April 20, 1965 W. B. McLEAN 3,179,259

SNUBBING SYSTEM FOR CRANES

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FIG. 1.

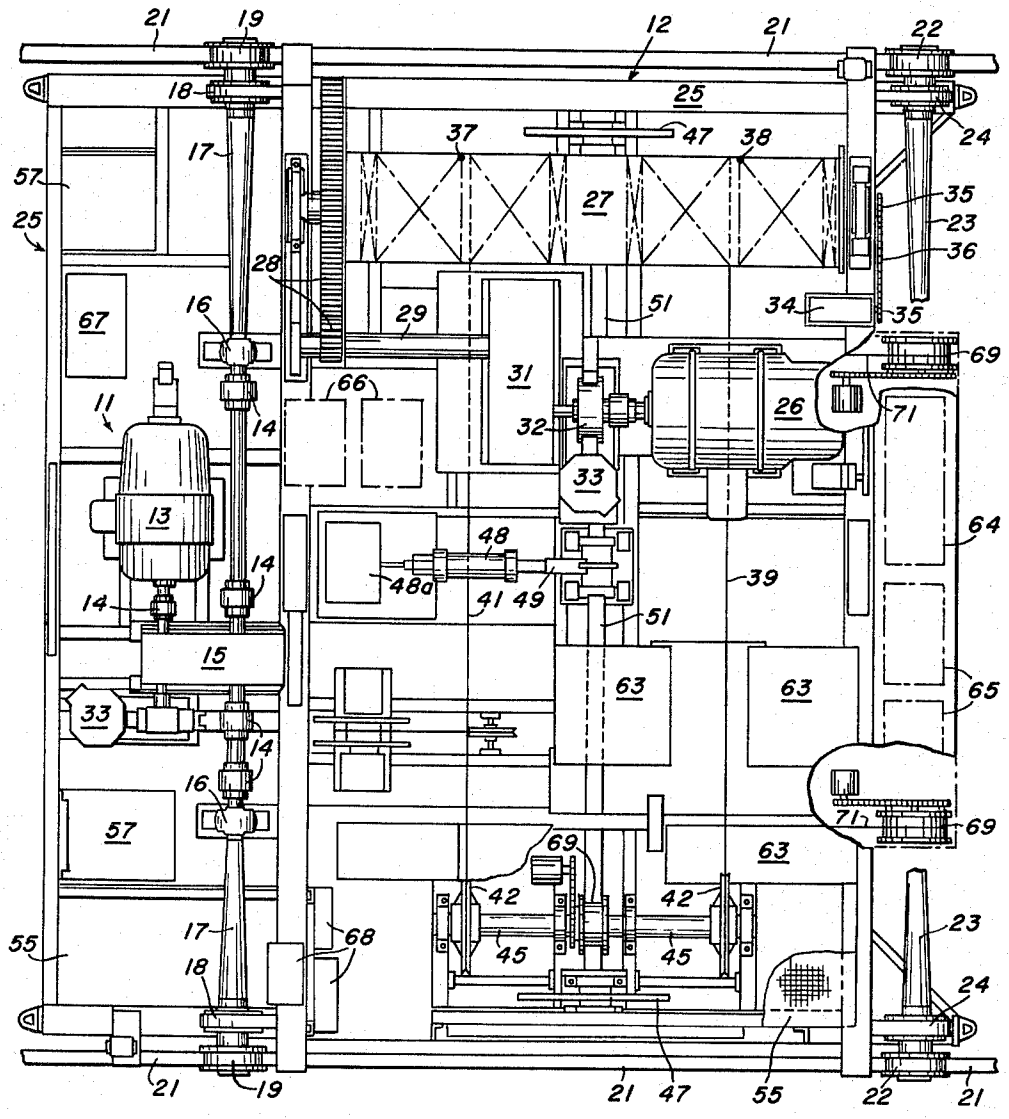


FIG. 7.

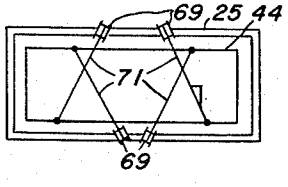
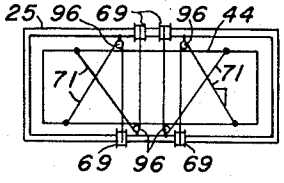


FIG. 10.



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FIG. 2.

