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(71) Ansøger: **LINCO Food Systems A/S, Vestermøllevej 9, 8380 Trige, Danmark**

(72) Opfinder: **Uffe Thrane, Fasanvej 8, 8450 Hammel, Danmark**

(74) Fuldmægtig: **Awapatent A/S, Rigensgade 11, 1316 København K, Danmark**

(54) Benævnelse: **A method of ventilating unloadable broiler transport units on a broiler transport trailer, and a broiler transport trailer**

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(57) Sammendrag:
A broiler transport trailer whith broiler transport units has a ventilation system with ventilation devices. The ventilation system supplies a plurality of ventilation column sections with forced ventilation. The individual ventilation column section extends into the inner volume or inner volumes of the broiler transport unit, and guides the forced ventilation through ventilation openings positioned at the ventilation column section inside the inner volume of the broiler transport unit.

Fortsættes ...

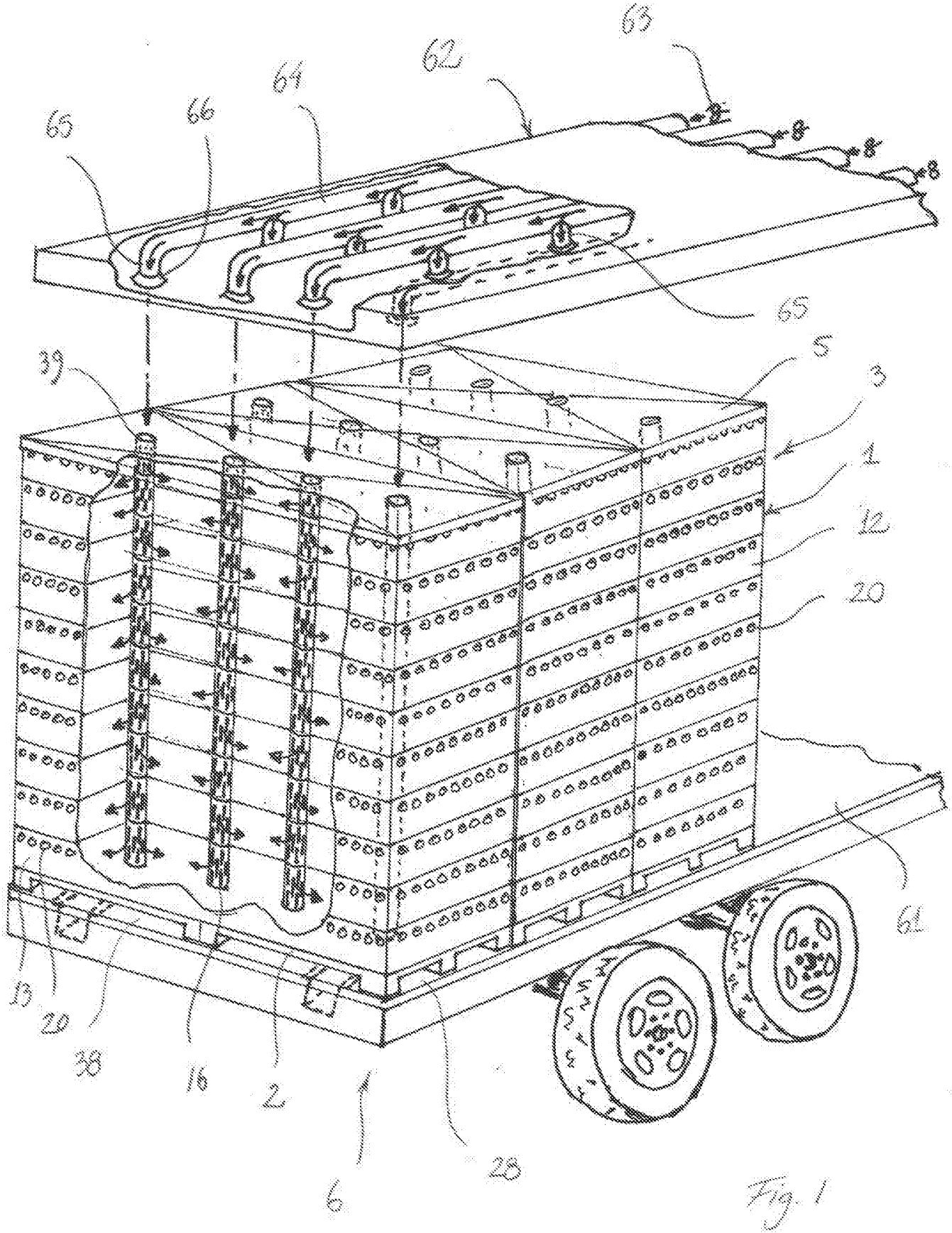

Fig. 1

The present invention relates to a method of ventilating unloadable broiler transport units on a broiler transport trailer, where the broiler transport units on the trailer comprise multiple floor areas arranged in rows on the trailer, and where an inner volume for holding broilers is present above the individual floor area, and where a ventilation system with ventilation devices provides forced ventilation air to the broiler transport units. The present invention further relates to a broiler transport trailer transporting broilers to the slaughterhouse. In the contents of the present invention the phrase unloadable has the meaning 'capable of being unloaded', and does not mean 'cannot be loaded'.

Broilers can be transported from farms to slaughterhouses in broiler transport units as described in WO 2011/010329 and US 6,382,141, where, during transportation, fresh air is supplied to the broiler by natural ventilation caused by the movement of the trailer, and possibly ventilation air can be ventilated onto the outside of the broiler transport units when the trailer is not moving.

The broiler transport units can be crates as known for example from EP 0 867 113 A2, which are of a relatively open design in order to allow air to penetrate into them, or crates arranged in a frame, or transport units having several floors in a frame structure, as disclosed in EP 1 330 952 B1 or in EP 0 384 530 A1.

The broiler transport units are loaded with broilers at the farm and are then loaded onto the broiler transport trailer and transported to the slaughterhouse, where the broiler transport units are unloaded from the trailer prior to processing the broilers. The broiler transport units with broilers can be unloaded and left at the slaughterhouse, and for example empty broiler transport units be loaded onto the trailer, which is then transported to the farm for a new load of broilers.

Broilers are slaughter-ready chickens or hens or turkeys grown to be ready for being slaughtered for meat to comsumers, and they have a fully developed feathering and a considerable weight of at least 1.6 kg per broiler.

An overview of current practices for slaughtering broilers is given by the European Food Safety Authority in the scientific report "Overview on cur-

rent practices of poultry slaughtering and poultry meat inspection", by Dr Ulrich Löhren, Supporting Publications 2012: EN-298. The broiler transport units relevant to the present invention are in the report called container systems or cages, and they are to be distinguished from liners, which are structures fixed on the truck and thus not unloadable.

The side walls and normally also the floors of the broiler transport units in use in the prior art are of a design with many openings in order to ventilate the broilers held in the units. The experiences obtained during many years show that it is often difficult to achieve sufficient ventilation in these broiler transport units. Insufficient ventilation may not only lead to a number of broilers dying during transport, but can also lead to reduced meat quality due to increased stress levels in the live broilers. The numbers of broilers, which are dead on arrival (DOA) at the slaughterhouse, and the frequency of the so-called PSE meat (pale, soft, exudative meat), which is a sign of stress, are widely used parameters in the evaluation of transportation efficiency.

If a trailer or truck is not driving, such as when the truck transporting the broiler transport units comes to a hold, for example in case of traffic jams, natural ventilation becomes less as the speed wind caused by driving disappears. In order to provide more reliable ventilation, trailers or trucks have been provided with mechanical ventilation by placing ventilators at the end of the vehicle and ventilate into an aisle or by placing ventilators in the side of the vehicle and ventilate across the vehicle.

It is an object of the present invention to provide a method of ventilating broiler transport units, which on the one hand allows broilers to be transported with less stress, both during transportation and also at standstill, and on the other hand allows more broilers to be transported on a broiler transport trailer of a given size.

With a view to this, the method according to the present invention is characterized in that the ventilation system supplies a plurality of ventilation column sections with forced ventilation, that the individual ventilation column section, extending into the inner volume or inner volumes of the broiler transport unit, guides the forced ventilation through ventilation openings positioned

at the ventilation column section inside the inner volume of the broiler transport unit, and that individual ventilation column sections of broiler transport units in a row form common ventilation columns, which common ventilation columns guide the forced ventilation air to ventilation column sections located in the row.

The ventilation system supplies ventilation to ventilation column sections extending into the inner volume of the broiler transport unit, and the forced ventilation flows through ventilation openings positioned inside the inner volume at the ventilation column section, where effective ventilation can be provided, also to broilers located with other broilers between themselves and the side walls of the broiler transport unit. The inner volume, or the individual inner volumes if the broiler transport unit has several floors, is thus ventilated inside-out, and all broilers in the transport unit received proper ventilation and may do so in amounts securing an acceptable local climate. The secure distribution of ventilation within the inner volumes permits the floors of the broiler transport units to be quite closely packed with broilers, and yet maintain acceptable welfare of the broilers positioned amidst other broilers in the central areas of the floors.

The ventilation system of the broiler transport trailer ventilates the inner volumes of transport units located behind other broiler transport units via the ventilation column section or sections in said other broiler transport units. The ventilation column sections function as part of the ventilation system on the trailer. The common ventilation columns formed by the ventilation column sections are distributing forced ventilation from the ventilation system to all broiler transport units in the row through which the common ventilation column extends. The individual ventilation column section serves to effectively ventilate the inner of the broiler transport unit, of which the section is part, and to distribute ventilation to other broiler transport units in the row.

The common ventilation columns are built up on the transport trailer as the broiler transport units are loaded onto the trailer, and the ventilation system on the trailer thus only needs to supply ends of the common ventilation columns with ventilation in order to ventilate all broiler transport units with

ventilation in every inner volume holding broilers.

Another advantage of the present method of ventilating broiler transport units is that the side walls and/or floors of the transport units can be made with no or only limited openings. The side walls are thus able to shield the broilers better from ambient environmental influences, like rain and sunlight, and floors without openings prevent bird droppings from floors above from falling onto the broilers below the floor.

The ventilation openings in the inner volumes are preferably positioned at a distance above the floors, and suitably above the breast level of broilers standing on the floor.

It is possible to arrange a central ventilation area extending along the length of the trailer, but a result would be that broiler transport units would have to be loaded onto the trailer from both sides. To simplify the loading of the trailer, it is in an embodiment preferred that the ventilation system of the broiler transport trailer ventilates forced ventilation air to and/or from ventilation column sections in broiler transport units located at an end of rows, preferably an upper end of downwards extending rows or a forward end of rows extending towards the back end of the trailer or a side end of rows extending in the width direction of the trailer.

