Feb. 17, 1959 K. J. TOBIN 2,873,695

FREIGHT LOADING APPARATUS

Original Filed Nov. 27, 1951 6 Sheets-Sheet 1

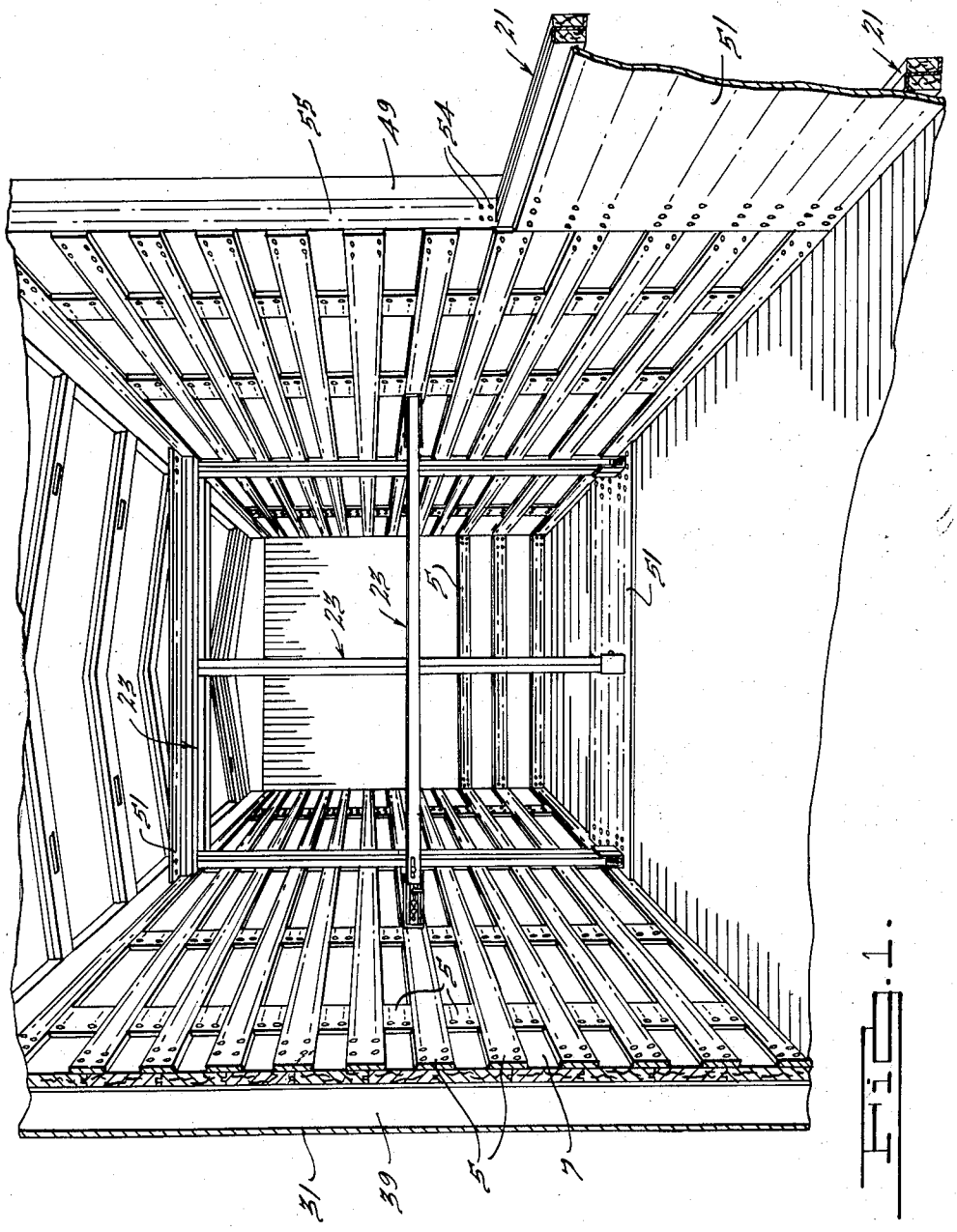


Fig. 1.

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Original Filed Nov. 27, 1951 6 Sheets-Sheet 2

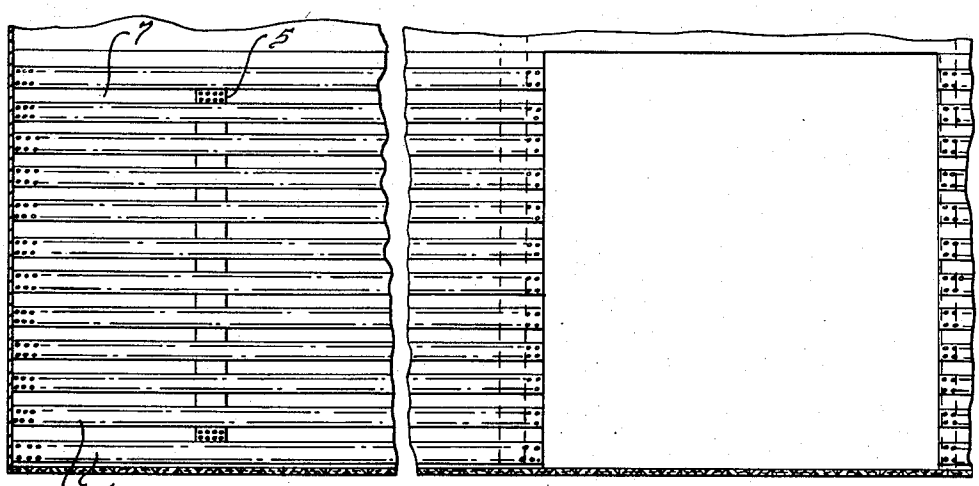


Fig. 2.

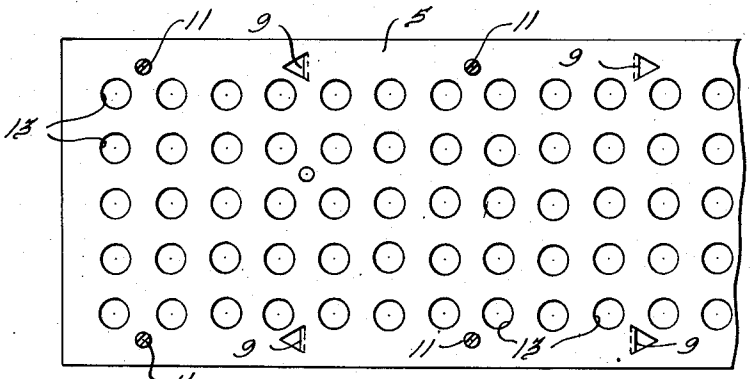


Fig. 3.

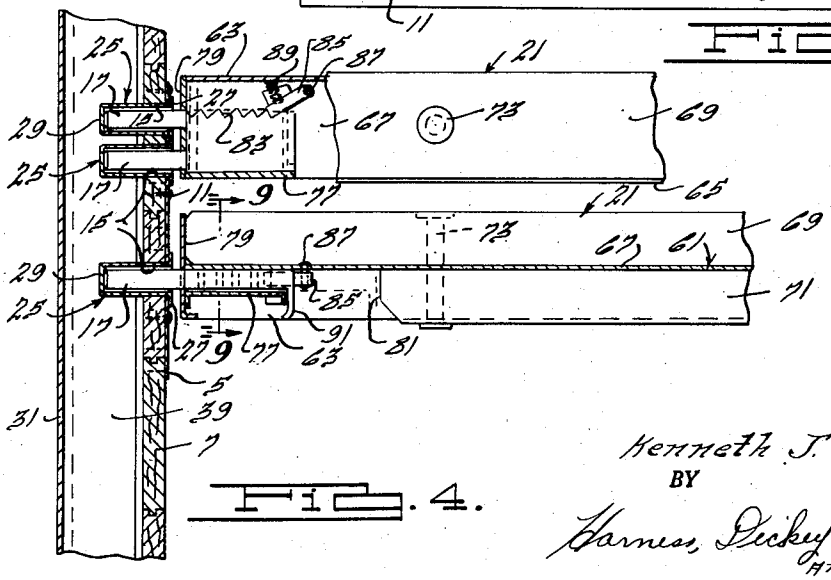


Fig. 4.

