

March 3, 1936.

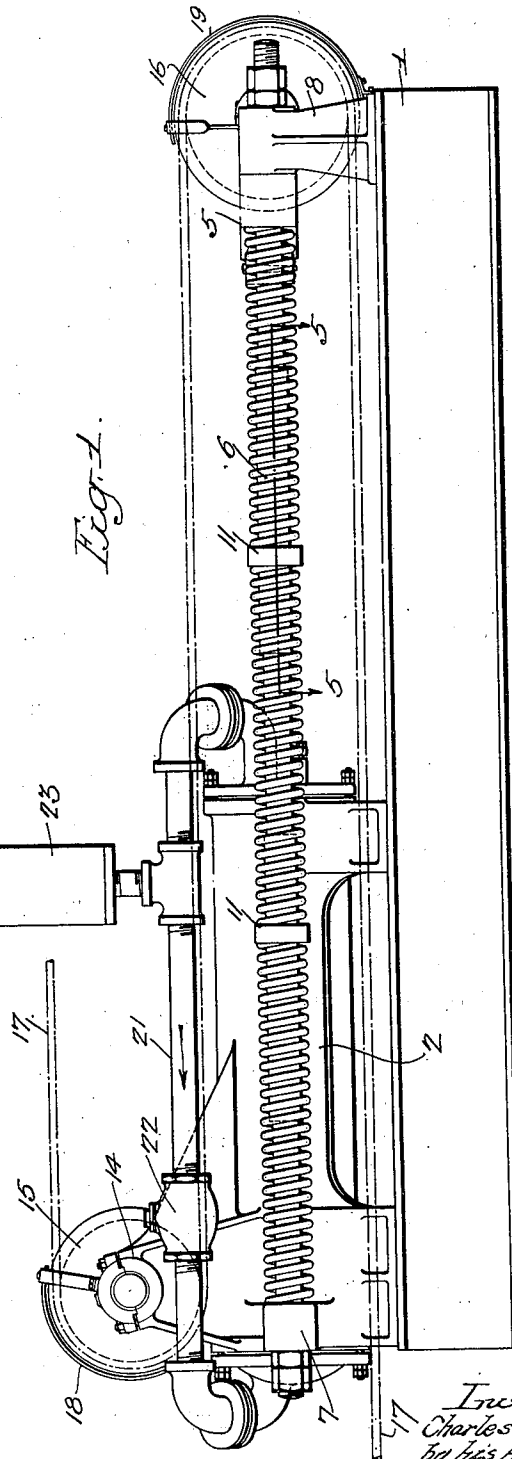
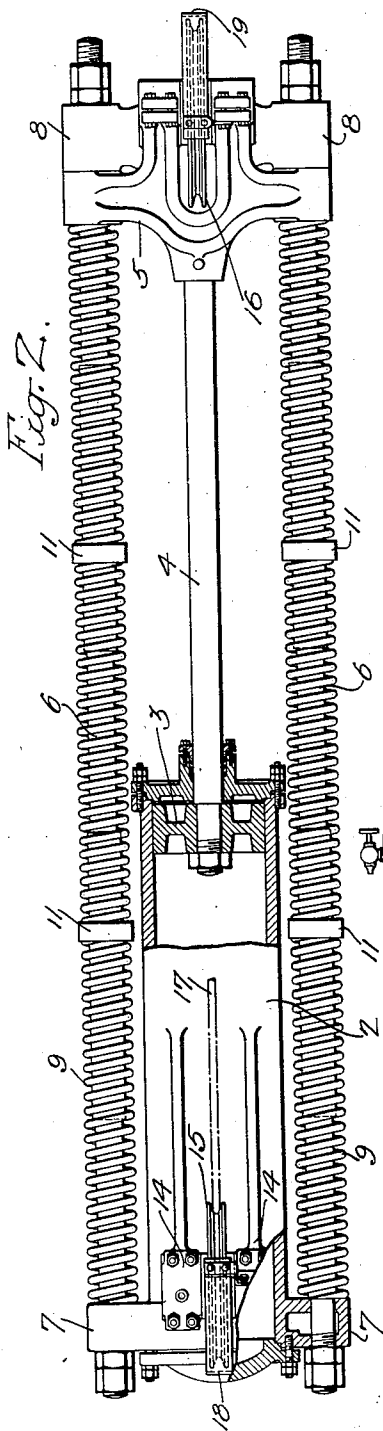
C. V. KOONS

