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(54) **Horizontal refrigerated display cabinet for assisted service or self-service**

Horizontales gekühltes Anzeigegehäuse für Bedienung oder Selbstbedienung

Armoire à vitrine horizontale réfrigérée pour service assisté ou self-service

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Description

Field of application

[0001] The present invention relates to a horizontal refrigerated display cabinet for assisted service or self-service.

[0002] "Refrigerated display cabinet" refers to medium temperature cabinets, that is, cabinets capable of ensuring product storage temperatures close to zero (typically comprised between -1°C and 5°C, or between -1°C and 7°C).

Prior art

[0003] As known, a horizontal refrigerated display cabinet for assisted service or self-service comprises an insulated tank V with shaped bottom, provided at the bottom with resting means on ground G. An example of this type of cabinet is shown in figures A and B.

[0004] More in detail, as can be seen in particular in figure A (where the components of the cooling system are not shown so as to better highlight the inner structure of tank V), the volume delimited by tank V is divided - by a removable intermediate bottom R (substantially horizontal) - into an upper volume or loading space VC, wherein the goods on sale are displayed, and a lower volume or technical space VT, not visible from the exterior, wherein the components of the air cooling system (evaporator, fans, expanders, etc.) are arranged.

[0005] Along the direction of longitudinal development of the display cabinet it is possible to identify a back side L1 on tank V, wherefrom the goods are loaded into the loading space VC and behind which the clerk works in case of assisted service, and a front side L2, facing the customers. At the two ends, tank V is closed by two shaped walls H that also serve as support for the intermediate bottom R.

[0006] More in detail, at the back side L1 tank V exhibits a raised edge B1 which serves as parapet for the clerk and on the top whereof a support surface Q is made. At the front side L2 tank V exhibits an edge B2 that slightly exceeds the height of the removable intermediate bottom R and whereon a transparent wall T, normally of glass, is applied with the function of window.

[0007] In the case of cabinets for assisted service, the transparent wall T has such height development as to prevent access to the loading space VC; in the case of cabinets for self-service, the transparent wall T has a limited height development, such as to allow free access to the loading space directly from the front side.

[0008] As known, the cooling of the loading space takes place by continuous circulation of a cold air current A by the entire longitudinal development of the cabinet on a substantially vertical plane arranged transversally to the tank. The air current A further creates a curtain of moving air that allows thermally separating the loading space (open at the top) from the warmer outer environment.

[0009] The air circulation is ensured by a plurality of fans arranged into the technical space. To this end, the removable bottom R, which separates the loading space from technical space, is sized so as to leave a first A1 and a second A2 longitudinal opening respectively open along the back side L1 and along the front side L2 of tank V.

[0010] As known, the air cooling system comprises in a sequence, following the air flow, a series of fans F distributed on the length of the cabinet, air expansion means P suitable for making the air flow in output from fans V even, and an evaporator E that substantially extends by the entire length of the cabinet and is suitable for cooling the air coming from the loading space.

[0011] Operatively, the air coming from the loading space is sucked in through the second opening A2 (i.e. parallel to the front side), enters the technical space VC where - suitably channelled - it passes through fans F, the air expansion means P and the evaporator E to return to the loading space coming out of the first opening A1 (i.e. parallel to the back side).

[0012] During the cabinet operation, the intermediate bottom R must be kept in its horizontal position, since it serves not only to screen the technical space but it also serves for confining the air that flows into the technical space. In order to vary the height or inclination of the display surface of the goods on sale, the cabinet is normally provided with an additional shelf S intended for being superimposed to the intermediate bottom R in different positions or heights, as illustrated for example in Figure A.

[0013] As can be seen in Figure A, the second opening A2 (hereinafter for simplicity, return opening) substantially develops at the level of the removable bottom R, whereas the first opening A1 (hereinafter for simplicity delivery opening) is obtained in a higher position, just below the support surface Q for the clerk obtained on the parapet. Air A is conveyed from the loading space to the fans by a substantially horizontal return channel C2 obtained in the technical space; from the technical space it is then conveyed to the delivery opening through a vertical delivery channel C2 delimited by parapet B1 and by a partition wall D parallel thereto.

[0014] This arrangement of the return and delivery openings allows imposing a descending motion to the air current from the back side to the front side.

[0015] As known, a first constraint to the manufacture of a horizontal refrigerated display cabinet is given by the need of maximising the ratio between total display area of the cabinet and its overall plan dimensions. In other words, defining the total display area, the attempt is to minimise the overall plan dimensions, that is, the surface occupied by the cabinet.

[0016] A second constraint is given by the need of imparting an appearance as slim and slender as possible to the display cabinets. With the same overall height of the display cabinet and height from the ground of the

removable intermediate bottom, this effect is obtained in the first place by relieving the shape of the front side of the cabinet and in the second place by rising as much as possible the bottom of tank V.

[0017] An attempt is therefore made to shape the tanks so that the prevalent part of the volume used for the technical space is moved as much as possible towards the back side, thus leaving only the volume strictly required for the correct conveyance of the return air to the fans towards the front side.

[0018] Finally, an attempt is made to reduce the mean height of the technical space as much as possible.

[0019] Based on the above dimensional constraints of the tanks and on the need of ensuring an acceptable energy performance in the field it is recognised that for the horizontal refrigerated display cabinets for self-service or assisted service, the best solution envisages the insertion of the evaporator into the air delivery channel C1, that is, into the channel obtained set against parapet B1 on the back side L1 of the cabinets.

[0020] Constructively, since the dimensions of the second air delivery channel C1 limited in horizontal direction by the need of not subtracting volume to the loading space, evaporator E must necessarily take an elongated shape in the vertical development direction of the delivery channel C1.

[0021] More in detail, taking as a reference a section of the evaporator made along a vertical plane orthogonal to the longitudinal development direction of the cabinet (see figure B), in the prior art solutions the evaporators take shapes characterised by a ratio between dimension LT transversal to the flow and dimension LP parallel to the flow below 0.5. Usually, the value of such ratio LT/LP is close to 0.25.

[0022] The selection made on the evaporator reflects on the dimensions and on the arrangement of the fans.

[0023] As known, in the loading space the air flow must have such velocity as to ensure both a sufficient thermal exchange with the loading space, and a suitable effect of thermal confining (the flow must not bee too turbulent so as to not incorporate ambient air).

[0024] In the horizontal refrigerated display cabinets currently widespread on the market (cabinets long about 2.50 m), to generate an air flow with suitable velocitys, the pressure drops that must be exceeded inside evaporators with the features defined above require nominal electrical powers at the fans of at least 80 Watts. Generally at least two fans are adopted, each with nominal electrical power of about 40 Watts and rotor diameter comprised between about 180 and 220 mm.

[0025] The selection of dimensions and power of the single fans is substantially the same also for similar cabinets, but having different lengths. The number of fans varies based on the length: 2 fans are adopted for 2.5 m cabinets, whereas 3 fans are adopted for 3.75 m cabinets.

[0026] Considering the dimensions of the technical space in vertical direction (that generally does not vary with the cabinet length) and substantial impossibility of lowering the tank bottom (for aesthetic reasons) or lifting the removable bottom R (so as to not reduce the volume of the loading space), the fans must be arranged with the axis of rotation z of the rotor substantially vertical, as schematised in Figure B.

[0027] While the prior art solution described above allows making display cabinets on the overall satisfactory from an aesthetic and functional point of view, however it exhibits a series of disadvantages.

[0028] A first disadvantage is related to the poor accessibility of the evaporator. In fact, to access the evaporator it is necessary to remove the vertical partition wall D that separates it from the loading space. This greatly complicates the periodical cleaning operations of the evaporator.

[0029] Another disadvantage is related to the fact that the evaporator substantially is in direct contact with the goods arranged in the proximity of parapet B1. In fact, given the need of maximising the loading space, wall D that separates the evaporator from the loading space generally consists of a simple metal sheet not insulated that can therefore be a suitable thermal barrier. Therefore, there is the risk that uneven temperature conditions set into the loading space, with the goods arranged in the proximity of parapet B1 at temperatures considerably lower that the goods arranged farther from the parapet.

[0030] A further disadvantage is related to the fact that the air flow in output from the fan must undergo a series of sudden deviations before entering the evaporator. This determines the onset of unevenness in the air flow A at the inlet of the evaporator. As a consequence, the thermal exchange does not occur in perfect counter current and the thermal exchange surface therefore is not used in an optimum manner, to the disadvantage of the energy performance of the refrigerated display cabinet.