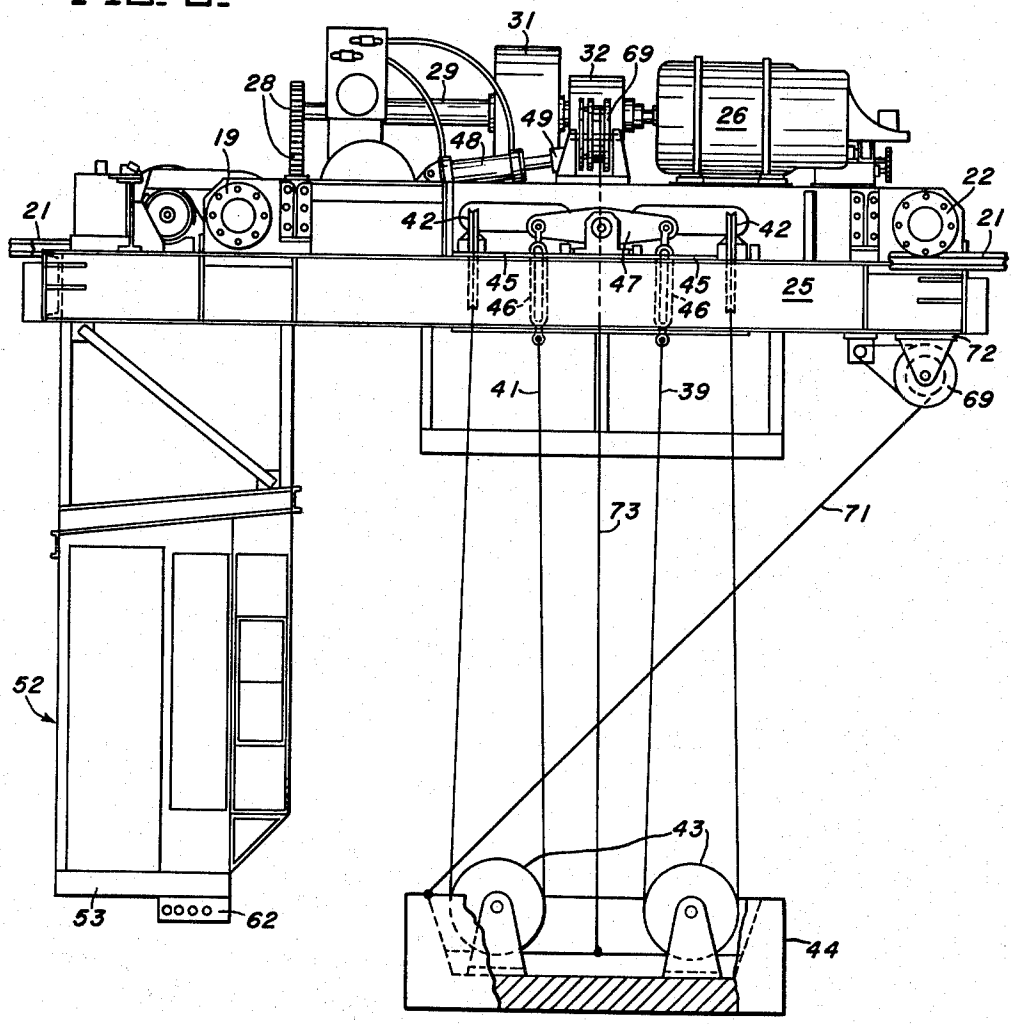


FIG. 4.

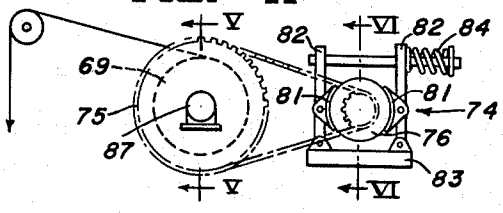


FIG. 5.

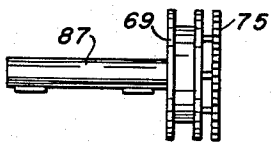
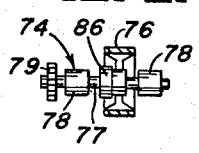


FIG. 6.



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SNUBBING SYSTEM FOR CRANES

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FIG. 3.

