United States Patent [19]
Muramatsu et al.

[11] **3,786,637**
[45] **Jan. 22, 1974**

[54] **OIL FENCE**

[75] Inventors: **Tateo Muramatsu; Kuninori Aramaki,** both of Yokohama; **Yoshikazu Kondo,** Tokyo, all of Japan

[73] Assignee: **Bridgestone Tire Company Limited,** Tokyo, Japan

[22] Filed: **Mar. 7, 1972**

[21] Appl. No.: **232,399**

[30] **Foreign Application Priority Data**

Mar. 13, 1971 Japan 46-13519

[52] **U.S. Cl.** .... **61/1 F**
[51] **Int. Cl.** **E02b 15/04**
[58] **Field of Search** ..... 61/1 F, 5; 210/242; 114/1 F

[56] **References Cited**

UNITED STATES PATENTS

3,686,870	8/1972	Blomberg	61/1 F
3,564,852	2/1971	Smith	61/1 F
3,645,099	2/1972	Saavedra	61/1 F
3,592,005	7/1971	Greenwood	61/1 F
3,638,430	2/1972	Smith	61/1 F
3,563,036	2/1971	Smith	61/1 F
3,184,923	5/1965	Galvaing	61/1 F
3,640,073	2/1972	Samsel	61/1 F

Primary Examiner—Jacob Shapiro
Attorney, Agent, or Firm—Fleit, Gipple & Jacobson

[57] **ABSTRACT**

An oil fence comprising an elongated resilient belt member and a float secured to it for keeping at least a part of the belt member floating above water level. The floating portion of the belt member is kept substantially upright by a weight means and reinforcing means. The oil fence so flexes as to conform with the profile of water surface.

