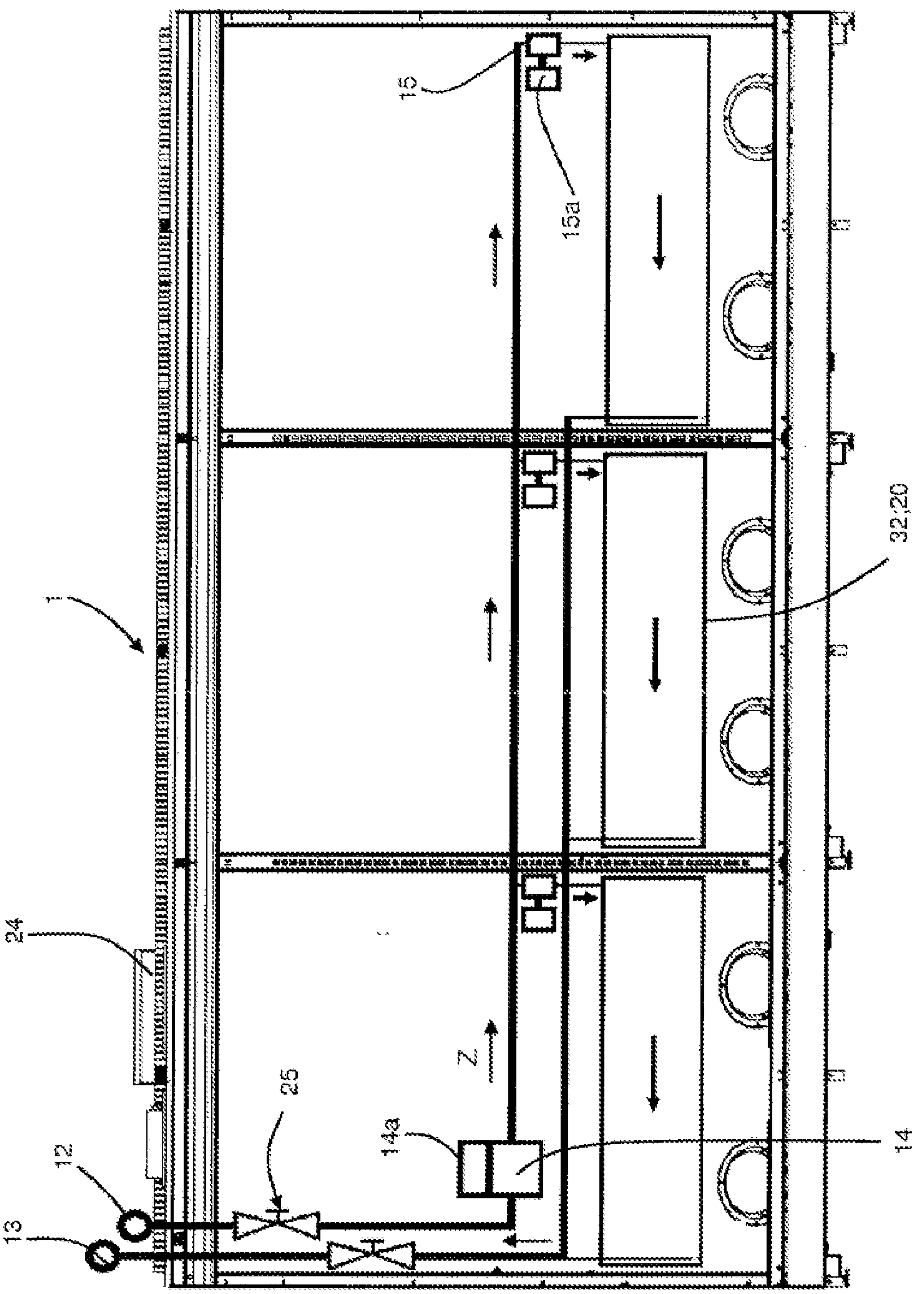

Fig. 5

