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Description

A cooling device and a method for operating a cooling device are described, wherein the cooling device has a goods compartment which is delimited by side walls, a rear wall, and a ceiling element and a bottom element. The goods compartment of the cooling device is accessible via the side opposite the rear wall. Such cooling devices are used, for example as refrigerated shelves in supermarkets. Foods which have to be cooled are stored in the goods compartment. In general, foods which do not have to be deep frozen are stored in such refrigerated shelves. Cooling in the positive degree range is carried out for this purpose. For the cooling, a coolant is supplied to the cooling device via a coolant supply line, via which cooling heat is withdrawn from the goods compartment and thus the goods compartment is cooled.

Cooling devices are known from the prior art which, in addition to a cooling unit and a heat exchanger, comprise a fan. The cooled air is circulated within the cooling device via the fan. The fans are operated so that a continuous air flow results. If there is a higher cooling requirement, for example because new goods are introduced into a cooling device designed as a refrigerated shelf, the cooling power has to be increased. Furthermore, cooling devices from the prior art also comprise closing devices having roller blinds, so that the cooling devices can be closed at night, outside business operations. There is a lower cooling requirement in the case of a closed cooling device. To always ensure adequate cooling, the flow rate of coolant is changed during the operation of the cooling device. In the case of a higher cooling requirement, the cooling power is increased in that a greater quantity of coolant is conducted via the heat exchanger, so that a greater quantity of heat is also absorbed via the coolant and conducted away from the cooling device vehicle and discharge lines. The cooling device is coupled to a further device which provides the cooling of the coolant. For example, such a device can be designed as a heat pump.

A refrigerator/freezer having an interior to be cooled and a fan module for supplying or conducting air over an evaporation bowl is known from DE 10 2012 018 021 A1. The object is to provide optimum evaporation, wherein the fan is arranged in the immediate vicinity of the evaporation bowl for this purpose, so that optimum evaporation can be achieved. Furthermore, a controller can be provided, which controls the fan as a function of the ambient humidity.

DE 10 2012 018 021 A1 relates to smaller cooling devices such as refrigerators for private use. Such an arrangement may only be used with difficulty for refrigerated shelves in commercial operation such as supermarkets.

DE 102 35 783 A1 discloses a cooling device having a fan and a control method for it, wherein the speed of the fan is settable differently. The speeds of the fan are established as a function of the relative switching-on time of a compressor for the cooling device designed as an air conditioner.

DE 20 2008 000 757 U1 discloses a refrigerator having a fan for generating an air flow in a compartment of the refrigerator to be cooled, wherein the refrigerator comprises detection means for detecting at least one parameter and also a control or regulating unit, which is embodied in such a way that it changes the speed of the fan as a function of the at least one measured parameter.

US 4,800,729 A discloses a cooling system having a goods storage compartment, wherein a fan is provided for air circulation.

US 2005/0126196 A1 discloses a refrigerated shelf having multiple cooling units arranged adjacent to one another.

The prior art has the disadvantage, in particular in the case of refrigerated shelves having constantly operated fans, that

the core temperature of goods received in the goods compartment and to be refrigerated may only be adjusted inadequately via a change of the supply of a coolant. To achieve a desired cooling of the goods, the required average cooling performance of the heat exchanger increases significantly in conventional refrigerated shelves.

It is therefore the object to specify a cooling device with a heat exchanger and a fan, wherein it is possible to reach the core temperature of goods received in a goods compartment faster and/or to cool with a lower power.

The object is achieved by a cooling device having the technical features specified in claim 1 and by a method for operating a cooling device having the technical features specified in claim 4. Advantageous refinements are specified in detail in the dependent claims.

A cooling device which achieves the above-mentioned object comprises a goods compartment to be cooled with surrounding side walls, a rear wall, and a ceiling element and a bottom element, wherein the goods compartment is at least temporarily accessible via the side opposite the rear wall. The cooling device furthermore at least comprises a coolant supply line and a coolant discharge line, heat exchangers connected to the coolant discharge line, coolant conveying devices, and fans for circulating air cooled by the heat exchangers, wherein the flow rate of coolant through the coolant conveying devices and the amount of air circulated by the fans can be controlled by at least one control device, and the amount of air circulated via the fans can be controlled depending on the flow rate of coolant.

If there is an elevated cooling requirement, for example if new goods are introduced into the goods compartment of the cooling device, the flow rate of coolant through the conveying devices of the respective cooling area is increased and the cooling power by the heat exchanger is also increased. Moreover, the amount of air circulated via the fans is increased so that faster

and more efficient cooling of the goods can take place. Above all in the case of cooling devices for foods, it is important that the goods received in the cooling devices have a specific core temperature and this is reached quickly. In the cooling device described herein, in particular upon the increase of the coolant mass flow rate, the volume flow rate of the cooled air via the fans is also increased. In the cooling devices known from the prior art, the volume flow rate of cooled air remains constant even upon the increase of a coolant mass flow rate. This has the result in the prior art that the core temperature of the goods is only reached after a longer time and by an increased coolant mass flow rate. The cooling device described herein, in contrast, enables a desired core temperature of the goods to be reached with a reduced coolant mass flow rate or the time for reaching the desired core temperature to be shortened, wherein the energy consumption is reduced in relation to conventional cooling devices.

