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Takahashi

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[54] **FREIGHT TRANSPORTING CONTAINER**

[76] Inventor: **Kenzo Takahashi,** No. 18-10 Yoshimachi, Ukiwa-gun, Fukuoka-ken, Japan

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Dec. 27, 1972	Japan	47-130032
Dec. 29, 1972	Japan	47-1069

[52] **U.S. Cl.** **98/33,** 220/15, 62/407, 62/410, 62/411, 62/412, 62/413

[51] **Int. Cl.** **F24f 13/00**

[58] **Field of Search** ..... 220/15; 62/407, 410, 411, 62/412, 413; 98/33 R, DIG. 7

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Primary Examiner—William J. Wye

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

A freight transporting container to be carried by various transportation means, particularly by trailers. The container has a rectangular cross-sectional outer container and an inner container of similar configuration disposed within the outer container, for accommodating freight. The inner container is held suspended by a plurality of spring means mounted between a plurality of fitting portions provided along the entire length of the vertical outer corner-edges of the inner container in spaced apart relationship and a plurality of fitting portions provided downwardly from the top along the vertical inner corner-edges of the outer container in spaced apart relationship, so as to protect freight from damage due to shocks or vibrations.

9 Claims, 11 Drawing Figures

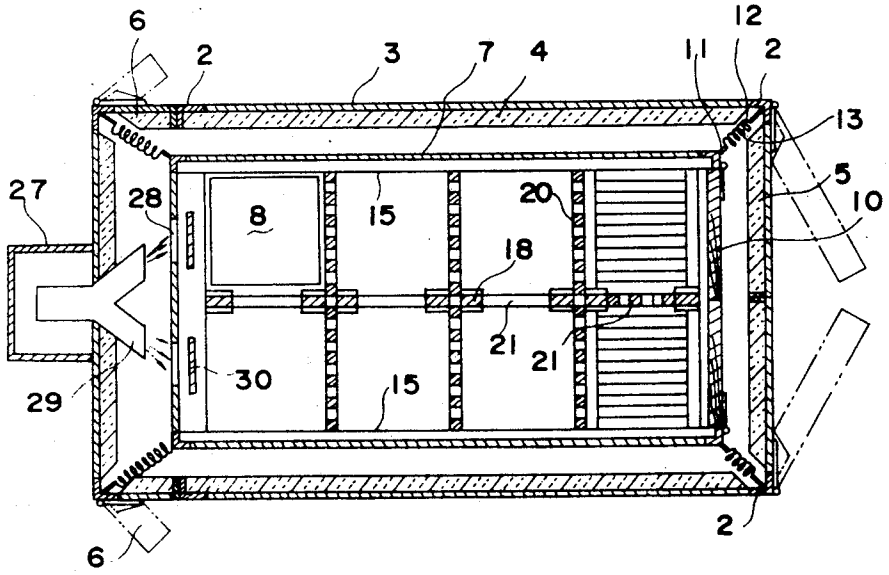


FIG. 1

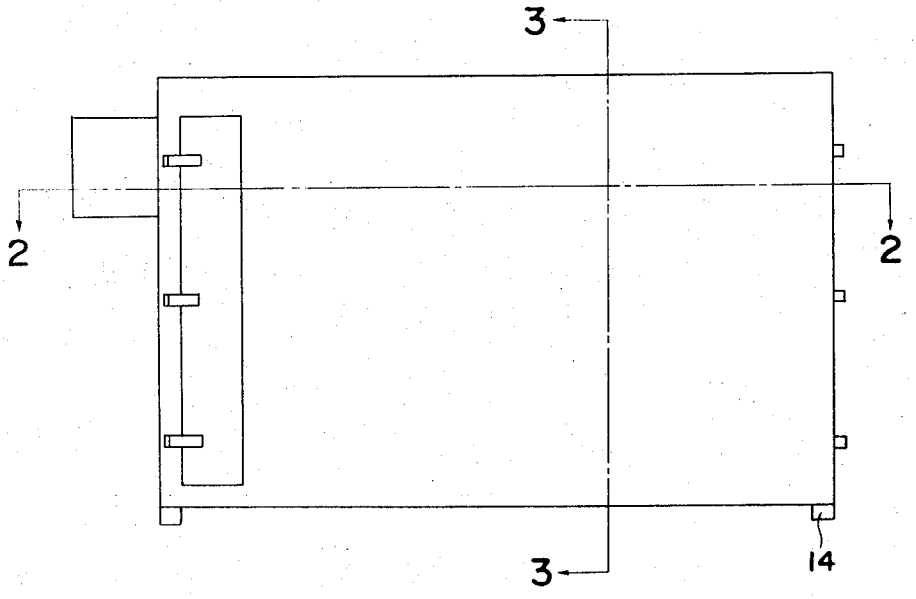


FIG. 2

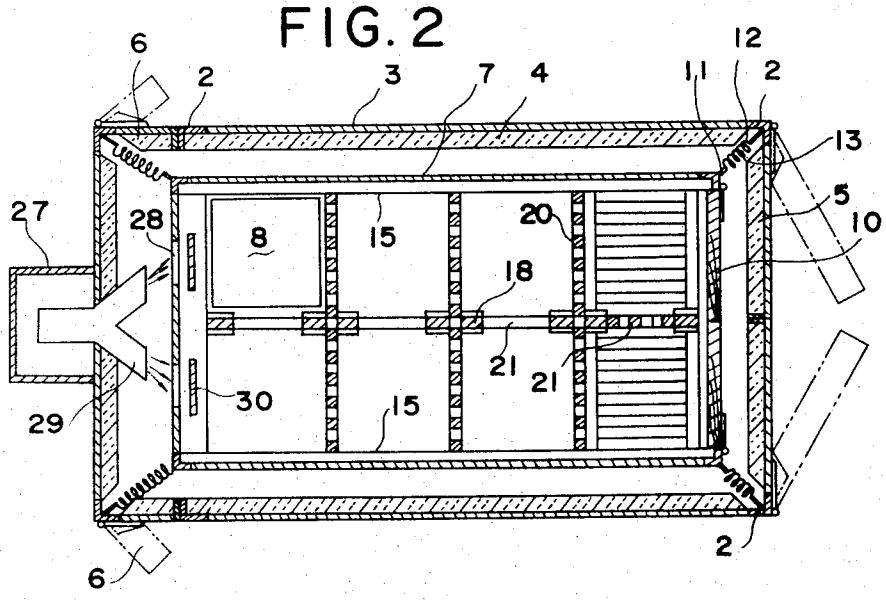


FIG. 3

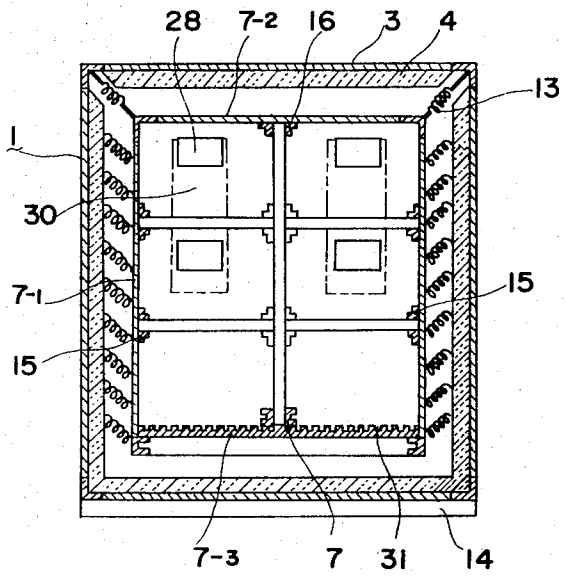


FIG. 4

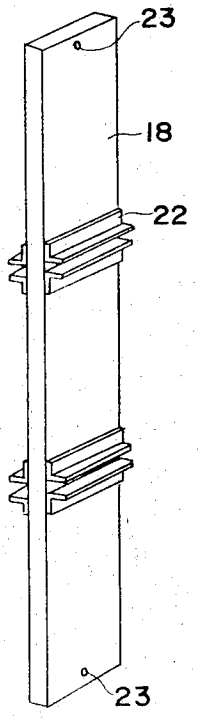


FIG. 5

