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TORPEDO BALLAST RELEASE

Filed Oct. 11, 1960

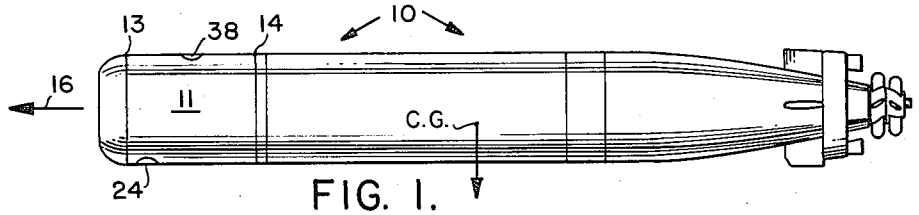


FIG. 1.

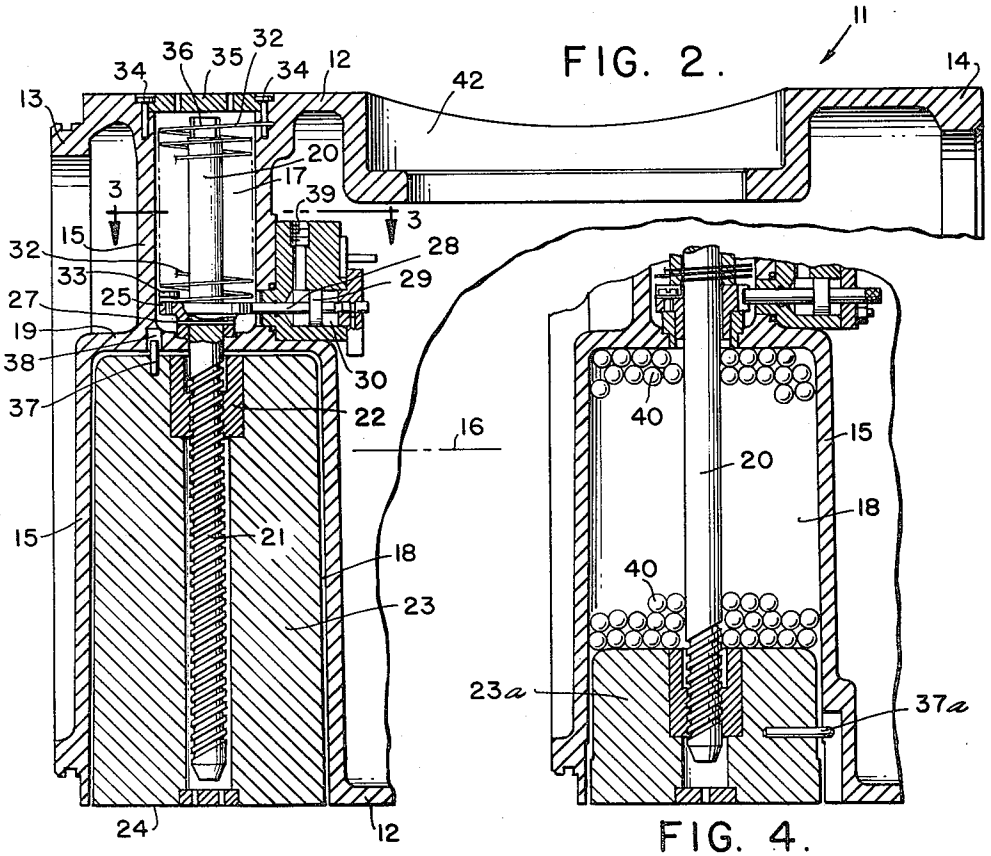


FIG. 2.

FIG. 4.

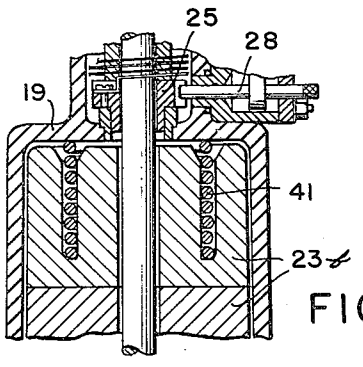


FIG. 5.

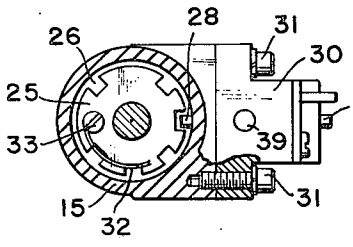


FIG. 3.

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TORPEDO BALLAST RELEASE

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8 Claims. (Cl. 114—20)

This invention relates to torpedoes and more particularly to improvements in ballast release apparatus for rendering a non-buoyant torpedo buoyant after completion of a test run to facilitate its recovery on the surface of the sea.