2,033,035

MOORING DEVICE

Filed Dec. 22, 1931

3 Sheets-Sheet 1



Inventor:
Charles V. Koons
by his Attorneys
Houston & Houston

March 3, 1936.

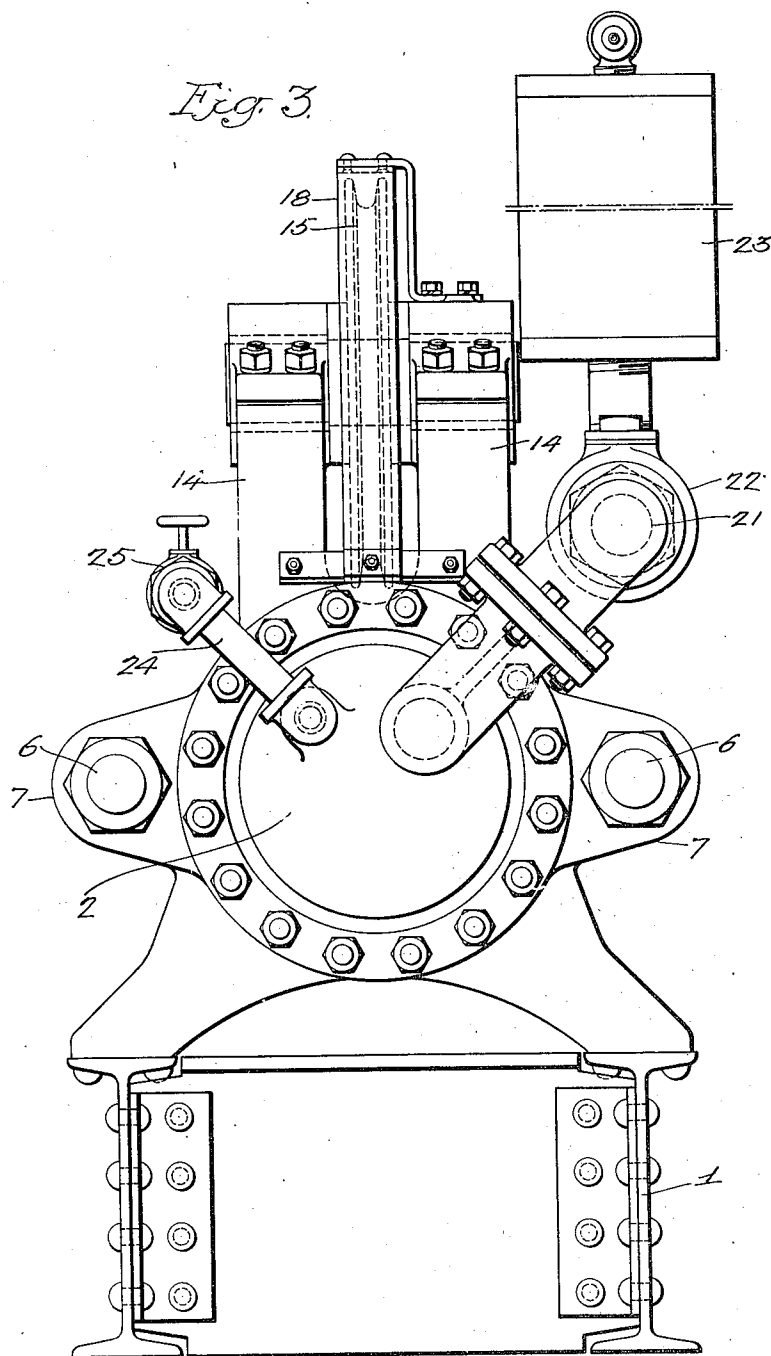
C. V. KOONS

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MOORING DEVICE

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3 Sheets-Sheet 2



Inventor
Charles V. Koons
By Two Attorneys
Harrison & Harrison

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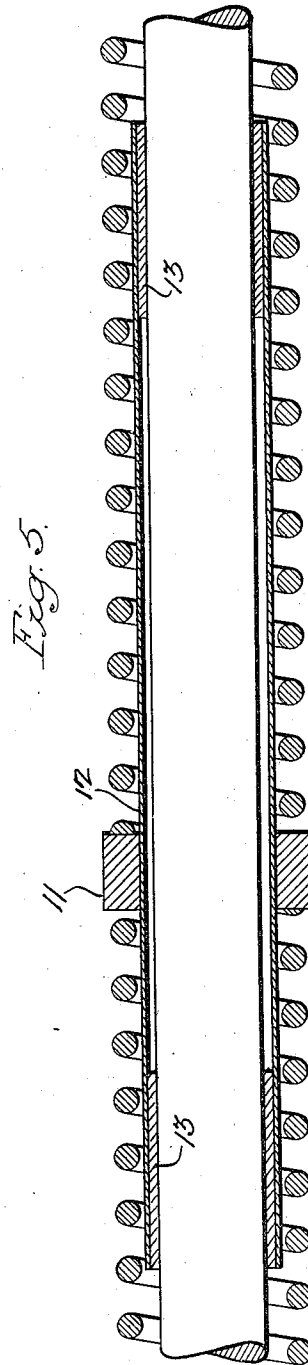
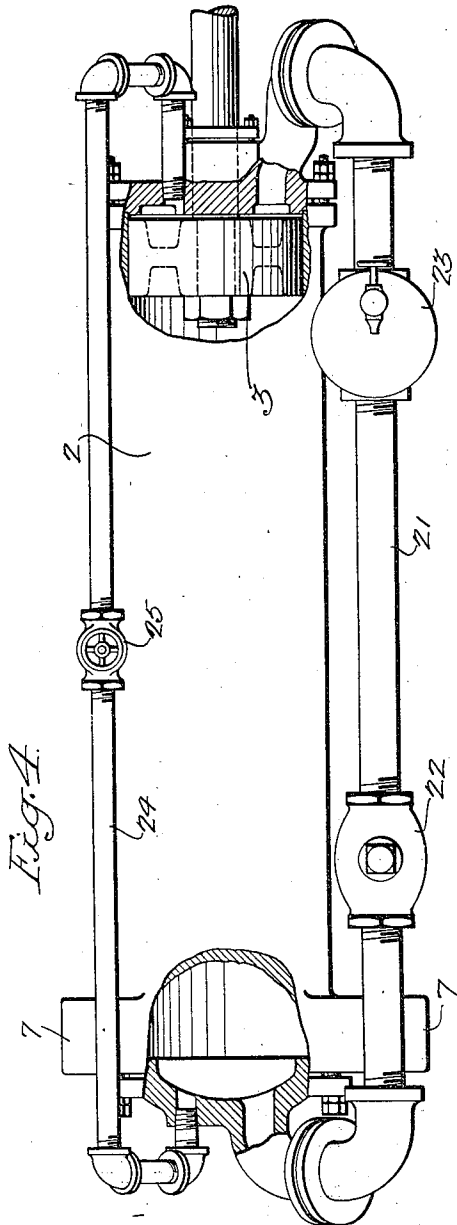
C. V. KOONS

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3 Sheets-Sheet 3



Inventor:
Charles V. Koons.
By Two Attorneys
Hewson & Hewson

UNITED STATES PATENT OFFICE

2,033,035

MOORING DEVICE

Charles V. Koons, Philadelphia, Pa., assignor to
American Engineering Company, Philadelphia,
Pa., a corporation of Pennsylvania

Application December 22, 1931, Serial No. 582,603

4 Claims. (Cl. 244-2)

The principal object of this invention is to provide novel and effective means for absorbing shocks and adjusting slack in mooring ropes or cables. While there is to be no implied limitation as to the uses to which my device may be put, it has an important application in mooring devices for dirigible air craft as an adjunct to tension winch mechanism by which the mooring cable is controlled and actuated.

