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GAS GENERATOR FOR FLOATING TORPEDOES

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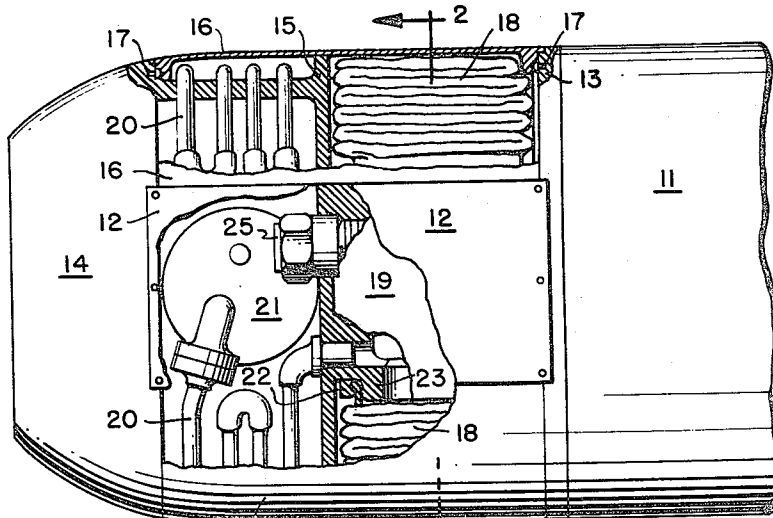


Fig. 1

Fig. 2

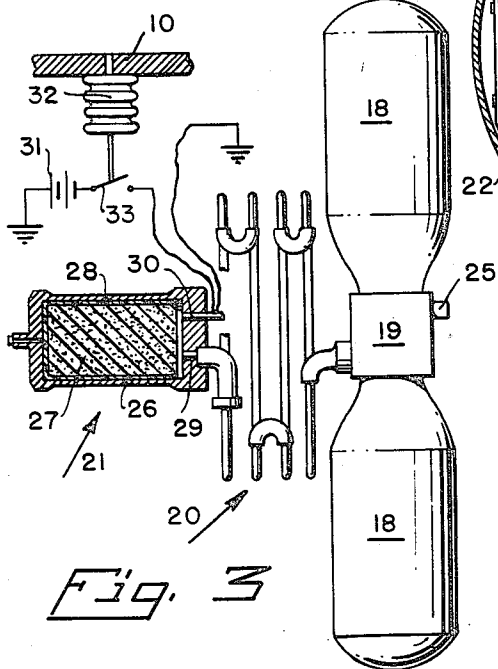
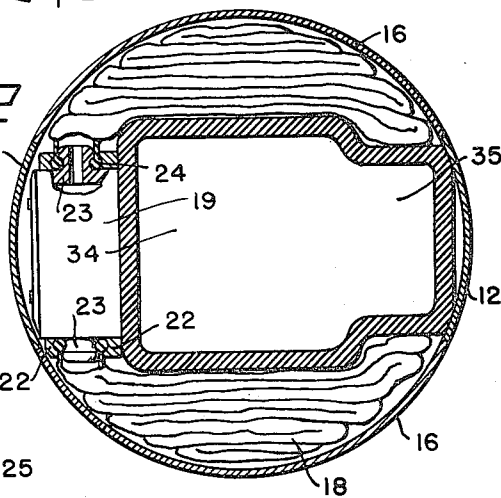


Fig. 3

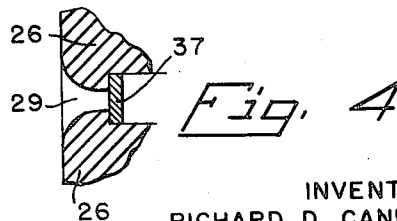


Fig. 4

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GAS GENERATOR FOR FLOATING TORPEDOES

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5 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 flotation apparatus and more particularly to apparatus for rendering buoyant a negative buoyant body, such as a torpedo.

