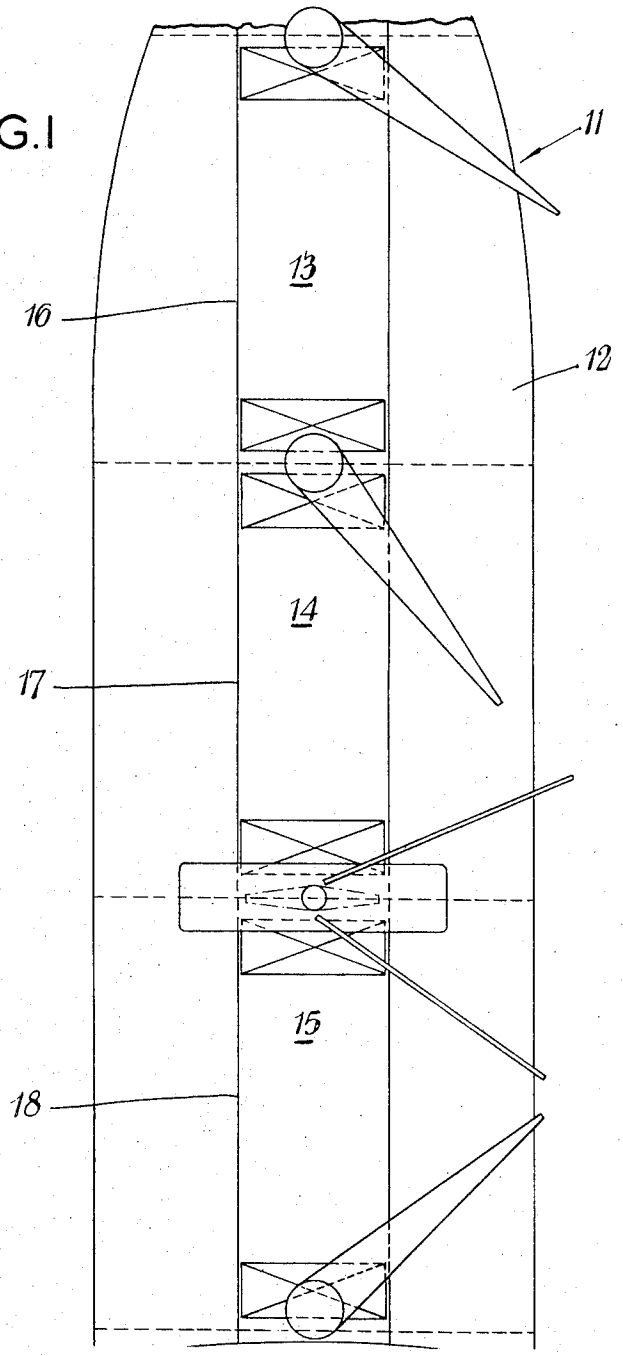
Dec. 13, 1966 J. R. FULCHER ETAL 3,291,324

METHOD AND APPARATUS FOR CARGO HANDLING

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FIG. 1



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METHOD AND APPARATUS FOR CARGO HANDLING

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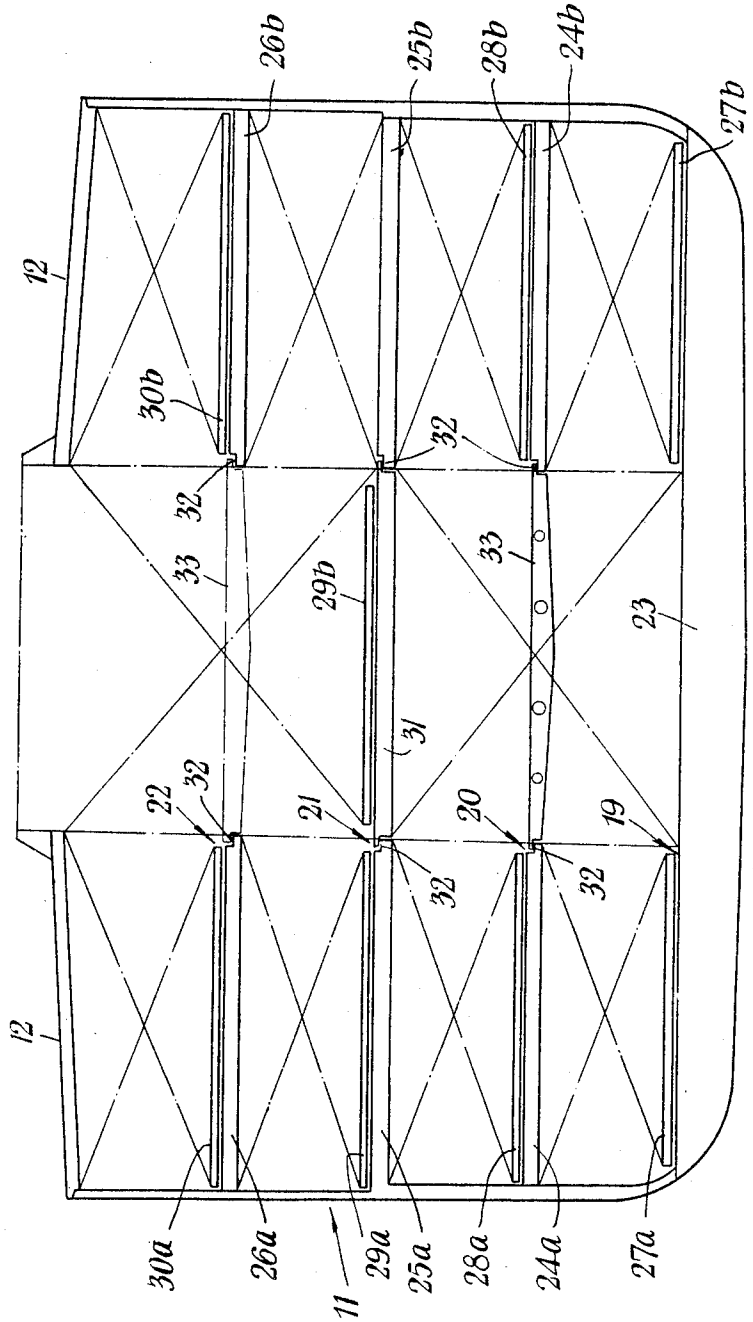