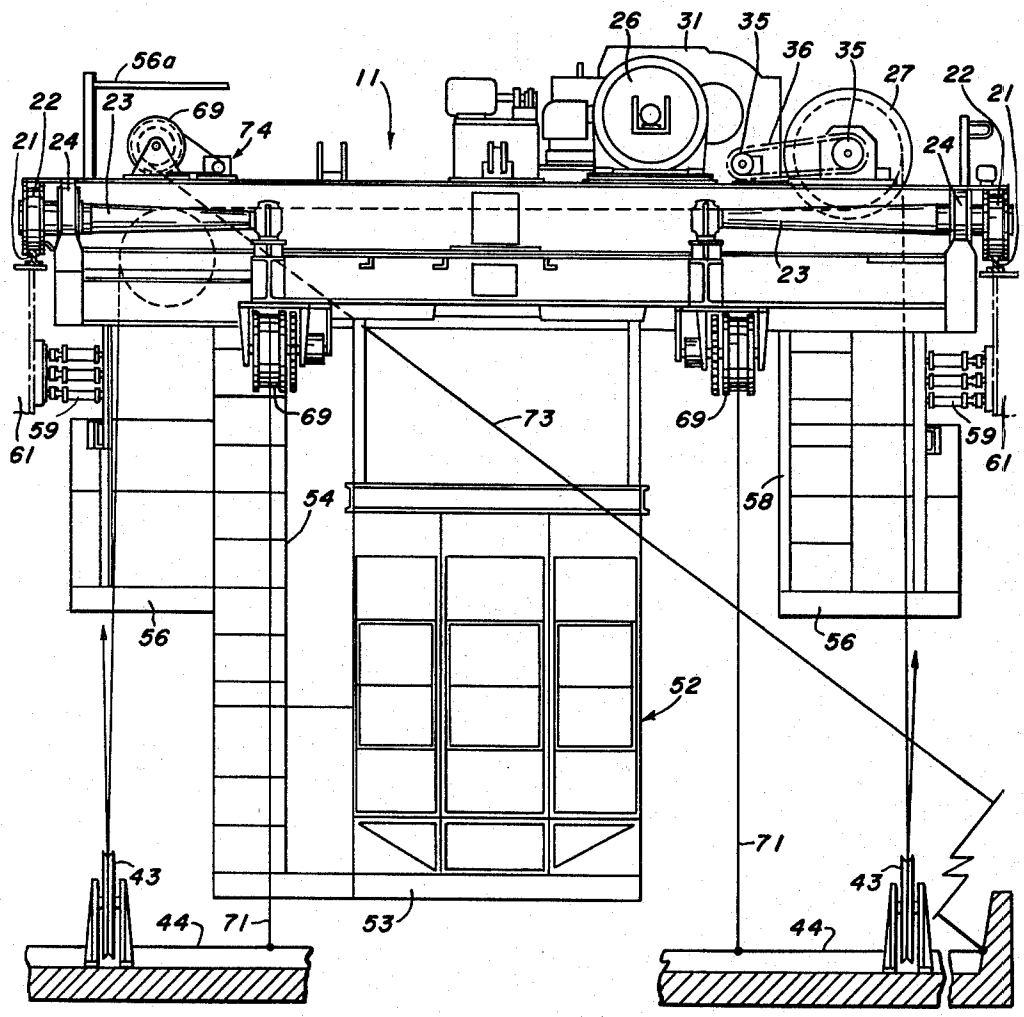


FIG. 9.

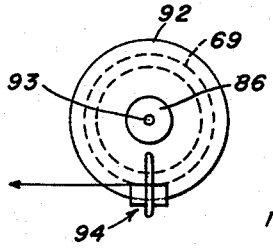
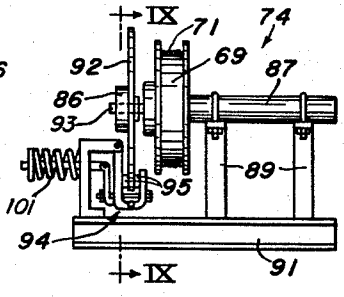


FIG. 8.



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SNUBBING SYSTEM FOR CRANES

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FIG. 11.

