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Inventor Paul E. Moody

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1 Navy Case No. 76772

2
3 A BLADDER ASSEMBLY FOR RETAINING
4 FLUID UNDER PRESSURE

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6 STATEMENT OF GOVERNMENT INTEREST

7 The invention described herein may be manufactured and used
8 by or for the Government of the United States of America for
9 governmental purposes without payment of any royalties thereon or
10 therefor.

11
12 BACKGROUND OF THE INVENTION

13 (1) Field of the Invention

14 The invention relates to submarine launch systems for
15 torpedoes, and the like, and is directed more particularly to a
16 bladder assembly for retaining and discharging water under
17 pressure.

18 (2) Description of the Prior Art

19 Launch systems utilizing elastomeric bladders or diaphragms
20 are known. Such systems provide advantages of low cost, minimal
21 moving hardware parts, and minimal signature, or noise,
22 associated with a launch.

23 Two types of elastomeric members have been proposed. A
24 first type constitutes a generally spherical bladder. Sea water
25 is pumped into the bladder, causing the bladder to expand. When
26 the pressurized sea water is ported to the aft end of a launch

1 tube, the elastomeric bladder forces the water to eject a
2 torpedo, or other body, out of the launch tube as the bladder
3 returns to its unstretched configuration. The launch is effected
4 by use of only one moving mechanical component in the system,
5 namely a firing valve which ports the pressurized sea water to
6 the launch tube aft end.

7 A second type of elastomeric member constitutes a diaphragm
8 which in an unextended state is essentially planar in
9 configuration. The diaphragm is distended by pumping sea water
10 on one side thereof. When the pressurized sea water is ported to
11 the launch tube, the diaphragm forces water to eject the torpedo,
12 or the like, out of the launch tube.

13 The first type of elastomeric member is disclosed in U.S.
14 Patent No. 4,848,210, issued July 18, 1989, in the name of
15 Laurent C. Bissonnette, wherein an elastomeric bladder of
16 generally spherical configuration is shown in a projectile launch
17 system. In U.S. Patent No. 5,200,572, issued April 6, 1993, in
18 the name of Laurent C. Bissonnette, et al, there is disclosed a
19 variation in which the bladder is generally ellipsoidal in
20 configuration. The second type of elastomeric member is
21 disclosed in U.S. Patent No. 5,231,241, issued July 27, 1993, in
22 the name of Laurent C. Bissonnette, wherein an elastomeric
23 diaphragm is shown in a projectile launch system.

24 The spherical and ellipsoidal bladders are expensive to
25 manufacture and require a relatively large volume of space,
26 always at a premium in submarine vessels. The diaphragm may be

1 manufactured relatively inexpensively and requires substantially
2 less space than the spherical bladder. However, the connection
3 of the periphery of the diaphragm to a foundation places bending
4 stresses on the diaphragm and on the foundation. It is difficult
5 to predict how many cycles of operation a diaphragm can safely
6 withstand.

7 It is, therefore, desirable to have available an elastomeric
8 member requiring less space than the spherical or ellipsoidal
9 bladder, and having a safe and secure means by which the member
10 is fixed to its foundation.

11 12 SUMMARY OF THE INVENTION

13 Accordingly, an object of the invention is to provide in an
14 elastomeric launch system, an elastomeric member which requires
15 less space than a spherical or ellipsoidal member, and which is
16 adapted for safe and secure attachment to a foundation.

17 With the above and other objects in view, as will
18 hereinafter appear, a feature of the present invention is the
19 provision of a bladder assembly for retaining and discharging
20 water under pressure to force a body from a launch tube. The
21 assembly includes a first expandable elastomeric bladder member
22 having a first annularly-shaped base end for anchoring to a
23 foundation and defining a first open fixed end. A first dome-
24 shaped wall portion upstands from the first fixed end and defines
25 a first closed movable end. A second expandable elastomeric
26 bladder member is disposed within, and is contiguous to, the

1 first bladder member, and has a second annularly-shaped base end
2 for anchoring to the foundation and defining a second open fixed
3 end and a second dome-shaped wall portion upstanding from the
4 second open fixed end and defining a second closed end. The
5 first and second bladder members and the foundation are provided
6 with means for fixing the first and second bladder base ends to
7 the foundation.

