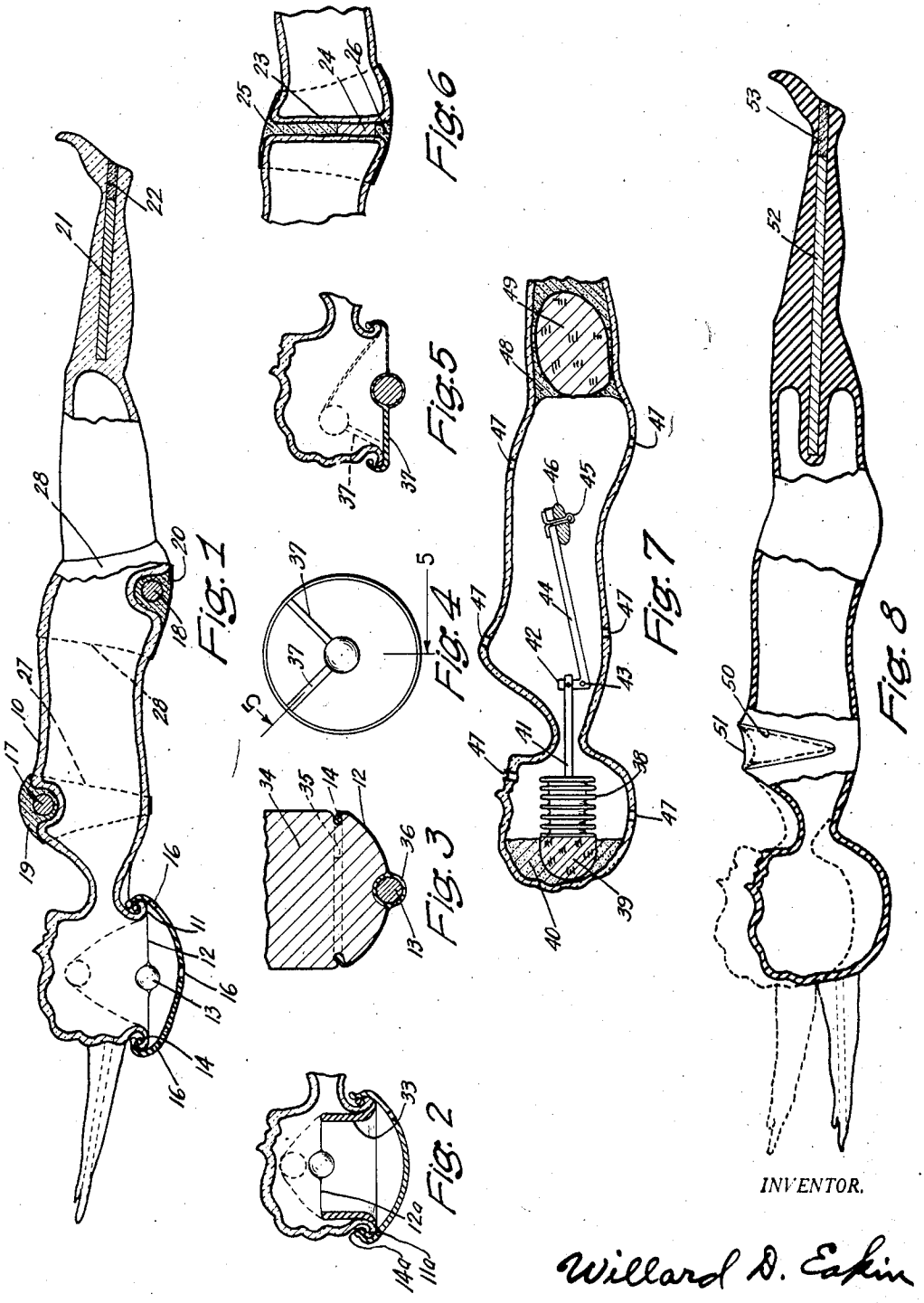
March 28, 1944. W. D. EAKIN 2,345,243

AQUATIC FIGURE AND APPARATUS FOR ACTUATING THE SAME

Filed May 7, 1942 3 Sheets-Sheet 1



INVENTOR.

