March 30, 1965 P. TALMEY ETAL 3,175,606

REFRIGERATED FREIGHT CONTAINERS

Filed Oct. 12, 1962 3 Sheets-Sheet 1

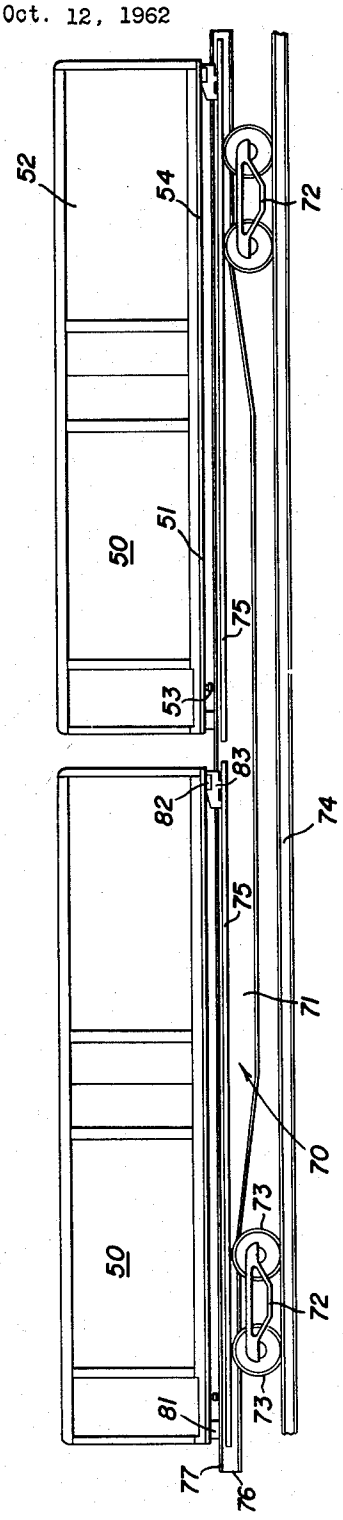


FIG. 2

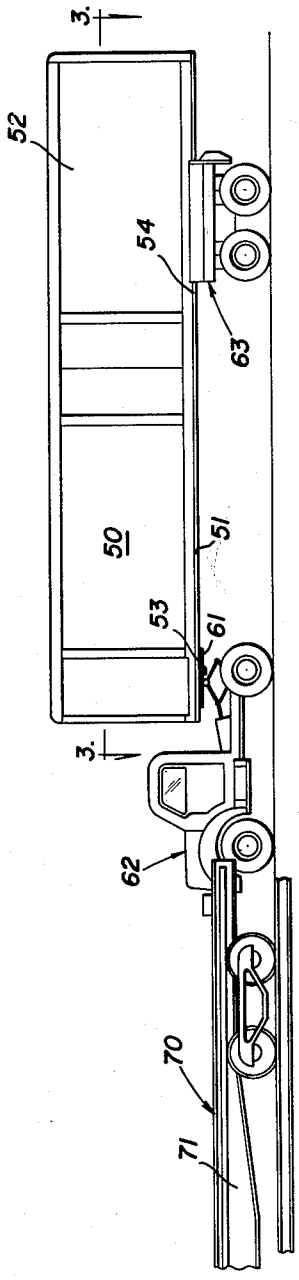


FIG. 1

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Filed Oct. 12, 1962 3 Sheets-Sheet 2