[0031] Another disadvantage is related to the fact that the arrangement of the fans with vertical axis z of the rotor imposes the creation of a suitable suction chamber of the air in the area below the fan. This complicates the shape of the return channel C2 that brings the air from the return opening A1 to fan V, with unavoidable increase of pressure drops.

[0032] As known, the periodical cleaning operations of the cabinets are carried out by water jets. The arrangement of the fan with vertical axis rotor z makes the motor directly accessible from the top, which is therefore easily exposed to the entrance of the liquids. This makes the adoption of means suitable for screening the fan at the top necessary. This is to the disadvantage of the cabinet construction simplicity. A horizontal refrigerated display cabinet according to the preamble of claim 1 is known fromEP1410746 A1.

Disclosure of the invention

[0033] The object of the present invention therefore is to eliminate the disadvantages of the prior art mentioned

above by providing a horizontal refrigerated display cabinet for assisted service or self-service which should have higher energy performance than that of the prior art solutions.

[0034] A further object of the present invention is to provide a horizontal refrigerated display cabinet for assisted service or self-service which should allow simplifying the evaporator cleaning operations.

[0035] A further object of the present invention is to provide a horizontal refrigerated display cabinet for assisted service or self-service which should not require screening means for the fan.

Brief description of the drawings

[0036] The technical features of the invention, according to the above objects, are clearly found in the contents of the claims below and the advantages of the same will appear more clearly from the following detailed description, made with reference to the annexed drawings, which show a purely exemplifying and non-limiting embodiment thereof, wherein:

[0037] - Figure 1 shows a cross cutaway view of a refrigerated display cabinet for assisted service ;

[0038] - Figure 2 shows a cross cutaway view of the refrigerated display cabinet of Figure 1 in a version for self-service;

[0039] - Figure 3 shows a cutaway front view of the display cabinet shown in Figure 1 according to line III - III indicated therein;

[0040] - Figure 4 shows a cross cutaway view of a horizontal display cabinet for assisted service ;

[0041] - Figure 5 shows a detailed view of the cabinet shown in Figure 4 relating to a ventilated removable intermediate bottom; and

[0042] - Figure 6 shows a partial side perspective view of a refrigerated display cabinet for assisted service according to a preferred embodiment of the invention, with some parts removed to better highlight other ones.

Detailed description

[0043] With reference to the annexed drawings, reference numeral 1 globally denotes a horizontal display cabinet for self-service or assisted service.

[0044] "Refrigerated display cabinet" refers to medium temperature cabinets, that is, cabinets capable of ensuring product storage temperatures close to zero (typically comprised between -1°C and 5°C, or between -1°C and 7°C).

[0045] In accordance with Figures 1 and 6, the horizontal refrigerated display cabinet 1 comprises an insulated tank 2 with shaped bottom, raised from the ground by support means 3 (not shown in Figure 6).

[0046] Advantageously, the support means 3 may be of any type and, for example, they may comprise support legs or, as an alternative, a box structure.

[0047] More in detail, the volume delimited by tank 2 is divided - by a removable intermediate bottom 4 (substantially horizontal) - into an upper volume or loading space 5, wherein the goods on sale are displayed, and a lower volume or technical space 6, not visible from the exterior, wherein the components of the air cooling system (evaporator 8, fans 7, air expansion means 18, etc.) are arranged.

[0048] As can be seen in particular from Figures 3 and 6, the display cabinet 1 has a development mainly in the longitudinal direction x.

[0049] Parallel to the direction of longitudinal development x of the display cabinet, on tank 2 it is possible to identify a back side 2', wherefrom the goods are loaded into the loading space 5 and behind which the clerk works in case of assisted service, and a front side 2", facing the customers.

[0050] At the two ends, tank 2 is closed by two shaped walls 16 that also serve as support for the intermediate bottom 4.

[0051] More in detail, at the back side 2' tank 2 exhibits a raised edge 9 that serves as parapet for the clerk and on top whereof a support surface 17 is made.

[0052] At the front side 2", tank 2 exhibits an edge that slightly exceeds by height the removable intermediate bottom 4 and whereon a transparent wall 10, normally of glass, is applied with the function of window.

[0053] In the case of cabinets for assisted service (see figure 1), the transparent wall 10 has such height development as to prevent access to the loading space 5; in the case of cabinets for self-service (see figure 2), the transparent wall 10 has a limited height development, such as to allow free access to the loading space 5 directly from the front side 2".

[0054] Functionally, the cooling of the loading space 5 takes place by continuous circulation of a cold air current A on a substantially vertical plane arranged transversally to tank 2. The air current A, besides exchanging heat with the loading space and thus with the goods displayed therein, further creates a curtain of moving air that allows thermally separating the loading space 5 (open at the top) from the warmer outer environment.

[0055] Operatively, as will be explained hereinafter, the air circulation is ensured by a plurality of fans 7 arranged into the technical space 5.

[0056] To this end, the removable intermediate bottom 4, which separates the loading space 5 from technical space 6, does not extend from one side to the other of tank 2 but is sized so as to leave a first longitudinal opening 11 and a second longitudinal opening 12 respectively open along the back side 2' and along the front side 2" of tank V.

[0057] Advantageously, the air cooling system comprises in a sequence, following the air flow, a series of fans 7 distributed on the length of cabinet 1 and, downstream of the fans, an evaporator 8 that extends by the entire length of the cabinet and is suitable for cooling the air coming from the loading space 5.

[0058] Preferably, the cooling system also comprises

air expansion means 18 arranged downstream of the fans and upstream of evaporator 8, essentially having the function of making the air flow in output from fans 7 even.

[0059] Functionally, the air coming from the loading space 5 is sucked in through the second opening 12, enters the technical space 6 where - suitably channelled - it passes through fans 7, the air expansion means 18 and then evaporator 8 to return to the loading space 5 coming out of the first opening 11.

[0060] As can be seen in particular in Figure 1, the second opening 12 (that serves as return opening of the air to the technical space 5) develops in longitudinal direction, substantially at the level of the removable intermediate bottom 4. The first opening 11 (that serves as delivery opening of the air into the loading space 6) always develops in longitudinal direction, but in a higher position than the second opening, preferably in the proximity of the top of parapet 9, just below the support surface 17.

[0061] More in detail, as illustrated in Figures 1, 2 and 4, once it has entered into the technical space 5 through the second (return) opening 12, air A is conveyed to the fans by a shaped return channel 22. In output from the technical space 6, the air is conveyed to the first (delivery) opening 11 through a vertical delivery channel 21 delimited by parapet 9 and by a partition wall 24 parallel thereto.

[0062] This arrangement of the return 12 and delivery 11 openings allows impressing a descending motion to the cold air flow from the back side 2' of tank 2 to the front side 2'.

[0063] During the operation of the refrigerated cabinet 1, the intermediate bottom 4 must be kept in its horizontal position, since it serves not only to screen the technical space 5 from the inlet of residues and/or liquids, but also to confine air A that after having flown into the loading space 6, returns into the technical space 5.

[0064] Advantageously, in order to vary the height or inclination of the display surface of the goods on sale, cabinet 1 is provided with an additional shelf (not shown in the attached figures) intended for being superimposed to the intermediate bottom 4 at different heights and with different inclinations (leaving the air delivery and return openings free).

[0065] According to an essential aspect, evaporator 8 and fans 7 are arranged below the removable intermediate bottom 4 and are oriented so that the air circulating into the technical space 6, remaining substantially parallel to the intermediate bottom 4, crosses them without undergoing sudden deviations.

[0066] The expression "below the intermediate bottom" means that - unlike the prior art solutions - evaporator 8 does not invade the second channel 23 (of air delivery). In some embodiment solutions (not shown in the annexed Figures) evaporator 8 may optionally protrude beyond the back edge of the intermediate bottom 4, but it must remain below the horizontal plane defined by the bottom itself.

[0067] The expression "substantially parallel to the intermediate bottom" means that the air circulating into the technical space 5 on the average keeps the same direction y crossing the technical space and that such mean direction y is defined as parallel to the plane passing by the intermediate bottom 4. However, this expression comprises also not perfectly parallel flows related to variations of direction of the air flow originated by the shaping of the bottom of tank 2. For example, at the return channel 22 the bottom of tank 2 is diverging relative to the bottom and determines an enlargement of the free flow section passing by the front side 2" to the back side 2' of tank 2 (as illustrated in Figures 1, 2 and 4).

[0068] According to another essential aspect, evaporator 8 is sized so that relative to a vertical section plane, orthogonal to the longitudinal development direction x of the cabinet (plane relative whereto the cutaway views of Figures 1, 2, 4 and 5) were made, the ratio between its dimension LT transversal to the flow direction y and its dimension LP parallel to the above direction y is not less than 0.5 and not higher than 1.

