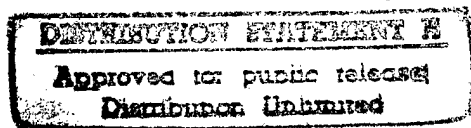


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NOTICE

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
ARLINGTON VA 22217-5660



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19980105 076

1 Navy Case No. 77942

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3 ISOLATED SENSING DEVICE HAVING AN ISOLATION HOUSING

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5 STATEMENT OF GOVERNMENT INTEREST

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

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11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 The present invention relates to an isolated sensing device
14 and in particular, to a flow noise isolation housing for
15 isolating flow noise from a hydrophone.

16 (2) Description of the Prior Art

17 The measurement of underwater sound is of increasing
18 interest, particularly in underwater direction and range finding
19 equipment (e.g., sonar). Sound is created in a water environment
20 by a source of acoustic energy that generates an acoustic
21 pressure field in the water. The sound pressure level is
22 typically measured with pressure measuring or sensing devices,
23 such as underwater microphones or hydrophones.

24 One difficulty with underwater measurements of a sound
25 pressure level is the adverse affect of fluid flow noise on the
26 sound measurement by a hydrophone. When fluid flows over the

1 hydrophone, pressure fluctuations caused by the flow are sensed
2 in addition to the acoustic pressures generated by the acoustic
3 energy source. The resulting sound pressure level measurements
4 are distorted and unclear as a result of the affect of the non-
5 acoustic pressure fluctuations or "flow noise" caused by the
6 flowing fluid, similar to the effect created by blowing over a
7 microphone. Existing hydrophones do not accurately measure
8 acoustic pressure or sound in an underwater environment because
9 this flow noise is not effectively isolated from the hydrophone.

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SUMMARY OF THE INVENTION

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Accordingly, one object of the present invention is to provide an isolation housing that isolates a sensing device or hydrophone from flowing fluid and therefore isolates the pressure fluctuations or other adverse conditions caused by the flowing fluid, allowing the desired conditions, such as acoustic pressure, to be accurately and clearly measured.

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A further object of the isolation housing is to mount the sensing device in a way that isolates the sensor or hydrophone from any structural vibrations.

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The present invention features an isolation housing for isolating at least one sensor from pressure fluctuations (flow noise) or other undesirable conditions in a flowing fluid. The isolation housing includes a cap portion having an interior region for receiving the sensor and fluid from the fluid environment. The cap portion further includes one or more

1 apertures extending through the cap portion into the interior
2 region, for allowing gas to escape so that fluid fills the
3 interior region of the cap portion. A retaining device is
4 disposed within the cap portion for retaining the sensor within
5 the interior region of the cap portion and for isolating the
6 sensor from structural vibrations or other effects of the
7 structure.

8 One example of the sensor includes a hydrophone. In an
9 isolation housing for a hydrophone, the cap portion is preferably
10 made of a material having an acoustic impedance which
11 substantially matches the fluid to allow the hydrophone to
12 measure acoustic pressure. According to one embodiment, the
13 fluid includes water and the material of the cap includes
14 polyvinylchloride (PVC).

15 A mounting portion is preferably coupled to the cap portion
16 for mounting the cap portion to a structure. One embodiment of
17 the mounting portion includes a base portion coupled to the cap
18 portion such that the base portion is mounted to one or more ribs
19 extending from the structure. Another embodiment of the mounting
20 portion further includes a clamp member mounting the base portion
21 to the structure.

1 One embodiment of the retaining device includes a resilient
2 member, such as a rubber band, coupled to opposing sides of the
3 interior region of the cap portion. The resilient member
4 suspends the sensor proximate a central region of the interior
5 region of the cap portion.

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BRIEF DESCRIPTION OF THE DRAWINGS

8 These and other features and advantages of the present
9 invention will be better understood in view of the following
10 description of the invention taken together with the drawings
11 wherein:

12 FIG. 1 is a side perspective view of an isolation housing
13 according to the present invention; and

14 FIG. 2 is a top, cross-sectional view taken along line 2-2
15 of the isolation housing shown in FIG. 1, according to the
16 present invention.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

19 An isolated sensing device 10, FIG. 1, according to the
20 present invention includes an isolation housing 12 and at least
21 one sensor 14, such as a hydrophone, housed within the isolation
22 housing 12. The isolated sensing device 10 is typically mounted
23 to a structure 16 in a fluid environment having a fluid 18 that
24 flows as shown generally by arrows 19. According to one example,
25 the isolated sensing device 10 is used in an underwater
26 environment, such as on submarines, torpedoes, ships or other

1 underwater vessels to measure acoustic pressure or sound in the
2 underwater environment where flow occurs (e.g., as used in sonar
3 systems). In the exemplary embodiment, the sensor 14 is a
4 pressure measuring device such as a hydrophone or miniature
5 hydrophone.