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AQUATIC FIGURE AND APPARATUS FOR ACTUATING THE SAME

Filed May 7, 1942 3 Sheets-Sheet 2

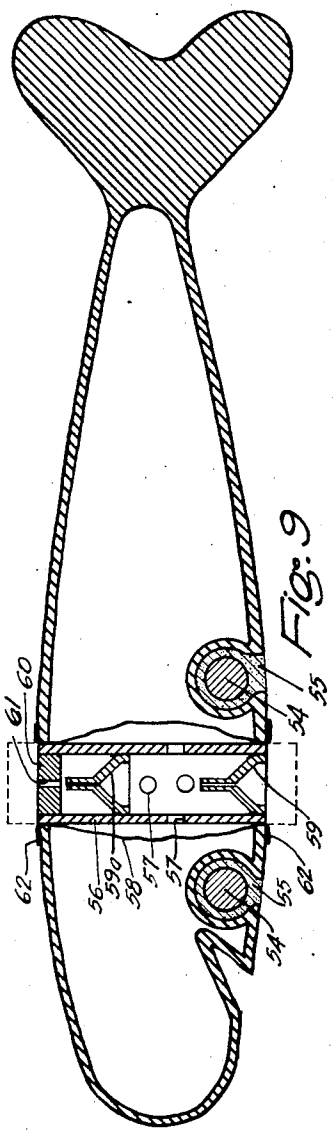


Fig. 9

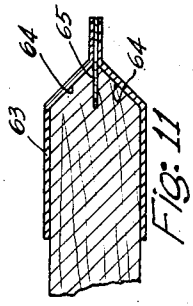


Fig. 11

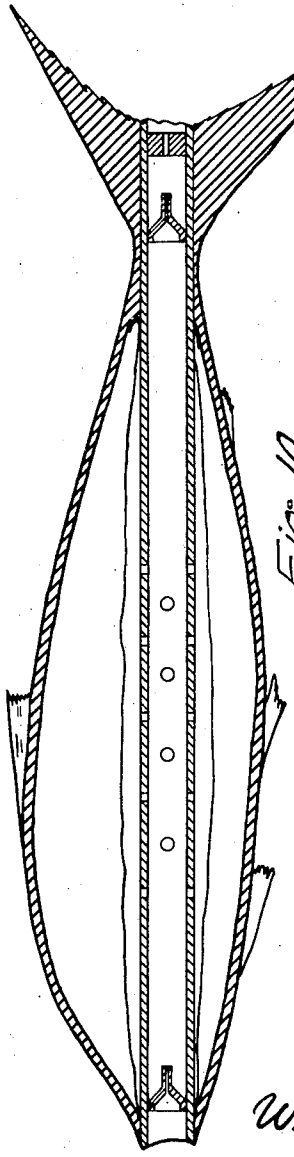


Fig. 10

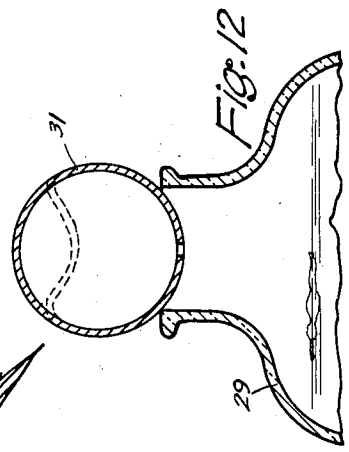


Fig. 12

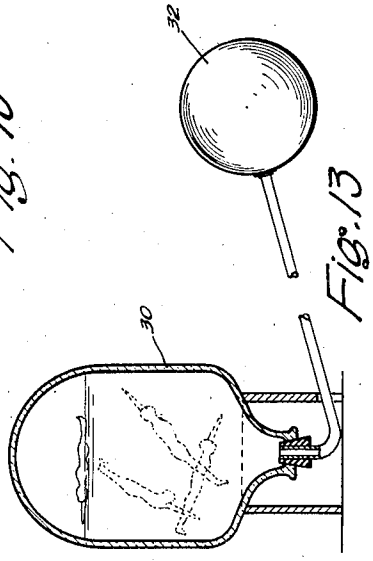


Fig. 13

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AQUATIC FIGURE AND APPARATUS FOR ACTUATING THE SAME

Filed May 7, 1942 3 Sheets-Sheet 3

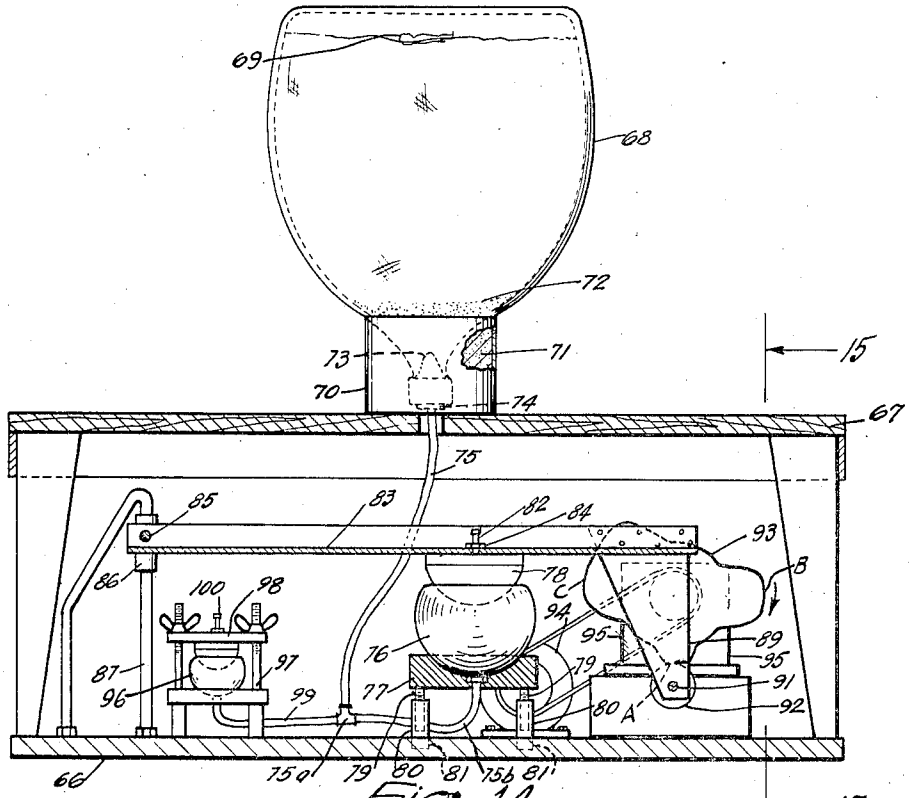


Fig. 14

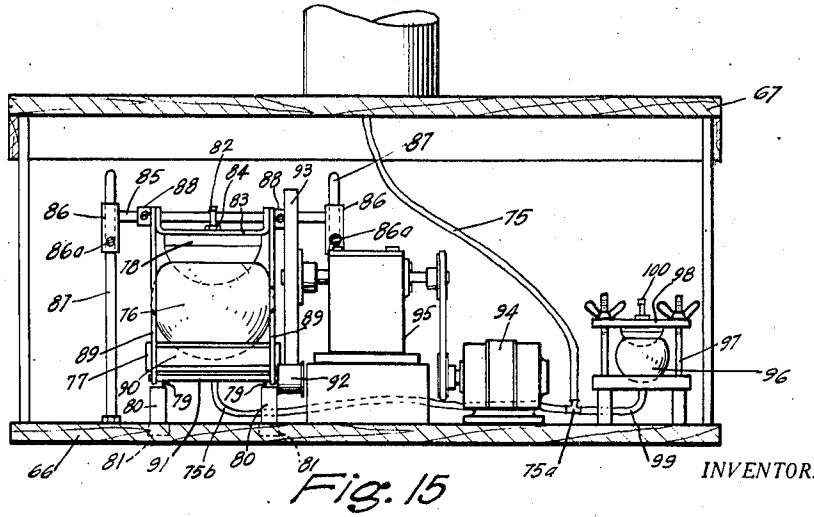


Fig. 15

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Patented Mar. 28, 1944 2,345,243

UNITED STATES PATENT OFFICE

2,345,243

AQUATIC FIGURE AND APPARATUS FOR ACTUATING THE SAME

Willard D. Eakin, Northampton Township, Summit County, Ohio

Application May 7, 1942, Serial No. 442,054

14 Claims. (Cl. 46—92)

This invention relates to aquatic figures and to apparatus for actuating them, and is based on the Cartesian diver principle.

Its chief objects are to provide an aquatic figure adapted to perform novel acts such as to mystify, entertain or educate the observer. More specific objects are to provide a desirable advertising display and to provide a desirable toy.

Of the accompanying drawings:

Fig. 1 is a middle, longitudinal section of a diving-girl doll embodying my invention in its preferred form as applied to diving human figures.

Fig. 2 is a middle section of the head of a doll embodying the invention in a modified form.

Fig. 3 is a middle section of a dipping form for making an actuating diaphragm for the doll, with the diaphragm thereon.

Fig. 4 is a face view of an actuating diaphragm of an alternative type.

Fig. 5 is a middle section of the head of a doll equipped with a diaphragm such as that of Fig. 4.

Fig. 6 is a fragmentary middle section of a doll having an alternative or additional provision for giving the center of gravity a desired position in the doll.