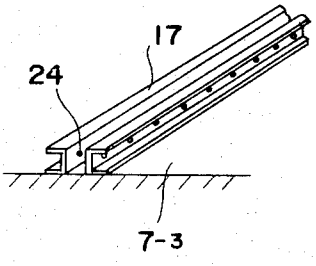


FIG. 6

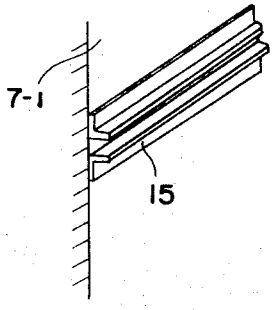


FIG. 7

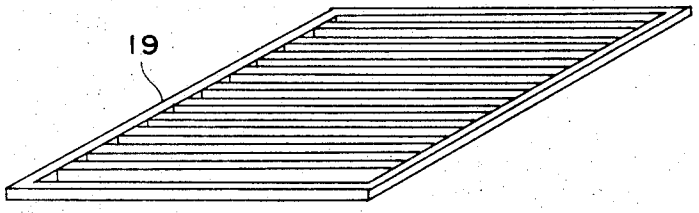


FIG. 8

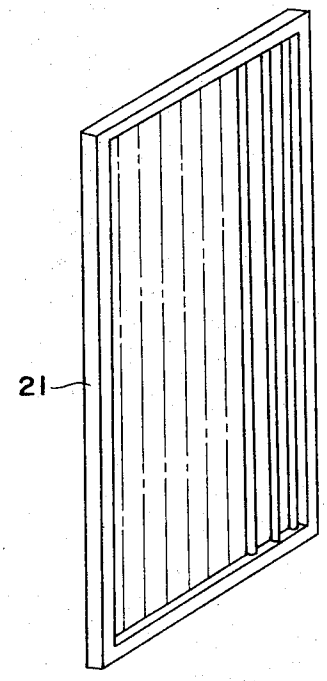


FIG. 9

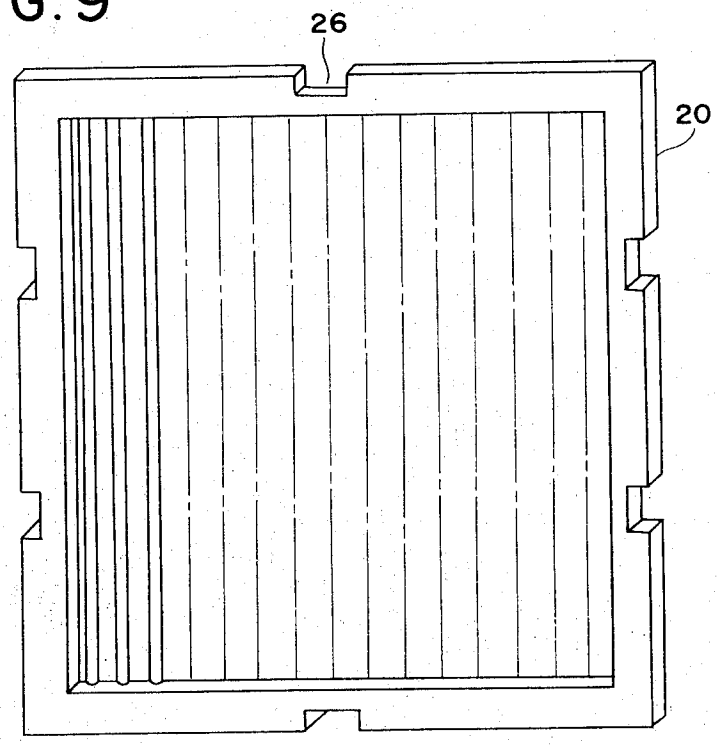


FIG.10

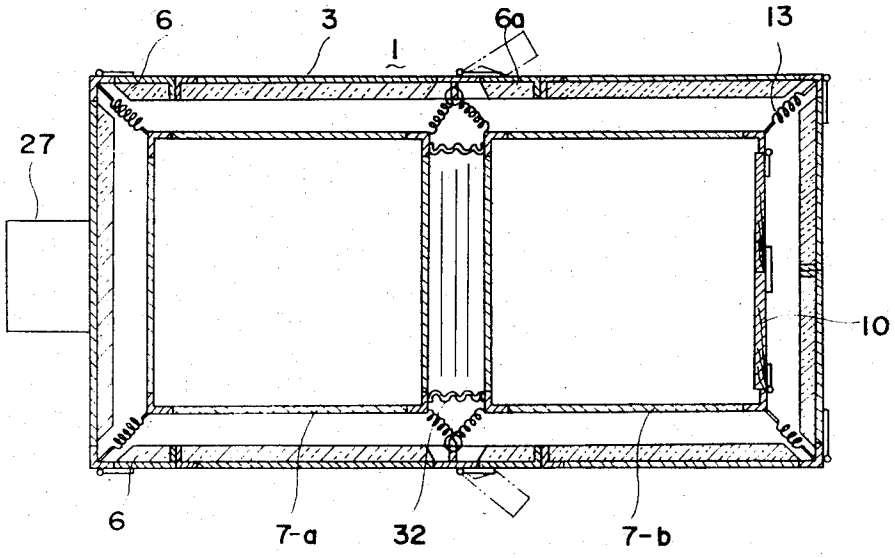
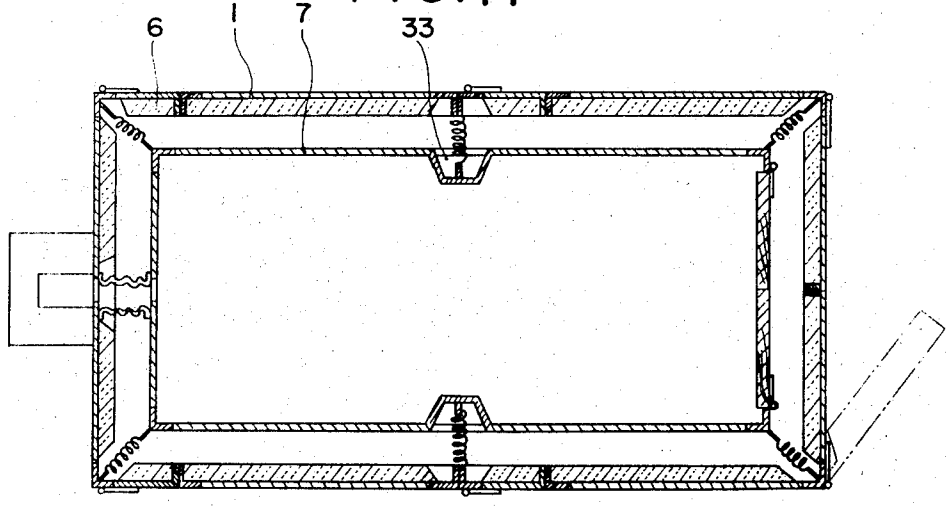


FIG.11



FREIGHT TRANSPORTING CONTAINER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a container for transporting freight such as fruit, such as grapes and precision machines or glass products which are liable to be damaged, or to break, or that are particularly subject to damage by vibrations or shocks.

2. Description of the Prior Art

Various kinds of freight are commonly transported to remote places by various transportation means such as automobiles, railroads and airplanes. Depending on the kind of freight, however, great care must be taken to protect it against vibrations during transportation. For instance, glass, ceramics, lacquer ware, precision machines or fruits are typical examples of such freight. Usually various shock-relieving measures are taken for such fragile freight. Covering individual freights with cushioning materials or making containers of foamed styrol are examples of such conventional shockrelieving measures. Of course, these methods are not sufficient to relieve shocks completely. Besides, such methods, because they require large spaces to accommodate the loads are irrational, inefficient and uneconomical. They also involve the problem of waste disposal, and cushioning materials are usually used only one time, and they must be discarded after use. In spite of all this, no good transportation means for such freight has yet been devised.