The cooling device moreover comprises at least two cooling areas, which are arranged side by side, wherein at least one coolant conveying device, one heat exchanger, and one fan are associated with each cooling area. Furthermore, a separate control device can be associated with each cooling area. Various cooling areas for various goods may be represented within a cooling device in this way. For each group of different goods, a targeted cooling via an adjustable mass flow rate of the coolant and an adjustable volume flow rate of the cooled air can be achieved in one of the cooling areas. In cooling devices, for example, dairy products are stored within a cooling device next to sausage or meat goods. For the various product types, core temperatures different from one another are necessary. Core temperatures adapted for the respective product type can be set energy efficiently and quickly via the design of the cooling device with multiple cooling areas. The targeted circulation of air moreover permits the cooling areas to be separated from one another. The arrangement of the components and the design of the ceiling element and the bottom element and the rear wall, on which the coolant conveying devices and heat exchangers and also the fans

are preferably arranged, is performed in such a way that an air flow from the ceiling element to the bottom element results. Cooling areas arranged side by side may thus be formed, which do not influence one another. The cooling device can comprise specially designed flow channels, air guiding elements, and also air outlet areas or nozzles and air inlet areas for this purpose.

The coolant conveying devices are speed-controlled pumps, wherein the fans can be speed-controlled fans. The pumps are preferably decentralized pumps arranged behind the cooling device and control the amount or the mass flow rate of the coolant supplied to the heat exchangers. The flow rate is adjusted via the control unit by a change of the speed of the pumps. If the speed of the coolant pumps is changed, the speed of the fans is thus changed in the same way via the control unit, so that an increased volume flow rate of cooled air is circulated. The central pumps can be designed and arranged similarly to the way described in the German patent application having the file number 10 2015 104 901.5.

The cooling device can furthermore comprise a closing device which is designed to close the side opposite the rear wall. In supermarkets, refrigerated shelves are generally designed to be open on one side, so that the goods can be removed from the shelves. When the supermarkets are closed and therefore the goods are no longer sold, the cooling devices are closed, for example via roller blinds. In a closed state, a lower cooling power is necessary, since no exchange of air within the goods compartment takes place with the ambient air in the supermarket. In addition, goods are no longer removed from the cooling devices and no new goods are transferred. In a so-called night mode, in general the flow rate of coolant is reduced. In the cooling devices described herein, the volume flow rate of the fans is then also reduced, whereby a lower power requirement results.

The above-mentioned object is also achieved by a method for operating a cooling device, wherein the cooling device comprises side walls surrounding a goods compartment to be cooled, a rear

wall, and a ceiling element and a bottom element, wherein the goods compartment is at least temporarily accessible via the side opposite the rear wall, wherein the cooling device comprises at least a coolant supply line and a coolant discharge line, heat exchangers connected to the coolant supply line and the coolant discharge line, coolant conveying devices, and fans for circulating air cooled by the heat exchangers. In the method, the flow rate of coolant through the coolant conveying devices and the amount of air circulated by the fans is controlled by at least one control device, wherein the flow rate of coolant through the coolant conveying devices is controlled according to a cooling requirement for the goods compartment and the amount of air circulated by the fans is controlled according to the flow rate of the coolant.

In the method, the mass flow rate of coolant is controlled according to the cooling requirement for the goods received in the goods compartment and the volume flow rate of the cooled air is controlled according to the mass flow rate. Due to the adaptation of the volume flow rate, a lower cooling power via the heat exchangers is required to reach a specific core temperature for the goods received in the goods compartment. Furthermore, the time until reaching the core temperature can be shortened via adaptation of the volume flow rate of cooled air. The cooling device can thus be operated energy efficiently, wherein the total power consumption of the components is less than in cooling devices from the prior art, in which a specific core temperature for the goods received in the goods compartment is only reached via an adaptation of the cooling power by the heat exchanger.

The cooling device comprises at least two cooling areas which are arranged side by side, wherein at least one control device, one coolant conveying device, one heat exchanger, and one fan are associated with each cooling area, and wherein the coolant conveying devices and the fans of adjacent areas within the cooling device are controlled independently of one another. The adjacent areas can thus be cooled differently, wherein a mass

flow rate of coolant different from the adjacent cooling area and a different volume flow rate of cooled air are supplied to each cooling area. In this way, different core temperatures can be provided for different goods groups within a cooling device.

The coolant conveying devices are speed-controlled pumps, wherein the fans can be speed-controlled fans. The flow rate of coolant is adjusted by changing the speed of the pumps, wherein the flow rate of cooled air can be adjusted by changing the speed of the fans. The mass flow rate of coolant and the volume flow rate of cooled air are controlled by the at least one control unit according to a core temperature to be reached for the goods associated with the respective cooling area and the values detected by measuring devices. The necessary cooling requirement and thus the necessary mass flow rate of coolant and the necessary volume flow rate of cooled air may be determined beforehand, for example, and stored for a specific occupancy of the cooling device with goods. Moreover, it is possible to draw inferences about the required cooling powers or the provided cooling via the temperature of the coolant and/or the cooled air in a feed and the temperature of the coolant and the cooled air in a return. The cooling device comprises a variety of measuring devices in all embodiments described herein, which are designed to detect at least the temperature in the coolant supply lines and coolant discharge lines. Moreover, the temperature of the circulated air can be detected before it has been cooled by the heat exchangers and after it has been cooled by the heat exchangers. The control unit then outputs a signal to change the mass flow rate of coolant to the coolant conveying device and the volume flow rate to the fans as a function of the detected temperatures.