4 Claims, 4 Drawing Figures

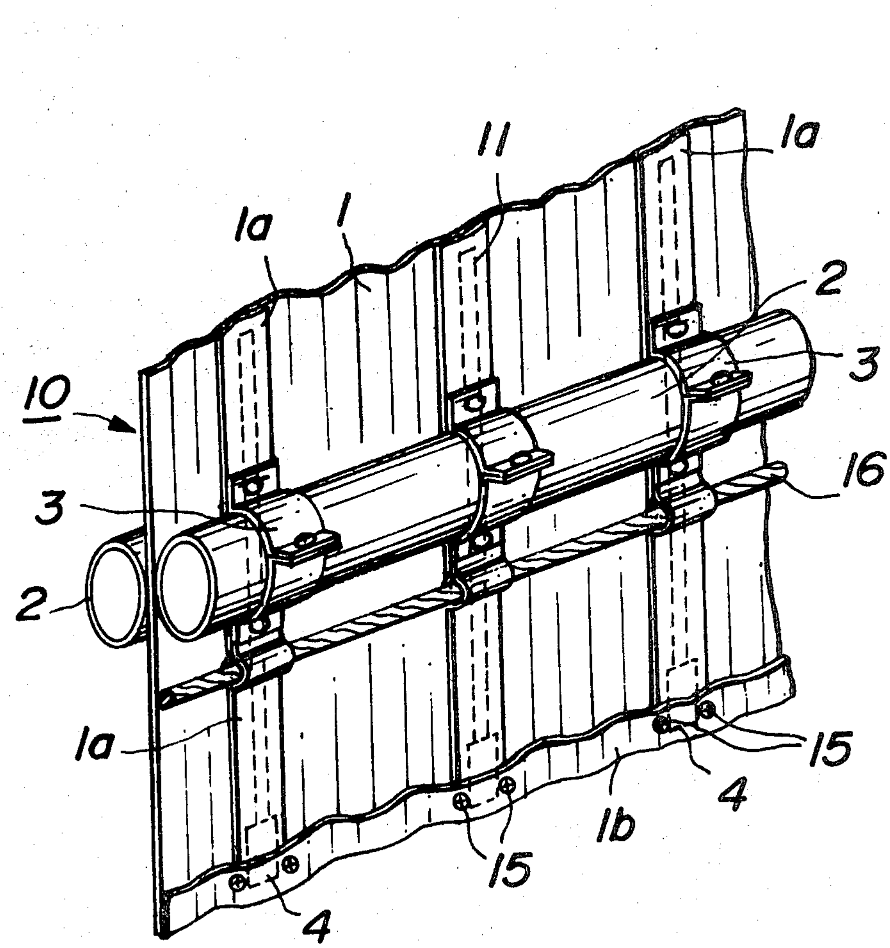


FIG. 1A

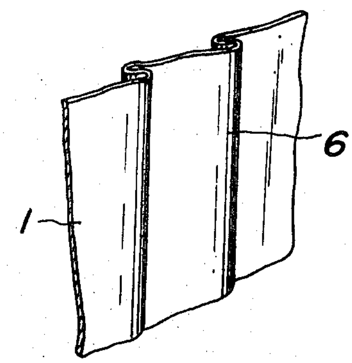


FIG. 1B

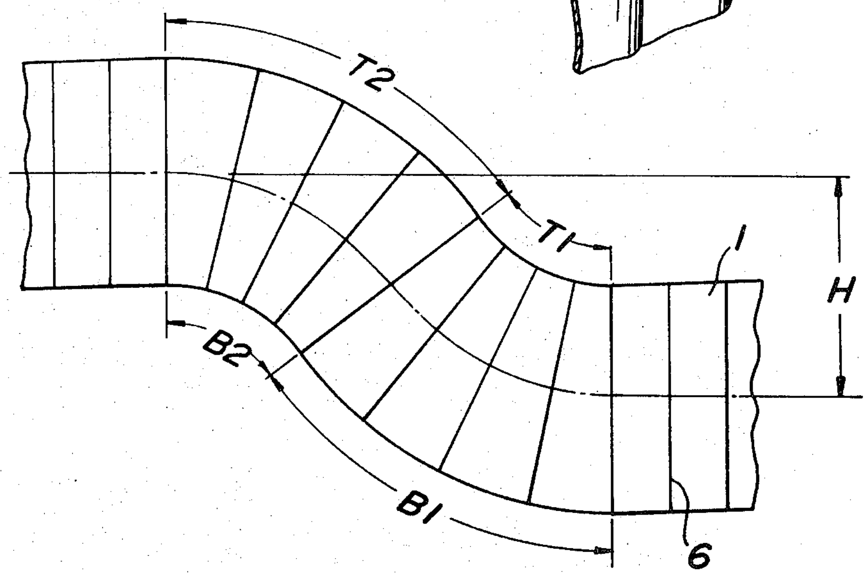


FIG_2

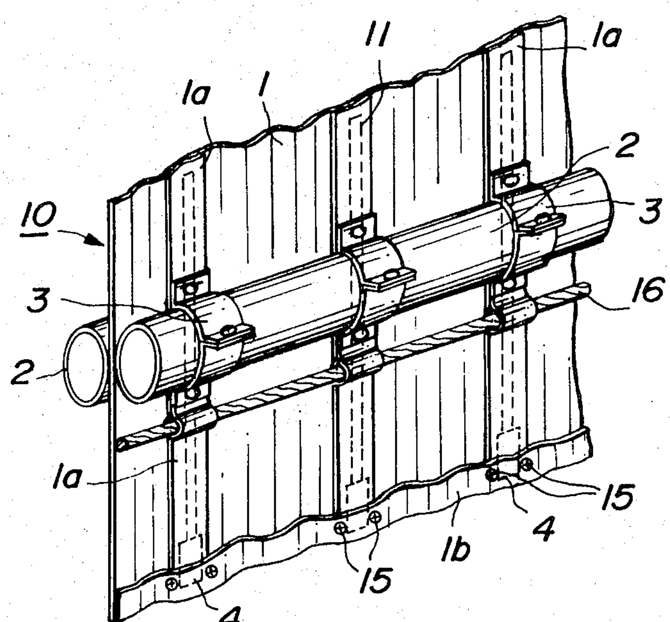
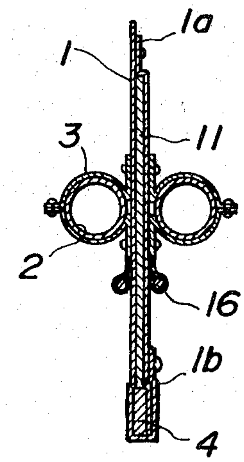


FIG_3



OIL FENCE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an oil fence, and more particularly to an oil fence which acts to prevent floating drifts, such as oil or dust particles on water surface, from dispersing beyond a limited area.

