

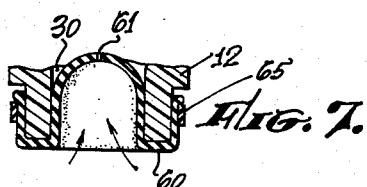
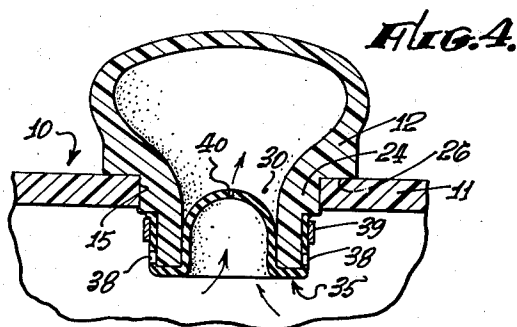
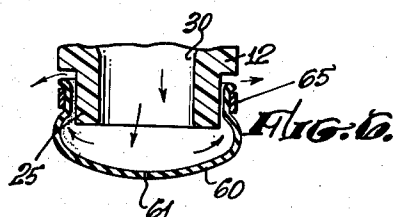
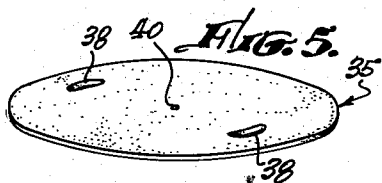
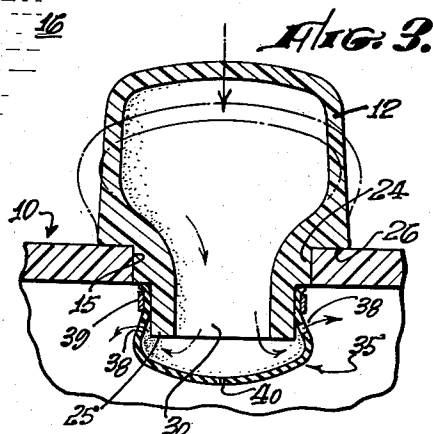
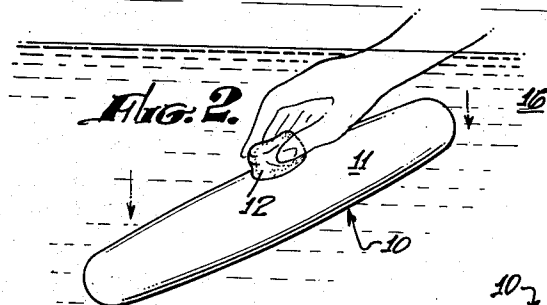
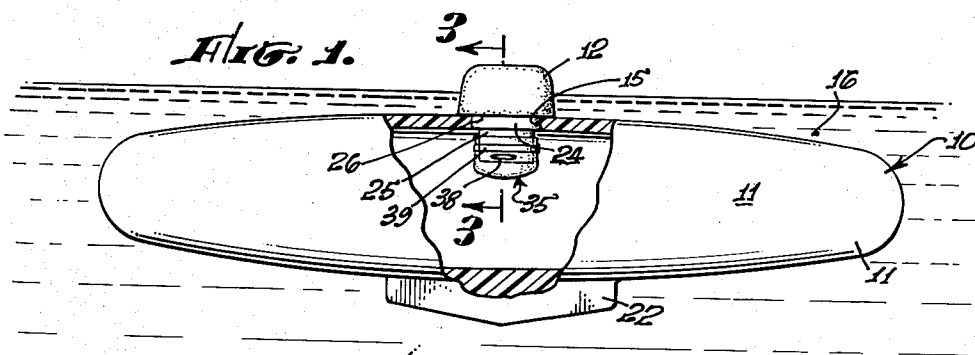
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A. RUIZ

2,964,874

SUBMERSIBLE TOY

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ARMANDO RUIZ
INVENTOR.

BY
William C. Babcock
ATTORNEY.

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2,964,874

SUBMERSIBLE TOY

Armando Ruiz, Bell, Calif.
(412 S. Palm Ave., Alhambra, Calif.)

