# United States Patent

[11] 3,540,404


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[21] Appl. No. **792,278**
[22] Filed **Jan. 21, 1969**
[45] Patented **Nov. 17, 1970**


[54] **SEA VALVE GRID COVER**
**6 Claims, 14 Drawing Figs.**


[52] **U.S. Cl.** ..... **114/229,** 114/198
[51] **Int. Cl.** ..... **B63b 43/16**
[50] **Field of Search** ..... 114/229, 198, 227



[56] **References Cited**

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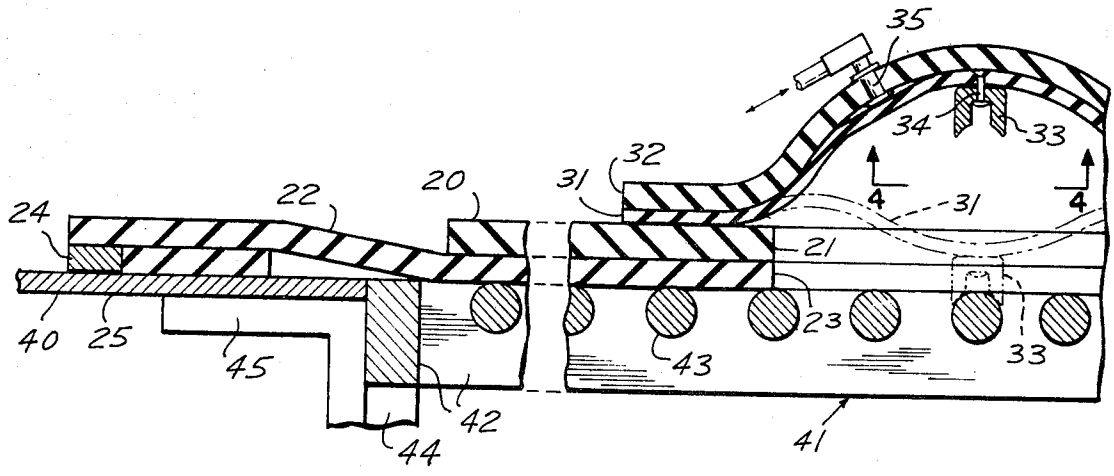
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**ABSTRACT:** Sea valves of a ship are located in a chamber having an underwater opening guarded by a bar grid. This disclosure teaches a cover to serve as a temporary closure of the underwater opening for allowing the chamber to be pumped dry. The cover is a rubber (or the like) pad with at least one pocket having at least one positioning magnet attached to its inside wall. The positioning magnet is biasable between a recessed position in the pocket and a popped position for magnetically engaging at least one bar of the grid to position the pad. Attaching magnets connect the pad about its margin to the ship's hull.

