

March 4, 1952

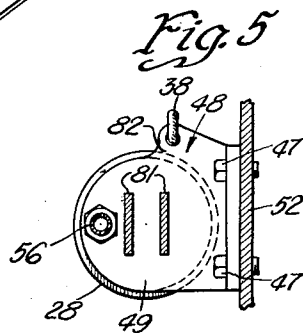
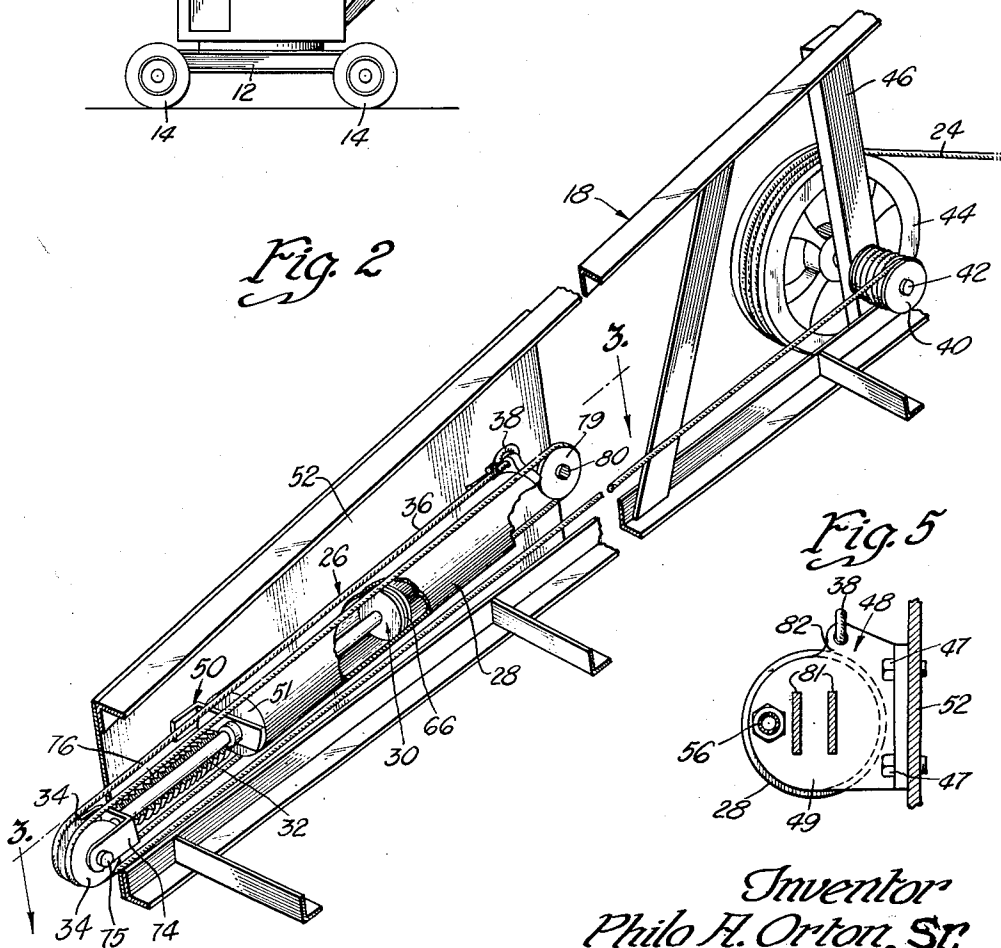
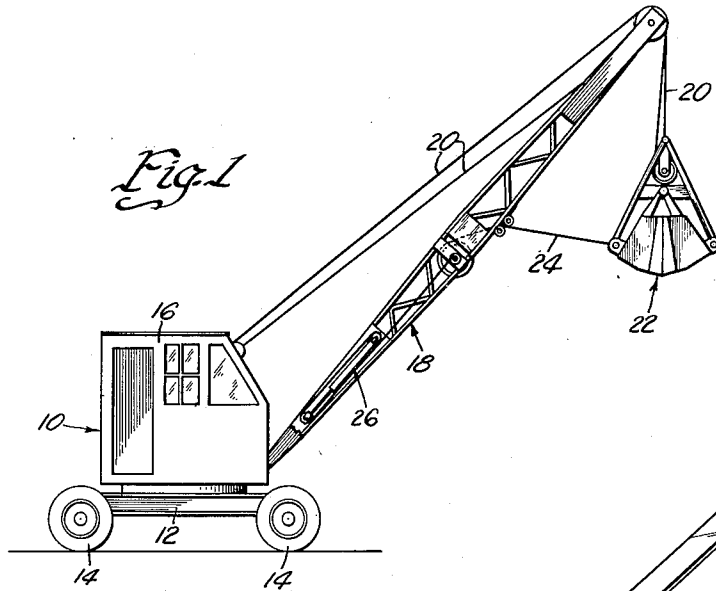
P. A. ORTON, SR

