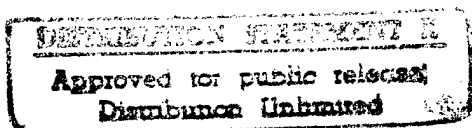


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Inventor                     Daniel W. French

NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH  
DEPARTMENT OF THE NAVY  
CODE OCCC  
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2  
3 FLUID PRESSURE MEASURING DEVICE INTERFACE  
4

5  
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 the payment of any royalties  
10 thereon or therefore.  
11

12 BACKGROUND OF THE INVENTION

13 (1) Field Of The Invention

14 This invention relates to a measuring device and more  
15 particularly, to an accurate fluid pressure measuring device  
16 interface for allowing the pressure of a fluid being measured to  
17 be transferred to a deformable, fluid filled fluid pressure  
18 transfer container.

19 (2) Description of the Prior Art

20 Data gathering equipment and instruments used in underwater  
21 or ocean environments must be sturdy enough to withstand the  
22 rough conditions in the ocean. Equipment, instruments and  
23 unmanned vehicles must be able to withstand harsh environments  
24 and must be reliable since accessibility and repairs are  
25 especially difficult.

26 One such instrument that is typically used is a pressure or  
27 wave-tide recorder that is mounted on an underwater platform.

1 The device measures the water pressure above the unit in real  
2 time. It is sensitive enough to detect changes in depth based on  
3 wave actions and tides.

4 Mounting such a wave-tide recorder instrument on an  
5 underwater platform is problematic. Prior art underwater  
6 platforms or vehicles with submersible equipment either put the  
7 equipment in a large free flood chamber inside the platform, or  
8 external to the platform. Mounted internally, a large free flood  
9 chamber sharply reduces the buoyancy of an underwater vehicle due  
10 to the large amount of water which is allowed to flood the  
11 internal area of the vehicle, and requires large structural  
12 bulkheads and multiple cable and plumbing penetrators and  
13 feedthroughs. Additionally, an underwater vehicle with a large  
14 free flood chamber is very unstable once flooded. Externally  
15 mounted equipment increases drag and hydrodynamic noise.

16 There are many other applications which would benefit from a  
17 reliable fluid pressure measuring device interface including, for  
18 example, measurement of hot, cold or caustic fluids such as  
19 underground crude oil, acid baths and other free and contained  
20 fluids.

21 Accordingly, what is needed is a fluid medium pressure  
22 measuring device interface which may be internally mounted to a  
23 unmanned undersea vehicle or other platform or device submerged  
24 in a fluid medium, and which does not require a large amount of  
25 fluid to be introduced into a chamber inside the vehicle or

1 platform which changes the buoyancy and stability parameters of  
2 the vehicle.

#### 3 4 SUMMARY OF THE INVENTION

5 The invention features a fluid pressure measuring device  
6 interface including an interface chamber fluidly coupled to a  
7 conduit which leads to the fluid medium whose pressure is to be  
8 measured. The interface chamber encloses a liquid-filled,  
9 deformable, fluid medium, pressure transfer container or bladder,  
10 which is completely surrounded by a limited quantity of fluid  
11 whose pressure is being measured. A second conduit fluidly  
12 couples the bladder to a pressure measuring and recording device.  
13 The bladder is typically filled with mineral oil based fluid that  
14 is not harsh and does not contaminate the sensitive pressure  
15 transducer.

16 The fluid medium pressure measuring device interface may be  
17 used in submersible structures such as submarines or unmanned  
18 underwater structures, platforms or vehicles. It can perform  
19 water pressure and wave and tide measurements. For use in an  
20 underwater structure, the conduit coupled to the interface  
21 chamber connects to the exterior surface of the underwater  
22 structure, at a point generally vertically above the interface  
23 chamber housing.

24 An end plug in the interface chamber allows access to the  
25 chamber for flushing and cleaning. The interface housing is  
26 preferably constructed of machined stainless steel. The bladder

1 preferably is of synthetic or natural rubber construction and  
2 filled with oil, generally mineral oil.