The ventilation system of the trailer can be integrated with the broiler transport units loaded onto the trailer in stacks placed on top of each other – without actually placing the stacks with any precision in relation to the trailer and each other - and then placing ventilation devices on top of individual vertical common ventilation columns or connect a positionable ventilation duct or ventilation hose on top of individual common ventilation columns. However, these operations consume some time, so it is preferred that the broiler transport units are loaded onto the broiler transport trailer in a predetermined pattern joining the ventilation column sections into the common ventilation columns, and that these common ventilation columns register with ventilation devices or ventilation opening arranged on the trailer in a pattern corresponding to the loading pattern for the broiler transport units. The predetermined pattern may involve predetermined positions on the trailer, and such prede-

termined positions can be defined by the provision of markers, or projections, on the floor of the trailer, which projections act as guides for surfaces on the broiler transport units or match with depressions or recesses in the bottom of the transport units. Alternatively, a more complex system may be used, where the transport units are positioned by a robotic handling device.

In an embodiment at least one ventilation section of the ventilation system is activated and begins to ventilate loaded broiler transport units, while further broiler transport units are loaded onto the trailer. It may take some time to load a full trailer, such as one hour, because the broilers are typically filled into the broiler transport units and then the units are loaded onto the truck. It is an advantage to broiler welfare if the local forced ventilation to the broiler in any broiler transport unit is initiated within 15 minutes from loading the broiler transport unit onto the trailer. It is thus advantageous if broiler transport units can be loaded onto a section of the trailer, and then be connected to the ventilation system of the trailer, while other sections of the trailer are loaded with broiler transport units. Alternatively, many broiler transport units can be loaded with broilers and loaded onto the trailer as a common set, and in that case the time from loading broilers into the units and to completion of the loading onto the trailer and connection of the ventilation can be so short that all broilers are fine without section-wise connection of ventilation. In another embodiment it is possible to place broilers in a stack and load the stack onto the trailer and connect ventilation, and then to proceed with the next stack.

The ventilation air supplied to ventilation duct sections in the broiler transport units flows from the ventilation openings inside the broiler transport units and out of ventilation openings at side walls of the broiler transport units. The ventilation air provided to the inner volumes may flow from within the inner volume and out through one or more rows of ventilation openings in for example one or two side walls of the broiler transport unit. In order to ventilate the outflow of air away from the broiler transport units, these could be arranged with a free distance to the adjacent row on at least one side of the row, leaving a ventilation flow space in between columns. Alternatively, the

rows of broiler transport units may be arranged close next to each other, and the joining side walls of the broiler transport units in adjacent rows may have mutually matching ventilation column sections so that the closely stacked, joined broiler transport units define common ventilation columns at the side walls for ventilation air flowing out of the broiler transport units. One advantage is that the side walls of the broiler transport units can be closed side walls, except for the ventilation column sections in the walls. The closed side walls make the broiler transport units almost independent of the ambient conditions, apart from the conditions of the ambient air.

It is as an alternative possible that ventilation air supplied to ventilation duct sections in the broiler transport units flows from ventilation openings at side walls of the broiler transport units to the ventilation openings inside the broiler transport units. The reversal of the flow directions does not change much in the principles. The just mentioned advantages are also relevant for the opposite flow direction. It is also possible to alternate between the one flow direction and the other flow direction. This could, over a time span, provide still more even ventilation to the broilers irrespective of their location on the transport trailer.

It is also possible to obtain the flow directions in other manners. The flow directions can be controlled by the ventilation system by applying an overpressure to the ends of some of the common ventilation columns, while no pressure or an underpressure is applied others of the common ventilation columns on the trailer. Ventilation column sections with different pressure and/or flow direction in the same broiler transport unit can be provided by the ventilation system, but it is also possible for example to supply overpressure to a ventilation column in one broiler transport unit and supply underpressure to a ventilation column in another broiler transport unit and provide for ventilation air flow from the one to the other broiler transport unit via ventilation openings in the side walls of the units. It is also possible that the ventilation system provides different flows, or different ventilation air compositions, to some common ventilation columns than to other ventilation columns. An example of this may be where there is an advantage in having differences in the

flows of ventilation in different broiler transport units, such as when only one side of the trailer is exposed to heating by solar radiation and in need of cooling, while the other side is not in need of cooling.

It is possible that the ventilation system only supplies ventilation air to the broiler transport units based on ambient air taken in by mechanical ventilation or by air taken in by the air pressure on air intake openings facing in the direction of driving, or by a combination of both. However, it is alternatively possible to condition the ventilation air by mixing spent ventilation air into the ventilation air supplied by the ventilation system. In an embodiment, the ventilation system on the broiler transport trailer receives ventilation air from the broiler transport units and recirculates at least part of the received ventilation air as ventilation air to the broiler transport units. This may be relevant in cold ambient conditions where the recirculated ventilation air results in a higher temperature within the broiler transport units, at least in the initial phases of transport.

On the trailer it is possible that at least one of the parameters a) air temperature, b) air humidity, and c) CO_2 level in air is measured in ventilation air received from the broiler transport units. These parameters may provide information on the current broiler welfare condition, and whether advantages may be present for improving the ventilation to the broilers. If broilers get too warm, they get rid of heath by aspiration, and the aspiration releases humidity, so air humidity and air temperature in the air flowing out from the broiler transport units are each an indicator of whether the ventilation is sufficient or needs adjustments. The CO_2 level on the other hand may need a maximum limit value, and under some ventilation conditions recirculation may be restricted by the CO_2 level in the air. However, the measurement of one or more of the parameters may also be performed solely in order to document the welfare of the broilers during a transport.

The recirculated air amount may be controlled in dependency of at least one of the measured parameters, preferably so that the amount increases if the air temperature is below a predetermined temperature value, or the amount decreases if the air humidity is above a limit value, or the amount

decreases if the CO_2 level is above a predetermined value.

In an embodiment, the ventilation system provides ventilation air to all broiler transport units on the broiler transport trailer in an aggregated amount in the range of from 10,000 m^3/h to 100,000 m^3/h, preferably in the range from 30,000 m^3/h to 80,000 m^3/h.

The present invention also relates to a broiler transport trailer transporting broilers to the slaughterhouse, which trailer has a ventilation system with ventilation devices for ventilation of live broilers in broiler transport units arranged in rows on the trailer.

With a view to obtaining improved broiler welfare and improved quality of meat at the same time as the transport efficiency may be improved, the broiler transport trailer according to the present invention is characterized in that the trailer is adapted to load broiler transport units in an arrangement with individual ventilation column sections in the broiler transport units of at least one row forming common ventilation columns extending inside the inner volumes of the broiler transport units, said common ventilation columns having end openings, and that the ventilation system is adapted to ventilate a plurality of end openings with ventilation via ventilation devices on the trailer.

With respect to results obtained by these features reference is made to the general explanations of the above-mentioned descriptions in relation to the method. It is noted that some of the individual ventilation column sections may be ventilated by other methods, such as natural ventilation in the outermost broiler transport units on the trailer.

In an embodiment the broiler transport units in at least one row comprises at least one entry common ventilation column for leading ventilation air to the inner volumes in the broiler transport units and at least one exit common ventilation column for leading ventilation air out of the inner volumes in the broiler transport units, and wherein the ventilation system is adapted to ventilate at least the end openings of the entry common ventilation columns. This embodiment provides for ventilation inflow and outflow so that it is possible to control the ventilation air flows within the broiler transport units independently of the ambient conditions caused by the driving of the broiler trans-

port trailer.

In an embodiment, the ventilation system of the broiler transport trailer is arranged to ventilate the end openings of the entry common ventilation columns with ventilation air from the ventilation devices, and the ventilation system has controllable gates arranged at least at one end of the exit common ventilation columns, preferably a lower end thereof, to open or close for part of or the full area of the exit common ventilation columns. The controllable gates can regulate the degree of recirculation of ventilation air in a simple manner.

In a further embodiment where each ventilation device ventilates a single common ventilation column, the ventilation devices are individually controllable, preferably controllable to deliver at least a preset ventilation rate (m^3 air per second), suitably at least 0.12 m^3/s, advantageously at least 0.18 m^3/s. These ventilation rates provide fine welfare conditions to the broilers being transported.

In another embodiment the ventilation system comprises a recordal system and sensors for detecting and recording parameters selected from the group of a) ventilation air temperature, b) ventilation air humidity, c) ambient air temperature, d) ambient air humidity, e) outlet air temperature, f) outlet air humidity, g) CO_2 level in outlet air, h) duration of transportation, i) duration of lairage, j) vibration level, k) noise level, and l) light intensity. The recordal of one or more of these parameters may contribute to the documentation of broiler welfare, and may be utilized in the control of the local climate in the broiler transport units.

In the following examples of embodiments of the invention will described in further detail with reference to the schematic drawings, in which

Fig. 1 illustrates three transport units each including ten broiler transport containers arranged on a truck trailer with a height adjustable roof and a ventilation system,

Fig. 2 illustrates ventilation on a truck trailer loaded with transport units each including four and five broiler transport containers,

Fig. 3 illustrates a truck with the trailer loaded with transport units

each including four and five broiler transport containers seen from the side,

Fig. 4 illustrates an embodiment of a transport unit in a perspective view seen from above,

Fig. 5 shows a cross-section along the line VI-VI in Fig. 4,

Fig. 6 illustrates the broiler transport container used in the transport unit in Figs. 4 and 5 in a perspective view seen from above,

Fig. 7 illustrates the broiler transport container in Fig. 6 seen a perspective view from below,

Fig. 8 corresponds to Fig. 7 but seen from a slightly different angle,

Fig. 9 shows the pallet in Fig. 4 in a perspective view from above,

Fig. 10 illustrates another embodiment of a broiler transport container in a perspective view seen from above,

Fig. 11 illustrates another embodiment of a broiler transport container in a perspective view seen from above, and

Fig. 12 illustrates still another embodiment of a broiler transport container in a perspective view seen from above.

The back end of a broiler transport trailer 6 transporting broilers to the slaughterhouse is illustrated in Fig. 1 loaded with transport units 403 each having a width corresponding to the width of the floor 61 of the trailer. In the context of the present invention the term transport trailer is to be understood in a broad sense. The transport trailer can be a trailer to be driven by a truck drive unit, with a possibility of being parked in a condition disconnected from the truck drive unit. The transport trailer can be a part of an articulated truck, such as the hanger connectable to and trailing behind the truck or behind a trailer driven by the truck drive unit. The transport trailer may have twin wheels, several boogies or simply a wheel axle at either end. The transport trailer may be of standard size, or it may be of large sixe (XL), in particular of large length. The transport trailer may also be of smaller size, such as a lorry. The term transport trailer also encompasses railway wagons.