FIG.2

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METHOD AND APPARATUS FOR CARGO HANDLING

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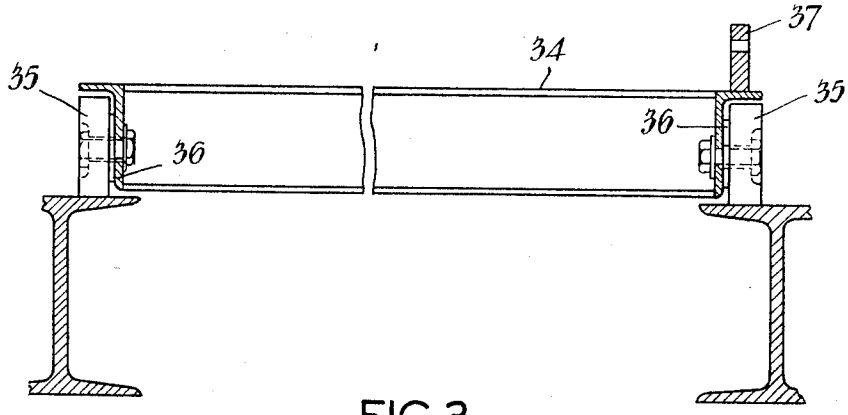


FIG.3

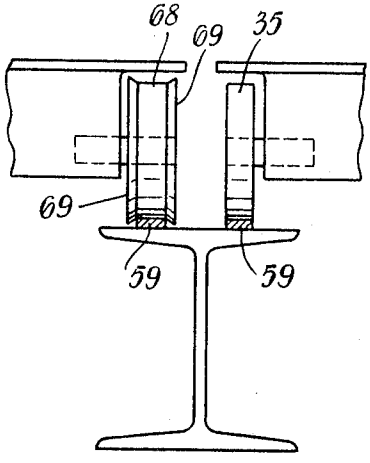


FIG.8

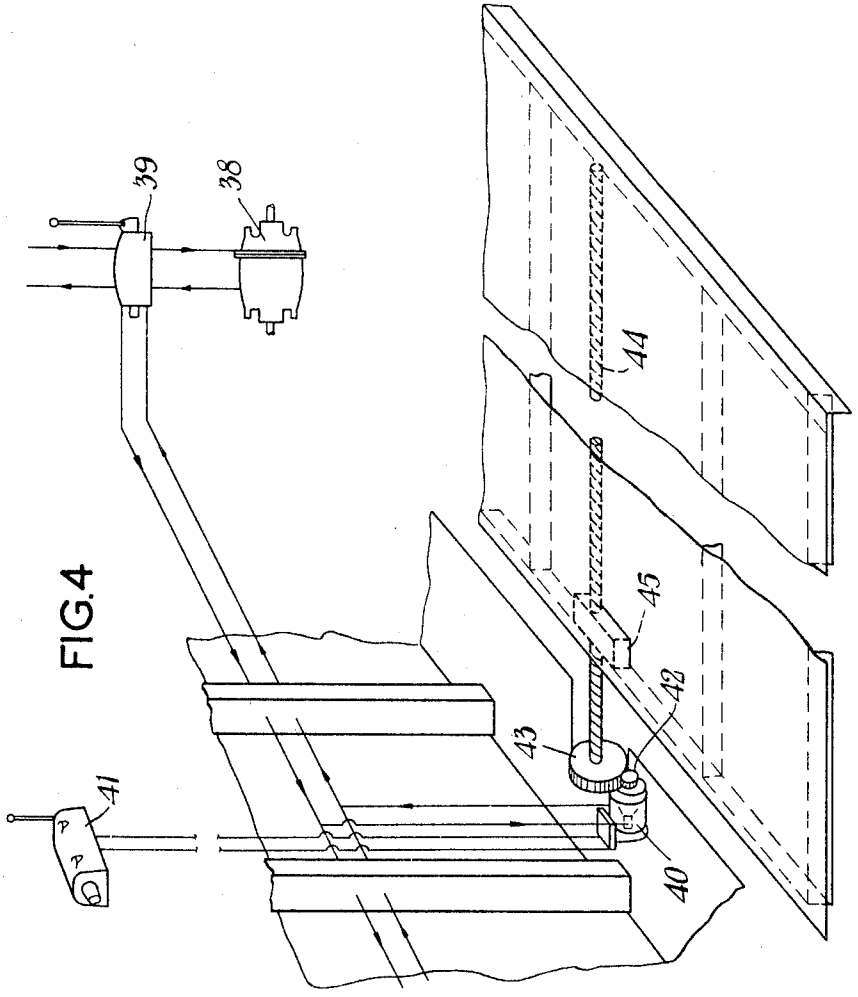
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METHOD AND APPARATUS FOR CARGO HANDLING