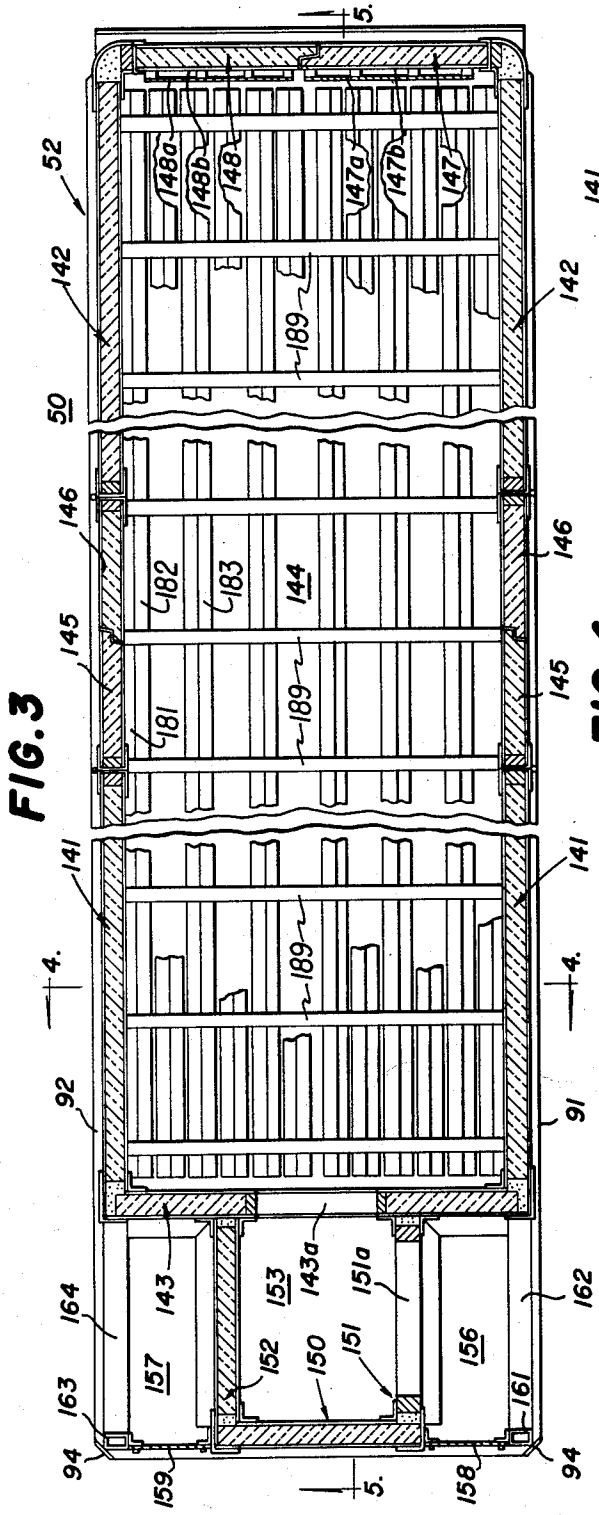


FIG. 3

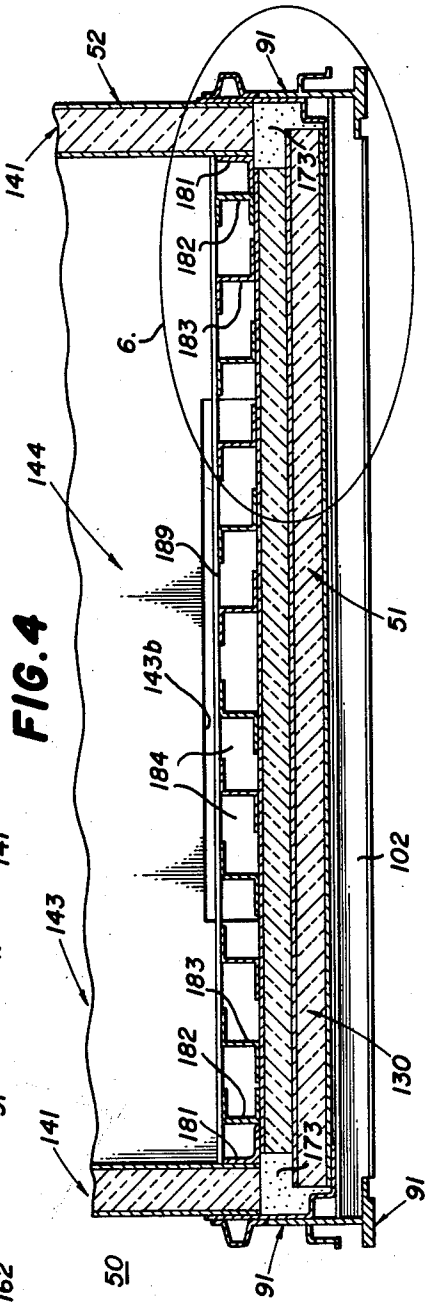


FIG. 4

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REFRIGERATED FREIGHT CONTAINERS

Filed Oct. 12, 1962 3 Sheets-Sheet 3

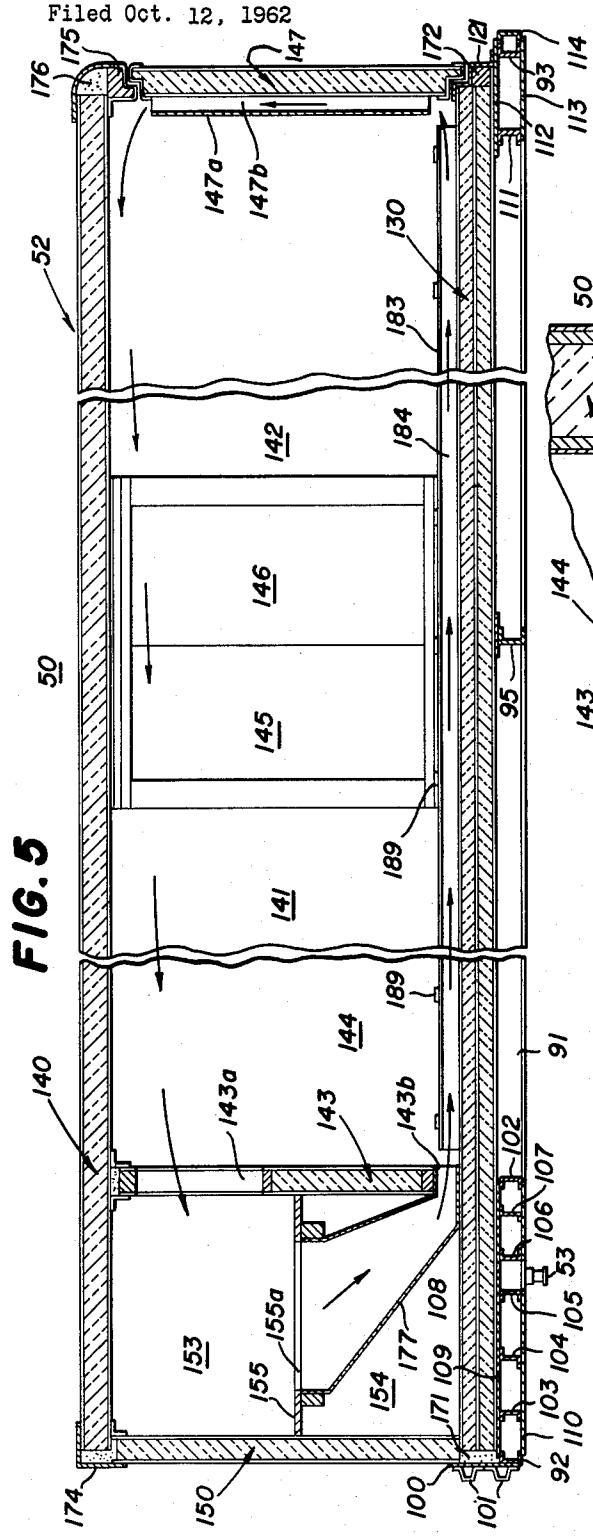


FIG. 5

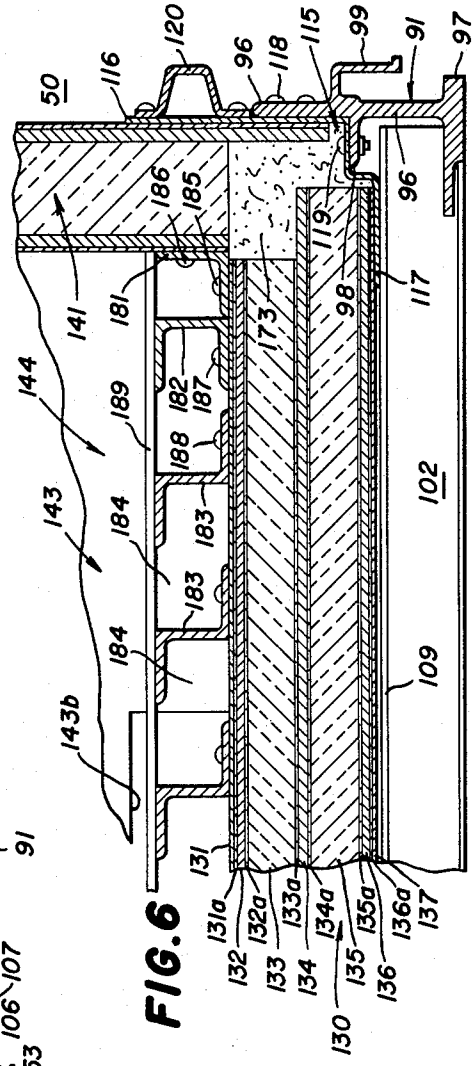


FIG. 6

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United States Patent Office 3,175,606 Patented Mar. 30, 1965

3,175,606

REFRIGERATED FREIGHT CONTAINERS

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Filed Oct. 12, 1962, Ser. No. 230,065
7 Claims. (Cl. 165—41)

The present invention relates to refrigerated freight containers, and more particularly to such containers that may be readily converted into the body of a road semi-trailer for highway operation and into the body of a railway car for railway operation; and it is a general object of the invention to provide in the freight container of this type that is disclosed in the copending application of Ernest Freudman, Serial No. 215,095, filed August 6, 1962, now Patent No. 3,133,658, granted May 19, 1964, improved structure for reinforcing the composite base thereof.

Another object of the invention is to provide in a refrigerated freight container, structure that not only reinforces the composite base thereof, but that also provides a lading-supporting floor in the lading compartment thereof and that defines floor flues therein so as to accommodate improved circulation of cooling air through the lading compartment to effect refrigeration of the lading therein.

A further object of the invention is to provide in a refrigerated freight container, a composite base of improved construction and arrangement that achieves great strength and rigidity therein and that provides a lading-supporting floor in the lading compartment thereof and that provides floor flues therein for circulating the cooling air in the lading compartment.

