United States Patent

Schneller

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[54] EQUIPMENT FOR HIGHLINE TRANSFER

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[73] Assignee: **Peacock Brothers Limited,** La Salle, Quebec, Canada

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[63] Continuation of Ser. No. 787,165, Dec. 26, 1968, abandoned.

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Oct. 28, 1968 Canada.....33725

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[51] **Int. Cl.**.....**B65g 67/58**

[58] **Field of Search**.....104/112, 113, 114, 115, 116, 104/117; 254/148; 214/13; 212/72

[56] **References Cited**

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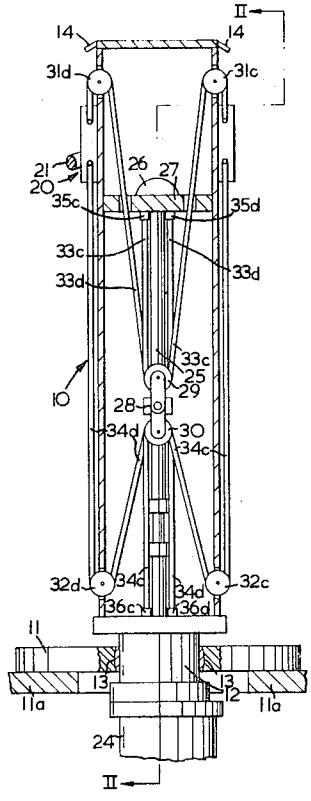
3,350,820 11/1967 Stonely.....214/13

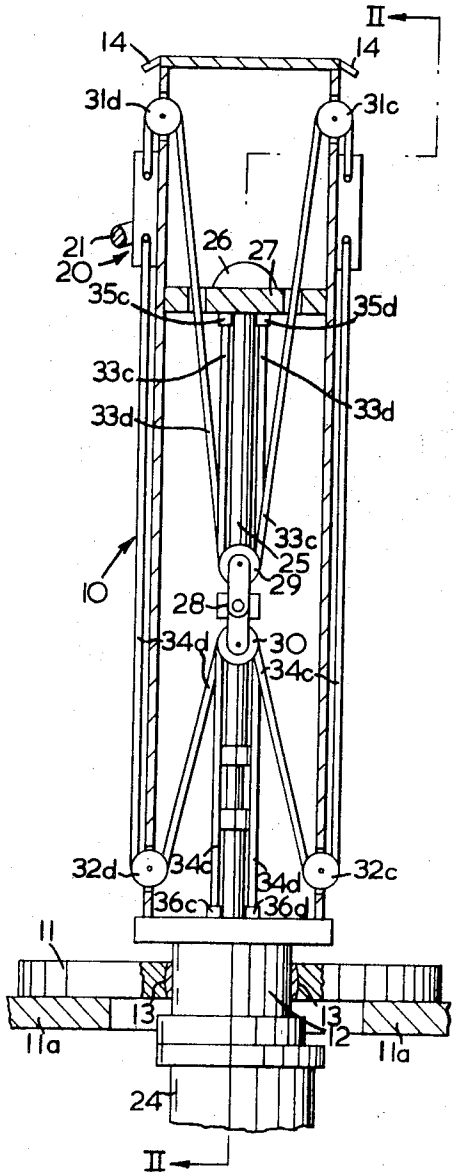
Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Frank E. Werner
Attorney—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

Apparatus for highline ship to ship transfer of loads comprises a king post with a pad eye mounted on the king post. Means are provided for moving the pad eye vertically on the king post which include a linear driving member passing over guiding means on the king post to form an arrangement providing opposing forces and wherein the pad eye is attached to the highline by connecting means. The said attachment points are situated both front and rear of the king post central axis.

14 Claims, 8 Drawing Figures

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14
14
31d
31c
21
20
26
27
35c
35d
33c
33d
33d
33c
25
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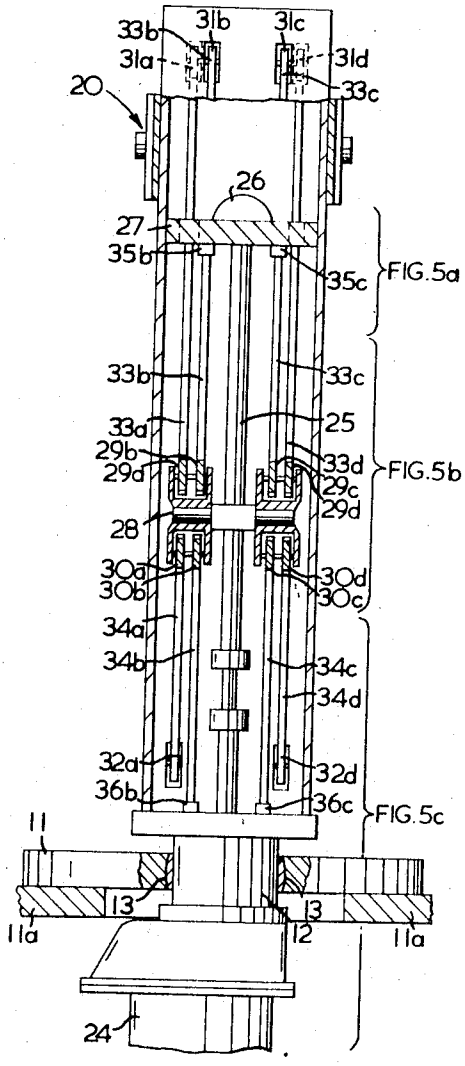
10
28
34d
30
34c
32d
34c
34d
32c
36c
36d
11
13
13
12
11a
11a
24
II