Transportation containers heretofore known have no shock-absorbing means; that is, they are containers that simply enclose a given space. Because of this, freight has frequently suffered from great shocks or has been subjected to the influence of vibrations or resonance during transportation, which has resulted in the reduction in (or, in extreme cases, the complete loss of) their commercial value when they arrived at their destinations.

OBJECTS AND SUMMARY OF THE INVENTION

An object of this invention is to provide a transportation container that protects freight from shocks without using cushioning materials, which must be disposed of after use, as described above.

Another object of the invention is to provide a transportation container the inside of which is partitioned into a number of independent compartments by removable dividing frameworks and shelves, so that, when many articles of freight are loaded into the container the weight of the freight in the upper part of the container will not act on the freight in the lower part, and so that the freight will not be crushed or move about during transportation.

A further object of the invention to to provide means which will prevent the deformation and denaturation of freight loaded in the container by keeping such freight at a constant temperature and/or humidity during transportation.

A still further object of the invention is to provide an improved freight transportation container which is not only advantageous from the viewpoint of strength but also convenient from the viewpoint of use.

To achieve these objects the inventor has made a variety of studies for the development of a transportation container having a good ability to absorb shocks and vibrations during transportation. As a result of such studies, this invention has been made and has succeeded in satisfying the above objects by suspending an inner container for accommodating freight in a space within an outer container by shock absorbers such as springs. This invention of course provides a very superior shock relieving effect. In addition, it has such ideal advantages as the complete elimination of cushioning materials, which must be disposed of after use, and the capability of efficient loading.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of a transportation container according to the present invention;

FIG. **2** is a cross section taken on the line **2—2** of FIG. **1**;

FIG. **3** is a cross section taken along the line **3—3** of FIG. **1**;

FIG. **4** is a perspective view of a support provided in an inner container as shown in FIGS. **1** through **3**;

FIG. **5** is a perspective view of steel channels disposed on the bottom and ceiling of said inner container;

FIG. **6** is a perspective view of steel beams disposed on the side walls of said inner container;

FIG. **7** is a perspective view of a shelf used inside said inner container;

FIG. **8** is a perspective view of a dividing frame-work used for longitudinal partitioning;

FIG. **9** is a perspective view of a dividing frame work used for lateral partitioning; and

FIG. **10** is a horizontal section of another embodiment of the invention, similar to FIG. **2.**

FIG. **11** is a horizontal section of further embodiment of the invention, similar to FIG. **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be hereinafter described concretely with reference to the preferred embodiments thereof illustrated in the accompanying drawings. In the first place, the following definitions will be given for the terms used in the description of the invention:

"Outer container" is generic to a container structure which has a certain capacity. It can be a frame having sheet material, wire netting or lattices, covering the sides, top and bottom. It can also be just a simple frame. It can be lined with a heat-insulating material. The outer container itself sometimes serves also as a van body proper for trucks or railway cars.

"Shock absorbers" is generic to means for taking up shock and vibrations and can be spring means such as an ordinary coiled spring, flat springs, or the like, or can be fluid shock absorbing means, such as hydraulic or air cushion shock absorbers.

In the drawings, reference numeral **1** denotes a rectangular prismatic outer container to be loaded onto an automotive vehicle or a railway car, which comprises sidewalls, top and bottom walls and an end wall made of frame members **2** and outer wall coverings **3** of sheet material as aluminum or steel sheet or of other material filling the spaces within the walls formed by said frame members **2,** and heat-insulating material **4** lining the insides of the walls.

At one end of said outer container is provided a double door **5,** and a narrow door **6** is provided in both side

walls adjacent the end wall at the other end. The doors have the same framework, wall covering and insulating material structure as the walls. A smaller inner container 7 having the same shape as the outer container is housed within said outer container 1, leaving a space on the sides, top and bottom and front and rear of the inner container. The walls of the inner container can also be of heat insulating material.

