

PATENT SPECIFICATION

(11)

1 277 364

DRAWINGS ATTACHED

1 277 364

- (21) Application No. 7053/70 (22) Filed 13 Feb. 1970
(31) Convention Application No. 804 957 (32) Filed 6 March 1969 in
(33) United States of America (US)
(45) Complete Specification published 14 June 1972
(51) International Classification F16L 11/12 55/00
(52) Index at acceptance
F2P 1A10 1A14 1A2 1A8 1A9 1B7



(54) IMPROVEMENTS IN MARINE HOSE WITH FLOATS

(71) We, UNIROYAL, INC., of Rockefeller Center, 1230 Avenue of the Americas, New York, State of New York, United States of America, a corporation organized and existing under the laws of the State of New Jersey, 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 floating marine hoses, and to floats for such hoses.

The use of industrial hose as a marine or a submarine hose, in the transfer of fluids such as oil between ship and shore installations, is well known. For ease of servicing of ships, it has also been found advisable to equip the hose with floats serving to keep the hose at some desired elevation in the water, e.g. at or near the surface of the water. The use of split annular or ring-type floats fitted about the hose for this purpose has heretofore been suggested, with the floats being closed by adhesives applied at the parting line surfaces or by mechanical clamping means.

In such a system, the floats may be seated loosely on the hose, or they may be firmly adhered or fastened in place by being tightly clamped to the hose or bonded thereto by adhesive. The use of loose floats entails the disadvantages that they may be damaged by their constant movement along the hose and that they may all bunch up at one spot and lead to an unbalanced or non-uniform buoyancy for the hose. Fastening the floats in place by bonding or clamping them over their entire length firmly to the hose tends to overcome these disadvantages somewhat but leads to the further problem that the firmly adhered floats restrict hose flexibility and movement over the entire float-to-hose contact area, whereby undue stresses are generated in

the inter-float regions of the hose when the same becomes bent.

According to the present invention we provide a marine hose having at least one split float fitted about the hose, the float having an inner surface of substantially circular cross-section and being secured in its closed state by external clamping means, characterised in that a solid but flexible raised shoulder structure is affixed to the exterior of the hose and extends circumferentially about the hose, and a corresponding groove is defined in the inner surface of the float to accommodate the said shoulder structure, the groove and shoulder structure coacting to ensure that the float, when secured by the clamping means, is secured in place on the hose against axial movement relative thereto.

The shoulder structures are firmly adhered to the hose, and their construction should be such as to make them sufficiently sturdy to withstand the dynamic forces to which the floats will be subjected by the water, but nevertheless sufficiently flexible so as not to impede hose flexibility. The floats are preferably made of a rubbery or resinous, rigid or semi-rigid, cellular or syntactic foam encased in an oil- and water-impervious skin or shell of a suitable rubber or resinous material modified to provide good resistance to weathering, and detrimental forms of marine life. The floats may be annular or barrel-shaped and are conveniently defined by pairs of semi-annular sections which, in addition to the aforesaid shoulder-accommodating grooves on their inner surfaces, have aligned grooves provided in their outer surfaces adapted to accommodate straps or bands for tying and clamping the sections together. An appropriate selection of the depths of the grooves on the inner surfaces of the floats relative to the heights of the shoulder structures, or of the circumferential dimensions of the

[Price 25p]

float sections may be used to ensure that the floats will be secured against both rotational and axial movement or only against axial movement.

- 5 According to a further feature of the invention a split float for a marine hose comprises two or more sections which may be secured together to present an inner surface of substantially circular cross-section
10 having a circumferentially extending groove therein capable of coacting with a raised shoulder structure on a hose to retain the float against axial movement relative to the hose, and external clamping means for
15 holding the float sections together.

The present invention will be more clearly understood from the following detailed description of specific embodiments thereof when read in conjunction with the
20 accompanying drawings, in which:

Fig. 1 is a fragmentary view of a marine hose in a body of water, the hose having floats secured thereto in accordance with the principles of the present invention;

25 Fig. 2 is a fragmentary, partly exploded, enlarged perspective view of the hose and floats shown in Fig. 1;

Fig. 3 is a sectional view taken along the line 3-3 in Fig. 2 and shows one type of
30 float non-rotatably mounted on the hose;

Fig. 4 is a sectional view taken along the line 4-4 in Fig. 3;

Figs. 5 and 6 are fragmentary sectional views, similar to Fig. 4, of somewhat modified forms of floats which are non-rotatably
35 mounted on the hose; and

Figs. 7 and 8 are fragmentary sectional views, similar to Fig. 4, floats shaped like those shown in Figs. 5 and 6 but rotatably
40 mounted on the hose.