A more specific object of the invention is to provide a device of the stated character that shall combine mechanical and hydraulic means in a manner affording operation of high efficiency.

Still more specifically, an object of the invention is to provide a device of the stated character wherein mechanical resilient means is utilized for slack adjustment and for absorbing minor or normal load variations, together with hydraulic means operative to aid the absorption of abnormal or relatively heavy shocks or surges.

A still further object of the invention is to provide a device of the stated character having operating characteristics well suited to the requirements of dirigible mooring.

The invention further resides in certain novel structural details and in a novel arrangement of elements hereinafter set forth and illustrated in the attached drawings, in which:

Figure 1 is a side elevational view of a mechanism made in accordance with my invention;

Fig. 2 is a plan and partial sectional view of the apparatus;

Fig. 3 is an enlarged front end elevation of the mechanism;

Fig. 4 is an enlarged plan and partial sectional view of the hydraulic cylinder and the associated elements, and

Fig. 5 is a section on the line 5-5, Fig. 1.

With reference to the drawings, a device made in accordance with my invention comprises a suitable base or pedestal 1 which in the present instance is fabricated of structural steel. Mounted at one end of the base 1 is a hydraulic cylinder 2 within which operates a piston 3. A piston rod 4 extends through the rear head of the cylinder 2 toward the opposite end of the base 1 and has attached to its outer end a cross head 5 which is supported and guided upon a pair of bolts or rods 6, 6 extending longitudinally of the base at opposite sides of the cylinder 2. At one end, the rods are mounted in lugs 7 at the head end of the cylinder 2 formed in the present instance integral with the latter, and at the opposite ends the rods are supported in

a bracket or brackets 8, 8 secured at the rear end of the base 1. Springs 9 carried by the rods 6 are interposed between the rear sides of the lugs 7 and the forward face of the cross head 5. In the present instance each of the spring means consists of three sections in end to end arrangement, the adjacent ends of the springs bearing against opposite sides of spring seat elements 11, see Fig. 5, which elements are secured to sleeves 12 embracing the rods and having bearing elements 13 slidably engaging the latter. Mounted on the forward end of the cylinder 2 in bearing brackets 14, 14 formed thereon is a vertical sheave 15, and a second sheave 16 is journaled in the cross head 5. These sheaves are adapted to receive a mooring cable 17 shown in broken lines in Fig. 1, which cable passes forwardly over the top of the sheave 15 and rearwardly from the bottom of the latter to the top of the sheave 16, the cable then passing forwardly over the base 1 as illustrated. Sheave guards 18 and 19 are provided at the front and rear sides of the sheaves 15 and 16 respectively.

The opposite ends of the cylinder 2 are connected by a bypass 21, this bypass containing a check valve 22 which prevents flow through the bypass from the forward end of the cylinder to the rear but permits flow in the opposite direction, as indicated by the arrow in Fig. 1. Between the rear end of the cylinder and the valve 22, this bypass is connected to a chamber 23, the function of which will be described hereinafter. A second bypass 24 also connects the front and rear ends of the cylinder 2, this bypass being provided with an adjustable valve 25 by means of which this bypass may be restricted as may be found desirable and for purposes hereinafter described.