A still further object of the invention is to provide in a refrigerated freight container, improved structure of the character described that may be readily installed into the base of the container after fabrication of the other component elements thereof and at small expense and in a simplified manner.

Further features of the invention pertain to the particular arrangement of the elements of the refrigerated freight container, whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a refrigerated freight container embodying the present invention and illustrating the combination of the container with highway running gear to produce a road semi-trailer;

FIG. 2 is a side elevational view of two of the freight containers and illustrating the combination of the two containers with railway running gear to produce a composite body for a railway car;

FIG. 3 is an enlarged fragmentary horizontal sectional view of the freight container, this view being taken in the direction of the arrows along the line 3—3 in FIG. 1;

FIG. 4 is a greatly enlarged fragmentary lateral vertical sectional view of the freight container, this view being taken in the direction of the arrows along the line 4—4 in FIG. 3;

FIG. 5 is an enlarged fragmentary longitudinal vertical sectional view of the freight container, this view being taken in the direction of the arrows along the line 5—5 in FIG. 3; and

FIG. 6 is a still further enlarged fragmentary view of the lower right-hand portion of FIG. 4, this view being taken within the ring 6, as shown in FIG. 4.

Referring now to FIGS. 1 and 2 of the drawings, the several identical freight containers 50 there illustrated, and embodying the features of the present invention, are adapted to be employed in freight transportation systems of the highway-railway-waterway type. Specifically, the container 50 may be combined with highway running gear to produce a road semi-trailer, as shown in FIG. 1; two of the containers 50 may be combined with railway running gear to produce a composite body for a railway car, as shown in FIG. 2; and a great plurality of the containers 50 may be suitably stored in the hold of a ship, not shown, to compartmentize the same in an obvious manner. Specifically, the container 50 comprises a rigid base 51 carrying on the top thereof a substantially box-like body 52. Also, the front central bottom portion of the base 51 carries a downwardly directed kingpin 53 and the rear side bottom portions of the base 51 respectively carry longitudinally extending downwardly directed rail-like structure 54.

When the container 50 is adapted for highway transportation, as shown in FIG. 1, the kingpin 53 thereof is coupled to a conventional fifth-wheel mechanism 61 carried by the rear end of a conventional road tractor 62, the fifth wheel mechanism 61 being of the elevator type selectively movable between a lower road-traveling position and an upper transfer position in the usual manner. Also, the fifth-wheel mechanism 61 is selectively operable to couple and to uncouple the kingpin 53 in the usual manner. Moreover, the structures 54 are connected to a conventional road bogie 63 of the usual road-wheel type. Thus, the container 50 and the road bogie 63 cooperate to produce a road semi-trailer.

When the containers 50 are adapted for railway transportation, as shown in FIG. 2, the respective bases 51 of two of the containers 50 are mounted upon the opposite top ends of the frame 71 of a cooperating railway car 70. Preferably, the railway car 70 is of the construction and arrangement of that disclosed in the copending application of Deodat Clejan, Serial No. 151,358, filed November 9, 1961, now Patent No. 3,102,646, granted September 3, 1963; which railway car 70 is of skeleton-like construction in that the frame 71 thereof consists essentially of an elongated beam or center sill arranged in bridging relation with a pair of longitudinally spaced-apart trucks 72 provided with flanged track wheels 73 engaging the rails of an associated railway track indicated at 74. Also, as best shown in FIG. 2, the opposite outer sides of the beam or center sill 71 respectively carry elongated longitudinally extending members 75, two of such members 75 being independently resiliently mounted upon each side of the center sill 71 and disposed in longitudinal alignment with each other. Also, the center sill 71 essentially comprises two longitudinally extending and laterally spaced-apart I-beams 76 and is of fish-belly construction. Thus, the top flanges 77 of the I-beams 76 constitute the respective rails of a narrow gauge track provided upon the top side edges of the center sill 71 and disposed, together with the members 75, well inwardly with respect to the inner

sides of the track wheels 73 carried by the trucks 72. Each of the members 75 is disposed below the adjacent top flange 77 of the associated I-beam 76, and also projects laterally outwardly somewhat beyond the adjacent top flange 77, so that the members 75 are readily accessible from the top sides of the center sill 71 for a securing purpose, and further the members 71 perform a shock-absorbing purpose; all as explained more fully below.

Preferably, each of the containers 50 is mounted upon the top of the railway car 70 employing a laterally extending front bolster 81 and a laterally extending rear bolster 82 of the construction and arrangement of that disclosed in the copending application of Robert L. Hassenauer and Samuel H. Enochian, Serial No. 209,946, filed July 16, 1962. More particularly, the front end of the base 51 is supported by the front bolster 81 disposed therebelow and the rear end of the base 51 is supported by the rear bolster 82 disposed therebelow, the bolsters 81 and 82 being individually removably supported upon the top flanges 77 of the I-beams 76 in longitudinally spaced-apart relation. The front bolster 81 is selectively secured in place in its supported position upon the top flanges 77, and in turn, is selectively locked to the adjacent bottom front end of the supported base 51; and similarly, the rear bolster 82 is selectively secured in place in its supported position upon the top flanges 77, and in turn, is selectively locked to the adjacent bottom rear end of the supported base 51. The bolsters 81 and 82 in their mounted and secured positions and the base 51 in its mounted and locked position are movable longitudinally along the top flanges 77, as permitted by the members 75. More particularly, as indicated in FIG. 2, the front bolster 81 is free to move along the top flanges 77, while the rear bolster 82 carries structures 83 on the opposite ends thereof that project downwardly therefrom into cooperating and connecting relation with the members 75 respectively carried by the opposite sides of the center sill 71, whereby the members 75 allow only limited and cushioned longitudinal movements of the mounted unit with respect to the center sill 71, and whereby the members 75 prevent the transmission of severe longitudinal shocks from the center sill 71 to the connected container 50. In the railway car 70, the members 75 are respectively mounted upon the opposite sides of the center sill 71 by a plurality of longitudinally spaced-apart blocks, not shown, of elastomeric material, such for example, as rubber; whereby the movements of each member 75 relative to the center sill 71 are not only cushioned, as previously noted, but are also damped, so that the members 75 serve the shock-absorbing function. Hence, the members 75 serve the resilient cushioning function, the shock-absorbing function and the securing function between the center sill 71 of the railway car 70 and the mounted container 50. In passing, it is noted that the two containers 50 mounted upon the top of the center sill 71, as shown in FIG. 2, are independently resiliently mounted and secured in place by the two pairs of members 75 respectively carried by the opposite ends of the center sill 71 upon the respective opposite sides thereof.

The containers 50 may be loaded and unloaded with respect to the railway car 70 in any suitable manner, such, for example, as by the utilization of an overhead gantry crane, not shown, as disclosed in the previously mentioned application of Hassenauer and Enochian.