By way of illustration, a marine hose 10 is shown in Fig. 1 as floating in a body of water with the aid of a plurality of annular, barrel-shaped floats 11 and 11a mounted
45 thereon. Such a hose is usually multi-sectional, with the various sections interconnected by end flanges 10a. In accordance with the basic principles of the present invention, at the location of each float the hose 10 is provided with a circumferential raised ridge or shoulder structure 12
50 securely fastened to its outer surface, as by bonding. Concomitantly, in the illustrated form of the invention, the various floats are constituted by respective pairs of identical, mated, generally semi-cylindrical sections, each float section being composed of a
55 respective body of rigid or semi-rigid, cellular or syntactic foam of rubbery or resinous material encased in a skin or shell of oil- and water-impervious rubbery or resinous material.

In the construction of each hose section, the end regions thereof adjacent the flanges are ordinarily considerably more reinforced,
65

i.e., composed of greater numbers of fabric plies and other structural components not necessary to set forth in detail, than the medial region of the hose section, the end regions thus having a considerably lower flexibility than the medial region. It is possible, therefore, to use at the end regions of the hose sections floats 11 having appropriately different inner surface configurations than the floats 11a used in the
75 medial regions of the hose sections.

Referring now to Figs. 2, 3 and 4, the float 11 there shown is of the type designed to be non-rotatably mounted on the end region of a hose section. The float 11,
80 accordingly, comprises two semi-annular sections 13 and 14 with cylindrically curved inner and outer surfaces and composed of respective bodies 13a and 14a of polymer foam encased in water-impervious polymer
85 shells 13b and 14b. The float sections are shown as having corresponding pairs of axially spaced narrow grooves 13c and 14c on their outer surfaces to accommodate belts or straps 15, preferably of stainless
90 steel, by means of which the sections are secured to one another in the desired barrel formation. It will be understood, of course, that longer floats may require more such grooves and straps to avoid possible
95 overloading of the individual straps in service.

The float sections further have corresponding single wide grooves or channels 14d on their inner surfaces to accommodate
100 the associated shoulder structure 12, so that when the float is closed, axial movement thereof along the hose is inhibited. Non-rotatability of the float is assured by virtue of the fact that the depth of the inner
105 grooves 13d and 14d is at most equal to, and preferably slightly less than, the height of the shoulder structure 12, so that upon tightening of the belts or straps 15 to close the float, the latter is simultaneously
110 clamped to the shoulder structure. This arrangement ensures the provision of a slight clearance between the inner float surface and the outer hose cover, or at most only a light surface to surface contact there-
115 between. Since the float is located at a region where practically no bending of the hose is likely to occur, even the slight clearance referred to is not essential, but in any case the float will not interfere with
120 such minimal bending of the hose as may occur in this limited flexibility region thereof.

To facilitate assembly and accurate alignment of the float sections, each of the
125 same is shown as being provided at one end face 13e or 14e thereof with a preferably somewhat tapered tongue 16 or 17 and at the other end face 13f or 14f with a correspondingly shaped recess 18 or 19.
130

The somewhat modified form of float 11a shown in Fig. 6 is of the type designed to be non-rotatably mounted on the medial region of a hose section. It will be readily seen that each section of the float 11a, although basically similar to the sections 13 and 14 of the float 11, differs therefrom only in that at its opposite sides its inner surface curves outwardly, as shown at 13a, while the portions of the inner surface adjacent the shoulder-accommodating groove are dimensioned to have a radius sufficient to leave a small clearance about the hose 10. The arrangement thus is such as to permit a relatively great degree of unimpeded bending movement of the hose under normal conditions. Under extreme bending conditions, of course, the laterally outermost regions of the float 11a will act as restrictions and be engaged by the hose to provide support therefor over a wider area.