FIG. 1


33b
31b
31c
31a
31d
20
33c
26
27
35b
35c
FIG.5a
33b
33c
33a
25
29b
33d
FIG.5b
29d
29c
29d
28
30a
30d
30b
30c
34a
34b
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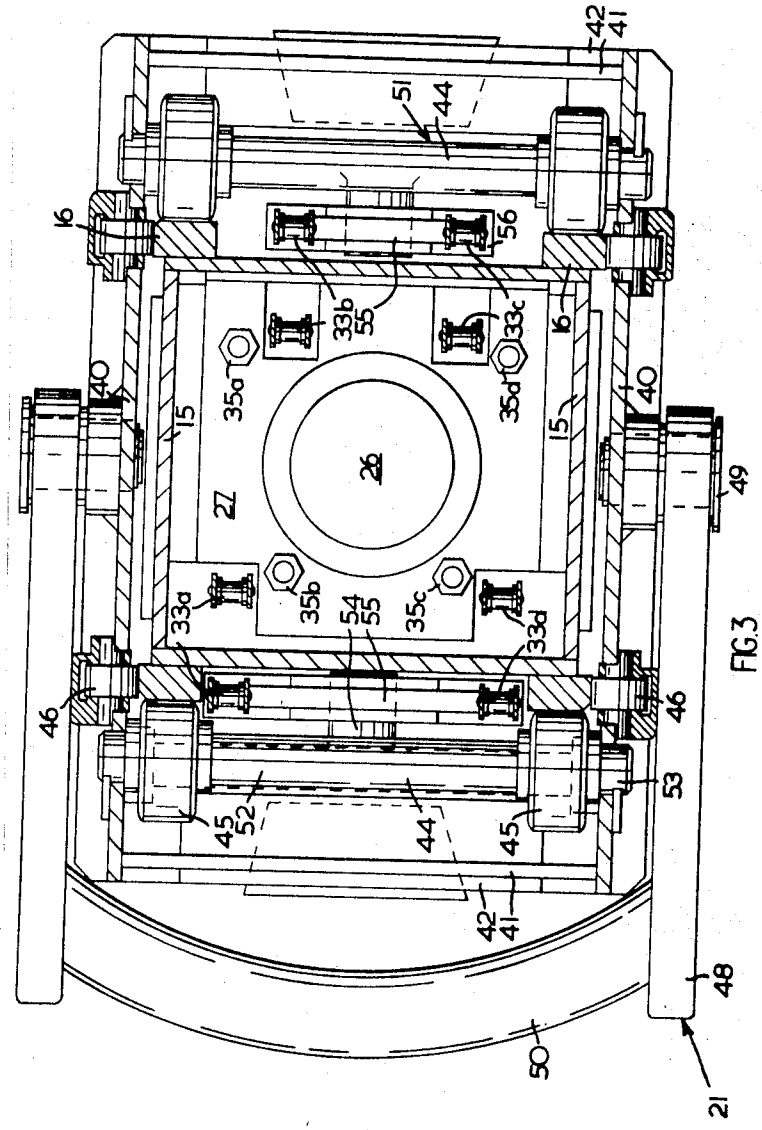
36b
36c
FIG.5c
11
13
13
11a
12
11a
24

FIG.2


42
41
51
44
16
56
33b
55
33c
16
40
35a
35d
40
15
15
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49
35b
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52
44
45
42
41
48
50
21

