Jan. 15, 1952 T. C. BOYLE 2,582,226

EXPANSION HEAD FOR TORPEDOES

Filed Oct. 13, 1949 3 Sheets-Sheet 1

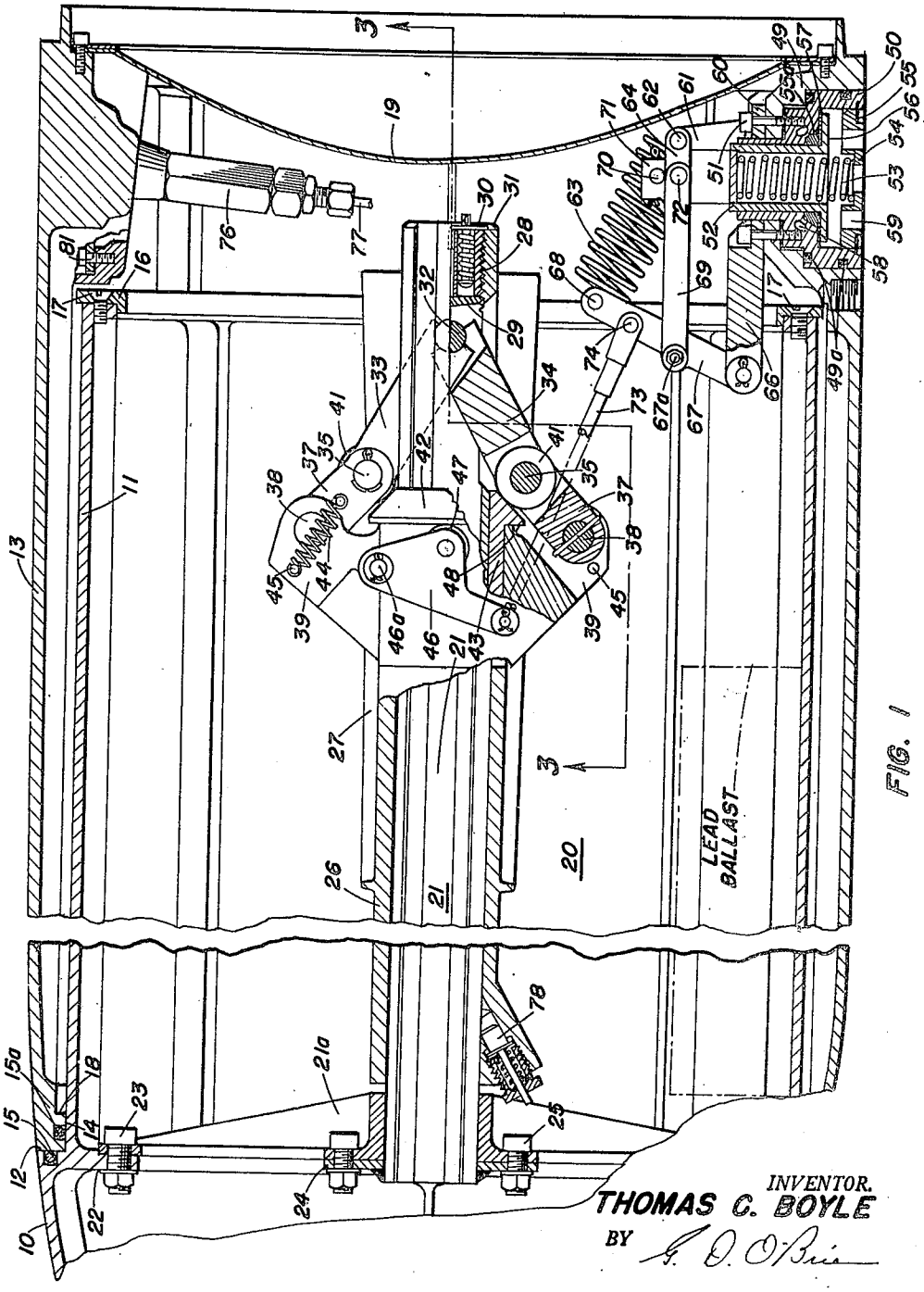


FIG. 1