Although the floats 11 and 11a are illustrated as constituted by fully closed, fully semi-cylindrical pairs of sections, it will be apparent that, subject only to the requirement of providing the desired degree of buoyancy, any non-rotatable float may be defined either by full or by multiple less than semi-cylindrical sections, of configurations otherwise essentially the same as those shown, which do not meet along the hose diameter and thus leave small gaps between the opposed faces of the sections. Merely by way of example, quarter-cylindrical sections may be used. Alternatively, each float section may be initially non-circularly curved, and in such a case the sections may be capable of being deformed, e.g. by the tightening of the straps, into the desired circular curvature or cylindrical configuration about the hose.

It will be understood from the foregoing that in use the floats are mounted on the hose only at the fixed locations determined by the respective shoulder structures, each associated set of appropriately designed float sections being fitted about the hose, with their internal grooves receiving the respective shoulder structure, and being secured to each other and to the shoulder structure by means of the encircling belts or straps. Nevertheless, since the shoulder structures are flexible, the floats, although restrained against both rotary and axial movement relative to the hose, do not unduly restrict the flexibility of the hose or its freedom of movement, as is invariably the case with one of the known floats when the same is tightly clamped or bonded over its entire inner surface to the body of the hose proper.

In lieu of floats immobilized against both axial and rotary movement, of course, it may on occasion be advantageous to use floats able to rotate relative to the hose

while still secured against axial movement herealong. Floats 11b and 11c of this type are illustrated in Figs. 7 and 8, from which it can be seen that the floats 11b and 11c closely resemble the floats 11 and 11a, respectively, differing therefrom only in that the depth of the shoulder-accommodating groove is slightly greater than the height of the shoulder structure 12. The illustration of the excess of the groove depth over the shoulder structure height is somewhat exaggerated in Figs. 7 and 8, however. In practice, a float of this type may be in light frictional contact with its associated shoulder structure, or it may have some substantial clearance thereabout. Merely by way of example, this arrangement is found to be highly advantageous where the bobbing float may come in contact with a relatively rough surface such as a barnacle-encrusted hull of a ship or a pier piling, in which case the rotatability of the float would prevent the shell from being merely dragged along such surface and thereby being lacerated severely or even perforated. The rotatability of the float would also serve to cushion the impact of a boat running against it.

The shoulder structures 12 are preferably made of a suitable natural or synthetic rubber or other elastomeric compound having the requisite resistance to oil and water, especially sea water, and affording in the finished form the desired strength and flexibility characteristics. If necessary, they may have incorporated therein internal reinforcement means in the form of filamentary material, i.e. filaments or fabrics, of natural or synthetic textile materials, e.g. cotton, rayon, nylon, polyester and the like, or of such materials as glass fiber and metallic wire. In any case, the shoulder structures must be wide enough to be able to withstand the possibly very large dynamic forces to which they may be subjected when in use. Obviously, where the hose is to be laid in a relatively calm body of water, the shoulder structures may be somewhat narrower than they would have to be in, say, an ocean. The shoulder structures may be provided in the form of full thickness slabs or sheets of the reinforced or non-reinforced rubber or other elastomer, or they may be built up of multiple layers of thin sheets or strips, and although they will generally be of rectangular cross-section, other profiles may be used to fit special requirements.

The floats are preferably made of any of various commercially available synthetic resinous and rubbery polymers in foam form. For the float shells we prefer to use polyethylene, but such other materials as synthetic rubbers (e.g. neoprene), polypropylene, polyurethane, polyester, ethylene vinyl

acetate, polyvinyl chloride, epoxy resin and the like, having either intrinsically or through additives the requisite resistance to weathering, oil, water, minerals and harmful marine life, may also be used. Where necessary, a fiber or fabric reinforcement of glass or natural or synthetic textile filaments may be incorporated in the polymer of which the shell is made. For any given material, the shell thickness will, of course, be a function of the float size and service conditions to be encountered, but thickness in the range of about 3/16 inch to about 1/2 inch are deemed at the present time to be adequate for most applications. For the float bodies we prefer to use, a chemically blown, microcellular, rigid or semi-rigid polyurethane foam, but similar foams of polyvinyl chloride, polyolefins, natural or synthetic rubber latex, and other suitable polymers and copolymers may also be used. Alternatively, syntactic foams composed of any of such polymeric materials admixed with sufficient quantities of hollow microspheres of glass, phenolic resins or the like to produce the desired low specific gravity may be used. Where a cellular rather than a syntactic foam is used, it is further preferred that the foam be a primarily closed-cell structure to minimize the possibility of water and oil absorption should the shell be punctured in case of accident or through an act of sabotage, with a minor proportion of open-cell structure, however, to improve its service life.