Referring now to FIGS. 3 to 6, inclusive, the container 50 is of the fundamental construction and arrangement of that disclosed in the previously mentioned copending application of Ernest Freudman; whereby the base 51 of the container 50 is of elongated rectangular form including a pair of longitudinally extending side sills 91, a laterally extending front end sill 92 and a laterally extending rear end sill 93. The front ends of the side sills 91 are respectively rigidly joined to the adjacent ends of the front end sill 92 by a pair of angularly disposed upstanding plates 94, while the rear end sill 93 is arranged between the rear ends of the side sills 91 and rigidly joined thereto. The intermediate portions of the side sills 91 are rigidly tied together by a laterally extending intermediate sill 95 arranged therebetween and rigidly joined thereto. The side sills 91 comprise special sections, as best shown in FIG. 6; whereby each of the side sills 91 comprises an upstanding web 96 terminating at the lower end thereof in a laterally extending flange 97, an inwardly and laterally directed ledge 98 carried by the intermediate portion of the web 96, and an outwardly and laterally directed and downwardly turned bumper element 99 carried by the intermediate portion of the web 96. The rear end portions of the flanges 97 of the side sills 91 constitute the previously mentioned structures 54 to which the road bogie 63 is selectively connected, as previously explained; whereby a longitudinally spaced-apart series of holes, not shown, are provided in each of the flanges 97 for the purpose of accommodating the securing of the road bogie 63 in place to the structures 54 at any one of a plurality of longitudinally spaced-apart positions with respect to the rear end of the base 51. Also, the front end sill 92 carries an upstanding end plate 100, that, in turn, carries two vertically spaced-apart laterally extending and forwardly projecting bumper elements 101.

The front end of the base 51 is especially reinforced due to the selective support thereof by the fifth-wheel mechanism 61 carried by the rear end of the road tractor 62; and more particularly, a laterally extending intermediate sill 102 is disposed rearwardly of the front end sill 92 and between the adjacent end portions of the side sills 91 and rigidly secured thereto. The area of the front end of the base 51 difined between the front end sill 92 and the intermediate sill 102 and the adjacent front end portions of the side sills 91 is reinforced by a number of laterally extending and longitudinally spaced-apart framing members 103 to 107 inclusive, as shown in FIG. 5. The framing members 105 and 106 coooperate to define a pocket therebetween into which is securely fastened in place a removable block 108 that carries the previously described depending kingpin 53. The framing members 103 to 107, inclusive, are enclosed by top and bottom plates 109 and 110 respectively carried by the corresponding portions of the front end of the base 51. The top plate 109 extends longitudinally between the top of the front end sill 92 and the top of the intermediate sill 102 and extends laterally between the adjacent front end portions of the side sills 91 and is rigidly secured in place thereupon. The bottom end plate 110 extends longitudinally between the bottom of the end sill 92 and the bottom of the intermediate sill 102 and extends laterally between the adjacent front end portions of the side sills 91 and is rigidly secured in place thereupon. Also, the bottom end plate 110 has an opening therein accommodating placement and removal therethrough of the kingpin block 108. When the front end of the base 51 is supported by the fifth-wheel mechanism 61 carried by the rear end of the road tractor 62, as shown in FIG. 1, the fifth-wheel mechanism 61 directly engages the bottom plate 110 and selectively couples and uncouples the kingpin 53 carried by the block 108 securely fastened in place in the pocket defined between the framing members 105 and 106.

The rear end of the base 51 is also especially reinforced; and more particularly, a laterally extending intermediate sill 111 is disposed forwardly of the rear end sill 93 and between the adjacent end portions of the side sills 91 and rigidly secured thereto. The rear end of the base 51 defined between the rear sill 93 and the intermediate sill 111 is enclosed by a rear top plate 112 and a rear bottom plate 113, the rear top plate 112 extending longitudinally between the top of the rear end sill 93 and the top of the intermediate sill 111 and laterally between the adjacent rear end portions of the side sills 91 and rigidly secured in place thereupon, and the rear bottom plate 113 extending longitudinally between the bottom of the rear end sill 93 and the bottom of the intermediate sill 111 and laterally

between the adjacent rear end portions of the side sills **91** and rigidly secured in place thereupon. Also, a laterally extending bumper element **114** is rigidly secured to the rear end sill **93** and projects longitudinally rearwardly therefrom.

Further, the front and rear ends of the base **51** respectively carry two pairs of laterally spaced-apart bottom connecting holes, not shown, that are employed in securing the corresponding ends thereof to the bolsters **81** and **82**, as shown in FIG. 2.

As best shown in FIG. 6, two side plates **115** are respectively carried by the side sills **91**, each of the side plates **115** being of substantially L-shape including a substantially vertically disposed flange **116** and a substantially horizontally disposed flange **117**. The lower portion of the vertical flange **116** is suitably secured to the upper portion of the web **96** of the side sill **91** by a series of rivets **118**, and the outer portion of the horizontal flange **117** is suitably secured to the ledge **98** carried by the web **96** of the side sill **91** by a series of bolts **119** provided with cooperating nuts. Also, the upper portion of the vertical flange **116** of the side plate **115** carries a bumper element **120**. Further, as best shown in FIG. **5**, a rear plate **121** is carried by the top of the rear end sill **93** and rigidly secured thereto, the rear plate **121** being substantially Z-shaped in cross section. In the arrangement the front plate **100**, the rear plate **121** and the pair of side plates **115** cooperate to define an upstanding substantially rim-like structure carried by the base **51**.

Referring now to FIGS. 4, 5 and 6, the base **51** further comprises a floor panel **130** of unitary rigid composite sandwich construction and arranged within the rim-like structure defined by the previously noted elements **100**, **121** and **115**. Specifically, the floor panel **130** extends longitudinally substantially between the front plate **100** and the rear plate **121** and extends laterally substantially between the side plates **115**. More particularly, as shown in FIG. 5, the extreme front end of the floor panel **130** terminates adjacent to the front plate **100** and the front end portion of the floor panel **130** is supported by the front top plate **109**. The extreme rear end of the floor panel **130** terminates adjacent to the rear plate **121** and the rear end portion of the floor panel **130** is supported by the rear top plate **112**. As best shown in FIGS. 4 and 6, the opposite sides of the floor panel **130** respectively terminate adjacent to the side sills **91** and the side portions thereof are respectively supported by the horizontal flanges **117** of the side plates **115**. Also, the intermediate portion of the floor panel **130** is supported upon the top of the intermediate sill **95**.

As best shown in FIG. 6, the floor panel **130** essentially comprises a top sheet **131** formed of a suitable aluminum alloy and having a thickness of about 0.025", an upper sheet **132** formed of fir plywood and having a thickness of about ¼", an upper layer **133** formed of synthetic organic resin of cellular structure, such, for example, as foamed polystyrene, and having a thickness of about 2", an intermediate sheet **134** formed of fir plywood and having a thickness of about ¼", a lower layer **135** formed of synthetic organic resin of cellular structure, such, for example, as foamed polystyrene, and having a thickness of about 2", a lower sheet **136** formed of fir plywood and having a thickness of about ¼", and a bottom sheet **137** formed of a suitable aluminum alloy and having a thickness of about 0.025". In the composite sandwich: the adjacent surfaces of the elements **131** and **132** are intimately secured together by an intervening layer of cement indicated at **131***a*, the adjacent surfaces of the elements **132** and **133** are intimately secured together by an intervening layer of cement indicated at **132***a*, the adjacent surfaces of the elements **133** and **134** are intimately secured together by an intervening layer of cement indicated at **133***a*, the adjacent surfaces of the elements **134** and **135** are intimately secured together by an intervening layer of cement indicated at **134***a*, the adjacent surfaces of the elements **135** and **136** are intimately secured together by an intervening layer of cement indicated at **135***a*, and the adjacent surfaces of the elements **136** and **137** are intimately secured together by an intervening layer of cement indicated at **136***a*; which layers **131***a*, etc., may be formed of a suitable epoxy resin cement.