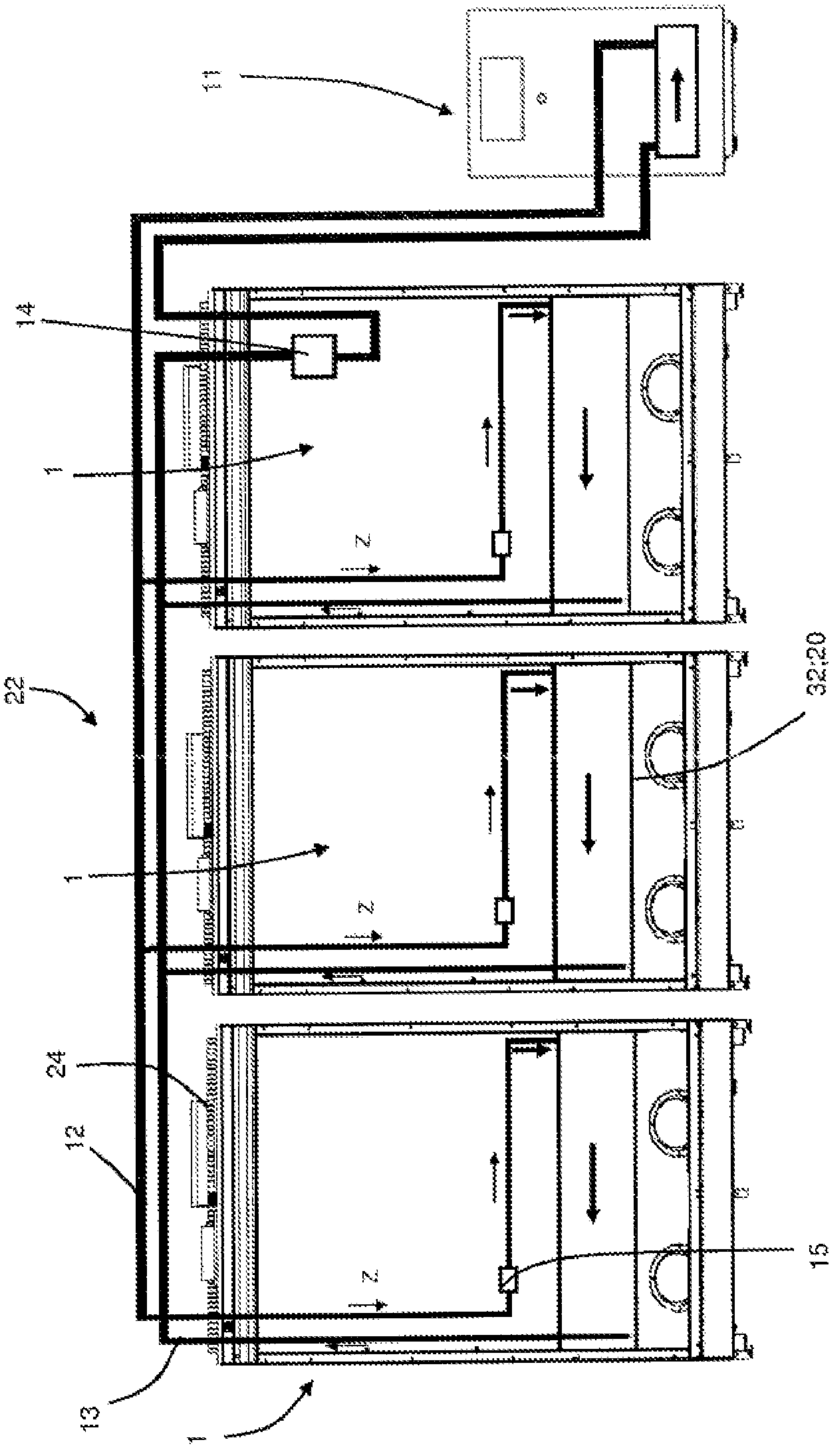

Fig. 6

