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IN REPLY REFER TO:

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110 004

IMPROVED SHUTTER DOOR SEAL

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT HENRY J. BANAS, citizen of the United States of America, employee of the United States Government, resident of Gales Ferry, County of New London, State of Connecticut, has invented certain new and useful improvements entitled as set forth above of which the following is a specification:

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PATENT TRADEMARK OFFICE

1 Attorney Docket No. 80010

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IMPROVED SHUTTER DOOR SEAL

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STATEMENT OF GOVERNMENT INTEREST

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CROSS REFERENCE TO OTHER PATENT APPLICATIONS

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Not applicable.

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BACKGROUND OF THE INVENTION

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(1) Field of the Invention

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This invention generally relates to a seal assembly for a sea vessel and more particularly to an improved seal assembly for a sea vessel having a hull portion and a shutter door, the seal assembly closing a gap formed between the hull portion and shutter door.

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(2) Description of the Prior Art

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The current art for a sealing a gap 12 formed between an outer hull wall 14 and a shutter door 16 of a sea vessel is generally shown in FIG. 1 of the drawings. At present, a nominal gap 12 exists between the hull wall 14 and the shutter door 16. This gap 12 is sealed in the current art with a soft pliable hollow core type (extruded section)

1 rubber seal 40. The rubber seal 40 is fastened to the hull  
2 wall 14 using a welded stud 42 secured with a washer 44 and  
3 nut 46 combination. A mating surface between the seal 40  
4 and an inner surface of the hull wall 14 is filled with an  
5 adhesive (not shown).

6 This known arrangement has many limitations and  
7 disadvantages. In particular, as seawater flows along an  
8 outer surface of the hull 14 and closed shutter door 16, a  
9 negative pressure develops along the hull boundary layer.  
10 With a higher positive pressure (filled with seawater)  
11 residing in a shutter recess area 22, the existing flexible  
12 seal 40 with a very large surface area extrudes into the  
13 flow, releasing the water from the shutter recess area 22.  
14 A continuous flopping motion of the seal 40 results,  
15 causing the tearing of the hollow seal, further resulting  
16 in a noisy turbulent flow of water past the now-exposed gap  
17 12.

18 An additional problem associated with this type of seal  
19 occurs when the shutter door 16 is open. The swing arc of the  
20 rotating shutter door 16 as it opens seaward is shown at 34.  
21 Under this condition, an extremely high velocity plume of  
22 water passes over the seal 40 just prior to and following a  
23 weapon launch. There is also the possibility of physical  
24 contact between a weapon being launched and the seal 40  
25 itself. Any one of these conditions could result in seal  
26 failure. The ship cannot attain high speed and stealth  
27 capabilities with this type of seal.

1           The following patents, for example, disclose sealing  
2 systems but fail to disclose a shutter door seal system as  
3 disclosed herein.

4           U.S. Patent No. 3,296,742 to Mortimer;

5           U.S. Patent No. 3,396,712 to Sakraida et al.;

6           U.S. Patent No. 3,913,971 to Green; and

7           U.S. Patent No. 4,394,044 to Hough et al.

8           Specifically, Mortimer discloses a locking and sealing  
9 device having a rigid latch attached to one of the closure  
10 member and a surround member. The device is adapted to engage  
11 the other member to secure the closure member in a locked  
12 closed position. A sealing means, which is expandable and  
13 disposed around the closure member, is expandable to effect  
14 movement of the latch to a latch closing position, the sealing  
15 means being in the form of an inflatable tube which is located  
16 to seal a clearance around confronting surfaces of the closure  
17 member and surround member, the latch being pivotally movable  
18 by expansion of the inflatable tube to be brought into locking  
19 relation between the closure member and the surround member.

20           The patent to Sakraida et al. discloses a cover seal  
21 arrangement having a removable cylinder head cover including  
22 peripheral seal retaining means having a splash lip and a seal  
23 retaining groove receiving a resilient seal, the groove and  
24 seal being shaped to provide improved sealing ability with low  
25 seal compression combined with good retention of the seal in  
26 the groove.

1           Green discloses a detachable sun panel for the roof of an  
2 automobile consisting of a transparent panel supported on a  
3 resilient molding extending around the perimeter of an  
4 aperture formed in the roof. The molding is installed in a  
5 hole cut in a conventional roof and engages the sheet metal of  
6 the roof as well as the underlying headliner. The panel  
7 carries a pair of extensions on one end that engage the  
8 underside of the molding and a pair of latches on the opposite  
9 side which may be moved into a closed position to lock the  
10 panel against the molding.