The roof 62 of the trailer is provided with a ventilation system comprising four ventilation devices 63 in form of a ventilator driven by an electric motor supplied with electricity from either the drive unit of the trailer, an ac-

cumulator on the trailer, or a power connection connected to a power supply at the farm, the slaughterhouse or another stationary supply point. The ventilation device provides forced (mechanical) ventilation to a ventilation pipe 64 extending along the length of the trailer 6. The ventilation pipe 64 supplies ventilation to a series of branched off outlets 65. The individual outlet 65 is located at a position corresponding with an end opening of a ventilation column 16 in the transport units 3. When the roof 62 is lowered to be located on top of the broiler transport units, the outlets register with or are integrated with or come into engagement with openings 39 at the upper ends of the ventilation columns, thus allowing ventilation air to flow between the ventilation pipes 64 and the ventilation columns 16 and via the columns and ventilation openings therein through inner volumes of the broiler transport containers as indicated by the arrows. In this manner each broiler transport unit or each stack of transport units is provided with forced ventilation. A section of the transport unit 3 sitting on the outermost end of the truck or trailer has been cut away to present a view of the ventilation columns 16 inside and the flow of air.

In this embodiment, the ends of the ventilation pipes 64 have been provided with collars 66 allowing a tight fit against the covers 5.

The ventilation devices may be individually controllable to provide ventilation conditions adapted to the local conditions in the ventilation column or the ventilation columns provided with ventilation from the ventilation device. A group of ventilation devices may be commonly controlled, such as when a special ventilation air composition is ventilated to all inner volumes, or when one side of the trailer is more exposed to sunlight than the other side. Ventilation devices may also be controlled to deliver less ventilation air when the natural ventilation is high, such as when driving at high speeds, and more ventilation air when there is less or no supplement of ventilation air from the driving speed.

Air may flow out from the broiler transport units via the ventilation openings 20 in the side walls 12, 13 and it is also possible that the ventilation columns 16 continue through the pallets 2 so that air may escape via pallet openings 28, 38. Here ventilation openings 20 are shown in all four sides of

the broiler transport units, but it may be expedient to have them only in the longitudinal side walls. The trailer floor 61 may also be provided with ventilation openings (not shown).

In Fig. 1 a single row of broiler transport containers fills the floor of the trailer, but it is also be possible to use broiler transport units of a smaller width and then arrange them in two, three, four or more rows extending in the length direction of the floor.

Fig. 2 illustrates another method for ventilating unloadable broiler transport units arranged on a trailer 106. Here the transport units 103, 103' are arranged in two layers on the floor 161. Each of the transport units 103 in the lowermost layer includes five floors, while each of the transport units 103' in the uppermost layer includes four floors. On the transport units in the second and third row from the driver's cabin the transverse side walls of the broiler transport containers forming the transport units have been removed to present a view to the inner volumes and ventilation columns 116. Openings in the transport unit covers 105 and pallets 102 allow the formation of common ventilation columns extending all the way from the roof 162 to the floor 161 via ventilation column sections 114 extending from the respective floors of the broiler transport containers and being arranged in continuation of each other into common ventilation columns.

In this embodiment the roof 162 includes an inner volume 167 in which an overpressure or an underpressure can be created using a ventilation device 163 arranged over the driver's cabin. When an overpressure is created in the inner volume 167, air is forced into the ventilation columns as indicated by the arrows and from there into the inner volumes of the broiler transport containers 101 and out through the ventilation openings (not visible) in the side walls 113 into a ventilation passages 136 between the transport units.

When openings 168 in the floor 161 of the trailer are left open, a constant flow of air through inner volume 167 of the roof, through the broiler transportation units, down along the outer sides of the units via ventilation passages 136 and out through the floor openings 168 can be obtained. This

flow may be aided by the underpressure usually occurring on the underside of a truck when in motion. Ambient air may be led directly into the inner volumes of the broiler transport units, or the air may be conditioned with regards to temperature and/or humidity and/or chemical composition in the ventilation system.

An overpressure in the inner volume 167 in the roof 162 may also be achieved or aided by leaving a damper or a controllable gate 170 in the front side of the roof open, so that air is forced into the inner volume when the truck is in driving forward.

If the weather is very cold, there may be a need for heating the ventilation air to the transport units. This may be achieved by closing at least some of the exit openings 168 from the common ventilation columns in the floor 161 using controllable gates or dampers 169, and potentially also the inlet to the roof using controllable gate 170, and recirculating the air as indicated by the arrows on the third row of transport units. In this manner the body heat of the broilers is used for gradually heating the air, however, a certain amount of fresh air is typically admixed to ensure sufficient oxygen levels and to control the level of carbon dioxide. Recirculation may require an additional ventilation device, which may for example be in the form of local fans 166 arranged on top of each ventilation column 116, and such local fans may also be used alone in order to induce airflow into the ventilation columns.

It is also possible to add additives such as anaesthetics to the air in order to keep the broilers calm during transport. In one embodiment, this is achieved by including tanks with for example CO_2 on the truck or trailer and add such gas to the air ventilated into the transport units via the ventilation columns, but it is also possible to collect exhaust gasses from the truck engine, sufficiently clean the exhaust gasses, such as by passing the gasses through a particle filter, one or more adsorption devices, and/or a zeolit filter removing volatile organic compounds, NOx, and/or SOx and possibly a filter with active carbon, and then add the cleaned gas to the ventilation air to the transport units via the ventilation system. Stunning of the birds while still on the truck is also possible, but will require a very speedy unloading of the

transport units in order to have the broilers slaughtered in time.

The ventilation system of any of the embodiments described as well as other embodiment of the invention may be used for ensuring sufficient ventilation of the broiler transport units 103 during loading of the truck. The loading of a typical broiler transport truck 106 as shown in its full length in Fig. 3 usually takes about one hour and it may therefore be expedient to have the ventilation divided in section as indicated by the broken lines. When section A has been fully loaded ventilation of this section is started, while loading continues in section B, and then section B is coupled into the ventilation and so on until finally starting ventilation in section C. This may simply be achieved by providing air regulation mechanisms, such as dampers or valves in ventilation pipes extending along the length of the truck as illustrated in Fig. 1 or in an inner roof volume as in Fig. 2. The number of rows in each ventilation section A-D may vary depending on the size of the broiler transport units and the size of the trailer, and by providing sufficient regulation mechanisms it is even possible to adjust the size of the individual sections depending on for example the ambient temperature and the speed with which broiler transport containers are loaded.

The ventilation may be controlled in response to measurement of for example air temperature, air humidity, and/or CO_2 level in either the air in the inner volumes of the broiler transport units or the ventilation air coming out of from the broiler transport units. Sensors measuring one or more of the mentioned air values may be arranged in the broiler transport units, possibly in the pallets thereof, or in the truck may be used for this purpose.

A recordal system may be used for controlling the ventilation and/or for recording different conditions of the ventilation system, broiler transport units and/or broilers. As an example outlet air temperature and humidity and/or CO_2 level at the exits may be used and indicators of the state of the broilers, while information about ambient air temperature and humidity may be used for evaluating a future need for adjustments. Other parameters such as ventilation air temperature and humidity and the duration of transportation etc. may be used for calculating expected values for other parameters and

comparing real and expected parameters may be used for adjusting the ventilation.

An embodiment of a broiler transport unit 3 having outer side walls 12, 13 and five floors 11 defining five inner volumes, each of which can accommodate at least five live broilers during transportation to a slaughterhouse, is shown in Fig. 4. Three ventilation columns 14 on each floor together form three continuous hollow cylindrical ventilation channels 16 composed of the ventilation columns 14 of the five broiler transport units 1, 1' being located in extension of each other. Each column section 14 is provided with ventilation openings 15 opening into the respective inner volumes so that it is possible at the same time to ventilate all of the broiler transport units 1, 1' in the transport unit by applying an air pressure on the ventilation column 16. In this manner it is possible to provide fresh air even to birds located at a distance from the side walls 12, 13. The air supply may also be used for heating or cooling of the inner volume of the container.

A ventilation column in a broiler transport container may be named a ventilation column section 14, because it becomes a section of a common ventilation column extending through a plurality of broiler transport containers, when these are stacked to form a unit, and possibly part of a ventilation column common to two or more broiler transport units when they are loaded onto a transport trailer.

The broiler transport unit shown in Figs. 4 and 5 is composed of a series of broiler transport containers 1 stacked on top of each other, and one such container is shown in Figs. 6-8. The floor 11 is rectangular with two transverse side walls 12 and two longitudinal side walls 13, which together delimit the inner volume. The three columns 14 extend from the floor 11 up through the inner volume at a distance d_T from the transverse side walls 12 and a distance d_L from the longitudinal side walls 13. These distances d_T, d_L are adapted for providing space for at least one broiler in between each of the columns 14 and the respective side walls 12, 13. The ventilation columns are arranged in a row along the centre length axis L of the container and are evenly spaced.

Each column 14 is adapted to serve as a ventilation column by being provided with elongate ventilation openings 15 extending over almost the entire height of the column. The openings here have a total opening area corresponding to approximately 40% of the total surface area of the column, corresponding to approximately 9% of the area of the floor of the broiler transport unit, but if a smaller opening area is desired, the openings may be shorter and/or narrower.

The columns 14 are cylindrical with a constant diameter d_C, except for a small angled section 17 being provided at the joint with the floor 11. This angled section not only strengths the structure, but also allows a column of another container to project slightly into the hollow as shown in Fig. 5. In this embodiment the height h_C of the columns 14 corresponds to the height of the side walls 12, 13, but they may be made slightly higher in order to be able to engage with a column of another container.

Both longitudinal side walls 13 of the broiler transport unit in Figs. 6-8 are provided with recesses 19 corresponding in size and shape to half a ventilation column 14 and are also provided with ventilation openings 20, but there is no angled section and no cross. To ensure the stability of the broiler transport unit 1, even when fully loaded with broilers, a beam 21 spanning across each recess 19 is provided in continuation of the plane of the longitudinal side wall 13. This beam is also suitable for use as a grip when handling the container and/or the transport unit either by hand or automatically.

In the broiler transport unit 3, the recesses 19 in the side walls are located above each other, as also appears from Figs. 4 and 5, so that they form a semi-circular continuous hollow ventilation column 36 joined with the longitudinal side walls 13 and having ventilation openings 20. Air ventilated via the ventilation openings 15 in the ventilation columns 14 may flow out via openings 20 in the recesses 19 in the side walls. Ventilation air may also be flowing in the opposite direction from the openings 20 in the side walls to the ventilation columns, e.g. if an underpressure is provided in the ventilation channel 16. It is also possible to provide different pressures in different ventilation columns 16 so as to induce a flow of air from one ventilation column to

another, thereby allowing ventilation even if there are no specific ventilation openings in the side walls. This may be done by providing the individual ventilation column with a ventilation device that is controllable independently of other ventilation devices for other ventilation columns in the ventilation system.