FIG.3

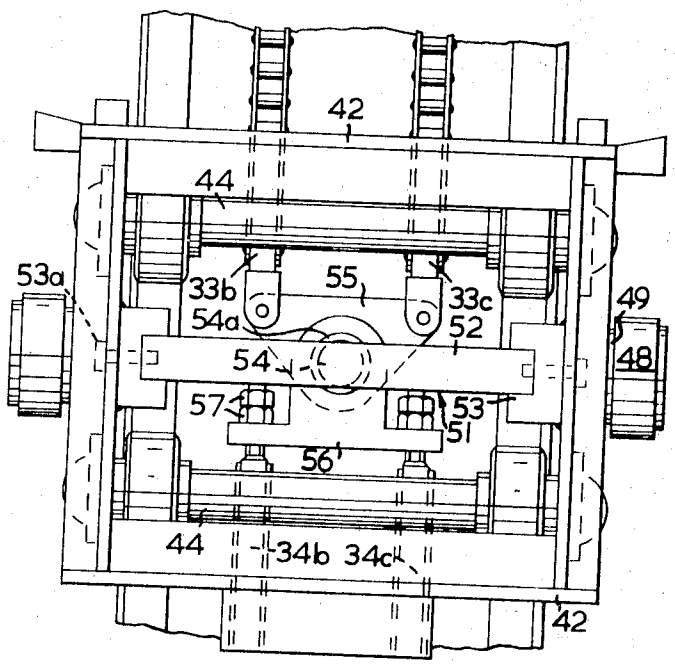


FIG.4

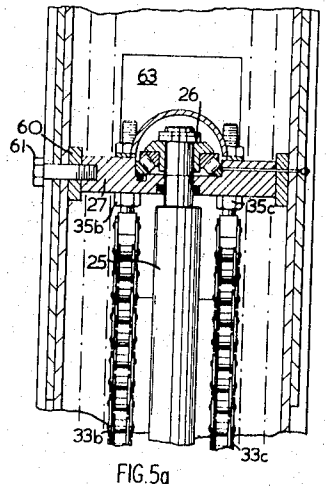

63
26
60
61
27
35b
35c
25
33b
33c

FIG.5a

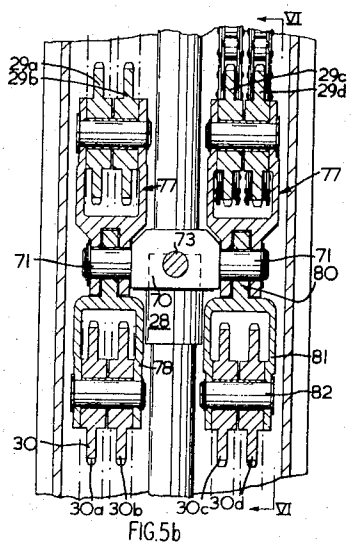
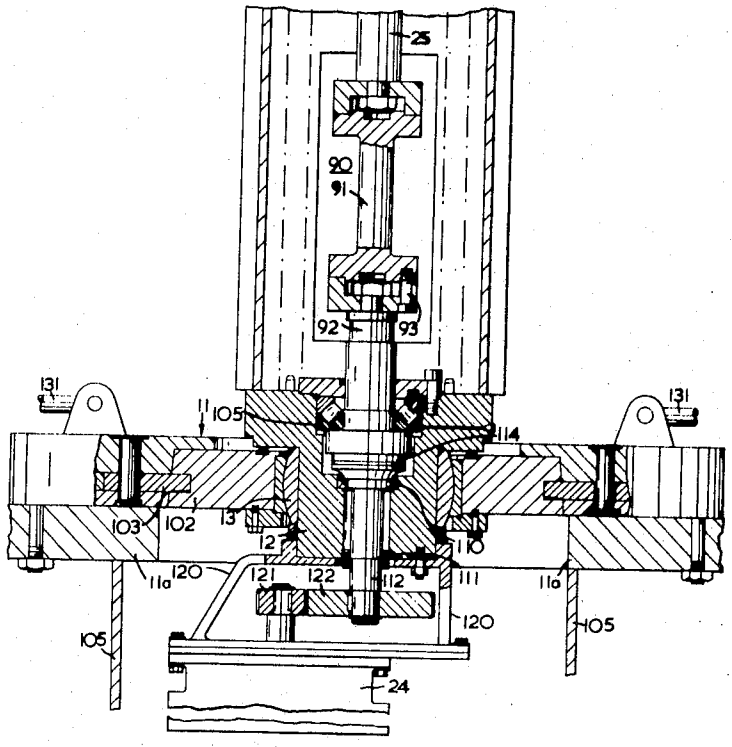

VI
29a
29b
29c
29d
77
77
73
71
71
80
70
28
81
78
82
30
30a
30b
30c
30d
VI

FIG.5b


25
90
91
92
93
131
131
11
105
114
103
102
13
12
110
11a
120
121
122
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11a
120
105
105
24

FIG. 5c

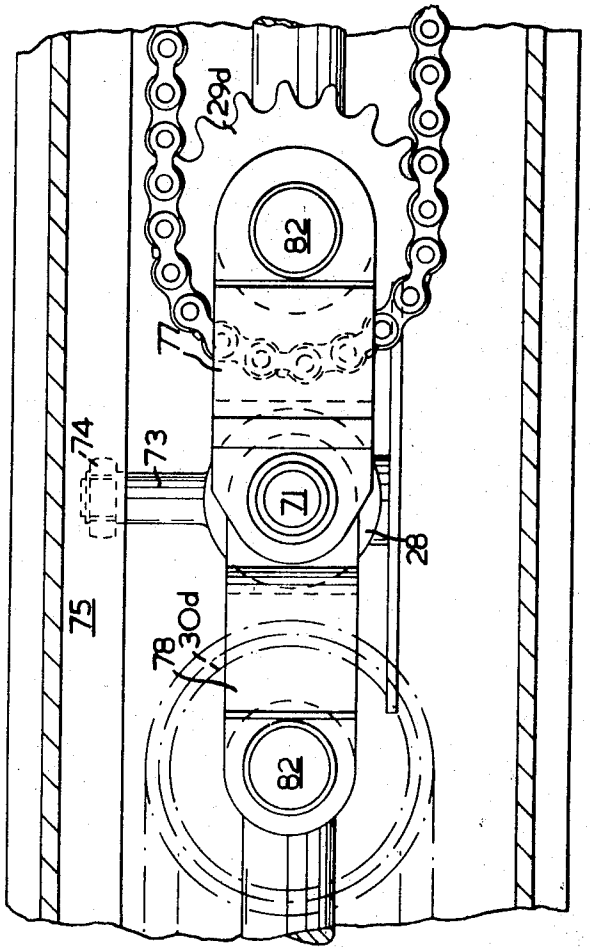

FIG.6

EQUIPMENT FOR HIGHLINE TRANSFER

This application is a continuation of application Ser. No. 787,165 filed Dec. 26, 1968, now abandoned.

The present invention relates to highline transfer systems for transferring loads along a highline extending, for example, between two ships at sea. The invention is particularly concerned with equipment carried by a ship for receiving loads transferred along a highline.

Known equipment for receiving loads by highline transfer systems includes a mast, known as a king post, adapted to be held in erect position on the deck of a ship, and having a highline attachment member to which an end of the highline is attached when the ship is receiving a load. The highline attachment member, which is termed a pad eye, may be vertically movable on the king post to allow loads to be lowered onto the deck when they have traversed the highline. A vertically movable attachment member used for this purpose is termed a sliding pad eye.

In this specification, reference to "vertical" or "horizontal" will be understood to mean, respectively, perpendicular and parallel to the deck of the ship, irrespective of the orientation of the deck at any instant.