The elements **131** and **137** being formed of metal serve to prevent penetration of the interior of the floor panel **130** by water, moisture, etc., either from the inside of the body **52** or from the exterior thereof, the element **137** constituting the usual exterior weather sheet in the floor panel **130**.

The composite floor panel **130** is securely fastened to the supporting elements **100**, **121** and **115** of the base **51**, as explained more fully hereinafter; whereby the floor panel **130** constitutes the fundamentally strong rigid structural element that is incorporated in the base **51**.

Referring now to FIGS. 3 to 6, inclusive, the body **52** of the container is of strong rigid unitary structure comprising, in addition to the floor panel **130**, a ceiling or roof panel **140**, a pair of front side wall panels **141**, a pair of rear side wall panels **142** and a bulkhead panel **143** cooperating with each other to define a lading compartment **144** in the central portion and in the rear end portion of the container **50**. Each of the panels **140**, **141**, **142** and **143** is of rigid composite sandwich construction, as disclosed in the previously mentioned application of Ernest Freudman, whereby the lading compartment **144** is heat-insulated by the body **52** of the container **50**. Each front side wall panel **141** cooperates with the adjacent rear side wall panel **142** to define an upstanding side doorway in the corresponding side of the body **52** and communicating with the corresponding side of the lading compartment **144**; which side doorway is provided with a pair of cooperating side doors **145** and **146**. Also the rear ends of the floor panel **130**, the roof panel **140** and the rear side wall panels **142** cooperate with each other to define an upstanding rear doorway in the rear end of the body **52** and communicating with the rear end of the lading compartment **144**; which rear doorway is provided with a pair of cooperating rear doors **147** and **148**. Also the side doors **145** and **146** and the rear doors **147** and **148** are of rigid composite sandwich construction, as disclosed in the previously mentioned application of Ernest Freudman.

Further, the container **50** comprises a front end wall panel **150** and a pair of dividing wall panels **151** and **152** that cooperate with each other to define a centrally disposed plenum chamber **153** and flue chamber **154** in the front end of the body **52**, the two chambers **153** and **154** being disposed in upper and lower positions and separated from each other by a horizontal baffle **155**, as best shown in FIG. 5. Each of the panels **150**, **151** and **152** is also of rigid composite sandwich construction, as disclosed in the Freudman application. Further, the panels **130**, **140**, **143** and **151** cooperate with each other to define a machinery compartment **156** disposed in one front corner of the body **52** and arranged exteriorly of the lading compartment **144** and the chambers **153** and **154**; and, similarily, the panels **130**, **140**, **143** and **152** cooperate with each other to define a fuel tank storage compartment **157** disposed in the other front corner of the body **52** and arranged exteriorly of the lading compartment **144** and the chambers **153** and **154**. The front end of the machinery compartment **156** is closed by a plate **158**, while the outer side thereof is open; and, likewise, the front end of the fuel storage compartment **157** is closed by a plate **159**, while the outer side thereof is open. The outer side of the machinery compartment **156** is suitably framed by structure, including an upstanding corner post **161**, so as to provide an outer side doorway **162** thereinto; and similarly, the outer side of the fuel storage compartment **157** is suitably framed by structure,

including an upstanding corner post **163**, so as to provide an outer side doorway **164** thereinto.

In the body **52** the various panels **130, 140, 141, 142, 143, 150, 151** and **152** are rigidly secured together and to associated framing structure so as to lend great strength and rigidity to the body **52**. For example, the front end of the floor panel **130** is secured to the front plate **100** and to the bottom of the front end panel **150** by a body of resin **171**; the rear end of the floor panel **130** is secured to the rear plate **121** by a wooden timber **172**; and the sides of the floor panel **130** are secured to the adjacent bottoms of the side panels **141** and **142** by bodies of resin **173**. Similarly, the front end of the roof panel **140** is secured to the top of the front end panel **150** by a body of resin **174**; the rear end of the roof panel **140** is secured to a top wooden framing timber **175** by a body of resin **176**; and the sides of the roof panel **140** are secured to the adjacent tops of the side panels **141** and **142** by bodies of resin, not shown. The bodies of resin **171**, etc., mentioned may comprise foamed polyurethane, whereby these bodies effect both the securing function and a heat-insulating function.

The machinery compartment **156** is adapted to receive a refrigerating machine of the compressor-condenser-evaporator type and provided with an internal combustion engine for driving the compressor; which apparatus comprises a unit that is removable with respect to the machinery compartment **156**; which apparatus is so constructed and arranged that the evaporator thereof projects through an opening **151***a* provided in the dividing wall panel **151** into the plenum chamber **153**, when the unit occupies its normal position in the machinery compartment **156**; and which unit further plugs the remainder of the opening **151***a* so as to close the plenum chamber **153** from the machinery compartment **156** and to heat-insulate the same from each other. Also, the evaporator of the refrigerating machine comprises a blower for circulating air between the lading compartment **144** and the plenum chamber **153**, as explained more fully hereinafter. Further, the internal combustion engine of the unit may operate using propane as a fuel; whereby fuel tanks containing compressed and liquified propane are removably arranged in the fuel tank storage compartment **157** and operatively connected to the internal combustion engine, when the unit occupies its normal position in the machinery compartment **156**.

More particularly, upper and lower openings **143***a* and **143***b* are respectively arranged in the corresponding central portions of the bulkhead panel **143**; a flue or conduit **177** is arranged in the flue chamber **154** and connected between an opening **155***a* provided in the baffle **155** and the opening **143***b* formed in the bulkhead panel **143**. Also a pair of baffle sheets **147***a* and **148***a* are respectively carried by the inner surfaces of the rear doors **147** and **148**, thereby to provide two corresponding upstanding rear flues **147***b* and **148***b* at the rear end of the lading compartment **144**, when the rear doors **147** and **148** occupy their normal closed positions. Thus, it will be understood that operation of the blower carried by the evaporator of the refrigerating machine effects the circulation of air from the top of the plenum chamber **153** through and into heat-exchange relation with the evaporator and thence through the opening **155***a*, the conduit **177** and the opening **143***b* onto the top of the floor panel **130** in the front end of the lading compartment **144**; the cool air then proceeds rearwardly along the floor panel **130** through the lading compartment **144** and thence upwardly through the flues **147***b* and **148***b* defined in the rear doors **147** and **148**, and thence forwardly along the roof panel **140** through the lading compartment **144**; and ultimately the air passes through the opening **143***a* and back into the top of the plenum chamber **153**; all as shown in FIG. 5.