The coolant conveying devices are speed-controlled pumps and the fans can be speed-controlled fans, wherein the flow rate of coolant is adjusted by changing the speed of the pumps and the flow rate of cooled air is adjusted by changing the speed of the fans. The control unit can output a signal to the fans of the pumps for this purpose, by which the speeds of the fans and the

pumps are changed.

The cooling device can furthermore comprise a closing device which is designed to close the side opposite the rear wall, wherein the flow rate of coolant and of cooled air is controlled according to an open or closed position of the closing device. In the above-mentioned night mode, the cooling power by the heat exchangers and thus the quantity of coolant supplied by the pumps is reduced and the speed of the fans is also reduced. The change of the speed of the pumps and the speed of the fans always takes place as a function of the core temperature to be achieved for the goods received in the goods compartment, wherein less or essentially no heat transfer takes place between the cooled air in the goods compartment and the air surrounding the cooling device, for example a sales area, in a night mode having, for example a closed roller blind.

The flow rate of cooled air can be increased in particular when the flow rate of coolant is increased. In addition, in the method, the flow rate of cooled air can also be controlled according to the mass flow rate of coolant in such a way that the volume flow rate of cooled air via the fans is also increased if no increase of the mass flow rate of coolant takes place. For example, in the event of a lower increase of the coolant temperature in the return in the coolant recirculation line, the required additional cooling power can be provided by an increased volume flow rate of cooled air. In a further embodiment, the volume flow rate of cooled air via the fans can only be increased in the respective cooling areas if the temperature in the return in a coolant supply line exceeds a definable threshold value. In this case, the difference between the normally required cooling power and the increased cooling power is provided solely via the additional flow rate of coolant. The volume flow rate of cooled air via the fans is only increased if the cooling requirement exceeds a determinable amount. For example, if the temperature of the coolant rises and exceeds a definable threshold value.

The cooling device of the variants described above and hereinafter can also comprise a central regulating/control unit, which controls the operation of the individual components and communicates with the components. The regulating/control unit can also control the communication of the individual components with one another. In addition to temperature detection devices, further measuring devices can be provided, for example devices for measuring the flow speed and the mass flow rate of the coolant.

The heat exchangers of a cooling device of the variants described herein can be, for example plate heat exchangers. A brine can be used as the coolant, wherein the brine can be a water-glycol mixture. In principle, all coolants provided for refrigerating systems can be used.

The cooling device comprises ventilation openings or ventilation slots on the bottom element and on the ceiling element in the region which is embodied to be open. Cooled air flows out of the ceiling element via ventilation openings and returns back into the cooling device via the ventilation openings in the bottom element. The cooling device comprises flow ducts in the bottom element, the ceiling element, and the rear wall for circulating the air. The air received in the ducts is circulated via the at least one fan so that the cooled air flows along the rear wall and the bottom element and the ceiling element and enters and exits again via the ventilation openings. Cooling of the walls of the cooling device and cooling of the goods compartment is provided via the air flow in this way.

Further advantages, features, and possible embodiments result from the following description of the figures of exemplary embodiments, which are to be understood as nonrestrictive.

In the figures:

Figure 1 shows a schematic illustration of a cooling device with three cooling areas;

Figure 2 shows a schematic sectional view through a cooling device; and

Figure 3 shows a further schematic sectional view through a cooling device having a closed roller blind.

Parts provided with identical reference signs in the drawings essentially correspond to one another if not otherwise indicated. Furthermore, components which are not essential to understanding the technical teaching disclosed herein are not described.

A cooling device 10 is described hereinafter with reference to Figures 1 to 3, which is designed for cooling various goods 92. The goods 92 can comprise, for example dairy products, meat or sausage goods, and/or fruit and vegetables.

The cooling device 10 comprises a goods compartment 12, which is surrounded by two side walls 14, a rear wall 16, and a ceiling element 18 and a bottom element 20. The side walls 14, the rear wall 16, the ceiling element 18, and the bottom element 20 are designed similarly to the cooling devices known from the prior art. Therefore, these parts are formed at least on their side facing toward the goods compartment 12 so that the goods compartment 12 can be cooled, wherein no or only a minor heat transfer takes place from outside the cooling device 10 via the rear wall 16, the ceiling element 18, the bottom element 20, and the side walls 14. The cooling device 10 comprises three cooling areas 30, 50, and 70. These cooling areas 30, 50, and 70 are schematically shown by the dashed line. The cooling device 10 is designed so that the individual cooling areas 30, 50, and 70 do not have to be separated by intermediate walls. It is possible via the design of the cooling device 10 to operate the individual cooling areas 30, 50, and 70 independently of one another and at different temperatures.

