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 [33] **Belgium**
 [31] **73018**

[56]

References Cited

UNITED STATES PATENTS

1,913,857	6/1933	Scherer	62/408
2,586,893	2/1952	Westling.....	62/408
2,696,086	12/1954	Jones.....	62/408

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[54] **INSULATED CONTAINERS FOR PERISHABLE**
GOODS
 10 Claims, 15 Drawing Figs.

[52] U.S. Cl. **62/408,**
 62/407, 62/419
 [51] Int. Cl. **F25d 17/04**
 [50] Field of Search **62/407,**
 408, 419

ABSTRACT: An insulated container for perishable goods comprises a pair of convergent passages defined by the upper wall of the container, a pair of convergent passages defined by the lower wall of the container and sets of channels open to the interior of the container formed in the respective sidewalls of the container, the channels extending between the convergent passages. When the container is filled with a load impervious to air, air is circulated through the passages and channels around the load. When the container is filled with a previous load, air is circulated through the channels and passages and passes through the load directly from one set of passages to the other.

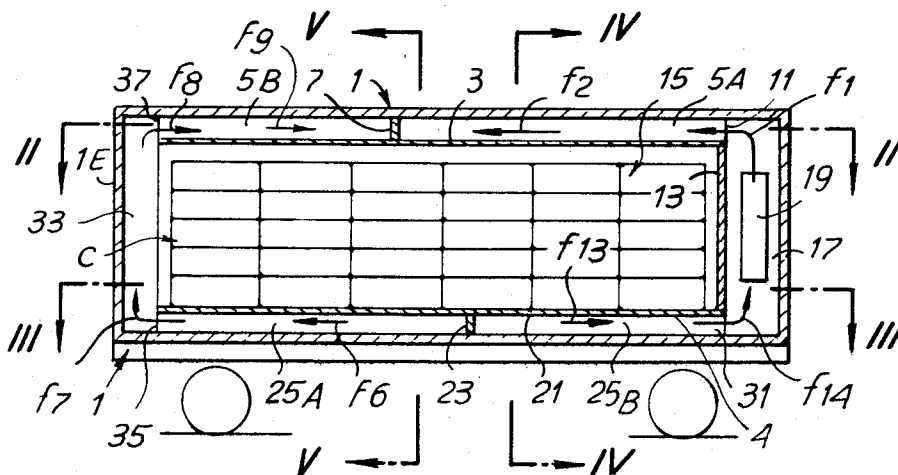


Fig. 4

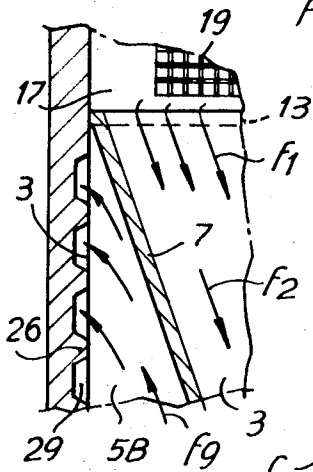
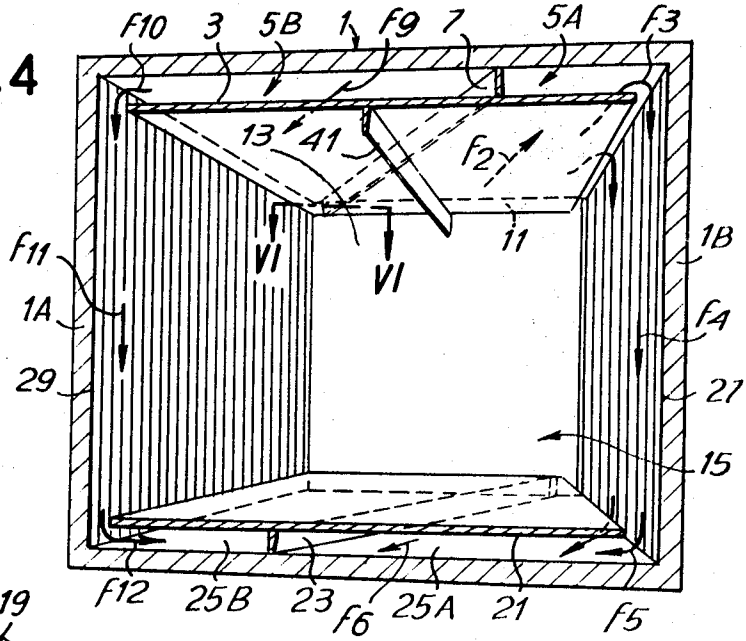