Fig. 7 is a middle, longitudinal section of parts of a doll of an alternative type.

Fig. 8 is a side elevation, with parts sectioned, of a doll of another alternative type.

Fig. 9 is a longitudinal middle section of a toy whale embodying the invention in its preferred form as applied to spouting whales and the like.

Fig. 10 is a longitudinal middle section of a toy fish embodying the invention in its preferred form as applied to fishes, submarine boats, or the like.

Fig. 11 is a longitudinal middle section of a dipping form for making valves such as are shown in Figs. 9 and 10.

Fig. 12 is a fragmentary middle vertical section of preferred means for actuating the figures manually for adjustment purposes in preparation for their being placed in an automatic actuator, said means being usable also for actuating the figure as a toy.

Fig. 13 is a vertical middle section, with parts in elevation, of an actuator of a desirable type for manual actuation for display purposes.

Fig. 14 is a vertical longitudinal section of an automatic actuator assembly.

Fig. 15 is a vertical transverse section of the same.

In attaining the above stated objects, I provide an aquatic figure adapted to be given a sequence of movements by changes of the pressure of surrounding fluid or fluids, as in the case of a doll diving head-first and then turning and rising head-first, with or without turning on one or more of other axes; or a toy whale submerging, rising to the surface, spouting one or more times, and then submerging again; or a toy fish or submarine boat descending and rising in the water and also having successive forward movements either while submerged or while at the surface.

Referring first to Fig. 1 of the drawings, the doll there shown comprises a shell or chief wall member 10 having the general shape of a diving girl figure and made, by any suitable method, of a rigid, impervious and non-absorbent material such as glass, porcelain, metal, Celluloid or the like.