The float construction may also differ somewhat from those so far described, in that, as illustrated in Fig. 5, the sections of the float 11' may, if desired, be constituted of merely hollow polymer shells. Such hollow float sections may, of course, have either the cylindrical inner surface contours shown, for use on hose end sections, or they may be outwardly curved in the marginal regions of their inner surfaces, in the manner shown in Figs. 6 and 8, for use on medial hose sections.

Although various ways of manufacturing the float sections may be utilized, we prefer to form the shells by rotational molding. Where such a shell is also intended to cover a foam body, it is then a simple matter to make a small opening in the shell and to pour an appropriate quantity of the usually liquid unblown foam composition into the shell, where it will blow and cure in situ, the opening, of course, being securely reclosed. Also, all sections of each float may be formed in the same mold, assembly then merely necessitating the inversion of adjacent sections relative to each other.

WHAT WE CLAIM IS:—

1. A marine hose having at least one split float fitted about the hose, the float having an inner surface of substantially

circular cross-section and being secured in its closed state by external clamping means, characterised in that a solid but flexible raised shoulder structure is affixed to the exterior of the hose and extends circumferentially about the hose, and a corresponding groove is defined in the inner surface of the float to accommodate the said shoulder structure, the groove and shoulder structure coacting to ensure that the float, when secured by the clamping means, is secured in place on the hose against axial movement relative thereto.

2. A hose according to claim 1 in which the shoulder structure is a band or belt of elastomeric material.

3. A hose according to claim 1 in which the shoulder structure is a band or belt of elastomeric material reinforced by filamentary material.

4. A hose according to any one of the preceding claims in which a plurality of circumferential grooves are formed in the outer surface of each float to accommodate respective encircling straps constituting the clamping means.

5. A hose according to any one of the preceding claims in which the diameter of the inner surface of the float increases gradually in the axially outer marginal regions of the inner surface of the float.

6. A hose according to any one of the preceding claims in which the depth of the groove is slightly less than the radial height of the shoulder structure, so that the float, when closed, is tightly clamped to the shoulder structure and is secured against both rotary and axial movement relative to the hose.

7. A hose according to any one of claims 1 to 5 in which the depth of the groove is slightly greater than the height of the shoulder structure, so that when the float is closed, there is only light contact between the shoulder structure and the interior surface of the groove so that the float may be rotated while remaining secured against axial movement relative to said hose.

8. A hose according to any one of the preceding claims in which the float comprises an inner core structure of rigid or semi-rigid, microcellular, primarily closed-cell, chemically blown polymer foam.

9. A hose according to any one of claims 1 to 7 in which the float comprises an inner core structure of rigid or semi-rigid syntactic polymer foam.

10. A hose according to any of the preceding claims in which each segment of the float comprises a liquid-imperious hollow shell of polymeric material.

11. A marine hose fitted with at least one split float substantially as herein described with reference to Figures 1 to 4 and 6, or to Figures 1 and 2 as modified by Figures 5, 12

acetate, polyvinyl chloride, epoxy resin and the like, having either intrinsically or through additives the requisite resistance to weathering, oil, water, minerals and harmful marine life, may also be used. Where necessary, a fiber or fabric reinforcement of glass or natural or synthetic textile filaments may be incorporated in the polymer of which the shell is made. For any given material, the shell thickness will, of course, be a function of the float size and service conditions to be encountered, but thickness in the range of about 3/16 inch to about 1/2 inch are deemed at the present time to be adequate for most applications. For the float bodies we prefer to use, a chemically blown, microcellular, rigid or semi-rigid polyurethane foam, but similar foams of polyvinyl chloride, polyolefins, natural or synthetic rubber latex, and other suitable polymers and copolymers may also be used. Alternatively, syntactic foams composed of any of such polymeric materials admixed with sufficient quantities of hollow microspheres of glass, phenolic resins or the like to produce the desired low specific gravity may be used. Where a cellular rather than a syntactic foam is used, it is further preferred that the foam be a primarily closed-cell structure to minimize the possibility of water and oil absorption should the shell be punctured in case of accident or through an act of sabotage, with a minor proportion of open-cell structure, however, to improve its service life.

