April 28, 1936. C. E. F. DUBOIS 2,039,151

DEVICE FOR CUSHIONING THE SHOCK OF SHIPS

Filed Feb. 2, 1933

Fig. 1.

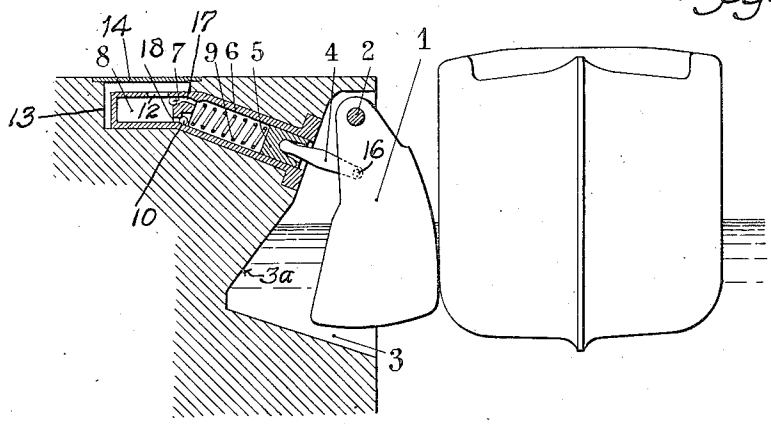


Fig. 2.

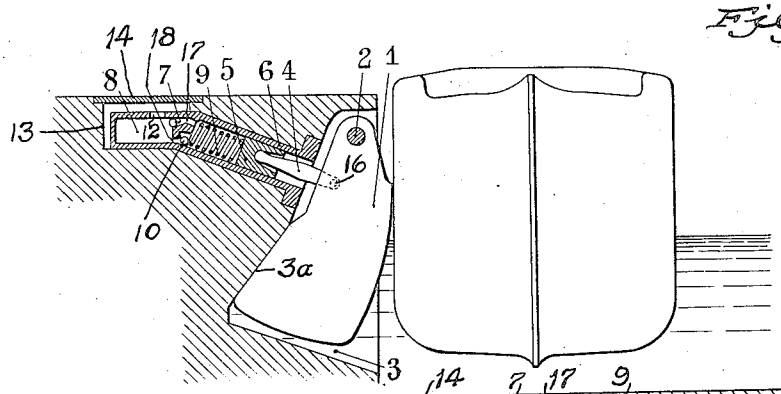
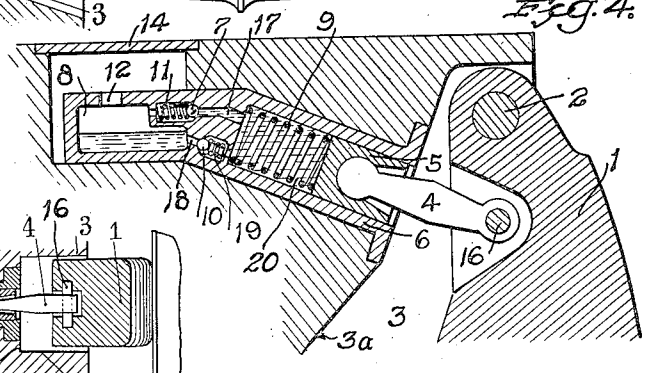


Fig. 4.



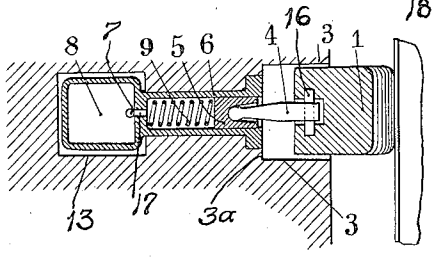


Fig. 3.

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DEVICE FOR CUSHIONING THE SHOCK OF SHIPS

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7 Claims. (Cl. 61—48)

The present invention has for its object a device adapted to cushion the shocks which may be given by ships against the constructive works which they approach, such as quays, moles, piers, stockades, wharfs, etc.

Damages so much the more serious as the shock is more violent may be caused either to the ship, or to the constructive work, or to both, but, in the majority of cases, constructive works are capable of receiving without great damage extremely important shocks, and it is nearly always the ship which runs the greatest risk of damages so much the more serious as its tonnage is greater.

The menace of these damages justifies the utilization, upon accosting, of powerful active means such as tugs, towing windlasses on mooring buoys, etc., for slowly stopping the ship in the right place alongside the work; this menace also justifies the interposition between the ship and work of passive, movable or fixed fenders more or less distortable and having some resiliency, such as fascines, bollards, etc., these passive fender subsisting after the ship has come alongside: they prevent the ship from heavily striking against the work, either under the action of the waves which cause it to roll, or under the action of the wind or of eventual currents which can drive it against the work.