6 The isolation housing 12 includes a cap portion 20 defining
7 an interior region 22 that receives the sensor 14 and fluid 18a
8 from the fluid environment 18. When used to isolate a
9 hydrophone, the cap portion 20 is preferably made of a material
10 having an acoustic impedance which substantially matches the
11 fluid 18, such as polyvinylchloride (PVC) when the fluid is
12 water. Matching the acoustic impedance allows the sound to be
13 accurately measured through the cap portion 20 and fluid 18a.
14 The present invention contemplates other materials that match the
15 acoustic impedance of water or any other type of fluid in which
16 the isolated sensing device 10 is used.

17 The cap portion 20 includes one or more apertures 24 located
18 at the top and/or sides of the cap portion 20. The apertures 24
19 extend into the interior region 22 of the cap portion 20,
20 allowing any air or gas bubbles trapped inside the cap portion 20
21 to escape, and ensuring that the cap portion 20 is completely
22 flooded so that the air bubbles do not adversely affect the
23 measurements or readings of the sensor 14.

24 When the sensor 14 measures acoustic pressure, flowing fluid
25 18 creates pressure fluctuations or "flow noise" that adversely
26 affect the measurement of acoustic pressure by the sensor 14.

1 Shielding the sensor 14 from the flowing fluid 18 with the cap
2 portion 20 prevents the sensor 14 from measuring the undesirable
3 pressure fluctuations caused by the flowing fluid 18. Since the
4 sensor 14 is suspended in the same fluid 18a as the fluid
5 environment and the cap portion 20 is made of a material having
6 an impedance that generally matches the fluid 18, 18a, the sensor
7 14 accurately measures the acoustic pressure or sound.

8 The isolation housing 12 further includes a mounting portion
9 26, for mounting the isolation housing 12 to the structure 16.
10 The mounting portion 26 preferably includes a base portion 28
11 coupled to the cap portion 20, for example, using PVC cement.
12 Alternatively, the cap 20 could be mounted directly to the
13 structure 16. According to one embodiment, the base portion 28
14 is mounted to ribs 30 or other similar members extending from the
15 structure 16, such as by bolting or other suitable fastening
16 methods. According to another embodiment, one or more clamp
17 members 32, such as angle clamps, are screwed or otherwise
18 secured to the base portion 28 and structure 16. The present
19 invention contemplates other methods and mechanisms for mounting
20 the isolation housing 10 to the structure 16.

21 The isolation housing 10 further includes a retaining device
22 40, FIG. 2, that is disposed within the interior region 22 of the
23 cap portion 20 and retains the sensor 14 such that the sensor 14
24 is suspended in the interior region 22 and yet isolated from
25 structural vibrations or other effects caused by the structure 16

1 as well as the flowing fluid 18. The retaining device 40
2 preferably includes a resilient member 42, such as a rubber band,
3 secured to opposing sides of the interior region 22, such as by
4 eye hooks 44. The sensor 14 is thereby retained and suspended in
5 a central region of the interior region 22 and is surrounded by
6 fluid 18a.

7 Accordingly, the isolation housing of the present invention
8 provides a simple, inexpensive means for isolating a sensor from
9 pressure fluctuations (flow noise) or other undesirable
10 conditions in a flowing fluid and allows the sensor to accurately
11 sense or measure the desired conditions, such as acoustic
12 pressure, in an underwater environment. The flow noise isolation
13 housing also isolates the sensor from structural vibrations and
14 eliminates gas bubbles that may adversely affect measurements.

15 In light of the above, it is therefore understood that
16 the invention may be
17 practiced otherwise than as specifically described.

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3 ISOLATED SENSING DEVICE HAVING AN ISOLATION HOUSING

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5 ABSTRACT OF THE DISCLOSURE

6 An isolation housing is used to isolate a sensor, such as a
7 hydrophone, from pressure fluctuations or other adverse
8 conditions caused by fluid flow in a fluid environment. The
9 isolation housing includes a cap portion that receives the sensor
10 and fluid from the fluid environment. The isolation housing
11 further includes a mounting portion that mounts the housing to a
12 structure disposed in the fluid environment. When the sensor is
13 a hydrophone, the cap portion is made from a material having an
14 acoustic impedance that matches the surrounding fluid
15 environment. The cap portion further includes one or more
16 apertures allowing gas bubbles to escape from within the cap
17 portion. The isolation housing further includes a retaining
18 device, such as a resilient member, that retains the sensor
19 centrally within the cap portion and isolates the sensor from
20 structural vibrations or other adverse effects caused by the
21 structure.