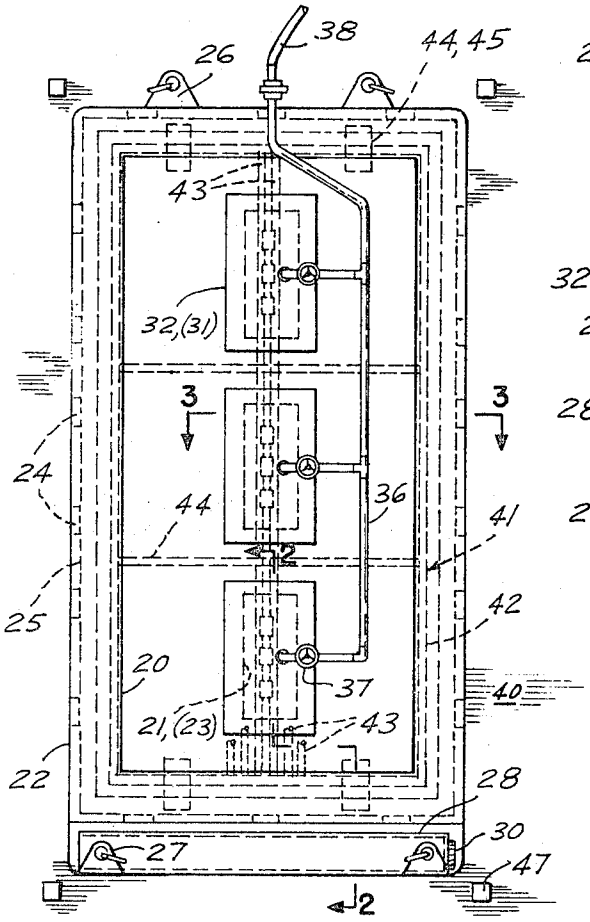



FIG. 1

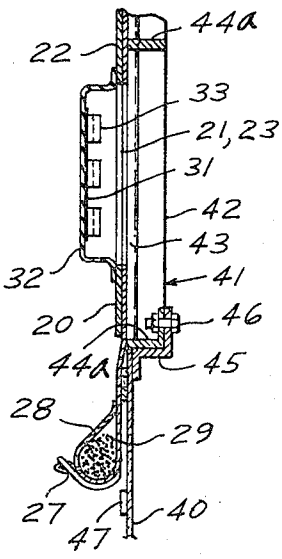



FIG. 2

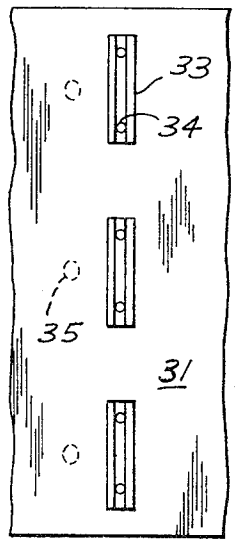



FIG. 4

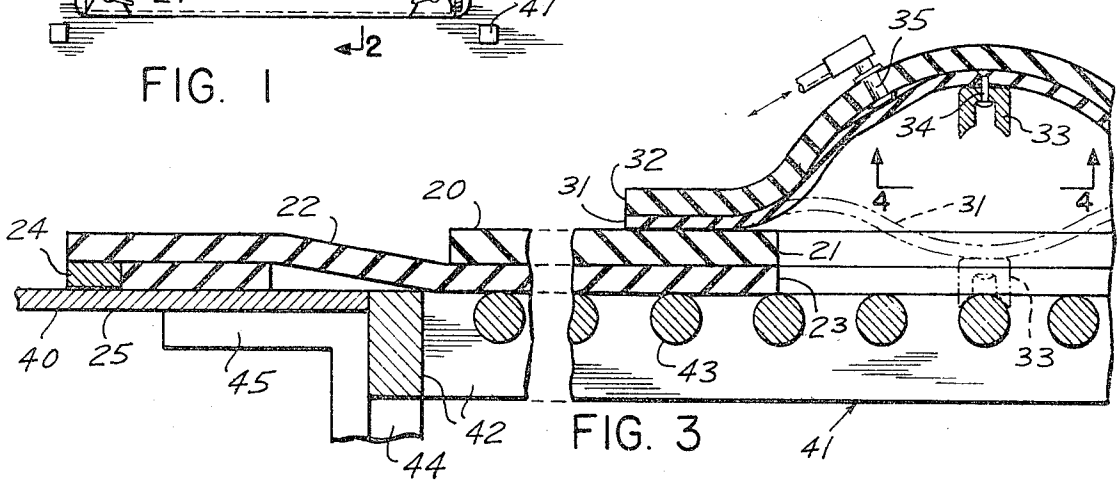



FIG. 3

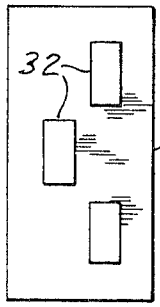



FIG. 5

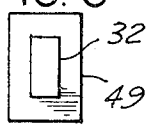



FIG. 6

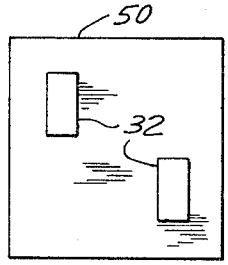



FIG. 7

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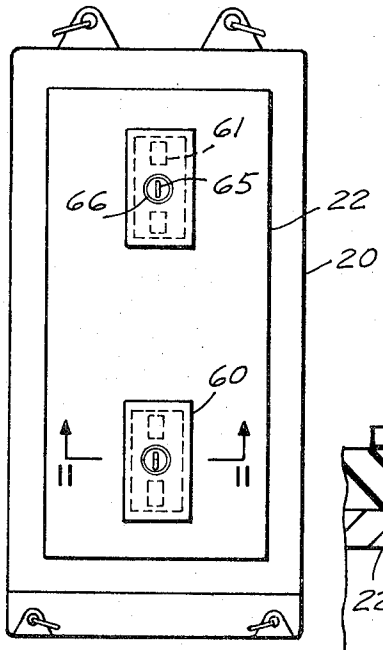



