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CODE OOCC3
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Navy Case No. 76350

A STUD MOUNTING FOR WITHSTANDING TRANSVERSE FORCES AND METHOD FOR MOUNTING A STUD

STATEMENT OF GOVERNMENT INTEREST

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

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The invention relates to strengthening of studs welded to exteriors of submarine hulls, and is directed more particularly to a stud mounting including a threaded flanged nut and a threaded stud, the nut being threadable onto the stud such that a flange portion of the nut engages the hull, a tubular portion of the nut upstands from the flange portion, is threadedly engaged with the stud, and extends around the stud.

(2) Description of the Prior Art

Studs are welded to the exterior of a submarine hull for the attachment of various rigid components to the hull. When the submarine submerges, the hull contracts under hydrostatic pressure upon the submarine's descent to greater depths.

Contraction of the hull creates a load on such studs, the load being applied transversely to the axis of the stud.

The lateral force, or bending moment, that the stud can withstand is limited by the method of welding used to attach the stud to the hull. Spot welding is the most economical type of welding; however, once the diameter of the stud gets above a certain size, spot welding is impractical. Accordingly, an efficient method for strengthening a spot welded stud without penetrating the submarine pressure hull is required.

United States Patent No. 4,850,771 to Hurd shows a nut having a head portion with an enlarged flange portion and a threaded sleeve for engaging a replacement bolt fastened through an aperture in a work piece. The Hurd '771 patent is only applicable to bolts joined through an aperture, and does not teach use of the nut in a structure that cannot be penetrated by an aperture.

United States Patent No. 5,054,980 to Bedefeld shows a method for joining two plates together by a welded stud. An aperture is formed in the outermost plate, and the stud is welded to the base plate through the aperture. A nut is applied to the stud to retain the outermost plate. This apparatus includes a nut provided with a welded stud, but like Hurd, Bidefeld does not teach the use of a stud in an application where the plate cannot be penetrated. Furthermore, the nut is provided as a means of retaining the outermost plate, not strengthening the stud.

SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to provide a method and apparatus for mounting a stud on a wall such that the stud can withstand a transverse force applied to the stud.

It is a further object that such stud be attached to the wall by economically efficient means without penetrating or reducing the strength of the wall.

Another object of this invention is to provide a method and apparatus readily adaptable to existing studs.

With the above and other objects in view, as will hereinafter appear, a feature of the present invention is the provision of a stud mounting, the mounting including a flanged nut, and a stud fixed at a first end to a plate and subjected to high load forces applied transversely to the axis of the stud. The stud is provided with a threaded post portion and a base portion larger in diameter than the post portion, the base portion being disposed at the first end of the stud. The nut comprises a first annular flange portion at a first end thereof, the flange portion having a flat surface for engagement with the plate, a housing portion upstanding from the first flange portion for covering the base portion of the stud, and a cylindrical tubular portion upstanding from the housing portion and having internal threads complementary to the threaded post portion of the stud. The tubular portion of the nut is threadedly engageable with the threaded post portion of the stud such that the nut is threadedly movable from a second end of the stud

toward the first end of the stud until the flange portion of the nut engages the plate.

In accordance with a further feature of the invention, there is provided a stud mounting as described immediately above and further comprising a second annular flange extending from a second end of the nut, and an elastomeric bushing disposed within and filling an annular groove defined by the first annular flange, the housing portion, the tubular portion, and the second annular flange.

In accordance with a still further feature of the invention, there is provided a method for attaching a stud to a wall. A threaded stud is spot welded to a wall. A base portion of the stud is in contact with the wall and a distal end of the stud extends away from the wall. A nut is provided having a first annular flange portion, a housing portion capable of covering the base portion of the threaded stud, a cylindrical tubular portion upstanding from the housing portion with internal threads therein capable of engaging the threaded stud. The nut has an axial length less than that of the threaded stud. The nut can be screwed upon the stud until the nut contacts the wall and provides a pre-stress load on the stud and the wall. The distal end of the stud remains exposed beyond the nut.