A mechanism for raising and lowering the pad eye on the king post is described in U.S. Pat. No. 3,350,820. This mechanism includes a screw coaxial with the king post and rotatable by a motor located at the base of the king post, a nut nonrotatably mounted on the screw and movable vertically by rotation of the screw, and chains passing through pulley blocks held by the nut, which chains also pass over the pulleys at the top and bottom of the king post and are attached to the pad eye externally of the king post, so that the pad eye is caused to move by the chains on movement of the nut along the screw.

The same screw and nut operated chain mechanism may also be used for raising and lowering the king post out of or into trunking below the deck level, so that the king post can be stowed when not in use. For this purpose the base of the king post is arranged to be releasably engaged by a deck fitting. In order to stow the king post, the pad eye is lowered to the deck fitting, in which position it supports the king post, and is secured thereto. Subsequently, the base of the king post is released from the deck fitting, and the king post is lowered into the trunking through the pad eye and through the deck by operation of the screw mechanism in the same manner as this would be operated to raise the pad eye on the post. The king post may be raised from the deck by the reverse procedure. Accordingly, the arrangement of chains attached to the pad eye must include both upper chains which extend upwardly from the pad eye and are normally tensioned by the weight of the pad eye and of the load on the highline, and lower chains extending downwardly from the pad eye which are tensioned by the weight of the king post while this is being lowered into or raised from the deck. In some circumstances, for example when the highline is attached to a dispatch point much higher than the pad eye, the highline tension may apply an upwards force to the pad eye, which force must also be withstood by the lower chains.

In the arrangement described in U.S. Pat. No. 3,350,820, the chains are attached to the rear end of the pad eye, that is to say the end of the pad eye which is remote from the front end which faces the direction of highline delivery, and the highline is attached to link means associated with the front end of the pad eye. Consequently, the pad eye is subjected to considerable vertical turning moments by the opposed pulls of the highline and the supporting chains, and these turning moments may give rise to friction and cause difficulty in moving the pad eye smoothly on the king post.

According to the present invention, apparatus for highline ship to ship transfer of loads comprises a king post adapted to be held in erect position on the deck of a ship, a pad eye mounting on the king post, and means for moving said pad eye vertically on the king post including chains passing over pulleys at the top of the king post and secured to the pad eye at attachment points which are situated both front and rear of the king post central axis, the pad eye being attached to the highline by link means including a swivel arm mounted to pivot on the pad eye about a horizontal axis which axis lies between the said front and the rear attachment points of the said chains.

The term "chains" as used herein and in the claims is intended to include flexible elements which could be used in the same manner as chains.

Preferably, the horizontal pivotal axis of the swivel arm on the pad eye lies approximately midway between the front and rear attachment points of the chains. This arrangement insures that the tensions in the chains connected to the front and rear ends of the pad eye are balanced.

In a preferred embodiment, the chains are used in pairs disposed front and rear of the pad eye, there being provided two upper pairs of chains extending upwardly from the pad eye and attached respectively to front and rear pairs of attachment points thereof for supporting the pad eye and loads thereon. The chains of each pair are attached to opposite ends of a centrally pivoted member mounted on the pad eye, whereby the tensions in the chains of each pair are balanced. There may also be provided two lower pairs of chains extending downwardly from the pad eye and attached respectively to front and rear pairs of attachment points thereof, for supporting the king post when this is being lowered into or raised from the deck. Again, the chains of each lower pair are preferably attached to opposite ends of a centrally pivoted member mounted on the pad eye, whereby the tensions in the chains of each pair are balanced.

A particular embodiment of the present invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic sectional elevation taken along the central axis of the king post,

FIG. 2 is a similar partly sectioned elevation of the king post taken along lines II—II of FIG. 1,

FIG. 3 is a cross-sectional plan view taken through the pad eye and showing details of the pad eye and king post,

FIG. 4 is a rear view of the pad eye together with a portion of the king post,

FIGS. 5*a*, 5*b*, and 5*c* are detailed sectional elevations of portions of the king post which are indicated in FIG. 2, and

FIG. 6 is a view on lines VI—VI of FIG. 5*b*.

Referring to FIGS. 1 and 2 of the drawings, a king post **10** is shown supported on a deck fitting **11** mounted on the deck **11***a* of a ship by mounting means which are indicated diagrammatically. Details of the mounting means are described hereinafter with reference to FIG. 5*c* but as shown in FIG. 1 a spigot or stem **12** of the king post is supported in a spherical bearing **13** which allows rotation of the king post and limited deflection thereof. When erected on the deck as shown the king post is maintained in the vertical position, against the considerable pull of the highline, by stays or guy lines attached to the top of the king post at lugs **14** and to the deck **11***a*.

A highline attachment member in the form of a pad eye **20** is arranged to slide vertically on the king post. The pad eye, which will be described in more detail with reference to FIGS. **3** and **4**, includes rollers which engage with runners at the corners of the king post and allow smooth movement of the pad eye up and down the king post under the action of the screw and nut operated chain system to be described. The pad eye also includes link means for the highline in the form of a swivel arm **21**, which is a U-shaped member extending from pivot points at the sides of the pad eye and having a runner member extending across the front face of the pad eye, namely the left-hand side of FIG. **1**.

For raising and lowering the pad eye a screw and nut operated chain mechanism is provided including a screw **25** extending coaxially of the king post and rotatable in an upper bearing **26** held by a crossmember **27** within the upper part of the king post, and in a lower bearing within the base of the king post (see FIG. 5*c*). The screw **25** is driven by a reversible motor **24** attached to the base of the king post. Details of the

motor drive arrangement and the bearings and couplings involved will be described in detail with reference to FIG. 5*c*.