[0069] Preferably, the evaporator is of the finned pack type.

[0070] According to the preferred embodiment illustrated in Figure 1 or 2, the evaporator is of the finned pack type, that is, it comprises a plurality of tubes, connected in a series at the ends thereof by elbows, thus making one or more coils wherein the coolant preferably circulates in counter current relative to the air flow. The tubes are arranged parallel to each other along the longitudinal development direction x of cabinet 1. Orthogonal to the axis of the tubes (i.e parallel to the air flow direction y), aluminium plates (fins) are arranged at regular distances suitable for increasing the thermal exchange surface.

[0071] More in detail, the evaporator is made with a ratio LT/LP equal to 1. The finned pack exhibits, for example, along the surface transversal to the air flow a series of 4 tubes and along the direction parallel to the air flow a series of 4 tubes, globally making a solution with 16 tubes, connected to form one or more circuits.

[0072] In accordance with the preferred embodiment illustrated in Figure 4, the evaporator is still of the finned type.

[0073] More in detail, the evaporator may be made, for example, with a ratio LT/LP equal to 0.5 or with a ratio equal to 0.67.

[0074] In the particular case of ratio LT/LP equal to 0.5, the finned pack exhibits, for example, along the surface transversal to the air flow a series of 4 tubes and along the direction parallel to the air flow a series of 8 tubes, globally making a solution with 32 tubes, connected to form one or more circuits.

[0075] In the particular case of ratio LT/LP equal to 0.67, the finned pack exhibits, for example, along the surface orthogonal to the air flow a series of 4 tubes and along the direction parallel to the air flow a series of 6 tubes, globally making a solution with 24 tubes, connect-

ed to form one or more circuits.

[0076] Preferably, in all the solutions described above, the distance between the tubes along the above direction transversal to the air flow is equal to the distance between the tubes along the direction parallel to the flow, thus forming a square pitch. For example, such distance may be equal to 35 mm.

[0077] Advantageously, the distance between the aluminium fins is comprised between 10 mm and 5 mm and preferably it is equal to 7 mm.

[0078] Advantageously, pitches other than the square one may be adopted, for example a triangular pitch.

[0079] By sizing the evaporator as specified above, the extension in longitudinal direction x being equal, compared to the prior art solutions shown, the free flow surface is increased. This has the consequence of decreasing the pressure drops.

[0080] Surprisingly, it has been found that the thermal exchange surface and the delivery cold air flow velocity being equal, compared to the prior art solutions, thanks to the invention the decrease of pressure drops through the evaporator is such as to allow a reduction between 25% and 30% of the nominal electrical power absorbed by the fans.

[0081] Advantageously, the reduction of the nominal electrical power absorbed to the fans allows the adoption of lower power fans, preferably comprised between 12 and 16 Watts.

[0082] Advantageously, fans with these nominal electrical powers may be made in very compact shapes, preferably with a diameter of the rotor comprised between 100 mm and 140 mm.

[0083] Constructively, given the considerably smaller dimensions of the rotors, it is possible to arrange the fans with the axis of rotation z of the rotor substantially horizontal (or parallel to the plane defined by the removable intermediate bottom 4), as illustrated in the annexed Figures.

[0084] From the one side, compared to the prior art solutions, it is possible not to increase the height of the technical space 6, and on the other side it is possible to arrange the evaporator 8 and the fans 7 "in line" with each other. In other words, the air flow in output from the fans is already in the ideal direction of crossing of the evaporator, that is, in the direction that allows minimising the pressure drops and maximising the use of the thermal exchange surface.

[0085] Unlike what happens in the prior art solutions, the "in line" arrangement of the fans and of the evaporator along direction y with which the circulating air crosses the technical space makes the flow more constant and even, since no sudden changes of direction are provided. This leads to a further favourable reduction of pressure drops.

[0086] Moreover, it should be noted that the greater evenness with which the air flow impinges the evaporator allows improving the use of the thermal exchange surface. Thus, the evaporator power being equal, it is possible to reduce the thermal exchange surface and thus adopt smaller size evaporators.

[0087] In addition, the increase of the free flow surface has beneficial effects also in relation to the ice forming phenomenon on the thermal exchange surface.

[0088] More in detail, the ice mass formed inside the evaporator being equal, the solution according to the invention offers a larger deposition surface than in the prior art solutions. As a consequence, a reduction of the thickness of the ice layer is obtained. The smaller ice thickness formed leads to a lower obstruction of the free passage surface, with positive effects both on pressure drops (and thus on the power absorbed by the fans) and on the defrosting times.

[0089] In fact, compared to prior art solutions, in the refrigerated display cabinets, other conditions being equal, defrosting is necessary after a longer period, that is, after the deposition of a greater mass of ice.

[0090] Preferably, as illustrated in Figures 1, 2 and 3, evaporator 8 and fans 7 are arranged in the zone of the technical space close to the back side 2' of tank 2. In this way, tank 2 can be shaped with the prevalent part of the volume used for the technical space 5 arranged in the proximity of the back side 2'. The external shapes of the tank can thus be "relieved" to the advantage of the overall aesthetics of the cabinet.

[0091] Advantageously, to this end, evaporator 8 is arranged in the proximity of the inlet of the air delivery channel 21.

[0092] Preferably, in order to prevent a narrowing at the inlet of the delivery channel 21, evaporator 8 does not invade the inlet of such channel, but is arranged at most flush with the partition wall 24.

[0093] According to an embodiment, illustrated in Figures 1 and 2, evaporator 8 is sized so that the ratio between its dimension LT transversal to the flow direction y and its dimension LP parallel to the above direction y is comprised between 0.8 and 1. Preferably, such ratio is equal to 1.

[0094] This first solution is preferably adopted for refrigerated display cabinets intended for receiving food that may be stored in a range of temperature comprised between - 1°C and +7°C, as in the case of milk products and packaged products.

[0095] According to a second embodiment, illustrated in Figures 4 and 5, evaporator 8 is sized so that the ratio between its dimension LT transversal to the flow direction y and its dimension LP parallel to the above direction y is comprised between 0.6 and 0.8. Preferably, such ratio is equal to 0.67.

[0096] The above second solution is preferably adopted when for reasons related to the type of food displayed in the loading space (for example, in the case of meat) it is necessary to decrease the cold air flow velocity.

[0097] Operatively, to compensate the decrease of thermal exchange due to the flow velocity decrease, the overall thermal exchange surface is increased. Wanting to keep the free flow surface unchanged (and in particular

the cross dimension LT, since it defines the overall height of the evaporator) the parallel dimension LT increases. It has been noted that the advantages described above can be obtained up to values of the ratio LT/LP not below 0.5.

[0098] In accordance with the invention, illustrated in particular in Figures 4 and 5, the removable intermediate bottom 4 exhibits an inner cavity 15 which extends by the entire planar length of bottom 4.

[0099] Preferably but not necessarily, the intermediate bottom 4 is not made in a single piece but is divided into a plurality of transversal elements that extend from partition wall 24 to the second (return) opening 12. In this case, every single transversal element defines its own inner cavity.

[0100] Advantageously, as illustrated in Figure 5, on the intermediate bottom 15 there are obtained a back opening 15', which puts into communication the inner cavity 15 with the delivery channel 21, and a front opening 15", which puts directly into communication the inner cavity 15 with the technical space 6 at the return channel 22 in the proximity of the second opening 12.

[0101] Functionally, the above inner cavity 15 allows the circulation of a cold air flow inside the intermediate bottom 4. A ventilated shelf is thus obtained.

[0102] Preferably, the walls of the above inner cavity 15 are insulated at least in some portions through layers of insulating material 20. The insulated portions are selected so that the thermal exchange between the cold air flow A inside cavity 15 and the top surface of bottom 4 (intended for contacting the goods on sale) only or mainly occurs in the front portion of the intermediate bottom 4.

[0103] More in detail, as illustrated in Figure 5, the intermediate bottom 4 is constituted of a metal box structure. The top wall of the box structure is provided with a layer of insulating material only as regards the portion that extends from the partition wall substantially up to half of the bottom 4. The remaining portion of the wall, on the contrary, is free from insulation. On the contrary, the bottom wall of the box structure is provided with a layer of insulating material only as regards the portion that extends from half of the bottom 4 to the front edge, that is, where the front opening 15" of the inner cavity 15 is made.

[0104] Functionally, thanks to the shape of the ventilated bottom, the cold air flow circulating into the inner cavity 15 can exchange heat with the top plate only starting from half the shelf, that is, at the front volume of the loading space.