Said inner container 7 accommodates freight 8, and has a double door 10 through which said freight 8 and supports 18, shelves 19, and partitions 20, which divide the inside suitably depending on the size of the freight, can be placed in and taken out. This inner container 7 can be freely inserted into and taken out of said outer container 1, as will be described later.

At each of the four corners of said inner container 7 are a plurality of metal fittings 11, spaced vertically therealong, while a plurality of corresponding metal fittings 12 protrude into the outer container 1 from the corner frame members 2. Between oppposed metal fittings 11 and 12 are a plurality of shock absorbers, such as springs, spaced in the vertical direction along the corners of said inner container 7, whereby said freight holding inner container 7 is kept suspended in the space inside said outer container 1. Springs may be disposed at other locations than said four corners, but it is most preferable to provide them at said four corners.

At the end of container 1 with said door 5, the springs 13 can be mounted between or removed from said metal fittings 11 and 12 from outside using a scissors-like tool. At the opposite end (at the two corners at the left of FIG. 2), doors 6 are provided to permit mounting and removing of said springs therethrough. Reference numeral 14 designates a coupler which connects the container to a transportation vehicle.

On the inside of said freight holding inner container 7, as shown in FIG. 3, opposed pairs of steel angle beams 15 are longitudinally disposed on the side walls 7-1, at several appropriate heights. On the ceiling 7-2 and the floor 7-3 are disposed opposed pairs of steel channel beams 16 and 17, respectively, to define supporting channels therebetween. Supports 18 and shelves 19 are inserted in these channels. Furthermore, lateral dividing partitions 20 and longitudinal dividing partitions 21 are positioned between said supports 18, thereby partitioning the inside of said inner container 7 into a number of independent compartments.

Examples of the various dividing elements are illustrated in FIGS. 4 through 9. To be more precise, FIG. 4 shows a support 18 to be positioned in the central portion of said inner container 7, and which is comprised of a flat plate which has several pairs of spaced opposed steel angle beams 22 on both sides thereof spaced at intervals therealong to form several channels, and having a pin hole 23 near both the upper and lower ends thereof. FIG. 5 shows a pair of spaced opposed steel channel beams 17 fixed on the floor 7-3, each having a number of pin holes 24 at regular intervals along the web thereof. Channel beams 16 are fixed to the ceiling of container 7 in the same manner. The support 18 has the ends positioned between the pairs steel channel beams 16 and 17 to hold it erect and is fixed at a given position therealong by pins (not shown) passed through aligned holes 23 and 24.

FIG. 6 illustrates a pair of spaced opposed steel angle beams 15 horizontally fixed along the side wall 7-1 of said inner container 7. In the channels formed between said steel angle beams 22 on the supports 18 and steel angle beams 15 on this side wall 7-1 is inserted the edges of a shelf 19 shown in FIG. 7. For this shelf 19, a lattice-like element is more advantageous than a plate-like element, in order to carry out temperature and humidity control within the entire inner container 7. The same is true of the longitudinal dividing partition 21 shown in FIG. 8 which has the edges in the channels between said steel angle beams 16 and 17 on the ceiling and the floor, in the same manner as the supports 18, and, furthermore is interposed between the supports 18. FIG. 9 illustrates a lateral dividing partition 20 used for partitioning the inner container 7 from end to end. In the top and bottom and both sides edges of this lateral dividing partition 20 are notches 26 at positions corresponding to said pairs of steel angle beams 15 and 16 and steel channel beams 16 and 17. By using these elments, the interior of the inner container 7 can be partitioned in all directions, that is, from top to bottom, from side to side, and from end to end. In the foregoing description, the lateral dividing partition 20 extends from the ceiling to the floor and between the two sides of the inner container. Alternatively, although not illustrated, smaller lateral dividing partitions can also be provided which extend only between the longitudinal dividing partition 21 and the container side wall, or only between adjacent shelves.

