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Flessner et al.

[54] DEVICE FOR DAMPING PENDULUM MOVEMENTS

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[30] Foreign Application Priority Data

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[52] U.S. Cl. 212/14; 212/125

[51] Int. Cl. B66c 19/00

[58] Field of Search 212/124–129, 212/14, 15, 40; 188/303

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Primary Examiner—Evon C. Blunk
Assistant Examiner—Jeffrey V. Nase
Attorney, Agent, or Firm—Walter Becker

[57] ABSTRACT

A hoist structure with a load frame suspended on cables in which swinging movements of the load frame in which at least the lateral direction are damped. The suspending cables include a pair of cables in longitudinally spaced relation with the cables of each pair spaced in the lateral direction. Each cable leads downwardly to the load frame and about a pulley and upwardly to a point of connection. The pulleys pertaining to the cables of a pair of cables are coaxially and relatively rotatably and damping means are provided, preferably fluid damping means, and interposed between the pulleys of each pair of pulleys so that relative movement between the pulleys is damped and thereby lateral swinging movements of the load frame are damped.

7 Claims, 8 Drawing Figures

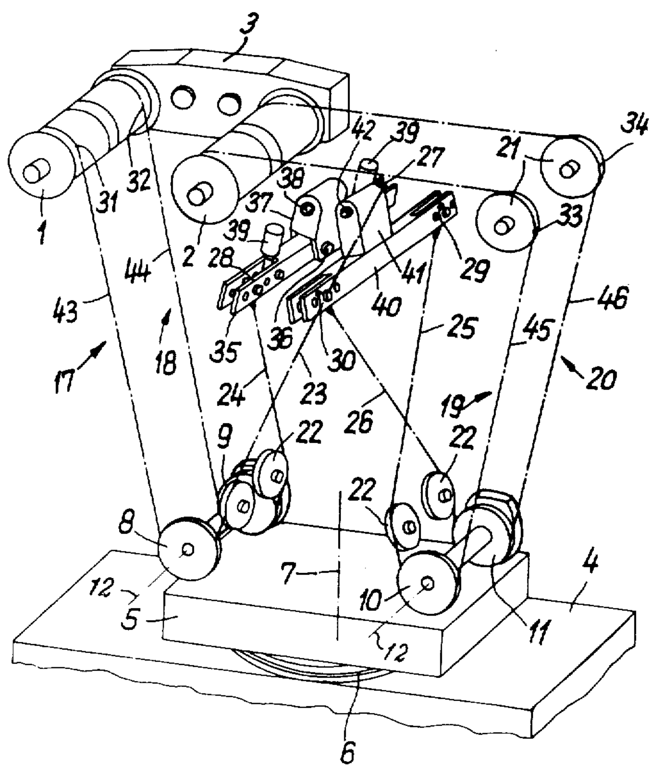

FIG. 1

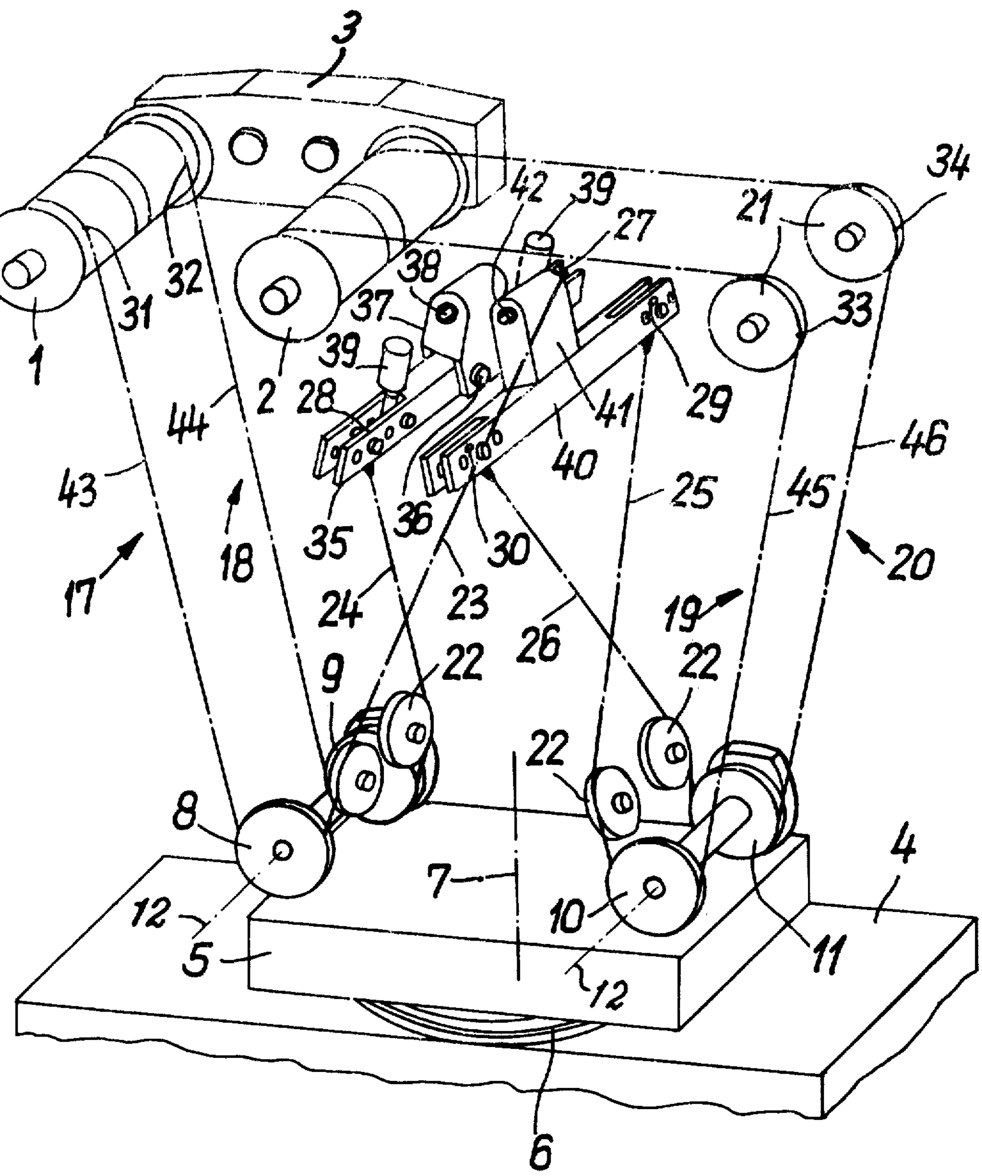
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FIG. 2