When a transport unit 3 of the type shown in Figs. 4 and 5 is arranged close to and aligned with another transport unit of the same type, the recess channels 19 in these two transport units will be aligned and form one common ventilation channel with a circular cross-section corresponding to that of the channel 16 formed by the ventilation columns 14. A similar effect may be achieved by arranging the transport unit with the longitudinal side wall 13 close to a wall or the like, thereby closing the recesses 19 and creating a semi-circular ventilation column. The ventilation column 36 thus formed functions in the same manner as the ventilation passage 136 described with reference to Fig. 2.

The broiler transport unit in Figs. 4-8 has a length of 240 cm and a width along the transverse side walls 12 of 80 cm and a diameter of the ventilation columns 14 of 20 cm, and the individual broiler transport units have a height of 22.5 cm. Such a broiler transport unit will span the entire width of a standard European truck trailer when arranged as shown in Fig. 1.

The pallet 2 used in Figs. 4 and 5 and shown alone in Fig. 9 is provided with a series of openings 27 on the same positions as the columns in the broiler transport units, as is also shown in Fig. 5, so that the ventilation columns 16 continue through the pallet. Though not the case in this embodiment, the ventilation columns formed by the recesses 19 may also continue into the pallet. Horizontal openings 28 in the pallet 2 are adapted for engagement with the arms of a fork-lift (not shown) used for handling the transport unit 3. These horizontal openings may contribute to the ventilation by being in communication with either of the ventilation columns 16, 19, even though it is not the case in the embodiment shown in Figs. 4, 5 and 9.

Another embodiment of a broiler transport container is shown in Fig. 10. This container corresponds closely to those in Figs. 4-8 except for being

smaller and with a different configuration of the ventilation columns and the same reference numbers will therefore be used.

The broiler transport container in Fig. 10 has a length and a width of 120 cm, a height of 22.5 cm and a diameter of the ventilation columns 14 of 20 cm. Two rows of broiler transport units assembled from such containers will fill the width of a trailer when arranged next to each other. The distance d_T to the side walls 12 without recesses is about 50 cm, and the distance d_L to the side wall opposite the side wall with the recess 19 is about 30 cm in the illustrated embodiment.

Another embodiment of a broiler transport container 101 is illustrated in Fig. 11. Reference numbers corresponding to those used in Figs. 1-10 are used but with 100 added, and when nothing else is stated features having such corresponding reference numbers have the same function.

This broiler transport container 101 too has three ventilation column sections 114 arranged to project from the floor 111 and to form a ventilation column 116. The container is of simpler design and the ventilation openings 115 are provided only at the upper edges of the column sections. These ventilation openings have a smaller total opening area than the ones shown in Figs. 4-8 and are located at level with the heads of the broilers.

The container in Fig. 11 has no recesses in the side walls. Instead it is provided with a series of openings 120 in the upper section of the longitudinal side walls 113. A flange 126 projecting away from the inner volume of the container serves as a distance keeper so that there will always be a ventilation passage 136 along the outer side of the longitudinal side walls. In addition to the vertical flow described with reference to Fig. 2, where the trailer is loaded with broiler transport units built from container of this type, this allows ventilation air to flow in a horizontal direction along the outer sides of the side walls.

The projecting flanges 126 may also be used as grips when handling the containers, and allow the container to be inserted in a frame system and used in a prior art transportation unit, if desired.

The trailer in Fig. 3 is also shown as loaded with broiler transport

units built from broiler transport containers of this type.

All of the embodiments described above rely on the use of broiler transport containers with ventilation column sections 14, 114 extending from the floor, meaning that the ventilation columns 16, 116 of the broiler transport units also extend in a substantially vertical direction, but it is also within the scope of the invention to use horizontal ventilation columns.

One example of a broiler transport container system with horizontal a ventilation column is shown in Fig. 12, where the reference numbers corresponding to those used in Figs. 1-9 will be used. As may be seen this container includes a column section 14 extending from one outer end side wall 12 to the other and having ventilation openings 15. When such containers are arranged end-to-end, the column sections will form a common ventilation column 16 extending through them and the ventilation system on the trailer will then have to be arranged along the side of the trailer or be provided with connection pipes or conduits extending along the side. Here too, recesses 19 with openings 20 as described with reference to Figs. 4-8 are adapted for contributing the ventilation and will form vertical ventilation columns 36 when containers are stacked on top of and next to each other. Accordingly, this embodiment of a broiler transport container enables the combination of horizontal and vertical ventilation columns. Alternatively, the recesses may be omitted and replaced by simple openings in the side walls, or by an additional horizontal ventilation column.

Details of the various embodiments may be combined into other embodiments within the scope of the patent claims.

C L A I M S

1. A method of ventilating unloadable broiler transport units on a broiler transport trailer, where the broiler transport units on the trailer comprise multiple floor areas arranged in rows on the trailer, and where an inner volume for holding broilers is present above the individual floor area, and where a ventilation system with ventilation devices provides forced ventilation air to the broiler transport units, c h a r a c t e r i z e d in that the ventilation system supplies a plurality of ventilation column sections with forced ventilation, that the individual ventilation column section, extending into the inner volume or inner volumes of the broiler transport unit, guides the forced ventilation through ventilation openings positioned at the ventilation column section inside the inner volume of the broiler transport unit, and that individual ventilation column sections of broiler transport units in a row form common ventilation columns, which common ventilation columns guide the forced ventilation air to ventilation column sections located in the row.

2. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to claim 1, wherein the ventilation system of the broiler transport trailer ventilates forced ventilation air to and/or from ventilation column sections in broiler transport units located at an end of rows, preferably an upper end of downwards extending rows or a forward end of rows extending towards the back end of the trailer or a side end of rows extending in the width direction of the trailer.

3. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to claim 2, wherein the broiler transport units are loaded onto the broiler transport trailer in a predetermined pattern joining the ventilation column sections into the common ventilation columns.

4. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to one or more of claims 1 to 3, wherein at least one ventilation section of the ventilation system is activated and begins to ventilate loaded broiler transport units, while further broiler transport units are loaded onto the trailer.

5. A method of ventilating unloadable broiler transport units in a broi-

ler transport trailer according to one or more of claims 1 to 4, wherein ventilation air supplied to ventilation duct sections in the broiler transport units flows from the ventilation openings inside the broiler transport units and out of ventilation openings at side walls of the broiler transport units.

6. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to one or more of claims 1 to 4, wherein ventilation air supplied to ventilation duct sections in the broiler transport units flows from ventilation openings at side walls of the broiler transport units to the ventilation openings inside the broiler transport units.

7. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to one or more of claims 1 to 6, wherein the ventilation system on the broiler transport trailer receives ventilation air from the broiler transport units and recirculates at least part of the received ventilation air as ventilation air to the broiler transport units.

8. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to one or more of claims 1 to 7, wherein one or more of the parameters a) air temperature, b) air humidity, and c) CO_2 level in air is/are measured in ventilation air received from the broiler transport units.

9. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to claims 7 and 8, wherein the recirculated air amount is controlled in dependency of at least one of the measured parameters, preferably so that the amount increases if the air temperature is below a predetermined temperature value, or the amount decreases if the air humidity is above a limit value, or the amount decreases if the CO_2 level is above a predetermined value.

10. A method of ventilating unloadable broiler transport units in a broiler transport trailer according to one or more of claims 1 to 9, wherein the ventilation system provides ventilation air to all broiler transport units on the broiler transport trailer in an amount in the range from 10,000 m^3/h to 100,000 m^3/h, preferably in the range from 30,000 m^3/h to 80,000 m^3/h.

11. A broiler transport trailer transporting broilers to the slaughterhouse, which trailer has a ventilation system with ventilation devices for venti-

lation of live broilers in broiler transport units arranged in rows on the trailer, characterized in that the trailer is adapted to load broiler transport units in an arrangement with individual ventilation column sections in the broiler transport units of at least one row forming common ventilation columns extending inside the inner volumes of the broiler transport units, said common ventilation columns having end openings, and that the ventilation system is adapted to ventilate a plurality of end openings with ventilation via ventilation devices on the trailer.

12. A broiler transport trailer according to claim 11, wherein the ventilation system wherein the broiler transport units in at least one row comprises at least one entry common ventilation column for leading ventilation air to the inner volumes in the broiler transport units and at least one exit common ventilation column for leading ventilation air out of the inner volumes in the broiler transport units, and wherein the ventilation system is adapted to ventilate at least the end openings of the entry common ventilation columns.

13. A broiler transport trailer according to one or more of claims 11 to 12, wherein the ventilation system is arranged to ventilate the end openings of the entry common ventilation columns with ventilation from the ventilation devices, and wherein the ventilation system has controllable gates arranged at least at one end of the exit common ventilation columns, preferably a lower end thereof, to open or close for part of or the full area of the exit common ventilation columns.

14. A broiler transport trailer according to one or more of claims 11 to 13, wherein ventilation devices are individually controllable, preferably controllable to deliver at least a preset ventilation rate (m^3 air per second), suitably at least 0.05 m^3/s, such as at least 0.12 m^3/s, advantageously at least 0.18 m^3/s, and optionally at least one ventilation device is mounted at the end opening of the common ventilation column it ventilates.

15. A broiler transport trailer according to one or more of claims 10 to 14, wherein the ventilation system comprises a recordal system and sensors for detecting and recording parameters selected from the group of a) ventilation air temperature, b) ventilation air humidity, c) ambient air temperature, d)

ambient air humidity, e) outlet air temperature, f) outlet air humidity, g) CO_2 level in outlet air, h) duration of transportation, i) duration of lairage, j) vibration level, k) noise level, and l) light intensity.