In a typical installation of my device, one end of the cable 17 is connected with a tension winch and the other end to a dirigible through the medium, for example, of a mooring mast. The springs 6 being designed for average normal loads will then function to take up slack and prevent undue stress on the cable, the springs being compressed and contracting as the pull upon the cable varies. If a sudden surge of the dirigible places a load upon the cable beyond the capacity of the springs 6, the resulting relatively rapid forward movement of the cross head 5 is cushioned or retarded by fluid resistance in the forward end of the cylinder and in the bypass 24, which as previously set forth may be restricted by the valve 25 to a degree affording the required retarding or cushioning action under the prevail-

ing conditions. By reason of the piston rod entering the rear end of the cylinder, the volume of fluid displaced from the forward end of the cylinder in the advance movement of the piston is greater than the receptive capacity of the rear end, and the excess fluid passing through the bypass 24 is received in the chamber 23, this influx of fluid to the chamber also effecting a compression of the air in the upper portion of the chamber, which has a still further cushioning effect upon the piston 3. When the load upon the cable drops sufficiently for the springs 6 to again take charge, the latter tend to force the cross head 5 and the piston 3 rearwardly, in which movement of the piston the fluid in the rear end of the cylinder passes freely to the forward end through the relatively large bypass 21 and the check valve 22, the extra fluid required for the forward end of the cylinder over and above that discharged from the rear end being provided from that previously stored in the chamber 23. If a sustained pull on the cable in excess of the spring capacity is experienced, the piston 3 advances to the forward end of the cylinder and remains against the cylinder head. If following compression of the springs as described there occurs a sudden slacking of the cable due to movement of the moored vessel, the springs will expand and immediately take up the slack so that any subsequent application of load cannot have the effect of snapping the cable, the latter merely paying out against the cushioning action of the springs and the fluid in the cylinder. The cable is thus relieved of undue strain.

It will be apparent from the foregoing description that I have provided in the springs 9 slack adjusting and shock-absorbing means adjusted to all normal demands; and in the hydraulic mechanism additional retarding and absorbing means automatically called into service to meet the requirements of the abnormal and heavier demands. In both cases, the resistance increases progressively with the demand. The device is highly flexible and efficient over the entire range, and is further characterized by its simplicity of form and manufacture.

I claim:

1. In a device of the character set forth, a base member, a cylinder mounted at one end of said base, guide elements extending longitudinally of said base, and a cross-head movable on said guides, a piston in said cylinder, a piston rod connected to said cross-head, a sheave at the cylinder end of said base, a second sheave at the opposite end of said base, springs associated with

said cross-head and resiliently opposing movement of the cross-head toward the cylinder, said springs tending to retain the piston at the rear end of said cylinder, a bypass between the opposite ends of said cylinder, a check valve permitting overflow of fluid from the rear to the forward end of said cylinder but preventing a reverse flow; means associated with said bypass for compensating for the differential in the volumetric capacities of the chambers of the cylinder at opposite sides of the piston, a second bypass connecting the ends of said cylinder, and adjustable means for restricting said bypass.

2. In a device of the stated character, the combination with a base, of a hydraulic cylinder mounted at one end of said base, a pair of guide rods extending longitudinally of the base at opposite sides of said cylinder, and means for supporting said rods, a cross-head movable on said rods, a piston in said cylinder, and a piston rod connected with said cross-head, springs on said guide rods engaging the cross-head and normally resiliently retaining the piston rod extended from the cylinder, a sheave journaled on the cylinder, a second sheave carried by the cross-head, and bypass means between the ends of said cylinder at opposite sides of the piston for permitting substantially free passage of fluid from the one end of the cylinder to the other when the piston is being actuated by said springs while partially retarding the flow of fluid between the ends of the cylinder when the piston moves in the opposite direction.

3. In a device of the class described, the combination with a mooring cable, of relatively movable cable engaging elements, guide rods extending between said cable engaging elements, a plurality of sleeves loosely mounted on said guide rods having abutments thereon, and a plurality of coil springs provided on said sleeves and extending between said cable engaging means and said abutments.

4. In a device of the class described, the combination with a mooring cable, of relatively movable cable engaging elements, fluid cushioning means retarding movement of said cable engaging elements toward each other, guide rods extending between said cable engaging elements, a plurality of sleeves loosely mounted on said guide rods having abutments thereon, and a plurality of coil springs provided on said sleeves and extending between said cable engaging means and said abutments.

CHARLES V. KOONS. 55