The shelves, longitudinal and lateral dividing partitions and supports need not always be provided in said inner container. Only longitudinal and lateral dividing partitions may be provided at one time, and only shelves may be provided at another, depending on the freight. By the adoption of such a construction, the inner container 7, which holds the freight, can be kept suspended in the space inside the outer container 1, whereby longitudinal, lateral or vertical vibrations during transportation can be absorbed by the shock absorbers 13, resulting in safe transportation of the freight. Of course, when a great vibration occurs, said inner container 7 may swing a little; but it is always limited to a very small extent and the influence exerted thereby on the freight is practically negligible.

Since the inner container 7 is divisible into a number of independent compartments depending on the size of the freight, even if some considerable degree of vibration occurs when many items of freight are loaded at one time, the lowermost freight will not be subjected to any great shock. Also, the freight will not collapse even under the influence of vertical, lateral or longitudinal vibrations due to irregularties or curves in roads, or to sudden starts and stops during transportation.

When said freight is fruits or precision machines, transportation containers therefor must have not only a shock relieving function but must also serve as a place for storage and preservation having means to control the temperature and humidity in the inner container at appropriate levels, which is necessary to maintain freshness and taste of the fruits or accuracy of the precision machines.

For this purpose, the outer container 1 of the invention is furnished, at the end opposite the end with the door 5, i.e., the closed or front end and the inner container 7 also is provided, opposite to said fan, with ventilating openings 28. As illustrated in FIG. 2, the outlet duct from said fan 27 is branched into a plurality of outlet ducts 29, which correspond, in number, to said

ventilating openings 28 and are respectively directed thereto. The distance bewteen the ends of said outlet ducts 29 and the ventilating openings 28 or the areas of the openings 28 and the ends of the outlet ducts 29 are given a size so that of the amount of air blown from said fan 27, a proportion of, for example, 70 per cent, is directed into the inside of said inner container 7 and the remainder 30 per cent is directed into the space between said inner container 7 and outer container 1. By this means, air is blown not only into said inner container 7 but also into said space, thereby increasing the cooling efficiency. Inside said inner container 7, when ventilating openings 28 alone are opened, the air blown in passes along a certain fixed course, which forms dead areas particularly in the front portion of said inner container 7, resulting in the non-uniformity of cooling throughout the entire inner container. To avoid this, with a view to uniformly diffusing the blown air throughout the container 7, baffle plates 30 are disposed near said ventilating openings inside the inner container 7.

Also, at the bottom of said inner container, as shown in FIG. 3, ventilation channels 31 are formed so that the blown air always passes therethrough to exercise a cooling effect on the freight 8 from below. Furthermore, although they are not shown, one or more ventilating openings or fans may be provided along the side walls of the inner container and ventilating windows, free to open and close, can be provided in the outer container at appropriate places to improve the flow of air into said inner and outer containers. Moreover, the outlet ducts 29 of said fan 27 and said ventilating openings 28 can be connected to each other by a bellows-like ventilating sleeve. All this enables the freight to be kept in a desirable condition, by passing gases of suitable temperature and humidity into the inner container even during transportation. When the fan 27 and the ventilating openings 28 in the inner container 7 are connected indirectly or by a flexible bellows, ventilation can be continued during transportation, and will be unaffected by the arbitrary vibrations of the outer container 1 and the inner container 7. The expression "ventilation" or "fan" used in the foregoing description does not simply mean the sending of fresh air from the atmosphere. The term "ventilation" includes the use of various gases, such as carbon dioxide or other gases used in some special cases, controlled to a given temperature or humidity; and the "fan" includes means for supplying such gases.

The above-described transportation container serves well enough for general purposes. But, when the freight to be transported has a very large unit weight or a large quantity of freight is transported at one time, the container must be enlarged. Particularly as a result of the extension of the span of the bottom of the container, this requires the use of uneconomical larger component members for the construction of the container. In addition, with an increase in the self weight of the inner container itself, the springs and outer container to support it must also be enlarged. However, the size of the transportation container, that is, the outer container, is naturally limited by the size of the transportation means, the road traffic regulations, and the like. A transportation container particularly effective for such cases has a plurality of inner containers inside an outer container of a given capacity, each inner container being suspended by shock absorbers such as springs extending into the inner container from the outer container.