2,588,037

TAGLINE MECHANISM

Filed Sept. 30, 1950

2 SHEETS—SHEET 1



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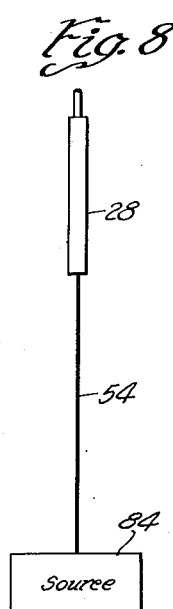
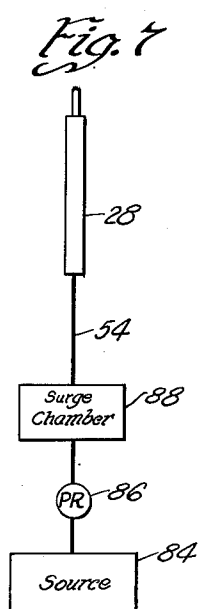
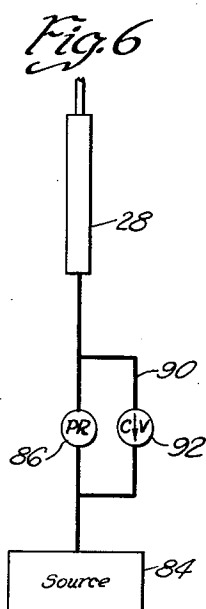
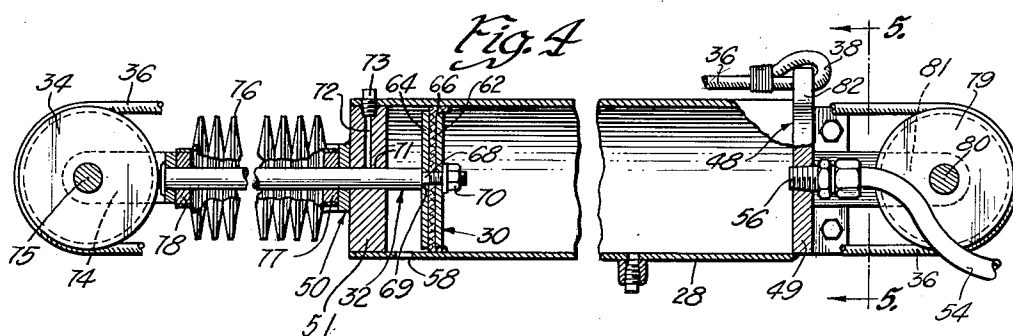
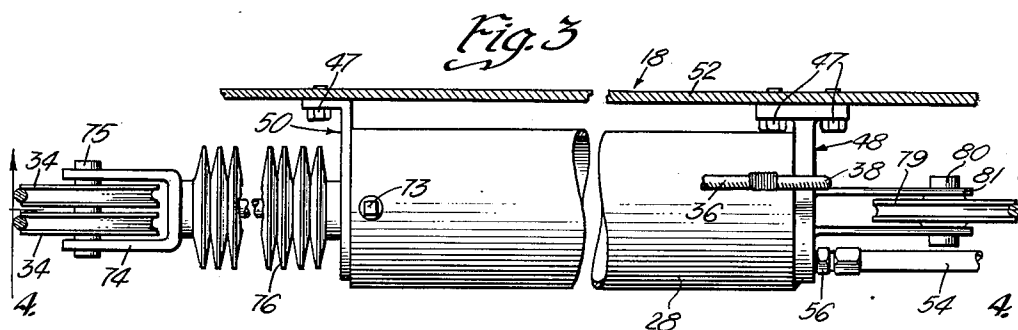
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P. A. ORTON, SR
TAGLINE MECHANISM

2,588,037

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2 SHEETS—SHEET 2



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TAGLINE MECHANISM

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12 Claims. (Cl. 242—47.5)

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This invention relates to a tagline tensioning device and more particularly to a tagline device actuated by compressed air and equipped with means for rapidly damping out oscillations which may exist in the tagline tensioning device.