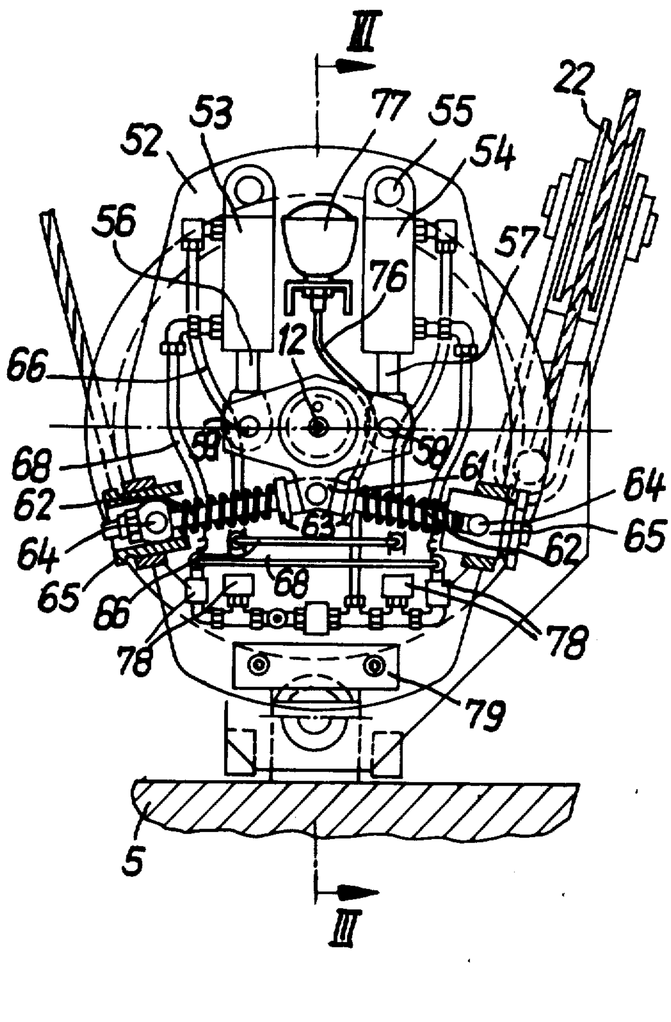
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FIG. 3

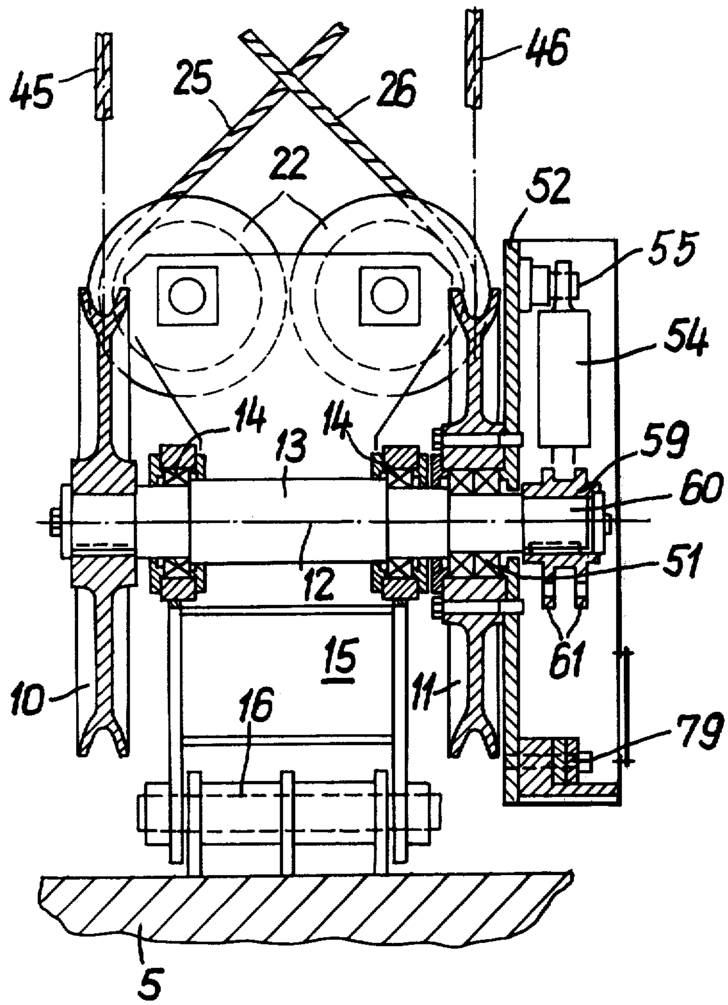
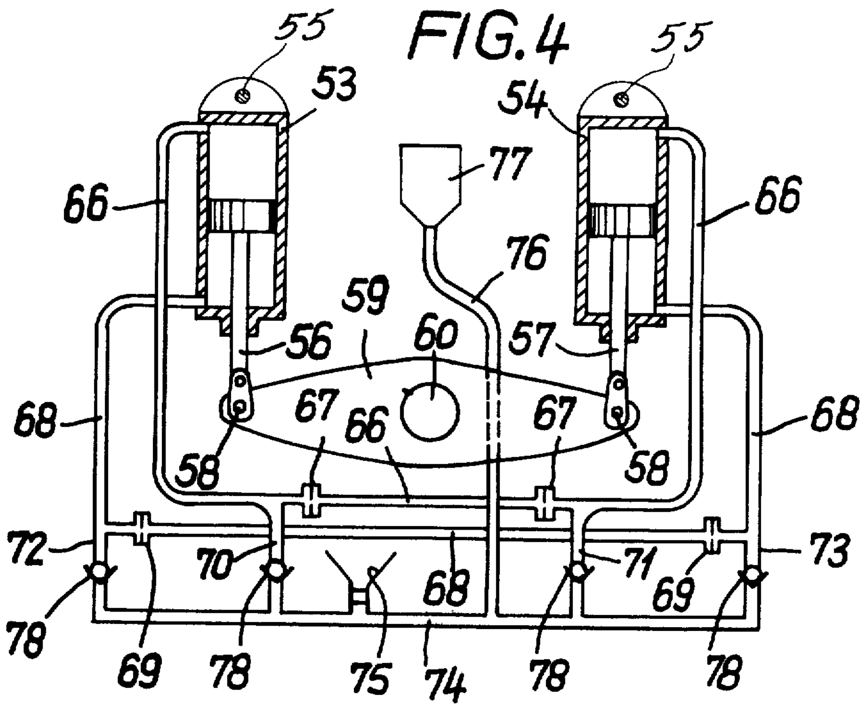