FIG. 10

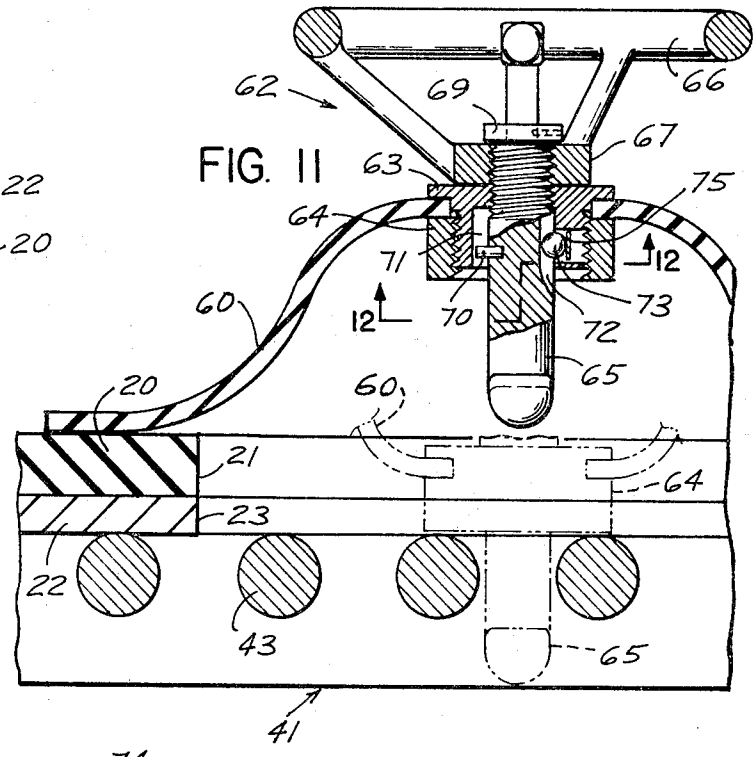



FIG. 11

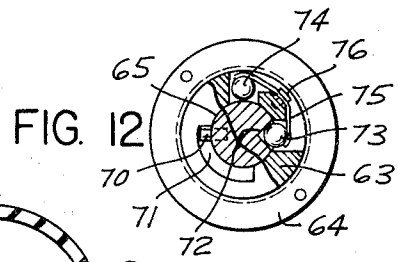



FIG. 12

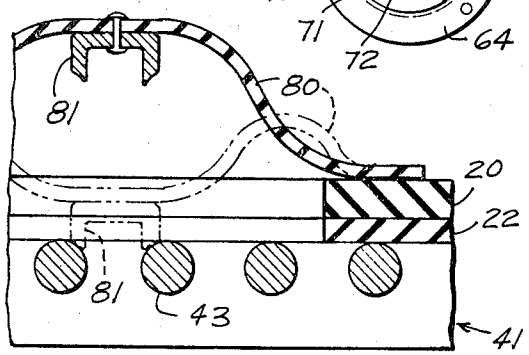



FIG. 14

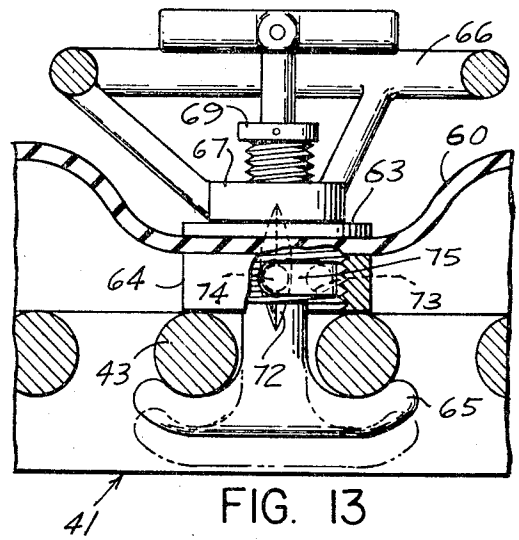



FIG. 13

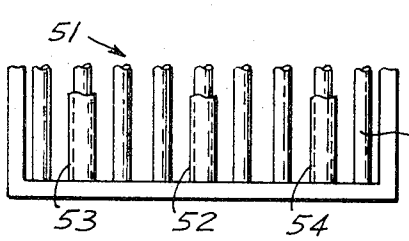



FIG. 8

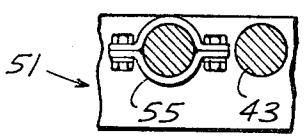



FIG. 9

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# SEA VALVE GRID COVER

## INVENTION

The cover for a sea valve grid serves as a temporary closure for the sea valve chamber. It is a most important object of this invention to provide a tight and reliable seal.