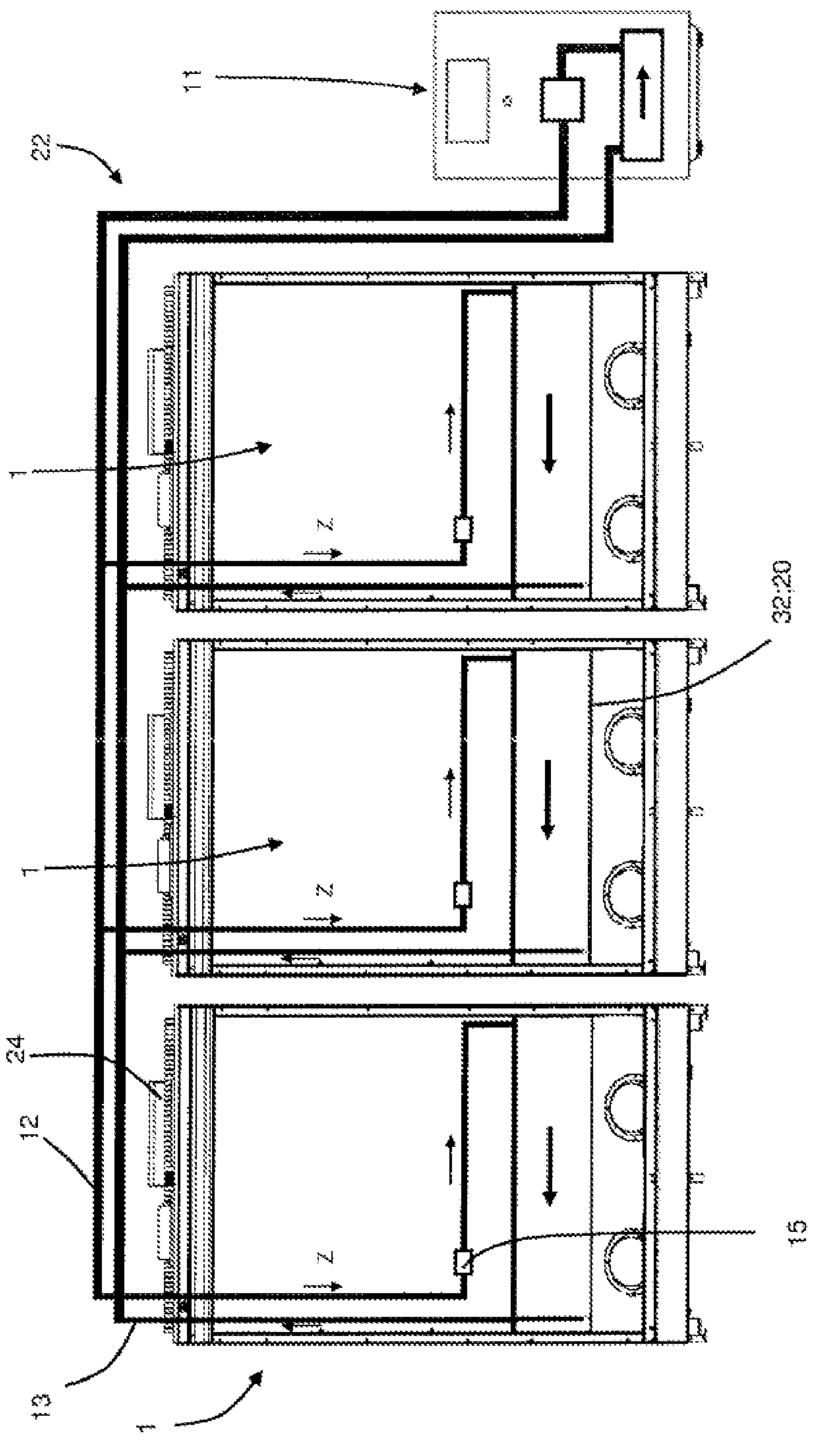

Fig. 7