FIG. 4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68
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69
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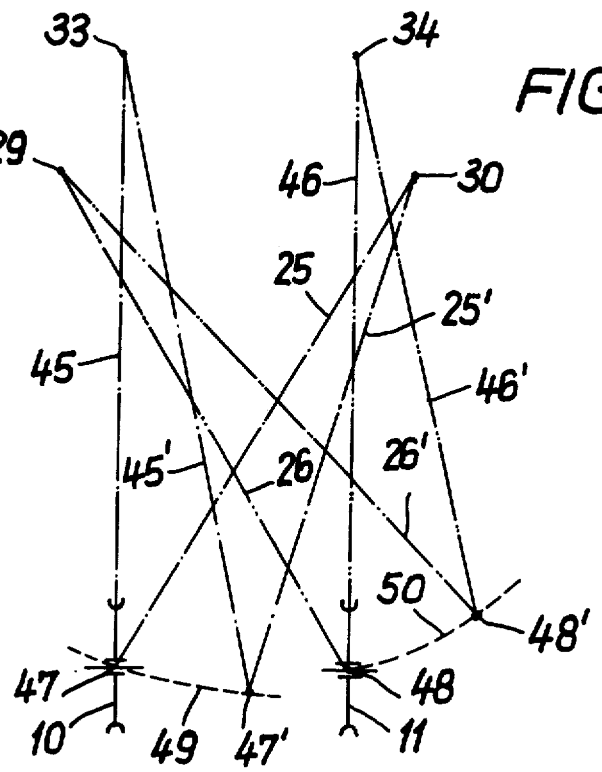
75
74
78
78

FIG. 5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34
29
46
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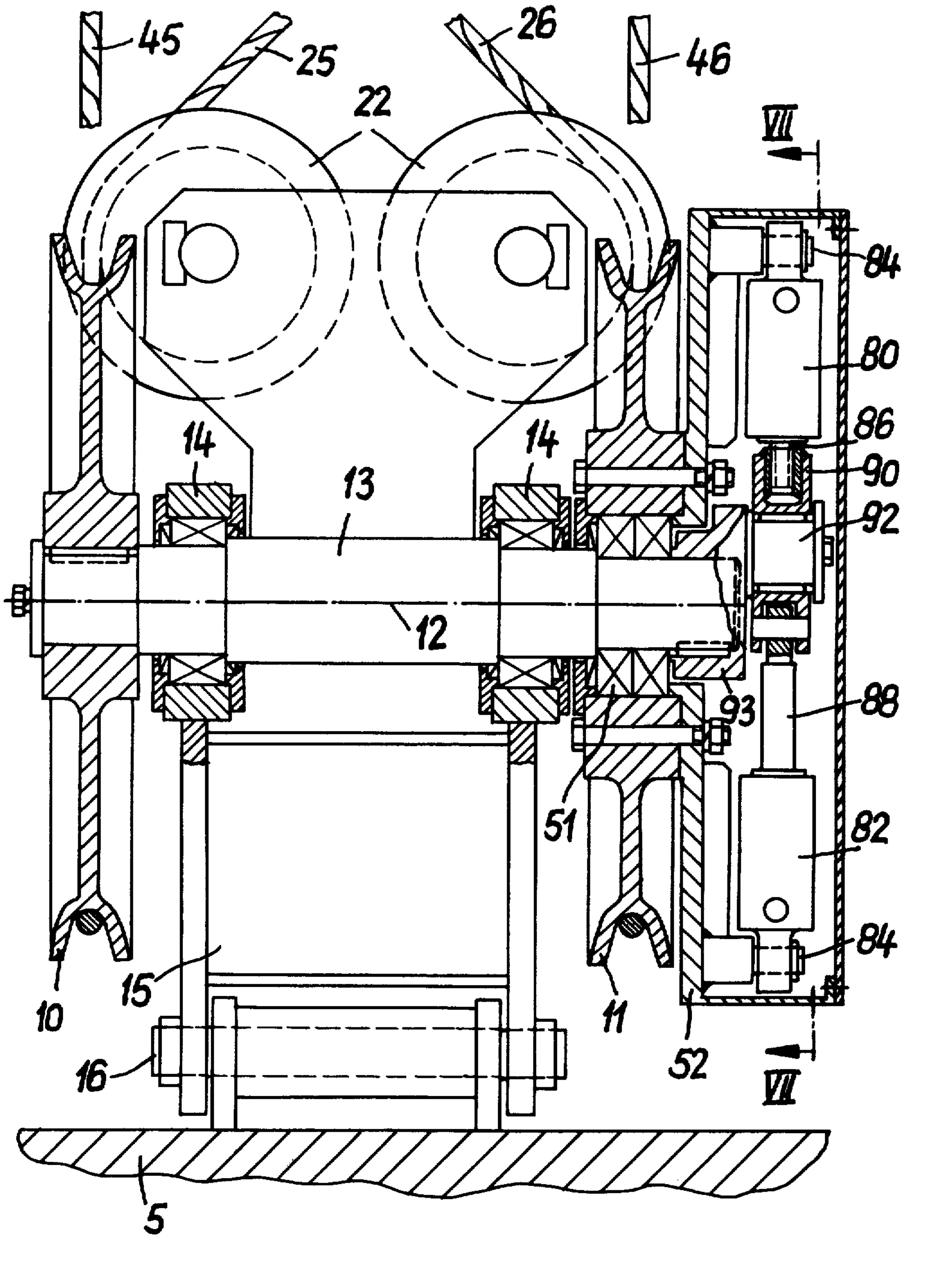
47'
11