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Original Filed Nov. 27, 1951 6 Sheets-Sheet 3

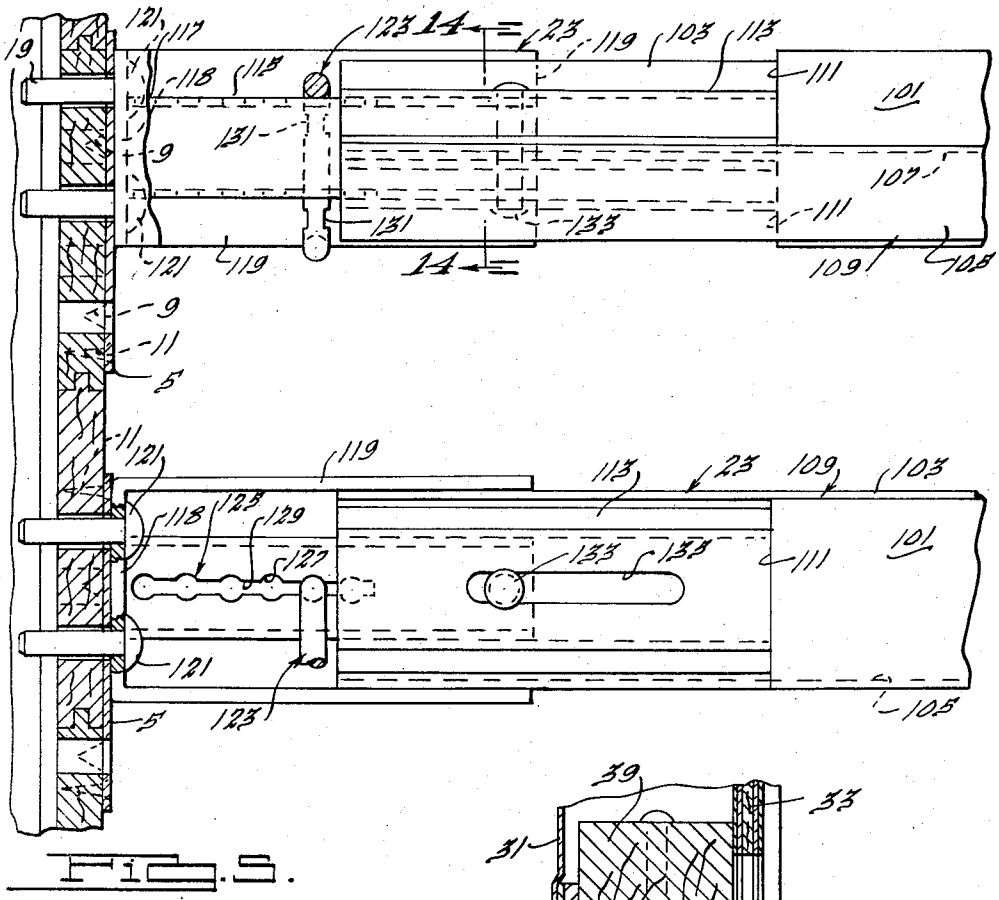


Fig. 5.

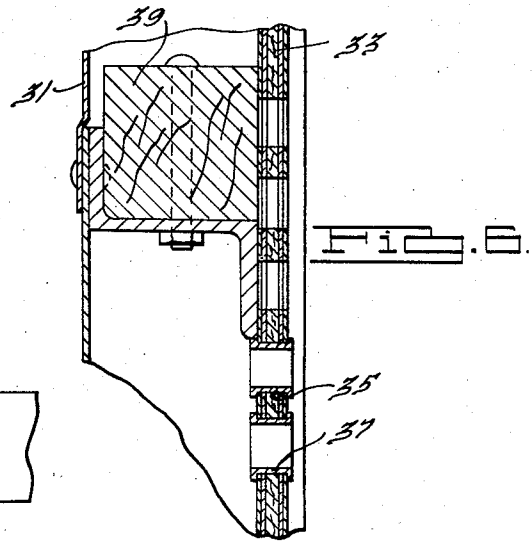


Fig. 6.

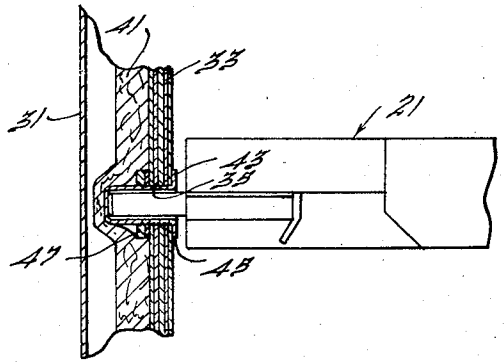


Fig. 6A.

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Original Filed Nov. 27, 1951 6 Sheets-Sheet 4

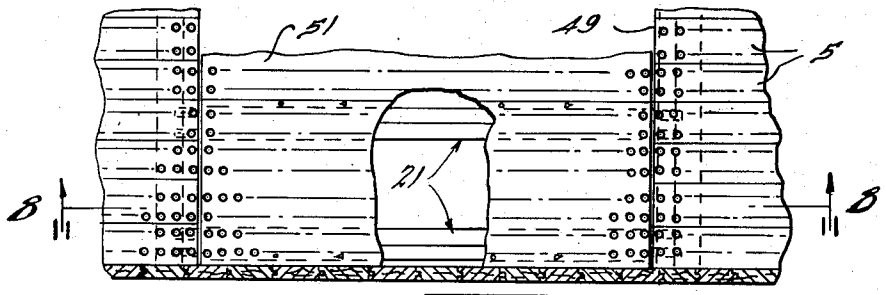


Fig. 7.

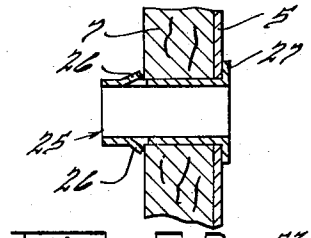


Fig. 6B.

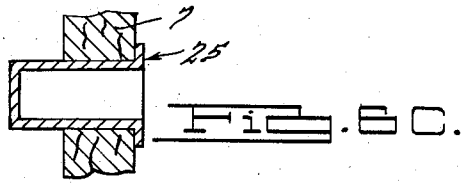


Fig. 6C.

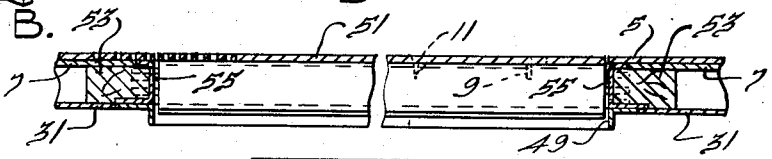


Fig. 8.