The first cooling device 30 comprises at least one pump 34, a cooling unit 36, and a control device 42. In addition, measuring

devices 32 and 44 are provided. The temperature and the flow rate of coolant can be detected by the measuring devices 32 and 44. The cooling unit 36 comprises at least one fan 40 and a plate heat exchanger 38. A coolant is supplied by the pump 34 to the heat exchanger 38 via a central coolant supply line 22 to cool the cooling area 30. Heat of the goods compartment 12 in the cooling area 30 is absorbed by the heat exchanger 38 and the heated coolant is supplied by a coolant discharge line to a central coolant discharge line 24. The speed of the pump 34 is controlled by the control device 42. Furthermore, the speed of the fan 40 is controlled by the control device 42. For this purpose, the speed of the fan 40 is controlled as a function of the speed of the pump 34. The measuring devices 32 and 44 can also be connected to the control device 42. Data such as the temperature of the coolant in the feed and in the return and the flow rate of the coolant are also transmitted to the control device 42. The control device 42 is designed in this case for controlling the temperature in the cooling area 30. Notwithstanding the illustration in Figure 1, a central control unit can also be provided, which is coupled to the respective control devices 42, 62, and 82.

The coolant is supplied by the coolant supply line 22 at a specific feed temperature. The pump 34 controls the flow rate of the coolant as a function of a cooling requirement. If the speed of the pump 34 is increased to increase the mass flow rate of coolant, the speed of the fan 40 is also increased via the control device 42. A greater volume flow of cooled air thus results in the goods compartment 12 and in particular in the cooling area 30. The return temperature of the coolant is detected via the measuring device 44. If the return temperature rises above a specific amount or exceeds a threshold value, the control device 42 causes the increase of the speed of the pump 34 and the increase of the speed of the fan 40. In comparison to the cooling devices known from the prior art, in which the speed of the fan is not increased, the speed of the pump 34 can be increased less strongly in the cooling device 10 described herein. If the speed of the pump 34 is increased by the same

amount, as takes place in the prior art, for example, the increase of the speed of the fan 40 causes strong circulation of the cooled air, however, so that faster cooling of goods 92 is achieved.

The plates of the heat exchanger 38 can include, for example, areas of the rear wall 16 or can bear on areas of the rear wall 16. Moreover, the fan 40 is arranged so that the air conveyed via the fan 40 is cooled by the heat exchanger 38.

The second cooling area 50 comprises, similarly to the first cooling area 30, at least one pump 54, a cooling unit 56 with a heat exchanger 58 and a fan 60, and a control device 62 and measuring devices 52, 54, and 66. The third cooling area 70 comprises, similarly to the first cooling area 30 and the second cooling area 50, at least one pump 74, a cooling unit 76 with a heat exchanger 78 and a fan 80, and a control device 82. Moreover, the third cooling area 70 comprises measuring devices 72, 84, and 86. The pumps 34, 54, and 74 are connected to the central and shared coolant supply line 22. Moreover, the return lines of the respective cooling areas 30, 50, and 70 are connected to a central and shared coolant discharge line 24. The coolant supply line 22 and the coolant discharge line 24 are connected to a cooling device, for example a heat pump. The coolant is brought to a specific feed temperature by the heat pump.

The design of the individual cooling areas 30, 50, and 70 ensures that independently of the other cooling areas 30, 50, and 70, a specific cooling can be achieved for the respective cooling area 30, 50, or 70. For this purpose, the pumps 34, 54, and 74 can both be controlled in their speed independently of one another by the control device 42, 62, and 82 and also the speed of the fans 40, 60, and 80 can be controlled. In the exemplary embodiment shown in Figure 1, for example, a core temperature for goods 92 received in the cooling area 30 of 2°C can be achieved, wherein a core temperature for goods 92 of 4°C can be set in the second cooling area 50 and a core temperature for goods 92 of 3°C can be set in the third cooling area 70. The

increase of the speed of the fans 40, 60, and 80 upon an increase of the speed of the pumps 34, 54, and 74 assists the cooling of the goods 92 received in the goods compartment 12, so that the core temperature of the goods 92 is reached faster. Per unit of time, a greater air flow then flows over the goods 92, wherein a greater amount of heat is dissipated from the goods 92 and the goods 92 are cooled. In contrast, at lower volume flow rates of cooled air, the air is heated more strongly until it reaches the lower area of the goods compartment 12. The heat absorption capacity is therefore lower. In addition, the amount of cooled air is also lower, so that the time for reaching the desired core temperature is greater than in the case of an increased volume flow rate of cooled air via an increase of the speed of the fans 40, 60, and 80.

Figure 2 shows a schematic sectional view through a cooling device 10. The cooling device 10 is shown looking toward the third cooling area 70 in Figure 2. The cooling device 10 comprises two fittings 88 and 90 on the ceiling element 18. The fitting 88 is connected to the coolant supply line 22 and the fitting 90 is connected to the coolant discharge line 24. The arrows show the flow direction of the coolant. The schematically shown pump 74 and the schematically shown cooling unit 76 are arranged on the rear wall 16 or inside a rear wall arrangement. The control device 82 is arranged on the outside of the rear wall 16. However, it is to be noted that the illustration shown in Figure 2 is schematic and only shows one possible embodiment among a variety of variants. Thus, for example the control device 82 can also be arranged inside the cooling device 10 in various positions. The control lines between the control device 82 and the pump 74 and also the cooling unit 76 are shown by the dashed lines. The feed line and the return line for the coolant are also schematically indicated. The measuring devices 72, 84, and 86 are not shown in Figure 2. The cooling unit 76 can also be arranged differently than illustrated in Figure 2. Only the arrangement of the pump 74 in front of the cooling unit 76 in the coolant through-flow direction is required for the cooling device 10 so that the supply of coolant to the heat exchanger