FIG. 6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25
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22
VII
84
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92
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52
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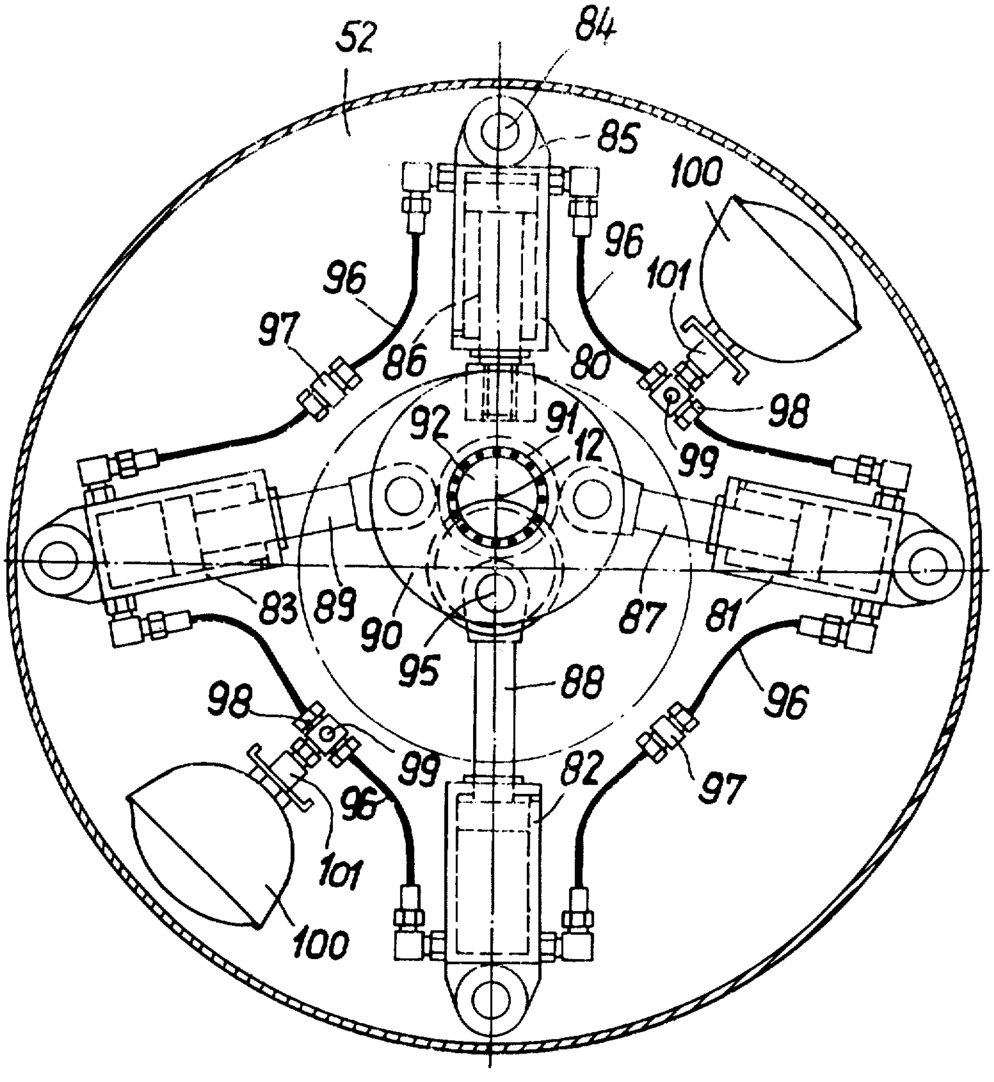
VII
5

FIG. 7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101
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92
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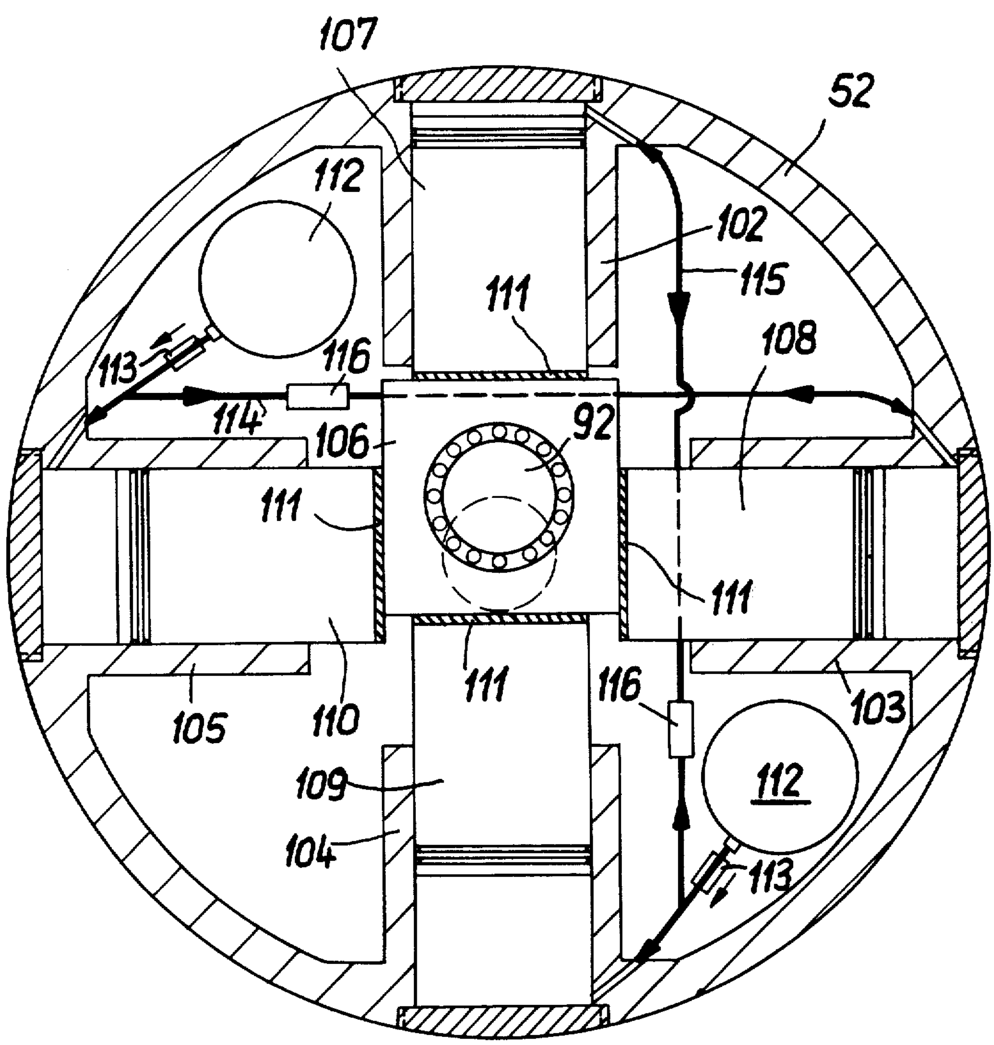
96
101
100