Fig. 6

Fig. 5

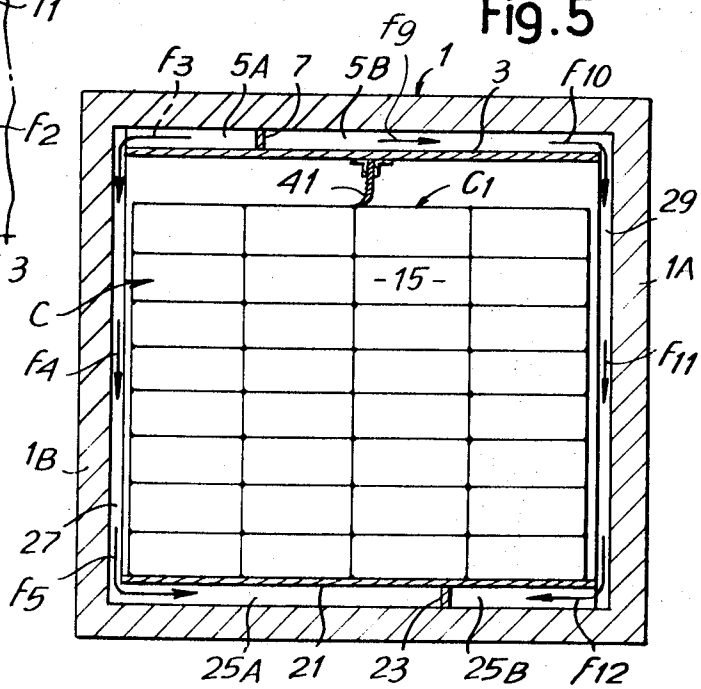


Fig. 7

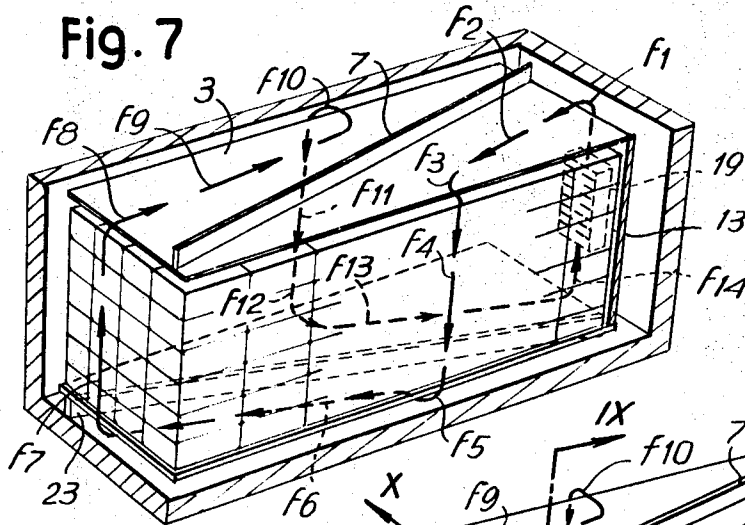


Fig. 8

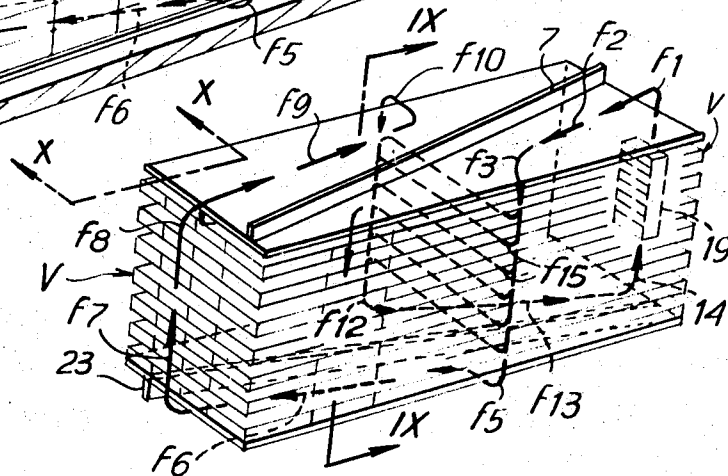


Fig. 9

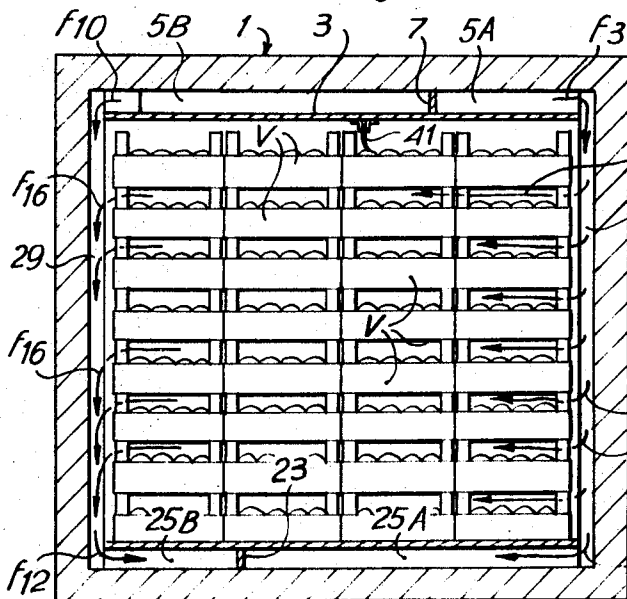