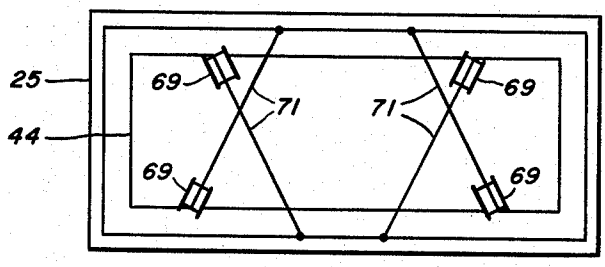
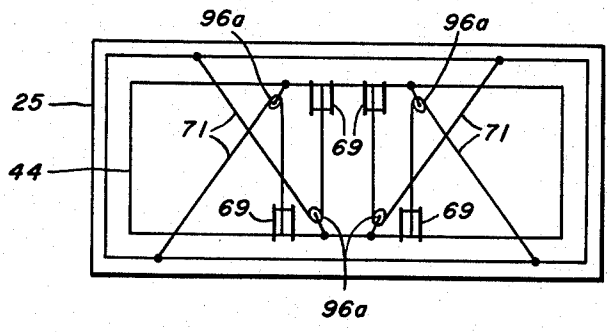


FIG. 12.



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United States Patent Office 3,179,259 Patented Apr. 20, 1965

3,179,259

SNUBBING SYSTEM FOR CRANES

William B. McLean, Moon Township, Allegheny County, Pa., assignor to Dravo Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Aug. 12, 1963, Ser. No. 303,208
13 Claims. (Cl. 212—11)

This invention relates to a snubbing system for cranes, and more particularly to a snubbing system for cranes for dampening pendulous motions of loads suspended by an overhead crane. This is a continuation-in-part application of my co-pending application Serial No. 227,450, filed October 1, 1962.

Oftentimes it becomes necessary to steady containers suspended by the cables of cranes in order to avoid longitudinal, transverse, and swinging motions which interfere with the accurate placement of such suspended loads onto carriers and the like. For example, in the loading of truck trailers onto "piggyback" railroad cars a projecting pin on the bottom of the trailer must be guided into a matching recess in the car structure.

It is the usual custom to employ hand lines tied to the suspended load to steady and to guide the load to a desired location. When heavy loads are experienced, as in the instance of trailers, for example, the hand line technique is inadequate to avoid free swinging of the suspended load. Without some external dampening device the only swing-retarding forces are the slight friction of the suspending cables and sheaves and whatever wind resistance is developed, and the pendulous motion of a suspended load can continue almost undiminished for a considerable length of time.

The concept of the present invention is the provision of a snubbing system which includes at least three lines or cables, each leading from a point on the supporting crane structure downwardly and diagonally at the smallest angle possible to the horizontal to a point on the suspended load or container. One line extends longitudinally to check longitudinal load swinging motion, and at least two lines extend transversely, one near each end of the supported load to eliminate transverse and twisting motions of the load. The snubbing system lines are in addition to and independent of the main load supporting cables. The upper ends of these lines are wound around reels which are so designed that the lines will take up and pay out as the load is raised or lowered. The lines also will take up and pay out from the reels as the suspended load swings or twists, and the reels are engaged to energy dissipating devices that are operative in response to the undesired motions of twisting and swinging of the load.

It is a principal object of the invention to provide a new and improved snubbing system for cranes.

Another object is the provision of a crane snubbing system to counteract and dampen undesired longitudinal, transverse and twisting motions of a load suspended from the crane.

Still another object of the instant invention is to provide a snubbing system for cranes which operate independently of crane hoisting cables.

A further object is to provide a snubbing system for cranes which eliminates pendulous and twisting motions of suspended loads by energy dissipating devices engaged to snubbing line reels which take up and pay out the snubbing lines to control the movement of the load.

A complete understanding of the invention may be had from the following detailed description of a specific embodiment thereof when read in conjunction with the appended drawings, wherein:

FIG. 1 is a plan view, partly broken away, of an overhead crane with a trolley and showing reels and dampening devices of the snubbing system arranged on the crane structure;

FIG. 2 is a side elevation of the crane showing hoisting cables connected to a suspended container frame and snubbing lines attached to the load for elimination of a container frame with a snubbing line attached to the container frame;

FIG. 3 depicts an end elevational view, partially broken away, of the crane structure and hoist cables supporting a container frame with a snubbing line attached to the frame for elimination of transverse movement of the container frame;

FIG. 4 shows a snubbing line secured about a reel, and an energy dissipating device connected to the reel by a chain drive;

FIG. 5 illustrates in cross-section the snubbing line reel taken along line V—V of FIG. 4;

FIG. 6 is a cross-sectional view of the snubbing line reel energy dissipating device taken along line VI—VI of FIG. 4;

FIG. 7 is a schematic of one arrangement of snubbing line attachment to a container frame for elimination of unwanted free motion of the crane suspended frame;

