

PATENT SPECIFICATION

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(54) FENDERS

(71) We, BYRON JACKSON INC., a corporation duly organized and existing under and by virtue of the laws of the State of Delaware, United States of America, having its principal office and place of business at 6505 Paramount Boulevard, Long Beach, California 90805, 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 fenders which are used to fend or preclude excessive shock on bumping, collision, or contact of two bodies, such as between a truck and a loading dock or curb, a boat and a pier or wharf, a boat and a barge, two boats, or other moving or converging bodies, the fenders being attached to one of the bodies, or both of them may be equipped with fenders. The invention has particular, but not exclusive, application to fenders used on the curved hull of a boat or ship, where the impacts with barges, piers or wharves may be quite severe due to wave motion and forward speed on impact.

Examples of such fenders are disclosed in United States Letters Patent No. 3,411,304. It is an object of the invention to provide an improved fender.

Thus, the invention (whose scope is defined in the appended claims) includes a fender comprising an elongate, resilient pad and a plurality of rigid metal plates affixed thereto, adjacent ones of said plates being spaced from each other in a direction considered lengthwise of said pad, with said pad providing a flexible section extending between said adjacent ones of said plates, said plates having portions projecting laterally outwardly from the opposite longitudinal sides of said pad.

The invention also includes a fender for

connection to a structure, comprising a plurality of metal plates disposed with spaced apart edges to form an elongate array of plates, and an undivided and flexible elongate, resilient body pad fixed to and merged with each respective plate and disposed along said array of plates to permit said body pad to bend and thereby enable the orientation of each of said plates to be adjusted, each of said plates having portions projecting laterally away from said elongate pad.

In order that the invention may be well understood there will now be described some embodiments thereof, given by way of example only, reference being had to the accompanying drawings, in which:

Fig. 1 is a plan view of a conformable fender;

Fig. 2 is a side elevation view of the fender of Fig. 1, partly in section, and shown attached to the hull of a ship;

Fig. 3 is an enlarged transverse sectional view of the same fender, taken on the line 3-3 of Fig. 2;

Fig. 4 is a side elevational view of the same fender showing it conformed to a curved portion of a ship's hull, shown in section, and attached thereto;

Fig. 5 is a view similar to that of Fig. 4, of another form of fender which is preformed to the curvature of the surface to which it is affixed;

Fig. 6 is a plan view of still another form of conformable fender;

Fig. 7 is a side elevational view of the fender of Fig. 6, shown attached to a hull of a ship, shown in section;

Fig. 8 is an enlarged transverse sectional view of the fender of Figs. 6 and 7, taken on the line 8-8 of Fig. 6, looking in the direction of the arrows; and

Fig. 9 is a side elevational view of the fender of Figs. 6, 7, and 8 showing it conformed to a curved portion of a ship's

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hull, shown in section, and attached thereto.

Referring to Fig. 1, there is shown an elongate fender 10 having a resilient, elongate body portion or pad 11, moulded of rubber or other elastomeric material with a crown portion 13 and a wider base portion 14, into which are moulded an elongate array of spaced metal reinforcing insert plates 16, which may vary in number, depending on the length of the fender 10. The rigid plates 16 are generally bent in the form of a V or arch so that their lateral portions or ends 16a extending beyond the body 11 are approximately even with the bottom surface of the base 14 and their crests are embedded in the pad 11. The plates 16 are adhesively bonded to the elastomeric material of the body 11, the bond and resilience being enhanced by connection of the crown and base portions 13 and 14 through openings or holes 17 in the crests of the plates 16. The views of the fender 10 in Figs. 2, 3 and 4 illustrate how it may be affixed to the hull or bow 19 of a towboat or push boat by tack welds 18 welding the ends 16a of the plates 16 to the hull surface 19. Fig. 4 shows the conformability of the fender 10 to a curved portion of the hull 19 by flexing of the body 11 at its elbow joints 15, the flexibility being enhanced by the transverse grooves 12 between the edges of the adjacent spaced plates 16 through the base 14 of the elastomeric body 11. The angular bend at the elbow or flexible section 15 provides a cavity 12a between the hull 19 and the base portion 14 into which the rubber of the body 11 may flow on impact of the crown 13 with another object, the size of the cavity 12a depending on the width of the plates 16. It should be noted that Fig. 4 depicts an exaggerated or extreme configuration of the fender 10 in which the plates 16 are relatively wide, and that the narrower the spaced plates 16 the smaller will be the cavity 12a and the more conformed or concentric the surfaces of the pad 11 with the surface of the hull 19.