FIG. 8


107
52
112
102
115
111
108
113
116
114
106
92
111
111
111
116
105
110
103
112
109
104
113

DEVICE FOR DAMPING PENDULUM MOVEMENTS

The present invention relates to a device for damping the pendulum movement of a load suspended on a lifting cable of a hoisting device, or of a supporting frame for a hoisting device, with pairs of pulleys which are so journaled on the upper side of the load, or the supporting frame, that in pairs they have common axes of rotation or at least axes of rotation which are approximately parallel to each other.

In order to limit the pendulum movement of loads suspended in this manner, so-called cable pyramids are employed, which means that the lifting cables are so guided that they form the edges of truncated pyramids which flare in upward direction. However, the desired result is questionable, particularly when considerable lifting height of the hoisting device is involved, in case the load hangs far downwardly so that the lifting cables are almost completely off the lifting drum, in which instance the lifting cables form only small angles with the vertical plane. In order to remedy this situation, it would be necessary to enlarge the upper end face of the truncated pyramid, which means that the distance between the suspension points of the lifting cables on the hoisting device would have to be increased in longitudinal as well as in transverse direction. Such modification, however, is limited by the local conditions, especially with regard to the length and width of carriages. Attempts have been made to limit the pendulum of loads hanging on carriages as far as the pendulum movement thereof is brought about by accelerating and retarding forces. These attempts were directed manual influences, especially by a corresponding control of the carriage and the crane driving mechanism. This, however, required considerable skill on the part of the crane conductor. while electrical control devices have been created by means of which the carriage and crane driving mechanisms are automatically so controlled that they produce forces counteracting the pendulum movement, such devices are rather expensive and are subject to disorders in the rough crane operation. Moreover, in this way, the pendulum movement of loads suspended on lifting cables cannot easily be limited when other causes such as acceleration and retardation of the carriage driving mechanisms are present or created for instance, by changes in the wind velocity and also changes in the wind direction, and wind exposed surfaces are involved during the lowering and lifting of the load.

It is, therefore, an object of the present invention to provide a device of the above mentioned general type which at low structural expenses will limit the pendulum movement of loads or supporting frames suspended on lifting cables and will, in particular, limit the pendulum movement of traverses with suspended bulky load bodies such as sheet metal pieces, pipes, containers, and the like.

It is a further object of this invention, above all, to dampen the pendulum movement of containers suspended on lifting cables in a direction transverse to the longitudinal direction of such containers, and furthermore to dampen the pendulum movement in the form of rotary oscillations about the vertical axis of rotation, for instance, of a rotary carriage.

These and other objects and advantages of the invention will appear more clearly from the following specification, in connection with the accompanying drawings, in which:

FIG. 1 illustrates an isometric view of a lifting mechanism according to the invention, of a crane carriage with the lifting cables and a traverse suspended thereon.

FIG. 2 is an end view, and partially a section, of a pertaining device for damping the counter-rotary movements of two pulleys, for use in connection with the device of FIG. 1.

FIG. 3 is a vertical axial section taken along the line III—III of FIG. 2 through the device of FIG. 2 and also shows the pulleys and the mounting thereof.

FIG. 4 shows the circuit for the hydraulic device of FIGS. 2 and 3.

FIG. 5 diagrammatically illustrates two coaxial pulleys in an axial section with the pertaining lifting cables in their normal position and after a pendulum movement.

FIG. 6 illustrates in a vertical axial section, two coaxial pulleys and the journaling thereof and also shows a hydraulic device for damping rotary movements which run counter to each other, according to a second embodiment.

FIG. 7 represents a section taken along the line VII—VII of FIG. 6.

FIG. 8 represents a section similar to that of FIG. 7, through a hydraulic device for damping the rotary movements of two pulleys running counter to each other, this arrangement illustrating a third embodiment of the invention.

The device according to the present invention is characterized primarily in that the two lifting cables pertaining to each of the pairs of pulleys are guided from two suspension points on the hoisting device, preferably on the hoisting drums, in two strands downwardly to the two cable pulleys and around the same and from there upwardly in a converging manner in two strands to two other suspension points which in the lifting hoist are located lower than the first mentioned suspension points, and furthermore characterized in that the two pulleys of each pair of pulleys are mounted on a suspension device of the load body or of the supporting frame, so that when pendulum movements of the load body or supporting frame occur they can, approximately in the direction of their axes of rotation, turn counter to each other, and finally characterized in that means are provided for damping such counter-running rotary movements. Preferably, the arrangement is such that those cable strands which are guided from the cable rollers of each cable roller pair to the lower suspension points, cross each other.

In this connection, for damping the counter-running rotary movements of the cable rollers of each cable roller pair, expediently, hydraulic devices with two displacement parts each are provided, which are movable toward each other. These displacements parts are so mounted on bodies nonrotatably connected to the two cable pulleys that these bodies during a counter-running rotary movement of the pulleys will press liquid through the throttle elements. The cylinders of two or more hydraulic devices may be connected to a body which is nonrotatably connected to one of the pulleys, and the pertaining piston rods may be connected to a body which is nonrotatably connected to the other pulley, while in at least one connecting line between the two cylinders there is inserted at least one throttle member.