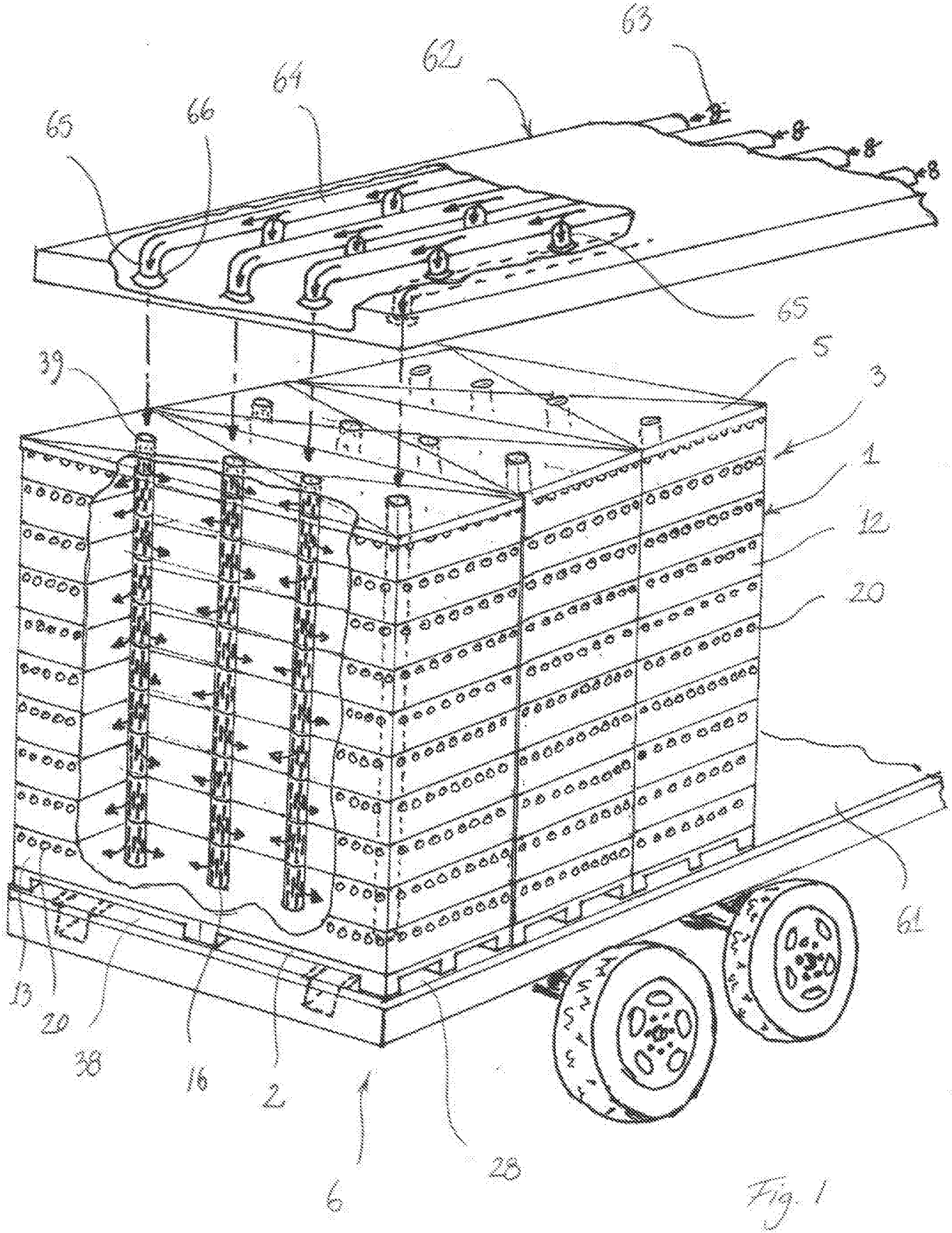

Fig. 1

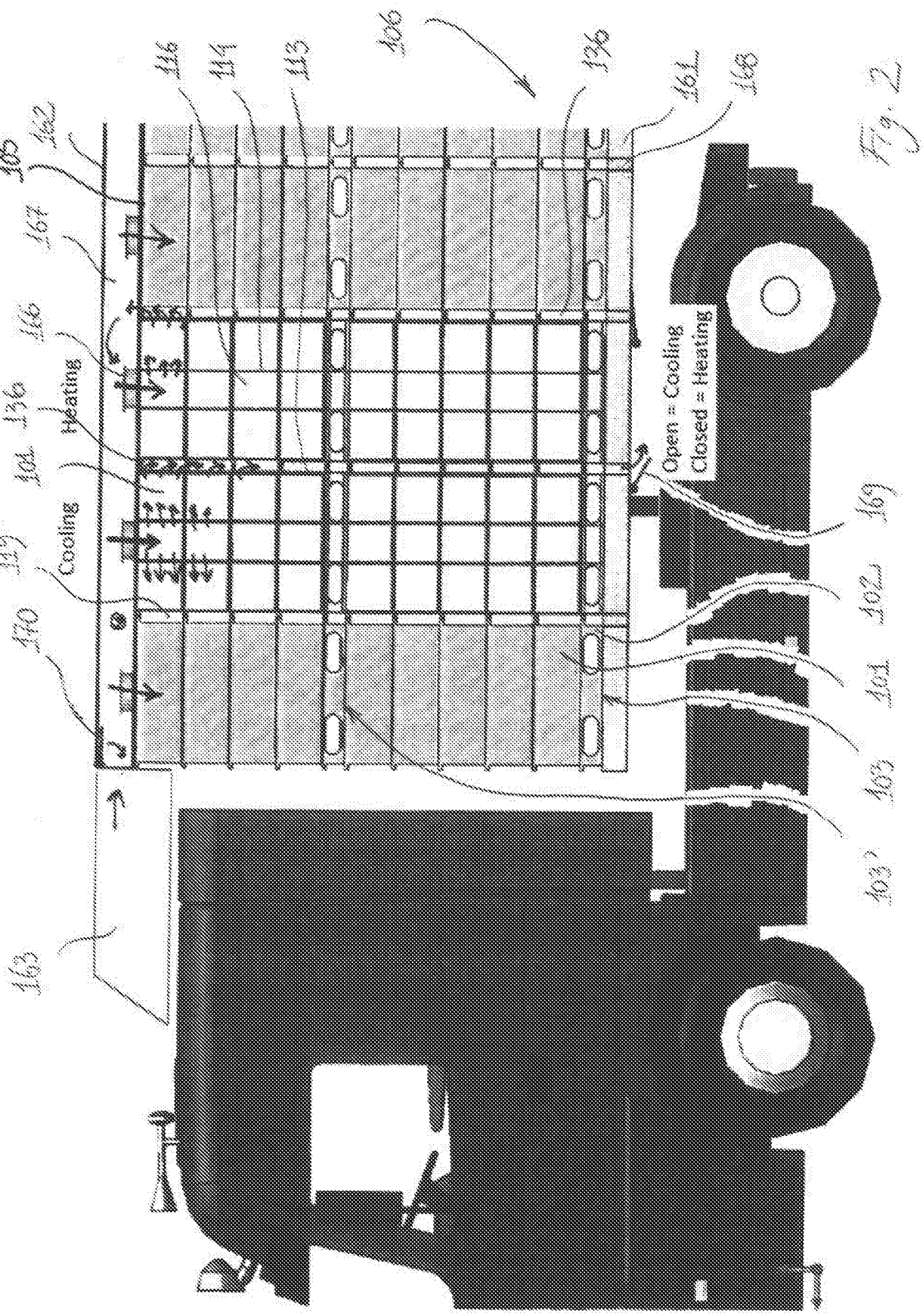

Fig. 2

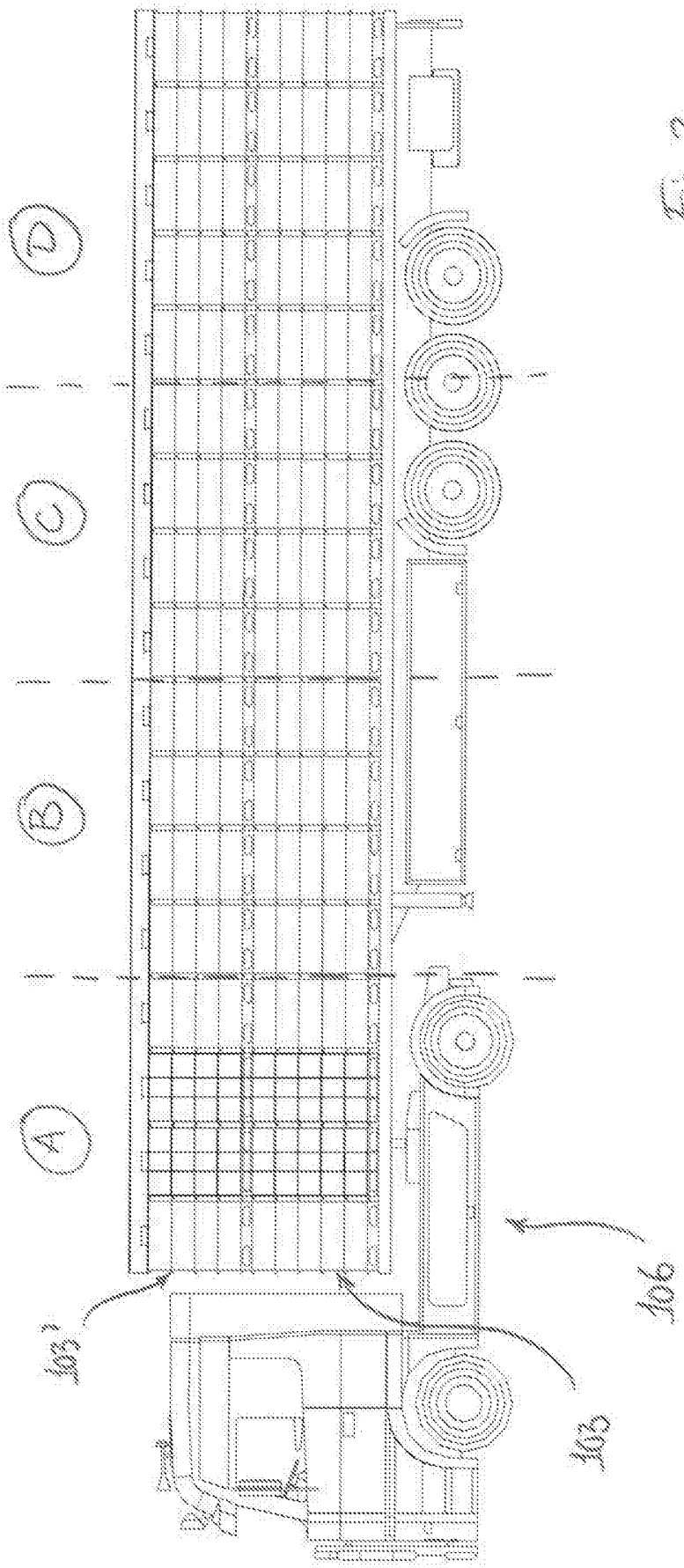

Fig. 5

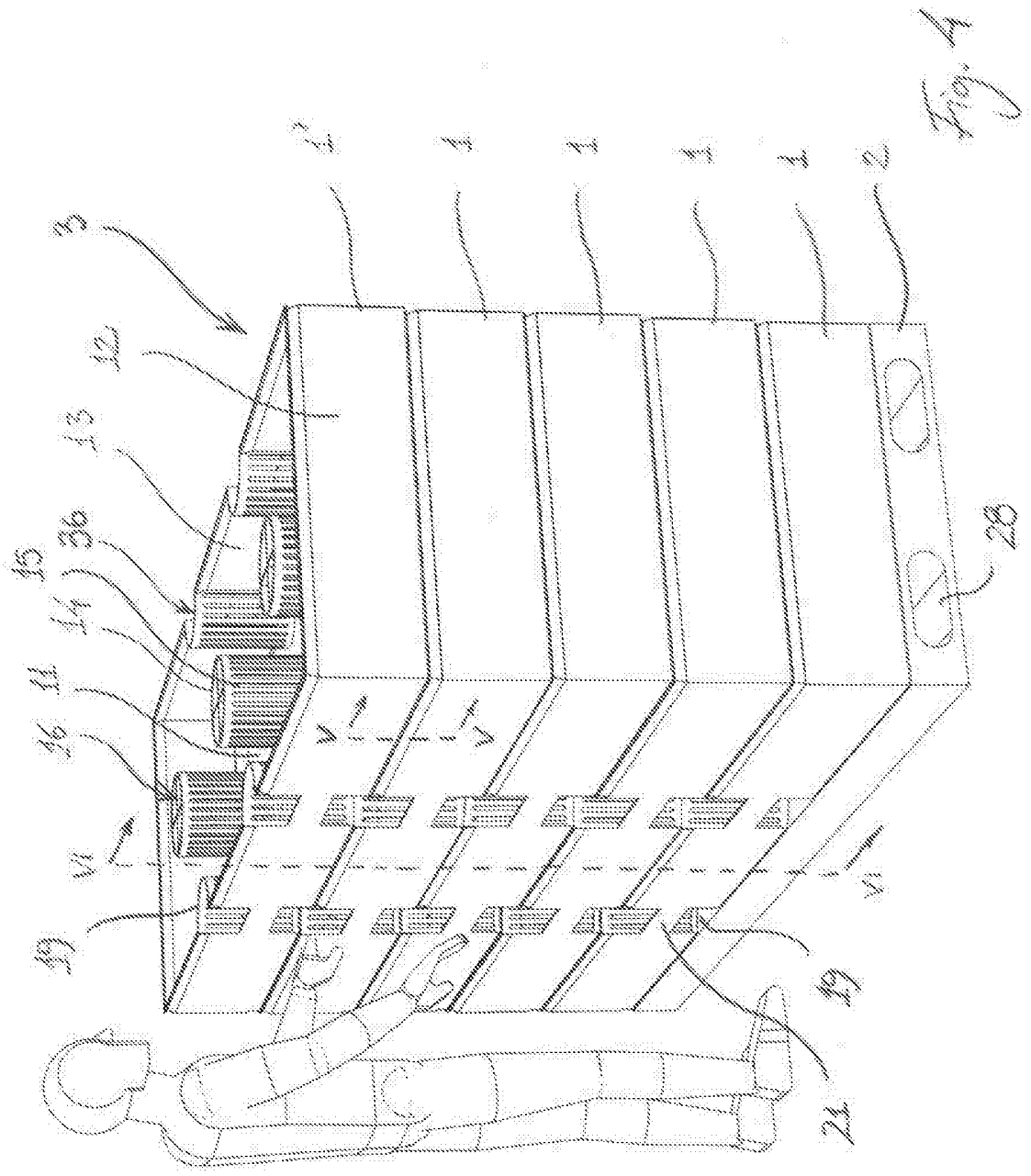
Fig. 4
3
12
13
26
15
14
11
16
17
19
21
29
2
1