8 In preferred embodiments, a hypothetical extension of the
9 curvature of the closed end of the dome-shaped first bladder
10 member, in a non-expanded state, defines an arc which intersects
11 a plane defined by the open fixed end of the first member, the
12 distance from the center of the first bladder member fixed end to
13 the intersection substantially exceeding the distance from the
14 center of the fixed end to the apex of the arc, and substantially
15 exceeding the distance from the center of the fixed end to an
16 outboard side of the first bladder member in the aforesaid plane
17 such that the bladder is of less height, or "flatter" than a
18 spherical or ellipsoidal bladder.

19 In a preferred embodiment, the means for fixing the bladder
20 base ends to the foundation includes rigid rings embedded in the
21 first and second bladder members proximate the first and second
22 base ends, the base ends being provided with holes aligned with
23 threaded holes in the rings, and rigid flange portions of the
24 foundation having holes therein aligned with the base end holes
25 and adapted to receive fasteners for engagement with the rings
26 for the fixing of the base ends to the foundation.

1 FIG. 2 is a bottom plan view of the bladder member portion
2 shown in FIG. 1;

3 FIG. 3 is a centerline sectional view of a portion of an
4 alternative bladder member and another form of anchoring means
5 therefor, illustrative of an alternative embodiment of the
6 invention; and

7 FIG. 4 is a bottom plan view of the bladder member portion
8 shown in FIG. 3.

9
10 DESCRIPTION OF THE PREFERRED EMBODIMENTS

11 Referring to FIG. 1, it will be seen that the illustrative
12 assembly includes a first expandable elastomeric member 10 having
13 a first annularly-shaped base end 12 anchored to a foundation 14.
14 The first base end 12 defines a first open fixed end 16. The
15 first elastomeric member 10 further is provided with a first
16 dome-shaped wall portion 18 upstanding from the first fixed end
17 16 and defining a first closed movable end 20.

18 The assembly further includes a second expendable
19 elastomeric bladder member 30 disposed within and contiguous to
20 the first bladder member 10. The second bladder member 30 is
21 provided with a second annularly-shaped base end 32 for anchoring
22 to the foundation 14, and defines a second open fixed end 36.
23 The second bladder member 30 further is provided with a second
24 dome-shaped wall portion 38 upstanding from the second open fixed
25 end 36 and defining a second closed movable end 40.

1 The first and second bladder members 10, 30 and the
2 foundation 14 are provided with means 50 for fixing the first and
3 second base ends 12, 32 to the foundation 14. Referring to FIGS.
4 1 and 2, it will be seen that a preferred embodiment of the means
5 50 for fixing the base ends 12, 32 of the bladder members 10, 30
6 to the foundation 14 include rigid rings 60 embedded in the first
7 and second bladder members 10, 30 in the bladder member base ends
8 12, 32. In each of the bladder members 10, 30, the rigid rings 60
9 preferably are of metal and include for each bladder member a
10 large ring 62 intermittently mechanically attached to a smaller
11 ring 64 by a spacer 66. The large and small rings 62, 64 are
12 provided with internal threads adapted to receive fasteners, such
13 as bolts, inserted through holes 68 provided in the bladder ends
14 16, 36.

15 The means 50 for fixing the bladder members 10, 30 to the
16 foundation 14 further comprises the provision of bores 70 in the
17 foundation 14 aligned with the holes 68 for receiving the
18 aforementioned fasteners for threaded engagement of the fasteners
19 with the rings 62, 64 to secure the bladder members 10, 30 to the
20 foundation 14.

21 The foundation 14 comprises a rigid cylindrically shaped
22 wall 80 having a rigid flange portion 82 extending inwardly
23 therefrom. The bores 70 extend through the flange portion 82 to
24 enable the aforementioned fasteners to anchor the bladder members
25 10, 30 within the confines of the wall 80.

1 Referring to FIGS. 3 and 4, it will be seen that an
2 alternative means 50 for fixing the bladder members 10, 30 to the
3 foundation 14 comprises the provision of a radial cross section
4 configuration 84 of the first and second bladder members 10, 30
5 together which is largest at the base ends 12, 32 and tapers
6 therefrom to a smaller cross section 86 removed from the base
7 ends.