A particularly advantageous design of a hydraulic device for damping the counter-running rotary movements of the pulleys is characterized in that on a disc which is nonrotatably connected to one of the pulleys there is provided a plurality of cylinders which are uniformly distributed around the axis of rotation of the pulleys and are, in pairs, interconnected by conduits comprising throttle members. The pertaining piston rods are connected in a nonrotatable manner to a crank pin by means of an element rotatably journalled thereon, said crank pin being provided on the other pulley. The cylinders may be journalled on the disc in joints with axes which are parallel to the axis of rotation of the pulleys, and the piston rods pertaining to one of the cylinders may be firmly connected to the element which is rotatably journalled on the crank pin. The remaining piston rods are pivotally connected to this member. Expediently, each of the cylinders is connected to the two adjacent cylinders by conduits and comprises two or more conduits—throttle elements, whereas pressure storage means are connected to the remaining conduits through check valves. It is, however, also possible that the cylinders are firmly mounted on the disc in radial arrangement with regard to the axis of rotation of the pulleys and that the piston rods with sliding surfaces transverse to the devices actuating the piston rods engage sliding surfaces of the member rotatably mounted on the crank pin and that the piston rods engage said sliding surfaces at a pressure which is maintained in the cylinders by at least one pressure accumulator.

Such a design of the hydraulic damping device has the advantage that the pulleys can rotate opposite to each other in an unlimited manner and that no returning device is necessary. A further advantage of the design of the hydraulic damping device according to the invention consists in that with each rotary position of the pulleys relative to each other, the device according to the invention is fully effective and a damping will also be realized if the cables should slip in the grooves of the pulleys. Such hydraulic damping device may advantageously be employed in connection with other devices than with the device for damping the pendulum movement of a load suspended on lifting cables of a lifting hoist, for instance, for damping rotary oscillations of long transmission shafts.

Referring now to the drawings in detail, FIG. **1** illustrates two cable drums **1, 2**, forming a part of a crane carriage (not illustrated.). The axes of rotation of said drums **1, 2** are arranged parallel to each other, and the drums **1, 2** are driven by a drive **3** common thereto. A traverse **4** which may, for instance, be a spreader for conveying containers, is supported by a plate **5** through the intervention of a turntable **6**, which latter is adapted to permit rotation of the traverse **4** relative to plate **5** about a vertical axis **7**. The turning of the transverse **4** is effected by means of a nonillustrated turning mechanism which may be arranged, for instance, on plate **5**. Mounted on plate **5** are two pairs of rollers or pulleys **8, 9**; **10,11**, which are so arranged that the pulleys of each pair have a common axis of rotation **12** (FIGS. **2** and **3**), which with the suspension illustrated in FIG. **1** is parallel to the axes of rotation of the cable drums **1, 2**. As illustrated in FIG. **3**, two pulleys each, for instance, pulleys **10** and **11**, have a common shaft **13**, which by means of two bearings **14** carries a sheet metal box **15**, which by means of a joint **16** with an axis parallel to the axis of rotation **12** has suspended thereon the above mentioned plate **5**.

From each of the two cable drums **1, 2**, two lifting cables **17, 18**; **19, 20** (lifting cables **19,20** through two deviating rollers **21** journalled on the carriage frame) lead to the rollers **8, 9**; **10, 11** of one of the two cable roller pairs. The lifting cables **10** and **20** pass about the cable rollers and from there through deviating rollers **22** journalled on the sheet metal boxes **15** upwardly in a converging manner. The strands **23, 24**; **25, 26** located above the deviating rollers **22** and pertaining to the lifting cables **17, 18**; **19, 20** cross each other and are connected at the points **27, 28**; **29, 30** which are located considerably lower than the points **31, 32**; **33, 34** where the cables **17, 18** run off from the cable drum **1** and the cables **19, 20** run off from the deviating rollers **21**.

Powers **27** and **28** are located at the ends of an equalizing lever **35** which extends in its illustrated normal position parallel to the axes of rotation of the cable drums **1, 2**. The lever **35** is at its center connected to a holder **37** by means of a bolt **36** which extends transverse to said lever **35**. The holder **37** is journalled on the carriage frame in a joint **38** with its axis extending parallel to the axes of rotation of the cable drums **1, 2**. In this way, the holder **37** together with the lever **35** forms a rocker. Pivoting movements of the lever **35** relative to the holder **37** are cushioned by hydraulic devices, the cylinders **39** of which are mounted on the holder **37**, whereas their piston rods engage the lever **35**.

The points **29, 30** are located at the ends of a support **40** which is firmly mounted on a holder **41**. Holder **41** is journalled on the carriage frame in a joint **42** with its axis extending parallel to the axes of rotation of the cable drums **1, 2**. The holder **41** thus together with the support **40** forms a rocker.

The arrangement is such that the planes through the strands **43, 44** of the cables **17, 18**, which strands are located between the cable drum **1** and the pulleys **8, 9**, and the plane through the cable strands **23, 24** extend in a V-shaped manner with regard to each other. This also applies to the planes through the strands **45, 46** of the lifting cables **19,20** between the deviating rollers **21** and the cable rollers **10, 11**, and to the plane through the cable strands **25 26**. In view of this arrangement of the lifting cables, a pendulum movement of the traverse **4** and of the load carried thereby in the longitudinal direction of the load is counteracted. By means of the lever **35**, a three-point suspension of plate **5** is realized.

FIG. **5** diagrammatically illustrates the conditions when the plate **5** at traverse **4** and the suspended load carries out a pendulum movement transverse to the longitudinal direction of the load. The cable rollers **10, 11** are shown in their starting position, in which their center points **47, 48** are located in the vertical planes passing through the upper suspension points **33, 34**, in which planes also the cable strands **45, 46** are located. The cable strands **25, 26** which extend from the points **47, 48** to the lower suspension points **29, 30** cross each other.

It may now be assumed that the plate **5** with the traverse **4**, which plate is suspended on the cable rollers carries out a pendulum movement transverse to the longitudinal direction of the traverse **4**. In such an instance, the center points of the cable rollers **10** and **11** will move onto elliptical paths **49, 50** into positions **47'**, **48'**. The cable strands **45** and **26** will then be extended and the cable strands **25** and **46** will be shortened while the total of the cable strands, for instance, **45** and **25**, of each lifting cable, for instance, **19**, remains unchanged. The extended and shortened cable strands are designated in FIG. **5** with the numerals **45'**, **26'**; **25'**, **46'**. As a result thereof, cable **19** will be pulled below the cable roller **10** so that it turns the rollers in a counterclockwise direction with regard to FIG. **1**, whereas the cable **20** is pulled below the cable roller **11** in such a way that the latter is turned in clockwise direction with regard to FIG. **1**.