Referring now to FIGS. 3 to 6, inclusive, in accordance with the present invention, the composite base **51** oft he container **50** is further strengthened and reinforced adjacent to the intermediate and rear end portions thereof by a pair of longitudinally extending and laterally spaced-apart structural elements **181** respectively disposed adjacent to the opposite sides of the floor panel **131** at the respective junctions thereof with the pairs of side wall panels **141** and **142**, a pair of longitudinally extending structural elements **182** respectively arranged inwardly adjacent to the elements **181**, and a plurality of longitudinally extending and laterally spaced-apart structural elements **183** arranged between the elements **182**. The elements **181** are L-shaped; the elements **182** are U-shaped; and the elements **183** are Z-shaped; whereby the elements **181, 182** and **183** cooperate with each other to define both a lading-supporting floor in the lading compartment **144** and a plurality of floor flues **184** therebetwen and extending longitudinally substantially from end to end of the lading compartment **144**. The elements **181** extend the entire length of the lading compartment **144**, while the elements **182** and **184** extend from a position disposed somewhat rearwardly of the inner side of the bulkhead panel **143** to a position disposed somewhat forwardly of the inner sides of the rear doors **147** and **148**, as best shown in FIG. 5; whereby the elements **182** and **183** span substantially the length of the intermediate portion of the floor panel **130** disposed between the front and reinforcement of the composite base **51**, produced by the intermediate sill **102**, etc., and the rear end reinforcement of the composite base **51**, produced by the intermediate sill **111**, etc. Thus, the front end portion reinforcement and the rear end portion reinforcement of the composite base **50** are effected from below the floor panel **130**, while the intermediate portion reinforcement of the composite base **50** is effected from above the floor panel **130**. This arrangement is very advantageous, since the elements **181, 182** and **183** being positioned on top of the floor panel **130** not only produce the required reinforcement of the composite base **51**, but they also establish the lading-supporting floor in the lading compartment **144** and define the floor flues **184**.

The elements **181** are rigidly secured to the adjacent portions of the panels **130** and **141** and **142** utilizing a respective series of fasteners **185** and **186**; and the elements **182** and **183** are rigidly secured to the floor panel **130** utilizing respective series of fasteners **187** and **188**. Also, a plurality of laterally extending and longitudinally spaced apart straps **189** are carried by the top elements **181, 182** and **183**; which straps **189** are suitably secured in place with respect to the elements **181, 182** and **183** in order to integrate the reinforcement of the intermediate and rear end portions of the composite base **51** into a unitary structure. Thus, the elements **181, 182** and **183** and the straps **189** lend great rigidity to composite base **51**.

Again referring to FIG. 5, will be observed that the cool air issuing through the bottom opening **143***b* formed in the bulkhead panel **143** proceeds rearwardly into the front ends of the floor flues **184**, and that the air flows rearwardly through the floor flues **184** past the areas of the side doorways and then from the rear ends of the floor flues **184** and then upwardly through the rear door flues **147***b* and **148***b*.

In a constructional example of the container **50**, the same may have a maximum outside width of 7'9⅛", a maximum outside height of 8'6", and a maximum outside length of 40'0". The railway car **70** has a length between the striker plates carried by the opposite ends of the center sill **71** of 85'8", and a height of the top of the center sill **71** above the tops of the track rails **74** of 3'8½", as shown in FIG. 2. When the container **50** occupies its mounted position upon the railway car **70**,

employing the bolsters **81** and **82**, as shown in FIG. 2, the maximum clearance height between the tops of the track rails **74** and the top of the body **52** of the container **50** is 12'8$\frac{3}{16}$". The other dimensions of the container **50** are generally related to those set forth in accordance with the scales of the different figures of the drawings.

In the container **50**, the floor panel **130** is of block-like configuration having a length (X) of 39'7½", a width (Y) of 7'4⅞" and a thickness (Z) of 4.8"; whereby the floor panel **130** has a length X that is in excess of about 30 feet and a width Y that is in excess of about 6 feet and a thickness Z that is in excess of about 4 inches. In the floor panel **130**, each of the inner liner sheet **131** and the other weather sheet **137** is preferably formed of a suitable aluminum alloy, as previously noted, but the same may be formed of steel, including stainless steel; and ordinarily the gauge thereof is within the general range 20 to 100 mils, 0.025" aluminum sheet being entirely satisfactory, as previously noted. Of course, additional strength may be imparted to the floor panel **130** by increasing the thickness of each of the plywood sheets **132**, **134** and **136**; however, the use of ¼" fir plywood for this purpose is altogether adequate. Similarly, the "*k*" factor of the floor panel **130** may be further reduced by increasing the thickness of each of the slabs **133** and **135**, but here again little advantage is gained since the floor panel **130** already has an exceedingly low "*k*" factor employing the foamed polystyrene slabs **133** and **135** each of a thickness of 2".

At this point, it is noted that the peculiar arrangement of the elements **132**, **133**, **134**, **135** and **136** in the floor panel **130** is productive of a stiffness therein that greatly exceeds that obtained by the mere sandwich utilization of such materials of equivalent thicknesses. Specifically, a reference sandwich construction of 5-ply might comprise an outer weather sheet of aluminum of 0.025", an adjacent outer fir plywood sheet of ⅜", a foamed polystyrene core of 4", an adjacent inner fir plywood sheet of ⅜", and an inner liner sheet of aluminum of 0.025"; which reference sandwich of 5-ply has equivalent thicknesses of materials as the present sandwich of 7-ply, as disclosed heretofore; however, this reference sandwich of 5-ply is not nearly as stiff as the present sandwich of 7-ply. In other words, the present sandwich of 7-ply achieves a synergistic result with respect to stiffness in the present peculiar distribution of the same materials in the same total thicknesses; which increased stiffness is obtained without substantial increase in manufacturing costs of the floor panel **130** and with no particular increase in the weight thereof. Also, the present sandwich of 7-ply has a "*k*" factor that is somewhat lower than that of the reference panel of 5-ply, as described above. Hence, the present sandwich of 7-ply is productive of unique and unexpected characteristics with respect to those of the above described reference panel of 5-ply; and while the improved mode of the present sandwich of 7-ply is not altogether understood, it is none the less emphatic.

In the structure of the container **50**, where materials of construction are not specifically designated, it will be understood that suitable materials of construction may be employed; however, steel is such suitable material of construction of a majority of the structural elements of the container **50**, as herein disclosed.