2. Description of the Prior Art

A conventional oil fence consists of a flexible tubular float, a wall member depending from the lower edge of the float, and a weight member secured to the lower end of the depending wall member for spreading the wall member in the water. With such conventional oil fence, the tubular float member extends above the water level for preventing the floating drifts from overflowing across the oil fence, and the depending wall member acts to prevent the floating drifts from passing underneath the oil fence together with wave and turbulence.

The conventional oil fence has a shortcoming in that in order to ensure effective prevention of overflow of floating drifts across the fence, it is necessary to provide a high blocking wall above water level by using a tubular float of large diameter. The increased diameter of the tubular float makes the oil fence bulky and difficult to handle. Furthermore, with the increased diameter, the time necessary for inflation and deflation of the tubular float increases. To provide an oil fence covering a large area, a number of oil fence sections must be joined, and if tubular floats of large diameter are used in the oil fence sections, joint means for connecting the adjacent sections of tubular float becomes bulky and heavy. Such heavy joining means acts to further reduce the buoyancy of the float, so that the float diameter must be increased again to compensate for the weight of the heavy joining means. This is a kind of vicious cycle, which results in a very large float diameter.

Another shortcoming of the conventional oil fence with a tubular float of large diameter is that, as the float diameter increases, the oil fence becomes less flexible, and the oil fence may not flex along the profile of the water surface, so that the top of the oil fence may be partially washed by wave and turbulence. As a result, floating drifts may overflow across the oil fence at such washed portions.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to obviate the aforesaid difficulties of conventional oil fence, by providing an improved oil fence of compact and inexpensive type. With the oil fence of the present invention, a flexible tubular float means is secured to one or both surfaces of an elongated flexible belt member, the top edge of the belt member flexes in line with the profile or the shape of the water surface, even under wavy or turbulent conditions, so as to ensure the prevention of floating drifts from passing across the oil fence line above or below the oil fence itself. With the oil fence according to the present invention, two tubular floats may be secured to the belt member, so that in the event of puncture of one float, the oil fence may retain a part of its buoyancy and it does not sink deep in water. Thus, it can easily be repaired.

According to the present invention, there is provided an oil fence which includes an elongated resilient belt member, a tubular float means secured to the resilient belt member, so as to extend in parallel to the longitudinal direction of the belt, a weight means secured to one longitudinal edge of the belt means, and a plurality of reinforcing portions each being secured to the resilient belt member so as to reinforce the belt means in a direction perpendicular to the longitudinal direction of the belt member. Opposite longitudinal side edges of the resilient belt member are independently flexible and bendable, so that the resilient belt member smoothly follow the curvature of water surface profile for ensuring blocking of the floating drifts against passing across the oil fence. In operation of the oil fence of the present invention, about one half of the resilient belt member is placed in water, so that the buoyancy caused by that portion of the resilient belt member which is placed in water acts to assist the buoyancy of the tubular float means. Accordingly, a comparatively small tubular float means may be sufficient for providing the buoyancy necessary for operating the oil fence.

It is one of the important features of the present invention that a reinforcing means is secured to the resilient belt member, so as to substantially uprightly keep that portion of the belt member which lies above the water level. Thereby, overflow of floating drifts across the oil fence is greatly reduced.

BRIEF DESCRIPTION OF THE DRAWING

For a better understanding of the invention, reference is made to the accompanying drawings, in which:

FIGS. 1A and 1B are diagrammatic illustrations of the manner in which an oil fence according to the present invention flexes;

FIG. 2 is a diagrammatic illustration of an oil fence, according to the present invention; and

FIG. 3 is a sectional view of the oil fence of FIG. 2.