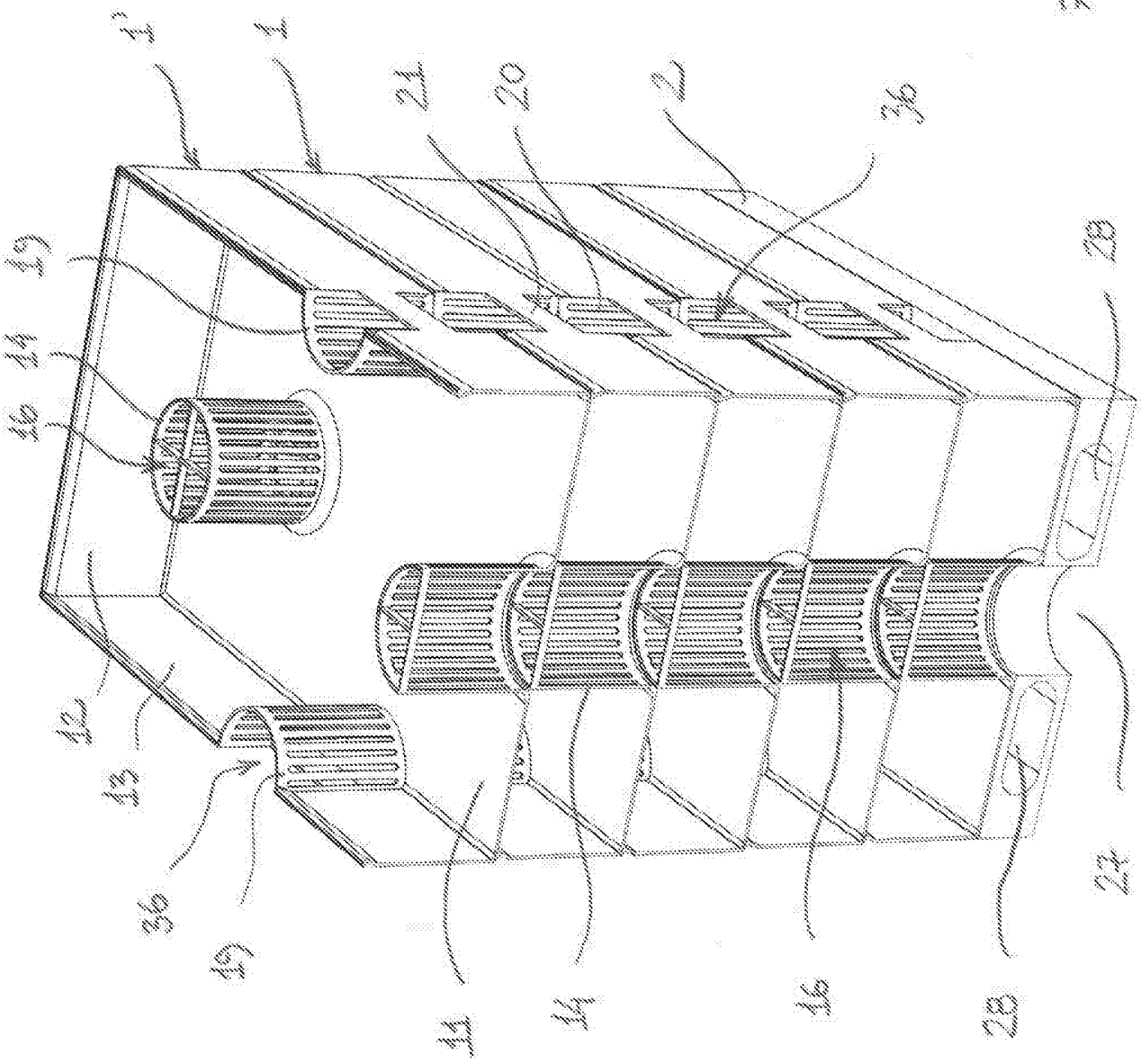

Fig. 5

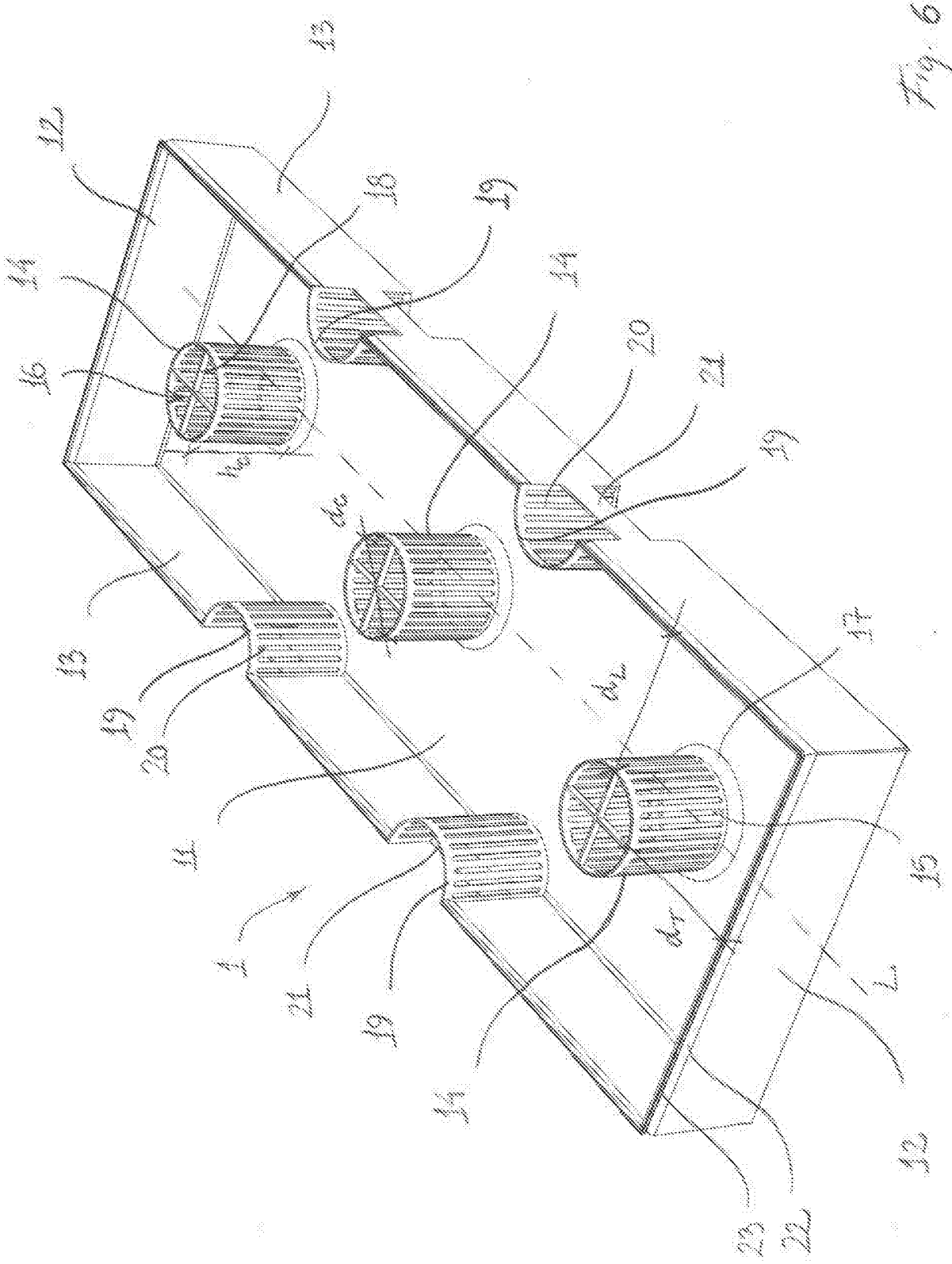

Fig. 6

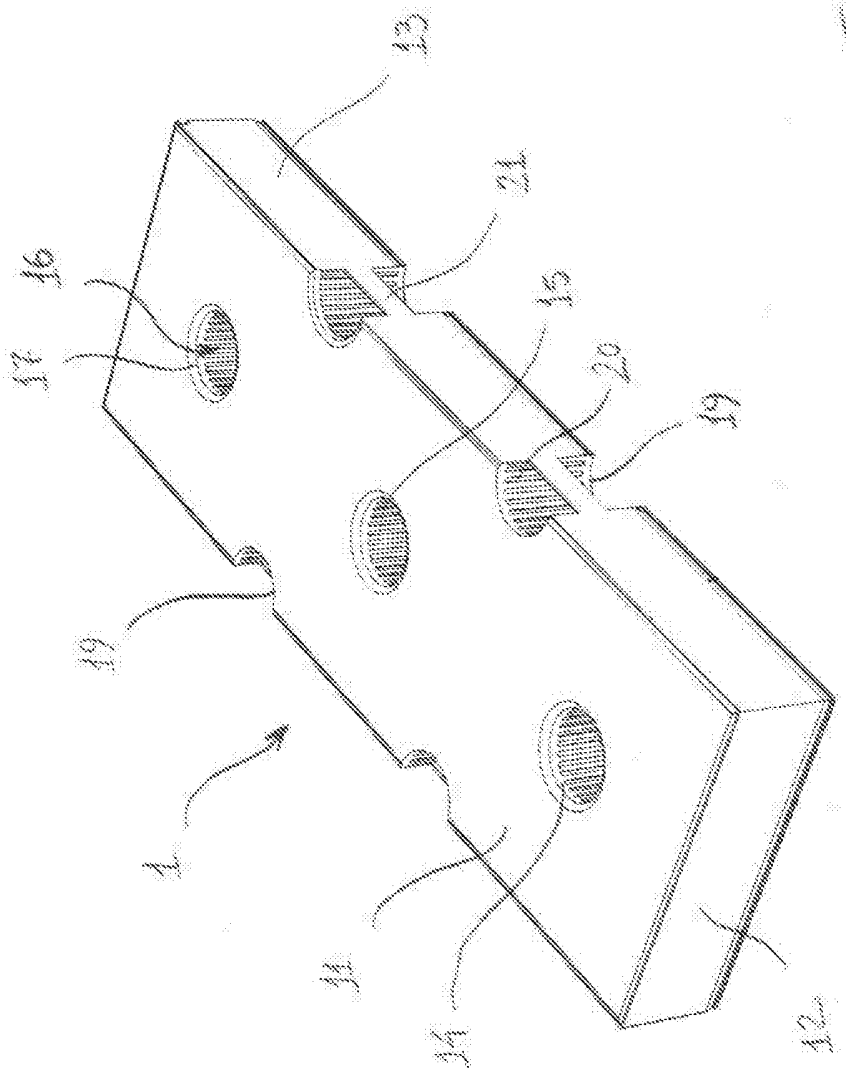