The fenders used up to this day can be distorted only to a slight extent and are scarcely efficient when ships having tonnages of 50,000 tons and more, such as are actually built, are considered.

The violence of the shock, that is to say the magnitude of the reaction of the work on the ship is proportional to the mass of the latter as well as to the square of the number expressing the speed at which the ship moves towards the work when approaching; but the violence of the shock or of the reaction of the constructive work diminishes in proportion as the possibility of displacement of the point of contact (that is to say of distortion of the body receiving the shock) increases.

This conception of the necessity of a great distortion is in particular the reason for which large rafts of tree trunks are used as fenders in New York Harbor in order that large ocean liners may enter without great danger between two adjacent piers and come alongside the same, which manoeuvre must be effected notwithstanding the relatively violent current of the Hudson River which pushes the ships against the wing-wall of the pier; these large rafts, which are several meters wide, are completely crushed during the manoeuvre, and, after crushing, they have lost about ⅔ of their width and they can be used only for one accosting operation.

According to the present invention, the member receiving the shock can not only be subjected to great distortion, but it can also automatically resume its initial condition after the ship has stopped; such a shock absorber constituted a real advance by reducing the violence of the shock to a value computed as admisible for the ship, as well as for the constructive work if the latter is not very resistant.

The proposed shock absorber will preferably be constituted by a fixed fender permanently arranged on the constructive work and capable of being subjected to great resilient distortion. A form of construction of this device is illustrated, by way of example, in the accompanying drawing.

Fig. 1 is a vertical section of the shock absorber at the beginning of the shock at the moment the ship comes in contact with it.

Fig. 2 is a vertical section of the shock absorber at the end of the shock after the ship has stopped.

Fig. 3 is a horizontal section of the shock absorber at the beginning of the shock.

Fig. 4 is a vertical section, on an enlarged scale, showing the details of the device.

The proposed shock absorber is constituted as follows:

A pendular body 1 is freely hung from a fixed shaft, rigid with the constructive work. In the wall of this constructive work, in contact with the water, is provided a recess, the side walls 3 of which support the shaft 2 and between which can oscillate the pendular body 1, said side walls acting as guides for said pendular body.

In the rear wall 3a of the recess opens a hydraulic cylinder 6 firmly anchored in the fixed constructive work and which terminates at the rear in a tank 8 arranged in a well 13 opening in the platform of the fixed constructive work and closed by a cover 14.

In the cylinder 6 is slidably mounted a piston 5, on which is pivoted a connecting rod 4 pivoted, on the other hand, on a shaft 16, rigid with the pendular body 1. Between the piston 5 and the bottom of the cylinder 6 is interposed a compression spring 9 adapted to facilitate the return of the pendular body to its initial position.

The bottom of the cylinder 6 is connected to the interior of the tank 8 by a delivery channel 17 in which is arranged a ball delivery valve 7, adapted to open inwardly of the tank 8 in op-

position to the action of a compression spring 11. In the bottom of the cylinder 6 is moreover provided a suction channel 18, in which is arranged a ball valve 10, adapted to open inwardly of the cylinder 5 in opposition to the action of a compression spring 19.

In the top of the tank 8 is provided an opening 12 which puts it in communication with the interior of the well 13.

The cylinder 6 is filled with a liquid 20 which is delivered into the tank 8 through the valve 7, when the piston moves backwards and compresses the spring 9, and which is sucked through the valve 10, when the piston moves forward. The air contained in the tank 8 above the liquid can easily escape through the opening 12, during the delivery period, and can return during the suction period.

The operation of the device is as follows:

When a ship strikes upon the pendular body 1, the latter is pushed back towards the rear wall 3a of the recess 3, by rocking about its shaft 2. Through the medium of the connecting rod 4, the piston 5 is pushed back within the cylinder 6; it compresses the spring 9 and delivers the liquid 20 into the tank 9 through the delivery valve 7. This backward movement is checked to a great extent by the weight of the pendular body 1, the compression of the spring 9 and the checking of the liquid in the delivery channel 17. At the end of the backward movement, the entire device slowly returns towards the position of rest under the action of the weight of the pendular body and of the spring 9. This movement is also greatly checked by the fact that the liquid, previously delivered into the tank 8, is sucked through the narrow channel 18.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a shock absorber adapted to deaden the shock of a ship against a fixed structure, the combination of a pair of side walls rigid with said structure and spaced apart to form an open recess in said structure, an axle transversely disposed in said recess and secured to the side walls at a level above the highest water level, a buffer member pendently mounted and supported upon said axle in said recess so as to expose a portion of said buffer member to be engaged by the approaching ship, and a fluid press comprising a cylinder secured to said fixed structure and containing a fluid, a piston within said cylinder, a tank, an outlet channel and a return channel connecting said cylinder to said tank, a spring delivery valve mounted on said outlet channel, means acting on said delivery valve for checking the fluid delivered, and a suction valve mounted on said return channel, said buffer member being operatively connected to said piston in order to force the fluid contained in the cylinder towards the tank through the delivery valve when said buffer member is moved in the direction of the fixed structure.