It has long been the practice to provide torpedoes with ballast release apparatus of the general type referred to, exemplary of which is the patent to Whiting, 1,097,700, wherein a lead weight is disposed within a cavity in the torpedo and permitted to drop from the cavity in response to hydrostatic pressure. Lead shot has also been similarly employed as exemplified by the patent to Asbury, 1,180,366.

In view of the considerable cost of complicated modern torpedoes and the instrumentation carried by same during an exercise run, together with the valuable information recorded by the instrumentation, it is apparent that recovery after a run should be as infallible as possible. The reliability of recovery apparatus depends upon many factors, including the number of parts, the complexity of their operation, and the speed, attitude and location of the torpedo in the water at the time of ballast release. While some of these factors are not subject to alteration, it is apparent that simplicity of parts and their operation will, in general, provide greater reliability. Reliability of such apparatus under all operating conditions of a torpedo can probably be determined only empirically.

One of the objects of this invention is to provide torpedo ballast release apparatus of increased simplicity of construction and highly reliable in operation.

Another object is to provide apparatus in which stored energy may be released to augment gravitational forces or, under some conditions, to overcome gravitational forces to effect forcible release of torpedo ballast irrespective of the torpedo attitude relative to the sea or floor of the sea.

Still further objects, advantages and salient features will become more apparent from a consideration of the description to follow, the appended claims, and the accompanying drawing, in which:

FIG. 1 is a side elevation of a torpedo embodying the invention;

FIG. 2 is an enlarged longitudinal central section of a portion of FIG. 1;

FIG. 3 is a section taken on line 3—3, FIG. 2; and

FIGS. 4 and 5 are sections like FIG. 2 illustrating alternative embodiments.

Referring now to the drawing, torpedo 10 may be of any desired construction having an exercise section 11 which may be removably connected to the torpedo hull and substituted for another section, such as a warhead, when the torpedo is to be exercised to obtain performance information.

Section 11, as best illustrated in FIG. 2, comprises a circular hull 12, having ends 13, 14 which may be secured to adjacent torpedo sections in any conventional manner, the hull having a tubular wall 15 extending diametrically across it perpendicular to the longitudinal axis 16 of the torpedo, providing an upper chamber 17 and a lower chamber 18, separated by a transverse wall 19. The center of mass, C.G., is below axis 16.

A shaft 20 is supported for rotation by wall 19, the lower end of the shaft having threads 21 which threadedly engage a bushing 22 disposed within a lead weight 23 the lower end 24 of which (FIG. 1) is circular, forming a smooth continuation of the torpedo hull surface.

A collar 25, having a plurality of angularly spaced notches 26 disposed in its peripheral surface is affixed to the shaft by a pin 27, one of which notches may receive one end of a slideable pin 28 having an affixed piston 29 disposed in a cylinder 30, the cylinder being detachably secured to wall 15 by screws 31. One end of a torsion spring 32 is affixed to collar 25 by a screw 33 and the other end is affixed to one of a pair of screws 34 which detachably secure a cover plate 35 in the upper end of chamber 17. The cover plate is preferably provided with bayonet type slots to permit its removal by loosening screws 34 and without detaching the upper connection of the spring. The upper end 36 of shaft 20 is non-circular to receive a socket wrench, or alternatively, may be provided with a non-circular recess to receive the non-circular male end of a wrench, such as an Allen wrench.

In the loading of the weight into its chamber, cover plate 35 is removed and a wrench applied to shaft 20 which may be rotated as desired to preload the spring. The threads in the bushing in the weight are then engaged with the lower end of the screw and rotation of the latter continued until the weight is moved to the position shown. An indexing pin 37 is provided in the weight to engage in an aperture 38 to prevent rotation and unauthorized lowering of the weight along the shaft and also maintain the circular lower end 24 of the weight aligned with the cylindrical surface of the hull. Pin 28, one end of which is accessible through hand hole 42 is then slid axially engaging its opposite end in one of notches 26, thereby locking the shaft against rotation by the spring. Cover 35 is then replaced and the ballast weight is in condition for release. To release the weight pressure is applied within the cylinder 30, as by an electrically initiated gas producing explosive squib (not shown), which may be suitably secured within cavity 39 in the cylinder. This may be initiated by hydrostatic pressure, a timer or in any other conventional manner understood in the art. As will be apparent, when the piston is moved its attached pin disengages the notched collar permitting the energy stored in the spring to apply torque to the threaded shaft thus rotating it and moving the weight downward out of its chamber. To facilitate such movement and prevent jamming of the weight, the chamber bore and weight may be slightly tapered so that the clearance space increases as the weight moves downwardly. The threads on the shaft are preferably of the multiple type with rapid lead so that the weight may move independent of shaft rotation (after pin 37 is disengaged). In normal operation, however, there is no tendency for the weight to rotate, due to its mass, the energy in the spring being effective to provide releasing rotation for the shaft as the weight drops from its chamber. Sufficient energy is stored in the spring, however, to forcibly eject the weight in event the torpedo should come to rest on the ocean bottom before the weight has disengaged the screw. Similarly, in the event the torpedo should roll to a position in which the weight cavity is directed other than downwardly, the spring will rotate the shaft and eject the weight.