Like parts are designated by like numerals and symbols throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 2 and 3, an oil fence according to the present invention is generally represented by a reference numeral **10.** The oil fence **10** includes an elongated resilient belt member **1** and a flexible float means. The float means of this embodiment comprises two tubular float members **2**, each being connected to the resilient belt member **1** by a plurality of fastening means **3**,. The fastening means **3** may be made of a metallic strap which is bonded to the belt member **1** by any suitable known means, so as to securely fasten the float means to the belt member **1**; for instance, by adhesive, bolts and nuts, rivets, sewing, and the like.

In FIGS. 2 and 3, the elongated resilient belt member **1** of an oil fence **10** essentially consists of a single resilient sheet and a plurality of resilient straps **1a** suitably bonded to the single resilient sheet, each strap acting to sandwich one reinforcing member **11** between the strap and the single sheet of the belt member **1.** To ensure the reliable bonding of the straps **1a** to the single sheet, a part of the lower portion of single sheet of the belt member **1** is preferably folded back, so as to cover the lower end of the straps **1a**, as shown by reference symbol **1b** in FIG. **2.** Each reinforcing member **11** carries a weight member **4** secured to the lower end thereof, so that the folded back portion **1b** of the sheet of the belt member **1** acts to enclose such weight member 4. To improve the stability of the weight members 4 in the belt member 1, the folded back portions 1b may be riveted to the non-folded back portion of the single sheet of the belt member 1, as shown by reference numeral 15 in FIG. 2. Two tubular floats of this embodiment are bonded to the single sheet and the resilient strap *1a*, respectively. Suitable fastening means 3, e.g., resilient straps, may be used to ensure the bonding of the tubular floats of the float member 2 to the single sheet and the resilient strap 1a of the elongated belt member 1. Preferably, the fastening straps 3 are integrally secured to the resilient strap 1a and the float members 2 by suitable adhesive. To give additional flexibility, the length of the elongated belt member between the adjacent fastening straps 3 is selected to be longer than the corresponding length of the float member 2 between the same adjacent fastening straps, e.g., by about 10 percent. Whereby, the single sheet of the elongated belt member 1 is pre-flexed as shown in FIG. 2. Furthermore, to facilitate the handling of the elongated belt member 1, a rope 16 may be secured to the elongated belt member 1 together with the tubular float means 2, as shown in FIG. 2.

A plurality of weight members 4, e.g., metallic blocks, are embedded in the resilient belt member 4 along one longitudinal edge thereof at suitable intervals, as shown in FIG. 2. It is apparent to those skilled in the art that the longitudinal edge of the belt member 1, which includes the weight members 4 thus embedded, sinks in water, as depicted in the figure.

The resilient belt member 1 is secured to the flexible tubular float members 2 at a position intermediate between the opposite longitudinal edges thereof, so that each of the two opposite longitudinal edges can flex and extend independently of the other. Thus, the two opposite longitudinal edges of the belt member 1 can follow any change of the shape of water surface, such as changes caused by waves and turbulences. On the other hand, the reinforcing members 11 in the belt member 1 act to reinforce the sheet member in the direction perpendicular to the longitudinal direction of the belt member 1, so that as the weight members 4 sink in water, the belt member 1 tends to rise substantially upright. Thus, the belt member 1 acts to effectively hold floating drifts, e.g., oil and dust particles, against passing across the oil fence 10, by flexing the belt member 1 in line with the profile of water surface inclusive of waves and turbulences.

Each tubular float member 2 can be made of suitable water-resistant elastomer, such as rubber. Preferably, the tubular float member 2 is made of a cord-reinforced rubber hose, in which fibrous reinforcing cords are spiralled at an angle of about 55° relative to the longitudinal direction of the hose.