A recirculating ball nut **28** is mounted on the screw **25**, and means to be described are provided for preventing rotation of the nut so that as the screw **25** is rotated by the motor **24**, the nut moves vertically up or down the screw. The nut **28** holds a pulley block (to be described with reference to FIGS. **5***b* and **6**) having freely rotatable upper and lower sprocket pulleys **29** and **30**. As apparent from FIG. **2**, the pulleys **29** and **30** are arranged in four pairs, the pairs being symmetrically arranged above and below the nut **28** and on either side of the screw **25**.

Additional freely rotatable sprocket pulleys **31** and **32** are rotatably mounted in the sides of the king post at the top and bottom thereof. Four such pulleys **31** are situated at the top of the king post in pairs back and front, and four more pulleys **32** are similarly arranged in pairs at the bottom of the king post.

Four upper chains, which are roller link chains, are indicated at **33** and are each attached at one end to attachment points **35** on crossmember **27**, and pass around upper pulleys **29** of the nut **28**, and also around pulleys **31** at the top of the king post, having their outer ends attached to the pad eye **20** by means shown in more detail in FIG. **4**. These upper chains **33** extending upwardly from the pad eye are those which normally support the weight of the pad eye and the vertically downwards component of the force applied by the highline.

The four upper chains **33** are individually identified by letters *a*, *b*, *c* and *d*. Chains **33***a* and **33***d* form an outer pair which are attached to points **35***a* and **35***d* on the side of the member **27** nearest to the rear of the king post (see also FIG. **3**). These chains pass around the outermost two pulleys **29**, namely pulleys **29***a* and **29***d*, and then around a widely spaced pair of upper pulleys **31***a* and **31***d* at the front of the king post, before being attached to the front of the pad eye. The positioning of the pairs of pulleys **29***a*, **29***d* and **31***a*, **31***d*, and the attachment points **35***a*, **35***d*, is such that the spacing between the chains **33***a* and **33***d* remains constant from end to end thereof.

Conversely, the chains **33***b* and **33***c* form an inner pair which are attached to attachment points **35***b* and **35***c* at the side of member **27** nearest the front face of the king post (see also FIG. **3**), and extend around the inner two pulleys **29**, namely **29***b* and **29***c*, around a closely spaced pair of upper pulleys **31***b* and **31***c* at the rear of the king post, and have their ends attached to the rear end of the pad eye **20**. The attachment points **35***b* and **35***c*, the pulleys **29***b* and **29***c*, and pulleys **31***b* and **31***c*, are also all similarly spaced, so that the inner pair of chains **33***b* and **33***c* also have a constant spacing throughout their length. It can be seen from FIG. **2** that the inner chains **33***b* and **33***c* can readily pass between the outer chains **33***a* and **33***d* where these cross over, without any mutual interference. It will be understood that the crossmember **27** allows spaces for passage of the upper chains to pass therethrough.

In addition, four lower chains **34** are provided which are attached at one end to attachment points **36** at the bottom of the king post, and pass therefrom around the sprocket pulleys **30** of the nut **28**, and then around the lower sprocket pulleys **32** at the bottom of the king post, and are attached to the pad eye **20** by means described in detail with reference to FIG. **4**. These lower chains **34** are also identified by letters *a*, *b*, *c* and *d*. In a manner similar to that of the upper chains, the lower chains **34***a* and **34***d* form an outer pair attached at one end to attachment points **36***a* and **36***d* at the base of the king post near to the rear face thereof, and to the front end of the pad eye at their other ends, and passing over outer pulleys **30***a* and **30***d* attached to the nut **28** and around the lower pulleys **32***a* and **32***d* and maintaining a substantially constant spacing throughout their runs. Conversely, chains **34***b* and **34** *c* form an inner pair, these chains having one end attached to the attachment points **36***b* and **36***c* at the base of the king post near to the front face thereof and with their other ends attached to the rear end of the pad eye, passing over pulleys **30***b* and **30***c* attached to the nut **28** and over the lower pulleys **32***b* and **32***c* at the bottom of the king post, these inner chains also maintaining a constant spacing throughout their length, and being arranged so that these inner chains pass between the outer chains at points where crossover occurs.

FIG. **3** shows a detailed cross section through the king post and pad eye. As shown, the king post is a hollow box structure formed on sideplates **15**, the corners of which are stiffened by longitudinal ribs **16** which also form runners engaged by rollers of the pad eye to be described. Within the sideplates **15** is mounted the crossmember **27**, which carries the upper chain attachment points **35***a*, *b*, *c* and *d* and also the upper screw bearing **26**. It will be seen that the attachment points **35***a* and **35***d* are spaced widely apart and are situated near the rear face of the king post, whereas the attachment points **35***b* and **35***c* are spaced more closely together and are near to the front face of the king post. FIG. **3** also shows apertures in the crossmember **27** which allow the chains **33***a*, *b*, *c*, *d* to pass freely therethrough. It will be seen that there is ample space for chains **33***b* and **33***c* to pass between the outer pair of chains **33***a* and **33***d* without interference where crossover occurs. The arrangement of the lower chains **34***a*, *b*, *c*, *d* is identical in plan view to that of the upper chains.

FIGS. **3** and **4** also show further details of the pad eye, which includes sideplates **40** connected together by end plates **41** and narrow top and bottom plates **42**. Between the sideplates **40** there are supported four axles **44**, each axle carrying two rollers **45** rotatable thereon, the rollers being in contact with the main faces of the runners **16**. In addition, eight small rollers **46** are mounted on the sideplates **40**, and these rollers engage the side faces of the runners **16**. These rollers all lightly engage the runners in such manner as to ensure easy movement of the pad eye vertically on the king post.