78 can be controlled or regulated by the pump 74 according to a cooling requirement. Areas of the rear wall arrangement which face toward the goods compartment 12 can be coupled to the heat exchanger 78 or can be part of the heat exchanger 78. The fan 80 is arranged so that air is guided over the heat exchanger 78 and cooled. The flow direction of the air is partially schematically shown by the arrow 96. For this purpose, the cooling device 10 comprises cooling ducts extending inside the cooling device 10. Furthermore, the cooling device 10 comprises an outlet opening or an outlet area for cooled air on the ceiling element 18. The cooled air flows downward as shown by the arrow 96 via this upper outlet area and is drawn in via an air inlet opening on the bottom element 20 by the fan 80. The fan 80 guides the heated air over the heat exchanger 78 and back to the ceiling element 18, wherein the cooled air flows along the rear wall and therefore also cools the rear wall arrangement. Circulation of air takes place through the cooling compartment 12 in the direction indicated via the arrow 96. If an increased cooling requirement for the goods 92 received in the goods compartment 12 is established, the speed of the pump 72 is thus increased so that a greater mass flow rate of coolant is supplied to the heat exchanger 78. Moreover, the speed of the fan 80 is increased by the control device 82, whereby a greater volume flow rate of cooled air results. The cooled air does not heat up as strongly in the case of a stronger volume flow rate, so that heat can also still be absorbed in a lower area of the goods compartment 12.

In addition to a circulation of the air via the goods compartment 12 and the bottom element 20, the rear wall arrangement, and the ceiling element 18, the rear wall arrangement can comprise opening slots on the side facing toward the goods compartment 12, so that cooled air can also flow into the goods compartment 12 via these slots. The ceiling element 18, the bottom element 20, and the side walls can also comprise openings via which air can flow in and out.

The cooling device 10 furthermore comprises a closing device 94.

The closing device 94 is used to close the goods compartment 12 so that no or only a minor heat exchange takes place between the air in the goods compartment 12 and also the goods 92 and the goods compartment 12 and the environment surrounding the cooling device 10.

Figure 3 shows a schematic section through the cooling device 10 with a closed goods compartment 12. For this purpose, a roller blind 98 is rolled down, which closes the goods compartment 12. The roller blind 98 can be designed to be insulating in order to reduce or prevent a heat exchange between the goods compartment 12 and the environment of the cooling device 10. Since less introduction of heat takes place into the goods compartment 12 by the environment of the cooling device 10, there is also a reduced cooling requirement. Accordingly, the speed of the pump 74 is reduced and also the speed of the fan 78. The speed of the fan 80 is always adapted to the flow rate of the pump 74. At a high flow rate of the pump 74 and of the pumps 34 and 54, the fans 40, 60, and 80 are controlled accordingly. An increase of the volume flow rate via the fans 40, 60, and 80 causes faster cooling of the goods compartment 12 and above all the goods 92 received in the goods compartment 12. If a greater volume flow rate of cooled air is guided through the goods compartment 12 by the fans 40, 60, 80, a lesser reduction of the feed temperature of the coolant is thus necessary in order to achieve a higher cooling power, for example upon the introduction of new goods 92. In conventional cooling devices from the prior art, the feed temperature always has to be strongly reduced when new goods 92 are introduced. The cooling devices 10 and methods for operating the cooling devices 10 described herein, in contrast, also enable cooling of goods 92 newly introduced into the goods compartment 10 with a lesser reduction of the feed temperature of the coolant. Additionally thereto or alternatively thereto, in the event of a reduction of the feed temperature of the coolant, the reduction of the core temperature of the goods 92 can also be carried out faster than in cooling devices from the prior art. Therefore, the reduction of the feed temperature of the coolant has to be

carried out over a shorter time span than in cooling devices from the prior art. This is cost-effective in particular for the operation of the cooling device 10. In addition, the components, for example the pumps 24, 54, and 74, can have a lower flow rate if a greater volume flow rate of cooled air is guided through the goods compartment 12 by the fans 40, 60, and 80.

List of reference signs

10 cooling device
12 goods compartment
14 side wall
16 rear wall
18 ceiling element
20 bottom element
22 coolant supply line
24 coolant discharge line
30 cooling area
32 measuring device
34 pump
36 cooling unit
38 heat exchanger
40 fan
42 control device
44 measuring device
50 cooling area
52 measuring device
54 pump
56 cooling unit
58 heat exchanger
60 fan
62 control device
64 measuring device
66 measuring device
70 cooling area
72 measuring device
74 pump
76 cooling unit
78 heat exchanger
80 fan
82 control device
84 measuring device
86 measuring device
88 fitting
90 fitting

