Feb. 25, 1958 T. C. BOYLE 2,824,537

EXERCISE HEAD FOR TORPEDOES OR OTHER UNDERWATER, SURFACE OR AIR MISSILES, SHIPS OR CRAFT

Filed April 13, 1953 2 Sheets-Sheet 1

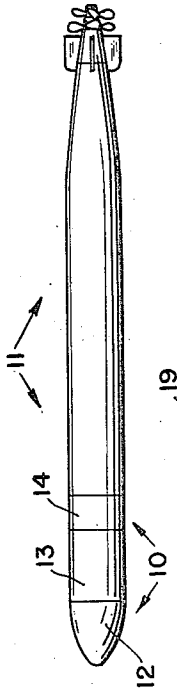


Fig. 1.

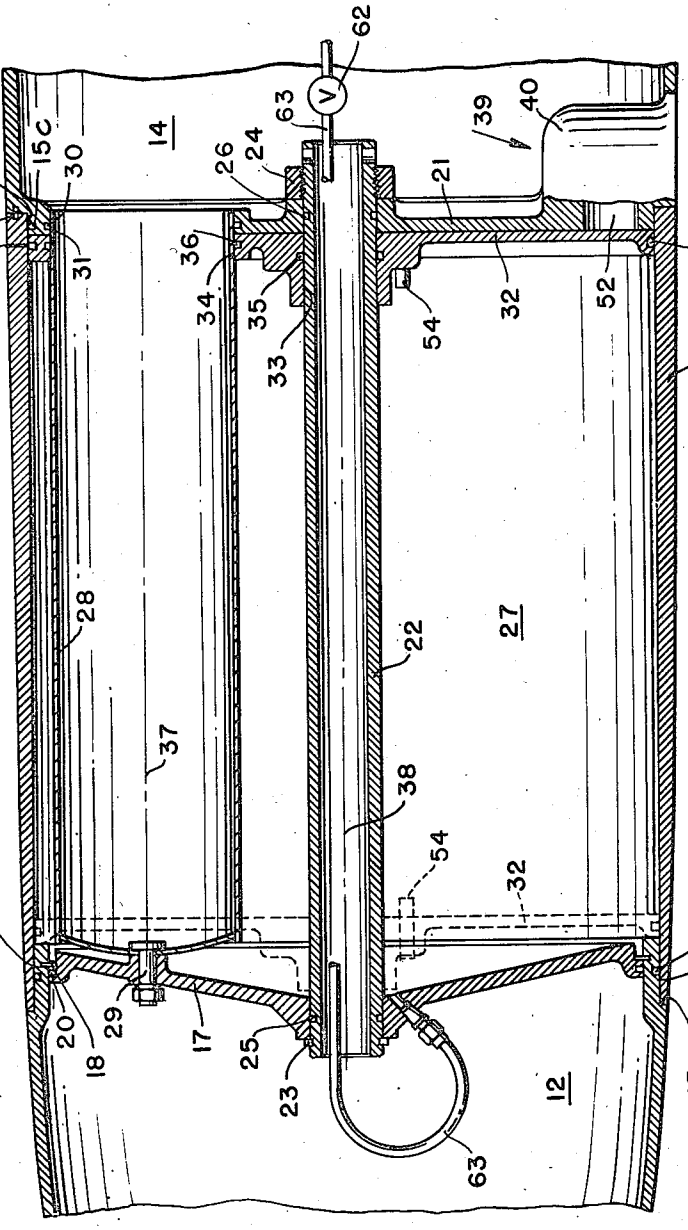


Fig. 2.