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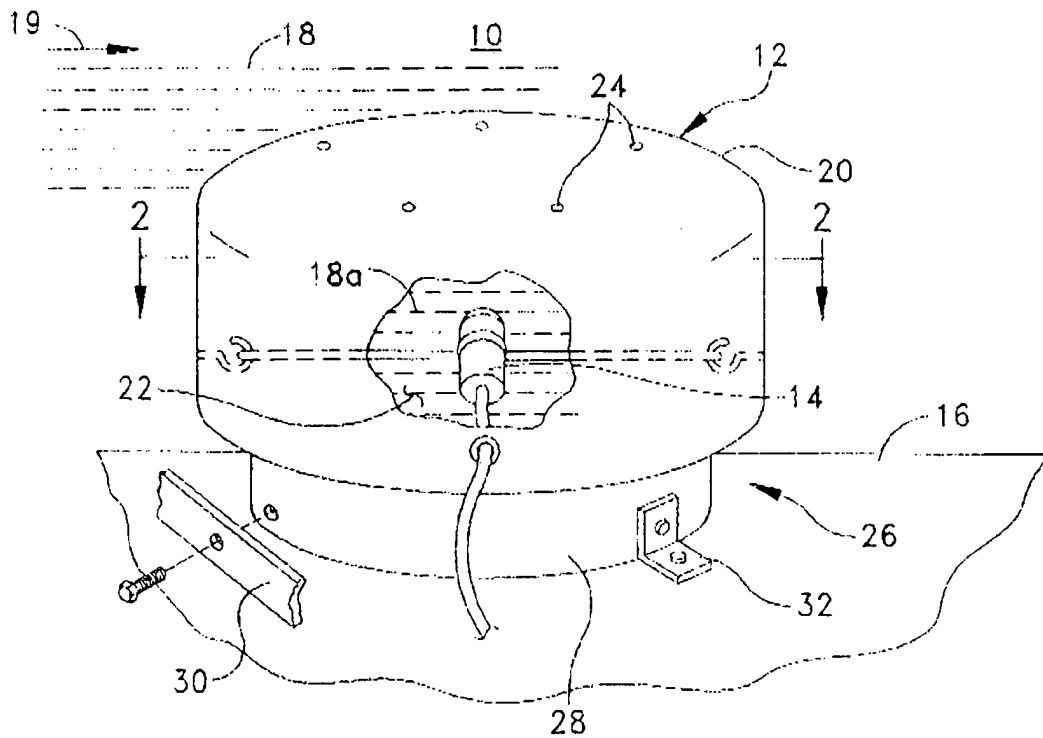


FIG. 1

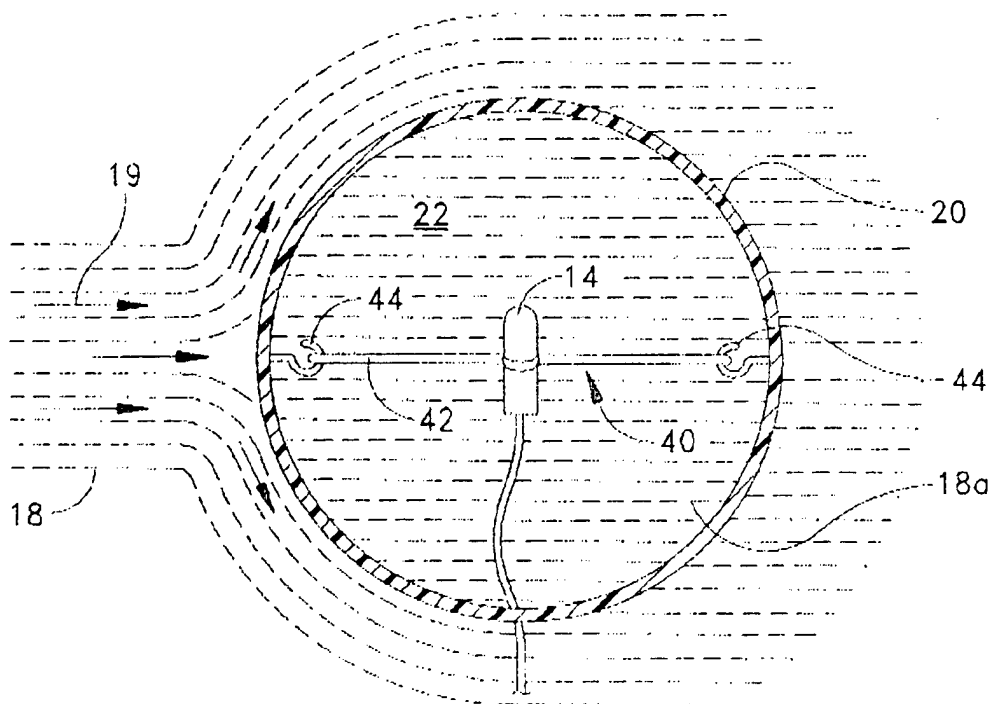


FIG. 2