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FIG.4



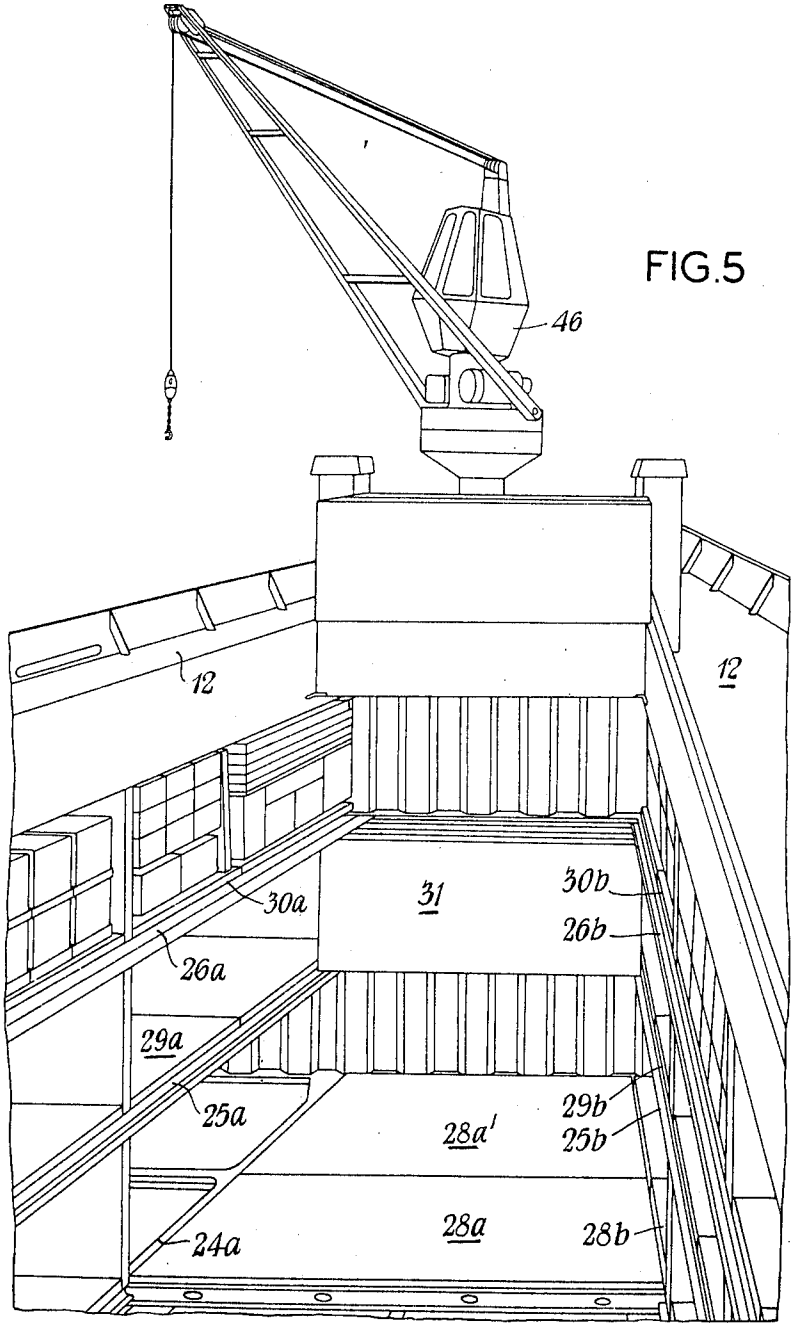
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METHOD AND APPARATUS FOR CARGO HANDLING