FIG. 8 depicts a modification of an energy dissipating device frictionally engaged to a snubbing line reel;

FIG. 9 is a cross-section of the energy dissipating device and snubbing line reel taken along line IX—IX of FIG. 8;

FIG. 10 shows in schematic a second arrangement of snubbing line attachment to a suspended container lifting frame;

FIG. 11 is a schematic of a snubbing system as in FIG. 7 but with lines attached to a trolley frame and with line reels mounted on a container frame; and

FIG. 12 is a schematic of a snubbing system as in FIG. 10 but with reels attached to a container frame and lines connected to a trolley frame.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1, which illustrates a preferred embodiment, a trolley **11** of an overhead crane **12** which includes a trolley travel motor **13** coupled through couplings **14**, reducer **15**, and pillow blocks **16** to drive stub shafts **17**. The shafts **17** are supported for rotation by bearings **18** and are connected to trolley drive wheels **19** which travel on trolley track rails **21**. Disposed at the opposite end of the trolley **11** from the drive wheels **19** are follower wheels **22** aligned with wheels **19** and joined to stub shafts **23** supported for rotation through bearings **24**.

The wheels **19** and **22** support a trolley frame **25** on which is secured the trolley travel motor **13** and a hoist motor **26**. The hoist motor **26** drives a hoist cable drum **27** through gears **28**, shaft **29**, reducer **31**, and gear coupling **32**. Brakes **33** are provided for both the hoist and the trolley motors, and a travelling nut type limit switch **34** is actuated by rotation of the hoist drum **27** through chain sprockets **35** and roller chain **36** such that the hoist cable pay out lengths from the drum **27** are controlled.

The hoist cable drum is grooved to pay out and take up four hoist cables or wire ropes **37**, **38**, **39** and **41**. The ropes **37** and **38** are wound about the drum **27** at its outer portions and depend downwardly at points adjacent the points of departure from the drums of ropes **39** and **41**. The latter ropes extend transversely of the trolley frame **25** and pass around sheaves **42** downwardly and around traveling sheaves **43** which are fastened by suitable means not shown to a container lifting frame **44**, FIGS. 2 and 3. Sheaves **42** traverse on fixed shafts **45** for guiding the cables or ropes **39** and **41** onto the cable drum **27**. The ends of the wire ropes **39** and **41** are anchored to turn-

buckles 46 which are mounted on a rocker arm 47. The arm 47 is rocked to accommodate for listing of the lifting frame 44 by a double acting hydraulic cylinder 48 connected to a toggle 49 which moves a shaft 51 through a predetermined arc when actuated by a hydraulic cylinder power unit 48*a*. The shaft 51 is secured at its ends to the rocker arms 47 positioned on the sides of the trolley frame 25. The wire ropes 37 and 38 pass downwardly from the drum 27 around similarly disposed sheaves 43 which are fastened to the side of the container lifting frame 44 opposite the sheaves 43 around which pass wire ropes 39 and 41.

The trolley 11 includes an operator's cab 52 which is dependingly supported by the trolley frame 25 for travel therewith. The cab 52 is provided with a platform 53, FIG. 3, and a ladder 54 joins the trolley frame 25 with the platform 53. The frame 25 is floored by suitable material such as wire mesh or grating 55 above which extends a handrail 56*a*. An opening 57 is provided through the grating 55 at the head of the ladder 54 through which access is made from the cab 52 for an operator to stand on the floor of mesh or grating 55. Secondary platforms 56 are provided beneath the trolley frame 25, one of which is reached by ladder 54 and the other of which is accessible through a tray door 57 and a ladder 58. Electrical connectors 59 slide along conductors which are fastened to crane support structure 61 and are joined by flexible conduits to the platforms 56 and to an electrical junction box 62 secured to the cab 52, FIG. 2. Leads, not shown, electrically connect operator controls within the cab 52 to the hoist motor 26 and the trolley motor 13.

Other elements comprising the trolley 11 which need not be discussed in detail for the purposes of a full understanding of the invention include hoist primary reactors 63, hoist secondary reactors 64, hoist resistors 65, trolley secondary reactors 66, trolley resistor 67, and trolley lighting and switch panels 68.

The description hereinabove refers to a known type of overhead crane with a trolley and with hoist mechanism for raising and lowering a load, and does not, per se, comprise the present invention. The crane snubbing system which includes the crane hereinabove described is provided with three snubbing reels 69 shown in FIGS. 1, 2 and 3 supported on the trolley frame 25, one at the front side of the frame, and two spaced apart at the end of the frame opposite the end to which the cab 52 is secured.