FIG. 1A shows a part of the belt member 1, in which a plurality of folds or wrinkles 6 are formed in the belt member 1. The folds or wrinkles 6 provide allowance to the belt. member 1 to flex in response to change of the water surface profile caused by waves and turbulence. More particularly, let it be assumed that a part of the belt member 1 is kept substantially vertically in water with the top edge held above water level while the bottom edge dipped in water and that the left-hand portion of the belt member 1 is raised by a height H relative to the right-hand portion of the belt member, for instance, due to wave in a sea, as shown in FIG. 1B. The dash-dot line in FIG. 1B represents the position of the tubular float member. In the intermediate portion between its comparatively high left-hand portion and its comparatively low right-hand portion, the belt member 1 flexes, and such intermediate portion has two parts: namely, a right-hand part includes a compressed top edge T1 and a stretched bottom edge B1, and a left-hand part including a stretched top edge T2 and a compressed bottom edge B2. Such compression and stretch of the top edge and bottom edge of the belt member 1 are exaggerated in FIG. 1B. It is an important feature of the present invention that, at any part of the belt member 1, the top edge and the bottom edge can flex in an independent fashion; for instance, the top edge portion T1 shrinks while its corresponding bottom edge portion B1 stretches, and another top edge portion T2 stretches while its corresponding bottom edge portion B2 shrinks, as shown in FIG. 1B. Such independent flexibility of the top edge and the bottom edge of the belt member 1 is indispensable in order to use the belt member 1 as an oil fence component in the aforesaid manner, because it provides for the flexing of the belt member 1 along the water surface profile. For brevity, the aforesaid flexing of the belt member 1 along the water surface profile will be referred to as the "wave-profiling flexibility" hereinafter.

In the above embodiment of the invention, the upper portion of the belt member 1 extends above the water level, which upper portion is continuously exposed to winds, waves, direct sun beams, and collision with floating drifts. Thus, the elongated belt member 1 should be made of a resilient material having a high weather-resistivity, a high abrasion resistivity, and a high corrosion resistivity to floating drifts which are expected in the service of the oil fence. A high resistivity to aging is, of course, one of the preferable properties of the elongated belt member 1 of the oil fence, according to the present invention.

On the other hand, the lower portion of the elongated belt member 1 is dipped in water, e.g., sea water, so that the belt member 1 should resist against corrosion by sea water and various chemicals dissolved in the water. In addition, the belt member 1 is required to resist against physical and chemical attack by fish and other lives in water. The belt member 1 is preferably repellent to shellfish and the like, because any deposits of comparatively heavy matters, such as shellfish, on the surface of the belt member 1 tends to reduce the buoyancy acting on it.

Thus, typical examples of the material for the elongated belt member 1 are vinyl chloride and neoplene. It is also possible to produce an elongated belt member with desirable properties by applying a suitable coating, such as shellfish-repellent paint.

In the preceding embodiments of the invention, the reinforcement of the belt member 1 in the direction perpendicular to its longitudinal direction is accomplished by embedding cords or by forming folds or bent portions including corrugations. Instead, such reinforcement of the belt member 1 can be accomplished by forming suitable ribs in it; for instance, by forming solid thick ridges or linear gas-filled cylindrical portions extending at right angles to the longitudinal direction of the belt member.

As regards the material for the tubular float member 2, one or two flexible rubber tubes reinforced by rubberized cords are used in the foregoing embodiments, but the invention is not restricted to such materials of the tubular float member. For instance, soft vinyl chloride tubes with suitable reinforcement or light synthetic resin blocks may be used for purposes of providing the buoyancy necessary for floating the elongated belt member **1**. The reinforcement of the tubular float member **2** may be made by using metallic wires.

In order to prevent the float member **2** from being punctured due to collision with foreign matters, e.g., sea drifts or floating buoys, it is desirable to provide suitable protective covering to the float member, at least at those portions which are most frequently exposed to such collisions.

To enhance the flexibility of the float member **2**, bellows tubes or coiled tubes may also be used in the oil fence according to the present invention.