A further object is to provide a cover which can be installed using only one diver.

A further object is to permit the cover to be installed even when underwater visibility is nil.

A further object is to position the cover by means of positioning magnets, with or without mechanical clamping.

A further object is to arrange the positioning magnets in pockets when they are nonoperational so as to facilitate handling of the cover.

A further object is to bias the positioning magnets into their popped positions by pneumatic means.

A further object is to allow removal of the cover by simply pulling upward thereon.

A further object is to accommodate storage of the cover using the attaching magnets.

## DRAWINGS

The foregoing and other features will appear more fully from the accompanying drawings wherein like numerals refer to like parts and wherein:

FIG. 1 is a front elevation view of the cover in position on a sea valve grid;

FIG. 2 is an elevation section view taken on line 2–2 in FIG. 1;

FIG. 3 is a broken plan section view taken on line 3–3 in FIG. 1;

FIG. 4 is an elevation section view taken on line 4–4 in FIG. 3;

FIGS. 5, 6 and 7 are schematic elevation views of covers and positioning arrangements differing from the embodiment of FIG. 1;

FIG. 8 is a fractional elevation view of a nonferrous sea valve grid modified to serve in this invention;

FIG. 9 is a fractional plan section showing an iron-jacketed bar alternate to the scheme of FIG. 8;

FIG. 10 is a somewhat schematic elevation view of a cover differing from the cover of FIG. 1;

FIG. 11 is a plan section view taken on line 11–11 in FIG. 10;

FIG. 12 is an elevation section view taken on line 12–12 in FIG. 11;

FIG. 13 shows FIG. 11 in an alternate position of operation; and

FIG. 14 is a fractional plan section view of yet another cover differing from FIGS. 1 and 10.

## PREFERRED EMBODIMENTS

FIGS. 1—4 show the proposed cover for a relatively large grid of 4 by 8 feet. The only change in the hull optionally needed for installation of the cover is the provision of locating lands 47 which serve as tactile guides for the diver. If the grid is made from a nonferrous metal (such as bronze) one or more of its bars would be covered with steel tubing as shown in FIGS. 8 and 9. Outer pad 20 is provided with rectangular opening 21 and has inner pad 22 cemented thereto and has opening 23 registering with opening 21. Inner pad 22 has magnets 24 arranged about its margin for attaching the cover to hull 40 when it is properly positioned.

The cover is lowered overboard from a derrick with the lines fastened to eyelets 26 fixed to inner pad 22. The bottom portion of inner cover 22 is either formed as shown or has added to it ballast housing 28 which has lead shot 29 therein and is loadable via filler cap 30. Proper ballasting assures that the cover will sink upright and that it will stretch out.

In conditions of poor visibility, the diver guides the lowering operation until he can feel the upper corners of inner pad 22 to be close to locating lands 47. When the cover has reached this position, the diver operates the mechanism which effects positioning of the cover relative the valve grid. This mechanism is shown in detail and has been named the pop box. Outer pad 20 has fixed to it rubber diaphragm 31 and pop-box cover 32. This mechanism is called a pop box because, on admission of compressed air, its diaphragm pops outward. Diaphragm 31 has magnets 33 fixed thereto by rivets 34. Pop-box cover 32 has air passage 35 communicating in flow series with air manifold 36 via valves 37. Valves 37 are triple acting in that one setting permits supply of air under pressure from air hose 38 to passage 35, in a second setting the valves shut off the air supply and in a third setting the valves vent pressurized air from passages 35. Two or three pop boxes are required for fastening an 8-foot pad. The diver opens valve 37 of the uppermost pop box so that compressed air enters between cover 32 of the pop box and its diaphragm 31 which is thereby biased, through openings 21 and 23 in outer and inner pads 20 and 22 respectively, to its popped position shown in broken lines in FIG. 3 wherein magnets 33 each magnetically engage themselves firmly to the center iron bar of the grid for positioning the cover relative the sea valve opening. The upper third of the cover is now attached to the grid which makes it easy for the diver, even in a strong current, to position the second pop box correctly in a straight line with the upper pop box. The diver then opens the valve of the middle pop box and this pop box in turn attaches itself magnetically to the grid. The diver then repeats the operation for the lower pop box.