Two snubbing lines 71, such as wire rope, are wound on the end reels 69 and pass downwardly at a non-vertical angle with their ends fastened to the container lifting frame 44 at spaced locations on the same side of the frame. The angle the lines 71 make with a horizontal plane or with the trolley frame 25 is maintained as small as circumstances will permit, and the end reels 69 are accordingly secured by brackets 72 as near to the end of the trolley frame 25 as is possible. A single side snubbing line reel 69 is supported by a base 72 on the trolley frame 25 and the snubbing line 73 is wound on the reel and extends downwardly and diagonally across the area under the frame 25 ahead of the cab 52 to fasten at its end to the container lifting frame 44 at a point proximate the midpoint of the side opposite that underlying the reel 69.

The reels 69 and energy dissipating devices 74 engaged to the reels are shown in detail in FIGS. 4, 5 and 6, which show one type of device 74, and in FIGS. 8 and 9 which illustrates another embodiment of dissipating device 74. In the modification shown in FIGS. 4, 5 and 6 there is shown a chain sprocket 75 fixed to the reel 69 for rotation therewith. A brake or energy dissipating device 74 is shown to include a brake wheel 76 mounted on an axle 77 which is supported by bearings 78. A sprocket 79 is fixed to the end of the axle 77 in alignment with the sprocket 75, and an endless chain is entrained around the sprockets whereby rotation of the reel 69 imparts rotation to the axle 77 and brake wheel 76. Brake shoes 81 are diametrically opposed in frictional braking contact with

the wheel 76 by posts 82 of a support 83. A spring 84 is adjustable on a guide rod 85 passed through the posts 82 and yieldingly urges the brake shoes 81 into braking engagement with the wheel 76 at a predetermined torque value. A clutch 86 is positioned between the wheel 76 and the sprocket 79, and is preferably an automatic one-way type. The brakes 74 and 94 may be controlled from a remote location such as the cab 52 for engaging and disengaging the brake wheel 76 with the sprocket 79.

The snubbing line reels 69 are suitably spring loaded for automatic line take-up, and each reel 69 is carried on a stub shaft 87 supported by the bracket 72 fastened to the underside of the trolley frame 25, or by the stands 89 upstanding on a base 91, FIG. 8, which is mounted on the frame 25.

In FIGS. 8 and 9 there is shown an energy dissipating device 74 comprising a friction disk 92 mounted on a stub shaft 93 secured by suitable means such as welding to the reel stub shaft 87. A clutch 86 is provided which is free-wheeling in one direction and automatically engaging in the other; that is, the friction disk 92 is either independent of rotation in relation to the shaft 93 or is engaged with the shaft 93 to rotate with the reel 69. A caliper type brake 94 cooperates with the friction disk 92, and friction pads 95 frictionally contact the disk with a force determined by the tension on a spring 101 which is adjustably pre-set. The brake 94 is positioned at a point of tangency of the rope 71 on the reel 69 to balance forces.

The snubbing system shown in FIGS. 1, 2 and 3 functions independently of the hoist system, with three snubbing lines 71, 71 and 73, being wound about reels 69 supported on the trolley frame 25 and having their running ends connected to a container lifting frame 44. Two lines 71, 71 extend diagonally and downwardly transversely of the trolley crane 25 to spaced points of a container lifting frame 44, one near each end of the structure to dampen and eliminate transverse swinging and twisting motions of the frame 44 and its load. The remaining line 73 leads from a reel 69 on the trolley frame 25 near its end downwardly and diagonally at the flattest angle possible to a point on the lifting frame 44 approximately on its longitudinal axis to eliminate longitudinal swinging motion of the frame 44 and its load. The reels 69 automatically take up and pay out the lines 71, 71 and 73 by reason of their being spring loaded, for example, and the clutch 86 of the energy dissipating devices operates automatically to brake the take-up or pay-out action of the snubbing lines to counteract the unwanted motions of transverse, longitudinal swinging, and twisting motions of the load and the lifting frame 44. The clutch is engaged when the frame 44 is lowered away from the reels 69, but is disengaged when the frame is moved toward the reels, allowing the automatic take-up of the lines by the reels to take place. Remote control of the brake may be employed to actuate or to eliminate the snubbing action as conditions warrant. In this fashion pendulous motion of the load is eliminated and the load steadied for accurate handling by the crane hoist cables 37, 38, 39 and 41.

