

FIG. 3

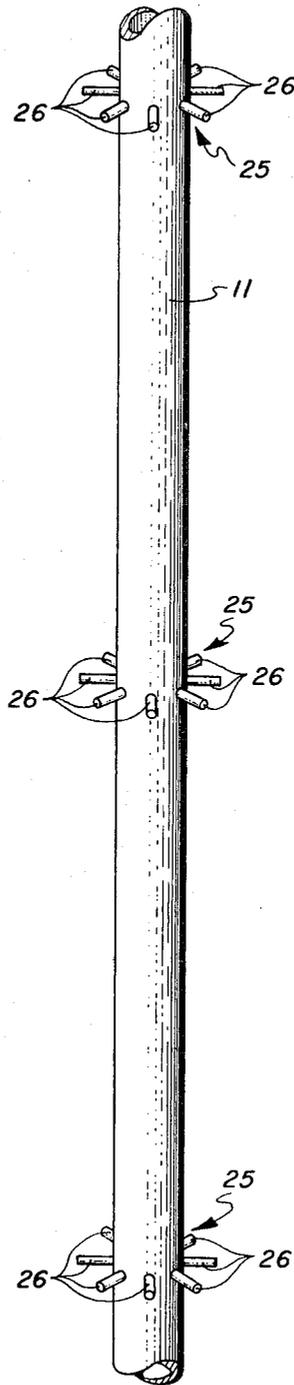


FIG. 2

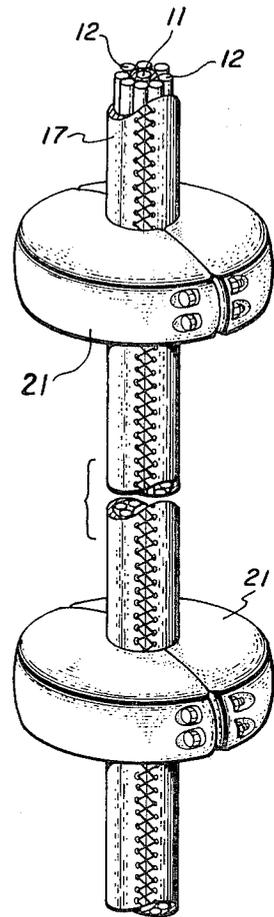


FIG. 1

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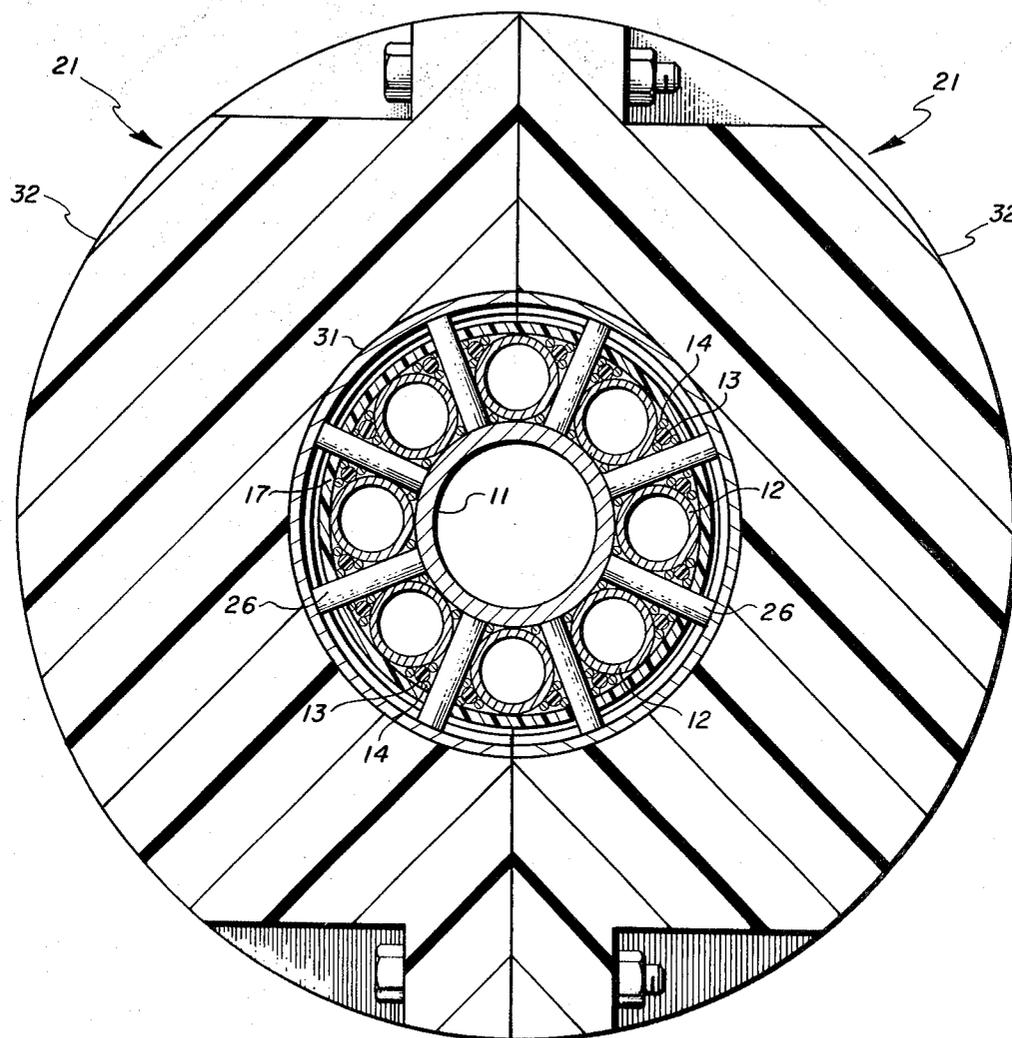


FIG. 4

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MULTICONDUIT BUOYED UNDERWATER LINE

This invention relates to underwater lines and more particularly to flexible lines which may, for example, function as risers.

In my U.S. Pat. application, Ser. No. 721,014 filed on Aug. 12, 1968, now U.S. Pat. No. 3,526,086 and assigned to the same assignee as this patent application there is disclosed an underwater line wherein a plurality of conduits are layed in a helical configuration around a central core member which is capable of withstanding a relatively high tensile load. Therefore, when the underwater line is used as a riser, the top end of this core member is tied to a buoy to support all weight of the riser. This arrangement produces relatively large stresses in the core member near the buoy, especially in very long risers. Of course the stress decreases linearly with depth. Therefore, the core member is understressed at the lower end making inefficient use of the available material.

Therefore, an object of this invention is to produce a riser wherein efficient use of the material is made.

Another object of this invention is to provide means in a riser to periodically support the weight thereof to prevent the development of relatively large stresses.