[0105] Advantageously, the arrangement and the relative extension of the different insulating layers may vary according to the specific operating requirements.

[0106] Preferably, the inner cavity 15 is sized so that a fraction of the total mass flow rate of circulating cold air circulates therein, comprised between 10% and 20%, and preferably equal to 15%.

[0107] Preferably, but not necessarily, the intermediate ventilated shelf is adopted in refrigerated display cabinets 1 intended for displaying food for which storage conditions with more restricted temperature ranges (for example in the case of meat, the temperature in the loading space must be kept in a range comprised between -1°C and + 5°C) are required.

[0108] In these cases, the adoption of a ventilated shelf as described above allows cooling in a targeted manner the intermediate bottom just at the volume of the loading space that unavoidably receives a less cold air flow and that therefore could not remain within the desired temperature ranges.

[0109] Preferably, but not necessarily, the ventilated shelf is adopted in refrigerated display cabinets provided with evaporators with LT/LP ratio comprised between 0.6 and 0.8, as illustrated in Figures 4 and 5.

[0110] Advantageously, evaporator 8 and the fans are arranged separate from the removable intermediate bottom 4, so as to form an air space 14 thereinbetween. During the operation of cabinet 1, air space 14 is intended to fill with air that from the loading space circulates to the technical space and which therefore has not been cooled yet. An air cushion therefore creates into the air space that acts as thermal barrier. In this way, the direct thermal exchange between evaporator 8 and the intermediate bottom 4 is prevented or at least is greatly reduced, which would otherwise have as a consequence a preferential cooling of the volume of the loading space 5 above the evaporator.

[0111] This device is preferably adopted in the refrigerated display cabinets 1 according to the invention with intermediate bottom not ventilated, where the lack of insulation would make this phenomenon stronger.

[0112] Thanks to the invention it is possible to improve the energy performance of a horizontal refrigerated display cabinet for assisted service or self-service.

[0113] The improvement of the energy performance results both from the decrease of the pressure drops (and thus of the nominal electrical power absorbed by the fans with the flow rate of circulating air being equal), and from the greater use of the thermal exchange surface allowed by the greater evenness with which the air flow impinges the evaporator.

[0114] The decrease of pressure drops is related not only to the increase of the free flow surface in the evaporator, but also to the fact that the air flow undergoes a smaller number of sudden variations of direction in the passage from the second (return) opening 12 to the first (delivery) opening 11.

[0115] The arrangement of the fans with horizontal rotation axis, besides allowing the "alignment" of the fans with the evaporator, obtaining the favourable effects already mentioned, also allows simplifying the shape of the air return channel. In fact, since the air needs not be conveyed below the fans (in special suction chambers), two 90° curves are eliminated from the path.

[0116] In addition, since the fan motor is not directly accessible from the top, as it is screened by the case of the fan itself, it is not necessary anymore to setup special

means suitable for screening the motor from any liquid infiltrations.

[0117] The arrangement of the evaporator below the removable intermediate bottom finally allows easier access to the evaporator directly from the loading space, since it is sufficient to lift the removable intermediate bottom.

[0118] The invention thus conceived thus achieves the intended purposes. Of course, in the practical embodiment thereof, it may take shapes and configurations differing from that illustrated above without departing from the present scope of protection. Moreover, all the parts may be replaced by technically equivalent ones and the sizes, shapes and materials used may be whatever according to the requirements.

Claims

1. Horizontal refrigerated display cabinet for assisted service or self-service, provided with a tank (2) which is raised from the ground by support means (3) and is internally divided by a removable intermediate bottom (4) in a top loading space (5) for displaying the goods on sale, and a bottom technical space (6), wherein there are arranged fans and at least one evaporator (8) for generating a circulation of cold air (A) in said loading space (5), said tank (2) being provided on its back side (2') with a parapet (9) and on its front side (2") with a transparent wall (10), said cold air (A) entering the loading space (5) trough a first opening (11) obtained in the proximity of the top of said parapet (9) and returning to said technical space (8) through a second opening (12) obtained in the proximity of said front side (2"), the air being conveyed from said technical space (6) to said first opening (11) through a delivery channel (21) obtained adjacent to said parapet (9), said cabinet (1) being **characterised in that** said evaporator (8) and said fans (7) are arranged below said intermediate bottom (4) and are oriented so that the air circulating into said technical space (6), remaining substantially parallel to said intermediate bottom (4), crosses them without undergoing sudden deviations, said evaporator (8) being sized so that relative to a vertical section plane orthogonal to a longitudinal development direction (x) of said cabinet (1), the ratio between its dimension (LT) transversal to the flow direction and its dimension (LP) parallel to the flow direction is not less than 0.5 and not higher than 1 and **in that** said removable intermediate bottom (4) exhibits an inner cavity (15), that extends by the entire extension of said bottom (4) and that communicates with said delivery channel (21) by a back opening (15') and directly with said technical space by a front opening (15") obtained in the proximity of said second opening (12), said cavity (15) allowing the circulation of a cold air flow said bottom (4).

2. Horizontal refrigerated display cabinet according to claim 1, wherein said fans are arranged with the rotor axis substantially parallel to said removable intermediate bottom (4),

3. Horizontal display cabinet according to claim 1 or 2, wherein said fans have a nominal electrical power comprised between 12 and 16 Watts.

4. Horizontal display cabinet according to one of the previous claims, wherein said fans have a rotor with diameter comprised between 100 and 140 mm,

5. Horizontal refrigerated display, cabinet according to any one of the previous claims, wherein said evaporator (8) is arranged so that the circulating air crosses it in an ideal manner for the purposes of the thermal exchange remaining substantially parallel to said removable intermediate bottom (4).

6. Horizontal refrigerated display cabinet according to any one of the previous claims, wherein said evaporator (8) is arranged in the proximity of the inlet of said delivery channel (21).

7. Horizontal display cabinet according to any one of the previous claims, said evaporator (8) is of the tube bundle type.

8. Horizontal refrigerated display cabinet according to any one of the previous claims, wherein said evaporator (8) and said fans (7) are arranged in the zone of said loading space close to said back side (2').

9. Horizontal refrigerated display cabinet according to any one of the previous claims, wherein in said evaporator the ratio between its dimension (LT) transversal to said flow direction and its dimension (LP) parallel to said flow direction is comprised between 0,8 and 1.

10. Horizontal refrigerated display cabinet according to any one of claims 1 to 8. wherein in said evaporator the ratio between its dimension (LT) transversal to said flow direction and its dimension (LP) parallel to said flow direction is comprised between 0.6 and 0.8 and preferably is equal to 0.67.

11. Horizontal refrigerated display cabinet according to any one of the previous claims, wherein said intermediate bottom and said evaporator (8) and said fans there is an air space (14) which is intended for filling with air circulating from said loading space into said technical space so as to act as thermal barrier.

12. Horizontal refrigerated display cabinet according to any one of the previous claims, wherein at least some portions of the of of said cavity (15) are insulated so

the thermal exchange between said cold air flow (A) inside said cavity (15) and the top surface of said bottom (4) intended for contacting the goods on sale only or mainly occurs in a front portion of said intermediate bottom (4).

13. horizontal refrigerated display cabinet according to any one of the previous claims, wherein said inner cavity (15) is sized so that a fraction of the total mass flow rate of circulating cold air circulates therein, comprised between 10% and 2.0%, end preferably equal to 15%.