2. In a device for deadening the shock of the impact of a ship against a fixed structure, the combination of a pair of side walls rigid with said structure and spaced apart to form an open recess in said structure, a horizontal axle held in said recess by both of said side walls in parallelism with the general direction of said fixed structure, and a buffer member pendently mounted and supported upon said axle in said recess and exposed to make contact with said ship, there being a rear wall in said recess which is sufficiently distant from the buffer member to allow the latter to oscillate, and the vertical profile of the shock-receiving surface of said buffer member having a convex curvature on a large portion of its height, and means interposed between the fixed structure and the buffer member to check the oscillations of the latter.

3. In a device for deadening the shock of the impact of a ship against a fixed structure, the combination of a pair of side walls rigid with said structure and spaced apart to form an open recess in said structure, there being a rear wall in said recess, a horizontally disposed pivot means supported by at least one of said side walls in spaced position from said rear wall and above the water level, a buffer member pendently mounted and supported in said recess upon said pivot means and exposed to make contact with said ship, which buffer member comprises a pendular body having a plane of oscillation disposed at right angles to said fixed structure, the rear wall of said recess being sufficiently distant from said buffer member to allow the latter to oscillate in the direction of the fixed structure, and means interposed between the fixed structure and the buffer member to check the oscillations of the latter.

4. In a device for deadening the shock of the impact of a ship against a fixed structure, the combination of a pair of side walls rigid with said structure and spaced apart to form an open recess in said structure, there being a rear wall in said recess, a horizontally disposed pivot means supported by at least one of said side walls in spaced position from said rear wall and above the water level, a buffer member pendently mounted and supported in said recess upon said pivot means and exposed to make contact with said ship, which buffer member comprises a pendular body, the rear walls of the recess and of the buffer member also leaving a space between them when the latter is in its position of rest and the side walls of the recess holding and guiding the buffer member, and means interposed between the fixed structure and the buffer member to check the oscillations of the latter.

5. In a device for deadening the shock of the impact of a ship against a fixed structure, the combination of a pair of side walls rigid with said structure and spaced apart to form an open recess in said structure, a horizontal axle held in said recess by both of said side walls at a level above the highest water level, and a buffer member suspended upon said axle and exposed to make contact with the ship, said buffer member being held in position of rest under the action of its own weight, a cylinder in said fixed structure disposed at right angles to said axle, a piston movable in said cylinder, means for connecting said piston to said suspended buffer member, a spring delivery valve located in a delivery channel provided in the bottom of said cylinder, a suction valve located in a suction channel also provided in the bottom of said cylinder, and a tank containing a liquid into which both said delivery and suction channels open.

6. In a device for deadening the shock of the impact of a ship against a fixed structure, the combination of a pair of side walls rigid with said structure and spaced apart to form an open recess in said structure, a horizontal axle held in said recess by both of said side walls at a level above the highest water level, and a buffer member pendently mounted upon said axle and ex-

posed to make contact with the ship, said buffer member being held in position of rest under the action of its own weight and having a shock-receiving surface which is curved in the direction of its height, a cylinder in said fixed structure disposed at right angles to said axle, a piston movable in said cylinder, means for connecting said piston to said buffer member, a compression spring interposed between the bottom of said cylinder and said piston, a delivery valve located in a delivery channel provided in the bottom of said cylinder, a suction valve located in a suction channel also provided in the bottom of said cylinder, and a tank containing a liquid and into which both said delivery channel and said suction channel open.

7. In a device for deadening the shock of the impact of a ship against a fixed structure, the combination of a pair of side walls rigid with said fixed structure and spaced apart to form an open recess in said structure, a horizontal axle held in said recess by both of said side walls at a level above the highest water level, and a buffer member pendently mounted upon said axle in exposed position in said recess so as to be capable of making contact with the ship, said buffer holding the position of rest under the action of its own weight, a hydraulic press comprising a cylinder rigid with said fixed structure and containing a delivery valve and a suction valve, a piston movable in said cylinder, and means connecting the piston to said buffer.

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