8 In the embodiment shown in FIG. 3, the foundation 14 is
9 provided with an annular groove 90 configured complementarily to
10 the bladder base ends 12, 32 together, to retain the first and
11 second bladders 10, 30 in the groove 90. The foundation
12 comprises the rigid cylindrical wall 80, the flange portion 82
13 extending inwardly from the cylindrical wall 80, and a collar
14 portion 92 upstanding from the flange portion 82 generally
15 concentrically of the cylindrical wall 80. A base portion 94 of
16 the groove 90 is defined by the cylindrical wall 80, the collar
17 portion 92, and the flange portion 82.

18 The flange portion 82 may be integral with the cylindrical
19 wall 80, or may be fixed to the wall 80 by an annular key 96
20 lodged in a groove 98 in the wall 80 and secured to the flange
21 portion 82 by a fastener, such as a bolt 100, as shown in FIG. 3.
22 The fasteners for disposition in the bores 70 (FIG. 1) may also
23 be bolts 100 of the type shown in FIG. 3.

24 The assembly illustrated in FIG. 3 further includes a
25 retaining ring 102 extending inwardly from the cylindrical wall
26 80. An inward-most extent 104 of the retaining ring 102 is

1 disposed proximate a free end 106 of the collar portion 92. An
2 inboard surface 108 of the retaining ring 102 is complementary to
3 an outboard surface 110 of the first bladder member 10, and an
4 outboard surface 112 of the collar portion 92 is complementary to
5 an inboard surface 114 of the second bladder member 30. The
6 retaining ring 102 may be fastened on the wall as by bolts 103
7 shown in FIG. 3 to allow assembly and replacement of the
8 bladders.

9 The first and second bladder members 10, 30 are bonded
10 together by a sealant bonding material in areas 116 where the
11 bladder members base ends 12, 32 abut each other, to insure that
12 the bladder members 10, 30 act as a unit and that no fluid gets
13 between the bladder members. The sealant areas 116 are shown in
14 FIG. 1, but preferably are utilized also in the embodiment shown
15 in FIG. 3.

16 The collar free end 106 and a ridge 118 defined by the
17 inward-most extent 104 of the retaining ring 102 are rounded such
18 that expansion of the bladder members 10, 30 does not press the
19 bladder members against a sharp edge.

20 In FIG. 3, there is shown in phantom a diagrammatic
21 extension C of the curvature of the first closed end 20 of the
22 bladder member 10 in a non-expanded state. The hypothetical
23 extension C defines an arc A which intersects at T a plane P
24 defined by the first fixed end 16 of the first bladder member 10.
25 The distance R1 from the center Y of the first fixed end 16 to
26 the intersection T substantially exceeds the distance R2 from the

1 center Y of the first fixed end 16 to the apex X of the arc A.
2 Further, the distance R1 substantially exceeds the distance from
3 the center Y of the first fixed end 16 to an outboard side of the
4 first bladder member 10 in the plane of the first fixed end 16.
5 Thus, the first bladder member 10, as well as the second bladder
6 member 30, which is contiguous to the first bladder member 10,
7 are of a configuration substantially "flatter" than the spherical
8 and ellipsoidal types of bladders.

9 While the description immediately above of the configuration
10 of the dome-shaped bladder members is undertaken with reference
11 to FIG. 3, it will be apparent that the description applies
12 equally to the embodiment shown in FIG. 1.

13 There is thus provided a bladder assembly requiring less
14 space than a spherical or ellipsoidal bladder, and in which
15 bending stresses applied to the bladder and to the foundation at
16 the juncture of the bladder and foundation are greatly reduced.
17 In addition, there is provided a bladder having increased
18 reliability. Because the failure of one bladder member does not
19 result in the entire assembly becoming inoperable, the chances of
20 launch failure are substantially reduced. Further, inasmuch as
21 the thickness of either of the bladder members is substantially
22 less than the thickness of the prior art single bladder, molding
23 of the bladder members is less complex and less expensive.

24 It is to be understood that the present invention is by no
25 means limited to the particular constructions herein disclosed

1 and/or shown in the drawings, but also comprises any
2 modifications or equivalents.