Fig. 7

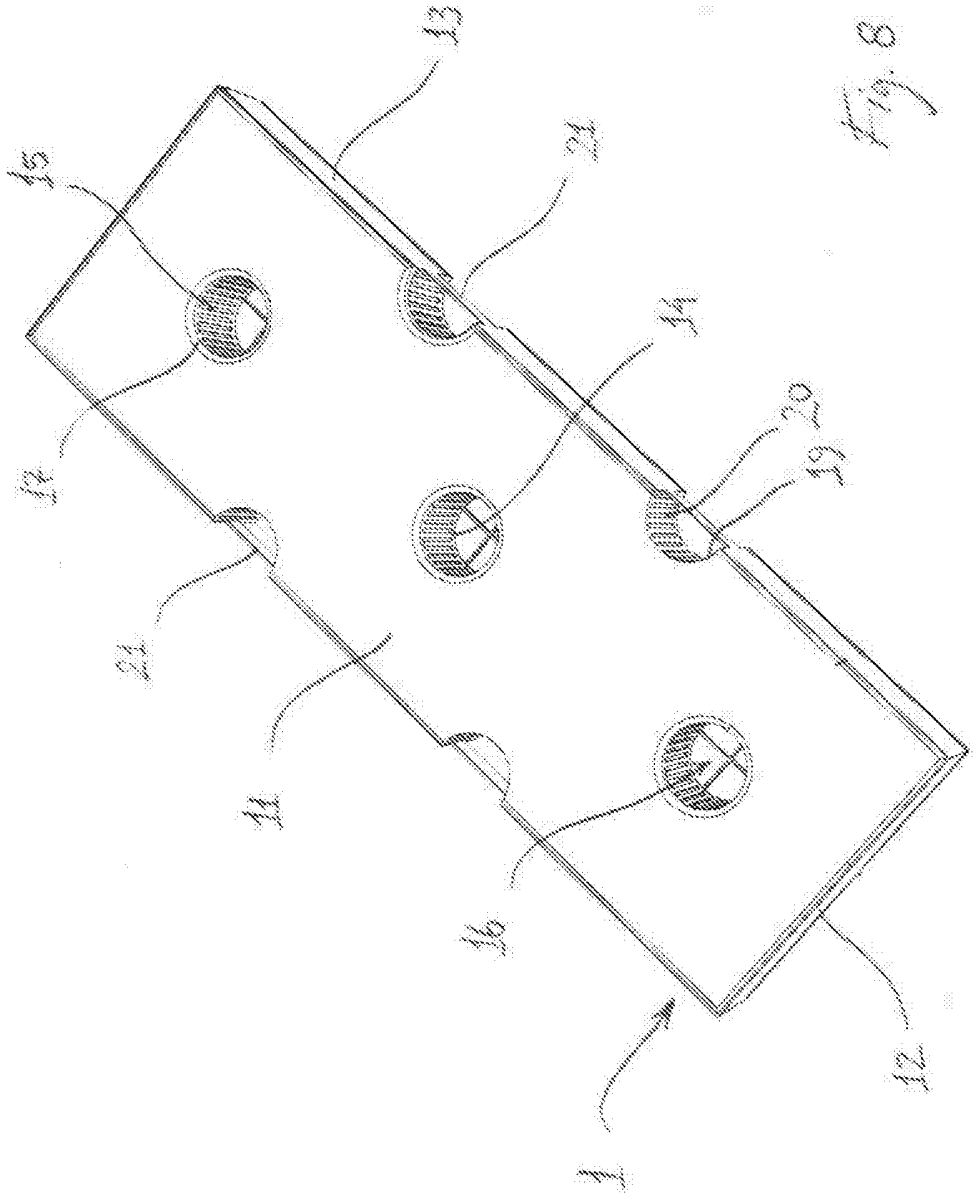

Fig. 8

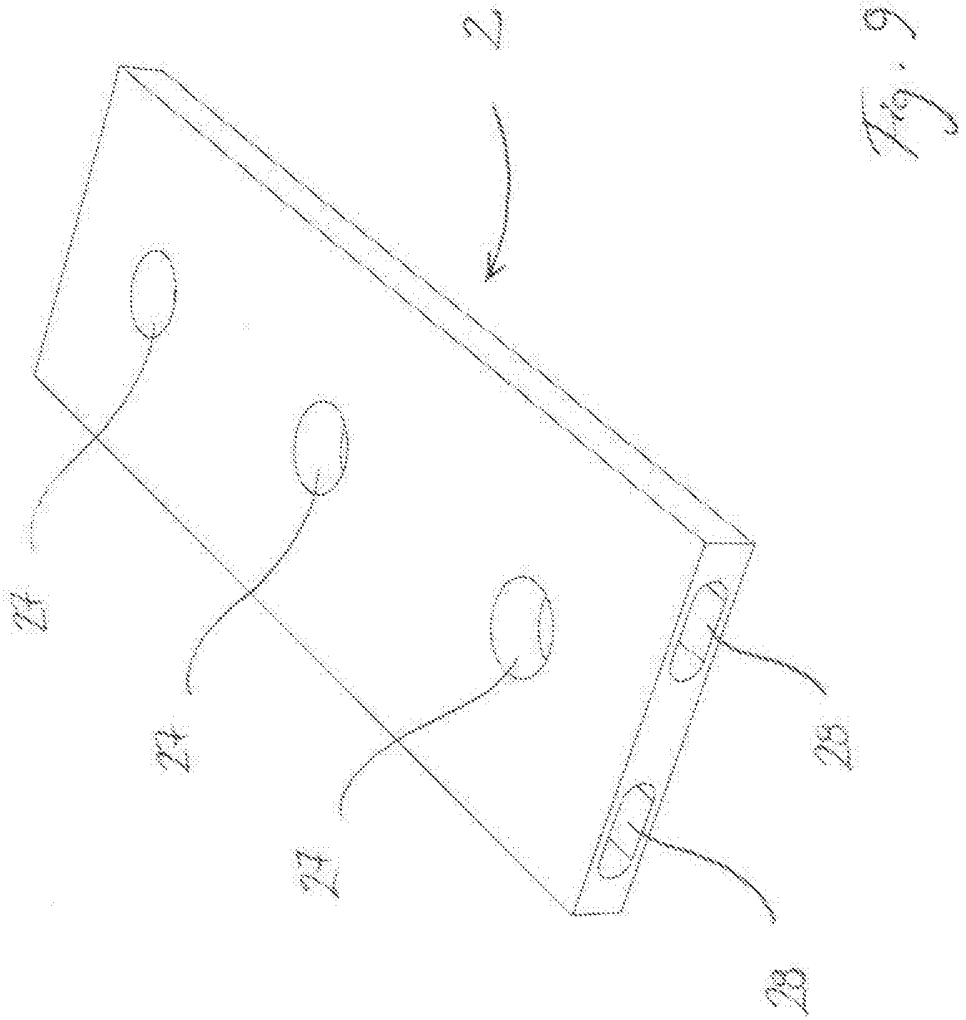

Fig. 9