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This invention relates to toys, and more particularly to a toy which simulates a submarine.

It is an object of the present invention to provide a toy which will automatically submerge or descend within a liquid.

Another object of the present invention is to provide a toy submarine which will normally float near the surface of the liquid in which it is disposed but which may be caused to descend below the surface thereof at a predetermined rate of descent.

A further object of the present invention is to provide a toy submarine which includes a novel valving arrangement permitting it to automatically dive and ascend within a water-filled tank at a predetermined rate.

Yet another object of the present invention is to provide a toy submarine of the character described which in appearance and performance simulates the dive and ascent of a full scale submarine.

In accordance with the presently preferred embodiment of this invention the toy includes a hollow, generally solid elongate body simulating the shape of the hull of a submarine. Extending from the upper surface into an opening within the hull is a substantially hollow cylindrical chamber which simulates the conning tower of a submarine. The conning tower is essentially a flexible walled cylindrical chamber and is joined to the hull to effect a hermetic seal therebetween. A flexible diaphragm which serves as a two-way air valve, is secured to the lower end of the conning tower where the opening there-through communicates with the hollow interior of the hull.

The valve which is preferably of flexible rubber, serves to admit air from the conning tower by exhaustion therefrom into the hollow of the hull, thus effectively substantially reducing the volume of the flexible conning tower which will thus be in a substantially collapsed state. The valve is adapted to admit the air from the tower into the hull at a relatively high rate. Means are provided for readmitting air from the hollow hull into the hollow conning tower at a slower rate. Thus, after an extending period of time the conning tower will again be inflated and will thus assume its original shape and volume. This increase and decrease in the volume of the hull will cause an overall effective decrease and increase in the volume of the entire submarine, thus changing the volume of water displaced thereby. The weight of the entire submarine is chosen so that it will barely float when the tower is inflated, thus it will sink when it is exhausted.

The novel features which are believed to be characteristic of the invention both as to its organization and method of operation, together with further objects and advantages thereof will be better understood from the following description considered in connection with the accompanying drawing in which two embodiments of the present invention are illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and example only, and

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is not intended as a definition of the limits of the invention.

In the drawing:

Figure 1 is a front elevation, partly in section showing a toy submarine in accordance with the presently preferred embodiment of the present invention;

Figure 2 is a perspective view showing the submarine of Figure 1 on a somewhat reduced scale during the diving sequence;

Figure 3 is an enlarged sectional view taken along line 3—3 of Figure 1;

Figure 4 shows the valve of Figure 3 as it will appear after the flexible walled chamber has been exhausted of trapped air;

Figure 5 is a perspective view of the diaphragm air valve of Figures 3 and 4; and

Figures 6 and 7 are sectional views showing an alternative valve arrangement somewhat modified from that shown in Figures 3 and 4.

Referring now to the drawing, and more particularly to Figure 1, there is shown a front elevation of a toy submarine generally designated by the numeral 10. The toy submarine includes an elongate hollow hull section 11 and an upwardly extending hollow conning tower section 12 substantially cylindrical in shape. The tower 12 is secured within, and hermetically sealed about an opening 15 provided within the upper wall of the hull section 11. The toy submarine 10 of Figure 1 is shown to be floating within a body of water 16 in such a manner that the conning tower 12 is partly submerged. The hollow hull section is made of a rigid material such as plastic. Extending vertically downward amidship from the hull is a ballast section 22 which provides additional weight and stability to the vessel while adding to the simulated appearance of a submarine.

The hollow conning tower 12 which rises vertically from the upper surface of the hull 11 substantially along a vertical axis extending through the hull and ballast sections is defined by a substantially flexible wall and roof. The conning tower 12 includes an extension 24 which defines a shoulder region 26. The extension 25 extends within opening 15 through hull 11 while the shoulder region 26 rests upon the outer surface of the hull. Thus, the hollow of the hull communicates with the hollow of the conning tower. Referring now to Figures 1 and 3, secured beneath the opening 30 at the end of the extension 26 is an air valve 35. Air valve 35 provides a novel means for automatically causing the entire submarine to dive and ascend in a manner as will hereinafter be explained. The valve 35 is formed of a generally disc-shaped diaphragm of flexible material such as rubber, and as best seen in Figure 5.