In the case of an oil fence of considerably large length, a plurality of oil fence sections of the aforesaid construction may be connected with each other. The connection of the float members of adjacent sections are made by any suitable means, such as flanges, unions, and nipples. The joint portion of the tubular float members should be kept as light as possible, to avoid detrimental effects to buoyancy. If necessary, the diameter of the tubular float member may be reduced, so as to facilitate the use of a comparatively small joining means. The connection of the elongated belt members of adjacent sections can be carried out in any of various means: namely, hinging, overlapping, abutting, rivetting, insertion reinforced by wedge member, and backing plate secured by rivetting. The use of wedges or backing plates at the joint between adjacent oil fence sections enhances the reinforcement of the belt member in the direction perpendicular to the longitudinal direction of the fence.

To maximize the mechanical strength at the joint of adjacent oil fence sections, the joints of the tubular float members should be spaced from the joints of the elongated belt members, or the former joints and the latter joints may be staggered with each other in the longitudinal direction of the oil fence.

Various light and corrosion-resisting materials can be used for making reinforcing members to be secured to the belt member **1** of the oil fence; for instance, hard vinyl chloride, aluminum, and glass fiber. The reinforcing members can be formed in various shapes, e.g., bars or tubes of different cross-sectional shapes. In any case, such reinforcing members must allow the belt member to flex to a limited extent in response to the application of wave or turbulence load, so as to keep the belt member in vertical posture as far as possible.

The weight members **4** may be secured to the lower ends of the aforesaid reinforcing members. It is also possible to embed the weight members **4** in the lower edge portion of the belt member **1**.

As described in the foregoing disclosure, according to the present invention, the height of the oil fence above water level can be increased by using an elongated belt member, without causing any excessive expansion of the float member. Furthermore, oil fence of the present invention has a high wave-profiling flexibility, so as to ensure effective prevention of floating drifts, e.g., oil and dust particles, from spreading beyond an area limited by the oil fence. When a flexible tubular float means **2** including two tubular floats is used one on either side of the belt member **1**, the diameter of individual tubular floats can be reduced, so that the entire oil fence can be formed in a compact fashion. Compact oil fence can be handled with ease. Furthermore, with an oil fence having a flexible tubular float means **2** consisting of two tubular floats, puncture of one tubular float will not cause the entire loss of the buoyancy, so that the oil fence remains as suspended in the proximity of the water surface even after such partial puncture. Thus, the repair of the punctured oil fence is greatly simplified.

What is claimed is:

1. An oil fence comprising a single sheet of elongated resilient belt member having two parallel longitudinal edges, each edge being flexible in the longitudinal direction of the belt member independently of the other edge, a plurality of resilient straps bonded to said belt member at uniform intervals, a flexible reinforcing means secured to said belt member to reinforce the belt member in a direction transverse of the belt member consisting of a plurality of resilient bar members each being sandwiched between said belt member and one of said resilient straps, a pair of tubular flexible float means connected to opposing surfaces of said belt member only at the positions of said resilient straps so as to extend in the longitudinal direction of said belt member at a central position between said two edges, the length between adjacent connections between the resilient straps and the tubular flexible float means being shorter than the spacing between the adjacent resilient strap measured along the longitudinal surface of said elongated belt member, so as to uniformly slacken the belt member between the adjacent straps while holding the slackened belt between the two floats, and a weight means secured to one of said two edges so as to be distributed along the entire length of the belt member such that upon placing the oil fence in water said tubular flexible float means maintains the other of said two edges above water level and holds said belt member substantially vertically and such that the belt member is able to flex along the water surface profile.

2. An oil fence according to claim **1**, wherein said weight means consists of a plurality of metallic blocks embedded in said belt member at uniform intervals.

3. An oil fence according to claim **1**, wherein said reinforcing means consists of a plurality of flexible bars secured to said belt member at uniform intervals, and said weight means consists of a plurality of metallic blocks, each being secured to one end of said flexible bars.

4. An oil fence according to claim **1** and further comprising a handling rope secured to the belt member adjacent said tubular flexible float means.

* * * * *