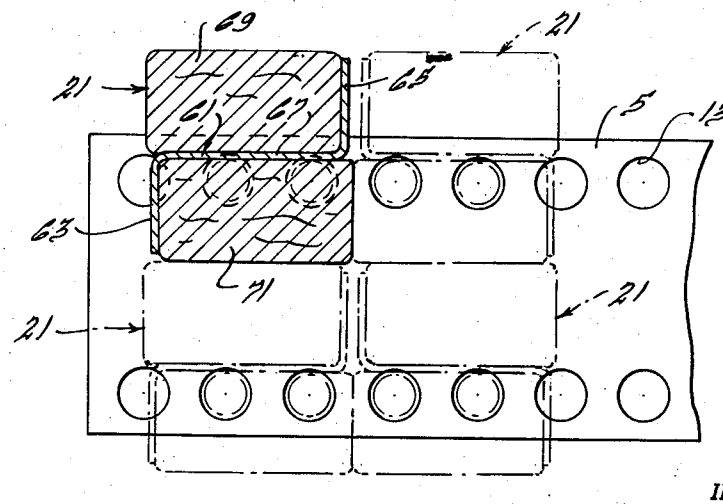


Fig. 11.

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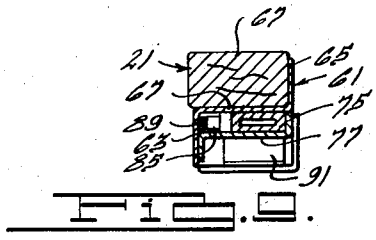


Fig. 9.

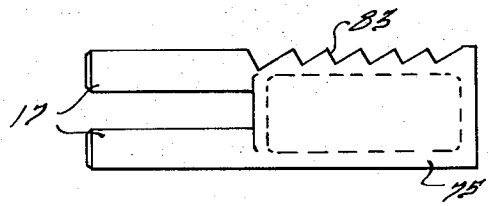


Fig. 10.

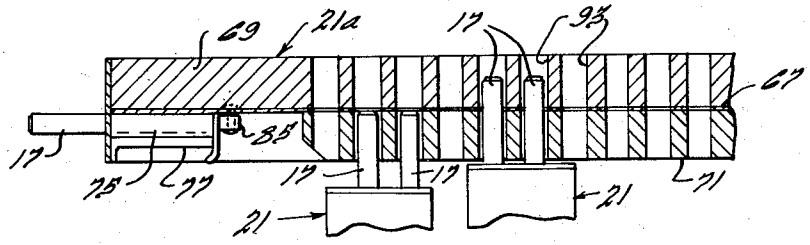


Fig. 12.

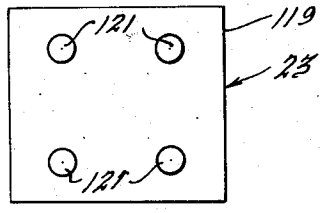


Fig. 13.

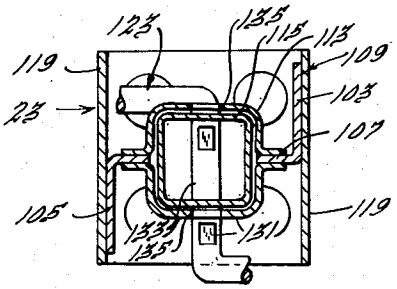


Fig. 14.

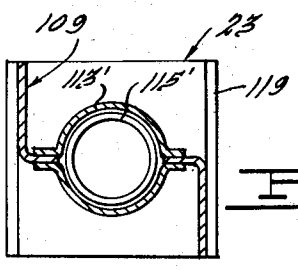


Fig. 15.

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FREIGHT LOADING APPARATUS

Original Filed Nov. 27, 1951 6 Sheets-Sheet 6

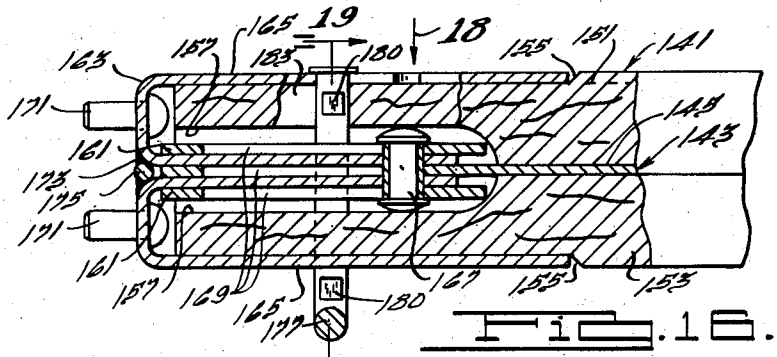


Fig. 16.

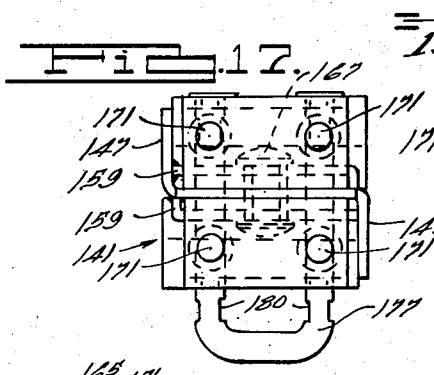


Fig. 17.

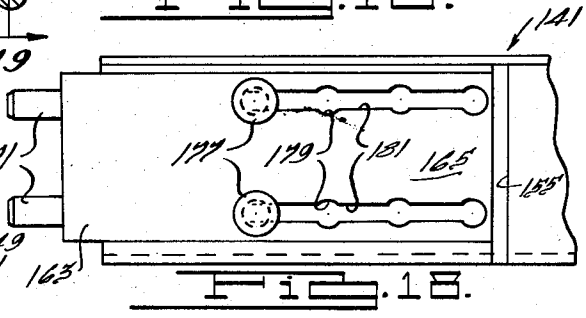


Fig. 18.

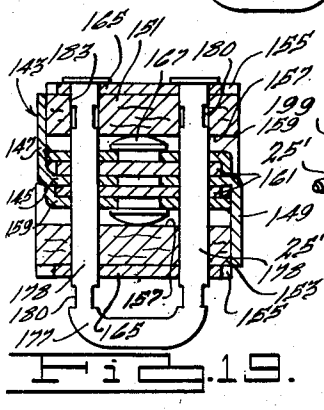


Fig. 19.

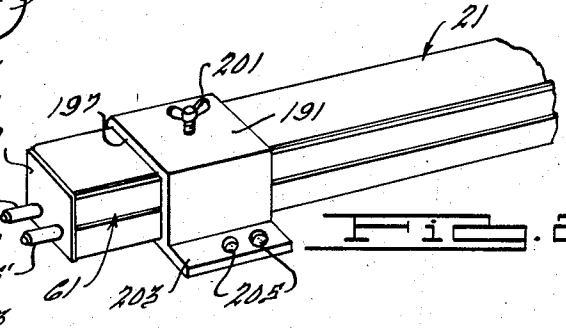


Fig. 20.

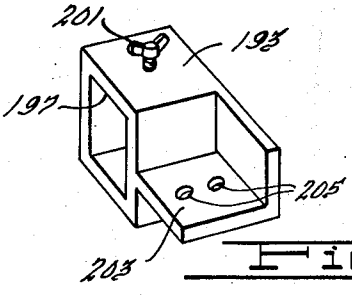


Fig. 21.

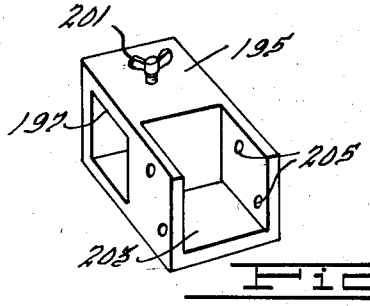


Fig. 22.