The pad eye includes link means for attachment of the highline including the swivel arm **21**, which as shown in FIG. **3** is a U-shaped member having two arms **48** pivoted at their ends to stub shafts **49** extending from the sideplates **40** of the pad eye. The swivel arm is thus free to rotate about a horizontal axis through the center of the pad eye, and thus no turning moments in the vertical plane are applied to the pad eye by the swivel arm. The two arms are attached by a curved runner **50** on which a shackle (not shown) constituting the end of the highline is slidable, this arrangement being described in our copending U.S. Pat. application No. 787,174.

The means whereby the chains are attached to the pad eye are shown most clearly in FIG. **4**. These means, which are indicated generally at **51**, are provided at each end, front and rear, of the pad eye, spaced vertically between the main roller axles **44**. Each such means includes a central beam **52**, the ends of which engage in slots in blocks **53** welded to the sideplates **40**, the ends of beam **52** being releasably secured in these slots by bolts **53***a*. Each beam **52** has welded thereto a central stub shaft **54** which extends inwardly towards the king post. This stub shaft **54** is associated with a sleeve **54***a*, this sleeve having mounted thereon two centrally pivoted members including an upper pivot plate **55** and a lower pivot plate **56**, FIG. **4** showing those pivot plates on the rear side of the pad eye. Each lower pivot plate **56** is thick enough to carry two tongues embracing a single tongue attached to the relatively thin upper plate **55**. Each upper plate **55** is of triangular form and that plate shown at the rear of the pad eye carries at its upper corners terminal fittings of the chains **33***b* and **33** *c*. The rear lower pivot plate **56** includes two lateral flanges with holes therein through which pass screwed rods attached to the ends of lower chains **34***b* and **34***c*, the outer ends of these screwed rods having locknuts **57** for securing the ends of the chains to the pivot plates. The end attachments of the chains to the pivot plates are such as to enable the chains to support the pad eye both when loaded by the highline, and when the pad eye is itself supporting the king post. Since any stretching of one chain of either of the pairs connected by a single pivot plate is accompanied by slight pivoting of the respective plate, the tensions in the chains of each pair remains equal.

Although not shown in FIG. **4**, the front end of the pad eye is provided with an arrangement of pivot plates which is the

same as that shown for the rear end of the pad eye in FIG. 4, except in that since the chains 33*a*, 33*d*, and 34*a* and 34*d* associated with the front end are spaced more widely apart than those shown attached to the rear end, the pivot plates for the front end of the pad eye are wider than those shown in FIG. 4.

It may be noted that the chain attachment points on the pad eye are readily accessible through the spaces provided between the roller axles, and also that the locknuts 57 provides readily accessible means for adjusting the tensions in the chains, in case any stretching occurs in use. Furthermore, if it becomes necessary to lower the pad eye, for example by hoist means, when the chain operating means becomes inoperable for any reason, the pad eye can be released by removal of the bolts 53*a* holding the beams 52, with subsequent withdrawal of the beams 52 together with the stub shafts 54. The chains then remain in position, since the plates 55 and 56 are held together by sleeve 54*a*.

Referring now to FIGS. 5*a*, 5*b* and 5*c*, these show further details of the upper and lower bearings of the screw 25 (FIG. 5*a*) of the sprocket pulley mountings on the nut 28 (FIG. 5*b* and FIG. 6), and of the drive transmission to the screw (FIG. 5*c*).

FIG. 5*a* shows the upper end of screw 25 held by the bearing 26, which is mounted in crossmember 27. The inner attachment points 35 for the upper chains are also shown.

The crossmember 27 is a thick plate held between two reinforcing ribs 60 welded within the king post, the crossmember being held by means of bolts 61 inserted through the king post sideplates 15 and the ribs 60. The crossmember 27 is thus removable so that if the screw 25 is released at its lower end, and the upper chains 33 are also detached, the member 27 together with the screw and the upper bearing can be removed through the top of the king post.

The bearing 26 is a spherical roller-type self-aligning bearing, arranged to withstand a tensile force in the screw 25. The self-aligning feature of the bearing enables the screw to remain straight even if the king post becomes bent under the heavy side loads applied by the highline.

For inspection of the bearing and chain attachment points, an aperture normally covered by the plate 63 is provided in the adjacent part of the sideplate 15 of the king post.

FIG. 5*b*, together with FIG. 6, shows in more detail the recirculating ball nut 28 and the sprocket pulley mountings attached thereto.

The nut 28 carries a yoke member 70, having two stub shafts 71 extending from opposite sides of the yoke member transversely of the king post axis. The yoke member 71 also carries an arm 73, shown in FIG. 6, which extends perpendicular to the stub shafts 71 and has at its outer end a roller 74 engaging in a guideway 75 attached to the inside of the king post. This arrangement prevents rotation of the nut 28 on the screw 25 so that the screw rotation is accompanied by positive vertical movement of the nut.

Each of the stub shafts 71 carries an upper and a lower pulley block each comprising a clevis 77, 78 supporting respectively the freely rotatable sprocket pulleys 29 and 30. All the four pulley blocks can swivel as necessary on the stub shafts 71, so that no bending force can be applied to the screw in the plane of the pulleys. Each upper clevis 77 has two bored tongues fitting onto the respective stub shafts 71 and holding between them similarly bored tongues attached to the respective lower clevis 78. As can be seen from FIG. 6, the four pulleys 29*a*, *b*, *c*, *d* are generally coaxial and the same applies to the four pulleys 30*a*, *b*, *c*, *d*. It can readily be seen that vertical movement of the nut 28 causes all the pulleys 29 and 30 to move vertically together to pull in either the upper or the lower chains.