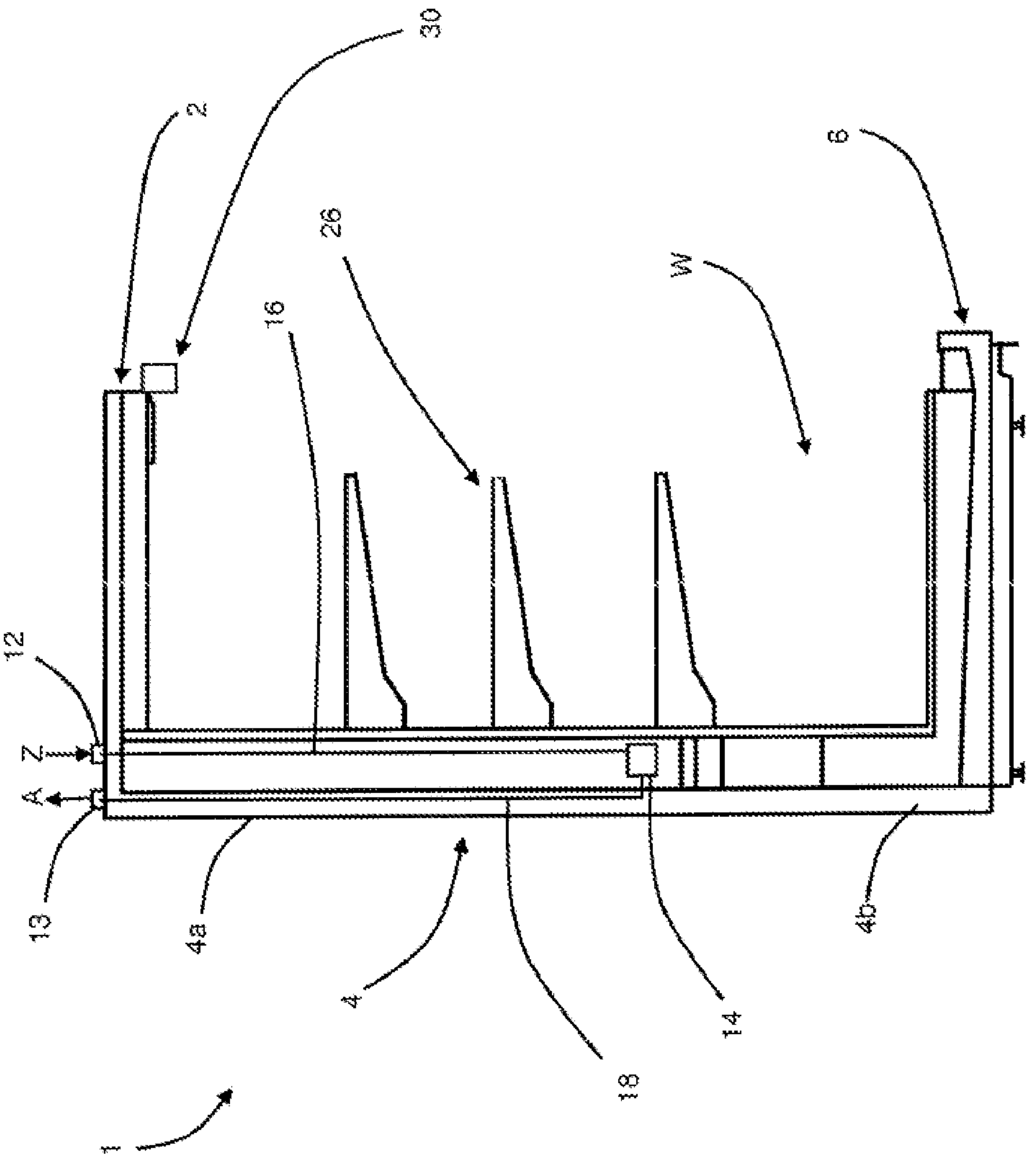

Fig. 8a