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FIG.5



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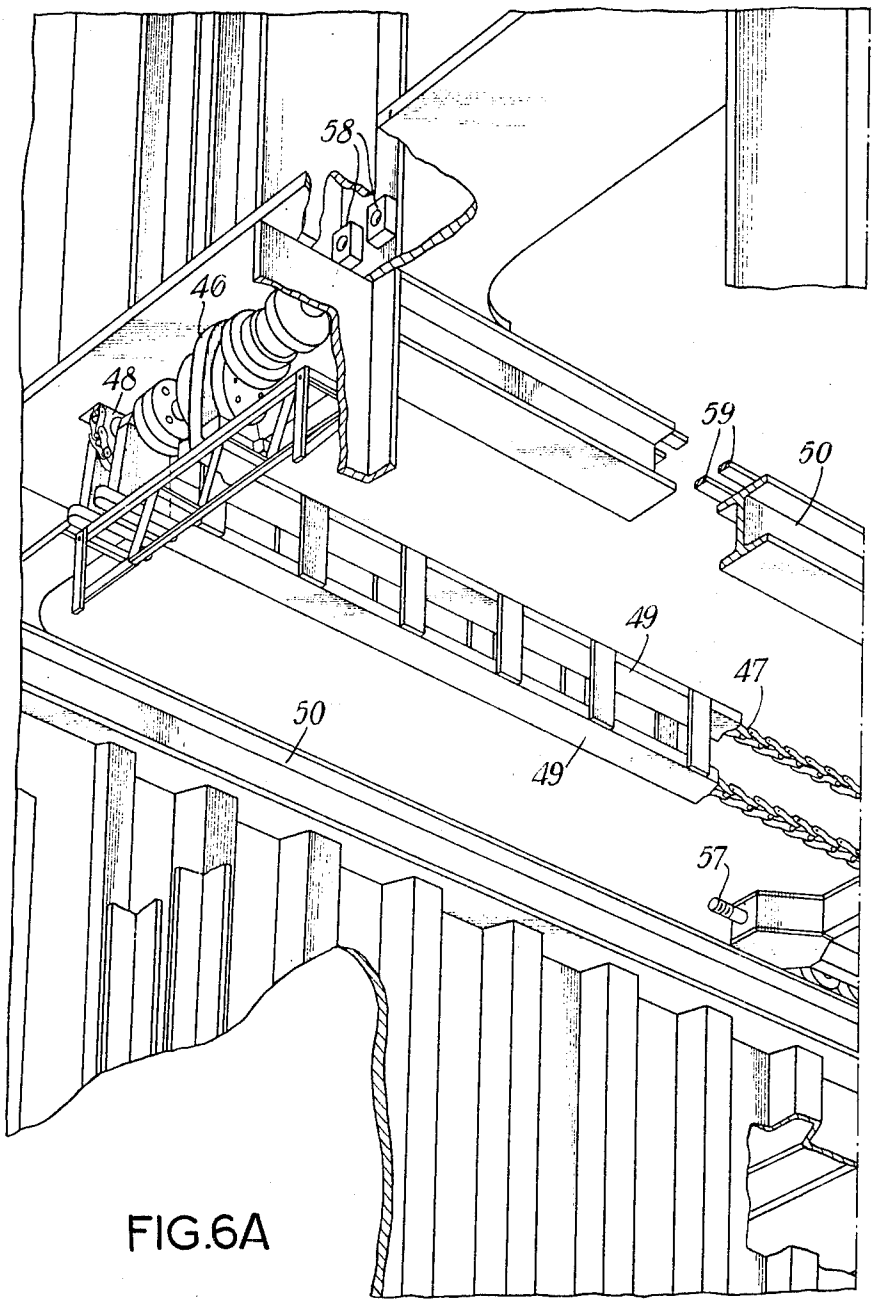


FIG.6A

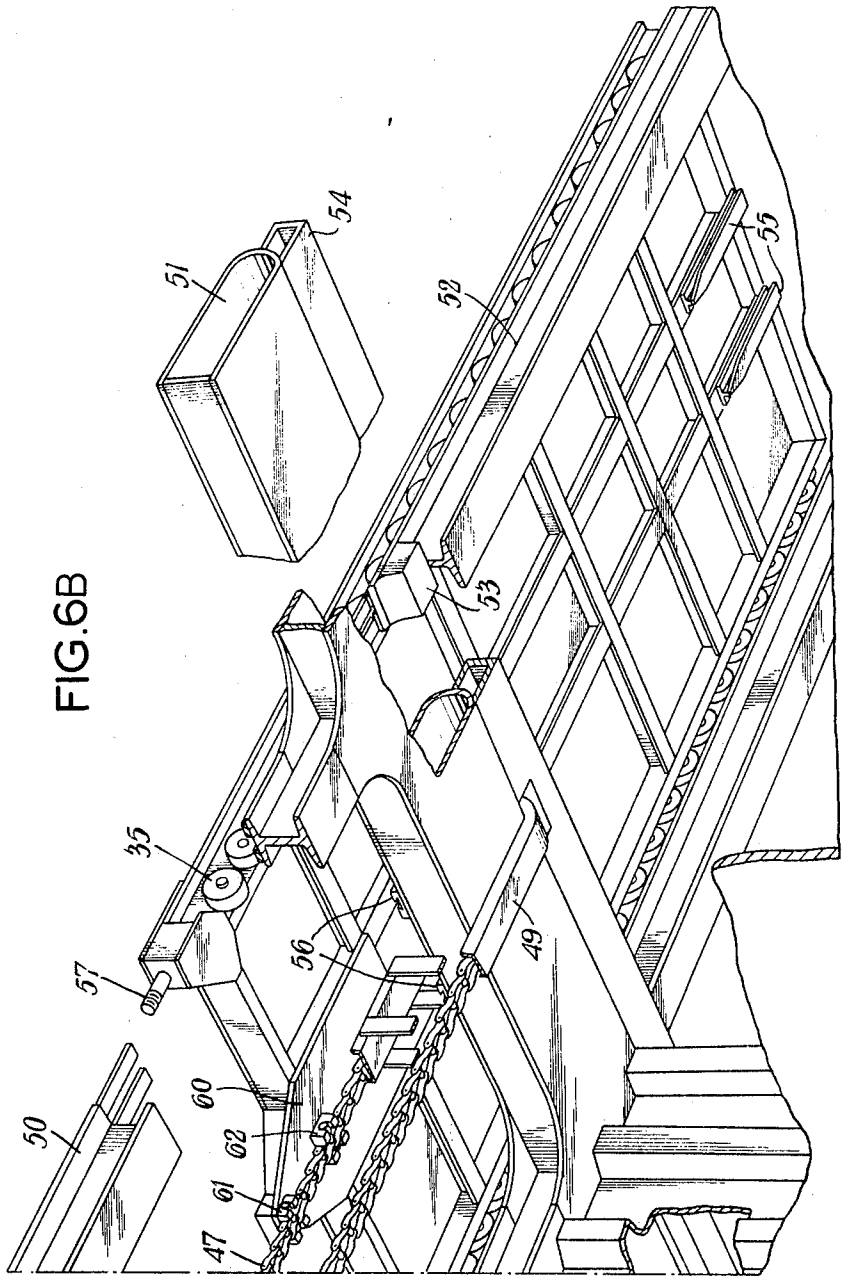
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METHOD AND APPARATUS FOR CARGO HANDLING