The schematic of snubbing line arrangements shown in FIGS. 7 and 10 are employed when the brakes 74 and 94 of FIGS. 4 and 8, respectively, cannot be released by remote control. Four snubbing lines 71 are arranged in a balanced pattern to avoid the pulling of the lifting frame 44 too far sideways or endways when it is lowered from a high position by the crane 12. In the arrangement shown in FIG. 7 pairs of reels 69 are located on opposite sides of the trolley frame 25 and the lines 71 leading from opposing reels on each side of a transverse center line of the frame 25 cross one another and are fixed at their ends to the lifting frame 44 at points on opposite sides of the frame 44 near its ends. The points on the frame 44 to which the lines 71 are attached are thus in sets which are staggered with re-

spect to a transverse line perpendicular to the sides of the frame **44** whereby torque motion is compensated for. The lines **71** from each pair of the reels **69** on opposite sides of the frame **25** lead from the reels at an angle of forty-five degrees for maximum efficiency of snubbing action.

The pattern of wire ropes or snubbing lines **71** shown schematically in FIG. 10 resembles that of the pattern shown in FIG. 7 with the exception that the lines **71** extend from the reels **69** substantially horizontally around sheaves **96** and then diagonally and downwardly across the width of the lifting frame **44** to fasten to points situated in like manner as the points of fastening of lines **71** to the frame **44** as in FIG. 7. It has been found by experience that the arrangement shown in FIG. 7 is best suited for cooperation of the reels **69** with the type of energy dissipating device **74** which employs the brake wheel **76** and shoes **81** of FIGS. 4, 5 and 6; whereas the arrangement of snubbing lines **71** of FIG. 10 is planned for operation with the caliper type brake depicted in FIG. 8.

Referring to FIGS 11 and 12, the system is depicted therein with lines and reels in reverse arrangement than that disclosed in FIGS. 7 and 10, respectively. In FIGS. 7 and 10 the lines **71** have their ends connected to the container frame **44** and the reels **69** are mounted on the trolley frame **25**. However, these elements are reversed in the organization shown in FIGS. 11 and 12, i.e., the lines **71** have their ends connected to the trolley frames **25** and the reels **69** are mounted on the container frames **44**. In the embodiment of FIG. 12 the sheaves **96***a* are shown attached to the container frame **44** whereas in FIG. 10 the sheaves **96** are connected to the trolley frame **25**. In both arrangements the sheaves are connected to that frame on which the reels are mounted.

It is manifest that the above-described embodiment of the invention is merely illustrative and that numerous modifications may be made within the spirit and scope of the invention. Further, it will be understood that the particular energy dissipating devices illustrated are only two examples of the types of devices which may be operated upon in practicing the invention, and that the invention is not limited to use with these types of energy dissipating devices.

What is claimed is:

1. A snubbing system for cranes comprising a frame, a hoist mechanism including cables for suspending a load, load snubbing lines attached to the load at spaced points for steadying the load against pendulous motions, reels mounted on the frame, the snubbing lines being wound about the reels, the reels including means for tensioning the lines during pay-out, take-up and rest actions of the lines, and dampening means connected to the reels for braking the rotation of the reels selectively whereby transverse, longitudinal and swinging motions of the load are eliminated.

2. A snubbing system for cranes comprising a frame, a hoist mechanism including cables for suspending a load, snubbing lines attached to the load at spaced points for steadying the load against pendulous motions, reels mounted on the frame, the snubbing lines being wound about the reels, the reels including means for tensioning the lines during pay-out, take-up and rest actions of the lines, and dampening means including a brake mechanism coupled to the reels and actuated in response to rotation of the reels for braking the rotation of the reels selectively whereby transverse, longitudinal and swinging motions of the load are eliminated.

3. A snubbing system for cranes comprising a frame, a hoist mechanism including cables for suspending a load, snubbing lines attached to the load at spaced points for steadying the load against pendulous motions during suspension of the load, reels mounted on the frame, the snubbing lines being wound about the reels, the reels including means for tensioning the lines during pay-out, take-up and rest actions of the lines, a friction brake operatively connected to each reel, clutch means for engaging and disengaging the brake means with the reels, the brake means being responsive to rotation of the reels when engaged therewith whereby transverse, longitudinal and swinging motions of the load are eliminated.