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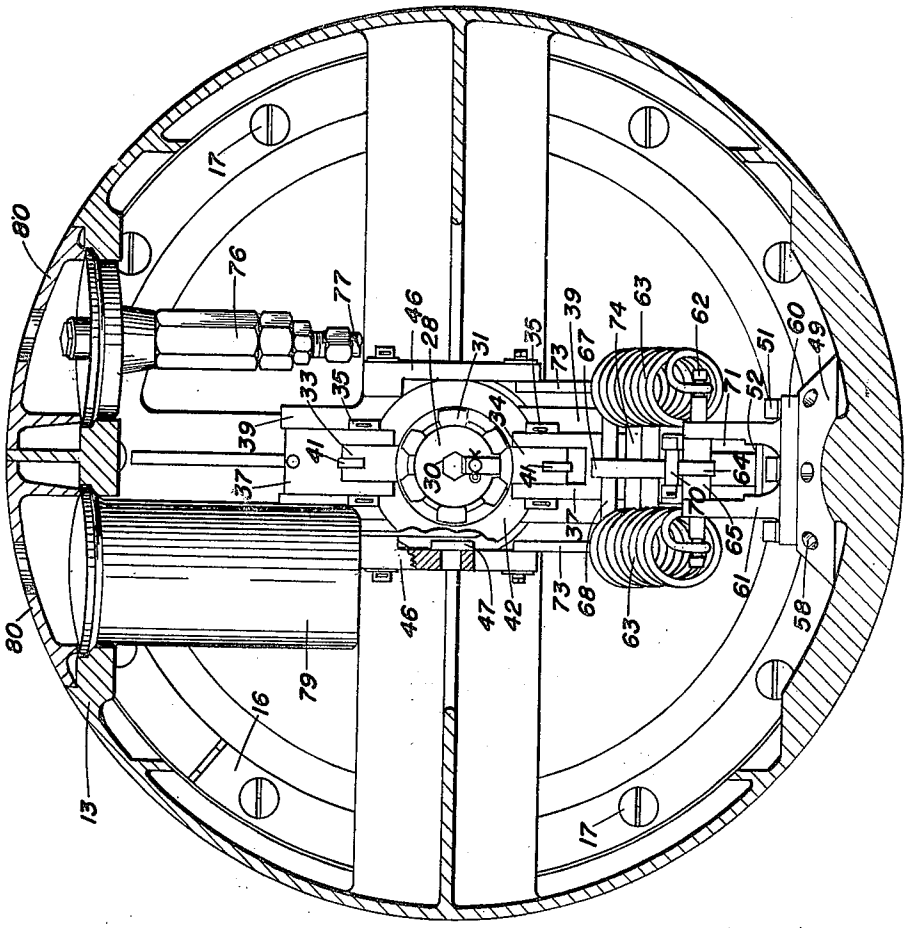


FIG. 2

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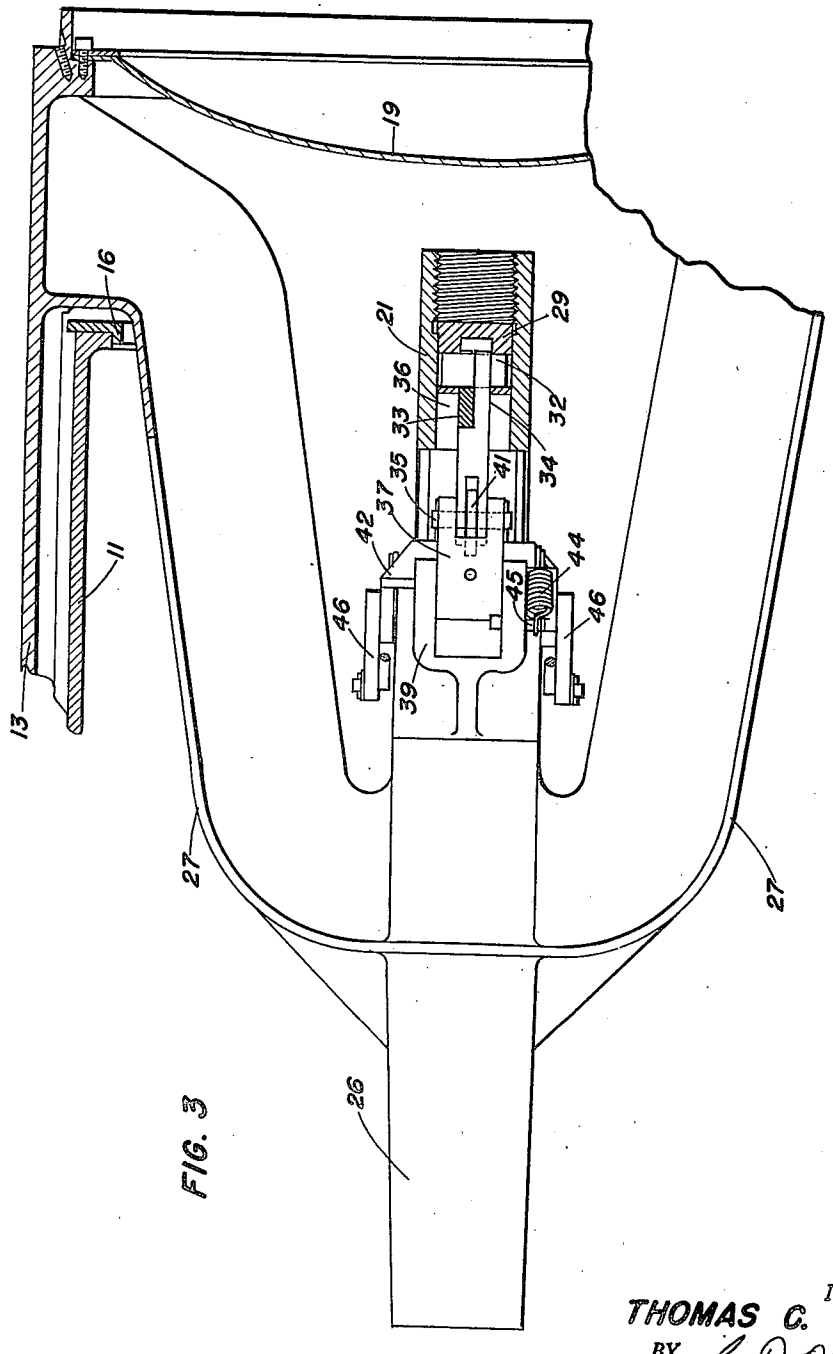