Two generally arc-shaped openings 38 are defined by the valve 35 near opposite ends of a diameter thereof. At the center of the diaphragm a small pin hole 40 is provided which is considerably smaller in cross section than openings 38. The diaphragm 35 is secured about the periphery of the extension 26 near the edge thereof by means of a ring clamp 39. Thus, the openings 38 are just above the lower edge of the extension 26 when the valve is in its normal position. The submarine floats in its normal or equilibrium position with the conning tower 12 extending partly above the water line 5. This is accomplished by weighting the vessel properly in order that it will float thus. In order to cause the vessel to dive below the surface, i.e., to the bottom of a tank for example, the user submerges the same by gripping the tower 12, as shown in Figure 2. The tower is then squeezed, causing the air to be evacuated therefrom and discharged into the hull section 11 through the relatively large openings 38 within diaphragm 35. Thus, a partial vacuum will be created within the flexible walled conning tower.

This partial vacuum will have two effects. Firstly, it will force the lower part of the flexible diaphragm to be sucked up into the tower causing it to assume a shape as shown in Figure 4. Thus, the openings 38 will effectively be temporarily closed as the side walls of the diaphragm surrounding and defining the openings 38 will be drawn flush against the exterior wall of the extension 25. Secondly, the partial vacuum within the tower will result in the effective collapse of the side walls of the tower as indicated by the dotted lines in Figure 3, due to the external water pressure. Thus, the volume of the tower will be substantially reduced.

Archimedes' principle states that a body immersed in a fluid is buoyed up with a force equal to the weight of the displaced fluid. As was previously mentioned, the vessel is so weighted as to cause it to float with but a portion of the conning tower extending above the water line. As that part of the tower's volume displaces a predetermined volume of water, it follows that its volume contributes to the buoyant force causing the vessel to remain afloat.

Upon exhaustion of the air from the tower, its volume will be substantially reduced thereby causing the trapped air within the tower to no longer displace the same volume of water, the volume now being reduced. As the weight of the vessel remains constant, the buoyant force will no longer be capable of supporting the vessel and it will sink, thus producing a diving effect. The air exhausted from the conning tower section will, of course, pass into the hull section, which itself will have been filled with captured air. Thus, the air pressure within the hull section will be somewhat increased as a result of the added air from the conning section.

As a small pin hole opening 40 exists through the diaphragm, the air pressure gradient between the hull side and the tower side of the diaphragm will cause the air exhausted from the conning tower to slowly leak back into the tower. This return air flow is indicated by the arrows in Figure 4. Thus, the tower will again assume its initial shape, causing a greater volume of water to be displaced and the submarine will thus slowly ascend to the equilibrium position shown in Figure 4.

In Figures 6 and 7 there is shown a partial sectional view of an alternate valve arrangement in accordance with the present invention. In this embodiment all parts are the same as that described hereinabove. The only difference exists in connection with the valve itself. Herein the valve includes a diaphragm 60 of resilient rubber or the like. The diaphragm is similar to that of Figure 5 except that it has but one small central hole 61 of equivalent size to hole 40 of diaphragm 35.

Diaphragm 61 is secured to the extension 25 of the flexible conning tower 12 by means of an elastic band 65, as may best be seen in Figure 6. In operation, and as shown in Figure 2, the user grips the flexible side walls of the tower 12 and compresses them thereby forcing the trapped air from the flexible wall chamber 12, causing the air to exhaust out of the flexible wall chamber into the hollow chamber defined by the hull portion. The air escapes by passing between the outer wall of the extension 25 by forcing the resilient band 65 to somewhat expand under the increased air pressure, and the air follows the path as indicated by the arrows in Figure 6. Thus, an effective partial vacuum will be created as explained hereinabove in connection with Figures 3 and 4, and the diaphragm will be sucked into the conning tower as is shown in Figure 7, resulting in the closing off of the air escape path along the exterior side wall of the extension 25. Thereafter, as was explained in connection with Figure 4, the air pressure gradient resulting from the fact that air under increased pressure is within the hull portion and the partial vacuum exists in the conning tower portion, will cause the air to slowly leak back into the conning tower portion through the small opening 61 whereby the conning tower will again become inflated, causing it to assume its original shape and volume. Thus,

the effect of diving and ascension of the submarine will be accomplished in a manner substantially as explained hereinabove with respect to the first embodiment.