When plate **5** with traverse **4** carries out a pendulum movement in opposite direction, which means toward the left with regard to FIG. **5**. The cable rollers **10** and **11** are turned counter to each other in opposite direction. Corresponding rotations in the direction counter to each other are simultaneously carried out by the cable rollers **8** and **9**.

When plate **5** with the traverse **4** and the suspended container carries out rotary oscillations about the vertical axis **7**, the cable rollers **8** and **9** are likewise turned in a direction counter to the cable rollers **9, 11**, but in such a way that the cable rollers **9** and **10**; **8** and **11**, which are located diagonally opposite each other will rotate in the same direction. The damping of the opposite rotary movements of the cable rollers of each cable roller pair is effected, for instance, by means of a device according to FIGS. **2** and **3**.

As shown in FIG. **3**, the cable roller **10** is keyed to that end of shaft **12** which protrudes beyond one bearing **14**, whereas the cable roller **11** is journalled on that end of shaft **12** which protrudes beyond the other bearing **14**. Accordingly, the cable rollers **10** and **11** will rotate independently of each other about the axis **12**. A disc **52** is flanged to the cable roller **11**. Mounted on said disc **52** are cylinders **53, 54** of two hydraulic displacing devices. At each end these displacing devices are pivotally mounted on disc **52** by means of bolts **55** which extend parallel to the axis of rotation **12**, and will in the vicinity of the circumference of the disc **52** arranged in short spaced relationship to each other. The pertaining piston rods **56, 57** which extend through stuffing boxes at those ends of the cylinders **53, 54** which are located opposite the bolts **55** engage through the intervention of bolts **58** the ends of a two-arm lever **59** with equally long lever arms. The lever **59** is keyed to a pivot **60** of shaft **12**, which pivot protrudes relative to disc **55**.

Lever **59** has an extension **61** on that side which is located opposite the cylinders **53, 54**. This extension **61** is engaged by a returning device. This returning device comprises two bars which from oppositely located sides pivotally engage the extension **61** and are surrounded by pressure springs **62**. These springs rest on one hand on collars **63** arranged on the above mentioned bars and on the other hand rest against counterbearings which by means of two pivots **64** are held in slots of bushings **65**, which bushings are adjustably connected to disc **52**.

As will be evident in particular from FIG. **4**, those ends of cylinders **53** and **54** which are respectively located opposite the piston rods **56** and **57** are connected to each other by a conduit **66**. In this conduit there are provided two chokes **67**. Furthermore, the oppositely located ends of the cylinders **53, 54** are interconnected by a conduit **68** in which are located two chokes **69**. Branching off from the conduits **66** and **68** between one choke each and one of the cylinders are conduits **70–73** which are united to a conduit **74**.

Conduit **74** has a filling connection **75** adapted to be closed. A pipe **76** coming from a pressure accumulator **77** leads into the conduit **74**. The conduits **70–73** have arranged therein check valves **78** in such a way that no liquid can pass from the cylinders **53, 54** into the conduit **74**.

When the pulleys **10** and **11** are turned counterclockwise to each other, the lever **29** turns relative to the disc **52** on which the cylinders **53, 54** are journalled. Consequently, for instance, the piston in the cylinder **53** is moved upwardly with regard to FIG. **4**, and the piston in cylinder **54** is moved downwardly. As a result thereof, liquid is from the upper portion of cylinder **53** through conduit **66** and chokes **67** pressed into the upper portion of the cylinder **54**. At the same time, liquid is pressed from the lower portion of cylinder **54** through conduit **68** and chokes **69** into the lower portion of cylinder **53**. The passing of the liquid through the chokes **67** and **69** brings about a damping of the rotary movements of the cable rollers relative to each other. As a result thereof, also the pendulum oscillations are damped which are brought about by the rotation of the cable rollers opposite to each other. By means of the pressure accumulator **77**, a certain overpressure is maintained in the conduits **66** and **68** and thereby also in the cylinders **53** and **54**.

When plate **5** with the traverse **4** of each of the cable drums **1** and **2** is lifted or lowered without pendulum oscillations occurring transverse to the longitudinal direction of the traverse **4** or if rotary oscillations occur about the axis **7**, the cable rollers **8, 9** and **10, 11** are located uniformly and in the same direction so that the hydraulic damping device does not become effective. At disc **52** on that side which is located opposite the cylinders **53, 54** there are arranged counter weights **79** by means of which the unbalance is substantially counteracted, said unbalance being caused by the unilateral arrangement of the cylinders **53** and **54** and of the pressure accumulator **77**.

According to the embodiment of FIGS. **6** and **7**, it is again a pulley **10** keyed to the shaft **13**, whereas the other pulley **11** is, by means of bearings **51**, rotatably journalled on a pivot of shaft **13**. Furthermore, a disc **52** is flanged onto the pulley **11**. Pivotally mounted on this disc **52** by means of bolt **84** are four cylinders **80–83** of a hydraulic damping device. These cylinders are uniformly distributed in the vicinity of the circumference of disc **52** over the circumference of the latter and are mounted on said disc **52**. This mounting is effected by means of eyes **85** respectively located at the ends of the cylinder. The pertaining piston rods **86–90** are connected to a ring **90** which, by means of a needle bearing **91**, is journalled on a crank pin **92**. Crank pin **92** is with an eccentricity relative to the axis of rotation **12** arranged on a hub **93** keyed onto shaft **13**. The piston rod **86** is, by means of a threaded pin **84**, rigidly connected to the ring **90**, said threaded pin **84** being screwed into a bushing arranged in ring **90**. The other piston rods **87, 88, 89**, however, are by means of joint bolts **95**, connected to ring **90**, said bolts extending parallel to the axis of rotation **12**. That end of each of the cylinders **80–83** which faces away from ring **90**, is through conduits **96**, in communication with those ends of the two adjacent cylinders which face away from said ring **90**. In two conduits **96** located opposite to each other, there are provided throttles **97**, whereas in the two other conduits **96** distributing nipples **98** are inserted. These nipples respectively have fill-in openings **99** which are adapted to be closed and also respectively have connections which are in communication with a pressure accumulator **100** each through a check valve **101**. The pressure accumulators **100** are arranged on disc **52** diametrically opposite to each other in such a way that their common center of gravity is located in the axis of rotation **12**.