#### 3 4 BRIEF DESCRIPTION OF THE DRAWINGS

5 A more complete understanding of the invention and many of  
6 the attendant advantages thereto will be readily appreciated as  
7 the same becomes better understood by reference to the following  
8 detailed description when considered in conjunction with the  
9 accompanying drawing wherein:

10 FIG. 1 is a cross-sectional schematic diagram of the  
11 measuring device interface of the present invention; and

12 FIG. 2 is an end view of the measuring device interface of  
13 the present invention.

#### 14 15 DESCRIPTION OF THE PREFERRED EMBODIMENT

16 A fluid pressure measuring device interface 8, FIG. 1  
17 according to the present invention may be employed inside a  
18 submersible structure 10. A submersible structure includes, but  
19 is not limited to, a Large Diameter Unmanned Undersea Vehicle  
20 (LDUUV), which is a powered undersea vehicle used for data  
21 collection. The fluid pressure measuring device interface 8 is  
22 exposed to fluid or water pressure through an opening 12 in the  
23 exterior surface or hull 14 of the submerged structure 10. The  
24 fluid whose pressure is being measured flows through conduit 18  
25 into interface housing 22.

1           In the preferred embodiment, conduit 18 is connected to  
2           opening 12 in the hull through-connection 16 which is a typical  
3           1/4 inch tube high pressure fitting which utilizes a beveled  
4           crush on an O-ring as a seal. A similar connection 20 connects  
5           conduit 18 to interface housing 22.

6           Interface housing 22 is typically mounted directly on end  
7           plate 42 of a commercially available measuring device such as an  
8           oceanographic sensor 34 known as a wave and tide recorder. In  
9           the preferred embodiment, interface housing 22 is typically  
10          machined from a block of stainless steel although any suitable  
11          material such as aluminum or plastic may be used.

12          Interface housing 22 encloses and forms a cavity or flood  
13          chamber 24 which is large enough to hold a pressure sensing  
14          deformable bladder 26. Typically, cavity or flood chamber 24 is  
15          approximately 1.25 inches in diameter and 2.624 inches in length.  
16          A bladder 26 is constructed from a deformable material such as  
17          rubber, or reinforced polypropylene, and is filled with an  
18          appropriate amount of fluid, preferably a non-compressible fluid  
19          such as mineral oil. Bladder 26 may be constructed from any  
20          material which allows pressure to be transferred to the internal  
21          fluid, and can withstand the environmental conditions including  
22          rubber, polypropylene, plastics, and other materials by employing  
23          "accordion" type folding construction. The pressure transfer  
24          liquid employed inside bladder 26 can be any fluid which meets  
25          the environmental requirements of temperature range and  
26          compressibility, such as oil. Bladder 26 which typically

1 measures 1.00 inch by .75 inch and is connected to base plate 42  
2 of wave and tide recorder 34 by seal 28. Seal 28 connects to  
3 conduit 30 which transfers the oil pressure to pressure sensing  
4 device 32 within the oceanographic sensor 34. In the preferred  
5 embodiment, oceanographic sensor 34 is a time recording pressure  
6 sensor which can measure minute changes in pressure such as  
7 caused by waves on the surface of the water above submerged  
8 structure 10.

9 Wave and tide recorder 34 typically includes an electronic  
10 connection outlet 36 which carries data from pressure sensing  
11 device 32 to a data storage device or other means of collecting,  
12 displaying and/or recording data.

13 Flood chamber 24 contains a small enough volume (typically  
14 2.964 cubic inches) to not substantially change the ballast of  
15 submersible structure 10, yet allows bladder 26 to be completely  
16 surrounded by the fluid whose pressure is being measured.

17 In the preferred embodiment, the fluid pressure measuring  
18 device interface 8 is placed inside submersible structure 10 so  
19 that conduit 18 is generally vertically oriented above flood  
20 chamber 24. This orientation guarantees that once the  
21 submersible structure 10 is submerged, fluid will enter opening  
22 12 and substantially completely fill flood chamber 34. Even if  
23 some air remains inside flood chamber 24, fluid pressure  
24 measuring device interface 8 will still function correctly.

25 Interface housing 22 is mounted to the front of wave and  
26 tide recorder 34 using an o-ring seal 37. Mounting screws 38a,

1 38b, 38c and 38d, FIG. 2, secure interface housing 22, and allow  
2 interface housing 22 to be removed if necessary. An access port  
3 40 allows access to flood chamber 24, for cleaning and flushing.  
4 Access port 40 is a threaded screw plug with o-ring seal (not  
5 shown).

6 Bladder 26 is completely surrounded by the fluid whose  
7 pressure is being measured. This allows bladder 26 and pressure  
8 sensing or measuring device 32 to be extremely accurate in  
9 measuring fluctuations and fluid pressure. Any variation in  
10 pressure is translated through the collapsible membrane of  
11 bladder 26 to the fluid in conduit 30, to be measured by  
12 measuring device 32. Measuring device 32 is completely isolated  
13 from the fluid medium whose pressure is being measured. This  
14 allows the fluid pressure measuring device interface 8 to be used  
15 in any environment and any type of fluid where accurate  
16 measurements are required. The device may be used to measure  
17 extremely hot, cold or corrosive fluids, for example measuring  
18 crude oil pressure in an oil well. Other potential uses include  
19 measuring pressures inside an enclosed containers such as a tank  
20 or pool.

