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## Description

This invention relates to a releasable closure arrangement and particularly to a closure arrangement designed to release a load on impact with a surface of water.

European Patent Specification No. EP 0,061,398 describes a closure arrangement for releasing a cylindrical object from a vehicle. Here, the object is held in a container by means of a lockable end cap. An inflatable bladder within the container and to the rear of the object is used to eject the object. When release is required, the bladder is inflated and the end cap is unlocked by remote control, causing both object and end cap to be ejected by the inflation pressure of the bladder.

In many applications, however, it is desired to release the load from a housing only on impact with water. Whilst this can be done by relying on shearing pegs or pins, the breaking properties of such pegs are prone to be variable, making deployment unpredictable. Alternatively, stored energy devices may be used. However, these may be costly.

An object of this invention is to provide a releasable closure arrangement which alleviates these problems.

According to the invention a releasable closure arrangement of the type comprising a housing and a closure member adapted to fit loosely in the housing is characterised by further comprising resilient means adapted to fit in a compressed condition in a predetermined stable position between the closure member and the housing to hold the closure member in the housing, the inner surface of the housing and the outer surface of the closure member being of such formation that forcible displacement of the closure member into the housing causes said resilient means to be dislodged from said stable position into a relatively unstressed condition allowing the closure member to be released from the housing.

The inner surface of the housing or the outer surface of the closure member or both may have which is complementary to the shape of the resilient means so as to afford further support for said resilient means. The resilient means may be prevented from moving from said stable position into the housing by a shoulder protruding from the inner surface of the housing. The closure member is preferably free to move from the housing after dislodgement of the resilient means.

The resilient means is preferably an elastic O-ring arranged to be stretched about the closure member in said stable position and to relax to a smaller diameter when the closure member is forcibly displaced into the housing.

The arrangement preferably includes means to limit the movement of the closure member into the housing. The arrangement may include a removable spigot arranged to engage a hole in the housing to prevent release of the closure member. The spigot may be one of a number on a ring arranged to be placed about the housing and to be readily removable.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings, of which:

Figure 1 shows in cross-section an arrangement in accordance with the invention prior to release; and

Figure 2 shows the arrangement on the point of release.

The arrangement shown in the drawings comprises a housing 1 containing sonar equipment 3 sealed with a nose cap 5 which is designed to be released on impact with the water, the whole system being deployed from an aircraft. Figure 1 shows the equipment 3 held in place by the closure member (nose cap 5) which is itself held in place by a stretched elastic O-ring 7. The housing 1, equipment 3 and nose cap 5 are all of circular cross-section. On impact with the water the nose cap 5 is forced upwards, the O-ring is prevented from following by the formation of the inner wall 2 of the housing, snaps off the nose cap into a relaxed condition and the nose cap, equipment and O-ring are all then free to descend out of the housing 1 into the water.

A groove 11 is cut in the inner wall 2 near the mouth of the housing 1 whilst the nose cap 5 is formed with a roundcut shoulder or ridge 9. When the nose cap is assembled in the housing the hollow beneath the ridge 9 is aligned with the groove 11 so an annular channel is formed between the two members. Jigging pins 13 (one shown) are used in the assembly and then removed. The O-ring 7 is stretched about the nose cap to abut the ridge 9 and, when assembled, is compressed tightly in the channel between the two members. With the O-ring held in this stable position the nose cap is supported in the housing, and the nose cap 5 in turn supports the sonar equipment 3 which rests on a resilient foam pad 12.

Various modifications may be made to this arrangement. For instance, the ridge 9 can be omitted if the frictional resistance is high enough or the equipment 3 light enough. On the other hand, if are support is required, the groove 11 may be formed with a protruding lower edge on which the O-ring can rest.

Figure 2 shows the system immediately after its impact on the surface of the water. The nose cap 5 is forced upwards into the housing. The O-ring, however, is trapped in its stable position by the

upper edge of the groove 11 and cannot move with the nose cap. At a certain distance above the groove 11, the inner diameter of the housing 1 becomes less than the outer diameter of the nose cap 5. The shoulder 10 formed at this change of diameter limits the nose cap's upward travel but allows it to move far enough to release the O-ring as a part of the nose cap of decreased diameter moves adjacent the O-ring. This therefore relaxes, springing away from the housing wall. The equipment 3, nose cap 5 and O-ring 7 are then free to descend under gravity into the water.