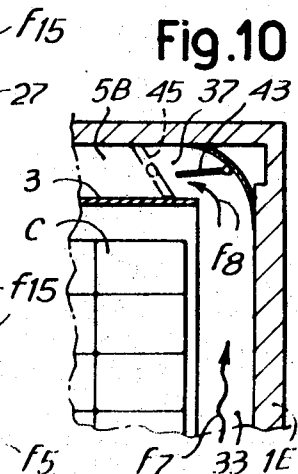
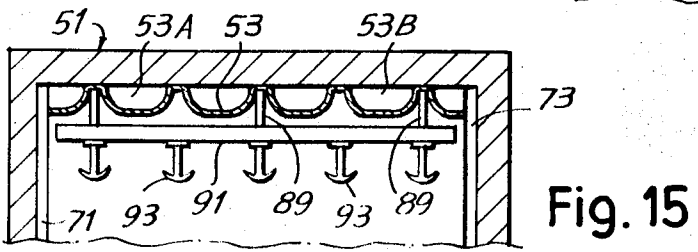
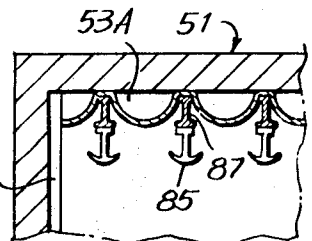
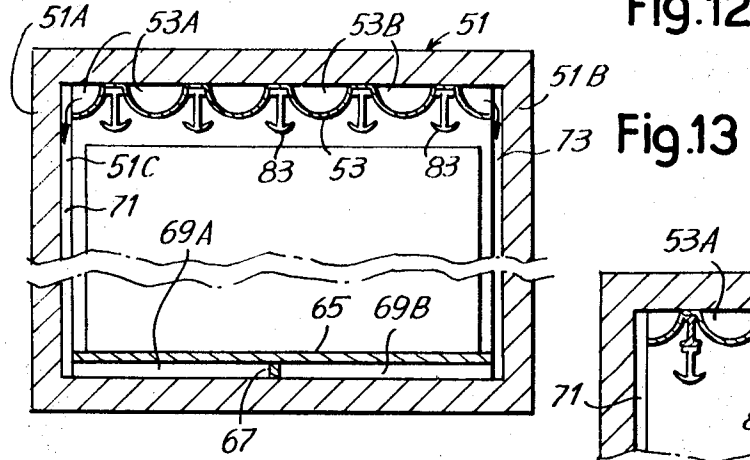
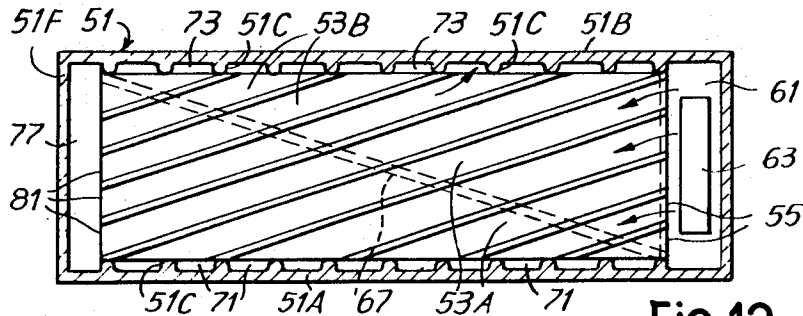
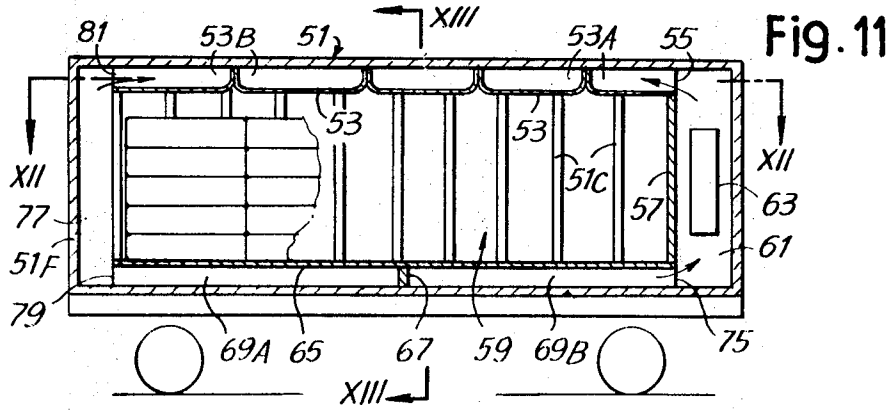