FIG. 3

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EXPANSION HEAD FOR TORPEDOES

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Application October 13, 1949, Serial No. 121,081

10 Claims. (Cl. 114—20)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates to torpedoes and more particularly to a new and improved exercise head therefor.

It is customary to test the delicate mechanisms of torpedoes by substituting an exercise head for the usual war head and giving the device a run or series of such runs which are intended to simulate the actual operating conditions when the torpedo is used for destructive action. In making such tests or practice runs with the exercise head attached, it is essential that the weight and buoyancy characteristics of the torpedo be substantially the same as when the war head is attached for use in enemy action.

An exercise head of this character usually includes a closed hollow shell like casing which is filled with a liquid ballast to provide the necessary weight. As the torpedo approaches the end of the run, a valve connected to the air flask of the torpedo automatically admits air into the exercise head thus expelling the liquid ballast from the head through a suitable outlet valve. If the chamber in the exercise head is of sufficient capacity, the reduction in weight resulting from the discharge of the ballast causes the torpedo to become buoyant and it will rise to the surface where it may be easily located and recovered.

It is sometimes necessary to increase the weight of the exercise head to make it conform to the weight of a particular war head for which it is to be substituted. Since this must be done without changing the exterior dimensions, it is the practice to secure a bar of heavy material such as lead in the bottom of the exercise head chamber to provide the necessary additional weight. When this is done with previously known exercise heads, the reduction in weight that occurs when the liquid ballast is expelled at the end of the run may not be great enough to give the torpedo the necessary positive buoyancy to cause it to rise to the surface. Accordingly, considerable difficulty may be encountered in locating and recovering the torpedo. The present invention overcomes the disadvantages of prior art exercise heads and assures sufficient buoyancy regardless of the weight carried by the exercise head.

It is an object of the present invention therefore to provide an exercise head which may be used as a substitute for a variety of war heads of different weight.

A further object is to provide an exercise head having a chamber that may be automatically expanded when positive buoyancy is desired.

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A still further object is the provision of an exercise head whose normal length is the same as that of the war head for which it serves as a replacement and which may be extended to increase its buoyancy.

Another object of this invention is to provide a valve actuated mechanism for automatically increasing the buoyancy of a torpedo.

Still another object is to provide an exercise head made up of a plurality of replaceable sections which are normally secured together to form a chamber of predetermined capacity.

Other objects and their attendant advantages will become apparent from the following description read in conjunction with the accompanying drawings, in which:

Fig. 1 is a fragmentary longitudinal view partly in section illustrating one embodiment of the present invention;

Fig. 2 is a vertical view partly in section as viewed from the right end of Fig. 1 with the end plate removed; and

Fig. 3 is a fragmentary view looking up from below and taken along a line substantially corresponding to line 3—3 of Fig. 2.