In the testing of negative buoyant torpedoes it is essential that the torpedo be recovered after a test run to obtain and evaluate the test data recorded by its recording apparatus. Various devices have been employed for this purpose such as ballast in the form of a weight, lead shot, or heavier than water liquids which may be released at the end of the exercise run to thus provide a void space within the torpedo which thus lightens it for the same overall displacement and renders it buoyant. Other devices employing a source of gas under pressure, carried by the torpedo or chemicals adapted to react with water to produce gas have also been employed. Such devices are, in general, complicated, bulky or subject to unreliable operation.

One of the objects of this invention is to provide flotation apparatus which is simple in construction, compact, reliable in operation and economical of manufacture.

Another object is to provide an extremely compact source for generating gas for inflating flotation bags which latter render the torpedo buoyant.

Further objects, advantages, and salient features of the invention 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 broken away side elevation of the front end of a torpedo, some parts being shown in section,

Fig. 2 is a section taken on line 2—2, Fig. 1,

Fig. 3 is a diagrammatic arrangement of the apparatus, and

Fig. 4 is an enlarged detail of Fig. 3.

Referring to the drawing, the invention comprises a torpedo exercise nose section 10, forming a part of torpedo 11, the former containing the flotation apparatus forming the subject of the invention. Section 10, as shown in Fig. 1 is the same shape as the warhead section employed for a war shot and the torpedo is non-buoyant in the same manner as it would be with the war head attached. Section 10 comprises an integral casting including a rear joint ring member 13 which detachably secures it to the next rearwardly section of the torpedo, a central bulkhead 15 and a transducer 14 at its forward end. A pair of arcuate access plates 12, 12 extend longitudinally of the section at diametrically opposite sides thereof and are detachably secured thereto by screws or the like. A pair of similar plates 16, 16, detachably secured to the section by detents 17, 17, close and fair the remaining portions of the periphery of the section. Detents 17, 17 retain plates 16, 16 affixed to the section during its run but permit disengagement of the plates

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upon application of outward pressure to their inner surfaces.

Referring now to Fig. 3, the flotation apparatus comprises, in general, a collapsible two part bag 18, 18, a manifold 19, to which the bag parts are attached, a cooling coil 20, and a gas generator 21.

Each bag part 18 is formed of flexible sheet material, such as rubber or plastic, connected to manifold 19 by split or two part plates 22, 22 which squeeze the neck of each bag onto oval projections 23, 23 which are grooved to receive a bead 24 extending around the neck of each bag. The manifold is provided with a pressure relief valve 25 of any conventional type which will maintain a desired differential pressure between the interior of the bags and ambient water in which the torpedo is submerged. One end of cooling coil 20 is connected to manifold 19 and the other end to gas generator 21.

Gas generator 21 comprises a closed casing 26 containing a solid propellant powder grain 27 which is encased within an inhibitor 28 except at one end, this being the right end as shown in Fig. 3. The propellant grain is thus of the "cigarette" burning type, burning only on its exposed end face. It is preferably of the slow burning type and which will produce products of combustion at relatively low temperature. A suitable discharge orifice 29, closed by a burst diaphragm 37, through which the exhaust gases must throttle, maintains the combustion pressure in the generator at about twice the pressure in the cooling coil and two part bag whereby the grain burning characteristics will not be affected by changes in back pressure as occurs with a deep running torpedo. As will be apparent, the pressure in the cooling coil will balance the ambient pressure of the water, this being maintained at all depths by pressure relief valve 25. Thus, as the torpedo rises to the surface, gas is bled through valve 25.

To initiate burning of the propellant any suitable type of squib may be employed, this being illustrated as an electrical or hot wire squib 30 which is fired by an electrical source 31, such as a battery. The electrical circuit may be closed in any suitable manner such as by a pressure responsive hydrostat 32 which controls a switch 33. The circuit may be established in any other manner known in the art such as a time responsive switch or a switch responsive to the completion of the torpedo run.

In the operation of the device, and prior to the exercise run, bag parts 18, 18 are deflated and are folded into spaces within the exercise section as shown in Figs. 1 and 2. Plates 16, 16 are then applied to the exercise section and retained to same by the detents previously described. At the desired time of operation of the flotation device squib 30 is fired which ignites the solid propellant which begins to burn, bursting diaphragm 37. In approximately .1 second full pressure is reached and gases are delivered to the bag parts which commence to inflate. The inflation of the bag parts applies pressure to plates 16, 16 disengaging same from detents 17, 17, the disengaged plates thus permitting the bag parts to inflate to generally cylindrical shape, as shown in Fig. 3. As will be apparent, when the plates are disengaged, coil 20 will be exposed to the sea water. The plates may be either expendable or attached to the torpedo by lanyards, wires or the like (not shown) so that they may be recovered with the torpedo. Since the temperature of the generator gases exhausting from the generator would injure bag parts 18, 18, constructed of the material described, it is essential that the gases be cooled prior to delivery of the gases to same, which is performed by coil 20. The bag parts become inflated in a relatively short time, rendering the torpedo buoyant and as it rises to the surface gas is bled through valve 25 maintaining the pres-

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sure in the bag parts substantially equal to ambient gas pressure, as previously described.

In addition to the parts above described, the exercise section carries a camera (not shown) in space 34 and a hit indicator (not shown) in space 35 which records the final result of the torpedo run toward its target.

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. An exercise section for rendering buoyant a negatively buoyant torpedo, comprising a casing of the size and shape of the similar section employed with the torpedo for a war-shot, said casing having at least one shell portion detachably engaging same and adapted to be moved away from the casing by application of internal pressure thereto to expose the interior of the casing to sea water, a collapsed flexible bag member disposed within the casing adapted, when inflated, to expand and apply said internal pressure, and when fully inflated, to be disposed with the major portion thereof outside the casing, a heat exchanger disposed within the casing adapted to be exposed to sea water, a solid propellant container disposed within said casing, a solid propellant grain disposed within the propellant container adapted to produce gas under pressure when it burns, means for igniting the solid propellant, and means including the heat exchanger communicating the propellant container with the interior of the bag member, the construction and arrangement being such that gases exhausted from the propellant casing are cooled by the heat exchanger prior to delivery to the bag member.

2. Apparatus in accordance with claim 1 including a pressure relief valve communicating with the bag member for bleeding gas therefrom as the torpedo rises to the surface to maintain the pressure in the bag member substantially equal to ambient sea water pressure at various depths of submergence.

3. Apparatus in accordance with claim 1 including an orifice communicating the solid propellant casing with the heat exchanger for maintaining the pressure within the solid propellant casing at a desired pressure above the pressure in the heat exchanger.

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4. Apparatus in accordance with claim 1 wherein said heat exchanger comprises a tubular metallic coil.

5. An exercise section for rendering buoyant a negatively buoyant torpedo, comprising a casing of the size and shape of the similar section employed with the torpedo for a war-shot, said casing having a pair of diametrically opposed shell portions detachably engaging same and adapted to be moved away from the casing in opposite directions by application of internal pressure thereto to expose the interior of the casing to sea water, a manifold member disposed within the casing, a pair of collapsed flexible bag members, each having an open neck portion sealingly secured to the manifold and being collapsed in positions such that each is disposed in a space adjacent a shell portion and adapted, when inflated, to expand and apply said internal pressure, and when fully inflated to be disposed with the major portions thereof outside said casing, a heat exchange coil disposed within the casing adapted to be exposed to sea water, a solid propellant container disposed within said casing, a solid propellant grain disposed within the propellant container to provide gas under pressure when it burns, one end of said coil communicating with said manifold and the other end with said propellant container, the construction and arrangement being such that gases exhausted from the propellant container are cooled by said coil prior to delivery to the manifold, a pressure relief valve communicating with the bag members for bleeding gas therefrom as the torpedo rises to the surface to maintain the pressure in the bag members substantially equal to ambient sea water pressure at various depths of submergence, and an orifice communicating the solid propellant casing with the cooling coil for maintaining the pressure within the solid propellant casing at a desired pressure above the pressure in the cooling coil, and means for igniting the solid propellant.

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