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United States Patent Office 2,873,695 Patented Feb. 17, 1959

2,873,695

FREIGHT LOADING APPARATUS

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Continuation of application Serial No. 258,403, November 27, 1951. This application January 24, 1956, Serial No. 561,026

12 Claims. (Cl. 105—369)

The present application is a continuation of applicant's copending application Serial No. 258,403, filed November 27, 1951. Claims to subject matter disclosed but not claimed herein are presented in a divisional application Serial No. 694,249, filed on November 4, 1957.

This invention relates to freight loading apparatus which may be installed in transport vehicles such as railroad cars.

It is an object of this invention to provide freight loading apparatus which may be readily installed on the wooden lining or inner wall of existing type freight cars.

Another object of the invention is to provide freight loading apparatus of such a nature that when the movable parts are removed an ordinary, as distinguished from a "special," freight car remains.

Another object of the invention is to provide freight loading apparatus which is substantially dunnage free and which does not substantially decrease the inside dimensions of the freight car.

Another object of the invention is to provide freight loading apparatus which is at least as adjustable as the freight loading apparatus known heretofore, but which is appreciably less expensive to manufacture and install.

Another object of the invention is to provide freight loading apparatus which is especially well adapted for use in insulated chambers such as refrigerator cars.

Another object of the invention is to provide an improved cross bar which may be supported so that any one of its four sides will engage freight and in which the support means is offset relatively to said sides and located different distances from each.

A further object is to provide means in which a cross bar having different section moduli or resistance to bending in two mutually perpendicular directions may be rotated about its length so that the desired section modulus may be used against the load.

A further object is to provide a freight bracing bar having support means at opposite ends thereof having portions extending longitudinally therefrom for nonrotatably attaching the bar to support structures in a plurality of axially rotative angular positions of the bar to advance each freight engaging surface of the bar toward the freight in increments, the support means having a center which is offset with respect to the longitudinal axis of the bar and located different distances from each of the freight engaging surfaces of the bar and in an area enclosed by the bar body, i. e., by all sides of the bar body, including the freight engaging surfaces of the bar body, so that the bar and support means can be rotated together about the longitudinal axis of the bar and the support means engaged with the support structures in each one of the plurality of axially rotative angular positions.

The invention contemplates the use of suitably strengthened holes in the conventional wooden inner wall of a double-wall freight car to support cross bars extending transversely of the car. The cross bars are provided

with axially extending pins which project into these holes to support the cross bars on the walls. The pins are eccentric with respect to the geometric axis or center line of the bar. Thus, by turning the bar angularly in 90° increments the four side faces thereof will occupy four different positions and different section moduli will be presented to the load.

There are other objects and features of the invention and these, as well as the preceding, will appear upon consideration of the accompanying drawings, in which:

Figure 1 is a perspective view of the interior of a freight car embodying the invention and looking lengthwise of the freight car, the thickness of the metal strips 5 being substantially exaggerated;

Fig. 2 is a vertical section lengthwise of a freight car embodying the invention with parts broken away;

Fig. 3 is a plan view of a suitable plate that may be mounted on the inner wooden wall of a freight car in the practice of the invention;

Fig. 4 is a vertical section through the inner and outer side walls of a freight car and shows a preferred form of cross bar mounted on the wall in two positions which are spaced 90 degrees from each other;

Fig. 5 is a view similar to that of Fig. 4 showing a different form of cross bar and the use of the metal plate alone without sleeves inserted in the holes in the wooden lining;

Fig. 6 illustrates the substitution of a composite metal and wood lining for the normal wooden lining of the freight car, the substituted lining being provided with holes for supporting the cross bars;

Fig. 6A illustrates the use of the composite lining of Fig. 6 with an insulating barrier wherein a closed-end thimble is used to provide a seal between the inside of the car and the space between the inner and outer wall;

Fig. 6B shows a thimble having tangs formed in it whereby it may be used to hold the metal strip in place, the tangs serving to prevent the thimble from backing out;

Fig. 6C shows the use of a thimble without a reinforcing strip;

Fig. 7 is a vertical section through a portion of a freight car with parts broken away and parts removed and shows a method of bulkheading the doorway of the car;

Fig. 8 is a section taken on the line 8—8 of Fig. 7;

Fig. 9 is an end view of the cross bars shown in Fig. 4;

Fig. 10 is a detail plan view of the bolt used in the cross bars of Figs. 9 and 4;

Fig. 11 is a cross section through the cross bar of Fig. 4 when it is mounted on one of the plates and shows in phantom lines how the effective section of the cross bar may be built up by the use of other cross bars;

Fig. 12 is a cross section through a modified form of the cross bar of the type shown in Fig. 4 wherein the body of the bar is provided with transverse apertures which receive the projecting pins on the ends of other cross bars;

Fig. 13 is an end view of the cross bars shown in Fig. 5;

Fig. 14 is a section taken along the line 14—14 of Fig. 5;

Fig. 15 is a section similar to Fig. 14 showing the modified form of cross bar;

Fig. 16 is a section through the end of a cross bar which is generally similar to the cross bar of Fig. 5 but showing a modified construction;

Fig. 17 is an end elevation taken from the left of Fig. 16;

Fig. 18 is a plan view of structure shown in Fig. 16;

Fig. 19 is a section taken on line 19—19 of Fig. 16;

Fig. 20 is a perspective view of a cross bar having slid-

ably mounted thereon a fixture for holding special loads; and

Figs. 21 and 22 are perspective views of other forms of fixtures which may be mounted on the cross bar in the manner shown in Fig. 18.

As best seen in Figs. 1 and 2, the preferred form of the invention contemplates the attachment of a series of thin metal strips **5**, preferably about one-eighth of an inch in thickness, to the inside face of the usual wood tongue and groove inside wall or lining **7** of the freight car. Though the strips may be wider or smaller, they are preferably about 6 inches in width and as long as possible consistent with reasonable ease in handling and installation. As seen from an enlarged view of one of the plates in Fig. 3, they preferably have non-skid tangs **9** sheared out and bent normal to the main body of the strip which serve as a means for temporarily attaching the strips to the wooden walls of the car. The tangs will hold the strips **5** in place while screws **11** are inserted through suitable holes in the plate to thread into the wooden lining **7** and permanently secure the strips in place. The strips **5** preferably have a series of holes **13** formed therein by a suitable punching operation prior to their mounting on the wall **7** of the freight car. These holes may be of a size and location that vary widely from the arrangement shown in Fig. 3 and may, for example, be ¾ of an inch in diameter with the center spaced an inch and a half apart and arranged in horizontal and vertical rows. After the strips **5** have been mounted on the walls **7**, they serve as convenient templates or drill guides for the gang drilling of holes **15** in the wooden lining **7**.

Figs. 1 and 2 illustrate the use of plates **5** wherein they extend horizontally throughout the length of the car and are spaced vertically from each other. These figures also show the use of strips **5** arranged to extend vertically. It will be appreciated that the spacing between adjacent strips may be varied, as desired, and may be unequal, e. g., closer together in the lower half of the freight car to accommodate more common types of loading, or may be fitted against each other to completely cover the face of the lining **7**, as shown in Fig. 7. Inasmuch as the plates or strips **5** are ordinarily no thicker than about ⅛ of an inch, it will be seen that their attachment to the linings **7** does not result in any significant decrease in the inside dimension of the car and, furthermore, that a substantially flush wall having no harmful projections is retained. Furthermore, when compared with prior freight loading systems, it will be seen that the dead weight is practically eliminated.

The holes **13** which are formed in the plate and the aligned holes **15** in the wood lining receive and support suitable axially projecting bearing surfaces on the ends of cross bars that traverse the interior of the freight car. The cross bar bearing surfaces are preferably in the form of cylindrical pins **17** and **19**, as will be readily observed in Figs. 4 and 5, on the ends of the cross bars **21** and **23**, respectively. There is sufficient clearance between the walls of the holes and the pins **17** and **19** to take care of the usual misalignments and since each of the holes are spaced equal distances from one another, each hole of each row has another hole in the same row spaced therefrom a distance equal to the spacing between two of the rows, it is apparent that the pins **17** and **19** can be inserted within a pair of vertical holes and also in one of the vertical holes and another hole in the same horizontal row. With this construction, when the line joining the center of pins **17** and **19** as viewed from the end of the bar and a perpendicular bisector of such line are both laterally displaced from the longitudinal axis of the bar, as will be described hereinafter, the bar can be rotated through four 90° increments to selectively present each freight engaging face of the bar toward the freight at different laterally spaced parallel positions.

The major loads applied to the cross bars are lengthwise of the freight car and are occasioned by impact upon starting or stopping the car. These loads are transmitted through the bearing pins **17** or **19** to the walls of the holes **13** and **15**. Inasmuch as the wood of the lining **7** is relatively soft, it will serve to some extent to cushion the loads as well as to dampen vibratory tendencies of the cross bar. The loads lengthwise of the freight car are in large measure transmitted to the strips **5** which also extend lengthwise of the freight car in the preferred embodiment. The load on the edge of any one hole **13** is therefore distributed over a wide area of the metal plate **5**, and it will be recognized that the plate **5** acts as a tension member to react against the loads placed on the cross bars **21** or **23**. The load in the plates **5** is transmitted into the side wall lining **7** through the tangs **9** and the screws **11** but, in view of the large areas involved as compared with the wall of a single hole **13**, the unit stress will be relatively small.

Particularly, when heavier loads are expected to be handled, it is preferable to place sleeves or thimbles **25** in the holes **13** and **15**, such as the closed-end thimbles shown in Fig. 4. These may be provided with radial flanges **27** that are welded or otherwise suitably secured to the side faces of the plates **5**. The thimbles **25** will take the wear which would normally be applied to the edges of the holes **13** and **15** and yet will not interfere with the advantages of load distribution as mentioned hereinbefore. It will be seen that because of the closed ends **29** the thimbles **25** are constructed so that they provide a chamber for the pins which is sealed from the space between the inner wall **7** and the outer wall **31** of the freight car. Thus, if the space between the inner and outer walls is intended to serve as an insulating barrier, the present freight loading apparatus will not increase the rate of heat transfer between the inside and outside of the car.

It is, of course, within the broad purview of the invention to use the thimbles **25** without the strips **5** (Fig. 6C).

While it is preferred to attach plates **5** to the existing wooden linings **7** in a freight car, the invention may also be embodied in a freight car having a composite lining **33** substituted for the wooden lining **7** as shown in Figs. 6 and 6A. The lining **33** can be made up of thin sheets of metal on the inner and outer faces and sheets of metal on the inside alternated with thin layers of wood so as to provide composite metal and wood construction. With this type of construction, the thickness of the inner wall, i. e., wall **33**, can be reduced somewhat over that of the normal wood lining **7** with the result that the inside dimensions of the car is actually increased even though it is still adapted for freight loading apparatus. The composite lining **33** is preferably provided with holes **35** that extend through it and these preferably contain linings such as the sleeve **37** shown in Fig. 6. The sleeve may have its ends turned over to form radial flanges by means of which it is secured to the lining **33**, this operation being done before the lining **33** is attached to the conventional longitudinally spaced upright posts **39** of the car.

In case the space between the inner and outer walls **31** and **33** is used for insulation, as shown by the insulating material **41** in Fig. 6A, it is preferable that the linings for the holes **35** be thimbles having closed ends such as the thimble **43**. This thimble has a radial flange **45** which bears against the inside face of the lining **33** and the body of the thimble may be threaded to receive a nut **47** on the outside face of the lining **33** whereby the thimble is clamped tightly in place on the plate, this operation being done before the plate **33** is mounted in the freight car.

It will be appreciated that it is within the scope of the invention to simply press-fit the sleeve or bushing in the hole **35** or **15**. Also resilient tangs **26** may be formed in the side walls of the thimbles **25** to spring out behind the wood linging **7** (Fig. 6B) whereby they serve to hold the thimble **25** and strip **5** in place on the lining or alter-

nately threads could be rolled into the outer diameter of the thimble so that it could screw into the wooden lining.

As shown in Figs. 7 and 8, the perforated plates may be used as bulkheads for the doorway **49** of the freight car. For this use, the plates **51** may be used instead of plates **5** and they are preferably substantially wider, a suitable width being **24** inches. The doorway **49** is preferably made the same width as the inside of the freight car. When this is done, the plates **51** may be used to bulkhead the door and may also be placed on the floor of the freight car transversely of the width of the car, as shown in Fig. 1. This arrangement also permits the cross bars **21** or **23**, which span the transverse width of the freight bar, to be used to support the plates **51**. For this purpose, the door posts **53** on either side of the door opening **49** are provided with vertical rows of apertures **54** to receive the pins **17** or **19** on the ends of the cross bars. The posts **53** are ordinarily made up of a substantially channel-shaped metal facing **55** which protects the major wooden body of the post. The tangs **9** or the screws **11** may be used as means for securing the plates **51** to the cross bars and the arrangement is preferably such that the plates **51** are flush with the inside lining of the car as illustrated in Figs. 1 and 8. It will be seen that, since the cross bar is on the outside of the plate **51**, loads within the freight car tend to hold the plates in place. In the event that grain or other fluid material is carried within the freight car, paper or the like can be used to cover the openings in the plates **51**. Obviously, the plates **51** could be eliminated and other types of bulkheading utilized in conjunction with the cross bars which extend between the door posts **53**.

As shown in Fig. 1, the deckboards **51** can be used to form a ceiling for the freight car and may be supported for this purpose by vertical and horizontal cross bars as illustrated. It will also be appreciated that cross bars and deckboards can be used together to provide bins and compartments within the car and between the side walls thereof. For example, the deckboards can be extended vertically and longitudinally of the car and intermediate the side walls, so as to divide the width of the car, as by supporting them on vertical cross bars such as the bar **23** shown in Fig. 1. As will appear later, the cross bar **21***a* of Fig. 12 can also be advantageously employed in these arrangements and for bracing lading at intermediate positions within the car.

The construction of the cross bar **21** is best illustrated by reference to Figs. 4 and 9–11. This bar has the conventional **Z**-shaped metal reinforcing bar **61** with side legs **63** and **65** that extend in opposite directions from the transverse connecting web **67** with the result that there will be a different section modulus in a direction parallel to the side legs **63** and **65** than there is in a direction parallel to the web **67**. Wooden 2 x 4's (or pieces of other suitable size) **69** and **71** are mounted on the bar **61** on opposite sides of the connecting web **67**. Bolts **73** may be used to tightly clamp the wooden bars **69** and **71** against the web **67**. The axially projecting pins **17** are preferably formed as an integral part of a sliding bolt **75** which is supported between the web **67** and a retainer plate **77** that is welded to the leg **63** and bottom of leg **65** and to an end plate **79** likewise welded to the end of the reinforcing bar **61**. The bolt **75** and retainer **77** fit in a space beneath the web **67** which is provided by terminating the wooden bar **71** inwardly of the end of the cross bar as shown at **81**. The end plate **79** has holes in it which slidably pass the pins **17** but the plate serves to prevent movement of the bolt **75** beyond the end of the bar **21**. Movement inwardly of the bar toward the withdrawn dotted line position is prevented by a ratchet means which preferably includes the teeth **83** that are formed on the side of the bolt **75** and engage a dog **85** that is pivoted by pin **87** to the web **67** and held pressed against the bolt by a spring **89** confined between it and the leg **63** of the reinforcing bar **61**. The bolt **75** has a downwardly extending flange **91** that is accessible from the bottom of the bar when it is mounted as shown in Fig. 4 and which may be grasped in order to retract the bolt after the dog **85** has been pried away from the teeth **83**.

It will be seen that the two pins **17** define an axis or have a center of attachment to linings **7** which is eccentric with respect to the center line of the bar **61** and lies in the plane of the pins **17** and midway therebetween. Various spacings can therefore be obtained by turning the bar angularly in 90° increments about its axis even though the pins are projected in the same sets of holes. In the event that an extremely strong cross bar means is needed, more than one cross bar may be used in a given locality as illustrated in Fig. 11. As shown herein, the holes **13** are arranged so that the bars **21** can be positioned in groups which engage each other to distribute the load among them. It will be noticed that by retracting the bolt, the pins **17** may be withdrawn inside of the bar **21**. The other end of the bar may be provided with a similar telescopic adjustment for pins **17** or the pins may be simply affixed by means of a strap or the like to the end of the bars **61**, **69** and **71** (Fig. 20).

It is contemplated that on occasion, it may be desired to use a cross bar as a support for the ends of other cross-bars. Fig. 12 illustrates a cross bar **21***a* which is adapted to such use by means of transverse apertures **93** formed therein through both the bars **69** and **71** and web **67**. The apertures **93** will receive and support the pins **17** on the ends of cross bars **21**.

Another form of cross bar **23** is shown in Figs. 5, 13 and 14. In this form, the wooden 2 x 4's **101** are supported by the legs **103** and **105** and web **107** of the **Z**-shaped metal reinforcement bar **109**. The wooden bars **101** terminate inwardly of the end of the bar **109** as shown at **111**. Extending outwardly from the ends **111** of the bars is a square tube **113** that may be formed by flanged half-tube sections welded or otherwise affixed to the web **107** of the bar **109** as shown best in Fig. 14. The web **107** may be cut out in the area covered by the tube **113** so that a second square tube **115** can readily slide therein. The tube **115** is welded or otherwise fixedly secured at its outer end **117** to the bight **118** of a U-shaped strap **119** that embraces and slidably engages the ends of the bar legs **103** and **105**. Four pins or rivets **121**, that are preferably located on corners of a square as shown in Fig. 13, are fixed to the bight **118** and extend outwardly of the bar to provide the bearing surfaces **119**. Obviously, the rivets **121** could be located on corners of a rectangle, or otherwise, if desired. When the pins **121** define a square, the bar **23** may be turned 90 or 180 degrees to equalize wear and eliminate permanent set as well as to dispose the larger section modulus in the desired location.

It will be seen that sliding of tube **113** on the tube **115** permits the bar **23** to be adjusted in length. Various minimum length adjustments are permitted by a **Z**-shaped pin **123** that operates in slots **125** that are formed on the top and bottom of the tube **115**. The slots have circular enlargements **127** connected by narrower passages **129** and the pin **123** has cylindrical sections which fit in the circles **127** but not in passages **129** and flats **131** which will move through these passages. Weight of the pin **123** holds the cylindrical sections in the circular holes **127** and thus the pin abuts the end of the tube **113** to prevent shortening of the bar. By lifting the pin and turning it so that the flats **131** can slide in the passages **129**, the position of the pin **123** can be changed to thereby adjust the minimum length of the bar. The bar **23** is free to increase in length due to sliding of the tube **113** on tube **115** to the extent permitted by abutment of transverse pin **133** affixed to tube **115** with the outer ends of slots **135** formed in the tube **113**. It will be seen that when the pin **133** is at the ends of slots **135** there is a fairly large minimum area of contact between the legs of strap **119** and the

bar legs **103** and **105**, the pin **133** also preventing the separation of the strap **119** from the bar **109**.

Obviously, both ends of bar **23** may be provided with a telescopic adjustment as just described or one end may be non-adjustable as provided, for example, by fixed attachment of the strap **119** with its applied rivets **121**, to the other ends of the bars **101** and **109**, this attachment being readily accomplished by means of welding to the legs **103** and **105** or by means of transverse bolts.

As shown in Fig. 15, which is a view similar to Fig. 14 but with parts removed, the square tubes **113** and **115** may be replaced by round tubes **113'** or **115'** or by tubes of other shapes, if desired.

A cross bar **141** is shown in Figs. 16 and 17 which uses standard size 2 x 4's and which has a flush outer surface throughout its entire length. In this bar, a typical Z-shaped reinforcement member **143** is used having a web **145** and legs **147** and **149**. The top and bottom 2 x 4's **151** and **153** are clamped against the web and adjacent the legs by the usual through bolts (not shown). The outer face of the end of each of the wooden bars is provided with a relief **155** and the inner sides are cut away as shown at **157**. A pair of angle shaped retainer pieces **159** are disposed in the cutouts **157** and the side edges thereof are welded to the legs and web respectively of the bar **143** as seen in Figs. 17 and 19. The spaces between the retainer plates **159** and the web **145** form chambers which slidably receive the inner legs **161** of a pair of U-shaped straps **163**, the outer legs **165** of the straps fitting in the reliefs **155** so that they lie flush with the outer surfaces of bars **151** and **153**. The legs **161** of the straps carry a transverse pin **167** that slides in longitudinal slots **169** formed in the web **145** and in the retainers **159** and which defines the minimum and maximum length of the cross bar **141**. The bights of the U-shaped straps **163** have rivets **171** (substantially identical to rivets **121**) affixed thereto and these are preferably located so that they define corners of a square as hereinbefore described in connection with cross bar **23**. The straps **163** are preferably welded together to form a rigid unit as shown at **173**, a filler rod **175** being used to facilitate the welding operation and increase the strength of the weld. A U-shaped gravity stirrup **177** may be used as a slack adjuster to correspond to member **123** and the slack adjusting system of the cross bar **23**. The cylindrical legs **178** of the adjuster **177** fit in round holes **179** in the legs **165** of the straps **163** and flat sections **180** in the legs fit in passages **181** that connect the holes **179**. The bars **151** and **153**, the retainers **159**, and the web **145** have slots **183** through which the legs **178** pass and the inner ends of the slots shoulder on the legs to limit the extent to which the cross bar can shorten. By lifting the adjuster **178** and moving the flats **180** through passages **181**, its position relative to the ends of the straps **163** can be varied and thus the minimum adjusted length of the bar can be regulated to hold the cross bar locked between side walls of the car.

Figs. 20–22 illustrate the use of several fixtures **191**, **193** and **195** with a cross bar, the fixtures being designed to hold special types of articles such as motors, machines, etc. Each has a rectangular hole **197** by means of which it is slidably but non-rotatably mounted on the cross bar, the non-adjustable end of a cross bar **23** having axially fixed bearing surfaces **25'** carried by an end plate **199** welded to the Z-bar **61** being shown in Fig. 20. A tightening bolt or screw **201** threads through a wall of each hole **197** to serve as means for clamping it tightly on the cross bar in a fixed position. Each of the fixtures has a lateral projection **203** upon which the article to be carried rests, and to which it may be bolted, if desired, through the medium of holes **205**.

It will now be realized that the present invention provides freight loading apparatus which does not reduce the inside dimension of the car and which maintains a substantially flush inside lining in the car. Furthermore, the apparatus does not appreciably increase the dead weight of the freight car and, when the cross bars are removed, substantially a regular freight car remains. The number of different parts and the weight of the apparatus have been reduced to a minimum and yet the stability of the present freight loading apparatus is comparable to that of any known loading equipment. Additionally, the apparatus is such that a flush lining may be used for special purposes such as for the loading of grain. Also, the apparatus is well adapted to use in insulated or refrigerated cars. The cross bars are such that they can stand the severe punishment to which they are subjected in actual use, such as being thrown out of the freight car so that they land on their end sections. In the form of cross bar wherein four axial pins are used, permanent set and wear on the four sides of the bar can be equalized by turning the bar 90 or 180 degrees, and this feature also permits the increased bending resistance of one side of the bar to be used either horizontally or vertically, as desired. The cross bars and the arrangement of the inside walls of the freight car are such that advantage is taken of the space between the inner and outer walls to house the axially projecting pins and, as pointed out hereinbefore, the use of the thimbles and metal strips serve to distribute load throughout wide areas of the inner lining.

It is evident that some of these benefits can be obtained by modifying the structure shown herein in accordance with the principles described above. Hence, it is not intended to limit the invention to the precise constructions which have been revealed for purpose of illustration. It will also be evident that the invention can be used to advantage in ships, trucks, warehouses, etc., all of which may, in a certain sense, be considered equivalents of a freight car.

What is claimed is:

1. A freight bracing bar adapted to extend between and be supported in regular patterns of vertically and horizontally spaced holes in opposite sides of a freight car or other freight receiving space, said bar comprising an elongated body section including a Z-shaped metal reinforcement member having a web and legs extending in opposite directions from opposite sides respectively of the web, buffer bars on opposite sides of said web and engaging said legs, said buffer bars providing said body section with four sides adapted to engage freight, adjacent sides being substantially normal to each other, and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, means at one end of the body section for attaching the corresponding end of the bar to a said side of a freight receiving space, said means including a pair of laterally spaced rigid pins which extend outwardly and are maintained parallel to the length of the body section and are adapted to extend into pairs of either vertically or horizontally spaced said holes to support the corresponding end of the bar on a said side of a freight receiving space, means at the other end of the body section providing a second pair of laterally spaced rigid pins extending outwardly of and maintained parallel to the length of the body section and in longitudinal alignment respectively with the first mentioned rigid pins and also adapted to extend into pairs of vertically or horizontally spaced said holes to support the other end of the bar on an opposite said side of a freight receiving space, means on the bar for permanently maintaining each of said pins parallel to the length of the bar, said pairs of pins being eccentric to the longitudinal center line of the bar so that a line joining the pins of each pair and a perpendicular bisector of such line are both laterally spaced from said center line and intersect at a point located within an area enclosed by said body section, whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and vertically of a said freight car or other freight receiving

space by amounts determined by said lateral spacings between said center line of the bar and said other lines.

2. A freight bracing bar adapted to extend between and be supported in regular patterns of vertically and horizontally spaced holes in opposite sides of a freight car or other freight receiving space, said bar comprising an elongated body section having four sides adapted to engage freight, adjacent sides being substantially normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, a fitting at one end of the body section for attaching the bar to a said side of a freight receiving space, means mounting said fitting on said body section for movement lengthwise of the bar to thereby change the length of the bar, said fitting including means providing a pair of laterally spaced rigid pins formed thereon which extend outwardly and are maintained parallel to the length of the body section and are adapted to extend into pairs of either vertically or horizontally spaced said holes to support the corresponding end of the bar on a said side of a freight receiving space, means at the other end of the body section providing a second pair of laterally spaced rigid pins extending outwardly and maintained parallel to the length of the body section and in longitudinal alignment respectively with the first mentioned rigid pins and also adapted to extend into pairs of vertically or horizontally spaced said holes to support the other end of the bar on an opposite said side of a freight receiving space, means on the bar for permanently maintaining each of said pins parallel to the length of the bar, said pairs of pins being eccentric to the longitudinal center line of the bar so that a line joining the pins of each pair and a perpendicular bisector of such line are both laterally spaced from said center line and intersect at a point located within an area enclosed by said body section, whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and vertically of a said freight car or other freight receiving space by amounts determined by said lateral spacings between said center line of the bar and said other lines.

3. A freight bracing bar adapted to extend between and be supported in regular patterns of vertically and horizontally spaced holes in opposite sides of a freight car or other freight receiving space, said bar comprising an elongated body section having four sides adapted to engage freight, adjacent sides being substantially normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, means at one end of the body section for attaching the corresponding end of the bar to a said side of a freight receiving space, said means including a pair of laterally spaced rigid pins which extend outwardly and are maintained parallel to the length of the body section and are adapted to extend into pairs of either vertically or horizontally spaced said holes to support the corresponding end of the bar on a said side of a freight receiving space, means at the other end of the body section providing a second pair of laterally spaced rigid pins extending outwardly and maintained parallel to the length of the body section also adapted to extend into pairs of vertically or horizontally spaced said holes to support the other end of the bar on an opposite said side of a freight receiving space, means on the bar for permanently maintaining each of said pins parallel to the length of the bar, said pairs of pins being eccentric to the longitudinal center line of the bar so that a line joining the pins of each pair and a perpendicular bisector of such line are both laterally spaced from said center line and intersect at a point located within an area enclosed by said body section, whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and vertically of a said freight car or other freight receiving space by amounts determined by said lateral spacings between said center line and said lines.

4. A freight bracing system for holding articles of freight in stowed positions comprising spaced, oppositely disposed surfaces, means providing a plurality of parallel straight rows of regularly spaced holes in said surfaces which rows are aligned on said spaced surfaces, corresponding holes in said respective parallel rows lying in lines at right angles to said parallel straight rows, each hole of each row having another hole in the same row spaced therefrom a distance equal to the spacing between a pair of said rows, a freight bracing bar adapted to extend between and be supported at opposite ends in holes in said rows in respective said surfaces, said bar comprising an elongated body section having four sides adapted to engage freight, adjacent sides being substantially normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, means at one end of the body section for attaching the corresponding end of the bar to one of said surfaces, said means including a pair of laterally spaced rigid pins which extend outwardly and are maintained parallel to the length of the body section and are spaced and adapted to extend into pairs of said holes located in said rows and in said lines to support the corresponding end of the bar on a said surface, means at the other end of the body section providing a second pair of laterally spaced rigid pins extending outwardly of the body section also spaced and adapted to extend into pairs of said holes located in said rows and in said lines to support the other end of the bar on the other of said surfaces, means on the bar for permanently maintaining each of said pins parallel to the length of the bar, said pairs of pins being eccentric to the longitudinal center line of the bar so that a line joining the pins of each pair and a perpendicular bisector of such line are both laterally spaced from said center line and intersect at a point located within an area enclosed by said body section, whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and transversely of said rows by amounts determined by said lateral spacings between said center line and said lines.

5. A freight bracing system for holding articles of freight in stowed positions comprising spaced, oppositely disposed surfaces, means providing a plurality of parallel straight rows of regularly spaced holes in said surfaces which rows are aligned on said spaced surfaces, corresponding holes in said respective parallel rows lying in lines at right angles to said parallel straight rows, each hole of each row having another hole in the same row spaced therefrom a distance equal to the spacing between a pair of said rows, a freight bracing bar adapted to extend between and be supported at opposite ends in holes in said rows in respective said surfaces, said bar comprising an elongated body section having four sides adapted to engage freight, adjacent sides being substantially normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, a fitting at one end of the body section for attaching the bar to a said surface, means mounting said fitting on said body section for movement lengthwise of the bar to thereby change the length of the bar, said fitting including means providing a pair of laterally spaced rigid pins formed thereon which extend outwardly and are maintained parallel to the length of the body section and are spaced and adapted to extend into pairs of said holes located in said rows and in said lines to support the corresponding end of the bar on a said surface, means at the other end of the body section providing a second pair of laterally spaced rigid pins extending outwardly and maintained parallel to the length of the body section and in longitudinal alignment respectively with the first mentioned rigid pins and also spaced and adapted to extend into

pairs of said holes located in said rows and in said lines to support the other end of the bar on the other of said surfaces, means on the bar for permanently maintaining each of said pins parallel to the length of the bar, said pairs of pins being eccentric to the longitudinal center line of the bar so that a line joining the pins of each pair and a perpendicular bisector of such line are both laterally spaced from said center line and intersect at a point located within an area enclosed by said body section, whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and transversely of said rows by amounts determined by said lateral spacings between said center line of the bar and said other lines.