Fig. 10





INSULATED CONTAINERS FOR PERISHABLE GOODS

BACKGROUND OF THE INVENTION

The present invention relates to a container for perishable goods.

SUMMARY OF THE INVENTION

According to the invention, there is provided a container comprising an upper wall, a lower wall, opposed side walls extending between said upper and lower walls, opposed end walls extending between said sidewalls, inner upper wall means spaced from said upper wall, inner lower wall means spaced from said lower wall, a first partition extending between said inner upper wall means and said upper wall to divide the gap defined therebetween into first and second inversely convergent passages, a second partition extending between said inner lower wall means and said lower wall to divide the gap defined therebetween into first and second inversely convergent passages, said second partition extending in a direction generally transversely to said first partition, and air-conditioning means having an inlet in communication with one of said first passages and an outlet in communication with the other of said first passages, one of said side walls having first ducting extending between said first passage defined by said first partition and said second passage defined by said second partition, and the other of said sidewalls having second ducting extending between said second passage defined by said first partition and said first passage defined by said second partition, said second passage defined by said first partition being in communication with said second passage defined by said second partition.

Further according to the invention, there is provided a container for a load of perishable goods comprising an upper wall, a lower wall, a pair of opposed sidewalls extending between said upper and lower walls, a pair of opposed end walls extending between said upper and lower walls, inner upper wall means spaced from said upper wall to define therewith a first gap, inner lower wall means spaced from said lower wall to define therewith a second gap, a first partition dividing said first gap into first and second inversely convergent passages, a second partition dividing said second gap into first and second inversely convergent passages, the said second partition extending generally transversely to said first partition, air-conditioning and circulating means adjacent one end wall of said container, and having an inlet in communication with one of said passages and an outlet in communication with another of said passages, third and fourth gaps respectively defined by said load and each of said sidewalls, a fifth gap defined by the other said end wall of said container, the arrangement being such whereby when the load is impervious to air, air is fed from said air air-conditioning and circulating means through a first passage in one of said first and second gaps, then through the adjacent one of said third and fourth gaps, then through a first passage having an increasing section in the other of said first and second gaps, then vertically through the said fifth gap then through the second passage in the said one of said first and second gaps, then through the other one of said third and fourth gaps, and finally through the second passage in the said other of said first and second gaps, and thence back into said air-conditioning and circulating means, the flow paths in the different zones of the circuit being equal in length.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described by way of example only, with reference to the accompanying diagrammatic drawings in which:

FIG. 1 shows schematically and in sectional side elevation a container in accordance with the invention;

FIGS. 2 and 3 are sections taken on lines II—II and III—III in FIG. 1;

FIG. 4 is a perspective view to an enlarged scale taken on line IV—IV in FIG. 1;

FIG. 5 is a section taken on line V—V always in FIG. 1, the container housing a load impervious to air;

FIG. 6 is a section to an enlarged scale taken on line VI—VI in FIG. 4;

FIGS. 7 and 8 show schematically the air circuits around a load impervious to air and a load pervious to air respectively;

FIG. 9 is a section to an enlarged scale taken on line IX—IX in FIG. 8;

FIG. 10 is a section to an enlarged scale taken on line X—X in FIG. 8;

FIG. 11 is a section similar to FIG. 1 showing a modified embodiment of the invention;

FIG. 12 is a section taken on line XII—XII in FIG. 11;

FIG. 13 is a fragmentary section to an enlarged scale on line XIII—XIII on FIG. 11; and

FIGS. 14 and 15 are fragmentary sections, similar to FIG. 13 showing variations of the embodiment illustrated in FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. 1 to 9 of the drawings, there is provided an insulated rectangular container comprising opposed upper and lower walls, opposed sidewalls and opposed end walls. The container has an inner upper wall 3 which defines, with the outer wall, a gap which is divided into two passages 5A, 5B by a substantially diagonal partition 7. The passage 5A has a cross section decreasing from an inlet 11 for conditioned air, and in particular, cooled air. The inlet 11 is formed in wall 13 separating a chamber 15 for the load C from a chamber 17 for a conditioning unit 19. The chamber 15 comprises a lower wall 21 which is spaced from the lower wall of the container 1 to define therewith a horizontal gap which is divided into two passages 25A, 25B by a diagonal partition 23, extending generally transversely to the partition 7. The walls 3 and 21 abut against opposed sidewalls 1A and 1B of the container 1, the inner surface of the side walls 1A, 1B having a plurality of vertically extending ribs defining sets of channels 27 and 29 respectively. The longitudinal edges of the walls 3 and 21 lie adjacent to the tips of the ribs 26 to provide communication between the passage 5A and the channels 27, between the channels 27 and the passage 25A, between the passage 25B and the channels 29, and between the channels 29 and the passage 5B. The passage 25B communicates with the chamber 17 through a port 31, which is equivalent to the inlet 11 between the passages 5A and the chamber 17. At the end of the container opposite from the wall 13, a vertically extending gap 33 is defined between the load C within the container and the adjacent end 1E. The gap 33 communicates with the passage 25A through a port 35 and with the passage 5B through an inlet 37. It is to be noted that the ports or inlets 11, 31, 35, 37 extend across substantially the entire width of the container and thus correspond to the maximum cross section of the passages 5A, 25B, 25A, and 5B respectively. Also, the passages 5A, 25A, communicate with the channels 27 along one longitudinal edge of the walls 3 and 21 respectively, while the passages 5B and 25B communicate with the channels 29 along the other longitudinal edges of the walls 3 and 21 respectively.

In the case of a load C, that is impervious to air, the channels 27 define, with one side of the load, vertically extending ducting in the form of passages and the channels 29 define with the other side of the load further vertically extending ducting in the form of passages.

An intermediate longitudinal partition 41 is preferably provided on the underside of the wall 3, to extend between the wall 3 and the top surface C1 of the load C (see FIG. 5). The partition 41 is flexible to account for loads of different heights, and prevent direct communication between the channels 27 and 29.