The shell of the doll of Fig. 1 is integral and impervious except that it is formed with a large opening in the back of the head, defined by an annular flange 11 adapted to have snapped onto it, and to retain with a water-tight and air-tight gripping-pressure seal, an elastic actuating diaphragm 12 of rubber or the like having a weight 13 such as a buck-shot mounted at or near its center and preferably having a rolled or molded annular bead 14 at its periphery for secure engagement over the annular flange 11 of the doll's head.

A rubber or other bathing cap 15 formed with suitably positioned holes 16, 16 for ingress and egress of water or air can be mounted on the annular flange 11 to hide the actuating diaphragm 12.

For providing the desired distribution of weight in relation to the distribution of volume the shell 10 is molded with external recesses in the chest and in the hips to receive lead weights 17, 18 and bodies of paraffin 19, 20 for holding the weights in place and for giving the doll's body the desired external contours at those positions.

Also paraffin can be added to those bodies for increasing buoyancy at those positions or scraped or shaved away for the opposite purpose.

The weight on the diaphragm 12 and the weights in the chest and in the hips can be suitably correlated, with care, to provide the necessary "balance" for good performance as to turning of the doll, on a longitudinal rolling axis, lying between the center of gravity and the center of buoyancy, from face-up to face-down position, and as to turning on a transverse axis for head-first diving and head-first rising. However, fine adjustment of the center of gravity can be made easier by forming elongated recesses extending in-

ward from the extremity of one or more of the arms and legs for the reception of a weight such as the weight 21, which can be a piece of wire solder, and a filler plug 22 of paraffin or the like for avoidance of pocketing of air.

For fine adjustment of the center of gravity toward and from the face side the doll can be formed with a tubular portion 23, as in Fig. 6, extending through the body cavity and opening onto the face side and the back side of the shell, for the reception of an adjusting weight 24 and filler plugs 25, 26 of paraffin or the like.

The chest weight or weights 17 and the paraffin 19 of Fig. 1 can be hidden by a snap-on brassière 27 of rubber or other material and the hip weight or weights 18 and paraffin 20 can be hidden by a snap-on pair of swim trunks 28.

In the operation of the display or toy the doll is placed in a glass container such as the container 29 of Fig. 12 or the container 30 of Fig. 13, the container being nearly but not entirely full of water and the doll being suitably adjusted as to distribution of weight and volume, so that, at atmospheric pressure, she floats, but very lightly, and in a horizontal position, face up, at the surface of the water, the center of gravity then being directly under the center of buoyancy, which is the center of submerged volume at any given instant, as distinguished from the center of total volume.

By compressing the rubber ball 31 of Fig. 12 or the rubber ball 32 of Fig. 13, the pressure in the container is then increased, with the result that the diaphragm 12, carrying with it the weight 13, is pushed inward toward their dotted line positions of Fig. 1, the air in the figure yielding to the external pressure.

In the first part of this movement the center of gravity moves from a position lower than the center of buoyancy to a position higher than the center of buoyancy, with the result that the figure rolls over sidewise from the face-up attitude to a face-down attitude.

When the proportions and adjustments are good this rolling-over movement can be effected without appreciable turning of the figure on any axis other than the longitudinal rolling axis, and by careful application and release of pressure the figure can be caused to rotate through successive complete revolutions in the same direction without submerging.

If a dive is to be performed, greater pressure is applied and, because of the resulting decrease of air volume in the head of the figure the center of buoyancy moves to a position nearer the feet of the doll than the position of the center of gravity, which causes the doll to assume a head-downward position such as to bring those two centers back into, or closer to, vertical alignment.

Still greater pressure so reduces the total effective volume of the figure that it sinks, head first, as in the left-hand dotted line position of Fig. 13.

At a suitable time, before or after the figure has reached the bottom of the container, the pressure within the container is released, either slowly or quickly, by relieving the pressure upon the ball 31 or 32.

In the rising movement of the figure, as in the rolling-over and diving movements, its actions can be varied according to the timing of pressure changes.

If the pressure is completely relieved quickly when the doll is in a head-down and submerged position the center of buoyancy immediately returns to its original position, closer to the front wall and closer to the head than the center of gravity. In the case of such quick release of pressure the doll may turn face upward by lateral rolling movement concurrently with its turning on a transverse axis to a head-uppermost attitude, and then rise to a face-up, horizontal position at the top of the water.

With suitable adjustment and suitably slow release of pressure, however, the figure can be caused to rise, head-first, to the surface of the water before turning face-upward and then, at the surface, roll over onto its back.

Other variations of movement are that when the adjustment is such that the center of buoyancy is always closer to the front side of the doll than the center of gravity is, a backward dive can be effected, and, with an intermediate condition of adjustment, and with either quick or slow application of pressure, the turning movements on the longitudinal axis and on the transverse axis can be made concurrent, so that the doll does what might be called a "cork-screw" dive or rise.