Patentansprüche

1. Horizontale Verkaufskühltheke zur Bedienung durch Personal oder zur Selbstbedienung, die mit einem Behältnis (2) versehen ist, das mittels Ab-stützmittel (3) mit Abstand zum Boden gehalten ist und im Inneren durch einen entfernbaren Zwischenboden (4) in einen oberen Beladeraum (5) zum Auslegen der Verkaufsware und in einen unteren Technikraum (6) aufgeteilt ist, wobei darin Gebläse (7) und wenigstens ein Verdunster (8) zum Erzeugen einer Zirkulation von kalter Luft (A) in dem Beladeraum (5) angeordnet sind, wobei das Behälternis (2) an seiner Rückseite (2') mit einer Brüstung (9) und an seiner Vorderseite (2 '') mit einer transparenten Wand (10) versehen ist, wobei die Kaltluft (A) in den Beladeraum (5) durch eine erste Öffnung (11) eintritt, die nahe der Oberkante der Brüstung (9) ausgebildet ist, und durch eine zweite Öffnung (12), die nahe der Vorderseite (2 '') ausgebildet ist, in den Technikraum zurück strömt, wobei die Luft von dem Technikraum (6) zu der ersten Öffnung (11) durch einen Zuführkanal (21) geleitet wird, der neben der Brüstung (9) ausgebildet ist, wobei die Theke **dadurch gekennzeichnet ist, dass** der Verdunster (8) und die Gebläse (7) unterhalb des Zwischenbodens (4) angeordnet und derart ausgerichtet sind, dass die Luft in den Technikraum (6) zirkuliert und dabei im Wesentlichen parallel zu dem Zwischenboden (4) verbleibt und den Verdunster und die Gebläse passiert, ohne plötzlichen Ablenkungen zu unterliegen, wobei der Verdunster (8) derart dimensioniert ist, dass bezüglich einer vertikalen Schnittebene, die sich orthogonal zu einer Längserstreckungsrichtung (X) der Theke (1) erstreckt, das Verhältnis zwischen der Länge (LT), die sicher quer zur Strömungsrichtung erstreckt, und der Länge (LP), die sich parallel zur Strömungsrichtung erstreckt, nicht weniger als 0,5 und nicht mehr als 1 beträgt und dass der entfernbare Zwischenboden (4) einen inneren Freiraum (15) aufweist, der sich über die gesamte Länge des Bodens (4) erstreckt und mit dem Zuführkanal (21) durch eine hintere Öffnung (15') und mit dem Technikraum unmittelbar durch eine vordere Öffnung (15''), die nahe der zweiten Öffnung (12) vorgesehen ist, in Verbindung steht, wobei der Freiraum (15) die Zirkulation eines Kaltluftstroms in dem Boden (4) ermöglicht.

2. Horizontale Verkaufskühltheke gemäß Anspruch 1, wobei die Gebläse mit der Rotorachse im Wesentlichen parallel zu dem entfernbaren Zwischenboden (4) angeordnet sind.

3. Horizontale Verkaufskühltheke gemäß Anspruch 1 oder 2, wobei die Gebläse eine elektrische Nennleistung zwischen 12 und 16 Watt aufweisen.

4. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei die Gebläse einen Rotor mit einem Durchmesser von 100 bis 140 mm aufweisen.

5. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei der Verdunster (8) derart angeordnet ist, dass die zirkulierende Luft diesen in einer idealen Weise für den Wärmeaustausch kreuzt, wobei sie im Wesentlichen parallel zu dem entfernbaren Zwischenboden (4) verbleibt.

6. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei der Verdunster (8) nahe dem Einlass des Zuführkanals (21) angeordnet ist.

7. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei der Verdunster (8) zum Rohrbündel-Typ gehört.

8. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei der Verdunster (8) und die Gebläse (7) in dem Bereich des Beladeraums nahe der Rückseite (2') angeordnet sind.

9. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei bei dem Verdunster das Verhältnis zwischen seiner Länge (LT), die sich quer zur Strömungsrichtung erstreckt, und seiner Länge (LP), die sich parallel zur Strömungsrichtung erstreckt, zwischen 0,8 und 1 beträgt.

10. Horizontale Verkaufskühltheke gemäß irgend einem der Ansprüche 1 bis 8, wobei bei dem Verdunster das Verhältnis zwischen seiner Länge (LT), die sich quer zur Strömungsrichtung erstreckt, und seiner Länge (LP), die sich parallel zur Strömungsrichtung erstreckt, zwischen 0,6 und 0,8, jedoch vorzugsweise 0,67 beträgt.

11. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei zwischen

dem Zwischenboden und dem Verdunster (8) und den Gebläsen ein Luftraum (14) vorhanden ist, der dazu gedacht ist, mit Luft gefüllt zu werden, die von dem Beladeraum in den Technikraum derart strömt, um als Wärmedämmschicht zu wirken.

12. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei wenigstens einige Abschnitte der Wände des Freiraums (15) derart isoliert sind, dass der Wärmeaustausch zwischen dem Kaltluftstrom (A) in dem Freiraum (15) und der oberen Fläche des Bodens (4), die dazu gedacht ist, mit der Verkaufsware in Kontakt zu treten, nur oder hauptsächlich in einem vorderen Abschnitt des Zwischenboden (4) eintritt.

13. Horizontale Verkaufskühltheke gemäß irgend einem der vorangehenden An-sprüche, wobei der innere Freiraum (15) derart dimensioniert ist, dass ein Bruchteil der gesamten Massestromrate der zirkulierenden Kaltluft in diesem zirkuliert und zwischen 10% und 20% beträgt und insbesondere gleich 15% ist.

Revendications

1. Armoire à vitrine horizontale réfrigérée pour service assisté ou self-service, équipée d'un réservoir (2) qui est surélevé par rapport au sol par des moyens de support (3) et qui est intérieurement divisé par un fond intermédiaire amovible (4) en un espace de chargement supérieur (5) pour exposer les produits à vendre, et un espace technique inférieur (6), dans lequel sont agencés des ventilateurs (7) et au moins un évaporateur (8) destinés à créer une circulation d'air froid (A) dans ledit espace de chargement (5), ledit réservoir (2) étant doté d'un parapet (9) sur son côté arrière (2') et d'une paroi transparente (10) sur son côté avant (2"), ledit air froid (A) pénétrant dans l'espace de chargement (5) à travers une première ouverture (11) pratiquée à proximité du sommet dudit parapet (9) et retournant vers ledit espace technique (6) à travers une deuxième ouverture (12) pratiquée à proximité dudit côté avant (2"), l'air étant transporté depuis ledit espace technique (6) jusqu'à ladite première ouverture (11) à travers un canal d'amenée (12) ménagé à proximité dudit parapet (9), ladite armoire (1) étant **caractérisée en ce que** ledit évaporateur (8) et lesdits ventilateurs (7) sont agencés en dessous dudit fond intermédiaire (4) et sont orientés de telle manière que l'air circulant dans ledit espace technique (6) en restant sensiblement parallèle audit fond intermédiaire (4) les croise sans subir de déviations brusques, ledit évaporateur (8) étant dimensionné de telle manière que, par rapport à un plan de coupe vertical orthogonal à une direction de développement longitudinale (x) de ladite armoire (1), le rapport entre sa dimension (LT) transversale à la direction d'écoulement et sa dimension (LP) parallèle à la direction d'écoulement ne soit pas inférieur à 0,5 et pas supérieur à 1 et **en ce que** ledit fond intermédiaire amovible (4) présente une cavité interne (15), qui s'étend sur toute l'extension dudit fond (4) et qui communique avec ledit canal d'amenée (21) par une ouverture arrière (15') et directement avec ledit espace technique par une ouverture avant (15") pratiquée à proximité de ladite deuxième ouverture (12), ladite cavité (15) permettant la circulation d'un courant d'air froid sur le côté intérieur dudit fond (4).

2. Armoire à vitrine horizontale réfrigérée selon la revendication 1, dans laquelle lesdits ventilateurs sont agencés avec l'axe du rotor sensiblement parallèle audit fond intermédiaire amovible (4).

3. Armoire à vitrine horizontale réfrigérée selon la revendication 1 ou 2, dans laquelle lesdits ventilateurs ont une puissance électrique nominale comprise entre 12 et 16 watts.

4. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle lesdits ventilateurs comportent un rotor avec un diamètre compris entre 100 et 140 mm.

5. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle ledit évaporateur (8) est agencé de telle manière que l'air en circulation le croise d'une manière idéale dans l'optique de l'échange de chaleur en restant sensiblement parallèle audit fond intermédiaire amovible (4).

6. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle ledit évaporateur (8) est agencé à proximité de l'entrée dudit canal d'amenée (21).

7. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle ledit évaporateur (8) est du type à faisceau de tubes.

8. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle ledit évaporateur (8) et lesdits ventilateurs (7) sont agencés dans la zone dudit espace de chargement tout près du côté arrière (2').

9. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle, dans ledit évaporateur, le rapport entre sa dimension (LT) transversale à ladite direction d'écoulement et sa dimension (LP) parallèle à ladite

direction d'écoulement est compris entre 0,8 et 1.

10. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications 1 à 8, dans laquelle, dans ledit évaporateur, le rapport entre sa dimension (LT) transversale à ladite direction d'écoulement et sa dimension (LP) parallèle à ladite direction d'écoulement est compris entre 0,6 et 0,8 et est de préférence égal à 0,67.

11. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle il existe, entre ledit fond intermédiaire et ledit évaporateur (8) et lesdits ventilateurs, un espace d'air (14) qui est destiné à se remplir d'air circulant dudit espace de chargement vers ledit espace technique de façon à faire office de barrière thermique.

12. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle au moins certaines parties des parois de ladite cavité (15) sont isolées de telle manière que l'échange de chaleur entre ledit courant d'air froid (A) à l'intérieur de ladite cavité (15) et la surface supérieure dudit fond (4) destinée à être en contact avec les produits à vendre se produise uniquement ou principalement dans une partie avant dudit fond intermédiaire (4).