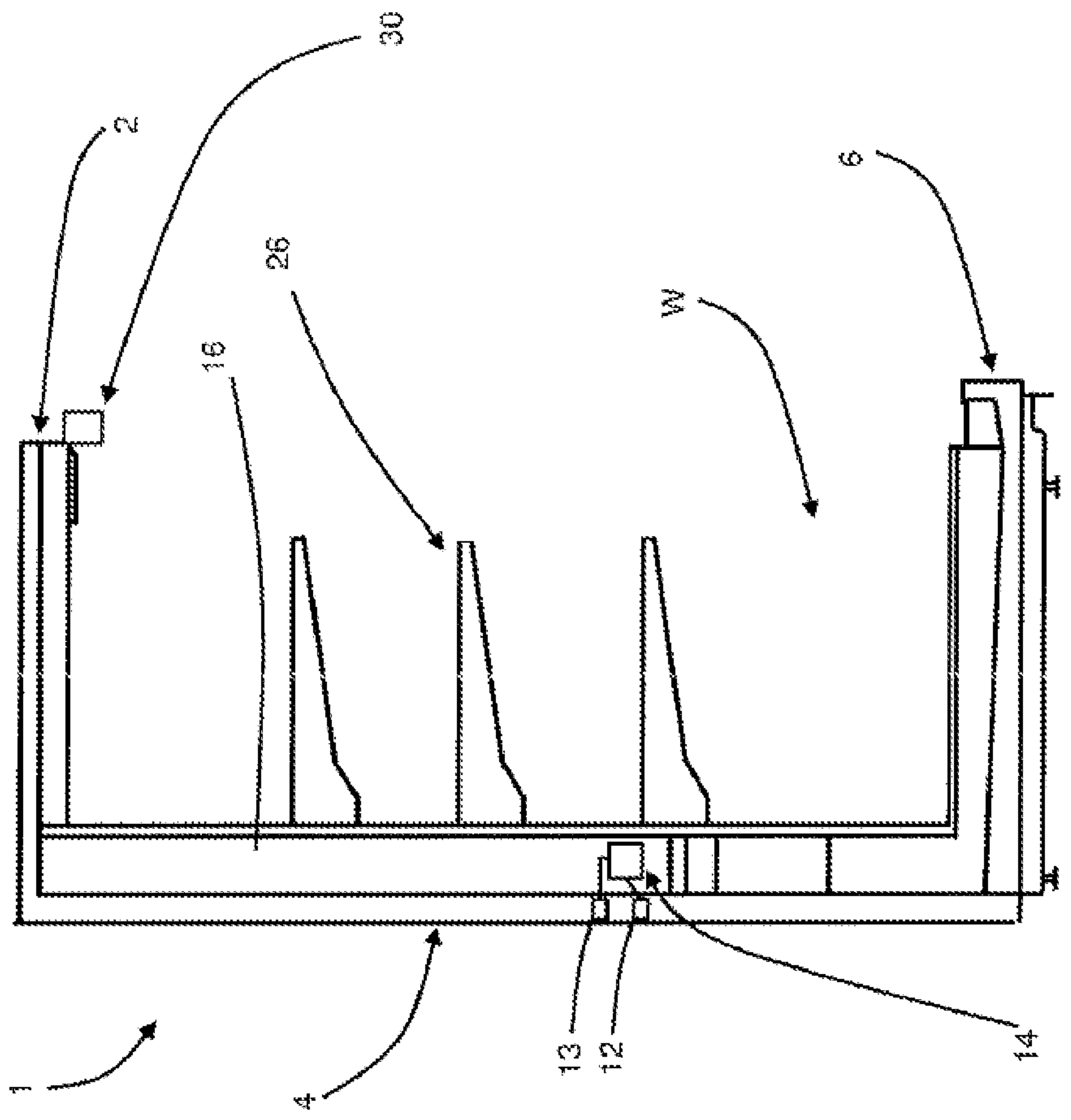

Fig. 8b