It is desirable that the actuating diaphragm 12 and its weight 13 be mounted as far toward the face side of the doll as they can be while still having sufficient range of movement, before the weight is stopped by contact with the inner face-wall of the figure. With a given weight 13 and a given distance of its movement the effect of its movement in shifting the center of gravity is the same whether that movement is from an original position higher or lower than, or at the level of, the center of buoyancy, as it is the same matter of inch-pounds in any of those cases. However, the reduction of head-volume which is incident to the face-ward movement of the weight has the effect of moving the center of buoyancy, as well as the weight, toward the face side of the figure and that volume-reducing factor is greater if it operates at a long distance from the rolling axis. Thus if the diaphragm 12 and its weight 13 are mounted too far to the rear of the head the volume-reduction factor may dominate over the weight-shifting factor, with the result that the center of buoyancy moves farther faceward than the center of gravity does, and thus holds the figure more strongly in its face-up attitude.

On the other hand, reduction of volume on the faceward side of the center of buoyancy causes a spineward movement of the center of buoyancy, the effect of which is added to, instead of subtracted from, the rolling-over effect of the shifting of the weight, and the spineward shifting of the center of buoyancy is the greater when a given reduction of volume occurs far faceward from the center of buoyancy.

Fig. 2 illustrates a construction which can be employed, in the light of the foregoing points, when the shape of the figure or special performance considerations make it desirable to mount the actuating diaphragm and its weight close to or on the faceward side of the rolling axis. Here the diaphragm, 12a, is formed as a thin and stretchable end-closure portion of a tubular rubber member 33 having a thick enough wall to be self-sustaining and at its outer end being flared, thinned down, and provided with an annular bead 14a adapted to be snapped over the annular flange 11a of the doll's head to provide the fluid seal.

Fig. 3 illustrates a method of making the diaphragm 12 of Fig. 1 with the weight 13 embedded in it, by the well known latex dipping process.

The dipping form, 34, is shown as being so formed with an annular groove 35 as to permit the forming of the bead 14 by a preliminary application of latex to the groove, and with a central depression in its end face adapted to permit the preliminary securing of the weight 13 therein by an application of latex to the depression and to a buck-shot dropped into the depression while the dipping form is held with the depression upward. The form is then turned to dipping position and the diaphragm 12 is formed by dipping, and is thus made integral with the bead 14 and the rubber jacket 36 which encloses the weight.

The diaphragm 12 is thus made of cup shape, when the dipping form is as here shown, and this is desirable because the mounting of the diaphragm on the doll's head puts the outer annular region of the diaphragm under greater circumferential tension than the central portion, so that light increase of pressure provides a large movement of the weight 13, for the rolling over movement, without such reduction of volume as to cause the doll to assume a head-down position before further increase of pressure has more pronouncedly stretched the outer annular portoin as well as the central portion of the diaphragm.

As to lateral stability, or instability for the rolling-over movement, the figure involves the canoe or ballast principle, with the rolling movement dependent upon relative positions of the center of buoyancy and the center of gravity.

As to turning on a transverse axis, on the other hand, for the head-first attitudes, the figure is controlled primarily by the flat-boat principle, which is a matter of increase and decrease of submerged volume at the two ends of the figure.

Thus, as the head volume is decreased by the pressure, resulting footward movement of the center of buoyancy is partially off-set or lessened by a slightly increased submergence of the face part of the figure and possibly by a slight decrease of submergence of the feet, so that the footward movement of the center of buoyancy can be so small as not to cause the head to submerge completely until after the rolling-over movement is completed.

If desired, the weight 13 can be caused to have either a headward component of movement, to accentuate the head-first effect; or a footward component, to separate the two turning movements more pronouncedly, by delaying all head-downward turning movement, on a transverse axis, until after the rolling movement, to a face-downward position, on a longitudinal axis, has been completed.

Provision for such headward or footward components in the weight's movements is illustrated in Figs. 4 and 5.

The diaphragm there shown is formed with two relatively thick and accordingly more stretch-resistant radial zones 37, 37, disposed at a substantial angle to each other. When the diaphragm is mounted on the doll's head with such zones near the top of the head the weight's movement has a forward component, as shown in Fig. 5. A rearward component is of course obtained when the diaphragm is mounted with those thick zones near the back of the neck, and side-wise diving can be had by mounting the diaphragm with its thick radial zones extending toward a side of the head.

Excellent results have been obtained by forming the actuating diaphragms of rubber cut from toy balloons, rubber cement being employed for holding the bead 14 in rolled form or for securing it to the stretchable part and for securing a wrapper on the buck-shot 13 and securing the wrapper to the stretchable part.

Excellent results have been obtained also by building the doll of paraffin upon a blown-glass hollow "skeleton" and also by forming the doll in two plaster of Paris mold-halves by successive applications of "liquid solder" and then soldering together the resulting half-shells.

Fig. 7 shows one of the early embodiments, in which a small metal bellows 38, commercially known as a Sylphon and extensively used in heat-control systems, for example, is secured at one end to a cork 39 which is anchored in the cranium of the doll by a pouring 40 of paraffin, with or without other anchoring means. The other end of the Sylphon is connected by a pull-stem 41 with the short arm 42 of a bell-crank lever which is fulcrumed on a wire 43 having its ends anchored in the shoulder walls of the doll. The bell-crank lever's long arm, 44, extends to about the center of the body cavity and there has secured on its outer end, by a cotter pin 45, a weight 46. It is desirable that the long arm of the bell-crank lever be of bendable material, such as a strip cut from a "tin" can, for chestward and spineward adjustment of the center of gravity.