92 product
94 closing device
96 arrow
98 roller blind
100 arrow

Patentkrav

1. Køleanordning med sidevægge (14), der omgiver et varerum (12), der skal køles, en bagvæg (16) samt et topelement (18) og et bundelement (20), idet varerummet (12) i det mindste temporært er tilgængeligt via den side, der ligger over for bagvæggen (16), med i det mindste en kølemiddeltilførselsledning (22) og en kølemiddeludledningsledning (24), med kølemiddeltilførselsledningen (22) og med kølemiddeludledningsledningen (24) forbundne varmevekslere (38; 58; 78), kølemiddeltransportenheder og ventilatorer (40; 60; 80) til cirkulation af via varmevekslerne (38; 58; 78) afkølet luft, idet
- køleanordningen (10) har i det mindste to køleområder (30; 50; 70), som er placeret ved siden af hinanden, idet der til hvert køleområde (30; 50; 70) er allokeret i det mindste en kølemiddeltransportanordning, en varmeveksler (38; 58; 78) og en ventilator (40; 60; 80),
kendetegnet ved, at
- transportmængden af kølemiddel kan reguleres via kølemiddeltransportanordningerne, og mængden af den via ventilatorerne (40; 60; 80) cirkulerede luft kan reguleres via i det mindste en reguleringsenhed (42; 62; 82),
- mængden af den via ventilatorerne (40; 60; 80) cirkulerede luft kan reguleres i henhold til transportmængden af kølemiddel, og
- kølemiddeltransportanordningerne er omdrejningstalsstyrede pumper (34; 54; 74).

2. Køleanordning ifølge krav 1, idet ventilatorerne (40; 60; 80) er omdrejningstalsstyrede ventilatorer.

3. Køleanordning ifølge krav 1 eller 2 med en lukkeanordning (94), som er udformet til at lukke den side, der ligger over for bagvæggen (16).

4. Fremgangsmåde til drift af en køleanordning, som har sidevægge (14), som omgiver et varerum (12), der skal afkøles,

en bagvæg (16) samt et topelement (18) og et bundelement (20), idet varerummet (12) i det mindste temporært er tilgængeligt via den side, der ligger over for bagvæggen (16), idet køleanordningen (10) har i det mindste en kølemiddeltilførselsledning (22) og en kølemiddeludledningsledning (24), og med kølemiddeltilførselsledningen (22) og med kølemiddeludledningsledningen (24) forbundne varmevekslere (38; 58; 78), kølemiddeltransportanordninger og ventilatorer (40; 60; 80) til cirkulation af via varmevekslerne (38; 58; 78) afkølet luft, og idet

- køleanordningen (10) har i det mindste to køleområder (30; 50; 70), som er placeret ved siden af hinanden, idet der til hvert køleområde (30; 50; 70) er allokeret i det mindste en reguleringsenhed (42; 62; 82), en kølemiddeltransportanordning, en varmeveksler (38; 58; 78) og en ventilator (40; 60; 80), og idet kølemiddeltransportanordningerne og ventilatorerne (40; 60; 80) uafhængigt af hinanden styres af tilstødende områder (30; 50; 70) inde i køleanordningen (10),

kendetegnet ved, at

- transportmængden af kølemiddel kan reguleres via kølemiddeltransportenhederne, og mængden af den via ventilatorerne cirkulerede luft kan reguleres via reguleringsenhederne (42; 62; 82)
- transportmængden af kølemiddel reguleres via kølemiddeltransportanordningerne i henhold til et kølebehov i varerummet (12),
- mængden af den via ventilatorerne (40; 60; 80) cirkulerede luft reguleres i henhold til transportmængden af kølemidlet,

og

- kølemiddeltransportanordningerne er omdrejningstalsstyrede pumper (34; 54; 74), og transportmængden af kølemiddel indstilles ved hjælp af en ændring i omdrejningstallet for pumperne (34; 54; 74).

5. Fremgangsmåde ifølge krav 4, idet ventilatorerne (40; 60; 80) er omdrejningstalsregulerede ventilatorer, og transportmængden af afkølet luft indstilles ved hjælp af en

ændring af omdrejningstallet for ventilatorerne (40; 60; 80).

6. Fremgangsmåde ifølge krav 4 eller 5, idet køleanordningen (10) har en lukkeanordning (94), som er udformet til at lukke den side, der ligger over for bagvæggen (16), og idet transportmængden af kølemiddel og af afkølet luft styres i henhold til en åbne- eller lukkestilling på lukkeanordningen (94).

7. Fremgangsmåde ifølge et af kravene 4 til 6 idet transportmængden af afkølet luft øges, hvis transportmængden af kølemiddel øges.