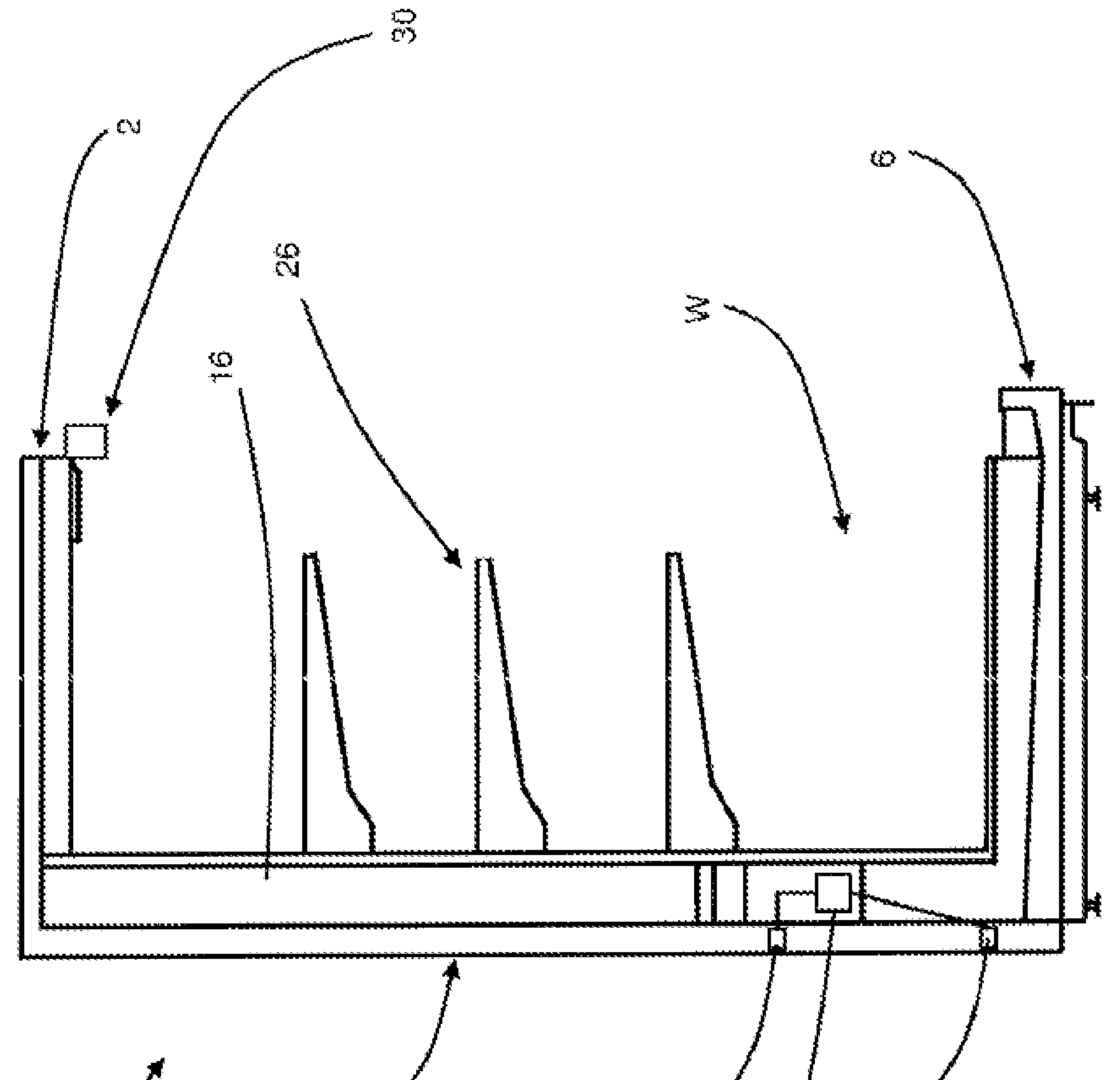

Fig. 8c