In view of the foregoing, it is apparent that there has been provided a refrigerated freight container that is selectively adapted for highway operation and railway operation and that is of strong unitary construction and arrangement. The fundamentally strong and rigid structural member of the container that contributes so greatly to the overall strength and rigidity thereof, is the floor panel thereof, that is of the peculiar sandwich construction, as previously described; however, the roof panel and the side wall panels, as well as the front end wall panel and the bulkhead wall panel and the dividing wall panels, all of strong rigid sandwich construction, materially contribute to the total strength and rigidity of the container. Further, another feature of construction of the container that is of substantial importance with reference to the strength and rigidity thereof, concerns the arrangement wherein both the floor panel and the roof panel run from end to end thereof and beyond the lading compartment and respectively under and over both the machinery compartment and the fuel tank storage compartment and the plenum chamber formed in the front end of the body of the container, and notwithstanding the circumstance that the floor panel and the roof panel perform no particular useful heat-insulating functions with respect to these two compartments, but which arrangement is most advantageous to obtain maximum strength and rigidity in the container. Another important feature of construction of the container thus provided resides in the circumstance that the individual panels incorporated in the body thereof not only achieve great strength and rigidity in the body thereof, but are individually of exceedingly light weight and have an excellent heat-insulating characteristic; whereby a very low "U" factor is automatically achieved for the lading compartment defined in the body of the container by the assembly of the panels described, each having not only great strength and rigidity, but also an exceedingly low "*k*" factor. Still another important feature of construction of the floor panel resides in the utilization of the reinforcing members upon the top thereof; wherein these members not only perform the reinforcing function mentioned, but they define the lading-supporting floor in the lading compartment and the floor flues therein for confining the circulated cooling air in the lading compartment.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A refrigerated freight container comprising an elongated substantially rectangular base frame including a pair of longitudinally extending side sills and a pair of laterally extending end sills, the opposite ends of said end sills being rigidly secured to the corresponding opposite ends of said side sills, a first laterally extending intermediate sill arragned within the front end portion of said base frame and located rearwardly of the front one of said end sills, the opposite ends of said first intermediate sill being rigidly secured to the adjacent front portions of said side sills, a front plate carried by the top front end portion of said base frame and extending longitudinally between said front end sill and said first intermediate sill and rigidly secured thereto and also extending laterally between the front portions of said side sills and rigidly secured thereto, thereby to reinforce the front end portion of said base frame, a second laterally extending intermediate sill arranged within the rear end portion of said base frame and located forwardly of the rear one of said end sills, the opposite ends of said second intermediate sill being rigidly secured to the adjacent rear portions of said side sills, a rear plate carried by the rear end portion of said base frame and extending longitudinally between said rear end sill and said second intermediate sill and rigidly secured thereto and also extending laterally between the rear portions of said side sills and rigidly secured thereto, thereby to reinforce the rear end portion of said base frame, an elongated substantially rectangular floor panel of prefabricated unitary rigid sandwich structure arranged upon the top of said base frame with the lower front portion of said floor panel supported upon the top of said front plate and with the lower rear portion of said floor panel supported upon the top of said rear plate, the opposite sides of said floor panel being securely

fastened to said side sills and the opposite ends of said floor panel being securely fastened to said end sills, whereby said base frame and said floor panel cooperate to produce a composite base with said floor panel lending great rigidity thereto, an upstanding laterally extending substantially rectangular heat-insulating bulkhead carried by the front end portion of said floor panel and rigidly secured thereto, said bulkhead being located approximately above said first intermediate sill, first heat-insulating structure rigidly secured to said composite base and located rearwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like body defining a lading compartment therein that is disposed above both the central portion and the rear end portion of said composite base, second heat-insulating structure rigidly secured to said composite base and located forwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like housing defining a plenum chamber therein that is disposed above the front end portion of said composite base, a plurality of longitudinally extending rigid structural members arranged in laterally spaced-apart relation and securely fastened to the top of said floor panel, at the central and rear end portions thereof, thereby to reinforce the corresponding central and rear end portions of said composite base, said structural members being disposed in said lading compartment and cooperating with each other to define in said lading compartment both a lading-supporting floor and a plurality of longitudinally extending and laterally spaced-apart floor flues, said lading supporting floor and said floor flues being positioned above the top of said floor panel, means for circulating aid from said plenum chamber through a bottom opening provided in said bulkhead and thence rearwardly through said floor flues in said lading compartment and then upwardly and back forwardly through the upper portion of said lading compartment and ultimately back through a top opening provided in said bulkhead and thus back into said plenum chamber, and means disposed in said plenum chamber for cooling the air that is circulated therethrough.

2. The refrigerated freight container set forth in claim 1, wherein each of said structural members includes an upstanding web carrying top and bottom flanges, said bottom flanges are securely fastened to the top of the central portion and the rear end portion of said floor panel, said top flanges define said lading-supporting floor, and said floor flues are defined between said webs.

3. The refrigerated freight container set forth in claim 1, wherein each of said structural members essentially comprises a Z-shaped member including an upstanding web carrying top and bottom flanges, said bottom flanges are securely fastened to the top of the central portion and the rear end portion of said floor panel, said top flanges define said lading-supporting floor, and said floor flues are defined between said webs.

4. The refrigerated freight container set forth in claim 1, wherein said structural members are spaced-apart laterally so as to provide a plurality of longitudinally extending slots communicating through said lading-supporting floor between the tops of said floor flues and the bottom of said lading compartment.

5. A refrigerated freight container comprising an elongated substantially rectangular base frame including a pair of longitudinally extending side sills and a pair of laterally extending end sills, the opposite ends of said end sills being rigidly secured to the corresponding opposite ends of said side sills, a first laterally extending intermediate sill arranged within the front end portion of said base frame and located rearwardly of the front one of said end sills, the opposite ends of said first intermediate sill being rigidly secured to the adjacent front portions of said side sills, a front plate carried by the top front end portion of said base frame and extending longitudinally between said front end sill and said first intermediate sill and rigidly secured thereto and also extending

laterally between the front portions of said side sills and rigidly secured thereto, thereby to reinforce the front end portion of said base frame, a second laterally extending intermediate sill arranged within the rear end portion of said base frame and located forwardly of the rear one of said end sills, the opposite ends of said second intermediate sill being rigidly secured to the adjacent rear portions of said side sills, a rear plate carried by the rear end portion of said base frame and extending longitudinally between said rear end sill and said second intermediate sill and rigidly secured thereto and also extending laterally between the rear portions of said side sills and rigidly secured thereto, thereby to reinforce the rear end portion of said base frame, an elongated substantially rectangular floor panel of prefabricated unitary rigid sandwich structure arranged upon the top of said base frame with the lower front portion of said floor panel supported upon the top of said front plate and with the lower rear portion of said floor panel supported upon the top of said rear plate, the opposite sides of said floor panel being securely fastened to said side sills and the opposite ends of said floor panel being securely fastened to said end sills, whereby said base frame and said floor panel cooperate to produce a composite base with said floor panel lending great rigidity thereto, an upstanding laterally extending substantially rectangular heat-insulating bulkhead carried by the front end portion of said floor panel and rigidly secured thereto, said bulkhead being located approximately above said first intermediate sill, first heat-insulating structure rigidly secured to said composite base and located rearwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like body defining a lading compartment therein that is disposed above both the central portion and the rear end portion of said composite base, second heat-insulating structure rigidly secured to said composite base and located forwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like housing defining a plenum chamber therein that is disposed above the front end portion of said composite base, a plurality of longitudinally extending rigid structural members arranged in laterally spaced-apart relation and engaging and secured to the top of said floor panel at the central and rear end portions thereof, a plurality of laterally extending straps arranged in longitudinally spaced-apart relation and engaging and secured to the tops of said structural members, thereby to reinforce the corresponding central and rear end portions of said composite base, said structural members and said straps being disposed in said lading compartment and cooperating mutually with each other to define in said lading compartment both a lading-supporting floor and a plurality of longitudinally extending and laterally spaced-apart floor flues, said lading supporting floor and said floor flues being positioned above the top of said floor panel, means for circulating air from said plenum chamber through a bottom opening provided in said bulkhead and thence rearwardly through said floor flues in said lading compartment and then upwardly and back forwardly through the upper portion of said lading compartment and ultimately back through a top opening provided in said bulkhead and thus back into said plenum chamber, and means disposed in said plenum chamber for cooling the air that is circulated therethrough.