As illustrated in Fig. 1, the present invention contemplates an extensible closed hollow casing comprising a nosepiece 10 which may be of cast metal or other suitable material and is formed with a suitable ogive contour on its forward exterior surface. Projecting rearwardly from the nose and integral therewith is a cylindrical extension 11 that is somewhat smaller in diameter than the major diameter of the nosepiece so that a shoulder 12 is formed at the juncture of these two members. A body member 13 tapered slightly to conform with the contour of the nosepiece has a bore 14 in its front end corresponding to the diameter of the extension and is adapted for sliding telescopic engagement therewith. Suitable seals 15 and 15a of the O ring type, made of rubber or similar material, may be provided for the bore 14 and shoulder 12 to prevent leakage. A stop ring 16 may be secured to the right end of the extension 11 by screws 17 for limiting the extending movement of the nosepiece by engaging an internal shoulder 18 in the front end of body 13.

The right end of body 13 is adapted for attachment in the usual way to the torpedo air flask portion of the conventional torpedo body (not shown) and has a partition 19 which forms one end of a ballast chamber 20.

A shaft 21 having a plurality of splines disposed about its periphery extends axially of

chamber 20 and connects the nosepiece 10 and body 13. The left end of the shaft projects through the central bore of a spider 21 the legs of which spider are secured at their extremities by bolts 23 to an internal flange 22 of the nosepiece. The end of the shaft may be secured to a plate 24 as by welding or other suitable means, and the plate may be secured to the spider by bolts 25. The right end of shaft 21 may be supported in an elongated bearing 26. As illustrated in Fig. 3, the bearing 26 may be supported centrally of body 13 by a pair of oppositely disposed integrally cast arms 27 extending at an angle from the inner wall of the body to the bearing. Relative rotation of body 13 and nosepiece 10 is prevented by the splines which, as shown in Fig. 1, engage in slots formed in bearing 26.

A releasable latch mechanism, described hereinafter, normally secures the shaft against longitudinal movement in bearing 26 and thus retains the extension 11 retracted in body 13 with the end of the body abutting against the shoulder 12.

It will be noted from Figs. 1 and 3 that the right end of shaft 21 is provided with an axial opening for receiving a vertically slotted latch block 29 which is adjustably retained in place by a threaded plug 28. This plug may be locked in position by a spring tensioned detent fitting 30 whose outer end engages one of a series of radially spaced notches 31 in the end of shaft 21. The inner end of the detent fitting may be bent at right angles to fit into a central hole in the shaft as shown in Fig. 1. The latch block 29 carries a transverse pin 32 which bridges the vertical slot and is engageable by the notched ends of a pair of swingably mounted release arms 33 and 34 when the shaft is latched in retracted position. Arms 33 and 34 are oppositely disposed in a vertical plane, the former being mounted above and the latter below shaft 21 so that their notched ends may project into a vertical slot 36 in the shaft for releasable engagement with pin 32. The ends of these arms have shallow arcuate notches corresponding to the curvature of the pin 32 as shown. Since arms 33 and 34 are mounted and operate in an identical manner like reference numerals are employed to indicate like parts.

The outer end of arms 33 and 34 are pivotally mounted on their respective toggle pins 35 which in turn are carried on the end of a bifurcated toggle link 37. The opposite end of link 37 is pivotally mounted on a transverse pin 38 in an outwardly projecting bracket 39 attached to bearing 26. Each of the toggle pins 35 carries a roller 41 that engages the inclined face of a cone carried on the right end of a collar 43. This collar is freely movable on shaft 21. When shaft 21 is latched in retracted position as shown in Fig. 1, it will be noted that arms 33 and 34 and their individual toggle links 37 bow in slightly at their toggle points so as to lock the toggle in extended position. In this position rollers 41 are in contact with cone surface 42. Tension springs 44 are located adjacent each pin 38 though only one is shown. These springs tend to move the toggle joints toward each other and hold the rollers against the cone surface 42 and in addition, upon release of the toggle tend to throw the arms out of the path of movement of the shaft 21 in a manner to be hereinafter described.

Release of the above-described latch mechanism is accomplished by movement of a pair of levers 46 one pivotally mounted on each side of the bracket 39 by means of pin 46a and they are connected at their lower or free ends to an outlet valve in a manner to be described hereinafter. As the lower ends of levers 46 are moved to the right, rollers 47 engage an annular flange 48 on collar 43 causing the collar and its integral cone surface 42 to act against rollers 41 until the tension springs 44 pass over the center of pin 38, and the toggle breaks. When this occurs release arms 33 and 34 and their corresponding toggle links 37 swing rapidly outwardly about the pivot pins 38. Shatf 21 is now free to move to the left.