These and other objects and features of advantages of the present invention will become more apparent from reading the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1 shows a portion of the complete riser incorporating the features of this invention;

FIG. 2 shows the central core member before wrapped with conduits and filler material;

FIG. 3 shows the riser with various items removed to show the novel features thereof; and

FIG. 4 is a section of the riser taken at one of the buoys, and at line 4-4.

Referring to the drawings and to FIGS. 2 and 3 in particular, there is shown the preferred embodiment of the novel riser which includes a core member preferably in the form of a metallic pipe or tube 11. Helically wound around the tube are a plurality of conduits or metallic tubes 12, for example, eight. Between the tubes 11 and 12 (FIG. 4) is disposed filler material, for example, plastic threads 13 and 14 of various diameters so that substantially all the spacing between the tubes is filled and the tubes are prevented from rubbing against each other whenever the riser flexes due to sea currents. A suitable cover, for example a plastic sheet 17, is placed around the tubes 12 and plastic threads 13 and 14 and secured by suitable means. In addition buoys 21 are axially spaced along the riser to provide a slight amount of positive buoyancy to the riser. Since the buoys have positive buoyancy and tend to rise and since the tubes 11 and 12 have negative buoyancy and tend to sink, one feature of this invention is to provide means for transferring the shear forces therebetween.