The shell of the figure permissibly is formed of vulcanized soft rubber and with apertures 47, 47 at the chief salients for ingress and egress of water, which occupies all of the body cavity except the interior of the Sylphon 38. The Sylphon is closed, preparatory to being mounted in the figure, while containing atmospheric air, preferably at or a little below normal room temperature.

To provide sufficient buoyancy, in view of the fact that water occupies the greater part of the volume and that some of the parts are of metal, the legs can be filled with paraffin 48 and cork 49. The figure can be given proper distribution of weight and volume by local addition or subtraction of the high gravity and low gravity substances.

In operation, an increase of pressure shortens the Sylphon and thus moves the weight 46 chestward, causing the doll to roll over to a face-down position, after which further reduction of the Sylphon's volume by further pressure causes the figure to dive head-first. Subsequent release of the pressure causes the figure to rise head first and, in timed relation determined by the adjustments and by the quickness or slowness of release, to assume a face-up, horizontal position at the top of the water.

Fig. 8 shows another early embodiment, in which a rubber doll has a notch 50 cut in her chest and closed by a piece of toy-balloon rubber 51 cemented in place, preferably under such tension as to bay inward substantially, as shown.

The necessary distribution of weight in relation to volume is provided by wire-solder weights such as the weight 52 mounted in elongated recesses molded in the arms and legs and preferably closed at their ends by paraffin 53 to prevent pocketing of air.

In operation increase of pressure causes the weighted arms to rise toward their dotted line positions, whereupon the doll rolls over, and further increase of pressure causes her to dive, head-first. The reverse movements occur upon release of the pressure. Here the decrease of chest vol-

ume, being near the face side of the figure, assists in the lateral rolling movement, and it causes the doll to move head first in the diving and rising movements because it is at a position substantially nearer the head of the figure than are the centers of buoyancy and of gravity.

Fig. 9 represents a toy whale in which ballast weights **54**, **54**, embedded in paraffin **55**, **55**, are provided for keeping the figure in back-upward position as it sinks and rises.

The body of the whale can be formed of rubber or other material, but with sufficient stiffness to sustain considerable external pressure without substantial reduction of volume. The body is imperforate except that the back and belly walls are formed with holes for the reception of a length of preferably rubber tubing **56** formed in its middle region with apertures **57**, **57** and having, surrounding it and cemented to its end portions, a section **58** cut from a cylindrical or other toy balloon. Mounted in the tube **56**, respectively below and above the apertures **57**, are two check-valves **59**, **59a** adapted to permit upward flow but prevent downward flow of water. Mounted in the upper end of the tube **56**, and preferably flush with it and with the back surface of the whale, is a plug **60** formed with a central squirt aperture **61**. The balloon-rubber tubular diaphragm can be longer than the tube **56**, as indicated by the dotted lines in Fig. 9, so that a more dependable seal and anchorage can be had between it and the body wall of the figure, when the latter is of suitable material such as rubber, by stretching out its end portions to the form of annular flanges **62**, **62**, and cementing them to the outer surface of the figure.

In operation this figure, upon being placed in apparatus such as that of Fig. 12 or Fig. 13 and subjected to increase of external pressure, becomes heavy and sinks by reason of water being forced into the stretchable tubular diaphragm **58**, through the lower valve **59** and the holes **57**, the surrounding air in the figure being reduced in volume by the expanding of the diaphragm.

Upon release of pressure the whale rises to the surface and spouts, water continuing to be expelled through the upper valve **59a** and the squirt hole **61** after the figure has reached the surface of the water.

Whether or not a live whale blows more than once before again submerging, the present whale can be caused to squirt water skyward repeatedly before being again submerged by relatively heavy and/or long sustained pressure.

The upper one of the check valves **59a** can be omitted without great detriment, because of the small flow capacity of the squirt hole **61** as compared with that of the lower check valve **59**.

The check valves **59**, **59a** of Fig. 9 can be made easily and inexpensively by the latex dipping method, with the use of a dipping form such as is shown in Fig. 11, in which **63** is a cylindrical piece of wood formed with oblique flats **64**, **64** at one end and having stuck into a slot between the flats a very thin piece **65** of sheet aluminum, paper, or other suitably thin sheet material, adapted to deposit upon itself a relatively thin film of rubber. The valve outlet is provided by cutting off the end of the thin portion of the rubber deposit.

The toy fish of Fig. 10 corresponds to the whale of Fig. 9 except that the tubular-diaphragm assembly is disposed lengthwise of the figure, so that the squirt provides successive forward movements of the figure, on the rocket or jet-propulsion principle, in response to successive releases of pressure. The figure also is subjected to a slight forwardly directed force-differential in the application of the pressure also, because water can flow freely into the figure at the front end, which slightly relieves the external pressure or head resistance there, whereas no such effect occurs at the rear end, because both of the valves permit only rearward flow of the water.