21 Accordingly, the present invention provides a fluid pressure  
22 measuring device which is optimal for use in a submersible  
23 vessel. The interface opening is small and will not interfere  
24 with surface integrity of the vessel. No external parts protrude  
25 outside the surface of the vessel to cause turbulence. The  
26 volume of the flood chamber of the interface will not



1 substantially affect the ballast weight of the vessel.

2 Additionally, the measuring device is isolated and protected from  
3 sea water and other corrosive or toxic environments.

4 Modifications and substitutions by one of ordinary skill in  
5 the art are considered to be within the scope of the present  
6 invention which is not to be limited

1 Navy Case No. 76611

2  
3 FLUID PRESSURE MEASURING DEVICE INTERFACE

4  
5 ABSTRACT OF THE DISCLOSURE

6 A fluid pressure measuring device interface which may be used  
7 in a submersible platform or vehicle includes an interface  
8 chamber fluidly coupled to a conduit which leads to the fluid  
9 medium whose pressure is to be measured. The interface chamber  
10 encloses a liquid-filled deformable pressure transfer container  
11 or bladder, which is generally completely surrounded by the fluid  
12 medium whose pressure is being measured. A second conduit  
13 fluidly couples the bladder to a pressure measuring device. The  
14 device can perform fluid medium pressure measurements including  
15 water pressure and wave and tide measurements. When used in an  
16 underwater structure, the conduit coupled to the interface  
17 chamber connects to the exterior surface of the underwater  
18 structure, at a point generally vertically above the interface  
19 housing.