11           Hough et al. discloses a removable sunroof panel adapted  
12 to be mounted in overlying relationship in an opening in the  
13 roof of a vehicle and includes front and rear mounting  
14 assemblies which allow either or both the front and rear of  
15 the panel to be held in an open position above the vehicle's  
16 roof. Each of the mounting assemblies includes a lever handle  
17 pivotally connected to the sunroof panel and a handle in a  
18 plurality of positions. A frame molding mounted in the  
19 sunroof opening includes a first section overlying the roof,  
20 and second and third sections below the roof defining a  
21 channel for receiving a resilient seal against which the roof  
22 panel seats; the second and third sections include a pair of  
23 opposed grooves for captivating a pair of ribs in the seal to  
24 retain the seal in the channel. An air deflector is mounted  
25 adjacent the leading edge of the sunroof opening in spaced  
26 relation to the leading edge and serves as a deflector for

1 either redirecting air through the opening into the vehicle or  
2 preventing wind buffeting noise.

3 It should be understood that the present invention would  
4 in fact enhance the functionality of the above patents by  
5 providing a seal assembly combining a metal retainer and a  
6 resilient seal portion.

7

8

#### SUMMARY OF THE INVENTION

9 Therefore it is an object of this invention to provide a  
10 seal assembly for an underwater vessel.

11 Another object of this invention is to provide a seal  
12 assembly that is durable in varying conditions.

13 Still another object of this invention is to provide a  
14 seal assembly for an underwater vessel that closes a gap  
15 between a hull wall and shutter door.

16 A still further object of the invention is to provide a  
17 sealing assembly including a metal retainer member and a  
18 resilient sealing member for closing the gap between the hull  
19 wall and shutter door.

20 In accordance with one aspect of this invention, there is  
21 provided a sealing assembly for closing a gap between a hull  
22 wall and a shutter door of a vessel. The sealing assembly  
23 includes a metal retainer member having a mounting block  
24 portion and a gap-closing portion extending from the mounting  
25 block portion. The mounting block portion is mounted to the  
26 hull wall and includes a slot formed therein parallel to the  
27 hull wall. The gap-closing portion has a tapered surface and

1 a flat surface such that the flat surface is flush with sea-  
2 exposed surfaces of each of the hull wall and the shutter  
3 door. A resilient rubber member is provided having at least a  
4 part thereof secured within the slot of the mounting block  
5 portion and a remainder thereof secured to the tapered surface  
6 of the gap-closing portion of the retainer member with an  
7 adhesive. The resilient member fills the portion of the gap  
8 not closed by the gap-closing portion of the retainer.

9

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#### BRIEF DESCRIPTION OF THE DRAWINGS

11 The appended claims particularly point out and distinctly  
12 claim the subject matter of this invention. The various  
13 objects, advantages and novel features of this invention will  
14 be more fully apparent from a reading of the following  
15 detailed description in conjunction with the accompanying  
16 drawings in which like reference numerals refer to like parts,  
17 and in which:

18 FIG. 1 is side sectional view of a prior art door seal;  
19 and

20 FIG. 2 is side sectional view of a sealing assembly  
21 according to a preferred embodiment of the present invention.

22

23

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

24 In general, the present invention is directed to an  
25 improved seal assembly 10 for an existing gap 12 between an  
26 outer non-pressure hull 14 of a ship and a torpedo tube  
27 shutter door 16 formed in the ship hull.



1 Referring again to FIG. 1, there is shown the prior  
2 art shutter door seal in a ship pressure hull. FIG. 2  
3 shows the present invention, the seal assembly shown at 10  
4 completely replacing the existing seal described in  
5 connection with FIG. 1 and any other known similar seal.  
6 The seal assembly 10 in FIG. 2 primarily includes a rubber  
7 seal member 18 and a metal retainer member 20.

8 As described in the Background above, a typical  
9 structure for an underwater portion of a vessel (not shown)  
10 includes the outer non-pressure hull portion 14 and the  
11 torpedo tube shutter door 16 that opens and closes in  
12 relation to the hull portion 14. The shutter door 16 is  
13 positioned so that there is a gap 12 from the distal end  
14 16a of the shutter door 16 to the opposing end 14a of the  
15 hull wall 14. The purpose of the seal assembly 10  
16 described herein is to close the gap 12 in a much more  
17 secure manner than previously known. As seen in FIG. 2,  
18 the combined hull wall 14, shutter door 16, and sealing  
19 assembly 10 provide a dividing wall between a shutter  
20 recess area 22 and a sea side 24 of the vessel. Although  
21 not part of the present invention, it will be understood  
22 that the purpose of the shutter door 16 is for the passage  
23 of a fired weapon such as a torpedo.