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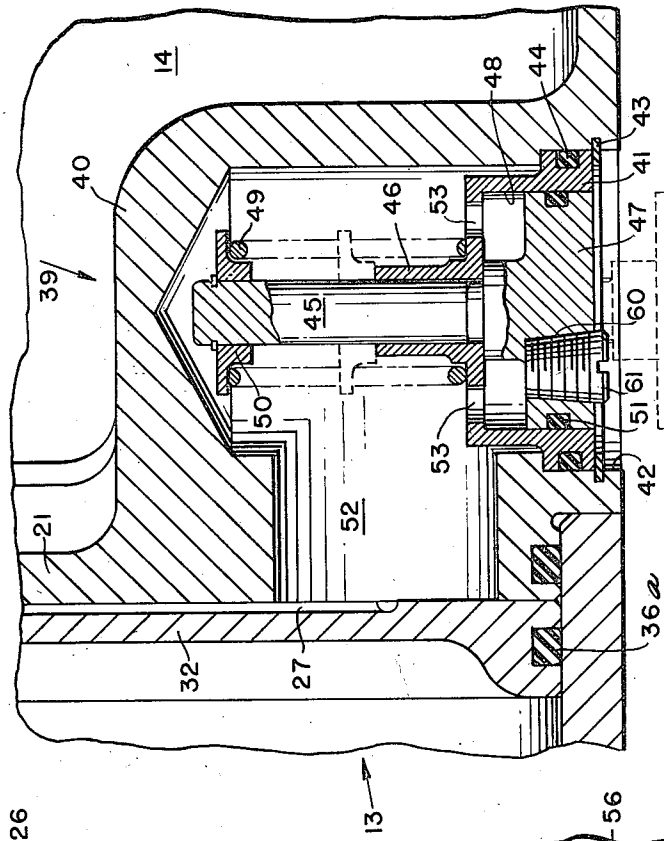


Fig. 4.

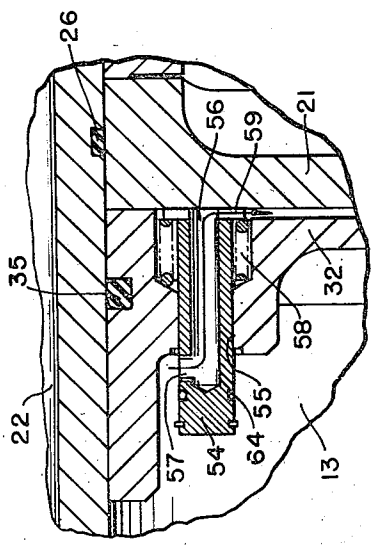


Fig. 3A.

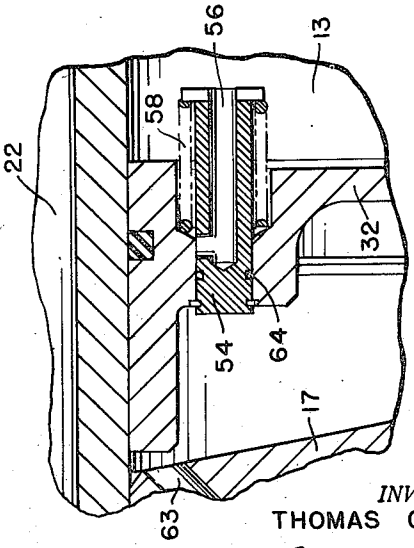


Fig. 3.

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EXERCISE HEAD FOR TORPEDOES OR OTHER UNDERWATER, SURFACE, OR AIR MISSILES, SHIPS, OR CRAFT

Thomas C. Boyle, Pasadena, Calif., assignor to the United States of America as represented by the Secretary of the Navy

Application April 13, 1953, Serial No. 348,599

4 Claims. (Cl. 114—20)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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.

This invention relates to torpedoes and more particularly to exercise heads employed during test runs of same.

It has been common practice to test certain mechanisms of torpedoes during torpedo runs, with exercise heads substituted for the usual war heads. If a test run, with a substituted exercise head, is to simulate actual operating conditions of the torpedo with its war head, it is essential that the exercise head provide the torpedo with substantially the same weight, trim and buoyancy characteristics as the war head.

A common type of exercise head, to fulfill the foregoing requirements, includes a chamber containing liquid ballast to provide the necessary weight. At the end of the run this ballast is discharged from the chamber, which, if of sufficient capacity, causes the torpedo to become buoyant and rise to the surface of the water where it may be readily located and recovered.

It has also been the practice to carry a certain amount of dead weight at the bottom of an exercise head of the foregoing type, in the form of lead or other metal, to render the torpedo pendulous and provide it with trim. In some exercise heads, when this dead weight is employed, the ballast discharge may not be sufficient to provide the necessary positive buoyancy to cause the torpedo to rise to the surface, thus rendering its recovery difficult.

One of the objects of this invention is to provide an exercise head in which the dischargeable ballast serves the dual purpose of providing the weight and trim characteristics formerly attained by use of liquid ballast and dead weight.

Another object is to provide an exercise head for a torpedo having a ballast chamber of such cross sectional configuration that the center of mass of its contained ballast is disposed below the longitudinal axis of the torpedo.

Another object is to provide an exercise head ballast chamber from which its ballast may be discharged regardless of the position of the torpedo.