A tagline, as applied to a lifting crane, for example, is a device for steadying the load suspended from the crane to prevent the load from rotating when hanging on the hoisting lines. The tagline also serves to stop the tendency of the load or crane bucket to swing in or out. If the load of a crane is permitted to rotate, the operating cables will become twisted and proper control of the load is hindered. The tagline is applied primarily to clam shell and other such types of buckets, grapples, electromagnets, etc., although it is also used for steadying a load such as a structural steel member.

The principle of the tagline is that, by maintaining a tension in the tagline, the load suspended from the crane boom is steadied and rotation about a vertical axis is hindered. It is important that the tension in the tagline be maintained substantially constant while the load is hoisted or lowered.

A number of different devices have been developed for maintaining a tension upon the tagline. The simplest device consists of a counterweight traveling on guides mounted either in the boom itself or in the vertical guides on the revolving superstructure of the crane.

Another common device consists of nothing more or less than drum on which the tagline is wound and upon which a tension is maintained by means of a spiral spring, similar to a clock spring, or several such springs in series.

The objections to the counterweight type of devices are that if the runway is mounted in the boom, the pull of the counterweight will vary with the boom angle. If the runway is mounted on the superstructure, space is then occupied that could well be devoted to other purposes and, in addition, the mechanism becomes rather complicated.

The spring operated tagline devices are expensive and provide a tension on the tagline which varies widely depending upon the position of the load to be steadied.

A further objection to both of these devices mentioned is that none of them are rapidly self-damping; that is, a material amount of the energy of the moving load suspended from the boom is not quickly absorbed by the tagline tensioning device. Unless the tagline is rapidly self-damping, there is a tendency for the load to oscillate. It is then necessary to await damping of these oscillations before the load can be accurately

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manipulated. Therefore, it is desirable that a large amount of the energy of the moving load be absorbed by the tagline tensioning device in as short a time as possible, for then the moving load is brought to rest more rapidly and control of the load is more easily obtained.

Thus, one of the objects of this invention is to provide a novel tagline tensioning device which is mounted on the boom of a crane or the like and which device maintains substantially a constant tension in the tagline regardless of the position of the crane boom.

Another object of this invention is to provide a tagline tensioning device wherein the oscillations which may exist in the tagline device are rapidly damped out.

A further object of this invention is to provide a novel tagline tensioning device wherein the tension in the tagline is regulated by compressed air pressure and wherein the tension in the tagline may be easily regulated.

Still another object of this invention is to provide a tagline tensioning device for crane buckets wherein a relatively large movement of the crane bucket is accommodated by a relatively small movement in the tagline tensioning device.

Still a further object of this invention is to provide a tagline tensioning device for a crane or the like, which device is relatively compact and which may be simply and inexpensively mounted on the crane's boom.

And still another object of this invention is to provide a fluid pressure system for a fluid pressure operated tagline tensioning device, which fluid pressure system is adapted to absorb or supply the fluid which operates the tagline tensioning device without any appreciable variation in the fluid pressure operating the tagline device.

And still a further object of this invention is to provide a fluid pressure system for use with a pressurized cylinder of a tagline tensioning device, which fluid pressure system is adapted to receive the fluid pushed from the cylinder, when a sudden force is applied to the tagline, without having an appreciable rise in the pressure within said cylinder.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawing in which—

Figure 1 is an illustration of a crane with my novel tagline tensioning device installed on the boom of said crane;

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Figure 2 is an enlarged isometric view of a portion of the boom of the crane showing my tagline tensioning device;

Figure 3 is a view of portions of the tagline tensioning device, taken on the line 3—3 of Figure 2;

Figure 4 is a cross-sectional view of the portion of the tagline tensioning device shown in Figure 3 and is taken on the line 4—4 of Figure 3;

Figure 5 is a cross-sectional view taken on the line 5—5 of Figure 3;

Figure 6 is a diagrammatic illustration of one piping system for supplying compressed air to the cylinder of the tagline tensioning device;

Figure 7 is a diagrammatic illustration of a second piping system for supplying compressed air to the cylinder of the tagline tensioning device; and

Figure 8 is a diagrammatic illustration of a third piping system for supplying compressed air to the cylinder of the tagline tensioning device.