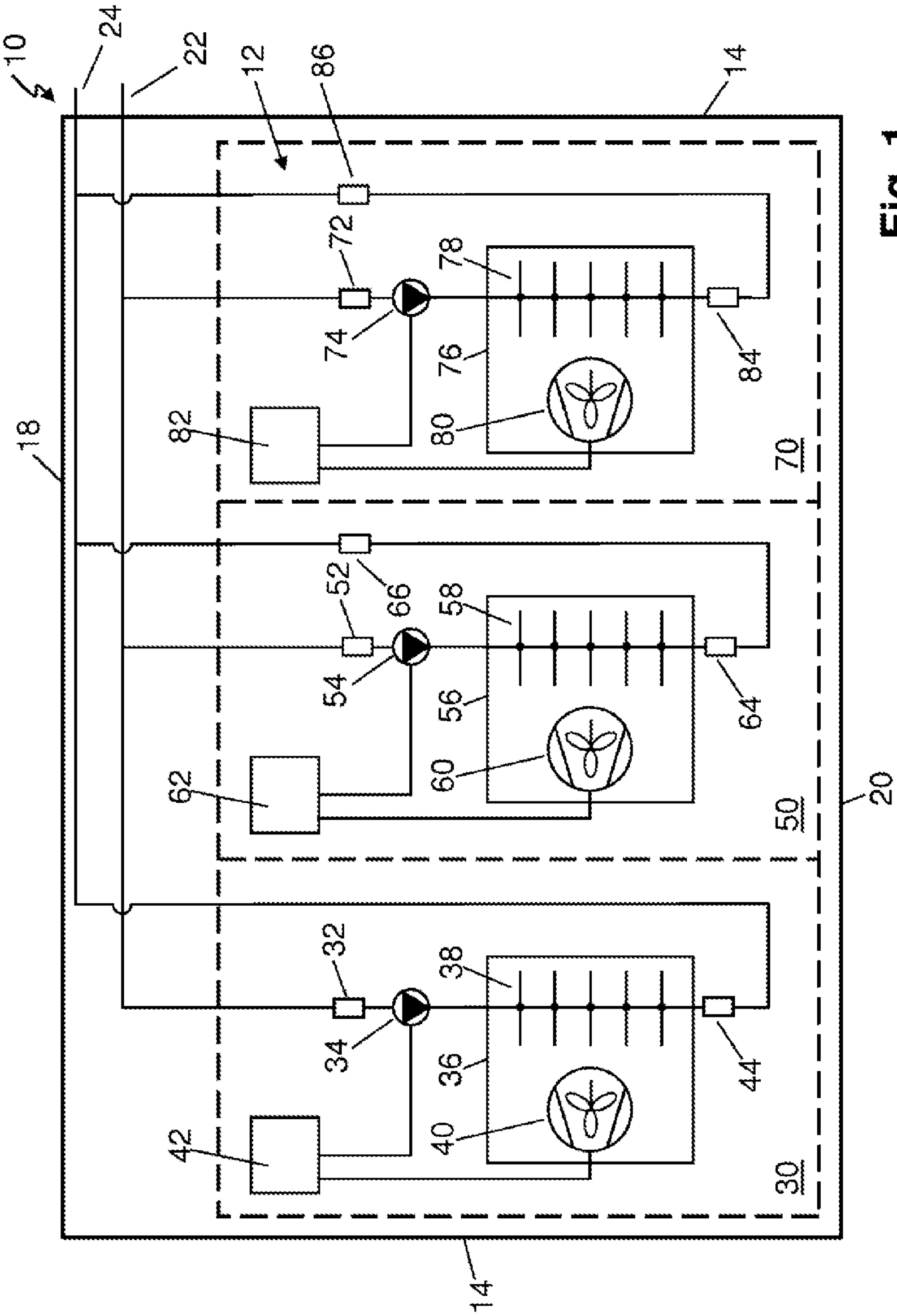

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Fig. 1