Another object is to provide an exercise head from which its ballast may be discharged at increased depths.

Another object is to provide an exercise head with a smaller and more rigidly constructed ballast chamber employing a fluid ballast of relative high density, enabling the use of higher chamber pressures to effect more rapid ballast discharge therefrom.

Another object is to provide an exercise head of simplified construction and subject to economical manufacture.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of a torpedo with which the subject of the invention may be employed;

Fig. 2 is a longitudinal fragmentary central section of the invention, portions being broken away;

Fig. 3 is an enlarged sectional detail of Fig. 2;

Fig. 3A is a similar detail showing the parts in a different position; and

Fig. 4 is another enlarged sectional detail of Fig. 2.

Referring in detail to the drawing, in which a preferred form of the invention is illustrated, the exercise head **10**, which is substituted for a war head (not shown) of a torpedo **11**, comprises, in general, a front or nose section **12**, an intermediate cylindrical section **13** forming a ballast chamber, and a rear section **14** in which suitable instruments are disposed. The front and intermediate sections are telescopically joined by a joint **15** and the intermediate and rear sections are similarly joined by a joint **16**, these joints being provided with abutments **15***a*, **16***a*, and O ring seals **15***b*, **15***c*, respectively. A closure wall or bulkhead **17** is disposed within a bore in the rear end of section **12**, the rear face of which abuts a split ring **18** retained within an annular groove **19** in section **12**. An O ring **20** seals the periphery of the wall within the bore. The front end of section **14** is provided with a similar, but integral wall **21**. These walls are provided with central bores which receive the front and rear ends of a tube **22**. A snap ring **23** engages a front face of wall **17** and a nut **24**, threadedly engaging the rear end of the tube, engages a rear face of wall **21**. O rings **25**, **26** seal the tube within the bores. As will be apparent, when nut **24** is tightened, the three sections are rigidly secured together, the intermediate section forming a chamber **27**. A circular tube **28** is secured at its forward end to wall **17** by a bolt **29**, the rear end of this tube being disposed in a bore **30** in wall **21** and sealed by an O ring **31**.

A piston **32** is slideably disposed within the bore of section **13** and is provided with a central bore **33** through which tube **22** extends. A second bore **34** similarly receives tube **28**. O rings **35**, **36**, carried by the piston, seal the latter in its movement along these tubes, and an O ring **36***a* seals the piston in its movement within the bore of section **13**. As will now be apparent, chamber **27** is annular in cross section except that it has a void of circular section, formed by tube **28**, the axis **37** of the void being parallel with the axis **38** of the torpedo and in a vertical plane containing the two axes. This places the centroid of the chamber cross section below the axis of the torpedo and when the chamber is filled with fluid, the center of mass of the fluid will be disposed below the torpedo axis.

As best shown in Fig. 4, a chamber discharge valve assembly **39** is carried in a boss **40** on section **14**, this assembly comprising a valve cage **41** retained in a bore **42** by a snap ring **43**, sealed by an O ring **44**, and reciprocably carrying a valve stem **45** in valve stem guide **46**, the stem having a valve head **47** disposed in a bore **48** in cage **41**, and retained in the full line position shown by a spring **49**, one end of which engages the cage and the other end of which engages an annular washer **50**, secured to the valve stem. An O ring **51** carried by valve head **47** provides a seal between the valve head and bore **48**. A conduit **52** in boss **40**, and a plurality of apertures **53** in cage **41** communicate chamber **27** with the inner face of the valve head so that when pressure is applied to this face, sufficient to overcome the urge of spring **49**, the valve opens to the dotted position to permit discharge of ballast contained in chamber **27**. While only one discharge valve is illustrated it will be apparent that several similar angularly spaced valves may be employed if desired.

To permit automatic closing of the discharge valve just described, an air discharge valve is provided in piston **32**, this valve comprising a stem **54**, slideable in a bore

55, and having an axial aperture 56 and a communicating lateral aperture 57, the stem being urged to closed position, as shown in Fig. 3, by a spring 58. As best shown in Fig. 3A, when piston 32 moves to a position near the end of its stroke the right end of the stem abuts wall 21 and further movement of the piston effects relative movement between it and the stem and communicates opposite sides of the piston as shown by arrow 59. When the piston is in the position shown in Fig. 3, an O ring 64, carried by stem 54, seals the stem within bore 55.