In the lower right end of body member 13 there is an integral mounting boss 49 extending upwardly into chamber 20 for supporting an outlet valve through which liquid ballast carried in the chamber may be expelled. This valve includes a body 50 positioned in an opening extending through boss 49 and is secured to a shoulder in the upper portion of the boss by screws 51. A valve stem 52 vertically movable in the body has a relatively deep internal recess for receiving a compression spring 53 that normally holds the valve closed. This spring is contained between an apertured plate 54 secured in the lower end of the valve body and the bottom of the recess in the stem. Plate 54 may be retained in place by a flat snap ring 55 extending over the edge of the plate and fitted into an annular recess in the valve body. Affixed to valve stem 52 by locknut 55a is a flat annular washer of leather or similar material that is interposed between a flange portion 56 on the stem and a flat valve seat 57 in the valve body thus providing a seal for this outlet valve. When the valve is open the fluid ballast contained in chamber 20 may be discharged through openings 58 extending through the boss and the walls of valve body 49 and communicating with the outside by openings 59 in retaining plate 54. Suitable seals 49a of the O ring type may be used to prevent leakage about the valve body.

Associated with the outlet valve is a spring tensioned toggle mechanism that is adapted to release the above-described shaft latch mechanism when the valve is opened to discharge the ballast. The toggle mechanism is supported on a bracket 60 which fits over the upper end of the valve body 50 and may be secured to boss 49 by the same screws 51 which hold the valve body in place. As may be seen in Figs. 1 and 2, a pair of spaced vertical extensions 61 on the bracket support a transverse rod 62 which provides an anchor for one end of tension springs 63 and also serves as a pivot pin for a short toggle link 64 maintained centrally between the vertical extensions by spacing collars 65. A horizontal extension 66 on the bracket may be bifurcated on its outer end to pivotally support the lower end of a trip lever 67 which carries a transverse pin 68 on its upper end and to which are anchored the other ends of tension springs 63. A pair of relatively long toggle links 69 pivotally secured to each side of trip lever 67 by a bolt 67a are connected to the short toggle link 64 by pivot pin 72. If desired, toggle links 69 may comprise a single link that is suitably bifurcated on each end for pivotal connection with lever 67 and link 64. The toggle links 64 and 69 extend between a pair of spaced vertical extensions 71 which are affixed to the upper end of valve stem 52. A transverse pin 70 in the extensions engages the knee of the toggle and

prevents it from moving upwardly under the influence of tension springs 63 when the outlet valve is closed. It will be apparent, however, that if stem 52 moves downwardly to open the valve, pin 70 will move the toggle links so that the knee is bent thereby permitting the upper end of trip lever 67 to be drawn to the right by the tension of springs 63. When this occurs, a pair of elongated connecting rods 73 which are attached to a cross rod 74 carried by lever 67 are suddenly moved to the right, moving with them the lower ends of levers 46 to which they are pivotally connected. As levers 46 swing to the right, rollers 47 act against the flange 48 moving cone 42 against the rollers 41 on the release arms until springs 44 are carried past the center of pin 38 at which time the arms swing rapidly outwardly under the influence of springs 44.

The ballast outlet valve is opened by a sudden increase in pressure within chamber 20, occasioned by the automatic opening of an air inlet valve 76 positioned in the upper right end of the head and suitably connected to the usual torpedo air flask (not shown) by tubing 77. The valve 76 operates to admit air to chamber 20 when the air pressure in the usual torpedo air flask is reduced below a certain point at the end of the torpedo run and serves to admit air into the ballast chamber 20. As the pressure in the chamber 20 rises it overcomes the resistance of outlet valve spring 53 and the valve stem 52 moves to open position to permit the expulsion of the liquid ballast through openings 58. The opening movement of the valve stem 52 actuates the shaft latch mechanism through the movement of the toggle mechanism associated with the ballast outlet valve as explained in detail above. Since shaft 21 is no longer restrained by the latch mechanism, the nosepiece 10 is acted upon by the increasing pressure in chamber 20 thereby moving the nosepiece and the cylindrical extension 11 outwardly to the left until the annular stop ring 16 at the right end of the extension engages shoulder 18 in body 13. The shaft 21 may be retained in projected position and the casing extended, even through the air pressure subsequently fails, by a spring urged plunger 78 mounted on the left end of bearing 26 for wedging engagement with the shaft. With the nosepiece and extension in extended position the length of the head has been increased and the chamber 20 has been likewise lengthened. It will be apparent that the capacity of the chamber is now much greater than it was at the start of the run and, since the liquid ballast has been replaced by air from the flask, the buoyancy of the torpedo has been increased so that it will rise to the surface regardless of its original weight.