4. A snubbing system for cranes comprising a frame, a hoist mechanism including cables for suspending a load, snubbing lines attached to the load at spaced points at one side and one end of the load for steadying the load against pendulous motions, reels mounted on the frame, the snubbing lines being wound about the reels, the reels including means for tensioning the lines during pay-out, take-up and rest actions of the lines, dampening means connected to the reels for braking the rotation of the reels selectively whereby transverse, longitudinal and swinging motions of the load are eliminated, the means including a braking wheel mounted on a shaft, drive means operatively joining the shaft of each brake with a reel whereby rotation of the reel imparts rotation to the brake wheel shaft, clutch means connected between the brake wheel and the connection of the brake shaft with the reel for engaging and disengaging the wheel for rotation with the shaft, and friction means engaged with the wheel at a predetermined torque for braking action.

5. A snubbing system for cranes comprising a trolley frame, a hoist mechanism including cables for suspending a load, a container frame attached to the cable ends for hoisting by the mechanism, and means for steadying the container frame including snubbing lines attached to the frame at spaced points, reels mounted on the trolley frame, the snubbing lines being wound about the reels, and means for dampening pendulous motions of the container frame operatively engaged with the reels.

6. A snubbing system for cranes comprising a support, a hoist mechanism including cables, a container frame connected to the cables, reels mounted on the support at spaced points, sheaves connected to the support at spaced points, and snubbing lines wound about the reels and extending from each reel horizontally and transversely around the sheaves and then downwardly and diagonally with their ends fastened to the container frame at points on the side of the frame diagonally opposite the location of the sheaves whereby transverse, longitudinal and swinging motions of the container frame are eliminated by selective tensioning of the snubbing lines.

7. A snubbing system for cranes comprising a rectangular trolley frame, reels mounted on the frame at spaced points on opposite sides of the frame, a rectangular container frame suspended beneath the trolley frame, and snubbing lines wound about the reels and extending from the trolley frame to spaced points on the rectangular sides thereof with the lines extending transversely beneath the trolley frame to their point of attachment to the container frame whereby pendulous motions of the container frame is controlled by snubbing action of the lines.

8. A snubbing system for cranes as in claim 7 wherein the reels are arranged in pairs on opposite sides of the trolley frame with each pair being symmetrical with the transverse center line of the trolley frame, and the lines extending diagonally from the reels to points of attachment on opposite sides of the container frame with the points of attachment being symmetrical about a transverse center line of the container frame.

9. A snubbing system for cranes as in claim 7 wherein a pair of reels are arranged on each side of the rectangular trolley frame with the reels of each pair symmetrical about a transverse center line of the trolley frame, and the snubbing lines extend transversely from the reels around sheaves positioned opposite the reels and then diagonally and downwardly to spaced points on the container frame, the snubbing line ends being attached to the container frame near its ends whereby pendulous motions of the container frame are eliminated by the action of the snubbing lines.

10. A snubbing system for cranes having a hoist mechanism mounted on a frame and cables operated by the hoist mechanism for suspending a load comprising self-recoiling reels, lines wound on the reels with running ends leading therefrom for connection to a load at spaced points for steadying the load against pendulous and twisting motions, and braking means with predetermined torques connected to the reels for dampening the winding and unwinding action of the reels.

11. A snubbing system as in claim 10 including a clutch for engaging the braking means with the reels when the lines pay-out from the reels and for disengaging the brake means with the reels when the lines are being taken up on the self-recoiling reels.

12. A snubbing system as in claim 11 wherein the brake means is remotely controlled.

13. A snubbing system for cranes comprising an upper

frame, a hoist mechanism including cables, a lower frame attached to the ends of the cables for vertical movement of a load carried by the lower frame, means for steadying the lower frame including snubbing lines attached at spaced points to one of the frames and extending diagonally to spaced points of the other frame; reels attached to the other of said frames, the snubbing lines being wound about the reels, the reels including means for tensioning the lines during pay-out, take-up and rest actions of the lines, and means connected to the reels for braking the rotation of the reels whereby transverse, longitudinal, and pendulous motions of the lower frame are damped.

No references cited.

SAMUEL F. COLEMAN, *Acting Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

April 20, 1965

Patent No. 3,179,259

William B. McLean

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 7, strike out "a container frame with a snubbing line attached to the" and insert instead -- free swinging, transverse, and longitudinal motions of the --.

Signed and sealed this 24th day of August 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents