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(71) We, REGAL INTERNATIONAL INC. (formerly known as Regal Tool & Rubber Co., Inc.,) a Corporation organised under the laws of the State of Texas, United States of America, of Highway 31 East, Corsicana, Navarro County, Texas, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a bumper for attachment to a marine structure for fending off vessels floating adjacent thereto.

Offshore platforms which the present invention is designed to protect are semirigid structures subject to damage by excessive shock loading. As drilling progresses to deeper water in more open seas with the use of heavier supply boats and barges, it has become necessary to develop better protective systems. Such systems are generally attached to individual legs of the offshore platform. In the past, it has been the practice to use cast-off vehicle tires, usually large off-the-road or aircraft tires, mounted on a supporting column next to the platform leg, as shown for instance in U.S. Patent No. 1,413,210 or U.S. Patent No. 2,952,979, the latter showing the practice of filling the tires with cable or other material to prevent their excessive sagging or collapse. Some special structures have been built for this purpose, as shown for instance in the U.S. Patent No. 3,005,435 and U.S. Patent No. 2,424,635. However, each has attendant drawbacks. The cast-off vehicle tire systems involve the difficulty of finding a plurality of tires of the same large size, as well as the problems which arise when corded tires become waterlogged and sag. Moreover, deflated vehicle tires exhibit very poor shock absorption capabalities. Schwall, supra, resorted to making special rubber bumper molding for this purpose, but such bumpers are mounted in a nonrotating manner, and are therefore subject to early destruction. Roach shows rotating cushions, but the use of axles and bearings provides too fragile a structure to withstand open-sea battering.

According to the present invention there is provided a bumper for attachment to a marine structure for fending off vessels floating adjacent thereto comprising:

(a) a rigid upright column;

(b) shock cell means at each end of the column for receiving and absorbing axially and radially directed forces transmitted from said upright column, said shock cell means each comprising, an outer cylinder connectable to said marine stable structure, an inner cylinder coupled to said rigid upright column concentrically positioned and telescoping into said outer cylinder, an annular member of elastomeric material bonded to the inner surface of said outer cylinder and to the outer surface of said inner cylinder.

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as further objects and advantages thereof, will best be understood by reference to the following detailed description of illustrative embodiments taken in conjunction with the accompanying drawings, in which:

Figure 1 is an elevation view showing an illustrative embodiment of the bumper system of the present invention;

Figure 2 is an elevation view of a second embodiment of the bumper system of the present invention.

Referring now to Figure 1, a leg 6 of an offshore platform (not shown) supports a bumper assembly 8. Bumper assembly 8 includes a pipe 10 which supports a stacked series of elastomeric cylindrical bumper rings 12 surrounding the column 10 and having inner peripheries loosely fitted thereto so that the rings 12 can freely rotate on the column 10. A lower stop plate 16 supports the bottommost ring and the other rings stacked thereabove. Pipe 10 is coupled to the platform leg 6 by two shock cells 20 and 22.

Shock cell 20 comprises a short vertical cylinder 24, which is welded to a short horizontal cylinder 26. Cylinder 24 is hollow with the lower end thereof being cut on a taper to slope downwardly and inwardly towards leg 6. The lower end 10a of pipe column 10 is conical in shape so that it can be stabbed into cylinder 24.

Cylinder 26 is supported by an outer cylinder 28 through a cylindrical rubber body 30, which is adhered to the inner surface of cylinder 28 and the outer surface of cylinder 26. The end of cylinder 26 opposite pipe 24 is closed by a plate 32.

Cylinder 28 is welded to a split cylinder clamp 34. Clamp 34 encircles and secures the shock cell 20 to the leg 6. The clamp 34 formed in two halves is to be secured to leg 6 by a series of bolts 36. Cylinder clamp 34 is provided lateral rigidity by beams 38. A reinforcing ring 42 encircles the cylinder 28 at the open end and functions to oppose forces applied for deflection of cylinder 26.

A stop plate 44 is welded inside pipe 28. Plate 44 is mounted to shear loose in response to unusual forces so that the cylinder 26 can continue its travel and further deflect the shock cell 20.

The upper end of plate 10 is secured in a split cylinder clamp 60 having an integral cylinder 62 which is supported coaxially in an outer cylinder 64 by a rubber cylinder 66. Rubber cylinder 66 is adhered to the outer surface of cylinder 62 and to the inner surface of cylinder 64. Cylinder 64 is secured to leg 6 by a doublet half cylinder 68, which include beams 70. Beams 70 strengthen and secure cylinder 64 to half cylinder 68. Shock cell 22 also includes a reinforcing ring 74 encircling cylinder 64 at its open end. Reinforcing ring 74 performs a similar function as reinforcing ring 42 of shock cell 20, opposing forces applied for deflection of cylinder 62.

Shock cell 22 further includes a stop plate 76 which is peripherally welded inside of cylinder 64. Stop plate 76 serves the same function as stop plate 44 in shock cell 20.

By providing like shock cells 20 and 22 both at the bottom and the top of pipe 10, energy absorption will be the same whether the bumper array 12 is contacted by a boat near the upper end or near the lower end. However, while providing this desirable reaction, it is also desirable to avoid maintenance of any substantial static load on shock cells 20 and 22. For this purpose, a tensile bearing support anchor such as a chain 100 or the like is connected to a lifting eye 102 on the lower end of pipe 10 and extends upwardly at an angle of approximately 15° measured from column 10 where it is secured to an eyelet 104 attached to leg 6. The chain 100 may be covered by a rubber encasement 106. By this means the static loads which would otherwise tend to cause the rubber mountings 30 and 66 to creep are substantially eliminated.

In Figure 2, a second bumper assembly 200 is shown, with like numerals being utilized for like and corresponding parts as in Figure 1. An elbow 202 extends from the upper end of pipe column 10. Elbow 202 serves to prevent vessels from hanging up upon the top end of pipe column 10. Bumper assembly 200 may be given static support by flexible tension bearing anchor 206. Anchor 206 may comprise a chain similar to chain 100 of Figure 1. Chain 206 is connected to a lifting eye 212 on the upper end of the elbow 212 and extends upwardly at approximately a 45° angle where it is secured to an eyelet 214 attached to leg 6. It functions to relieve the static loads on shock cells 20 and 22 and may be used in place of chain 100.

The reader's attention is drawn to our co-pending application No. 41417/77 (Serial No. 1,589,548) which also describes and claims a bumper.

WHAT WE CLAIM IS:—

1. A bumper for attachment to a marine structure for fending off vessels floating adjacent thereto comprising:
(a) a rigid upright column;
(b) shock cell means at each end of the column for receiving and absorbing axially and radially directed forces transmitted from said upright column, said shock cell means each comprising, an outer cylinder connectable to said marine stable structure, an inner cylinder coupled to said rigid upright column concentrically positioned and telescoping into said outer cylinder, an annular member of elastomeric material bonded to the inner surface of said outer cylinder and to the outer surface of said inner cylinder.

2. A bumper according to claim 1 further comprising support means for bearing static load on each shock cell.

3. A bumper according to claim 2 wherein said support means comprises a chain anchored to prevent downward movement of said rigid upright column.

4. A bumper according to claim 1, 2 or 3, further comprising clamp means integral with said outer cylinder for securing the outer cylinder to said stable structure.

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Shock cell 20 comprises a short vertical cylinder 24, which is welded to a short horizontal cylinder 26. Cylinder 24 is hollow with the lower end thereof being cut on a taper to slope downwardly and inwardly towards leg 6. The lower end 10a of pipe column 10 is conical in shape so that it can be stabbed into cylinder 24.

Cylinder 26 is supported by an outer cylinder 28 through a cylindrical rubber body 30, which is adhered to the inner surface of cylinder 28 and the outer surface of cylinder 26. The end of cylinder 26 opposite pipe 24 is closed by a plate 32.

Cylinder 28 is welded to a split cylinder clamp 34. Clamp 34 encircles and secures the shock cell 20 to the leg 6. The clamp 34 formed in two halves is to be secured to leg 6 by a series of bolts 36. Cylinder clamp 34 is provided lateral rigidity by beams 38. A reinforcing ring 42 encircles the cylinder 28 at the open end and functions to oppose forces applied for deflection of cylinder 26.

A stop plate 44 is welded inside pipe 28. Plate 44 is mounted to shear loose in response to unusual forces so that the cylinder 26 can continue its travel and further deflect the shock cell 20.

The upper end of plate 10 is secured in a split cylinder clamp 60 having an integral cylinder 62 which is supported coaxially in an outer cylinder 64 by a rubber cylinder 66. Rubber cylinder 66 is adhered to the outer surface of cylinder 62 and to the inner surface of cylinder 64. Cylinder 64 is secured to leg 6 by a doublet half cylinder 68, which include beams 70. Beams 70 strengthen and secure cylinder 64 to half cylinder 68. Shock cell 22 also includes a reinforcing ring 74 encircling cylinder 64 at its open end. Reinforcing ring 74 performs a similar function as reinforcing ring 42 of shock cell 20, opposing forces applied for deflection of cylinder 62.

Shock cell 22 further includes a stop plate 76 which is peripherally welded inside of cylinder 64. Stop plate 76 serves the same function as stop plate 44 in shock cell 20.

By providing like shock cells 20 and 22 both at the bottom and the top of pipe 10, energy absorption will be the same whether the bumper array 12 is contacted by a boat near the upper end or near the lower end. However, while providing this desirable reaction, it is also desirable to avoid maintenance of any substantial static load on shock cells 20 and 22. For this purpose, a tensile bearing support anchor such as a chain 100 or the like is connected to a lifting eye 102 on the lower end of pipe 10 and extends upwardly at an angle of approximately 15° measured from column 10 where it is secured to an eyelet 104 attached to leg 6. The chain 100 may be covered by a rubber encasement 106. By this means the static loads which would otherwise tend to cause the rubber mountings 30 and 66 to creep are substantially eliminated.

In Figure 2, a second bumper assembly 200 is shown, with like numerals being utilized for like and corresponding parts as in Figure 1. An elbow 202 extends from the upper end of pipe column 10. Elbow 202 serves to prevent vessels from hanging up upon the top end of pipe column 10. Bumper assembly 200 may be given static support by flexible tension bearing anchor 206. Anchor 206 may comprise a chain similar to chain 100 of Figure 1. Chain 206 is connected to a lifting eye 212 on the upper end of the elbow 212 and extends upwardly at approximately a 45° angle where it is secured to an eyelet 214 attached to leg 6. It functions to relieve the static loads on shock cells 20 and 22 and may be used in place of chain 100.

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(a) a rigid upright column;
(b) shock cell means at each end of the column for receiving and absorbing axially and radially directed forces transmitted from said upright column, said shock cell means each comprising, an outer cylinder connectable to said marine stable structure, an inner cylinder coupled to said rigid upright column concentrically positioned and telescoping into said outer cylinder, an annular member of elastomeric material bonded to the inner surface of said outer cylinder and to the outer surface of said inner cylinder.

2. A bumper according to claim 1 further comprising support means for bearing static load on each shock cell.

3. A bumper according to claim 2 wherein said support means comprises a chain anchored to prevent downward movement of said rigid upright column.

4. A bumper according to claim 1, 2 or 3, further comprising clamp means integral with said outer cylinder for securing the outer cylinder to said stable structure.

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