It will be noted from Fig. 3 that the casing body member 13 may be cast or molded so as to provide integral supports for the air valve 76 and a torch 79 each of which is securely held in place by a cover plate 80 fitted into a recess in the wall of the body. The plate may be attached thereto by screws 81 as shown in Fig. 1. A similarly cast integral support and cover plate therefor may be provided for a headlight carried in the nosepiece.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope

of the invention as set forth in the appended claims.

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

What is claimed is:

1. In an exercise head for torpedoes, an expandable chamber, means for securing the chamber against expansion, an inlet valve for admitting a fluid into the chamber, an outlet valve for expelling a ballast from the chamber, said outlet valve being operable by the pressure of the fluid entering the chamber, and means actuated by the opening of the outlet valve whereby said securing means is released so that the chamber may be expanded.

2. In a torpedo exercise head, in combination, a closed extensible casing comprising a plurality of telescopically connected sections, a shaft rigidly attached to one section, a latch mechanism for releasably securing the shaft to another section, an inlet valve for admitting air into the casing, an outlet valve operable to discharge ballast from the casing as air is admitted thereinto, and a toggle mechanism responsive to actuation of said outlet valve for releasing the latch mechanism whereby said casing may be extended to increase the buoyancy of the torpedo.

3. An exercise head for torpedoes comprising; a closed extensible casing, said casing including a body member, a cylindrical extension in telescopic engagement with the body, and a nosepiece attached to said extension; an inlet valve for admitting air into the casing; an outlet valve for expelling ballast from said casing; latch means for retaining said extension retracted in said body; and a toggle mechanism operable by movement of said outlet valve to release the latch means whereby said casing may be extended by the admission of air through said inlet valve.

4. An exercise head for torpedoes comprising a closed extensible casing, said casing including a body member, a cylindrical extension in telescopic engagement with said body member, a nosepiece attached to said extension, a shaft having one end attached to the nosepiece and the other end releasably secured to the body, an inlet valve for admitting air into the casing, an outlet valve for expelling ballast from said casing, a releasable latch mechanism engageable with the shaft for normally retaining the extension retracted in the body, and a toggle mechanism operable by movement of said outlet valve for releasing the latch mechanism whereby said casing may be extended by the admission of air through said inlet valve.

5. The torpedo exercise head defined in claim 4 including means for retaining said casing in extended position.

6. An exercise head for torpedoes comprising a nosepiece movable axially with respect to the torpedo body structure, guide means for supporting said nosepiece in alignment with the longitudinal axis of the torpedo body structure, means for securing said nosepiece in retracted position, said securing means including a latch pin, toggle means engageable with said pin to retain the nose in retracted position, and pressure sensitive means to break the toggle and release the latch pin.

7. A latch mechanism for an extensible nosepiece of a torpedo exercise head comprising; a latch block supported for movement with said

nosepiece; toggle means engageable with said latch block to retain the nosepiece in retracted position; and means for freeing said toggle whereby the nosepiece may extend.

8. In a torpedo exercise head of the character described wherein a shaft is mounted for longitudinal movement therein, a latch mechanism comprising a plurality of swingably mounted arms engageable with the shaft in latching position, and a collar engageable with said arms to move them out of latching position whereby the shaft is freed for longitudinal movement.

9. In a torpedo exercise head of the character described wherein a central shaft is supported for axial movement, a releasable latch mechanism for restraining said shaft against axial movement comprising; an adjustable latch block carried by said shaft, swingably mounted toggle arms engageable with said block in latching position, a toggle spring normally positioning the arms in latching apposition to the block, and means for moving said arms to unlatched position so as to free said shaft for longitudinal movement.

10. In a torpedo exercise head of the character described the combination with a valve having a movable stem of toggle arms supported adjacent said stem, a projection on said stem engageable with said arms to prevent bending of the toggle knee in one direction, and resilient means urging said arms against the projection when the valve is closed and operable to rapidly bend the toggle knee in the opposite direction when the valve opens.

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