Air cooled by the conditioner 19 traverses the following circuit around load C (for example a load formed by packed blocks of goods to be transported as frozen or deep-frozen goods). From the conditioner 19 the air is passed in the

direction of arrow *f1* through the inlet 11 into the convergent passage 5A, through which it flows in the direction of arrow *f2*. The air stream is distributed along the longitudinal edge of the wall 3 to be directed, as indicated by arrow *f3*, into the channels 27 to flow therealong in the direction of arrows *f4*. The air stream is distributed along the entire inner surface of the sidewall 1B due to the progressive reduction of the cross section of the passage 5A. From the longitudinal edge of the wall 21, the stream passes from the channels 27 as indicated by arrows *f5* into the passage 25A, which progressively increases in cross section, to flow therealong in the direction of arrows *f6*. The air stream then reaches the gap 33 and is directed upwardly therethrough according to arrows *f7*. The air stream passes from the gap 33 through the port 37 in the direction of the arrows *f8*, into the passage 5B, through which it flows in the direction of arrows *f9*. The air stream is distributed along the other longitudinal edge of the wall 3 and flows into the vertical channels 29 according to arrows *f10*. The stream then flows downwardly through the channels 29 according to arrows *f11* and then as shown by arrows *f12* passes into the passage 25B, to flow therealong in the direction of arrows *f13*. The airstream then reaches the chamber 17 through the port 31 in the direction of arrows *f14* to be fed again through the conditioner unit 19 and be recycled. It is to be noted that the stream is evenly distributed along the channels 27, 29 owing to the convergence of the passages 5A, 25A, 5B and 25B. Longitudinally extending partitions to deflect the airstream as required can be provided in the passages 5A, 25A, 5B and 25B. It is to be additionally noted that all of the elemental parts of the airstream flow along paths which are substantially equal in length. Thus a substantially uniform thermal insulation is provided around the load, thereby maintaining a substantially uniform temperature of the load.

The air flows through the gap 33 with a relatively high velocity, and has sufficient momentum to open a flap valve 43 (see FIG. 10) which is counter balanced by a weight and which controls the flow between the gap 33 and the passage 5B. Other valve means, for example a manually adjustable throttle valve 45 can be used instead of the flap valve 43.

When the load C (comprising for example parallelepipedic superfrozen packages) is replaced by a load through which air can be passed, for example a group of stacked trays V (see FIG. 9), communication is provided between the channels 27 and the channels 29, whereby at least a portion of the airstream descending along the channels 27, is withdrawn from the channels 27 to flow as indicated by arrows *f15*, *f16* (see FIGS. 8 and 9), directly into the channels 29; in this case the stream flows along the path indicated the arrows *f1*, *f2*, *f3*, *f15*, *f16*, *f12*, *f13*, *f14*. A small portion of the stream may flow along the path indicated by the arrows *f5*, *f6*, *f7*, *f8*, *f9*, *f10* as previously described. The flow along this latter path is either automatically controlled by the valve 43 (which owing to the reduced momentum of the stream tends to close) or by the throttle 45. The stream flowing through the gaps between the trays V is distributed over the entire horizontal surface of each layer of trays V to ensure the release of heat by the effect of metabolic action. This stream can also serve to reduce the temperature of the load from the ambient temperature to the regimen temperature slightly above 0° C. The flexible partition 41 effectively prevents a short circuit of the airstream above the load.

As described hereinbefore the type of load determines the circuit along which the air will flow. The airstream can additionally be controlled either by a manually adjustable valve for example the valve 45, or by an automatic valve, for example the valve 43. Also controls for modifying the output of the conditioning unit 19, according to the temperature desired are provided.

As an alternative to the flap valve 43, there can be provided a flexible lamina or reed valve which is opened according to the momentum of the airstream.

The direction of circulation can be reversed whereby the air is passed downwardly through the chamber 13 and along the reverse path to that described.