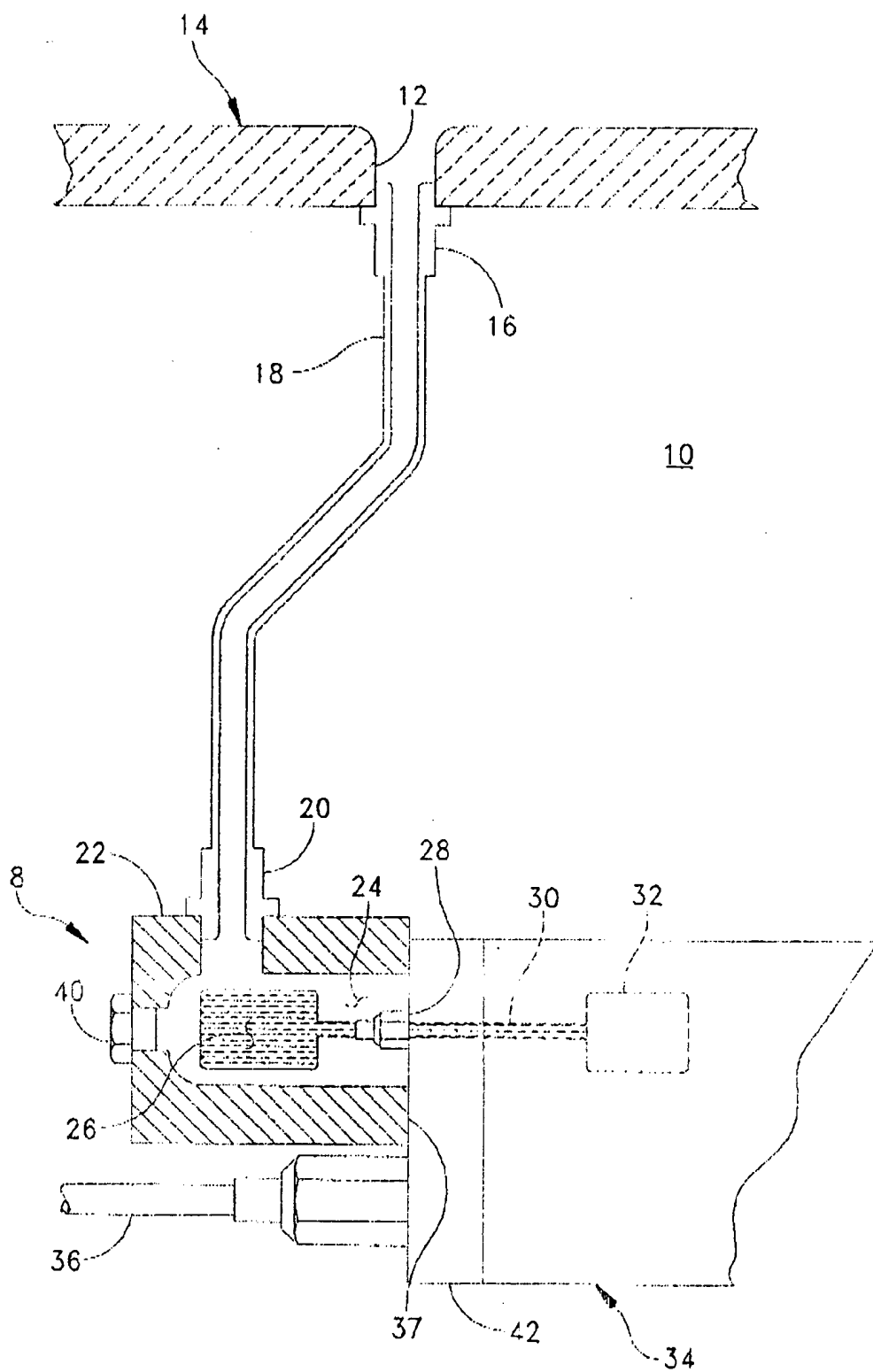


FIG. 1

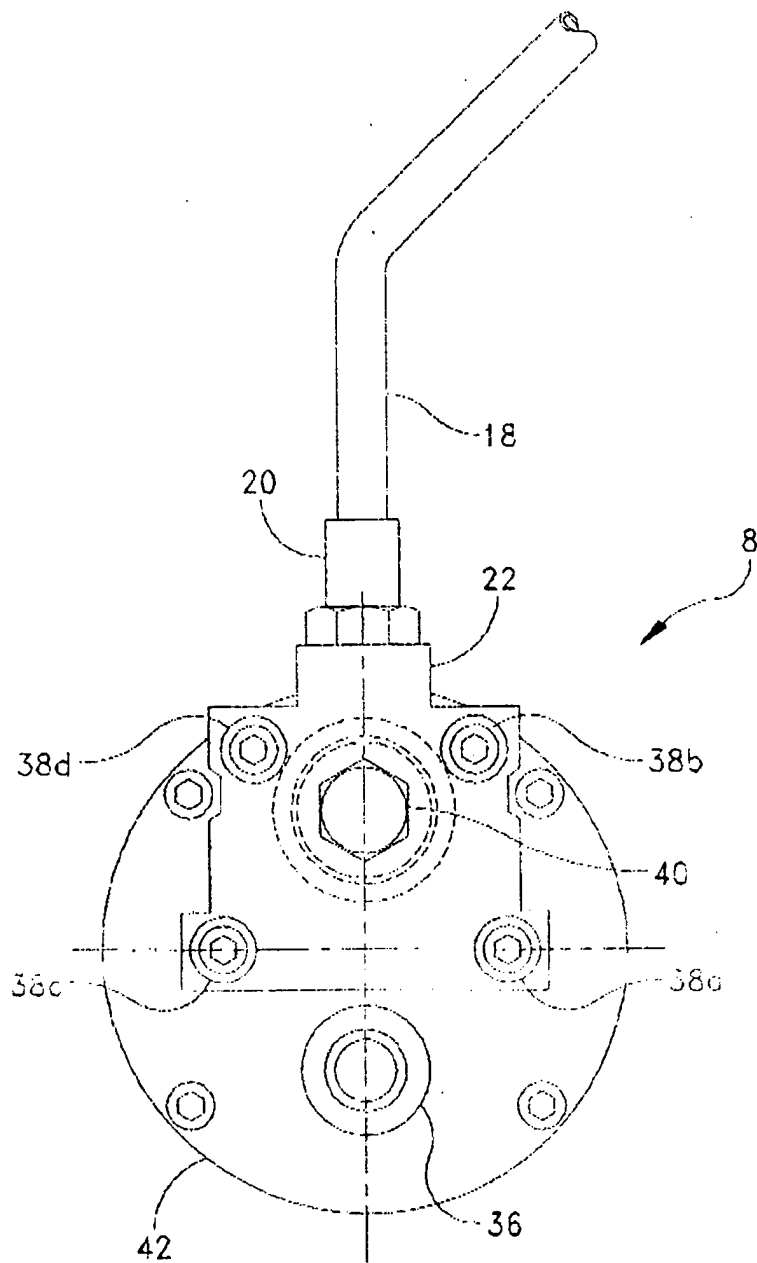


FIG. 2