The above and other features of the invention, including various novel details of construction and combinations of parts, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be

understood that the particular devices embodying the invention are shown by way of illustration only and not as limitations of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made to the accompanying drawings in which are shown illustrative embodiments of the invention, from which its novel features and advantages will be apparent.

In the drawings:

FIG. 1 is an elevational view illustrative of a stud portion of the inventive mounting;

FIG. 2 is a centerline sectional view of one form of nut illustrative of the nut portion of the inventive mounting;

FIG. 3 is a sectional view of the nut of FIG. 2 mounted on the stud of FIG. 1, shown in elevation and illustrative of an embodiment of the invention;

FIG. 4 is a top plan view of the stud and nut combination shown in FIG. 3;

FIG. 5 is a partly elevational, partly centerline sectional view of another form of mounting illustrative of an alternative embodiment of the invention; and

FIG. 6 is a top plan view of the stud and nut combination shown in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, it will be seen that a stud S of the improved stud mounting includes a threaded post portion P and an annular base portion B. Annular base portion B is disposed at a first end F of the stud S and is provided with a diameter exceeding the diameter of the stud S. The base portion B typically is integral with the post portion P and is provided with a flat surface L for attachment, as by spot welding, to a plate H, such as a portion of a hull of a submarine or other underwater vehicle.

Referring to FIG. 2, it will be seen that an illustrative nut 10 includes a first annular flange portion 12 at a first end 14 thereof. The flange portion 12 includes a flat surface 16 for engagement with the plate H. The nut 10 further includes a generally dome-shaped housing portion 18 upstanding from the flange portion 12 and adapted to cover the base portion B of the stud S, and a cylindrical tubular portion 20 which is upstanding from the housing portion 18 and which is threaded internally complementarily to the post portion P of the stud S.

The exterior surface of the nut 10 is smooth in the preferred embodiment, although it can be adapted to have a hexagonal or other shape. Typically, the nut 10 is fastened on the stud S using a spanner wrench which engages spanner holes (not shown) on the nut. An advantage of having a smooth external surface is the avoidance of stress concentrators, thereby maximizing strength for a particular nut configuration.

As may be seen in FIGS. 3 and 4, the nut 10 is threadedly engageable with the stud S and is threadedly moved thereon from the second end E of the stud toward the first end F thereof until the nut flange flat surface 16 engages the hull surface H. Preferably, the nut 10 is screwed tightly onto the stud S such that the flange portion 12 exerts a force on the hull H which exerts an equal and opposite force on the stud S. The housing portion 18 of the nut 10 receives the base portion B of the stud S and covers the base portion when the nut 10 is in place. A free end portion D (FIG. 3) of the stud S stands clear of a free end portion 21 of the nut 10 and receives a component to be held and a locking nut (not shown).

The nut 10 increases the load carrying capacity of the stud S by providing a resisting couple near the first end F of the stud. The resisting couple spreads the load-resisting forces over a larger distance, or moment arm, than that provided by the stud alone.

In FIGS. 5 and 6, there is shown an alternative embodiment in which the nut 10′ is provided with the elements noted above with respect to the embodiment shown in FIGS. 2 and 3, and, in addition, is provided at a second end 22 thereof with a second flange portion 24. The nut 10′ is further provided with an elastomeric bushing 26 which is disposed in, and preferably fully occupies, an annular groove 28 defined by the first annular flange portion 12, the housing portion 18, the tubular portion 20, and the second annular flange portion 24. The bushing 26,

near the first flange portion 12, is provided with a portion 30 having a diameter substantially equal to the diameter of the first flange portion 12, and near the second flange portion 24 is provided with a portion 32 having a diameter substantially equal to the diameter of the second flange portion 24. The bushing portions 30, 32 form therebetween an annular shoulder 34.