In the embodiment of the invention shown in FIGS. 11 to 13, there is provided an insulated rectangular container 51. Extending across the interior surface of the upper wall of the container parallel to a diagonal of the upper wall are two groups of conduits 53A, 53B, defined by flexible walls 53. The conduits 53A of the first group have an inlet 55 for the conditioned air, in particular cooled air. The inlet 55 is formed in the upper portion of a wall 57 separating a chamber 59 for the load from a chamber 61 containing a conditioner unit 63. The chamber 59 comprises a lower wall 65, spaced from the lower wall of the container 51 to define therewith a horizontally extending gap which is divided into passages 69A, 69B by a diagonal partition 67 extending in a direction generally transverse to that of the conduits 53A, 53B. The conduits 53A and adjacent one side wall 51A of the container while the conduits 53B and adjacent the opposed sidewall 51B of the container. The side edges of the wall 65 lie adjacent to the sidewalls 51A, 51B. The inner surface of each sidewall 51A, 51B has vertically extending ribs 51C which define channels 71, and channels 73 respectively. Communication is thereby provided between the conduits 53A and the channels 71, between the channels 71 and the passage 69A, between the passage 69B and the channels 73, and between the channels 73 and the conduits 53B. The passage 69A extends into the lowest portion of the chamber 61 through a port 75. At the end of the container opposite to the wall 57 a vertical gap 77 is defined by the adjacent end wall 51F, and by an additional wall or by the end of the load. The vertical gap 77 communicates with the passage 69A by means of a port 79 and with the conduits 53B by means of a port 81.

Extending from the upper wall of the container between adjacent conduits are rows of hooks 83 (see FIG. 13). The hooks 83 can be suspended directly from the upper wall of the container and are not illustrated in FIG. 11 for the sake of clarity. In an alternative arrangement shown in FIG. 14, hooks 85 are mounted for sliding movement along guides 87 extending between adjacent conduits, the respective hooks being lockable in a selected position along the guides. In a further alternative arrangement shown in FIG. 15, supports 89 are suspended from the upper wall of the container and carry crossbars 91, to which hooks 92 are engaged in conventional manner. In each case, carcasses of meat can be suspended from the hooks.

In the case of a compact load, that is impervious to air, the channels 71 define, with one side of the load, vertically extending passages and the channels 73 define with the other side of the compact load, further vertically extending passages. An intermediate longitudinal partition can be provided between the load and the conduits to close the space between the conduits and the upper surface of the load. The partition can be flexible as described in connection with the first embodiment, and can be formed by blocks of frozen or superfrozen goods, in which case the conditioned air flows along the following path. From the conditioner 63 the air flows through the port 55 into the conduits 53A, to be distributed along the channels 71 and flow downwardly therethrough. From the longitudinal edge of the wall 65, adjacent the sidewall 51A, the airstream passes from the channels 71 into the passage 69A, which progressively increases in cross section in the direction of flow towards the port 79. The stream then reaches the gap 77 and flows upwardly therethrough. The airstream is discharged from the gap 77 through the port 81 into the conduits 53B. The airstream is discharged from the conduits 53B, into the channels 73 to flow downwards therethrough and into the passage 69B, and then through the port 75 into the chamber 61. The air is subsequently recycled by the conditioner unit 63.

It is to be noted that the stream is distributed uniformly along all of the vertical channels 71 and 73 and that all the elemental parts of the air stream flow along paths which are substantially equal in length. Thus substantially uniform thermal insulation is provided around the load.

When the aforesaid load is replaced by a load through which air can be passed, for example a load formed by groups of stacked trays or by carcasses of meat hung from the hooks 83 or 85 or 93, direct communication is provided between the channels 71 and 73, whereby at least a portion of the airstream flowing along the channels 71 is removed from the channels 71 and flows transversely at different levels through the load directly into the channels 73. A minor portion of the stream may follow the previously described path which is automatically controlled by a valve as described in connection with the first embodiment of the invention.

The container described is particularly suited for the transport of perishable goods of three different types, i.e. fresh foods, for example vegetables, or fruit, which must be kept at a temperature above 0° C., or sometimes slightly below 0° C.; frozen foods or deep-frozen foods at a temperature considerably less than 0° C.; and goods which are at a higher temperature than the ambient temperature, which may be below 0° C. For fresh foods in addition to the amount of heat that must be extracted from the container to compensate for the heat which penetrates through the insulated walls, it is necessary to extract heat to compensate for the heat generated by metabolic action of the food and also to lower the temperature of the food.