Obviously kinetic and impact effects in the various movements of the several figures can be varied by employing different external contours.

In Fig. 12 the ball **31** seals itself against the mouth of the jug **29** when the ball is compressed by applying a downward force, as with a clenched fist, along the vertical center-line of the ball. The pressure preferably is applied only in a central zone of moderate area, so that the upper portion of the ball's wall is simply turned inside out, into the rest of the ball, without development of annular zones of tension such as occur when the ball is flattened by pressure of a flat surface.

In the apparatus of Fig. 13 changes of pressure can be effected by simply raising and lowering the rubber ball, with the ball and the tubing full of water, and if the system is closed while the pressure in the container is atmospheric, a partial vacuum is produced in the container when the ball is held at a low elevation, by reason of the head of water.

Automatic apparatus for actuating the figures is shown in Figs. 14 and 15, in which **66** is a base, preferably of ply-wood, having removably mounted thereon a table **67** which supports an inverted glass bottle or flask **68** almost but not entirely filled with water, on which and in which the cartesian figure **69**, performs.

The flask preferably is secured by its neck in a hollow metal cylinder **70** of sheet metal, by a pouring of plaster of Paris **71**, the plaster being poured and allowed to set while the flask is positioned with its neck upward. When the water and the diving figure are placed in the flask, before it is inverted, a quantity of pearl chips **72** can be placed in it to represent a multicolored ocean bottom when the flask is turned to working position, a screen **73** being mounted upon the inner end of the flask's rubber stopper **74**, to prevent escape of the pearl chips while permitting ingress and egress of water.

The rubber stopper **74** is apertured and is in communication, through a flexible hose **75**, a coupling **75a** and another flexible hose **75b**, with a hollow rubber ball **76** which is mounted in a cup-shaped depression formed in the upper face of an adjustable-height table member **77** and is adapted to have its upper portion turned inside-out into the lower portion by a hemispherical plunger head **78**, to increase the pressure in the flask.

The adjustable-height table member **77** is supported by preferably three externally threaded leg members **79**, **79** secured to and projecting downward from the member **77** and having threaded upon them respective elongated nuts **80**, **80** rotatably seated in positioning depressions **81**, **81** formed in the upper face of the base **66**.

At the middle of its top the ball **76** has mounted in its wall a check-valve stem **82** which extends upward through a central aperture in the plunger head **78** and holds the latter in position against the under face of a strong, wide, U-beam rocking lever **83**, a clamping nut **84** being provided on the check-valve stem **82**.

The rocking lever **83** is hinged on a rod **85** which connects a pair of sleeves **86**, **86** adapted

to be secured, by set-screws 86a, 86a, at selected positions of adjustment, upon vertical rod portions of a pair of bent-rod brackets 87, 87 mounted upon the machine base 66. Positioning collars 88, 88 are mounted upon the rod for keeping the rocking lever 83 in position thereon.

Riveted to the swinging outer end of the lever 83 are a pair of downwardly extending brackets 89, 89 the lower end portions of which are connected by a cross-brace 90 and by an axle rod 91 which has a projecting end portion serving as an axle for a cam-roller 92.

The cam-roller 92 coacts with a cam disc 93 which is driven by an electric motor 94 through a speed reducer 95.

When the cam is driven a predetermined series of pressure changes occur in the flask and the Cartesian figure performs a sequence of acts dependent upon the contour of the cam disc 93.

For example, assuming that the Cartesian figure is the diving girl of Fig. 1, 7 or 8, the low, short cam hill A effects a moderate increase of pressure for a short time and causes the figure to roll over from face-up to face-down position while remaining in a substantially horizontal position, without submerging, and the following release of pressure causes her to roll back to face-up position; the higher and longer cam hill B then causes a roll-over, a shallow head-first dive and head-first rise; and the high and longer cam hill C then causes a roll-over and a fast, deep, head-first dive and a head-first rise.

The ball 76 is virtually mounted in a nut-cracker of which one arm is the base 66 and the other arms is the U-beam or lever 83. Because the cam roller is off-set laterally and downwardly from the middle line of the lever 83 the latter is required to be resistant to torsional deformation and needs to have wide bearing at its hinged end. The downward off-set of the cam roller permits the use of a large cam without excessive over-all height of the machine.

Other sequences or repertoires can be provided by the use of differently contoured cams and, by careful adjustment, complete revolutions of the figure, without submergence, or with only shallow submergence, can be had.

From the foregoing suitable cam contours for the whale of Fig. 9 and the fish or submarine of Fig. 10 will be obvious.

The hose 75 preferably is of such length as to permit the flask to be turned neck up, on the table 67, without unmounting of the ball 76.

When the system is closed by insertion of the cork with the flask in that position and the flask is then inverted, a partial vacuum can be created in the flask, dependent upon the relative amounts of water and of air in the hose and the ball at the time the system is thus closed, and the stretchability of the ball under the internal pressure of the head of water. It seems best, however, to operate the apparatus with atmospheric pressure as the minimum pressure, so that pressure conditions in the flask closely approximate the pressure conditions in the testing jug 29 of Fig. 12. To that end it is desirable to have the ball 76 and all other parts of the system up to the stopper 74 entirely full of water when the system is closed.