In operation, the alternative embodiment of nut, shown in FIGS. 5 and 6, is applied in the same manner as the first embodiment, shown in FIGS. 2-4. The nut 10′ is screwed down on the stud S tightly, to create a preload between the first flange surface 16 and the hull H. A component C (FIG. 5) is provided with a hole 0 therein sized to receive the bushing portion 30, such that the nut 10′ is screwed down on the stud S and enters the hole 0 in the component C. Hole 0 is enlarged at 0′ in component C to avoid vibration and force transmission between flange portion 12 and component C. The shoulder 34 of the bushing 26 engages an outboard surface T of the component C slightly before, or at about the same time, as the flange surface 16 engages the hull H. Thus, in this instance the portion 32 of the bushing 26 overlies the component C and the bushing shoulder 34 engages and bears against the component surface T.

As in the case of the first embodiment, the alternative embodiment increases the load capability of the stud. By absorbing deflection, the elastomeric bushing 26 reduces the load on the stud. Accordingly, the bushing functions somewhat like a spring and operates to reduce a load caused by deflection.

There is thus provided a stud mounting including a nut threadedly mountable on a stud such that the nut increases the load carrying capacity of the stud with respect to loads applied transversely to the axis of the stud.

It is to be understood that the present invention is by no means limited to the particular constructions herein disclosed and/or shown in the drawings,

For example, the load capacity of the stud may be increased by providing a nut, as described above, of a material having a higher modulus of elasticity, or by providing a nut having a thicker first flange portion 12 and/or a first flange portion of increased diameter. Shims (not shown) may be added between the first flange surface 16 and the hull H to provide an even distribution of force between the circumference of the surface 16 and the hull H. Shims or washers (not shown) may be added to move the resisting couple along the axis of the stud, away from the hull. The load capacity of the stud can be increased by providing with the nut a shim or washer of material of a higher modulus of elasticity. In the alternative embodiment shown in FIGS. 5 and 6, the bushing 26, if provided with a lower modulus of elasticity and/or greater thickness, absorbs greater deflection, resulting in a greater reduction in load on the stud.

Navy Case No. 76350

A STUD MOUNTING FOR WITHSTANDING TRANSVERSE FORCES AND METHOD FOR MOUNTING A STUD

ABSTRACT OF THE DISCLOSURE

A stud mounting includes a stud fixed at a first end to a plate, the stud having a threaded post portion and a base portion, the base portion being disposed at the first end of the stud. The mounting further includes a flanged nut for disposition on the stud, the nut comprising a first annular flange portion at a first end thereof, a housing portion upstanding from the first flange portion for covering the base portion of the stud, and a cylindrical tubular portion upstanding from the housing portion and having internal threads complementary to the threaded post portion of the stud. The tubular portion of the nut is threadedly engageable with the post portion of the stud such that the nut is threadedly movable on the stud until the flange portion of the nut engages the plate.

The invention further provides a mounting as described above and comprising a second annular flange extending from a second end of the nut, and an elastomeric bushing filling an annular groove defined by the first annular flange, the housing portion, the tubular portion, and the second annular flange.

