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AQUATIC TOW ROPE WITH SHOCK ABSORBER

Filed Dec. 5, 1960

Fig. 1

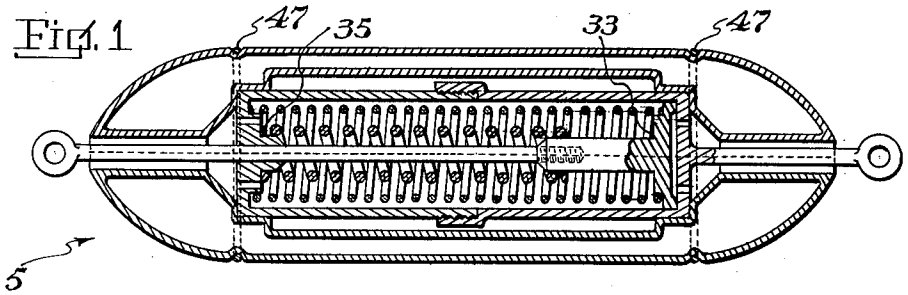


Fig. 2

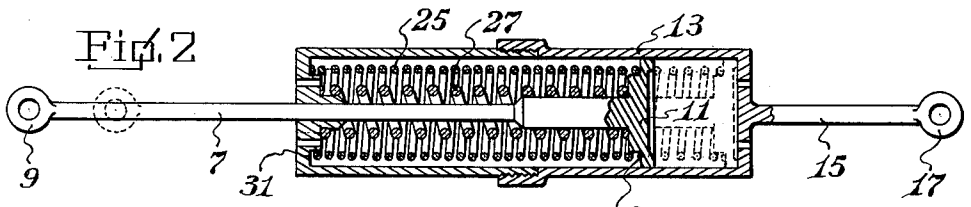


Fig. 3

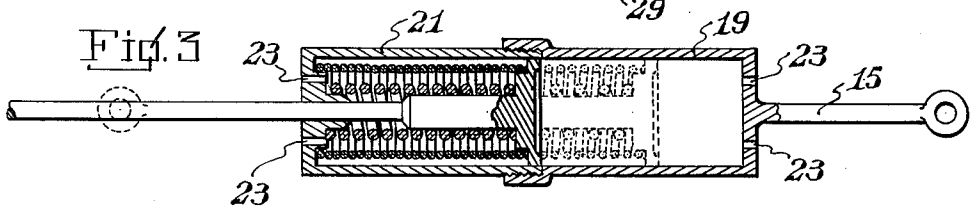


Fig. 4

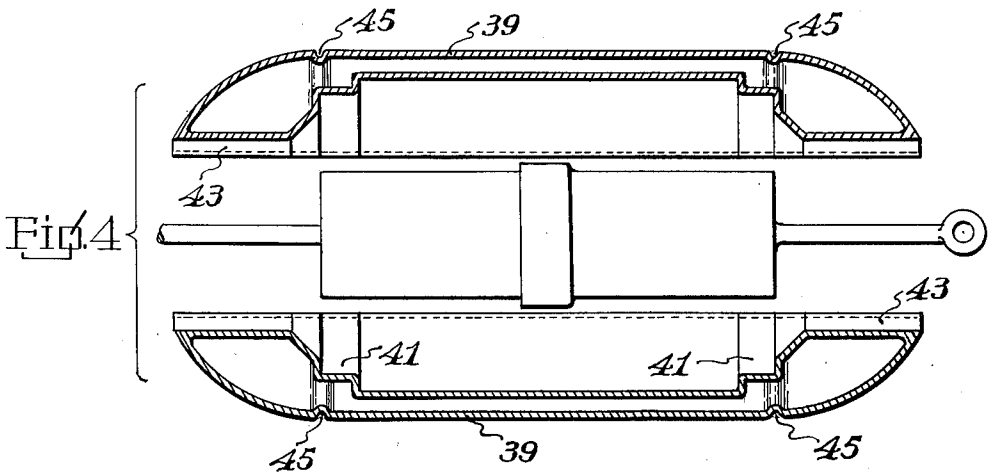
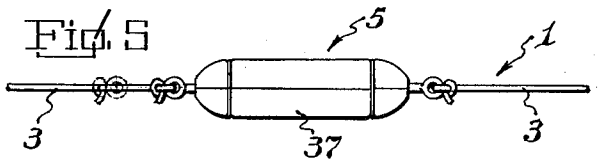


Fig. 5



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AQUATIC TOW ROPE WITH SHOCK ABSORBER

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The present invention relates to aquatic tow ropes, more particularly to aquatic tow ropes having shock absorbers designed to reduce the initial strain on the arms of a water skier.

In the sport of water skiing, it is customary for the skier to squat in the water holding his end of the tow rope, while the boat behind which he is to be towed takes up the slack in the line. When the line first becomes taut, the skier is largely immersed in the water and his inertia and the resistance of the water to his movement are quite great. The boat, however, is usually traveling at a relatively high speed. The result is that a great strain is imposed very suddenly on the arms of the skier.

Accordingly, it is an object of the present invention to provide an aquatic tow rope with a shock absorber designed to reduce the initial strain on the arms of a water skier.

Another object of the present invention is the provision of an aquatic tow rope having a shock absorber that will not sink.

Finally, it is an object of the present invention to provide an aquatic tow rope with shock absorber, that will be relatively simple and inexpensive to manufacture, and rugged and durable in use.

Other objects and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a view in section of a shock absorber for an aquatic tow rope according to the present invention, showing the shock absorber fully relaxed and the float in place;

FIGURE 2 is a view of the structure of FIGURE 1, with the float removed, showing the normal position of the parts while the skier is traveling at the same speed as the boat;

FIGURE 3 is a view similar to FIGURE 2 but showing the parts in the position they initially assume when the tension in the line is the greatest;

FIGURE 4 is an exploded assembly view of the shock absorber and float of the present invention; and

FIGURE 5 is a view showing an aquatic tow rope according to the present invention with included shock absorber.

Referring now to the drawing in greater detail, there is shown an aquatic tow rope indicated generally at 1 and comprising a flexible filament 3 in the form of a tow rope in a pair of sections. The adjacent ends of the sections of filament 3 are tied to opposite ends of a shock absorber indicated generally at 5 and extend lengthwise in the same direction as shock absorber 5.

Shock absorber 5 is comprised of an elongated piston rod 7 having an eye 9 at the end to which the adjacent section of filament 3 is tied, and a piston 11 at the other end. Piston 11 moves in closely sliding relationship within a cylinder 13 having an integral rod 15 extending axially therefrom in the opposite direction from piston rod 7. Rod 15 terminates at its free end in an eye 17 in which the adjacent section of filament 3 is tied. Cylinder 13 is comprised of a base portion 19 to which rod 15 is attached, circular end edges and a detachable end portion 21 in screw-threaded engagement with base portion 19. End portion 21 has an axial opening through its end remote from rod 15, and piston rod 7 slides in closely fitting relationship through this latter opening. Base portion 19 and end portion 21 are also provided with vent openings 23 in their end walls so as to avoid any air or water cushion effect upon movement of piston 11 in cylinder 13.

Disposed in cylinder 13 between piston 11 and the end of end portion 21 remote from rod 15 is a pair of coil compression springs 25 and 27. When relaxed, spring 25 is of a length at least as great as cylinder 13; but spring 27 when relaxed is of a length only about two thirds as great as cylinder 13, as will be seen in FIGURE 1. However, although spring 25 is relatively long, it is relatively weak; and spring 27, while relatively short, is relatively strong. Spring 25 is disposed outside of and concentric with spring 27 and both springs are coaxial with piston rod 7, piston 11, cylinder 13, rod 15, base portion 19 and detachable end portion 21.

Piston 11 is provided with an annular groove 29 that provides a shoulder for the outer spring 25, while the closed end of end portion 21 is provided with a similar groove 31 confronting groove 29 to provide a shoulder for the opposite end of spring 25. Piston 11 is provided with a smaller annular groove 33 at the juncture of piston 11 and piston rod 7, to provide a shoulder for the inner spring 27; while the closed end of end portion 21 is provided with a corresponding confronting groove 35 to provide a shoulder for the other end of spring 27. The springs are thus retained in place on and act between the closed end of end portion 21 of cylinder 13, and the confronting or under the side of piston 11.