There has thus been explained a new and improved toy which will automatically dive and ascend within a liquid such as water by a novel valve means. Various modifications and improvements may be made in the invention without departing from the spirit thereof, as will be clear to one skilled in the art. While a submarine has been depicted as the toy, various other shapes may be used, such as one simulating a diver, a fish, or the like. Further, while trapped air is indicated as the gas within the vessel, other gases may be used.

I claim:

1. A toy adapted for submersion and ascension within a liquid including: a substantially rigid hollow body of a predetermined shape, said body defining a first opening through one part of a wall thereof; a flexible walled chamber defining a second opening, said flexible walled chamber rising substantially vertically from said body, said flexible walled chamber being connected to said body so that said first and second openings are in communication; valve means for selectively admitting a gas at a predetermined rate from said flexible walled chamber into said hollow body thus to reduce the volume of said flexible walled chamber upon expulsion of the gas therefrom, said valve means being adapted to readmit the gas exhausted from said flexible walled chamber at a rate slower than said predetermined rate thereby to cause said flexible walled chamber to again assume its original volume.

2. A toy adapted for submersion and ascension within water including: a substantially rigid hollow body of a predetermined shape, said body defining a first opening through one part of a wall thereof; a flexible walled chamber defining a second opening, said flexible walled chamber being connected to said body so that first and second openings are in communication, said flexible walled chamber and said body being at least partially filled with air; valve means for selectively admitting air at a predetermined rate from said flexible walled chamber into said hollow body upon compression of the flexible wall of said flexible walled chamber into said hollow body thus to reduce the volume of said flexible walled chamber upon expulsion of the air therefrom, said valve means being adapted to readmit the air exhausted from said flexible walled chamber from said body at a rate slower than said predetermined rate thereby to cause said flexible walled chamber to again assume its original volume.

3. A toy adapted for submersion and ascension within water including: a substantially rigid hollow body of a predetermined shape, said body defining a first opening through one part of the wall thereof; a flexible walled chamber defining a second opening, said flexible walled chamber being connected to said body so that first and second openings are in communication, said toy being adapted to float in water so that part of said flexible walled chamber extends above the surface of the water; valve means for selectively admitting air at a predetermined rate from said flexible walled chamber into said hollow body thus to reduce the volume of said flexible walled chamber upon expulsion of the air therefrom, thereby to decrease the buoyant force upon said toy exerted by the water in which said toy is disposed, said valve means being adapted to readmit the air exhausted from said flexible wall chamber at a rate slower than said predetermined rate thereby to cause said flexible walled chamber to again assume its original volume.

4. A toy adapted for submersion and ascension within a tank of water including: a substantially rigid hollow body of a predetermined shape, said body defining a first opening through the upper wall thereof; a flexible walled chamber defining a second opening, said flexible walled chamber being connected to said body so that the first and second openings are in communication, said toy being adapted to float in water so that only part of said

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flexible walled chamber extends above the surface of water; valve means for exhausting air trapped within said flexible walled chamber upon compression of the walls thereof; said air being forced into said rigid hollow body thereby creating a partial vacuum within said flexible walled chamber thus to reduce the volume of said flexible walled chamber, said valve means including a relatively thin elastic diaphragm having at least one opening near the edge thereof, said diaphragm being connected across said second opening, said diaphragm being adapted to be sucked within said flexible walled chamber when air is exhausted therefrom thereby to close said opening, said

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diaphragm including an additionally small opening there-through which will readmit the air exhausted from said flexible walled chamber at a slower rate than said predetermined rate thereby to cause said flexible walled chamber to again assume its original volume.

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