When the cable rollers **10** and **11** rotate in opposite direction with regard to each other, the piston rods **86–89** are, in conformity with the eccentricity of ring **90**, displaced relative to shaft **13** within the cylinders **80–83**. Accordingly, liquid is, through conduits **96**, moved from one cylinder to another while, in view of the passage through the throttles **97**, a damping is effected.

A respective undesired damping is obtained independently of the rotary position in which the two cable rollers are. Therefore, it is not necessary that each time after a rotation of the cable rollers relative to each other these rollers are by a returning device returned to their starting position. Accordingly, it is not necessary either for purposes of setting a zero point position to take off the traverse in order to have a sagging cable to permit the return movement of the spring.

The embodiment of FIG. **8** differs from that of FIGS. **6** and **7** on one hand, in that the four cylinders **102**, 103, 104, and **105** are not pivotally connected to disc **52**, but are rigidly connected thereto. Furthermore, on crank pin **92** instead of ring **90** there is a block **106** rotatably mounted which has four sliding surfaces. It is against these four sliding surfaces that the pistons **107–110** displaceable in the cylinders are pressed with sliding plates **111**. This is effected by the liquid pressure which prevails in those parts of the cylinders which face away from block **106**. This pressure is maintained by two pressure accumulators **112** which are connected to disc **52** in a position in which they are located diagonally opposite to each other. The two pressure accumulators **12** are adapted through check valves **113** to be connected with one pair of cylinders each. The cylinders of each pair are interconnected by conduits **114**, 115 in which throttles **116** are provided.

When the cable rollers are thereby, the disc **52** and crank pin **92** turn in opposite direction with regard to each other, the pistons **107–110** are displaced in the cylinders in conformity with the eccentricity of block **106**. Consequently, liquid from one of the cylinders is, each time through a conduit **114, 115** pressed into the oppositely located cylinder. Inasmuch as in this connection the liquid passes through the throttled **116**, the counter-rotary movement of the cable rollers and thereby the pendulum movement of the traverse are dampened.

It is, of course, also possible with the embodiments of FIGS. **6**, **7** and **8** to employ any other number of cylinders instead of the four cylinders referred to above, when the cylinders are uniformly distributed over the circumference of the disc.

It is, of course, to be understood that the present invention is, by no means, limited to the specific showing in the drawings, but also comprises any modifications within the scope of the appended claims.

What is claimed is:

1. A hoist structure including:
a first frame,
a load supporting second frame which is suspended from said first frame,
by means of two pairs of lifting cables of a hoisting drum means mounted on said first frame,
and by means of two pairs of pulleys independently rotatable journalled upon said second frame,
the pulleys of each said pair having a common axis of rotation and being arranged with a distance from one another,
the two axes of rotation of said two pairs of pulleys being arranged horizontal and parallel to one another,
each pair of said cables leading from said first frame downwards to the pulleys of one of said pairs in such arrangement,
so that each of the cables of each said pair of cables is passed around a pulley of one of said pairs of pulleys,
the cables of each pair ascending from its pair of pulleys in two strands to a fastening means of said first frame in two spaced points,
said strands of each said pair of cables lying nearly within a plane parallel to said axes of rotation of said pairs of pulleys and inclined with respect to said axes,
said two strands of each pair crossing between said first and second frames in such a manner; that in response to swinging movement of said second frame parrallel to said axes, the pulleys of each of said pairs of pulleys are rotated in opposite directions,
a damping means being operatively interposed between the pulleys of each said pair of pulleys
and comprising a fluid displacement means including at least one pair of displacing members one of which is hollow and connected to one pulley of the same pair of pulleys, the other displacing member of the same pair of displacing members being guided within said first displacing member and connected to the other pulley of the same pair of pulleys,
said fluid displacement means including at least two volumes each being enclosed by at least one said pair of displacing members and filled with fluid,
a conduit means interconnecting said two volumes and including choke means
in such an arrangement that rotation of said pulleys of the same pair of pulleys in opposite directions will cause relative movement of said two displacing members so that a portion of said fluid will flow from one of said volumes through said conduit means and through said choke means to the other said volume.

2. A hoist structure according to claim **1** in which the fluid displacement means includes two pairs of displacing members, one displacing member of each pair being a cylinder supported by a body which is nonrotatably connected to one pulley of said pair of pulleys, the other displacing members of said pair being double acting pistons which are connected to the ends of a lever which is about midway between these ends connected to the other pulley of the same pair of pulleys, spring means acting between said body and said lever and biasing said lever toward a centered position relative to said body,

two conduits interconnecting corresponding ends of said two cylinders and including choke means.

3. A hoist structure according to claim **2** which includes a pressure accumulator mounted on said body and connected to said conduits through further conduit means which include check valve means opening toward said conduits,

counterweight means on said body to balance the body and the parts connected thereto about the axis of rotation of said pulleys.

4. A hoist structure according to claim **1** which includes a deviating roller adjacent the pulley end of each ascending strand and about which the respective cable is entrained in the region thereof between the lower end of the respective strand and the representative pulley.

5. A hoist structure according to claim **1** in which each said fastening means includes an arm connected to said first frame for each pair of cables and swingable

on the first frame on an axis substantially parallel to the axes of the rotation of said pulleys.

6. A hoist structure according to claim **5** in which at least one of said arms is also tiltable about a further axis substantially perpendicular to the swing axis of the same arm,

said further axis being about midway between the said points of connection of the cables to the said arm,

and a damping device connected to said one arm and damping tilting movements thereof.

7. A hoist structure according to claim **1** in which said first means comprises cylinders and said second means comprises pistons extending into said cylinders, a first body supporting said cylinders and nonrotatably connected to one of said pair of pulleys, a second body to which said pistons are connected and nonrotatably connected to the other of said pulleys, conduit means interconnecting said cylinders, said choke means comprising at least one throttle member in said conduit.

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