Referring now to the drawings, there is shown in Figure 1 a crane generally indicated at 10 consisting of a deck 12 mounted on wheels 14 and having a cab 16 and a crane boom 18 mounted thereupon. Suspended from the extended end of the crane boom 18 by means of hoisting wires 20 is a crane bucket generally indicated at 22. A tagline 24 is attached at one end to the crane bucket 22 and is actuated by my tagline tensioning mechanism, generally indicated at 26.

Referring now to Figure 2, the tagline tensioning device 26 is shown as consisting of a cylinder 28 and a piston 30 which is mounted within the cylinder 28. Pressure is applied to one face of the piston by means of a pressurized compressible fluid such as air. Secured to piston 30 by means of piston rod 32 are a pair of sheaves 34 over which are wound a first cable 36. This first cable 36 is secured at one end 38, and the other end of first cable 36 is wound around a first drum 40.

The first drum 40 is secured to a rotatably mounted shaft 42 which has a second drum 44 also mounted thereon. The shaft 42 is rotatably journaled in structural member 46 of crane boom 18. One end of the tagline 24 is wound around the second drum 44 and the other end of tagline 24 is connected to the crane bucket 22.

Referring more particularly to the air cylinder as shown in Figures 3 and 4, said air cylinder 28 is mounted by means of support members 48 and 50 upon a plate portion 52 of crane boom 18. Support member 48 has a cylindrical cap portion 49 which closes one end of the cylinder 28 and serves as the head of the cylinder 28. The support member 50 has a cylindrical plug portion 51 which closes the other end of a cylinder 28. Support members 48 and 50 are secured to plate 52 by means of bolts 47.

Compressed air is introduced into one end of cylinder 28 by means of a compressed air hose 54 leading from a compressed air source (not shown) to a coupling 56 threaded into member 48 and opening to the interior of air cylinder 28. The compressed air source may be mounted on the deck 12, or in the cab 16, of the crane 10, as desired. The end of the cylinder adjacent support 50 has an air vent 58 provided therein for a purpose that will be described hereinafter.

The piston 30 consists of a pair of circular face plates 62 and 64 and a cup leather 66 therebetween, which cup leather is of greater cross-sectional area than the internal cross-sectional area of air cylinder 28. The cup leather or piston packing 66 serves to provide a seal between the

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piston 30 and the air cylinder 28. The piston rod 32 has a reduced threaded portion 68 and a shoulder 69. The piston plates 62 and 64 and the cup leather 66 are mounted on the reduced portion 68. A nut 70 cooperates with the threaded portion 68 to clamp plates 62 and 64 and cup leather 66 against shoulder 69 on the piston rod 32.

The piston rod 32 extends from one end of the cylinder 28 and passes through a bore 71 in cylindrical plug portion 51. A well 72 for lubricant is also provided in cylindrical plug 51. A threaded plug 73 caps the well 72, providing both access to the well 72 and means for sealing well 72.

The extended end of piston rod 32 has a bifurcated sheave support 74 mounted thereon. The pair of sheaves 34 are rotatably mounted on a shaft 75 journaled in the arms of bifurcated member 74.

A cylindrical expansible bellows type leather boot 76 extends between support member 50 and bifurcated sheave support 74. The piston rod 32 is enclosed by and extends concentrically within cylindrical boot 76. The leather boot 76 is secured at its ends by being laced over a collar 77, which is secured to support member 50, and over a collar 78, which is secured to piston rod 32. The bellows type boot 76 serves as a cover to protect the piston rod 32, and the bore 71, through which piston rod 32 passes, from dust, dirt and the elements.

Adjacent the opposite end of air cylinder 28, another sheave 79 is rotatably mounted on a shaft 80, which shaft 80 is journaled in supporting arms 81. The supporting arms 81 are secured, as by welding, to support member 48.

The end 38 of first cable 36 is secured to ear 82 on support 48. The first cable then is wound around one of the sheaves 34 and then back over the sheave 79 and then over the second sheave 34 and finally wound around the first drum 40.

It can be seen that by means of the sheaves a mechanical advantage of four is obtained, in that for each unit of motion of the piston 30 within the cylinder 28, four times as much of the first cable 36 either is wound upon or winds off first drum 40.

The second drum 44 is of such dimension as compared with the first drum 40 that for a unit amount of cable 36 that is wound on or off drum 40, four times as much tagline 24 on drum 44 is, respectively, wound off or on.