Adjustment of the range of indentation of the ball 76 can be had by changing the position of the fulcrum rod 85, or by the use of different cams. Air and water can be vented from the ball 76 through the check-valve of the upwardly extending stem 82, a standard tire-valve stem, with the usual valve "insides," being suitable for this use. The normal pressure in the flask can be increased by forcing water or air into the system through the stem 82.

Another, more handy, expedient for varying the normal pressure in the flask 68 is a hollow rubber ball 96 mounted in a clamping device 97 provided with a hemi-spherical plunger head 98, the ball 96 being connected by a hose 99 with the coupling 75a and permissibly being provided with a venting and filling check-valve stem 100.

As the hoses 99 and 75b enter the respective balls from below they constitute U-tubes, and consequently rupture of either of the balls results in only a small escape of water from the system, the flow being promptly stopped by the development of a partial vacuum in the flask.

Numerous modifications are possible within the scope of the appended claims.

I claim:

1. An aquatic figure embodying the Cartesian diver principle and comprising a body, a non-flowing weight member having attachment thereto, and means constituting a part of the figure and actuated by change of volume incident to change of pressure of fluid externally contacting the figure for determinately shifting the weight with relation to the center of buoyancy of the figure.

2. An aquatic figure embodying the Cartesian diver principle and comprising a body, a weight member, and means constituting a part of the figure and actuated by change of pressure for shifting the weight with relation to the center of buoyancy of the figure, said means comprising a lever which carries the weight member.

3. An aquatic figure embodying the Cartesian diver principle and comprising a body, a diaphragm, and a non-flowing weight member adapted to be given movement in relation to the body by movement of the diaphragm in response to change of volume incident to change of pressure of fluid externally contacting the figure.

4. An aquatic figure embodying the Cartesian diver principle and comprising a body, a diaphragm, and a weight member mounted on the diaphragm, the diaphragm being less resistant to deformation in the vicinity of the weight member than in a part more remote therefrom.

5. An aquatic figure embodying the Cartesian diver principle and comprising a body, means defining a variable-volume chamber within the body, the parts being so formed as to provide inlet and outlet passages through which the chamber is in communication with the exterior of the body, and a check-valve mounted in the inlet passage.

6. An aquatic figure embodying the Cartesian diver principle and comprising a body, means defining a variable-volume chamber within the body, the parts being so formed as to provide inlet and outlet passages through which the chamber is in communication with the exterior of the body, and check-valves mounted respectively in the inlet and outlet passages.

7. A Cartesian diver and actuator assembly comprising a Cartesian diver adapted to perform in response to changes of pressure an act other than and not merely incident to the act of sinking or rising, and an actuator therefor comprising a container, a liquid therein, and means for effecting a timed sequence of unlike pressure-changes, in the same direction, in the container.

8. An actuator for a Cartesian diver, said actuator comprising a container, a body of liquid

therein, and means for effecting a timed sequence of unlike pressure changes, in the same direction, in the container.

9. An actuator for a Cartesian diver, said actuator comprising a container, a body of liquid therein, a hollow rubber ball having closed communication with the interior of the container, and means for effecting a timed sequence of variations of the volume of the ball.

10. An actuator for a Cartesian diver, said actuator comprising a container, a body of liquid therein, a conduit communicating with the interior of the container, means for effecting timed flow of fluid in the conduit, and means additional thereto for adjusting the pressure in the container without opening the system to the atmosphere.

11. An actuator for a Cartesian diver, said actuator comprising a container, a body of liquid therein, a conduit communicating with the interior of the container, and means for effecting flow of fluid in the conduit, said means comprising an arm like that of a nut-cracker, a variable-volume hollow member therein, and means for actuating the nut-cracker.

12. An aquatic figure embodying the Cartesian diver principle and comprising a body, a diaphragm actuated by change of pressure of liquid externally contacting the body and contacting the diaphragm, a fixed amount of a gaseous substance cushioning the diaphragm, and means for causing movement of the diaphragm to effect upward movement of a non-gaseous substance in relation to the body.

13. An aquatic figure embodying the Cartesian diver principle and comprising an elongated hollow body, and a diaphragm structure which with said body defines a closed air chamber in the body, said body comprising weighting means so distributed that at a low Cartesian pressure the body lies in a substantially horizontal position at the surface of the liquid, and the diaphragm structure being so positioned toward one end of the body from its center of gravity at low external pressure that upon the increase of external pressure the figure sinks in the liquid with that end foremost, and the distribution of weight and volume being such that at low Cartesian pressure the center of volume is toward that end from the center of gravity, so that the figure rises in the liquid with that end foremost, and assumes the substantially horizontal position only when the center of buoyancy has been shifted from the center of total volume by emergence of a part of the figure above the surface of the liquid.

14. A figure as defined in claim 13 in which the diaphragm structure is of such displacement characteristics and so positioned that upon the application of Cartesian pressure the figure is caused to roll laterally by shifting of the center of gravity upward past the center of buoyancy.

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