As shown in FIG. 2, the shear force transferring means includes spoke groups spaced axially along the core member 11. Each group contains spokes 26 that are arranged evenly around a circle to extend radially. The spokes 26 can be, for example, spot welded to the core member 11 for structural strength. In addition the spokes in one group are preferably aligned with the respective spokes on each of the other groups. The conduits 12 lie in the sector formed by two spokes 26 as shown in FIG. 4. Since the conduits 12 are helically wound around the core member 11, each conduit 12 advances preferably one sector in a clockwise direction as it winds around the core member as shown in FIG. 3. The plastic threads 13 and 14 preferably twist in the same manner that the conduits twist. Since the groups 25 are axially spaced along the riser, the plastic sheet 17 preferably extends from one group 25 to the next one. The sheet 17 can be fastened in place by, for example, stitches 18. As seen in FIG. 3 the spokes 26 have a length so that they protrude beyond the plastic sheet 17. The buoys 21, which are toroidal in shape, are made into two similar sections with a semicircular channel-shaped metallic stiffener 31 disposed on the inner curved

edge thereof. Suitable buoyant material 32 is molded onto the stiffeners 31. Therefore when both buoy sections are bolted in place as shown in FIG. 4 the ends of the spokes are disposed within the channel-shaped stiffeners 31 thereby preventing the buoys 21 from moving axially along the risers.

With the present disclosure in view, modifications thereof would appear to those skilled in the art. Accordingly, the invention is not limited to the illustrated embodiment but includes all such modifications and variations within the scope of the invention as defined in the appended claims.

What I claim is:

1. A riser comprising:

a core member adapted for extending substantially vertically in the ocean,
a plurality of conduits layed along side said core member, means for bundling said conduits and core member together,
a plurality of spokes extending from said core member and through said bundling means, and
at least one buoy fixed to said riser and engaging at least one of said spokes so that said buoy is prevented from moving along said riser.

2. The riser of claim 1 wherein:

said spokes are disposed in at least one group and lying in a circle around said core member, and
said buoy is toroidal in shape and made of two similar sections,
both of said sections are clamped around said risers and engage all the spokes in one of said groups.

3. The riser of claim 2 wherein:

said groups are spaced along said riser and said conduits lie in the sectors formed by two spokes.

4. The riser of claim 1 wherein:

said conduits are helically wound around said core member, and
filler material is placed between said conduits and core member to prevent rubbing therebetween when said riser flexes.

5. The riser of claim 1 wherein:

said buoy has a channel-shaped stiffener disposed at the inner curved periphery of each of said sections, and the ends of said spokes are disposed within said channel-shaped stiffener when said buoy is clamped to said riser.

6. The riser of claim 2 wherein:

said conduits are helically wound around said core member, and
filler material is placed between said conduits and core member to prevent rubbing therebetween when said riser flexes.

7. The riser of claim 3 wherein:

said conduits are helically wound around said core member, and
filler material is placed between said conduits and core member to prevent rubbing therebetween when said riser flexes.

8. The riser of claim 3 wherein:

said buoy has a channel-shaped stiffener disposed at the inner curved periphery of each of said sections, and the ends of said spokes are disposed within said channel-shaped stiffener when said buoy is clamped to said riser.

9. The riser of claim 4 wherein

said buoy has a channel-shaped stiffener disposed at the inner curved periphery of each of said sections, and the ends of said spokes are disposed within said channel-shaped stiffener when said buoy is clamped to said riser.

10. The riser of claim 6 wherein:

said buoy has a channel-shaped stiffener disposed at the inner curved periphery of each of said sections, and the ends of said spokes are disposed within said channel-shaped stiffener when said buoy is clamped to said riser.

11. The riser of claim 7 wherein said buoy has a channel-shaped stiffener disposed at the inner curved periphery of each of said sections, and

the ends of said spokes are disposed within said channel-shaped stiffener when said buoy is clamped to said riser.