The float construction may also differ somewhat from those so far described, in that, as illustrated in Fig. 5, the sections of the float 11' may, if desired, be constituted of merely hollow polymer shells. Such hollow float sections may, of course, have either the cylindrical inner surface contours shown, for use on hose end sections, or they may be outwardly curved in the marginal regions of their inner surfaces, in the manner shown in Figs. 6 and 8, for use on medial hose sections.

Although various ways of manufacturing the float sections may be utilized, we prefer to form the shells by rotational molding. Where such a shell is also intended to cover a foam body, it is then a simple matter to make a small opening in the shell and to pour an appropriate quantity of the usually liquid unblown foam composition into the shell, where it will blow and cure in situ, the opening, of course, being securely reclosed. Also, all sections of each float may be formed in the same mold, assembly then merely necessitating the inversion of adjacent sections relative to each other.

WHAT WE CLAIM IS:—

1. A marine hose having at least one split float fitted about the hose, the float having an inner surface of substantially

circular cross-section and being secured in its closed state by external clamping means, characterised in that a solid but flexible raised shoulder structure is affixed to the exterior of the hose and extends circumferentially about the hose, and a corresponding groove is defined in the inner surface of the float to accommodate the said shoulder structure, the groove and shoulder structure coacting to ensure that the float, when secured by the clamping means, is secured in place on the hose against axial movement relative thereto.

2. A hose according to claim 1 in which the shoulder structure is a band or belt of elastomeric material.

3. A hose according to claim 1 in which the shoulder structure is a band or belt of elastomeric material reinforced by filamentary material.

4. A hose according to any one of the preceding claims in which a plurality of circumferential grooves are formed in the outer surface of each float to accommodate respective encircling straps constituting the clamping means.

5. A hose according to any one of the preceding claims in which the diameter of the inner surface of the float increases gradually in the axially outer marginal regions of the inner surface of the float.

6. A hose according to any one of the preceding claims in which the depth of the groove is slightly less than the radial height of the shoulder structure, so that the float, when closed, is tightly clamped to the shoulder structure and is secured against both rotary and axial movement relative to the hose.

7. A hose according to any one of claims 1 to 5 in which the depth of the groove is slightly greater than the height of the shoulder structure, so that when the float is closed, there is only light contact between the shoulder structure and the interior surface of the groove so that the float may be rotated while remaining secured against axial movement relative to said hose.

8. A hose according to any one of the preceding claims in which the float comprises an inner core structure of rigid or semi-rigid, microcellular, primarily closed-cell, chemically blown polymer foam.

9. A hose according to any one of claims 1 to 7 in which the float comprises an inner core structure of rigid or semi-rigid syntactic polymer foam.

10. A hose according to any of the preceding claims in which each segment of the float comprises a liquid-imperious hollow shell of polymeric material.

11. A marine hose fitted with at least one split float substantially as herein described with reference to Figures 1 to 4 and 6, or to Figures 1 and 2 as modified by Figures 5, 120



7 or 8 of the accompanying drawings.

12. A split float comprising two or more sections which may be secured together to present an inner surface of substantially circular cross-section having a circumferentially extending groove therein capable of coacting with a raised shoulder structure on a hose to retain the float against axial movement relative to the hose, and external clamping means for holding the float sections together.

13. A float according to claim 12 in which the diameter of the inner surface of the float increases gradually in the axially

outer marginal regions of the inner surface 15 of the float.

14. A split float for a marine hose, the float being substantially as herein described and as illustrated in Figures 3 and 4 or in any one of Figures 5 to 8 of the accompanying drawings.

URQUHART-DYKES & LORD.

Columbia House, 69 Aldwych,
London, W.C.2.

and

12 South Parade, Leeds, 1, Yorkshire.
Chartered Patent Agents.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1972.
Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY from which copies may be obtained.



* C L M S *