24 Continuing, the metal retainer member 20 is formed to  
25 substantially cover the existing gap 12 between the hull  
26 wall 14 and the shutter door 16. The metal retainer 20 is  
27 shaped so as to include a mounting block portion 26 and an

1 extending portion 28. The mounting block portion 26 is  
2 securable to an inner surface of the hull wall 14 and the  
3 extending portion 28 extends beyond the end of the hull  
4 wall 14 and substantially fills the gap 12 with the  
5 exception of a very small area. That portion of the  
6 extending member 28 facing a sea side 24 of the vessel  
7 structure is conforming in surface shape to join the outer  
8 faces of the hull wall 14 and the shutter door 16 in an  
9 uninterrupted manner. In the example shown in FIG. 2, the  
10 outer surface is flat. That portion of the extending  
11 member 28 that faces the shutter recess area 22 of the  
12 vessel structure is fairly arcuate in shape so as to taper  
13 to a narrowest point just adjacent the distal end 16a of  
14 the shutter door 16. The distal end 16a of the shutter  
15 door 16 is angled so as to slant away from the recess  
16 shutter area 22. The taper in the extending portion 28 of  
17 the metal retainer 20 corresponds in shape to the slant at  
18 the distal end 16a of the shutter door 16.

19 The metal retainer 20 further includes a slot 30 where  
20 the mounting block portion 26 of the metal retainer 20  
21 begins its taper. The rubber seal 18 is inserted into the  
22 slot 30 of the retainer 20 and secured thereto by adhesive  
23 (not shown) and any number of flathead screws 32 as are  
24 necessary to make the connection. Additionally, the  
25 remainder of the rubber seal 18 is adhered to the tapering  
26 portion 28 of the metal retainer 20 and terminates flush  
27 with the surface of the vessel on the sea side 24 thereof.

1           In order to install this new sealing assembly 10, it  
2 is only necessary to remove the existing seal assembly and  
3 replace it with the new sealing assembly 10. The existing  
4 self-locking nut 46, washer 44 and corresponding stud 42  
5 can be reused to attach the mounting block portion 26 of  
6 the retainer 20 to the inner surface of the hull wall 14.

7           An arc of the rotated shutter door 16 is shown at 34.  
8 As the shutter door 16 rotates, it will clear the tapered  
9 portion 28 of the metal retainer 20 and brush against the  
10 rubber seal portion 18 of the seal assembly 10. After full  
11 rotation (to closure) of the shutter door 16, there will be  
12 a minimum or no gap 12 between the seal assembly 10 and  
13 shutter door 16. Further, the rubber seal portion 18 will  
14 be fully supported on both sides within the slot 30 of the  
15 metal retainer 20 of the seal assembly 10.

16           The rubber seal portion 18 of the described seal  
17 assembly 10 will not be subjected to the high loads known  
18 to exist in the rubber portion 40 of prior seals (see FIG.  
19 1), but rather in the metal retainer 20 of the seal  
20 assembly 10. Therefore, the rubber portion 18 of the seal  
21 assembly 10 will not fail and leave the gap 12 exposed. If  
22 the rubber portion 18 of the present seal assembly 10 ever  
23 did fail, it would only leave a small gap as reflected by  
24 the cross section of the rubber portion 18 of the seal  
25 assembly 10.

26           The present invention is highly advantageous over  
27 the known assemblies in that the metal retainer 20 fills

1 the large gap 12 and supports the resilient portion 18 of  
2 the seal assembly in the high stress area. Further,  
3 there is a minimum or no gap between the seal assembly 10  
4 and the shutter door 16. The resilient portion 18 of the  
5 seal assembly 10 will not extrude by design or flap back  
6 and forth, thereby eliminating the inherent high noise  
7 condition of the existing seal. With the new sealing  
8 assembly and installation thereof, the ship can now fully  
9 utilize its high speed and stealth design  
10 characteristics. Because of the design as a replacement  
11 part, there is a one to one replacement for existing ship  
12 components, thereby saving both time and cost.

13 In view of the above detailed description, it is  
14 anticipated that the invention herein will have far reaching  
15 applications other than those of a seal for closing the gap  
16 between the outer non-pressure hull and the torpedo tube  
17 shutter door of a vessel.

18 This invention has been disclosed in terms of certain  
19 embodiments. It will be apparent that many modifications can  
20 be made to the disclosed apparatus without departing from the  
21 invention. Therefore, it is the intent of the appended claims  
22 to cover all such variations and modifications as come within  
23 the true spirit and scope of this invention.

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IMRPOVED SHUTTER DOOR SEAL

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ABSTRACT OF THE DISCLOSURE

6 A sealing assembly is disclosed for closing a gap between  
7 a hull wall and a shutter door of a vessel. The sealing  
8 assembly includes a metal retainer member having a mounting  
9 block portion and a gap-closing portion extending from the  
10 mounting block portion. The mounting block portion is mounted  
11 to the hull wall and includes a slot formed therein parallel  
12 to the hull wall. The gap-closing portion has a tapered  
13 surface and a flat surface such that the flat surface is flush  
14 with sea-exposed surfaces of each of the hull wall and the  
15 shutter door. A resilient rubber member is provided having at  
16 least a part thereof secured within the slot of the mounting  
17 block portion and a remainder thereof secured to the tapered  
18 surface of the gap-closing portion of the retainer member with  
19 an adhesive. The resilient member fills the portion of the  
20 gap not closed by the gap-closing portion of the retainer.

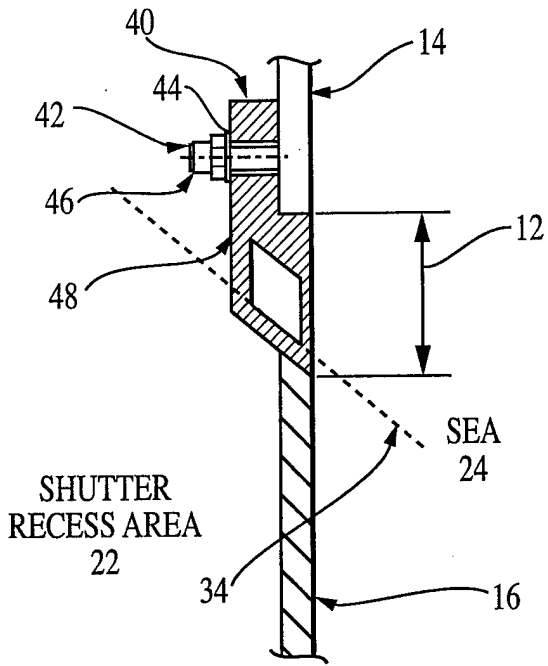


FIG. 1  
PRIOR ART

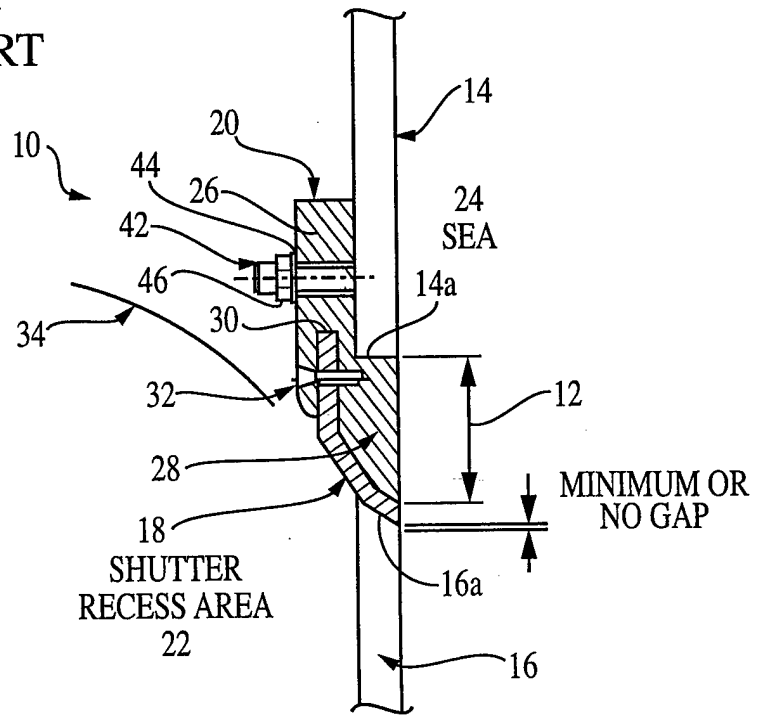


FIG. 2