In Fig. 5 is depicted another form of conformable fender, designated 20, which is contoured to fit the curved portion of the ship's hull 19. It has a resilient body portion 21 with a crown 23 and base 24, into which are moulded arched metal reinforcing insert plates 26, having lateral portions or ends 26a extending beyond the body 21 for attachment by welds 28 to the curved bow 19 of the ship. The metal plates 26 are adhesively bonded to the elastomeric material of the body 21, the bond and resilience being enhanced by connection of the crown and base portions 23 and 24 through holes 27 in the plates 26. Flexibil-

ity to adapt the fender 21 to varying contours of the bow 19 is provided at the flexible sections or elbow joints 25 between the adjacent spaced plates 26, the flexibility being enhanced by the transverse grooves 22 through the base 24; the grooves 22 also provides a space into which rubber may flow on impact of the crown 23 with another object, thus making the bumper 21 more resilient and resistant to shocks.

In Figs. 6 to 9 is depicted still another form of conformable fender, designated 30. It has a resilient body portion or pad 31 with a crown 33 and base 34, onto which are moulded and adhesively bonded a plurality of spaced flat metal plates 36, having ends or lateral portions 36a extending beyond the body 31 for attachment by welds 38 to the bow 19 of the ship. Flexibility to adapt the fender 31 to varying contours of the hull 19 is provided at the elbow joints or flexible sections 35 between the adjacent plates 36, the flexibility being enhanced by the transverse grooves 32 through the base 34. Fig. 9 shows the conformability of the bumper 30 to a curved portion of the bow 19 of the ship by flexing of the body 31 at its elbow joints 35, the angular bend providing a cavity 32a between the hull 19 and the base portion 34 into which the rubber of the body 31 may flow on impact of the crown 33 with another object.

In a typical installation of the conformable fenders 10 on the curved surfaces of a towboat or tugboat to reduce the shock on collision or impact of the towboat in its movement or its usual service in pushing a barge, the fenders 10 are aligned in parallel spaced groupings as on the leading curved surfaces of the bow 19, then the ends 16a of the plates 16 protruding from the rubber body 11 are affixed by tack welds 18 to the metal hull 19. By using tack welds 18 at the extremities 16a, away from the elastomeric body 11, the rubber-to-metal bond is not adversely affected by the heat of welding. Conversely, to remove the fenders 10 for replacement after they are worn, requires only a re-application of heat to cut the welds 18, and the surface 19 is ready for new fenders 10. Since the fenders 10 have spaces or flexible rubber elbow joints between the adjacent plates 16, they may be cut into any desired length for installation; and only worn portions, rather than the whole fender, need be removed for replacement.

By having the body 11 of the bumper 10 crowned, with the crown 13 narrower than the base 14, there is thus provided a tapered shape with more resistance to side or glancing impacts, and more space be-

tween the bodies 11 of the aligned fenders 10 on the hull 19 for welding the base ends 16a thereto. Additionally, having the surface of the base 14 substantially in the same plane as the base plate ends 16a provides support by both the reinforcing plate 16 and the rubber base 14 resting against the hull 19 to resist pressures and blows exerted against the crown 13 of the fender 10. The holes 17 also provide communication between the crown portion 13 and the base portion 14 so that the whole body 11 is able to absorb the shocks of impacts, thus providing a more rugged and resilient fender and a longer service life therefor. The fender 10 is adaptable or conformable to almost any contour of the hull 19, from flat to severe curves, may be twisted to conform it to warped surfaces and can adapt to distortions of the surfaces which may occur in service, the elbow joints 15 providing the necessary flexibility as described above.

The installation and use of the modified forms of the invention as described hereinabove, the fender 20 as depicted in Fig. 5 and the fender 30 as depicted in Figs. 6-9, are quite similar; and they also have advantages corresponding to those discussed above in relation to the fenders 10.

While the description above refers primarily to the use of the fenders as applied to towboats or tugboats, they may be applied with similar advantages in other installations such as on other types of ships for use as bumpers, on docks and wharves, barges, trucks and truck docks, and similar application.