As will now be apparent, the invention comprises, fundamentally, a ballast weight, a rotatable screw for effecting release of the weight, a manually wound spring motor for supplying rotational energy to the screw, and a latch or release device for initiating the operation of the motor. This arrangement may be employed in somewhat modified form with other weights which will now be described. FIG. 4 illustrates a relatively short weight 23a which fills a part of the weight chamber, the remainder being filled with lead balls or shot. This provides a more

rapid release than the embodiment previously described due to the shorter thread and also less resistance to the moving water as it emerges from the cavity, which is of advantage in high speed torpedoes where water forces on the weight could be excessive and tend to produce jamming of the weight just prior to release from the screw. FIG. 5 illustrates two other features, one wherein the weight **23***b* comprises two or more sandwiched sections, the lower section, only, containing the threads, as in FIG. 4. In this construction the lower section is ejected by the screw, as in FIG. 4, after which the upper sections fall out of the chamber in the same manner as the shot in FIG. 4. The other feature of FIG. 5 is the alternative addition of a spring **41** which is disposed between the uppermost weight and wall **19**. This provides positive ejection of the weight in event the torpedo assumes, at the time of weight ejection, some attitude which would prevent gavitational release of the weights disposed above the lowermost threaded weight.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. Ballast release apparatus for rendering a non-buoyant torpedo boyant upon release therefrom of ballast, said torpedo having a longitudinal axis and a cylindrical cavity having an axis disposed diametrically transverse to said axis and having an opening at one end thereof to ambient water, comprising;

(*a*) at least one solid cylindrical ballast weight disposed within said cavity,

(*b*) said weight having a threaded central aperture,

(*c*) a shaft disposed axially of said cavity, mounted for rotation,

(*d*) said shaft having threads engaging said threaded central aperture,

(*e*) a torsion spring having one end secured to said shaft and its other end secured to the torpedo,

(*f*) means for selectively latching said shaft against rotation by said spring and for unlatching said shaft for rotation by said spring,

(*g*) one end of said shaft being accessible through an opening in the torpedo for rotating it against the torsional urge of the spring.

2. Apparatus in accordance with claim 1 wherein the threads in said central aperture and on said shaft are

(*h*) of sufficiently high lead angle to permit said weight to rotate and descend along said shaft with the shaft stationary, when said opening is at the bottom of the torpedo, and

(*i*) means preventing rotation of said weight when disposed in an initial position completely within said cavity, constructed and arranged to permit it to rotate and descend when said shaft is rotated to move the weight away from said position.

3. Apparatus in accordance with claim 1 wherein

(*j*) said spring is constructed to store sufficient energy therein to rotate said shaft and expel said weight when said opening is disposed at the top of the torpedo.

4. Apparatus in accordance with claim 1 wherein

(*k*) said means for selectively latching and unlatching said shaft for rotation comprises a plurality of angularly spaced notches disposed around and rotatable with the shaft,

(*l*) a laterally slideable pin having an end adapted to engage within a slot to thereby lock the shaft against rotation, and

(*m*) a piston secured to said pin for moving the pin to unlocked position.

5. Apparatus in accordance with claim 1 wherein said ballast comprises

(*n*) at least two stacked solid weights, the outermost weight adjacent the opening containing the threaded aperture, and the other being unthreaded and adapted to slide along an unthreaded portion of the shaft.

6. Apparatus in accordance with claim 5 including

(*o*) a spring urging said other weight in a direction toward the open end of the cavity and adapted to expel it from same after said shaft disengages from the threaded aperture in the outermost weight.

7. Apparatus in accordance with claim 1 wherein

(*p*) said solid weight is of a length less than the length of said cavity,

(*q*) the remainder of the cavity being filled with a multiplicity of small particles, such as lead shot.

8. Apparatus in accordance with claim 7, including

(*r*) means for preventing rotation of said solid weight.

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