13. Armoire à vitrine horizontale réfrigérée selon l'une quelconque des revendications précédentes, dans laquelle ladite cavité interne (15) est dimensionnée de telle manière qu'une fraction du débit massique total de l'air froid en circulation qui circule dans celle-ci soit comprise entre 10 % et 20 %, et soit de préférence égale à 15 %.

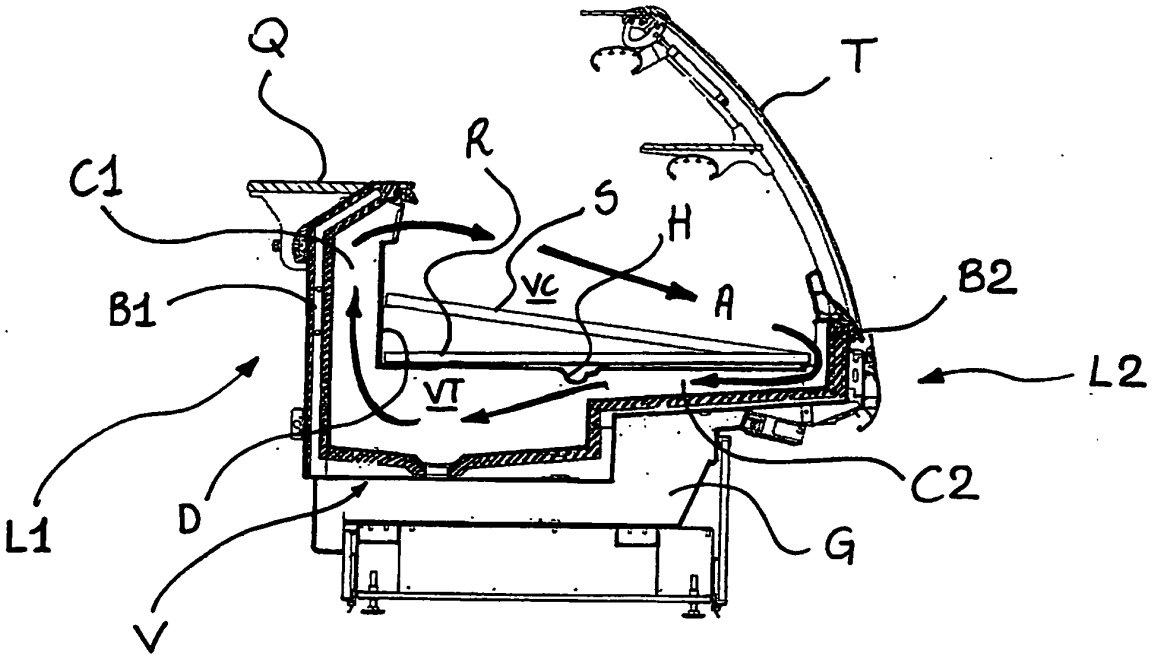

FIG. A

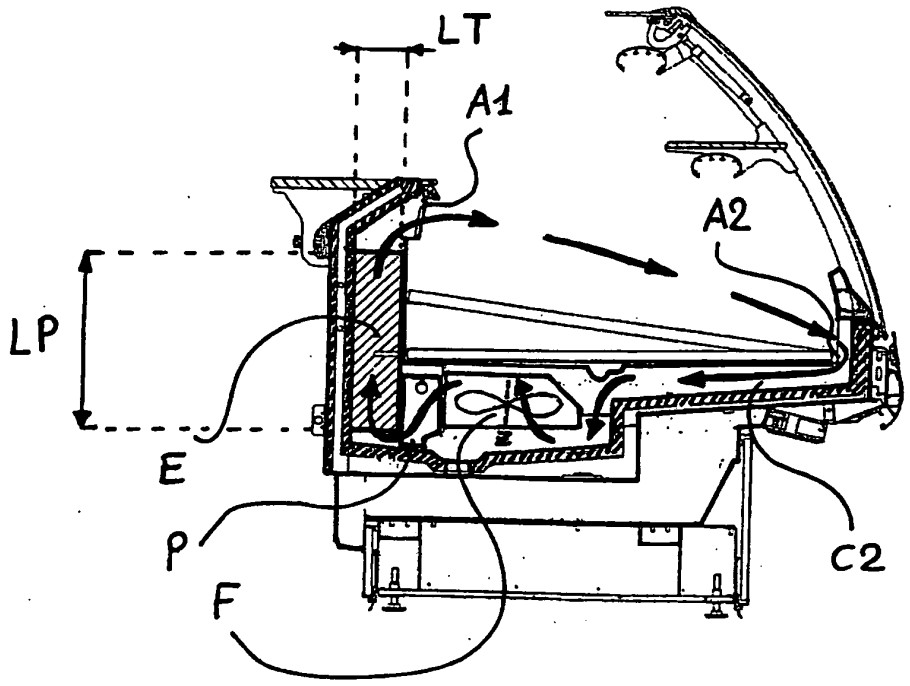

FIG. B

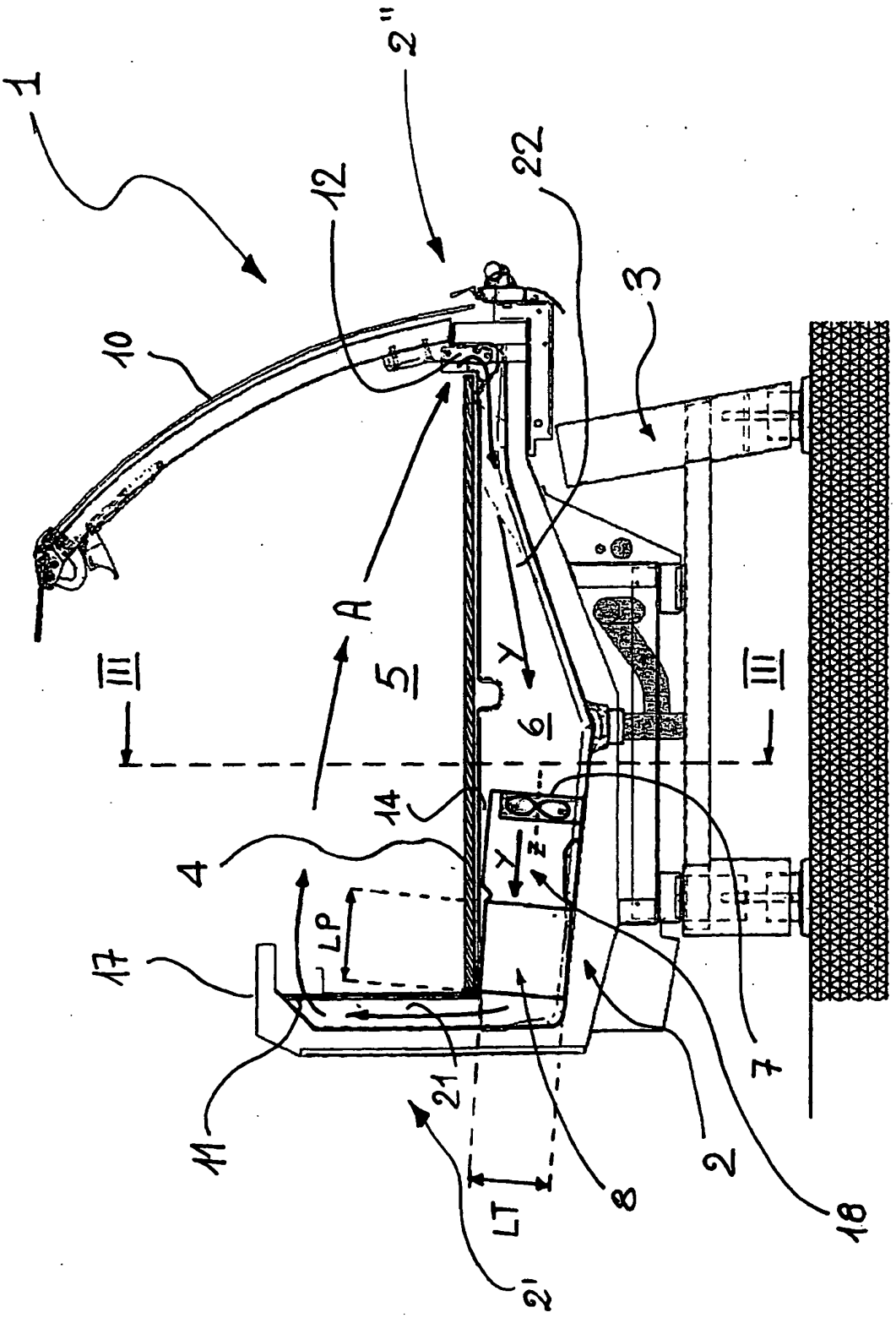

FIG.1

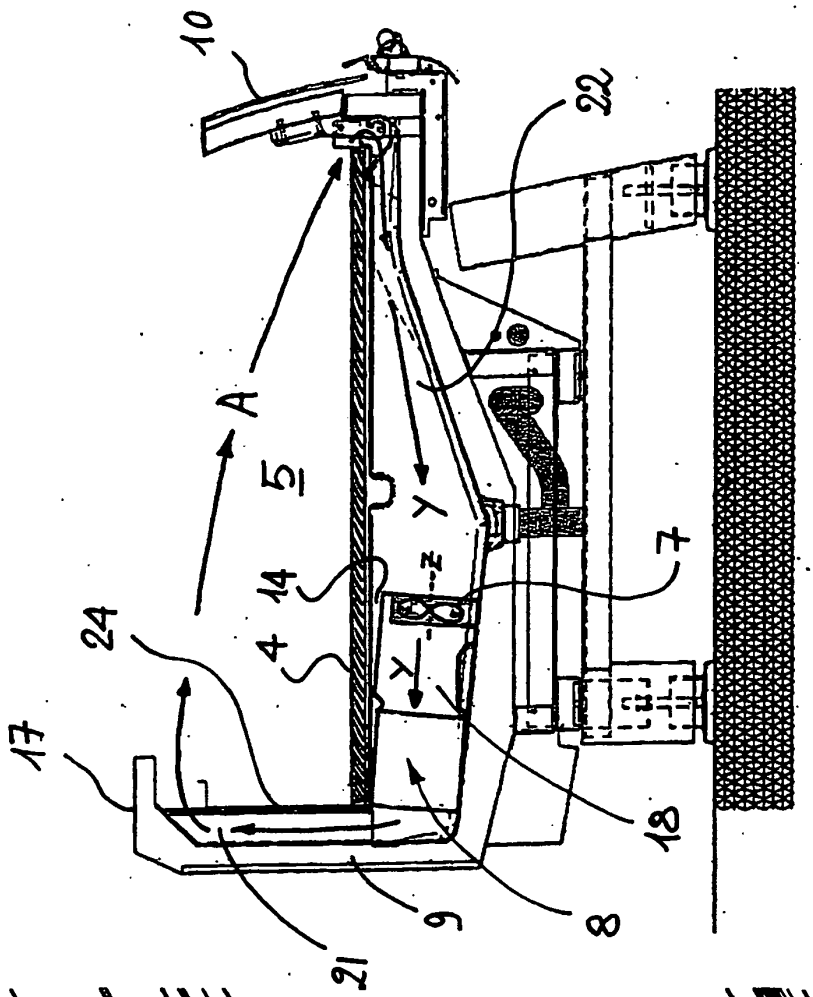

FIG.2