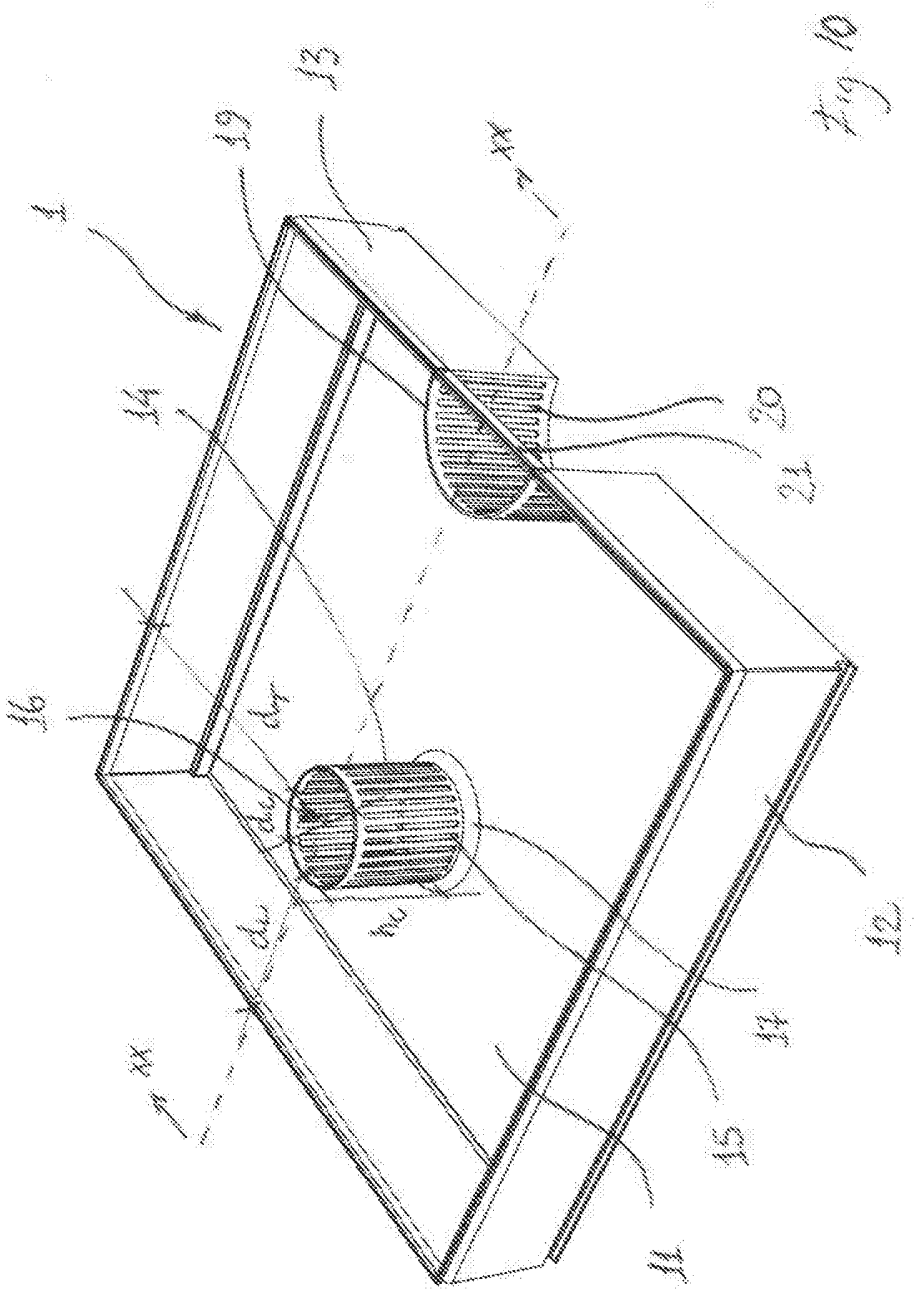

Fig 10

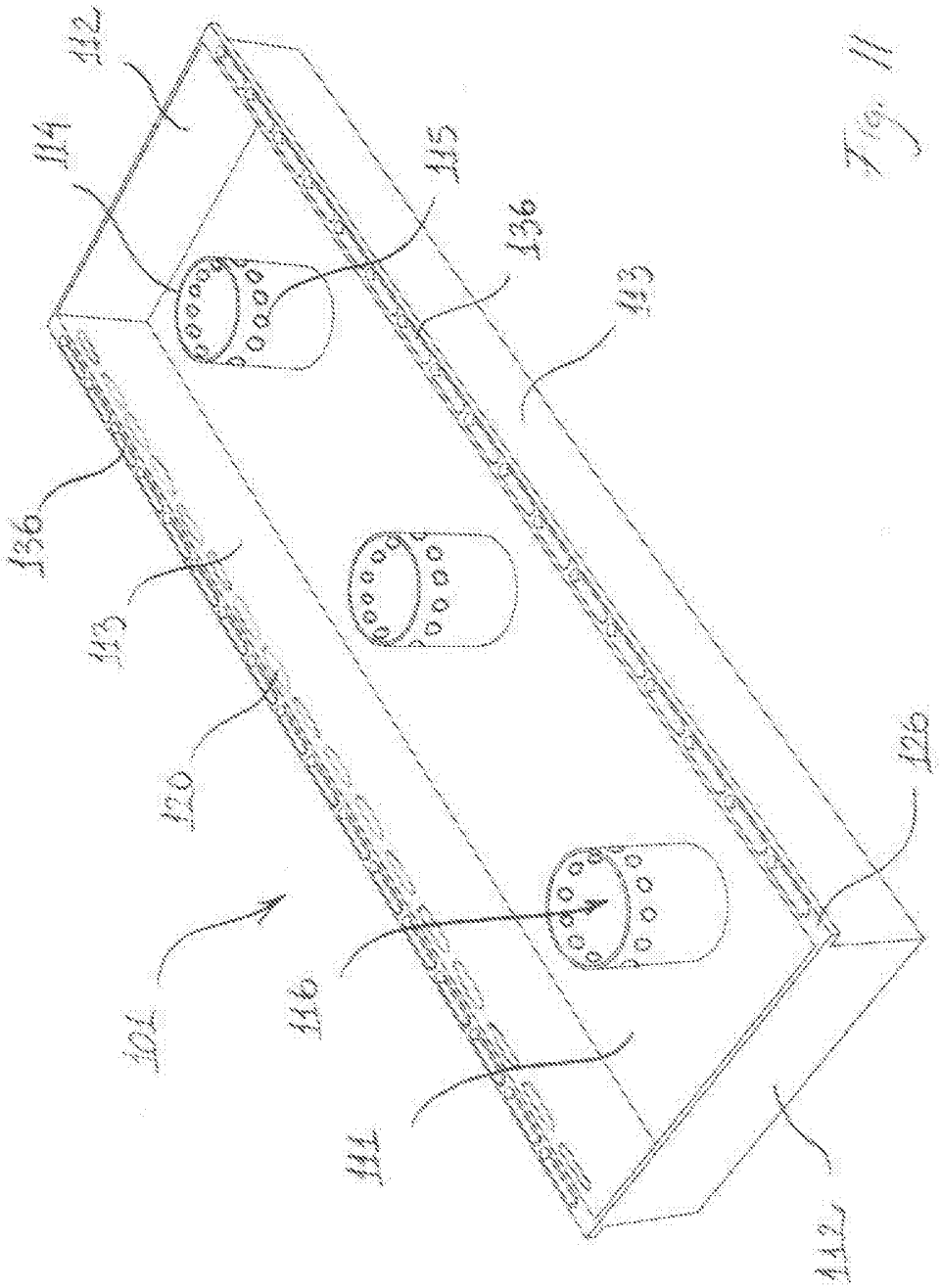

Fig. 11

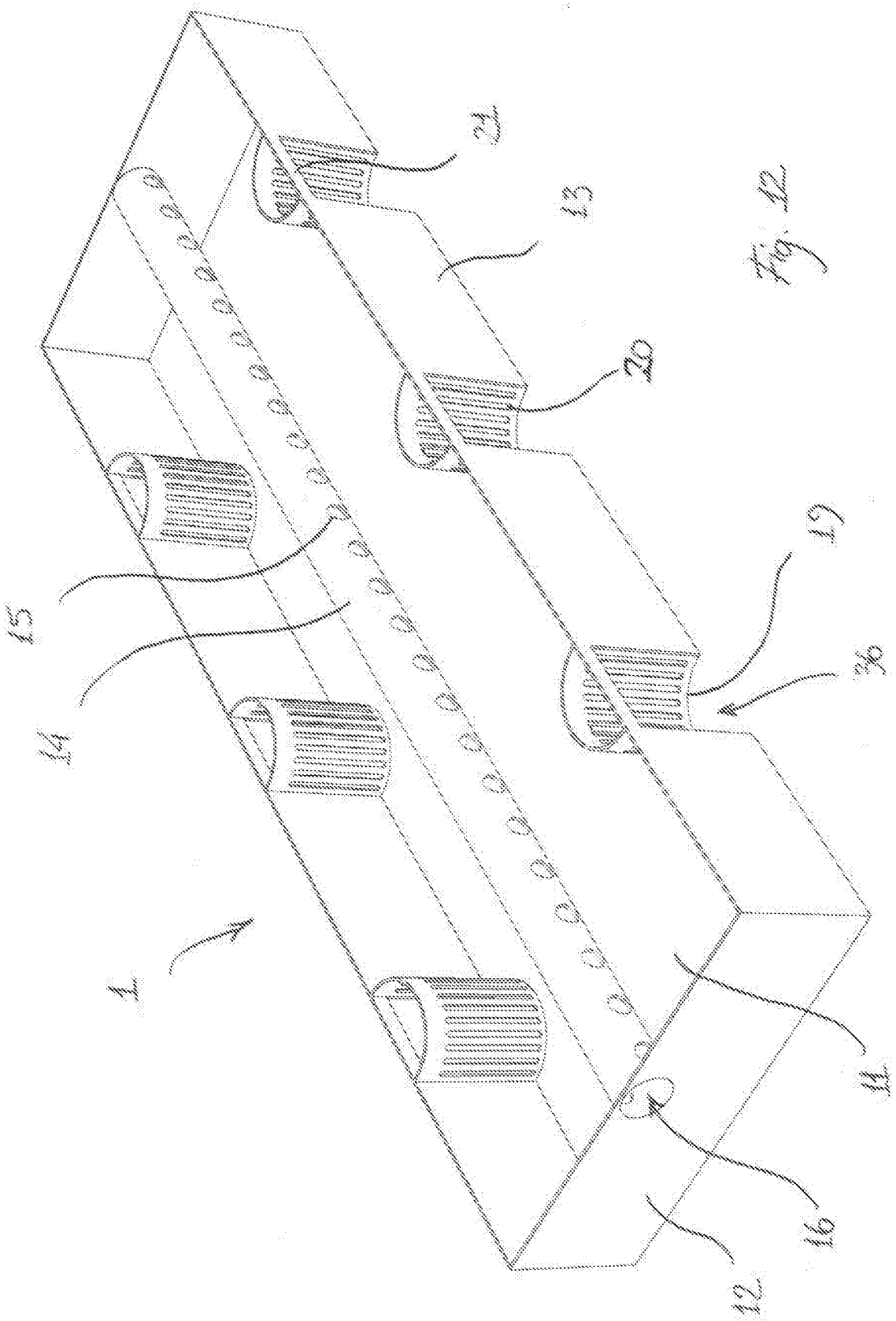

Fig. 12