The lowermost part of the king post is shown in FIG. 5*c*. This shows an inspection cover 90 which gives access to removable connector shaft 91 which connects the screw 25 to an end shaft 92, to be described. The ends of the connector shaft 91 can be detached from the adjacent ends of the screw 25 and shaft 92 by removal of bolts 93, whereupon the screw 25 can be removed from the king post together with the crossmember 27, assuming that this has been detached in the manner hereinbefore described.

FIG. 5*c* also shows details of the king post spigot 12 carried by the spherical bearing 13, which bearing is held by a base member 102. The base member 102 is in turn releasably secured to the deck fitting 11 by means of rotatable cams 103. This deck fitting is the subject of our copending U.S. Pat. application No. 787,164. As explained fully in this copending patent application, the base support arrangement allows the king post to be rotated (in bearing 13) to face either side of the ship depending on the direction of highline transfer, and the releasable feature of the deck fitting allows the king post to be lowered and stowed below the deck in trunking indicated at 105 when not in use.

Within the upper end of the king post spigot 12 there is provided a cavity holding a spherical roller bearing 105 carrying the lower extremity of end shaft 92. The bearing 105 is similar to the top bearing 26, though inversely mounted, and similarly allows for some bending of the king post while the screw, which is solidly held to the end of shaft 92 via the connector shaft 91, remains straight. The bearing 105 takes only tensile loads in the screw and the bearings 26 and 105 are initially adjusted so that the screw is just slightly under tension. With this arrangement an axial load applied to the screw can only cause tension in the screw, and since no compression force can be communicated to either end bearing there is no buckling load applied to the screw.

At the lower end of the spigot 12 an axial bore is provided having at its upper end a tapered roller bearing 110 and at its lower end a ball bearing 111. These bearings hold the upper part of a drive shaft 112, which is coupled to the end shaft 92 by means of a flexible coupling 114. The flexible coupling 114 is arranged at the center of curvature of the outer spherical surface of bearing 105, so that movement of the end shaft 92 relative to the spigot 12 of the king post (for example during bending of the king post) produces only angular misalignment (without parallel displacement) at the center of the coupling 114.

Attached to the lower end of the spigot 12 is a gear housing 120 which in turn carries the motor 24. The motor shaft is provided with a pinion 121 which meshes with a gear wheel 122 keyed to the drive shaft 112, thereby rotating the screw 25 through the coupling 114, end shaft 92, and the connector shaft 91.

The motor 24 is a two speed 900/1,800 r.p.m. motor. In normal use the motor runs at the fastest speed, but means are provided in the form of limit switches situated within the king post for automatic switching of the motor from high to low speed as the nut 28 approaches points which correspond to the limits of the pad eye run. These limit switches are indicated at 130 in FIGS. 5*a* and 5*c*. By this means the positioning of the pad eye near to the limits of its run can be precisely controlled.

In order to prevent damage to the motor and the mechanical elements of the system when the pad eye reaches the limits of its run with the motor still energized, the motor circuit is provided with a cutout which deenergizes the motor as soon as an increase in current indicates that the motor has stalled. This electrical cutout serves the same purpose as the mechanical slipping clutch of earlier designs, for example that of U.S. Pat. No. 3,350,820.

Generally, it is convenient to make electrical connections to the motor by means of flexible leads which extend within the trunking in which the king post is stowed, and which are of sufficient length to accommodate the vertical movement of the king post when being stowed. In this case, it is highly desirable that means are provided to limit rotation of the king post to avoid undue twisting of the leads, and such means are described in our copending U.S. Pat. application No. 787,171. The electrical connections to the limit switches within the king post can be lead directly from the motor into the king post.

In operation, the base member 102 holding the lower end of the king post is secured to the deck by means of deck fitting

11, and the king post is rotated in the bearing 13 to face the desired side of highline delivery. Guy lines or stays are then connected to the lugs 14 at the top of the king post to maintain this in an erect position, and it is to be understood that the king post is held by the spherical bearing 13 in a simply supported manner enabling it to deflect slightly.

With the highline attached to swivel arm 21, the pad eye is raised to a suitable height near the top of the king post by operation of the motor 24 in such direction as to cause the nut 28 to descend the screw 25, so causing the sprocket pulleys 29 to pull down the chains 33*a*, *b*, *c*, and *d* thus raising the pad eye. After a load has been received along the highline, this can be lowered to the deck by operation of the motor 24 in the opposite sense to lower the pad eye. During these raising and lowering operations, it may be noted that:

1. due to the pulley arrangement, the movement of the pad eye is always twice that of the nut 28,

2. the upper chains 33 remain in tension, lower chains 34 being relatively slack and the force on the nut 28 is upwards thus tensioning the lower part of the screw 25, although no compression can exist in the upper part of screw 25 by virtue of the unidirectional nature of the bearing 26,

3. the tensions in the upper chain are all substantially equal, since the arrangement of the swivel arm attachment to the pad eye, and the arrangement of the pivot plates attaching the individual chains to the pad eye, tends to equalize the tensions in all the chains.

For stowing the king post below the deck, the pad eye 20 is lowered onto the deck fitting 11 and secured thereto by means indicated at 131, in which position it supports the king post. The deck fitting 11 is then operated to release the base member 102, and the motor 24 is operated in the "up" direction this being the direction which normally raises the pad eye on the post. In this case however the pad eye remains at deck level and the king post sinks therethrough into the deck with the pad eye acting as a guide. In this operation, the lower chains 34 are tensioned, and the upper part of the screw 25 is also in tension, although the nature of the bearing 105 ensures that no compression is applied to the lower part of the screw.