1 Navy Case No. 76772

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3 A BLADDER ASSEMBLY FOR RETAINING

4 FLUID UNDER PRESSURE

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6 ABSTRACT OF THE DISCLOSURE

7 A bladder assembly for retaining and discharging a fluid
8 under pressure includes a first expandable elastomeric bladder
9 member having a first annularly-shaped base end for anchoring to
10 a foundation and defining a first open fixed end, and a first
11 dome-shaped wall portion upstanding from the first fixed end and
12 defining a first closed movable end. The assembly further
13 includes a second expandable elastomeric bladder member disposed
14 within and contiguous to the first bladder member, and having a
15 second annularly-shaped base end for anchoring to the foundation
16 and defining a second open fixed end, and a second dome-shaped
17 wall portion upstanding from the second open fixed end and
18 defining a second closed movable end. The first and second
19 bladder members and the foundation are provided with means for
20 fixing the first and second base ends to the foundation.

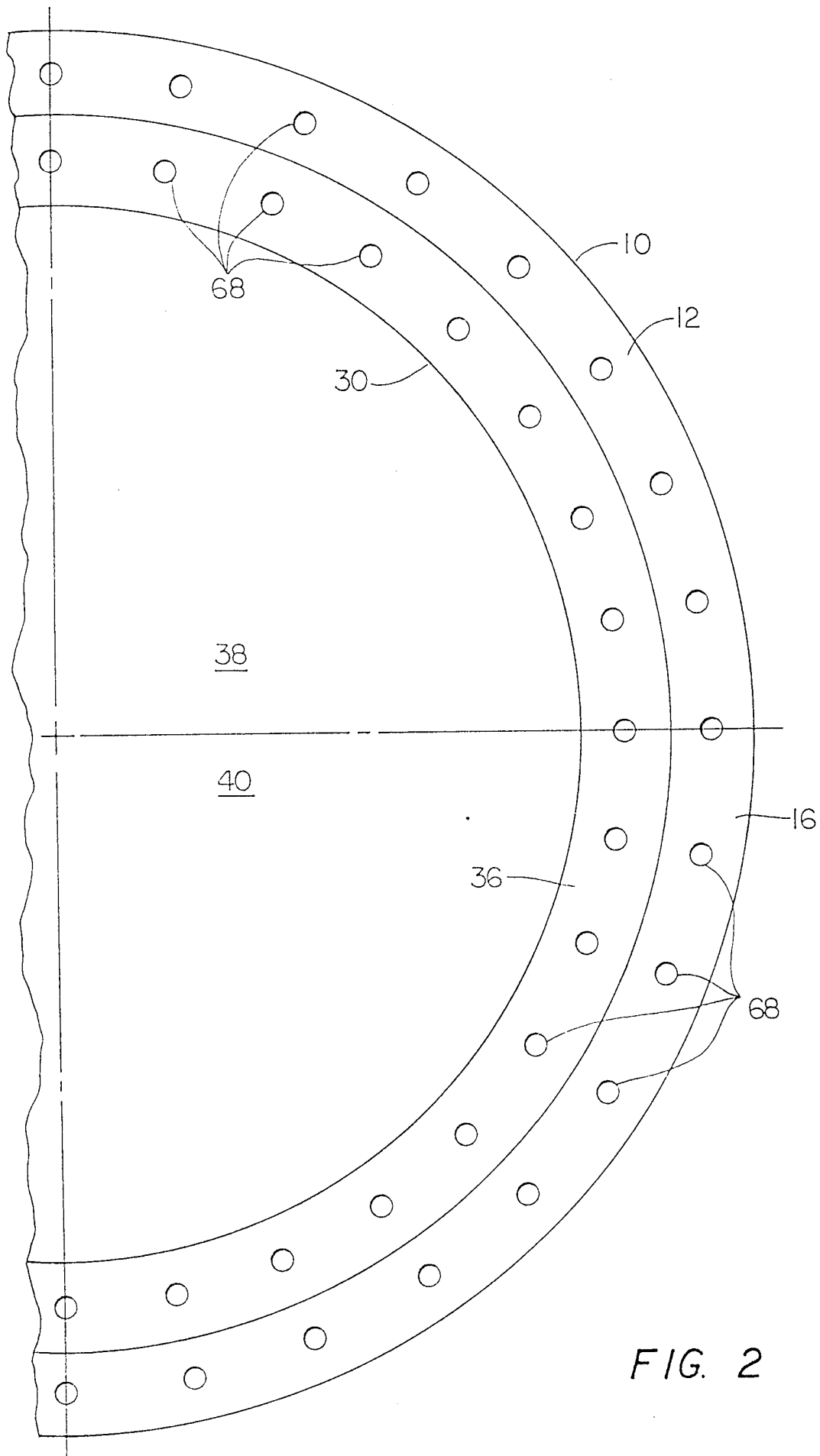


FIG. 2

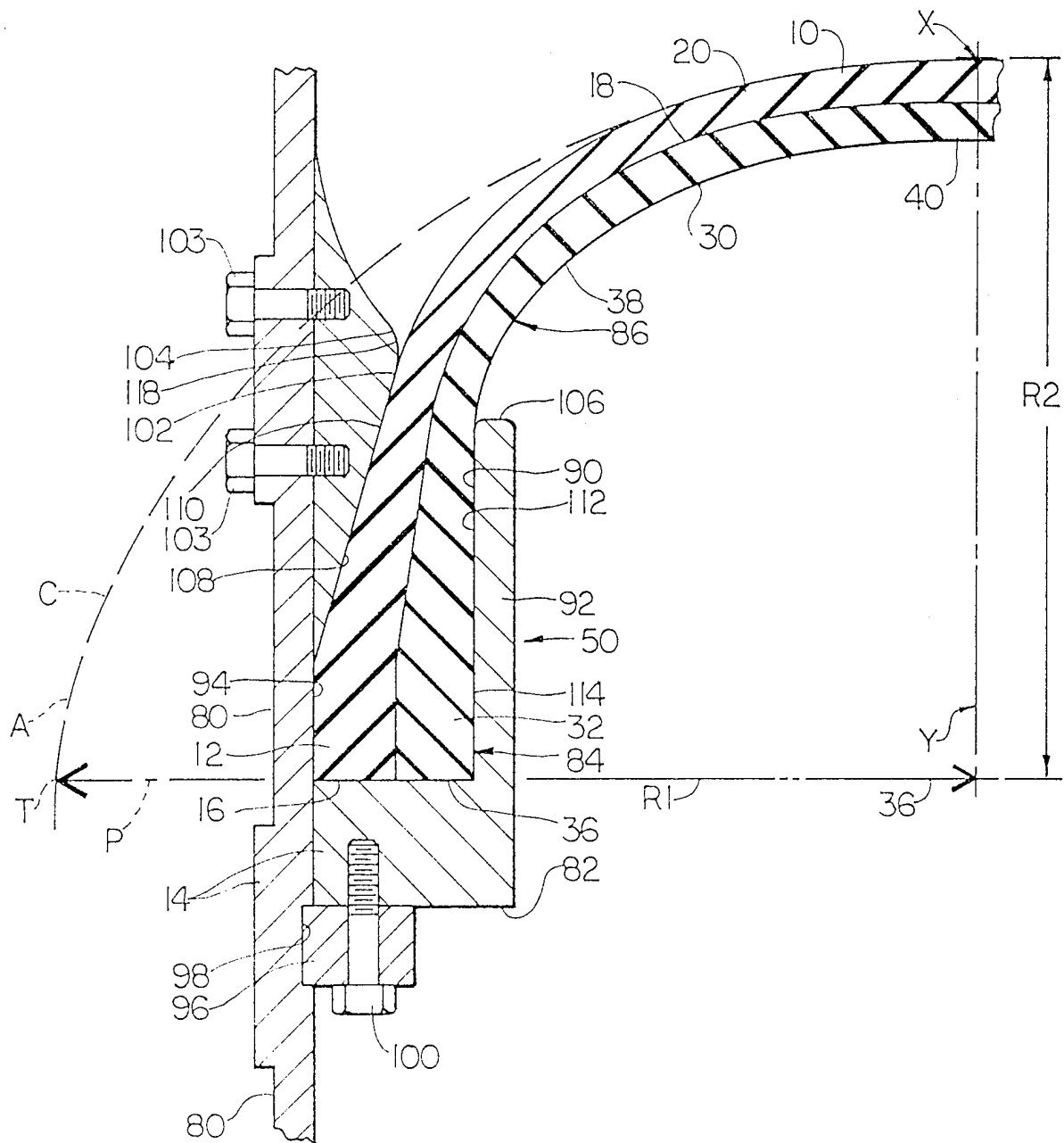


FIG. 3

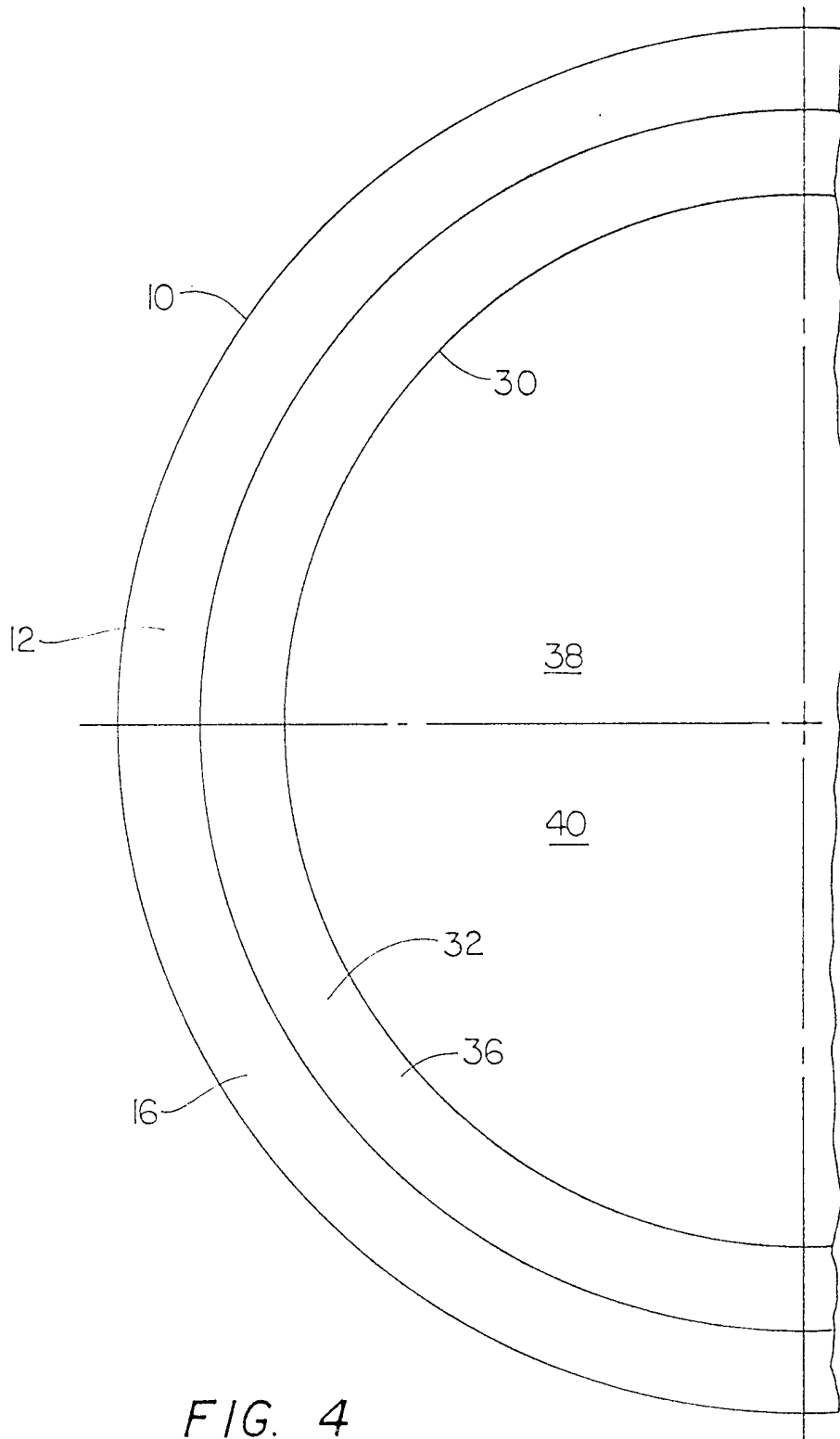


FIG. 4