In the operation of the device the chamber of the exercise head is filled with fluid, and preferably a high density fluid such as white or red lead in oil or the like, or a barium salt or salts in solution, by pumping same into the chamber. To provide the necessary communication, an aperture 60 in valve head 47 is illustrated, this being normally closed by a plug 61 which may be removed so that a conduit or the like, connected to the source of fluid, may be connected to the aperture. At the end of a torpedo run, an air valve 62 automatically opens, under control of apparatus well known in the art, and air from a pressure flask (not shown) is delivered to the left side of piston 32 through pipe 63. This forces the piston to the right applying pressure to the ballast and opening the discharge valve through which the ballast discharges. When the piston reaches the end of its stroke, after forcing the ballast from the chamber, the remaining air in the flask passes through the air discharge valve and when the air pressure is no longer sufficient to hold the ballast discharge valve open, the latter moves to closed position under urge of spring 49, preventing entry of water into the chamber. Since the torpedo is now buoyant, it will rise to the surface of the water where it may be readily located and recovered.

If it be desired to reduce the weight of section 13, by reducing its wall thickness, yet retaining sufficient strength to withstand pressures to which it is subjected, this may be attained by providing a minute aperture 65 extending through the wall of the casing. This permits external water pressure to be transmitted to the ballast thus equalizing the external and internal pressures acting on the peripheral wall of section 13. When the torpedo descends at the end of its run these pressures remain equalized until valve 62 is actuated, whereupon the pressure behind the piston becomes greater than the ballast chamber pressure thus placing the portion of the section to the left (Fig. 2) of the piston under tension. When piston 32 moves to the full line position O ring 36*a* covers aperture 65 and prevents pressure communication through the aperture. As the torpedo rises and the external pressure decreases air pressure in the ballast chamber will also decrease since the ballast discharge valve will remain open as long as the pressure in the chamber is greater than ambient water pressure.

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. A torpedo exercise head comprising a chamber adapted to contain liquid ballast, a movable wall adapted to reduce the volume of the chamber, a source of gas under pressure for moving the wall, a ballast discharge valve adapted to automatically open in response to pressure applied to the ballast by the wall and through which the ballast is adapted to discharge, a gas bleed valve adapted to automatically open when the ballast has been discharged from the chamber, the gas bleed valve, when open, permitting gas from said source to bleed through the discharge valve and retain same open until its pressure falls to a predetermined value depending on the depth of the submergence of the torpedo, said discharge valve being adapted to prevent entry of water into the ballast chambers at all depths of submergence.

2. A torpedo exercise head comprising a chamber adapted to contain liquid ballast, a movable wall adapted to reduce the volume of the chamber, a source of gas under pressure for moving the wall, a ballast discharge valve adapted to automatically open in response to pressure applied to the ballast by the wall and through which the ballast is adapted to discharge, and means for communicating ambient water pressure to the ballast, whereby the internal and external pressure on said chamber are equalized at any depth of submergence thereof.

3. A torpedo exercise head comprising a first hollow circular cylindrical member, a second circular cylindrical member disposed within the first member with its axis disposed parallel to and above the axis of the first member, the space between the members forming a chamber containing fluid ballast, the centroid of the ballast being disposed below the axis of the first member, and a piston slideably disposed within said chamber adapted to reduce the volume thereof and discharge the ballast therefrom.

4. A torpedo exercise head comprising a first hollow circular cylindrical member, walls closing opposite ends of said member, a second hollow circular cylindrical member disposed within the first member and extending between the walls with its axis disposed parallel to and above the axis of the first member, a piston slideably disposed within the space formed between said members, forming a liquid ballast chamber between one of its sides and one of the walls, and forming a gas chamber between its other side and other wall, liquid ballast filling the ballast chamber, its centroid being disposed below the axis of the first member, means for admitting gas under pressure to said gas chamber for effecting movement of said piston, and valve means adapted to open when said piston moves and communicate said ballast chamber with ambient water, said valve means adapted to prevent flow of ambient water into the ballast chamber after the ballast has been discharged therefrom.

References Cited in the file of this patent

UNITED STATES PATENTS

399,693	Poore et al.	Mar. 19, 1889
1,382,073	Fort	June 21, 1921
1,382,397	Whitehouse	June 21, 1921
1,803,530	King et al.	May 5, 1931
2,063,727	Davis	Dec. 18, 1936
2,377,181	Rabuse	May 29, 1945
2,593,362	Taylor	Apr. 15, 1952
2,630,092	Leonard	Mar. 3, 1953