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FIG.6B



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METHOD AND APPARATUS FOR CARGO HANDLING

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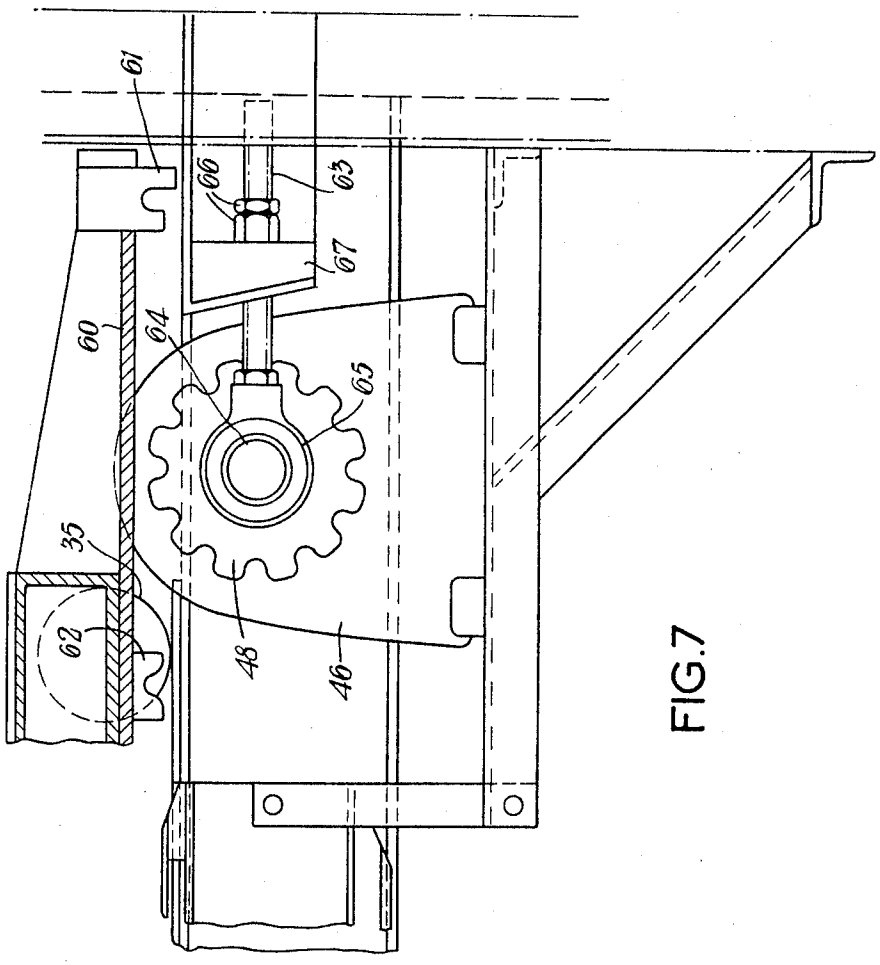


FIG.7

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METHOD AND APPARATUS FOR CARGO HANDLING

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Claims priority, application Great Britain, Mar. 18, 1963, 10,677/63
9 Claims. (Cl. 214—15)

The present invention relates to ships and apparatus therein for handling cargo, and is more particularly although, not exclusively, concerned with sea-going cargo ships.

It has already been proposed to construct the holds of vessels with a plurality of decks and to stow cargo in the tween deck spaces. However it is the lateral movement of cargo after it has been placed in the hold which most significantly affects the overall cargo handling productivity. Fork lift trucks do reduce the number of men required and increase the speed of the operation, but these are both cumbersome to maneuver and cause excessive buckling of tween deck plates. Also it is not practicable to operate a fork lift truck on top of cargo already stowed.

According to the present invention there is provided a ship having a hold for the stowing of cargo, a deck structure covering said hold and formed with a hatchway, said hold comprising an open frame structure defining a plurality of deck levels and located in said hold subjacent to, and at opposite sides of, said hatchway, said frame structure also defining a loading and discharging space in subjacent registry with said hatchway, a plurality of pallet decks located at each deck level and mounted for movement on said frame structure between a position in said loading and discharging space and a stowage position within said frame structure, means for moving each of said pallet decks between said positions, and support means for releasable engagement with, and adapted to extend between, frame members disposed at one deck level but at opposite sides of said space, so as to provide support for said pallet decks during the aforesaid movement thereof and when in said loading and discharging position.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

FIG. 1 is a plan view of part of a vessel fitted with cargo handling apparatus in accordance with the present invention;

FIG. 2 is a schematic transverse cross section of one of the holds illustrated in FIG. 1;

FIG. 3 is an end elevation, partly in section of one form of pallet deck;

FIG. 4 is a schematic view of a hydraulic drive arrangement for a pallet deck;

FIG. 5 is a perspective view of a hold incorporating cargo handling apparatus as illustrated in the preceding figures;

FIG. 6A and 6B when joined together constitute a fragmentary perspective view from below of a pallet deck according to a modified embodiment;

FIG. 7 is a side elevation, on an enlarged scale, of a detail of FIG. 6A; and

FIG. 8 is a fragmentary elevation showing a further modification.

In FIG. 1, **11** denotes a part of a ship's hull while **12** denotes a top deck, below which holds **13**, **14** and **15** are located. Hatchways **16**, **17** and **18** respectively permit access to the holds and occupy a central longitudinal portion which is a third of the total surface of a hold as seen from above.

FIG. 2 is a transverse cross section of any one of the holds **13**, **14** and **15** and shows four deck levels **19**, **20**, **21** and **22**. These are symmetrically divided by the longitudinal third portion of the hold which extends down to the lowermost deck level or tank top **19**. At each deck level except the lowermost one, there are two fixed structures **24***a*, **24***b*, **25***a*, **25***b*, and **26***a*, **26***b* respectively supporting the pallet decks each structure symmetrically located on opposite sides of the longitudinal axis of the vessel. The lowermost deck level **19** has one fixed deck **23** and two movable pallet decks **27***a* and **27***b*. Each fixed supporting structure **24***a*, **24***b*, **25***a*, **25***b*, **26***a* and **26***b* is provided with a movable pallet deck **28***a*, **28***b*, **29***a*, **29***b*, **30***a* and **30***b* respectively. Two similarly movable pallet decks **27***a* and **27***b* are provided on the fixed deck **23** and are shown in similar positions to those on structures **24***a* and **24***b*. A foldable steel hatch cover **31** interconnects structures **25***a* and **25***b*. This is stowable fore or aft in the hold. Each of the fixed supporting structures **24***a*, **24***b*, **25***a*, **25***b* and **26***a*, **26***b* has a longitudinal recess or groove **32** located on its inner upper edge and adapted to receive either the cover **31** (in the case of structures **25***a* and **25***b*) or roller beams **33** (in the cases of structures **24***a*, **24***b* and **26***a*, **26***b*) which are placeable therebetween.

FIG. 3 partially shows, in cross section, the components of one of the pallet decks. This has a frame **34** at either side of which are mounted rollers **35** which support the pallet deck on its respective fixed supporting structure and, depending upon the position of the pallet deck, upon the steel hatch cover **31** or the roller beams **33**. Brass washers **36** are provided between the rollers **35** and the pallet deck frame **34**. A plurality of eye-plates **37** (only one shown here by way of example) are welded to the top of the pallet deck frame for the connection to the pallet deck of rope for holding in position cargo placed on the pallet deck.

Guide flanges (not shown in FIGS. 1 to 5) may be provided on each fixed supporting structure for guiding the movement of the pallet deck between loading or unloading positions and their stowage position.

The steering mechanism of a great number of ships is at present operated by means of a variable speed gear pump and FIG. 4 shows how this pump **38** can be adapted to provide the necessary initial hydraulic pressure for a hydraulic drive arrangement for operating the movement of the pallet decks. During the loading and unloading of cargo, as will be explained more fully later, it is necessary for each pallet deck to move from its fixed supporting structure to a position in the central third area of the hold on either the steel hatch cover **31** or the roller bearings **33**, and back again. As the pump **38** is a piece of expensive equipment and is not generally used while the vessel, on which it is situated, is in harbor, it can be satisfactorily and economically put to use for moving the pallet decks.

FIG. 4 shows an arrangement for moving only one pallet deck by way of example, but it is to be understood that all pallet decks can be moved in this way. A four-way change-over valve **39** directs the hydraulic pressure created by the pump **38** either to the steering gear (not shown) or to the pallet moving arrangement. A hydraulic motor **40**, controllable by a control valve **41**, turns, via gear wheels **42** and **43**, a screw drive **44** on which a drive block **45** is mounted. The drive block engages with a part (not shown) of the pallet deck, and hence the latter can be moved into and out of the central third area of the hold. The control valve **41** is conveniently located on the top deck **12** (FIG. 1). The pallet deck

is anchored both in its position on the fixed supporting structure and in its position on the steel hatch cover **31** or the roller beams **33**. The drive block **45** may serve this purpose.

FIG. 5 shows the hold of a vessel which has been loaded with cargo with the aid of pallet decks. The steel hatch cover **31** is in its stowed position and some rollers are shown in position between structures **24***a* and **24***b*. Two pallet decks **28***a* and **28***a'* are shown in a position for receiving cargo from a deck crane **46** mounted on the top deck **12** between hatches. It is to be noted that the fixed decks are partitioned off into a separate compartments along their length for convenience and structural strength, and two pallet decks are provided for each compartment.

During the loading of one deck level, every alternate pallet deck of one side (as seen in plan view) is moved out into the central third area of the hold. Every alternate pallet deck of the other side also moves out into the central third area thereby filling in the spaces between the first mentioned pallet decks. The central third portion is now completely covered by an equal number of pallet decks lying adjacent a pallet deck from the opposite side of the hold to that from which it itself has come. The central third portion is then loaded with cargo in such a manner as to leave the balance of the vessel undisturbed either by loading from opposite ends and working towards the center or from one end and the center, and working towards the other end. When this is completed the loaded pallet decks are returned to their respective sides of the deck level and the remaining pallet decks are moved out into the central third portions and loaded and returned in a similar manner. This is effected through all the deck levels until the fixed supporting structures with their pallet decks on top of them are fully loaded with cargo. The central third portion may then be loaded with cargo, and the steel cover **31** moved into position. The roller beam **33** may or may not be used depending on the size of the cargo to be stowed in the central third area of the hold.

FIGS. 6A–6B and 7 illustrate an alternative form of drive mechanism for the pallet decks. This is a chain drive arrangement which is operated by an electric motor **46** through gearing which is incorporated in the same casing as the electric motor. An endless chain **47** is engaged and driven by a sprocket wheel **48**. Apart from the section of the path of travel of the chain where the chain passes around the sprocket wheel, the chain is encased in a casing **49**. A lubricant catch tray (not shown) may be located beneath the sprocket wheel **48**. For the purpose of FIGS. 6A–6B and 7, the open frame structure which defines the tween deck levels is indicated at **50**. The chain **47** passes around a member **51** of the frame structure. The side of the member **51** which faces inwardly towards the central third portion of the hold is of semicircular cross section, and this face defines the innermost extent of the path of travel of the chain. No sprocket wheels or the like are provided in or on the member **51**; the chain **47** simply slides round the curved side of the member **51** within the casing **49**. To avoid excess wear, the chain is supplied with a heavy duty lubricant. FIG. 6A–6B shows a pallet deck in a position during the movement to or from a loading position. A roller beam **52** is shown in more detail. It will be seen that one end thereof is provided with a profiled end portion **53**. This end portion **53**, when the roller beam is placed in position for supporting the pallet deck during its movement to and from a loading position, engages the member **51** and a further beam **54** which is integral with the frame structure which defines the pallet deck levels.

Two forms of locking means are illustrated. One form consists of wedge-shaped keys **55** engageable in keyways **56** located on the member **51**. The other form consists of pins **57**, which are provided with threaded

end portions, and washer members **58** through which the pins may pass. Nuts (not shown) are then screwed onto the threaded end portions of the pins **57**. The roller wheels **35** of the pallet decks run on runners **59**.

The end of each pallet deck remote from the central third portion of the ship is provided with a plate **60** which extends from the said end of the pallet deck along the path of the chain **47** (see FIG. 6A–6B). The plate **60** is provided with two chain-engaging claws **61** and **62**. Each claw is provided with a notch or recess for engagement with a link of the chain **47**. In FIG. 7, the pallet deck is shown in a stowage position and it will be seen that the claw **61** in this position extends beyond the path of the chain. Conversely, in a loading or unloading position of the pallet deck when it is in the central third portion of the hold, only the claw **61** will be in engagement with the chain **47**, the claw **62** having past the end of the chain track. This arrangement makes it possible for the entire top surface area of the pallet deck to be brought into and out of the central third portion of the hold with partial disengagement from the drive means.

A chain tensioning device is provided, as shown in FIG. 7. This device consists of one or more bolts **63** which engage a shaft **64** on which the sprocket wheel **48** is mounted. Bushes **65** are provided between the bolts and the shaft. The engagement of nuts **66**, which bear against a frame member **67**, on the bolts **63** provides the required degree of tension in the chain.

The motor **46** may be hydraulically or pneumatically operated. In either of these cases the power source therefor could already be available in the engine room of the ship, or a separate unit for this purpose could be supplied.

Control for the motor may be located on the weather deck as described in connection with the previous embodiment, or it may be located in a gangway running along the length of the hold. Trip micro-switches may be provided for automatically stopping the pallet deck when it is moving between its stowage and loading positions.