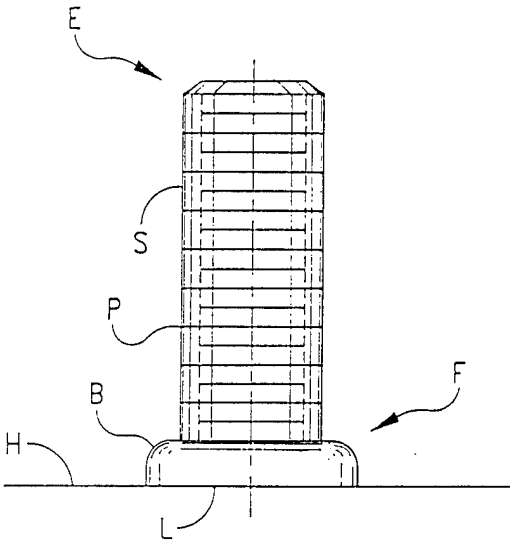

FIG. 1

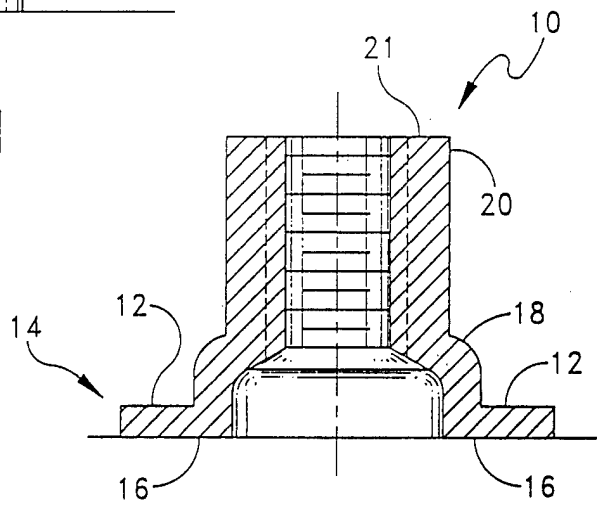

FIG. 2

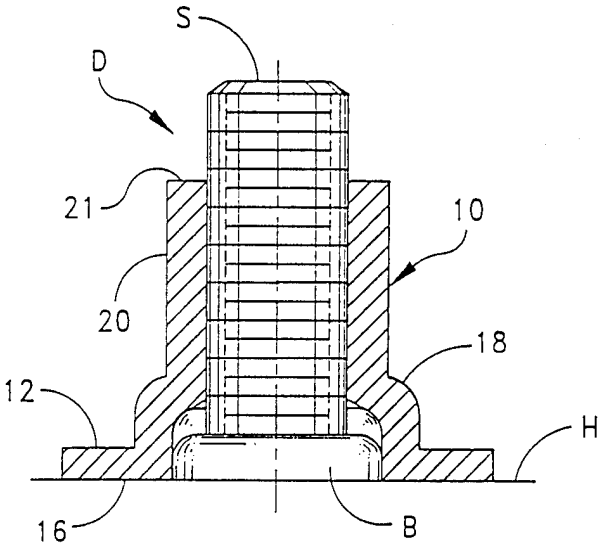

FIG. 3

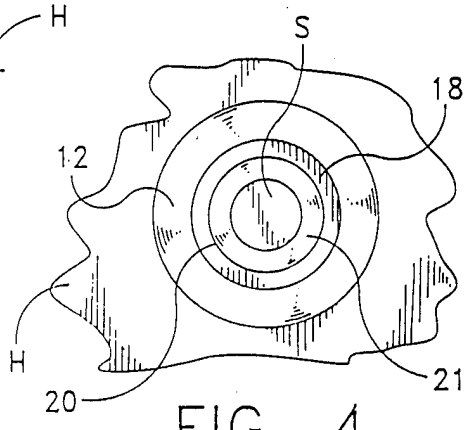

FIG. 4