The nose cap may take a variety of shapes besides that shown in the drawings, though a rounded surface is preferable for smooth entry into the water. The O-ring is not necessarily released from the nose cap - it could simply snap on to a narrower part of it.

For security against accidental release before deployment, the jiggling pins 13 shown in Figure 1 may be replaced with spigots or pins which prevent the nose cap from moving up into the housing. In an alternative arrangement these security pins could be arranged to penetrate the housing and the nose cap so as to hold the nose cap fixedly in the housing. The pins (or pin) may be replaced with a throwaway ring made of plastic, say, supporting a number of spigots which engage spigot holes in the housing. The ring is split in one place and snaps about the housing. It can then be quickly and easily removed immediately before launch.

Resilient balls or cylindrical blocks could be used instead of an O-ring. The force required to release the nose cap is determined by the degree of compression of the O-ring or other resilient means between the housing and the nose cap. For a system intended to be launched from an aircraft this force determines the minimum launch height.

### Claims

1. A releasable closure arrangement of the type comprising a housing (1) and a closure member (5) adapted to fit loosely in said housing (1), characterised by further comprising resilient means (7) adapted to fit in a compressed condition in a predetermined stable position between the closure member (5) and the housing (1) to hold the closure member (5) in the housing (1), the inner surface of the housing (1) and the outer surface of the closure member (5) being of such formation that forcible displacement of the closure member (5) into the housing (1) causes said resilient means (7) to be dislodged from said stable position into a relatively unstressed condition allowing the closure member (5) to be released from the housing (1).

2. A closure arrangement according to Claim 1, wherein at least one of the inner surface (2) of said housing (1) and the outer surface of said closure member (5) has a shape (9) which is complementary to the shape of said resilient means (7) so as to afford further support for the resilient means (7) in said stable position.

3. A closure arrangement according to Claim 1 or 2, wherein said resilient means (7) is prevented from moving from said stable position into the housing by a shoulder (11) protruding from the inner surface (2) of the housing (1).

4. A closure arrangement according to any one of the preceding claims, wherein the closure member (5) is free to move from the housing (1) after dislodgement of the resilient means (7).

5. A closure arrangement according to any one of the preceding claims, wherein said resilient means (7) is an elastic O-ring arranged to be stretched about the closure member (5) in said stable position and to relax to a smaller diameter when the closure member (5) is forcibly displaced into the housing (1).

6. A closure arrangement according to any one of the preceding claims, including means (10) to limit the movement of the closure member (5) into the housing (1).

7. A closure arrangement according to any one of the preceding claims, including a removable spigot arranged to engage a hole in the housing to prevent release of the closure.

8. A closure arrangement according to Claim 7, wherein said spigot is one of a number on a ring arranged to be placed about the housing and to be readily removable.

### Revendications

1. Ensemble à fermeture amovible, du type qui comprend un boîtier (1) et un organe de fermeture (5) destiné à se loger avec du jeu dans le boîtier (1), caractérisé en ce qu'il comporte en outre un dispositif élastique (7) destiné à se loger, à l'état comprimé, en position stable prédéterminée entre l'organe de fermeture (5) et le boîtier (1) afin que l'organe de fermeture (5) soit maintenu dans le boîtier (1), la surface interne du boîtier (1) et la surface externe de l'organe de fermeture (5) ayant une configuration telle que le déplacement à force de l'organe de fermeture (5) vers l'intérieur du boîtier