Additionally, while three forms of the invention have been shown and described, these forms are merely illustrative, and changes could be made without departing from the scope of this invention as set forth in the claims. For example, any of the pads 11, 21, 31 may be perforated or hollow to vary its resilience and bulk. Again, the lateral portions of any of the rigid metal plates may be curved in general conformity to the surface on which the fender is to be mounted.

WHAT WE CLAIM IS:—

1. A fender comprising an elongate, resilient pad and a plurality of rigid metal plates affixed thereto, adjacent ones of said plates being spaced from each other in a

direction considered lengthwise of said pad, with said pad providing a flexible section extending between said adjacent ones of said plates, said plates having portions projecting laterally outwardly from the opposite longitudinal sides of said pad.

2. A fender as claimed in claim 1, wherein said plates are bonded to said pad.

3. A fender as claimed in claim 1 or claim 2, wherein said portions of said plates are curved.

4. A fender as claimed in any of claims 1 to 4, wherein each of said plates has its central portion embedded in said pad, and said central portion provides an opening through which the material of the pad on one side of the opening is joined to the material of the pad on the other side of the said opening.

5. A fender as claimed in any of claims 1 to 4, wherein said plates are arched and their outer ends lie in a plane including a surface of said pad.

6. A fender as claimed in any of claims 1 to 3, wherein said plates are flat and are bonded to an exterior surface of said pad.

7. A fender as claimed in any of the preceding claims, wherein said flexible section provides a transverse groove adjoining said adjacent ones of said plates.

8. A fender for connection to a structure, comprising a plurality of metal plates disposed with spaced apart edges to form an elongate array of plates, and an undivided and flexible elongate, resilient body pad fixed to and merged with each respective plate and disposed along said array of plates to permit said body pad to bend and thereby enable the orientation of each of said plates to be adjusted, each of said plates having portions projecting laterally away from said elongate pad.

9. A fender as claimed in any of the preceding claims and in combination with a structure to be protected by the fender, each said plate having its said portions fixed to said structure by welding.

10. Any of the fenders substantially as herein described with reference to, and as shown in, the accompanying drawings.

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While the description above refers primarily to the use of the fenders as applied to towboats or tugboats, they may be applied with similar advantages in other installations such as on other types of ships for use as bumpers, on docks and wharves, barges, trucks and truck docks, and similar application.

Additionally, while three forms of the invention have been shown and described, these forms are merely illustrative, and changes could be made without departing from the scope of this invention as set forth in the claims. For example, any of the pads 11, 21, 31 may be perforated or hollow to vary its resilience and bulk. Again, the lateral portions of any of the rigid metal plates may be curved in general conformity to the surface on which the fender is to be mounted.

WHAT WE CLAIM IS:—

1. A fender comprising an elongate, resilient pad and a plurality of rigid metal plates affixed thereto, adjacent ones of said plates being spaced from each other in a

direction considered lengthwise of said pad, with said pad providing a flexible section extending between said adjacent ones of said plates, said plates having portions projecting laterally outwardly from the opposite longitudinal sides of said pad.

2. A fender as claimed in claim 1, wherein said plates are bonded to said pad.

3. A fender as claimed in claim 1 or claim 2, wherein said portions of said plates are curved.

4. A fender as claimed in any of claims 1 to 4, wherein each of said plates has its central portion embedded in said pad, and said central portion provides an opening through which the material of the pad on one side of the opening is joined to the material of the pad on the other side of the said opening.

5. A fender as claimed in any of claims 1 to 4, wherein said plates are arched and their outer ends lie in a plane including a surface of said pad.

6. A fender as claimed in any of claims 1 to 3, wherein said plates are flat and are bonded to an exterior surface of said pad.

7. A fender as claimed in any of the preceding claims, wherein said flexible section provides a transverse groove adjoining said adjacent ones of said plates.

8. A fender for connection to a structure, comprising a plurality of metal plates disposed with spaced apart edges to form an elongate array of plates, and an undivided and flexible elongate, resilient body pad fixed to and merged with each respective plate and disposed along said array of plates to permit said body pad to bend and thereby enable the orientation of each of said plates to be adjusted, each of said plates having portions projecting laterally away from said elongate pad.

9. A fender as claimed in any of the preceding claims and in combination with a structure to be protected by the fender, each said plate having its said portions fixed to said structure by welding.

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