By maintaining a uniform fluid pressure in the air cylinder 28, substantially a uniform tension will be maintained in the tagline 24. Furthermore, a mechanical advantage of 16 to 1 is obtained by the sheave and drum arrangement, as shown in Figure 2. Thus, a unit length of motion of the piston 30 results in 16 times as much motion in the tagline 24. This is very desirable because the movements of the crane bucket 22 will be rather large and it is desirable to accommodate this large movement by a relatively small movement in the tagline tensioning device. The tension in the tagline is correspondingly $\frac{1}{16}$ of the total force due to pressure upon the piston 30.

Primarily, damping of oscillations of the piston 30 within the air cylinder 28 is obtained by the pushing of air into and out of the cylinder 28 on the loaded side, through air hose 54. Further damping of oscillations of the piston 30 is obtained by increasing the friction of the oscillating system. Thus, the piston packing or cup leather 66 is made a little larger than usual so

as to increase the friction between cup leather 66 and the walls of air cylinder 28. The fluid friction of air movement in and out of cylinder 28 through air vent 58, as the piston 30 is pulled out or allowed to retract, also applies a natural damping action upon the system. By varying the size of the air vent 58, the amount of damping may be regulated.

It is intended that a number of fluid pressure systems may be used with this tagline tensioning device and accordingly three of these fluid systems are shown diagrammatically in Figures 6, 7 and 8. Figure 8 is the simplest and shows a source 84 of pressurized fluid which is maintained at a substantially constant pressure, primarily the pressure desired within the air cylinder. The source 84 is connected to the air cylinder 28 by means of an air line 54. The source 84 is of much greater volume than the volume of air cylinder 28, so that when fluid is forced from air cylinder 28 back to the source 84, there will be very little increase in the pressure of the fluid therein, thus maintaining substantially a constant pressure.

In the second system, the source 84 has interposed between it and the air cylinder 28, a pressure reducing valve 86 and a surge chamber 88. The pressure reducing valve 86 permits the source to be maintained at a higher pressure than the operating pressure in air cylinder 28. The surge chamber 88 is provided to receive the fluid that is pushed from air cylinder 28 when a sudden force is applied to the tagline 24, causing the piston 30 to force some air from the air cylinder 28. The surge chamber 88 absorbs the amount of fluid that is pushed from air chamber 28 without permitting large pressures to be built up against the face of air piston 30. The surge chamber 88 is of much greater volume than the volume of air cylinder 28.

In the system shown in Figure 6, a pressure reducing valve 86 is interposed between source 84 and the air cylinder 28. A by-pass line 90 is provided around pressure reducing valve 86. The by-pass line 90 has a check valve 92 therein. When the piston 30 is moved so as to force air out from the air cylinder 28, the check valve 92 permits flow of this air back to the source, and the source effectively acts as a surge chamber, as shown in the system diagrammatically illustrated in Figure 7. The check valve will operate only if the pressure built up by the forces on piston 30 is greater than the pressure at the source 84.

Thus, it can be seen that my tagline tensioning device overcomes the three major objections of other tagline tensioning devices, namely: Its operation is independent of the position of the device or the load being steadied; it is compact and it may be readily mounted on the boom of the crane where it does not occupy valuable space; it has natural rapid damping characteristics.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A tagline tensioning device in combination

with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized fluid against the piston, means connecting said piston to said tagline, whereby a tension is maintained in said tagline, and means for multiplying the motion of the piston, whereby a relatively large range of motion of the tagline is accommodated by a relatively small range of motion of the piston.

2. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized fluid against the piston, means connecting said piston to said tagline, and means for maintaining a substantially constant fluid pressure against said piston, whereby a substantially constant tension is maintained in said tagline, said means for maintaining a substantially constant pressure against said piston comprising a source of pressure, a surge chamber, and a pressure control between said source of pressure and said surge chamber, the pressure fluid passing from the source through the control and to the surge chamber and then to said cylinder.

3. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized fluid against the piston, means connecting said piston to said tagline, and means for maintaining a substantially constant gas pressure against said piston, whereby a substantially constant tension is maintained in said tagline, said means for maintaining substantially a constant pressure against said piston comprising a source of pressurized gas of much greater volume than the volume of said cylinder.

4. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized fluid against the piston, means connecting said piston to said tagline, and means for maintaining a substantially constant fluid pressure against said piston, whereby a substantially constant tension is maintained in said tagline, said means for maintaining substantially a constant pressure against said piston comprising a source of pressure, a conduit communicating fluid pressure from said source to said cylinder, a pressure reducing valve in said conduit, a bypass around said pressure reducing valve, and a check valve in said bypass providing passage therethrough of fluid only from said cylinder to said source.

5. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized fluid against one face of the piston, means for connecting said piston to said tagline, means for maintaining substantially a constant fluid pressure against said piston, whereby a substantially constant tension is maintained in said tagline,

and means for venting to atmosphere the portion of the cylinder bounded by the non-pressurized face of the piston.

6. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized fluid against one face of the piston, means for connecting said piston to said tagline, means for maintaining substantially a constant fluid pressure against said piston, whereby a substantially constant tension is maintained in said tagline, means for regulating the fluid pressure, means for multiplying motion of the piston, whereby a relatively large range of motion of the tagline is accommodated by a relatively small range of motion of the piston, and means for damping out oscillations of the piston including venting to atmosphere the portion of the cylinder bounded by the non-pressurized face of the piston.

7. A tagline tensioning device in combination with the boom of a crane having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, means for mounting said cylinder upon said crane boom, a piston within said cylinder, means for applying a pressurized gas against the piston, means connecting said piston to said tagline, and means for maintaining substantially a constant gas pressure against said piston, whereby a substantially constant tension is maintained in said tagline.

8. In combination with the boom of a crane, a tagline tensioning device comprising a cylinder, means for mounting said cylinder upon said crane boom, a piston within said cylinder, means for applying a pressurized fluid against the piston, means connecting said piston to a tagline, means for maintaining substantially a constant fluid pressure against said piston, whereby a substantially constant tension is maintained in said tagline, said means for connecting the piston to the tagline comprising a piston rod extending from said piston through one end of said cylinder, the extended end of said piston rod having a plurality of sheaves mounted thereon, a sheave fixed adjacent the other end of said cylinder, a first cable fixed at one end thereof and wound around said sheaves, whereby a mechanical advantage is obtained, the other end of said first cable being wound around a first drum, said first drum and a second drum being fixed to a shaft adapted to rotate, said shaft being rotatably mounted upon said crane boom, said second drum having one end of the tagline wound thereupon.

9. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder sealed at both ends, a piston within said cylinder, means for applying a pressurized gas against one side of said piston, means connecting said piston to said tagline, and means for venting the portion of the cylinder bounded by the non-pressurized side of the piston, whereby the fluid friction of air movement in and out of the cylinder through said venting means applies a damping action to the piston.

10. A tagline tensioning device in combination with a crane boom having a load suspended from

the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder sealed at both ends, a piston within said cylinder, means for applying a pressurized gas against one side of said piston, means including a piston rod extending through one end of said cylinder for operatively connecting said piston to said tagline, means for damping out oscillations of the piston, and a cylindrical expansible boot coaxially surrounding the piston rod, said boot being connected at one end to the cylinder and at the other end to the extended end of the piston rod.

11. A tagline tensioning device in combination with a crane boom having a load suspended from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder sealed at both ends, a piston within said cylinder, means for applying a pressurized fluid against one side of said piston, means including a piston rod extending through one end of said cylinder for operatively connecting said piston to said tagline, means for maintaining a substantially constant fluid pressure against said piston, whereby a substantially constant tension is maintained in said tagline, means for damping out oscillations of the piston, and a cylindrical expansible boot coaxially surrounding the piston rod, said boot being connected at one end to the cylinder and at the other end to the extended end of the piston rod.

12. A tagline tensioning device in combination with a crane boom having a load suspending from the end thereof, and a tagline adapted to be secured to said load; said tagline tensioning device comprising a cylinder, a piston within said cylinder, means for applying a pressurized gas against the piston, means operatively connecting the piston to said tagline, said means for connecting the piston to the tagline comprising a piston rod extending from said piston through one end of said cylinder, the extended end of said piston rod having a plurality of sheaves mounted thereon, a sheave fixed adjacent the other end of said cylinder, a first cable fixed at one end thereof and wound around said sheaves, whereby a mechanical advantage is obtained, the other end of said first cable being wound around a first drum, said first drum and a second drum being fixed relative to each other and adapted to be rotated together, and said second drum having one end of the tagline wound thereupon.

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