FIG. 8 is a fragmentary view which illustrates a different embodiment of roller wheels for the pallet decks. Each pallet is provided on one side with conventional rollers **35**, which, as mentioned previously, run on the runners **59**. However on the other side of the pallet decks, two or more rollers **68** are provided. The rollers **68** have side flanges **69** which engage the sides of the runners **59**. This prevents lateral displacement of the pallet decks during their movement into and from their stowage and discharge positions, and yet at the same time allows for lateral expansion of the pallet decks due to heat, compression from load, etc.

We claim:

1. A ship having a hold for the stowing of cargo, a deck structure covering said hold and formed with a hatchway, said hold comprising an open frame structure defining a plurality of deck levels and located in said hold subjacent to, and at opposite sides of, said hatchway, said frame structure also defining a loading and discharging space in subjacent registry with said hatchway, a plurality of movable pallet decks located at each deck level and mounted for movement on said frame structure between a position in said loading and discharging space and a stowage position within said frame structure, the movable pallet decks located at each deck level being arranged in a row on the deck structure thereof along each longitudinal side of the ship, each row consisting of a number of pallet decks respectively aligned with the pallet decks of the opposite row, the width of the loading and discharge space and the width of each row of movable pallet decks constituting approximately one-third of the width of the hold, means for moving each of said pallet decks between said positions, and support means for releasable engagement with, and adapted to extend

between, frame members disposed at one deck level but at opposite sides of said space, so as to provide support for said pallet decks during the aforesaid movement thereof and when in said loading and discharging position.

2. A ship according to claim 1, wherein there is further provided locking means for locking each pallet deck in its stowage position, said locking means comprising a member secured to each pallet deck, and a cooperating member secured to said open frame structure, said members being arranged for releasable locking engagement for holding the pallet decks in the stowage position.

3. A ship according to claim 1, wherein there is further provided locking means for locking the pallet decks in their stowage position, said locking means comprising a key member secured to the pallet deck and a keyway secured to said frame structure for the reception of said key member.

4. A ship having a hold for the stowing of cargo, a deck structure covering said hold and formed with a hatchway, said hold comprising an open frame structure defining a plurality of deck levels and located in said hold subjacent to, and at opposite sides of, said hatchway, said frame structure thereby also defining a loading and discharging space in subjacent registry with said hatchway, a plurality of pallet decks located at each deck level and mounted for movement on said frame structure, between a position in said loading and discharging space and a stowage position within said frame structure, chain drive means for moving each of said pallet decks between said positions, and support means for releasable engagement with, and adapted to extend between, frame members disposed at one deck level but at opposite sides of said space, so as to provide support for said pallet decks during the aforesaid movement thereof and when in said loading and discharging position, said chain drive means comprising an endless chain arranged to travel along a predetermined path subjacent the stowage position of a respective pallet deck, a sprocket engaged with said chain, means for driving said sprocket, claw means located on said respective pallet deck for engaging said pallet deck with said chain, means for guiding said chain along said predetermined path, said claw means comprising a pallet deck frame member secured to, and extending from said pallet deck, a first claw member secured to said pallet deck frame member and arranged for releasable engagement with a link of said chain, and a second claw member also secured to said pallet deck frame member and spaced apart from said first claw member, said second claw member being releasably engageable with a further link of said chain.

5. A ship according to claim 4, wherein the means for driving said sprocket comprises an electric motor, gear means intermediate said motor and said sprocket and operatively connected thereto, and control means operatively connected to said motor.

6. A ship according to claim 5, wherein there is further provided a chain tensioning means which is operatively connected to said sprocket.

7. A ship according to claim 4, wherein said sprocket is arranged at one end of the path of said chain remote from said loading and discharge space.

8. A ship according to claim 4, wherein there is further provided a frame member of said frame structure, which member is formed with a convex face directed towards said loading and discharge space, said chain being arranged to pass over said convex face.

9. In the loading of a ship having a hold for the stowing of cargo, and including a deck structure covering said hold and provided with a hatchway, said hold comprising an open frame structure defining a loading and discharging space in subjacent registry with said hatchway and also defining a stowage space including a plurality of deck levels, said frame structure being located in said hold subjacent to said hatchway and at opposite sides of said loading and discharge space, a row of movable pallet decks located along each longitudinal side of the hold on the deck structure at each deck level, each row consisting of a number of pallet decks respectively aligned with the pallet decks of the row along the opposite side of the hold, support means for releasable engagement with, and adapted to extend between frame members disposed at one deck level but at opposite sides of said loading and discharge space, so as to provide support for said pallet decks during the movement thereof and when in said loading and discharging space, moving pallet decks respectively from said rows into the loading and discharging space but from alternate longitudinal positions in said rows so that alternate pallet decks are in the loading and discharging space from the opposite sides of the hold, loading cargo onto the pallet decks of the resulting row in said loading and discharging space, and thereafter moving the loaded pallet decks into their original positions in the hold at the respective sides of said loading and discharging space, whereby loaded pallet decks of each of the opposite rows alternate with unloaded pallet decks in the hold.

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