In order to keep the shock absorber afloat so that it does not drag down the tow rope with it and so that it drains off any water that enters it, a float 37 is provided, which encompasses shock absorber 5. Float 37 is in the form of two complementary opposed sections 39 each of which is half of the float. Sections 39 are elongated and hollow but water tight and waterproof and may for example be of metal or strong plastic. On their interior, each is provided with half of each of a pair of opposed grooves 41 in which the end marginal edges of cylinder 13 are snugly received when the float halves are assembled about the shock absorber. At each end, the float has an opening 43 extending axially therethrough in communication with the interior of the float between grooves 41. Half of each opening 43 is provided in each of sections 39 of float 37, so that when the sections are brought together in the assembled relationship shown in FIGURE 1, each opening 43 will be completed by each section 39. Each section 39 of float 37 is also provided with a pair of axially spaced apart semi-circular external grooves 45, which in the assembled relationship of the float form a pair of axially spaced apart annular grooves in each of which is disposed a spring clip 47 for resiliently retaining the float sections 39 in assembled relationship about the shock absorber with rods 7 and 15 extending through openings 43 but with eyes 9 and 17 disposed outside of float 37 even in the fully relaxed position of the shock absorber. In the assembled relationship, the axis of the float is coincident with the axis of the shock absorber.

It will also be appreciated that the float, in addition to keeping the shock absorber from sinking, assures that the shock absorber will be largely out of the water so that water that gets inside the shock absorber will tend to drain out. This, in turn, assures that air rather than water will ordinarily surround the piston moving within the shock absorber, thereby to give the shock absorber a much more sensitive and rapid response to shocks in the tow rope than if the shock absorber were usually immersed and filled with water during use.

The operation of the device will now be apparent. Before the line is tensioned, the shock absorber has the posi-

tion shown in FIGURE 1. Upon the application of tension, however, the piston moves in the cylinder until the position of the parts is reached as shown in FIGURE 2. During this initial portion of the movement of the piston in the cylinder, only relatively weak spring **25** is compressed. However, when the parts reach the position of FIGURE 2, then not only weak spring **25** but also strong spring **27** undergoes compression. The force necessary to move the parts between the positions of FIGURES 1 and 2 is relatively small compared to the force needed to move the parts between the positions of FIGURES 2 and 3. Thus, there is initially a weak and then a strong shock absorbing action in the line. The combined strength of springs **25** and **27**, however, is sufficient to relieve the sudden strain on the arms of the water skier, and the towing boat and the skier are soon moving at the same rate of speed.

After the initial tension in the tow rope is relieved by the skier coming up to speed, the tension in the rope quickly falls off to that needed merely to move the skier at the same rate of speed as the boat. Strong spring **27** can expand until it is relaxed, whereupon the parts again assume the position shown in FIGURE 2, in which spring **25** is largely absorbing the small shocks encountered when water skiing at the same speed as the boat.

Thus, the weak spring in combination with the strong spring in the environment of an aquatic tow rope assures that the sudden shock will be applied to the arms of the skier only gradually, in two stages, and that when the skier is then up to speed, the small shocks thereafter encountered will be counteracted much more sensitively by only the weak spring. The float encasing the shock absorber, in turn, assures not only that the tow rope will not sink, but also that the shock absorber will be ordinarily above the water and will remain largely drained of water that otherwise would interfere with the sensitivity of its response to sudden shocks.

In view of the foregoing, it will be obvious that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

What is claimed is:

1. An aquatic tow rope comprising a flexible filament in two sections, one section being secured to one end of a piston rod having a piston at the other end and the other section being interconnected with a cylinder in which the piston slides, coil compression spring means surrounding the piston rod within the cylinder and acting between the cylinder and the piston continuously yieldably to urge the piston rod into the cylinder, the cylinder having a rod extending a substantial distance axially therefrom in alignment with but in the opposite direction from the piston rod, said other section of flexible filament being secured to said cylinder rod, said piston rod in its farthest position within the cylinder extending a substantial distance outside the cylinder, and a float encasing and mounted on the cylinder, the float extending a substantial distance beyond each end of the cylinder and having a rounded exterior end at each end thereof, the float closely encompassing both said rods for a substantial distance beyond each end of the cylinder but being spaced from at least the piston rod thereby to permit free movement of the piston rod within the float, said sections of the flexible filament being secured to said rods endwise beyond the float, the float being in two separable sections, each section defining a portion of each of a pair of passageways through which said rods extend, the cylinder having a cylindrical external contour including a circular end edge at each end of the cylinder, the float sections each having a pair of semicircular recesses therein spaced apart the length of the cylinder so that the float sections are supported on the cylinder by contact of the cylinder end edges in the semicircular float section recesses, the float sections being spaced outwardly of the cylinder between the semicircular recesses.

2. An aquatic tow rope as claimed in claim 1, said cylinder having a pair of opposite end walls and openings through both end walls thereof to permit the free flow of fluid into and out of the ends of the cylinder upon movement of the piston within the cylinder, the float being spaced from both said rods and from said openings so as to provide passages for the flow of fluid about both said rods and through each end of the float.

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