FIG. 10 shows an embodiment of such a transportation container according to the present invention. Although the basic construction is similar to that of FIG. 2, the inner container placed in the outer container 1 is divided into a plurality of sections 7-*a* and 7-*b*, each being suspended in space in said outer container 1 by springs 13 at the four corners thereof. The open opposed ends of said inner containers 7-*a* and 7-*b* are connected by a bellows-like ventilating sleeve 32, which has a size which will readily permit the passage of a man and which are detachably connected thereto. Intermediate narrow doors 6*a* are provided near the middle of the length of the outer container to provide access for mounting and removing springs adjacent the middle of the outer container. With this arrangement, heavy freight can be transported while relieving shocks during transportation, and enlargement of the container can be effected. Since the inner containers 7-*a* and 7-*b* are connected by a bellows-like sleeve ventilation can be increased economically. This connecting sleeve also permits loading and unloading of freight irrespective of the movement of the connected containers.

The span of the floor becomes longer as the size of the inner container increases, which gives rise to the possibility that the inner container will come in contact with the outer container, as a result of flexion of said floor. To prevent such flexion of the inner container, it is necessary to provide springs between the outer walls of the inner container and the inner walls of the outer container at points intermediate the ends of the inner container. But the space between the two containers is too narrow to permit provision of such springs.

FIG. 11 shows another embodiment of such a transportation container according to the present invention. Although the basic construction is similar to that of FIG. 2, a recess 33 is formed at a point intermediate the length of the side walls of the inner container 7, and springs 13 are connected between metal fittings provided at the bottom of such recess 33 and on the inner wall of the outer container 1.

The present invention has many advantageous effects as described above, because of the foregoing construction. It offers a really ideal transportation container for such freight as fruits, precision machines, glass and ceramics that are liable to be broken or require preservation to keep them in good condition.

What I claim is:

1. A freight transporting container comprising an outer container, at least one substantially rectangular cross-section freight holding inner container disposed in the space within said outer container and having corners which are vertical, and suspension means consisting of a plurality of tension springs connected between each corner of said freight holding inner container and said outer container at points spaced along said vertical corners and at an obtuse angle to both the side and the end of the container at each corner, said springs holding said inner container suspended in the space within said outer container.

2. A freight transporting container according to claim 1, further comprising a plurality of removable longitudinal and lateral dividing partitions and shelves within said inner container dividing the inside of said

inner container into a number of independent compartments.

3. A freight transporting container according to claim 1, further comprising a fan on the outside of said outer container and said inner container having a ventilating opening therein, and a flexible bellows-like sleeve connecting said fan and said ventilating opening.

4. A freight transporting container according to claim 3, in which said fan comprises means for blowing a gas taken from the group comprising fresh air, cooled air, moisture-conditioned air, and carbon dioxide.

5. A freight transporting container according to claim 1, further comprising a fan on the outside of said outer container and said inner container having a ventilating opening therein, said fan having an outlet duct extending toward and ending short of said opening to leave a space between said outlet duct and said opening.

6. A freight transporting container according to claim 5, in which said fan comprises means for blowing a gas taken from the group comprising fresh air, cooled air, moisture-conditioned air, and carbon dioxide.

7. A freight transporting container according to claim 1, in which there is a plurality of inner containers in the space within said outer container, and a plurality of shock absorbers connected between said outer container and each of said inner containers for independently suspending said inner containers within said outer container, and a flexible ventilating sleeve connecting the adjacent ends of adjacent inner containers.

8. A freight transporting container according to claim 1, in the walls of at least one of said containers are made of heat-insulating materials.

9. A freight transporting container as claimed in claim 1 in which the outer container is substantially rectangular in cross-section, and said tension springs extend to the inside vertical corners of said outer container.

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