- (1) provoque une séparation du dispositif élastique (7) de sa position de stabilité vers un état à contrainte réduite permettant la libération de l'organe (5) de fermeture en dehors du boîtier (1).
2. Ensemble de fermeture selon la revendication 1, dans lequel l'une au moins parmi la surface interne (2) du boîtier (1) et la surface externe de l'organe de fermeture (5) a une configuration (9) qui est complémentaire de celle du dispositif élastique (7) afin que le dispositif élastique (7) soit supporté de manière supplémentaire dans la position stable.
3. Ensemble de fermeture selon la revendication 1 ou 2, dans lequel le dispositif élastique (7) ne peut pas s'écarter de sa position stable dans le boîtier grâce à un épaulement (11) qui dépasse de la surface interne (2) du boîtier (1).
4. Ensemble de fermeture selon l'une quelconque des revendications précédentes, dans lequel l'organe de fermeture (5) est libre de se déplacer vers l'extérieur du boîtier (1) après la séparation du dispositif élastique (7).
5. Ensemble de fermeture selon l'une quelconque des revendications précédentes, dans lequel le dispositif élastique (7) est un joint torique élastique destiné à être tendu autour de l'organe de fermeture (5) dans la position stable et à se relaxer à un plus petit diamètre lorsque l'organe de fermeture (5) est déplacé à force dans le boîtier (1).
6. Ensemble de fermeture selon l'une quelconque des revendications précédentes, comprenant un dispositif (10) destiné à limiter le déplacement de l'organe de fermeture (5) vers l'intérieur du boîtier (1).
7. Ensemble de fermeture selon l'une quelconque des revendications précédentes, comprenant un ergot amovible destiné à pénétrer dans un trou formé dans le boîtier afin qu'il empêche la libération de l'organe de fermeture.
8. Ensemble de fermeture selon la revendication 7, dans lequel l'ergot fait partie d'un certain nombre d'ergots disposés sous forme d'un anneau d'ergots destinés à être placés autour du boîtier et à être facilement séparables.

## Patentansprüche

1. Lösbare Verschlussanordnung nach Art eines Gehäuses (1) und eines Verschlussteils (5), das so ausgebildet ist, daß es lose in das Gehäuse (1) paßt, ferner gekennzeichnet durch eine federnde Vorrichtung (7), die derart ausgebildet ist, daß sie in einem eingeeengten Zustand in einer vorbestimmten stabilen Position zwischen dem Verschlussteil (5) und dem Gehäuse (1) eingepaßt ist, um das Verschlussteil (5) in dem Gehäuse (1) zu halten, wobei die innere Oberfläche des Gehäuses (1) und die äußere Oberfläche des Verschlussteils (5) von solcher Gestalt sind, daß eine zwangsweise Verschiebung des Verschlussteils (5) in das Gehäuse (1) verursacht, daß die federnde Vorrichtung (7) aus der stabilen Position in einen relativ ungespannten Zustand gelangt, wodurch dem Verschlussteil (5) die Freilassung aus dem Gehäuse (1) gestattet ist.
2. Verschlussanordnung nach Anspruch 1, bei der wenigstens die innere Oberfläche (2) des Gehäuses (1) oder die äußere Oberfläche des Verschlussteils (5) eine Gestalt (9) hat, die komplementär zur Gestalt der federnden Vorrichtung (7) ist, um eine weitere Stütze für die federnde Vorrichtung (7) in der stabilen Position vorzusehen.
3. Verschlussanordnung nach Anspruch 1 oder 2, bei der die federnde Vorrichtung (7) durch eine von der inneren Oberfläche (2) des Gehäuses (1) vorspringende Schulter (11) an einer Bewegung aus der stabilen Position in dem Gehäuse gehindert ist.
4. Verschlussanordnung nach irgendeinem der vorangegangenen Ansprüche, bei der das Verschlussteil (5) frei aus dem Gehäuse (1) treten kann, nachdem die federnde Vorrichtung (7) aus der stabilen Position geraten ist.
5. Verschlussanordnung nach irgendeinem der vorangegangenen Ansprüche, bei der die federnde Vorrichtung (7) ein elastischer O-Ring ist, der so angeordnet und ausgebildet ist, daß er sich in der stabilen Position um das Verschlussteil (5) spannt und sich auf einen kleineren Durchmesser entspannt, wenn das Verschlussteil (5) zwangsweise in das Gehäuse (1) verschoben wird.
6. Verschlussanordnung nach irgendeinem der vorangegangenen Ansprüche, enthaltend ein Mittel (10) zum Begrenzen der Bewegung des Verschlussteils (5) in das Gehäuse (1).

7. Verschußanordnung nach irgendeinem der vorangegangenen Ansprüche, enthaltend einen entfernbaren Zapfen, der so angeordnet und ausgebildet ist, daß er in ein Loch im Gehäuse eingreift, um eine Freigabe des Verschußteils zu verhindern. 5
8. Verschußanordnung nach Anspruch 7, bei der der Zapfen einer einer Anzahl von Zapfen auf einem Ring ist, der um das Gehäuse gelegt und leicht entfernbar ist. 10

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