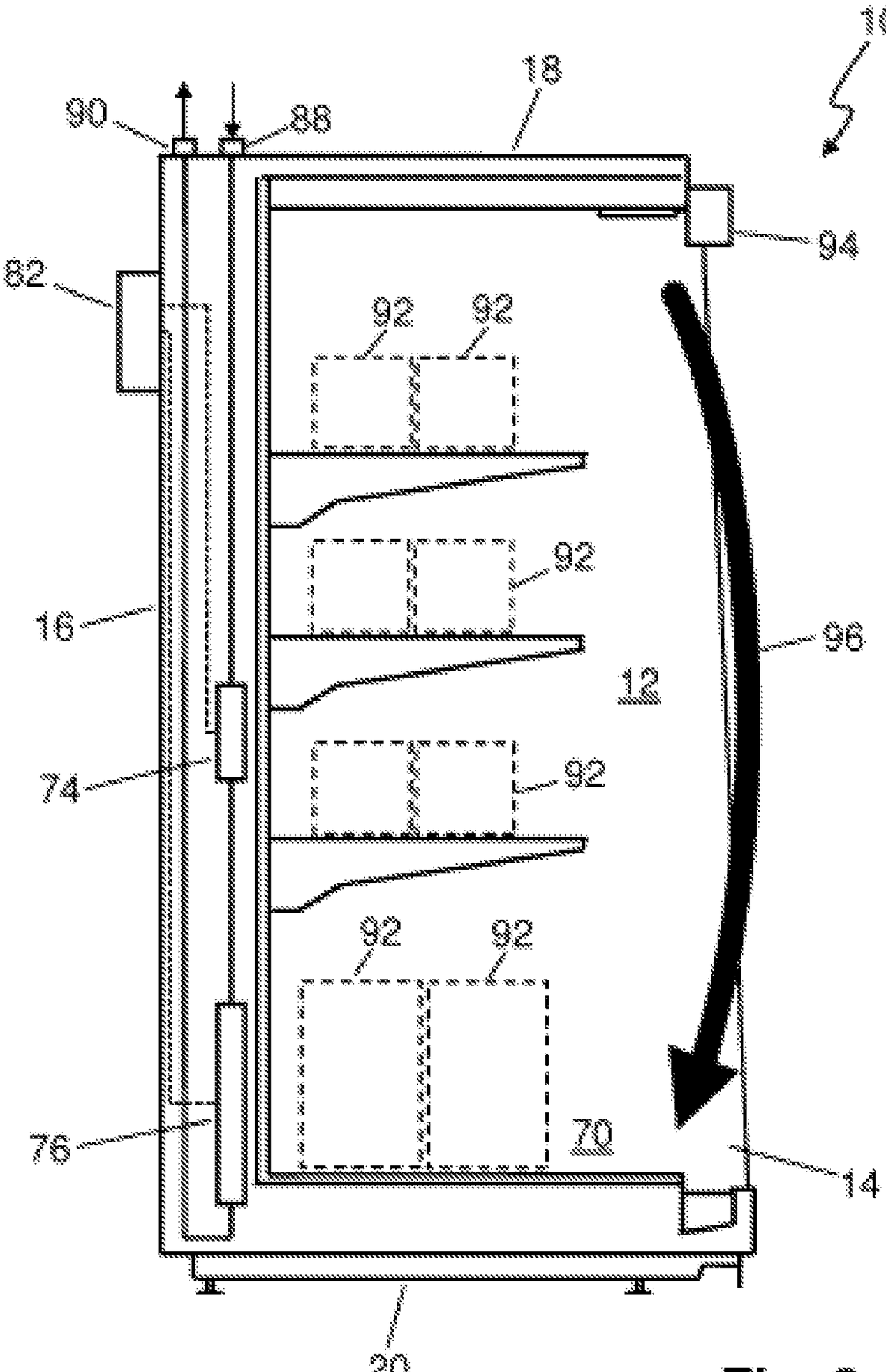


Fig. 2

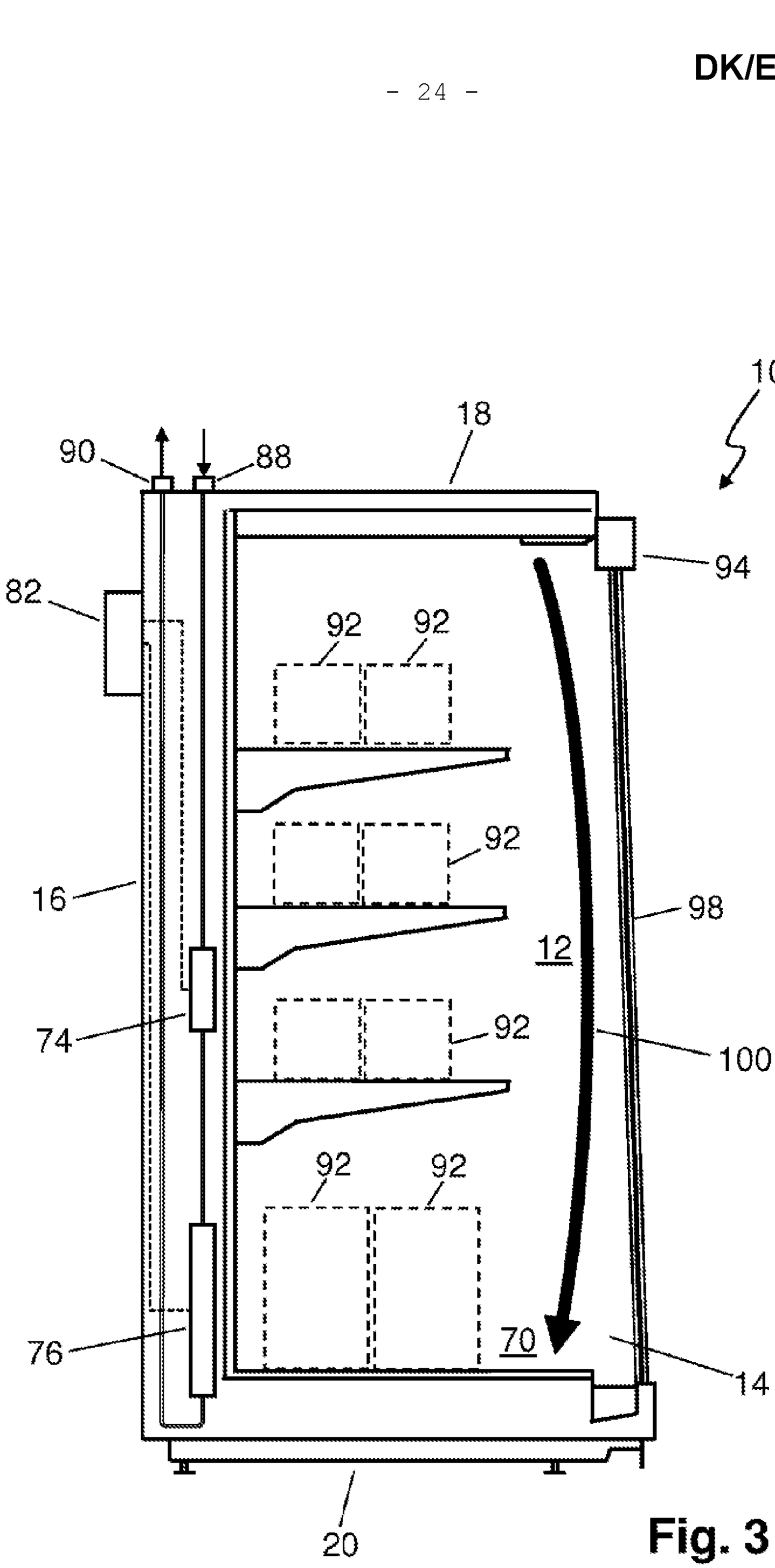


Fig. 3