If the ships between which the load is being transferred should move from their correct stations during the transfer operation, the shackle at the near end of the highline will tend to slide on the runner 50 of the pad eye pivot arm, and will not tend to rotate the king post. (See copending U.S. Pat. application No. 787,174.)

The chain arrangement according to this invention allows four chains to be accommodated in both the upper and lower parts of the king post without requiring much more space than that required by previously known two-chain arrangements, and the arrangement also ensures that all the chains take a substantially equal amount of tension. The king post according to the invention is thus able to deal with heavier loads than previous otherwise similar king posts, and the chain arrangement also allows for easy and steady movement of the pad eye up and down the king post, since there are no torques applied to the king post which would give rise to excessive friction.

I claim:

1. Apparatus for highline ship to ship transfer of loads comprising

a. a king post, a pad eye mounted on the king post,

b. means for moving said pad eye vertically on the king post including

c. a linear driving member passing over guiding means on the king post and secured to the pad eye at attachment points on the king post to form an arrangement providing opposing forces and wherein

d. the pad eye is attached to the highline by connecting means

e. said attachment points being situated both front and rear of the king post central axis.

2. Apparatus as claimed in claim 1 in which said linear driving member is comprised of chains adapted to pass over pulleys.

3. Apparatus according to claim 2 wherein the said chains are movable by means attached to a nut mounted for nonrotational vertical movement along a motor-driven screw extending longitudinally of the king post, and wherein the upper bearing of the said screw is mounted on a crossmember within the king post which crossmember is detachable for removal from the king post.

4. Apparatus according to claim 3 wherein the motor drivably connected to the screw is a variable speed motor, and wherein limit switches are included in the king post automatically to switch the motor from fast to slow speeds as the nut approaches the positions corresponding to the limits of the pad eye movements on the king post.

5. Apparatus according to claim 3 wherein the motor is connected to a power supply via an overload protection device which acts to cut off the power supply to the motor if the motor becomes stalled.

6. Apparatus as claimed in claim 5 wherein the power supply cutoff is adapted to actuate braking mechanism.

7. Apparatus for highline ship to ship transfer of loads comprising

a. a king post, a pad eye mounted on the king post,

b. means for moving said pad eye vertically on the king post including

c. a linear driving member passing over guiding means on the king post and secured to the pad eye at attachment points on the king post to form an arrangement providing opposing forces and wherein

d. the pad eye is attached to the highline by connecting means

e. a swivel arm mounted to pivot on the pad eye about a horizontal axis which axis lies between the attachment points.

8. Apparatus according to claim 7 in which the horizontal pivotal axis of the swivel arm on the pad eye lies approximately midway between the front and rear attachment points of the said chains.

9. Apparatus for highline ship to ship transfer of loads comprising

a. a king post, a pad eye mounted on the king post,

b. means for moving said pad eye vertically on the king post including

c. a linear driving member passing over guiding means on the king post and secured to the pad eye at attachment points on the king post to form an arrangement providing opposing forces and wherein

d. the pad eye is attached to the highline by connecting means

e. including two upper pairs of chains extending upwardly from the pad eye and attached respectively to front and rear pairs of attachment points thereof for supporting the pad eye and loads attached thereto, and wherein the chains of each pair are attached to opposite ends of a centrally pivoted member mounted on the pad eye, whereby the tensions in the chains of each pair are balanced.

10. Apparatus according to claim 9 including two lower pairs of chains extending downwardly from the pad eye and attached respectively to front and rear pairs of attachment points thereof and wherein the chains of each lower pair are attached to opposite ends of a centrally pivoted member mounted on the pad eye, whereby the tensions in the chains of each lower pair are balanced.

11. Apparatus according to claim 10 wherein the respective pairs of chains each have substantially constant spacing throughout their lengths, the spacing of each pair of chains connected to the front of the pad eye being different from the spacing of each pair of chains connected to the rear of the pad eye, and the arrangement being such that the chains of a closely spaced pair pass between the chains of the more widely spaced pair at points where crossover occurs without mutual interference.

12. Apparatus according to claim 9 wherein the attachment means connecting the chains to the pivoted members of the pad eye include adjustment means for tensioning the chains.

13. Apparatus for highline ship to ship transfer of loads comprising

a. a king post adapted to be held in erect position on the deck of a ship,

b. a pad eye mounted on the king post, and

c. means for moving said pad eye vertically on the king post including chains passing over pulleys at the top of the king post and secured to the pad eye at attachment points which are situated both front and rear of the king post central axis, and in which the pad eye is attached to the highline by link means including a swivel arm mounted to pivot on the pad eye about a horizontal axis which axis lies between the said front and rear attachment points of the said chains.

14. Apparatus for highline ship to ship transfer of loads comprising

a. a king post, a pad eye mounted on the king post,

b. means for moving said pad eye vertically on the king post including

c. a linear driving member passing over guiding means on the king post and secured to the pad eye at attachment points on the king post to form an arrangement providing opposing forces and wherein

d. the pad eye is attached to the highline by connecting means

e. said linear driving member being comprised of chains adapted to pass over pulleys

f. said chains being movable by means attached to a nut mounted for nonrotational vertical movement along a motor-driven screw extending longitudinally of the king post, and wherein the upper bearing of the said screw is mounted on a crossmember within the king post which crossmember is detachable for removal from the king post

g. wherein the screw is attached to a lower end shaft by a connector, access means being provided to allow disengagement of the connector from within the king post whereby the screw may be withdrawn upwardly through the king post simultaneously with the removal of the said crossmember.

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