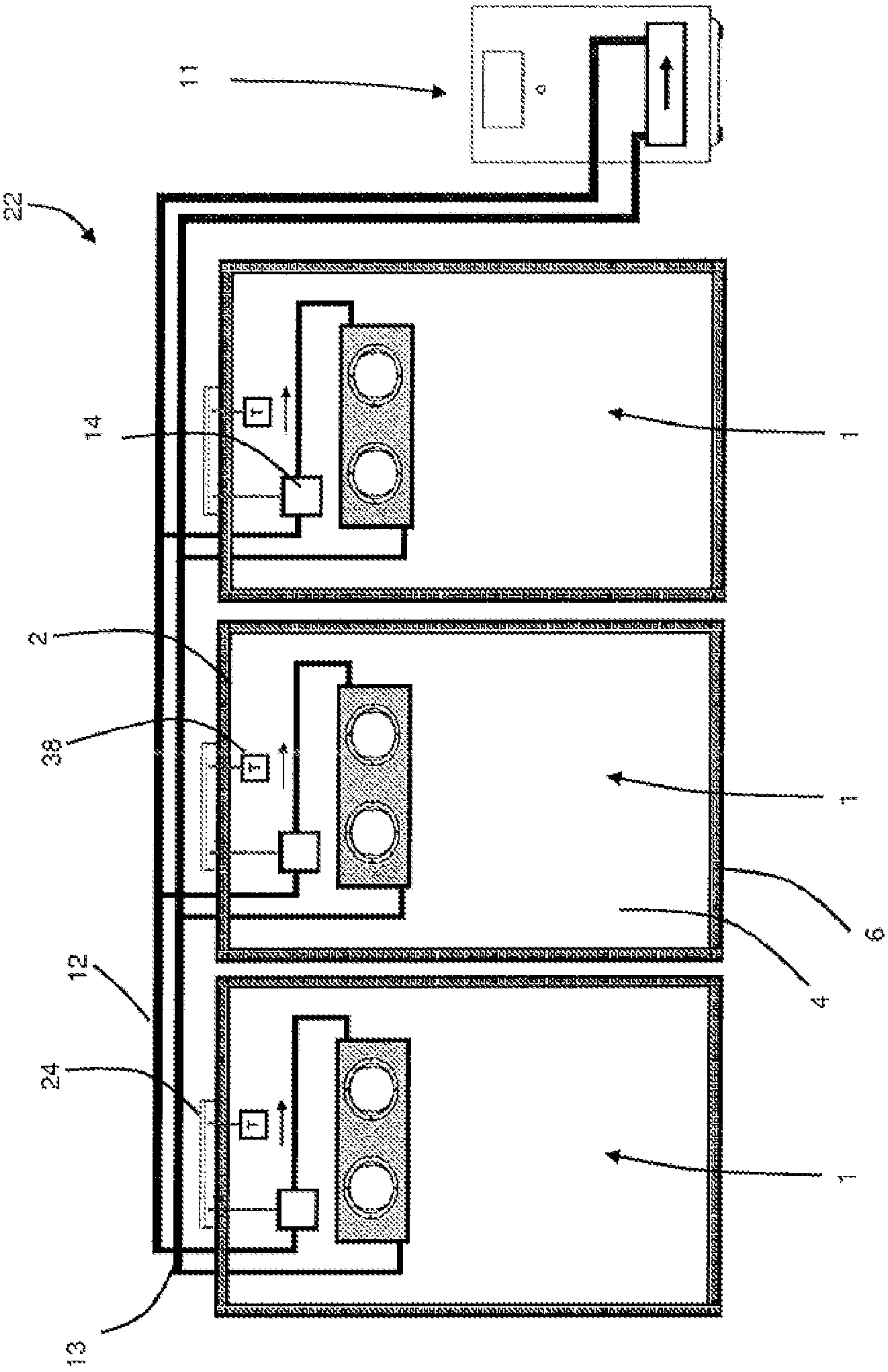

Fig. 9