To prevent curling and displacement of the margin portions of the cover, a number of small magnets 24 are embedded in the margin of inner pad 22 to keep the margin attached to hull 40. Slightly thicker than magnets 24 is sealing gasket 25 made of soft rubber. Magnets 24 and gasket 25 form the seal proper. In quiet waters, magnets 24 will attach themselves easily in proper position. If there is a current which tends to roll the margin off hull 40, it may be necessary for the diver to press the margin of inner pad 22 against the hull until all magnets 24 have become attached.

In the embodiment of FIGS. 1—4, on completion of these two operations (pop boxes and margin flaps) the diver's job is finished because his services are not required for subsequent removal of the grid cover. This means that the diver need not stand by, pending completion of the repairs to the sea valves. It is noteworthy that the required underwater operations are extremely simple and do not require much skill or experience in underwater work, because the pop boxes make these operations largely automatic. Most likely, a skilled diver is not required, and a crewman with some experience in frogman work, should be competent to attach the cover.

The next step is to pump out the sea valve chamber. As long as the chamber is filled with water, the pressure on either side of the cover is equalized and the cover is held by the various magnets but it does not yet seal the opening. As the sea valve chamber is pumped out, the outside hydrostatic water pressure takes effect and seals the pad tightly against the hull. This part of the operation constitutes the sealing operation proper. The water pressure makes the seal firm and reliable, provided that the cover has been correctly placed which in turn is ensured by the pop boxes.

Upon completion of operations at the sea valves, water is again admitted to the valve chamber which relieves the sealing pressure from the inner pad. Subsequently, the derrick begins to lift removal lines connected to removal eyelets 27 at the bottom of the cover. By pulling on these lines, the cover is rolled up from the bottom. In rolling up, the various magnets at the margin of inner pad 22 and in the pop boxes are lifted successively one by one. It would be quite impossible to remove all magnets 24 and 33 simultaneously by pulling on the cover, but it is easy to lift the magnets individually and successively. Through the longitudinal spacing of the magnets, in particular of the strong pop-box magnets 33, the whole cover can be peeled off the grid like a magnetic zip fastener. This feature is an important aspect of the magnetic attachment concept.

As soon as the last magnet **33** of the lowest pop box has been lifted off the grid, as described, diaphragm **31** of that pop box snaps back into its original position. As mentioned previously, air valve **37** is opened only temporarily by the diver, until the box has popped. When the valve returns to its normal position, it bleeds the air from the pop box. This valve arrangement permits the diaphragm to snap back, as described, as soon as magnets **33** are pulled off the grid.

After removal of air hose **38**, the cover can be stored conveniently. Upon its removal from the derrick, the cover should be rolled up temporarily. This will prevent difficulties in transporting it to the hold, since margin magnets **24** will tend to attach themselves to any steel part which they happen to touch. However, the strong pop-box magnets are inactivated, because they have been withdrawn automatically inside the pop boxes.

The cover should be stored flat and stretched out, so as to preserve the rubber. This is done very conveniently by holding it against a bulkhead, ceiling or other steel surface where it is held permanently and securely by its margin magnets, without being lashed down. The device can therefore be described as self storing.

Set into ship's hull **40** is ferrous grid **41** comprising rectangular frame **42** into which is fixed, at top and bottom, rods **43** further rigidized as necessary by crossmembers **44**. Grid **41** being a removable assembly is provided with brackets **44***a* secured to ship's hull brackets **45** by bolts **46**.

Referring to FIGS. **5**, **6** and **7**, FIG. **5** shows cover **48** similar in proportions to FIG. **1** but with a staggered arrangement of pop boxes. FIG. **6** shows a small cover **49** requiring only one pop box. FIG. **7** shows a cover **50** for a square grid with a staggered pop-box arrangement. For ease of production, it is advantageous to standardize the design of the pop box, and to vary only the size and configuration of the cover.