Fruits and vegetables are usually loaded in stacks of aeriated trays, a small airgap of the order of a few centimeters being left between adjacent layers of trays to allow for ventilation. Usually trays are provided with upwardly extending projections, to facilitate the formation of the airgaps. In the case of frozen or deep-frozen goods, heat is extracted merely to compensate for the penetration of heat through the insulated walls of the container and for leakage of air. The goods are stacked in a compact mass without any gaps or voids, to prevent penetration of air. The load in this case is therefore substantially impervious to the air, and the cooling air merely circulates around the load. For the transport of heated goods, i.e. goods at a temperature higher than 0° C., it is necessary to maintain the temperature, irrespective of the outside temperature which may be less than that of the ideal temperature for the goods. In this case, the metabolism of the goods—which produces heat then acts to maintain the temperature within the container, and there is no need to circulate a large amount of air within the goods.

The container described can be mounted on a railway vehicle, on a road vehicle or on a so-called container transporter. In the container described the temperature of the circulated air is maintained substantially constant all around the goods.

What is claimed is:

1. A container comprising

an upper wall,
a lower wall,
opposed sidewalls extending between said upper and lower walls,

opposed end walls extending between said sidewalls,
inner upper wall means spaced from said upper wall,
inner lower wall means spaced from said lower wall,

a first partition extending between said inner upper wall means and said upper wall to divide the gap defined therebetween into first and second inversely convergent passages,

a second partition extending between said inner lower wall means and said lower wall to divide the gap defined therebetween into first and second inversely convergent passages, said second partition extending in a direction generally transversely to said first partition, and

air-conditioning means having an inlet in communication with one of said first passages and an outlet in communication with the other of said first passages, one of said sidewalls having first ducting extending between said first passage defined by said first partition and said second passage defined by said second partition, and the other of

said sidewalls having second ducting extending between said second passage defined by said first partition and said first passage defined by said second partition, said second passage defined by said first partition being in communication with said second passage defined by said second partition.

2. A container according to claim 1 further comprising passage means extending between said second passage defined by said first partition and said second passage defined by said second partition, and valve means for controlling flow through said passage means.

3. A container according to claim 2 wherein said valve means is manually operable.

4. A container according to claim 2 wherein said valve means is automatically controlled in dependence upon the momentum of the flow through said passage means.

5. A container according to claim 1 further comprising longitudinally extending partition means dividing each said passage.

6. A container according to claim 1 wherein each said first and second passages defined by said inner upper wall means and said upper wall, comprises a plurality of conduits, said container further comprising

hooked support means supported between adjacent said conduits.

7. A container according to claim 6 further comprising guide members, said hooked support means being slidably mounted on said guide members.

8. A container according to claim 6 wherein said conduits comprise a flexible material.

9. A container according to claim 1 wherein said first and second ductings are open to the interior of said container.

10. A container for a load of perishable goods comprising an upper wall,
a lower wall,
a pair of opposed sidewalls extending between said upper and lower walls,
a pair of opposed end walls extending between said upper and lower walls

inner upper wall means spaced from said upper wall to define therewith a first gap,

inner lower wall means spaced from said lower wall to define therewith a second gap,

a first partition dividing said first gap into first and second inversely convergent passages,

a second partition dividing said second gap into first and second inversely convergent passages, the said second partition extending generally transversely to said first partition,

air-conditioning and circulating means adjacent one end wall of said container, and having an inlet in communication with one of said passages and an outlet in communication with another of said passages,

third and fourth gaps respectively defined by said load and each of said sidewalls,

a fifth gap defined by the other said end wall of said container, the arrangement being such whereby when the load is impervious to air, air is fed from said air-conditioning and circulating means through a first passage in one of said first and second gaps, then through the adjacent one of said third and fourth gaps, then through a first passage having an increasing section in the other of said first and second gaps, then vertically through the said fifth gap then through the second passage in the said one of said first and second gaps, then through the other one of said third and fourth gaps, and finally through the second passage in the said other of said first and second gaps, and thence back into said air-conditioning and circulating means, the flow paths in the different zones of the circuit being equal in length.