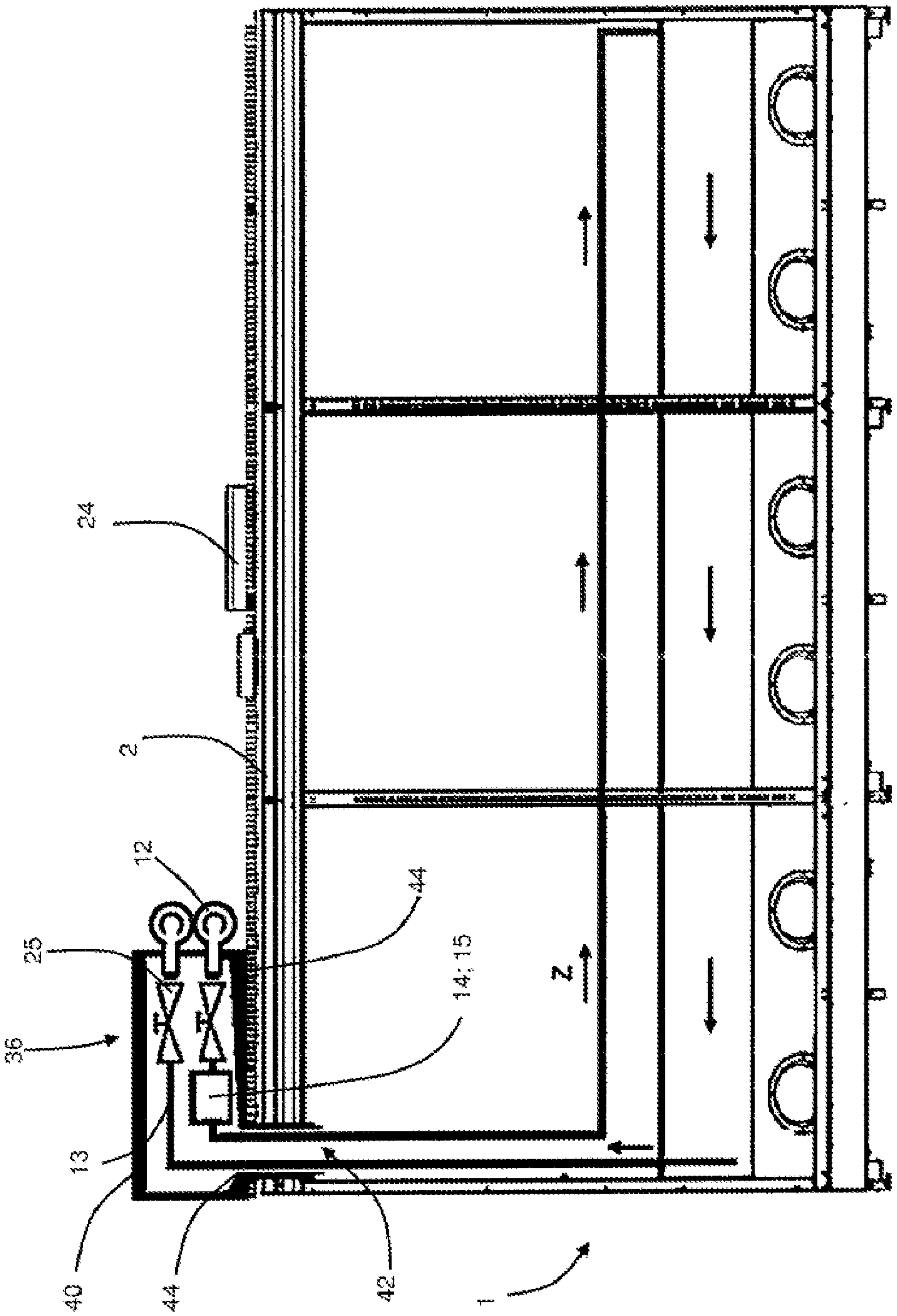

Fig. 10