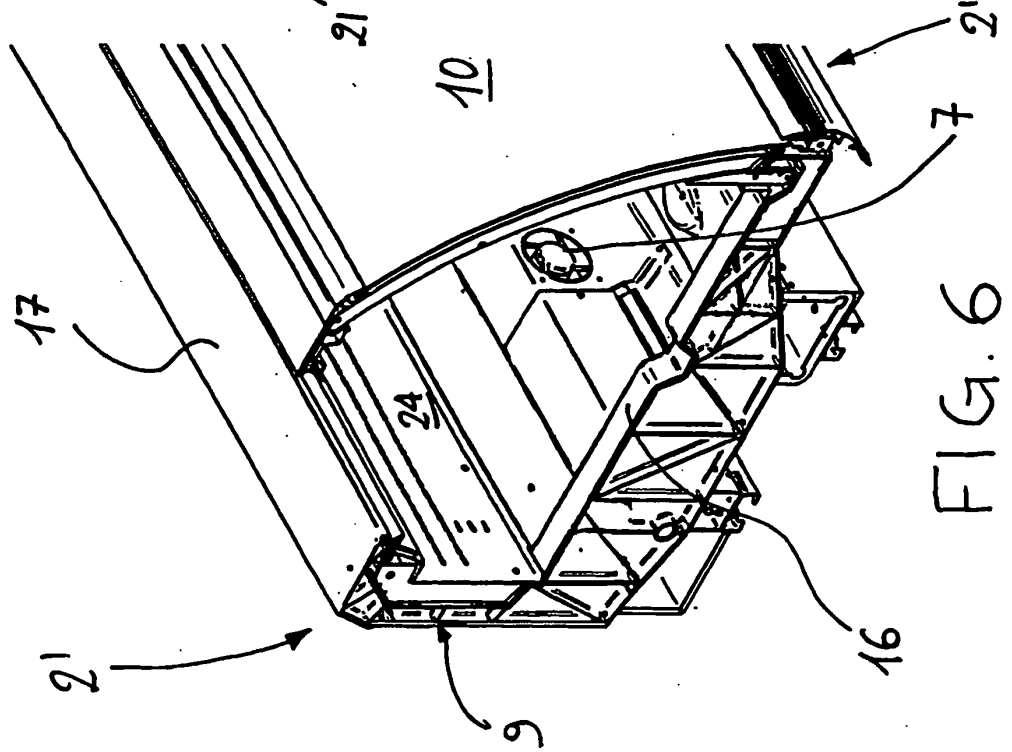

FIG.6

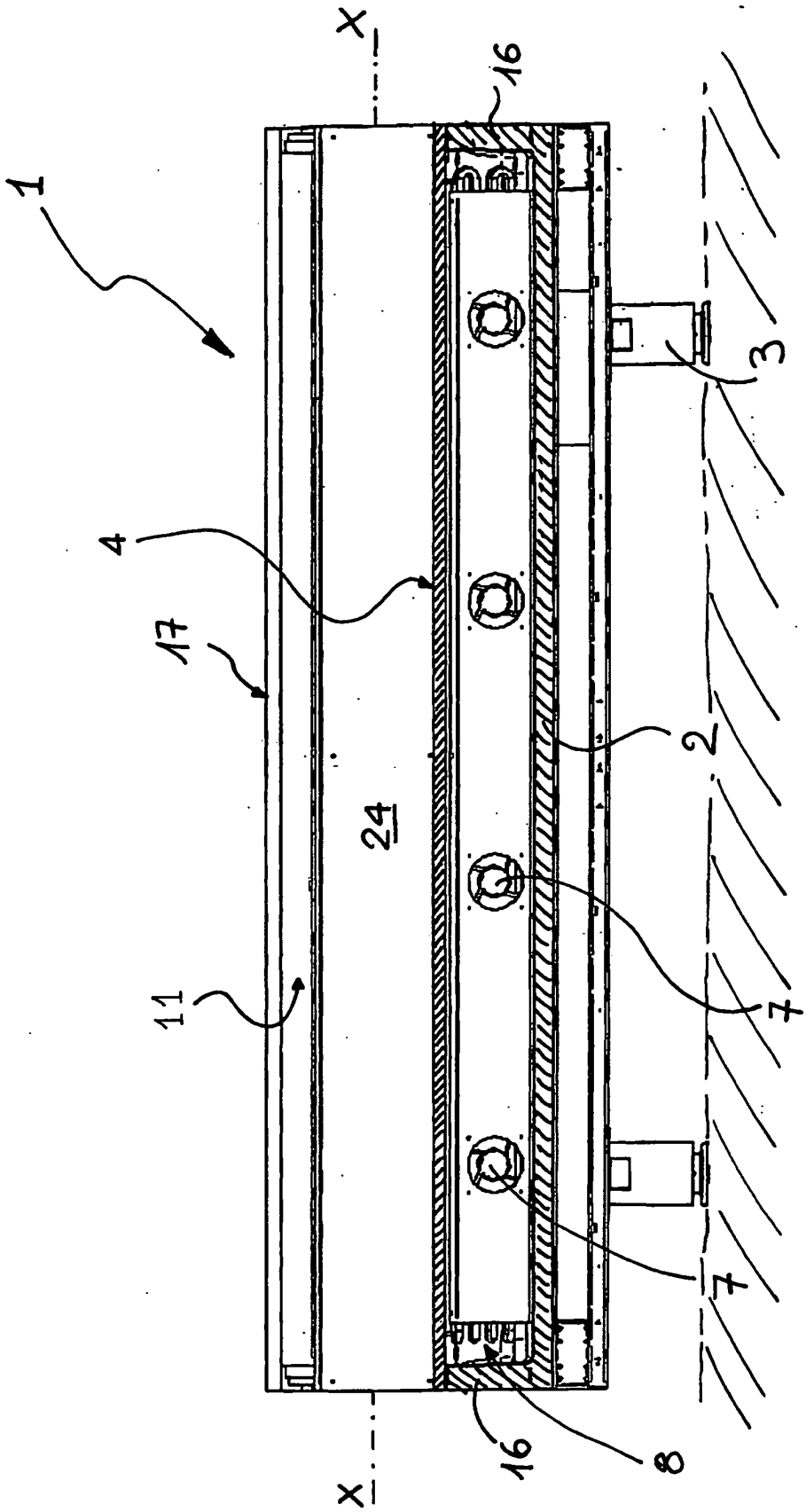

FIG.3

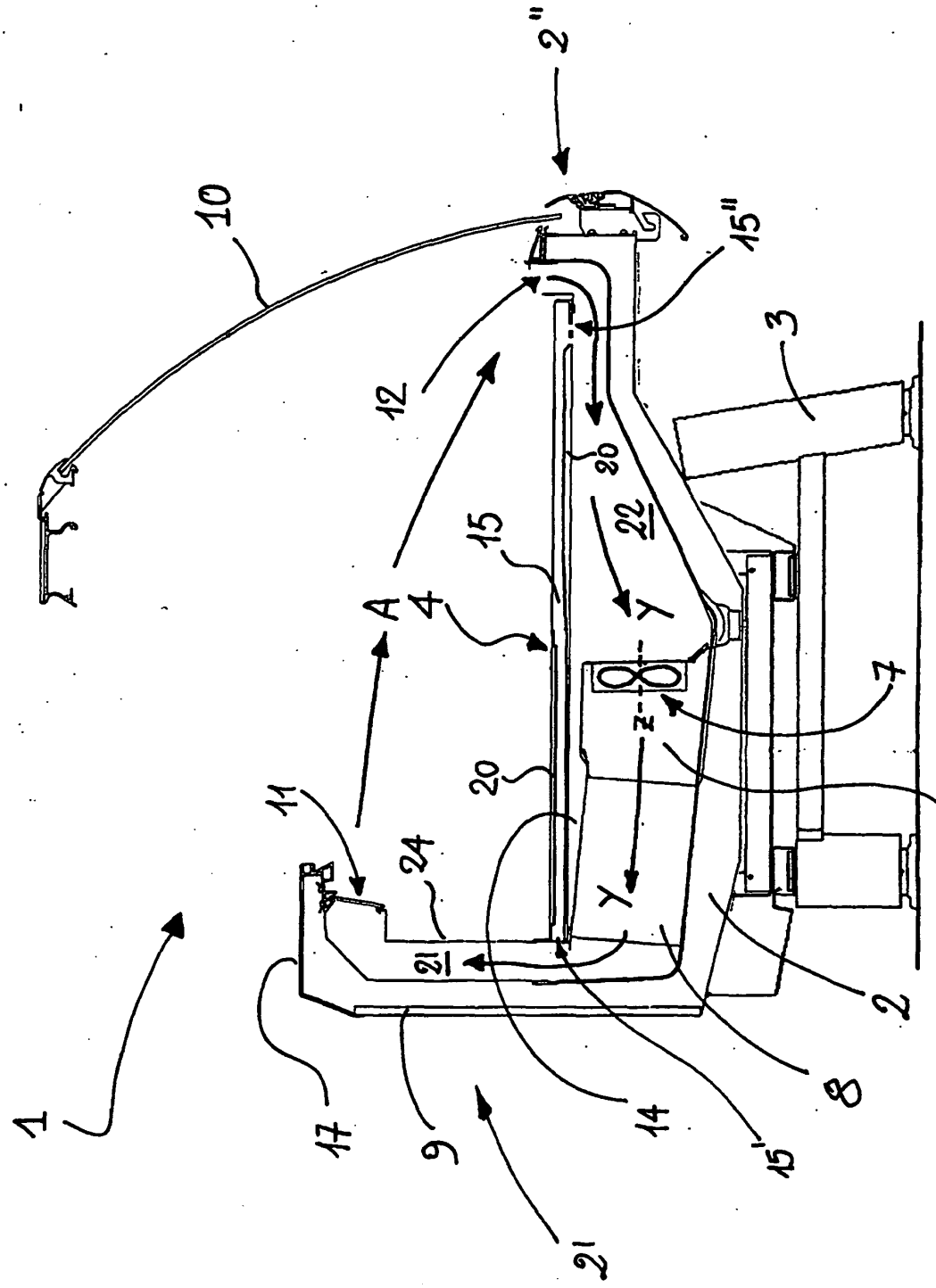

FIG. 4

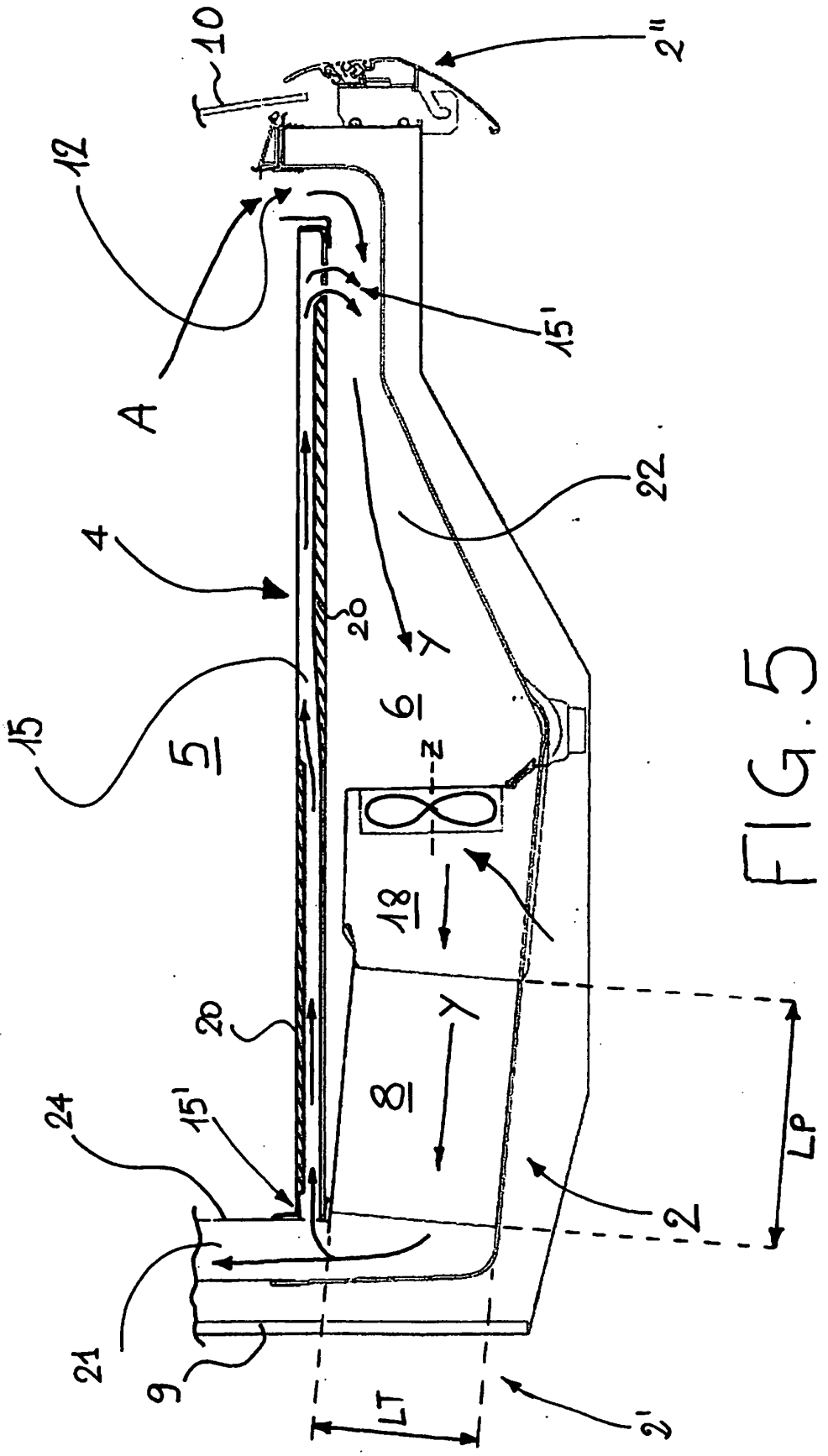

FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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