6. A refrigerated freight container comprising an elongated substantially rectangular base frame including a pair of longitudinally extending side sills and a pair of laterally extending end sills, the opposite ends of said end sills being rigidly secured to the corresponding opposite ends of said side sills, a first laterally extending intermediate sill arranged within the front end portion of said base frame and located rearwardly of the front one of said end sills, the opposite ends of said first intermediate sill being rigidly secured to the adjacent front portions of said side sills, a front plate carried by the top

front end portion of said base frame and extending longitudinally between said front end sill and said first intermediate sill and rigidly secured thereto and also extending laterally between the front portions of said side sills and rigidly secured thereto, thereby to reinforce the front end portion of said base frame, a second laterally extending intermediate sill arranged within the rear end portion of said base frame and located forwardly of the rear one of said end sills, the opposite ends of said second intermediate sill being rigidly secured to the adjacent rear portions of said side sills, a rear plate carried by the rear end portion of said base frame and extending longitudinally between said rear end sill and said second intermediate sill and rigidly secured thereto and also extending laterally between the rear portions of said side sills and rigidly secured thereto, thereby to reinforce the rear end portion of said base frame, an elongated substantially rectangular floor panel of prefabricated unitary rigid sandwich structure arranged upon the top of said base frame with the lower front portion of said floor panel supported upon the top of said front plate and with the lower rear portion of said floor panel supported upon the top of said rear plate, the opposite sides of said floor panel being securely fastened to said side sills and the opposite ends of said floor panel being securely fastened to said end sills, whereby said base frame and said floor panel cooperate to produce a composite base with said floor panel lending great rigidity thereto, an upstanding laterally extending substantially rectangular heat-insulating bulkhead carried by the front end portion of said floor panel and rigidly secured thereto, said bulkhead being located approximately above said first intermediate sill, first heat-insulating structure rigidly secured to said composite base and located rearwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like body defining a lading chamber therein and provided with a rear doorway communicating with the rear end of said lading compartment, said lading compartment being disposed above both the central portion and the rear end portion of said composite base, a pair of heat-insulating rear doors respectively mounted upon the opposite rear sides of said body for pivoted movements relative thereto and with respect to said rear doorway, said rear doors being movable inwardly into closed positions disposed within said rear doorway and movable outwardly into open positions removed from said rear doorway, second heat-insulating structure rigidly secured to said composite base and located forwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like housing defining a plenum chamber therein that is disposed above the front end portion of said composite base, a plurality of longitudinally extending rigid structural members arranged in laterally spaced-apart relation and securely fastened to the top of said floor panel at the central and rear end portions thereof, thereby to reinforce the corresponding central and rear end portions of said composite base, said structural members being disposed in said lading compartment and cooperating with each other to define in said lading compartment both a lading-supporting floor and a plurality of longitudinally extending and laterally spaced-apart floor flues, said lading supporting floor and said floor flues being positioned above the top of said floor panel, the front ends of said structural members terminating somewhat rearwardly of said bulkhead and the rear ends of said structural members terminating somewhat forwardly of said rear doors when they are in their closed positions, means for circulating air from said plenum chamber through a bottom opening provided in said bulkhead and thence rearwardly through said floor flues in said lading compartment and then upwardly and back forwardly through the upper portion of said lading compartment and ultimately back through a top opening provided in said bulkhead and thus back into said plenum chamber, and means disposed in said plenum chamber for cooling the air that is circulated therethrough.

7. A refrigerated freight container comprising an elongated substantially rectangular base frame including a pair of longitudinally extending side sills and a pair of laterally extending end sills, the opposite ends of said end sills being rigidly secured to the corresponding opposite ends of said side sills, a first laterally extending intermediate sill arranged within the front end portion of said base frame and located rearwardly of the front one of said end sills, the opposite ends of said first intermediate sill being rigidly secured to the adjacent front portions of said side sills, a front plate carried by the top front end portion of said base frame and extending longitudinally between said front end sill and said first intermediate sill and rigidly secured thereto and also extending laterally between the front portions of said side sills and rigidly secured thereto, thereby to reinforce the front end portion of said base frame, a second laterally extending intermediate sill arranged within the rear end portion of said base frame and located forwardly of the rear one of said end sills, the opposite ends of said second intermediate sill being rigidly secured to the adjacent rear portions of said side sills, a rear plate carried by the rear end portion of said base frame and extending longitudinally between said rear end sill and said second intermediate sill and rigidly secured thereto and also extending laterally between the rear portions of said side sills and rigidly secured thereto, thereby to reinforce the rear end portion of said base frame, an elongated substantially rectangular floor panel of prefabricated unitary rigid sandwich structure arranged upon the top of said base frame with the lower front portion of said floor panel supported upon the top of said front plate and with the lower rear portion of said floor panel supported upon the top of said rear plate, the opposite sides of said floor panel being securely fastened to said side sills and the opposite ends of said floor panel being securely fastened to said end sills, whereby said base frame and said floor panel cooperate to produce a composite base with said floor panel lending great rigidity thereto, an upstanding laterally extending substantially rectangular heat-insulating bulkhead carried by the front end portions of said floor panel and rigidly secured thereto, said bulkhead being located approximately above said first intermediate sill, first heat-insulating structure rigidly secured to said composite base and located rearwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like body defining a lading chamber therein and provided with a pair of side doorways communicating with the opposite central sides of said lading compartment, said lading compartment being disposed above both the central portion and the rear end portion of said composite base, two pairs of heat-insulating side doors respectively mounted upon the opposite central sides of said body for pivoted movements relative thereto and with respect to said side doorways, each pair of said side doors being movable inwardly into closed positions disposed within the associated one of said side doorways and movable outwardly into open positions removed from said one side doorway, second heat-insulating structure rigidly secured to said composite base and located forwardly of said bulkhead and cooperating mutually therewith to produce a substantially box-like housing defining a plenum chamber therein that is disposed above the front end portion of said composite base, a plurality of longitudinally extending rigid structural members arranged in laterally spaced-apart relation and securely fastened to the top of said floor panel at the central and rear end portions thereof, thereby to reinforce the corresponding central and rear end portions of said composite base, said structural members being disposed in said lading compartment and cooperating with each other to define in said lading compartment both a lading-supporting floor and a plurality of longitudinally extending and

laterally spaced-apart floor flues, said lading supporting floor and said floor flues being positioned above the top of said floor panel, the intermediate portions of said structural members being disposed somewhat above said side doorways arranged in lateral alignment with each other so that said lading-supporting floor and said floor flues are continuous from end to end of said lading compartment, means for circulating air from said plenum chamber through a bottom opening provided in said bulkhead and thence rearwardly through said floor flues in said lading compartment and then upwardly and back forwardly through the upper portion of said lading compartment

and ultimately back through a top opening provided in said bulkhead and thus back into said plenum chamber, and means disposed in said plenum chamber for cooling air that is circulated therethrough.

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