6. A freight bracing bar adapted to extend between and be supported in holes in opposite sides of a freight car or other freight receiving surface, said bar comprising an elongated body section having four sides adapted to engage freight, adjacent sides being substantially normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, a fitting at one end of the body section for attaching the bar to a said side of said freight receiving space, means mounting said fitting on said body section for movement lengthwise of the bar to thereby change the length of the bar, said fitting having rigid pin means formed thereon which extends outwardly and is maintained parallel to the length of the body section and is adapted to extend into said holes to support the corresponding end of the bar on a said side of said freight receiving space, but prevent rotation of the fitting about an axis parallel to the length of the bar while so supported, attachment means at the other end of the body section providing rigid pin means extending outwardly and maintained parallel to the length of the body section and in longitudinal alignment respectively with the first mentioned rigid pin means and also adapted to extend into said holes to support the other end of the bar on an opposite said side of said freight receiving space but to prevent rotation of the pin means about an axis parallel to the length of the bar while so supported, means on the bar for permanently maintaining each of said pin means parallel to the length of the bar and for preventing the rotation of said pin means, said pin means having a center which is eccentric to the longitudinal center line of the bar in a direction perpendicular to and in a direction parallel to each of said four sides and located in an area enclosed by said body section whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and vertically of a freight car or other freight receiving space by amounts determined by said eccentricity.

7. A freight bracing bar adapted to extend between and be supported in holes in opposite side walls of a freight car or other freight receiving space, said bar comprising an elongated body section having four sides adapted to engage freight, adjacent sides being substantially normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, attachment means at one end of the body section for attaching the corresponding end of the bar to a said side of said freight receiving space, said means including rigid pin means which extends outwardly and is maintained parallel to the length of the body section and is adapted to extend into said holes to support the corresponding end of the bar on a said side of said freight receiving space, attachment means at the other end of the body section providing rigid pin means extending outwardly and maintained parallel to the length of the body section also adapted to extend into said holes to support the other end of the bar on an opposite said side of said freight receiving space, means on the bar for permanently maintaining each of said pin means parallel to the length of the bar and for preventing the rotation of said pin means, said pin means having a center which is eccentric to the longitudinal center line of the bar in a direction parallel to and in a direction perpendicular to any one of said sides, and located in an area enclosed by said body section whereby the bar can be supported in any one of four different rotative positions each differing from the others lengthwise and vertically of the freight car or other freight receiving space by amounts determined by said eccentricity.

8. A freight bracing system for holding articles of freight in stowed positions comprising support structure including spaced apart freight bar securing means arranged in spaced apart aligned rows, a freight bracing bar adapted to extend between said rows and be supported by said securing means on said support structure, said bar comprising an elongated body having four sides adapted to engage freight, adjacent said sides being substantially flat and normal to each other and each of said sides having elongated substantially flat freight engaging surfaces extending substantially the entire length of the bracing bar, said body having section moduli designed to withstand bending loads applied respectively to adjacent of said sides, support means on the bar at opposite ends thereof having portions extending longitudinally of the bar body and operative with said securing means to nonrotatively attach the bar to a support structure in different rotative positions, said support means having centers which are offset with respect to the longitudinal axis of said bar and located diffrent distances respectively from each of the four sides and within an area enclosed by said bar body, so that said bar can be rotated through 90° to successively position said four sides to face in one direction, said sides being located in four different laterly spaced parallel positions when facing in said one direction.

9. A freight bracing bar adapted to extend between and be supported at opposite ends on support structure, said bar comprising an elongated body having a plurality of elongated substantially flat freight engaging sides extending substantially the entire length of the bracing bar, support means on the bar at opposite ends thereof having portions extending longitudinally of the bar body and operative to nonrotatively attach the bar to the support structure in any one of a plurality of axially rotative angular positions, said support means having a center which is offset with respect to the longitudinal axis of said bar and located different distances respectively from each one of said plurality of sides and in an area enclosed by said bar body, means on the bar for permanently fixing each of said support means against movement that is not parallel to the length of the bar, said bar being axially rotatable in angular increments to successively position each one of said plurality of sides to face in one direction, each one of said plurality of sides being located in different laterally spaced parallel positions when facing in said one direction.

10. A freight bracing system for holding articles of freight in stowed positions comprising spaced oppositely disposed support structure, a freight bracing bar adapted to extend between and be supported at opposite ends on said support structure, said bar comprising an elongated body having a plurality of elongated substantially flat freight engaging sides extending substantially the entire length of the bracing bar, support means on the bar at opposite ends thereof having portions extending longitudinally of the bar body and operative to nonrotatively attach the bar to said support structure in any one of a plurality of axially rotative positions spaced 90° from each other, said support means having a center which is offset with respect to each one of said plurality of sides and located different distances respectively from the longitudinal axis of said bar and in an area enclosed by said bar body, means on the bar for permanently fixing each of said support means against movement that is not paral-

lel to the length of the bar, said bar being axially rotatable in 90° increments to successively position each one of said plurality of sides to face in one direction, each one of said plurality of sides being located in different laterally spaced parallel positions when facing in said one direction.

11. A freight bracing bar adapted to extend between and be supported at opposite ends on support structure, said bar comprising an elongated body having a plurality of elongated substantially flat freight engaging sides extending substantially the entire length of the bracing bar, pin means on the bar at opposite ends thereof and projecting longitudinally therefrom and operative to nonrotatively attach the bar to the support structure in any one of a plurality of axially rotative angular positions, said pin means having a center which is eccentric to the longitudinal axis of said bar and located different distances respectively from each one of said plurality of sides and in an area enclosed by said bar body, means on the bar for permanently fixing each of said pin means against movement relative to the body of said bar that is not parallel to the length of the bar, said bar being axially rotatable in angular increments to rotate said pin means and to position each one of said plurality of sides to face in one direction, each one of said plurality of sides being located in different laterally spaced parallel positions when facing in said one direction.

12. A freight bracing system for holding articles of freight in stowed positions comprising spaced oppositely disposed support structure having a plurality of parallel straight rows of regularly spaced holes therein, a freight bracing bar adapted to extend between and be supported at opposite ends on said support structure, said bar comprising an elongated body having a plurality of elongated substantially flat freight engaging sides extending substantially the entire lenth of the bracing bar, pin means on the bar at opposite ends thereof having portions extending longitudinally therefrom and extendable within said holes in each of a plurality of axially rotative positions of the bar to nonrotatably attach the bar to said support structure, said pin means having a center which is eccentric to the longitudinal axis of said bar and located different distances respectively from each one of said plurality of sides and in an area enclosed by said bar body, means on the bar for permanently fixing each of said pin means against movement relative to the body of said bar that is not parallel to the length of the bar, said bar being axially rotatable in angular increments to rotate said pin means and to position each one of said plurality of sides to face in one direction, each one of said plurality of sides being located in different laterally spaced parallel positions when facing in said one direction.

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