FIG. **8** shows nonferrous grid **51** the bars of which are covered as required by ferrous sleeves. In a straight-line arrangement of pop boxes as shown in FIG. **1**, grid **51** is provided with one sleeve **52**. In staggered arrangements such as FIGS. **5** and **7**, conforming sleeves such as **53** and **54** are provided. FIG. **9** shows a sleeve **55** constructed to be replaceable without removal of grid **41**. If the cover is to be used in conjunction with a nonferrous grid having one or several steel-covered tubes, correct vertical positioning of the cover becomes automatic, because the pop boxes will operate only if the diver has placed them correctly over the center bar of the grid which alone is steel covered. With a steel grid, the pop boxes could of course attach themselves to any grid bar, and the diver has to use some care in placing the first pop box centrally, by means of the locating lands **47** which are easy to feel even if visibility is nil.

The embodiment shown in FIGS. **10—13** is an alternate design which employs a magnetic pop box for positioning but does not rely on the magnets alone for attachment of the cover. Initial placement of the cover is identical with the foregoing description. Openings **21**, **23** are here enclosed by diaphragm **60** on which is mounted magnets **61** and locking assembly **62**. When the upper part of the cover has been placed in its correct position, the diver pushes rubber cover **60** inward until magnets **61** attach to the grid bar. These magnets need not be very powerful because they only serve to position locking assembly **62** which comprises collar **63**, nut **64**, anchor **65** and wheel **66**. Collar **63** and nut **64** clamp diaphragm **60**, as shown, making a water-tight seal. Anchor **65** has threaded section **67** engaging the female thread on collar **63**. (This thread may be made water tight by means not shown or a seepage may be allowable in use). Wheel **66** also engaged by thread **67** is retained against runoff by pinned stop **69**. A pin **70** in anchor **65** is permitted to move in space **71** with axial and rotational movement of the anchor. Space **71** limits angular movement to 90°. Anchor **65**, further, has a 90° profile notch **72** milled into it, the full depth section of which is long enough to engage, over a range of adjustment, horizontal detent ball **73** and vertical detent ball **74** when the anchor is moved axially by turning wheel **66**. The detents are biased inwardly by leaf spring **75** fixed by screw **76** threaded into collar **63**. Both ends of spring **75** terminate above the balls placed in radially drilled holes in collar **63**. Handle and hooks on anchor **65** are intentionally oriented alike.

In installing the cover of FIG. **10—13**, the diver repeats the operation at the lower pop box, and checks placement of the cover margin or flaps which are secured by magnets **24**. As with the first-described type of cover, the seal with the hull is formed only when the sea valve chamber is pumped out.

If the cover is to be removed, the diver descends again (which is not required with the first-described type) and disengages the clamping mechanisms, by first loosening wheels **66** and subsequently turning the handles back into its upright position. Pull from the derrick at the removal eyelets **27** will then peel off the entire cover, as described earlier. As soon as all magnets in one pop box are separated from the grid bar, the box cover snaps back and thereby retracts the anchor clamp inside the box.

In FIG. **14**, diaphragm **80** has magnets **81** only.

I claim:

**1**. In a ship having a sea valve chamber provided with an underwater opening in the ship's ferrous hull and with the opening protected by a bar grid having at least one iron bar, a cover for said opening and comprising:

a pad for engaging the hull over the opening and having at least one pocket with at least one positioning magnet attached to an inside wall thereof;

popping means for biasing the positioning magnet between a recessed position in the pocket and a popped position for engaging the positioning magnet with the iron bar for positioning the pad; and

attaching magnets connected to the pad about its margin to attach the pad to the hull.

**2**. The cover of claim **1** and means for pumping water out of the sea valve chamber whereby the pad is urged by hydrostatic pressure into sealing engagement with the hull about the opening.

**3**. The cover of claim **1** with the popping means comprising:

a diaphragm mounted in the pocket to cooperate therewith in forming a fluid chamber;

the positioning magnet attached to the diaphragm; and

means for introducing pressurized fluid into the fluid chamber for advancing the positioning magnet to its popped position.

**4**. The cover of claim **3** and means for connecting the pad mechanically to the grid.

**5**. The cover of claim **4** and the pad including a housing for ballast to position it upright under water.

**6**. The cover of claim **5** and positioning lands provided on the hull.