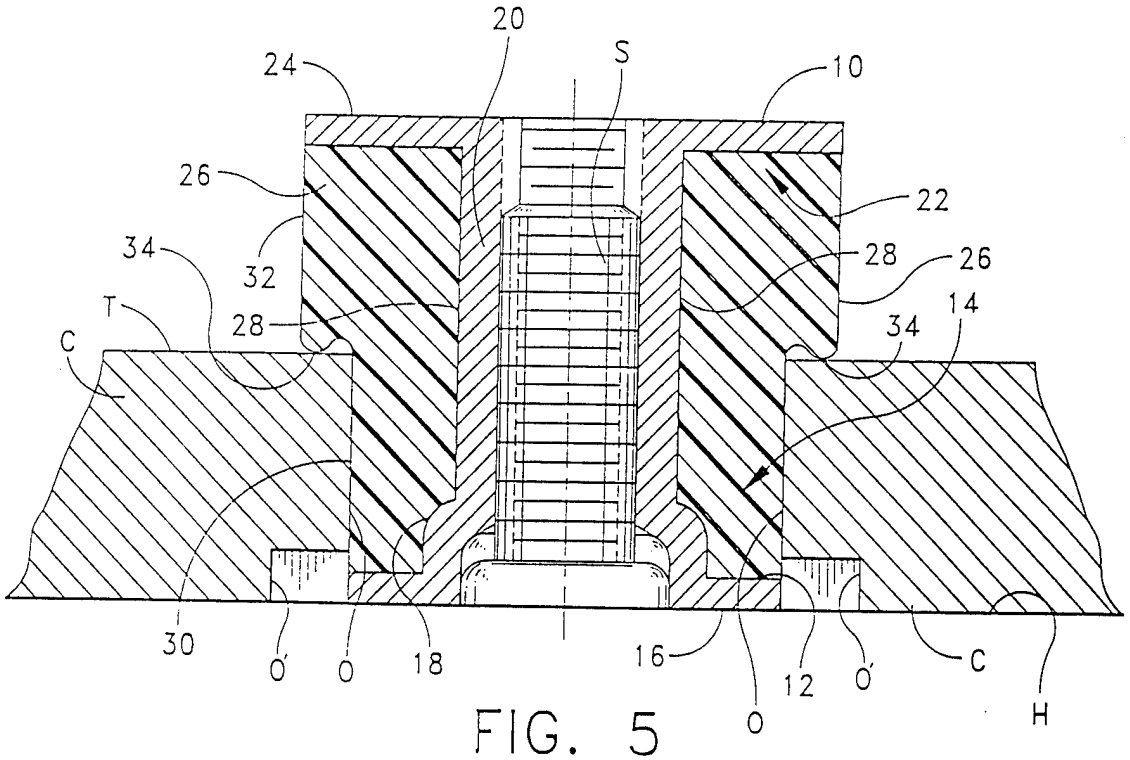
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FIG. 5

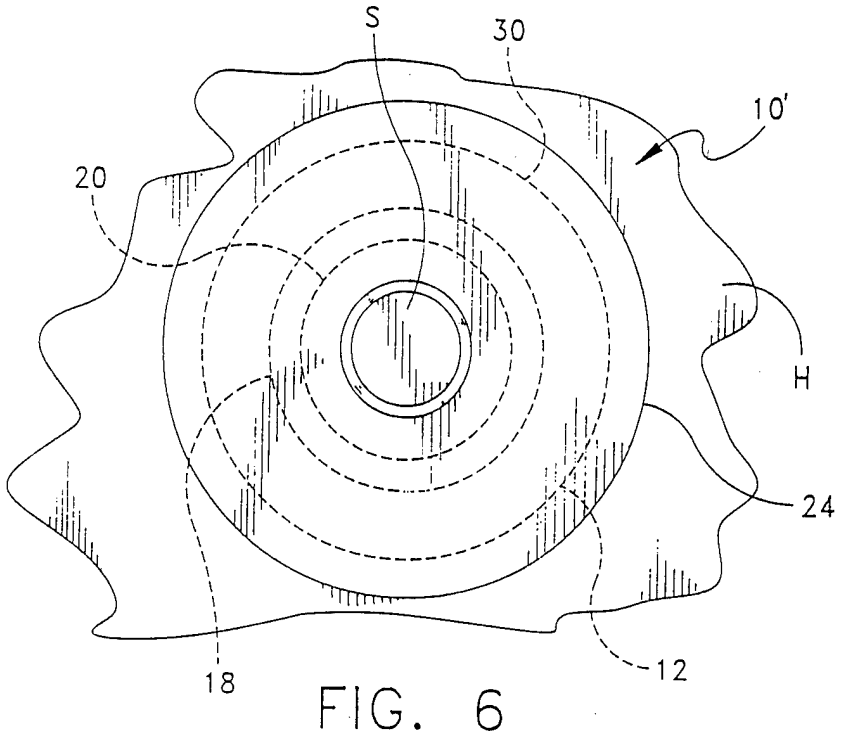
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FIG. 6