Sept. 15, 1959 D. V. REID 2,903,822

RADIO CONTROLLED MODEL SUBMARINE

Filed July 8, 1955 6 Sheets-Sheet 1

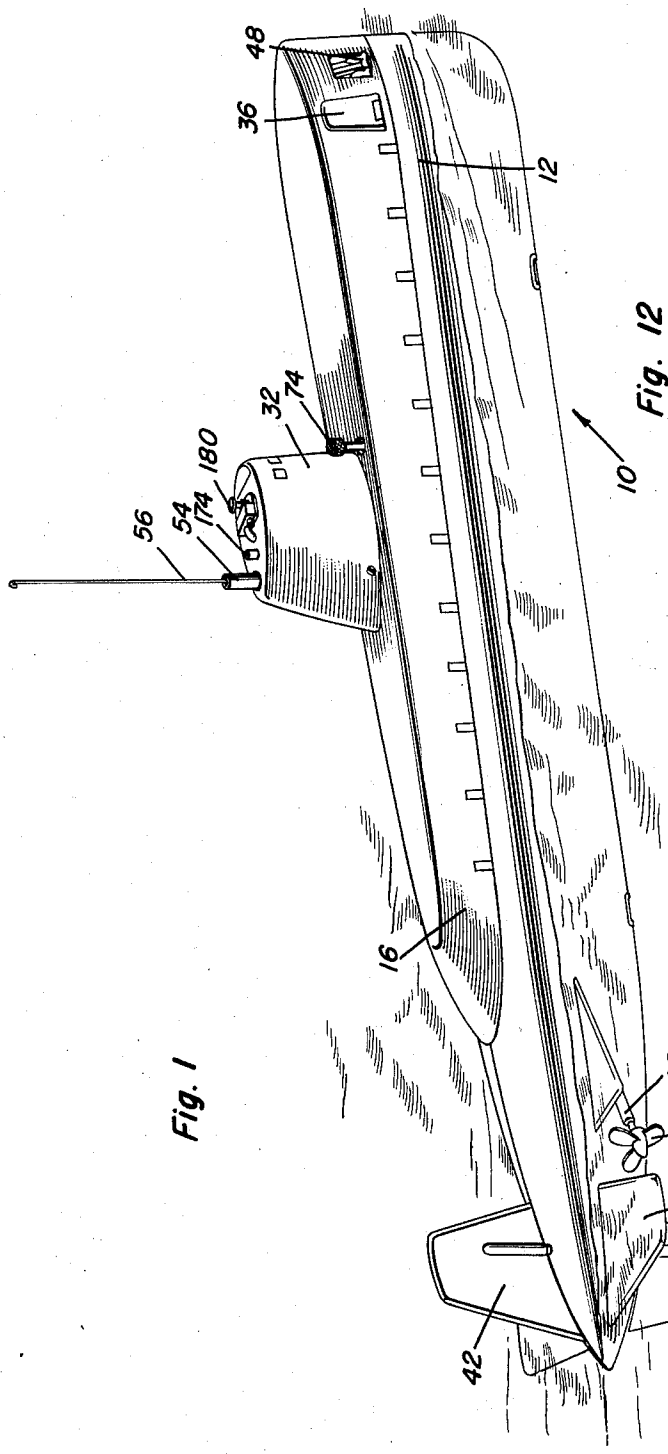

Fig. 1

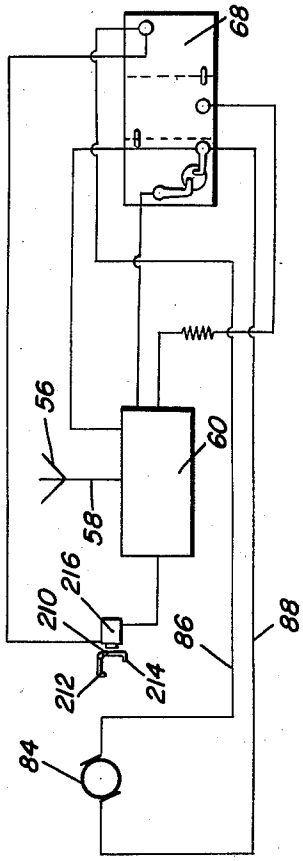

Fig. 12

Donald V. Reid
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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RADIO CONTROLLED MODEL SUBMARINE

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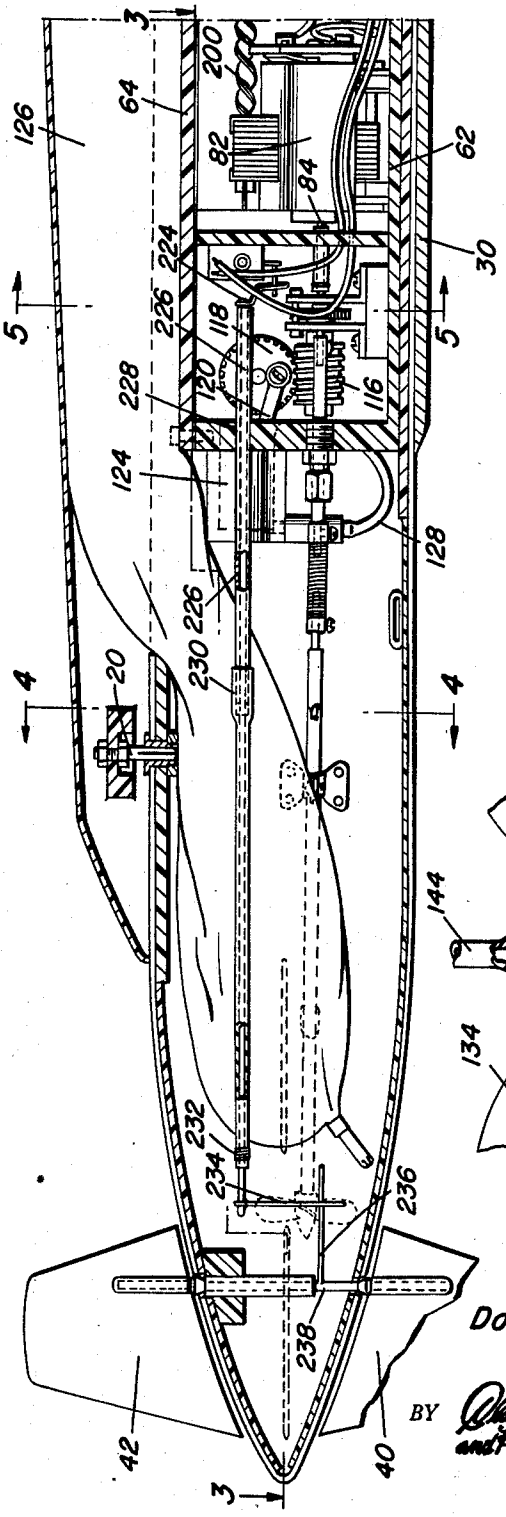

Fig. 2

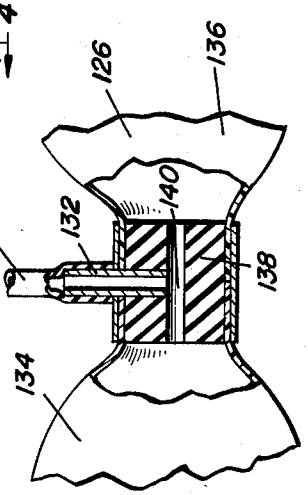

Fig. 10

Donald V. Reid
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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RADIO CONTROLLED MODEL SUBMARINE

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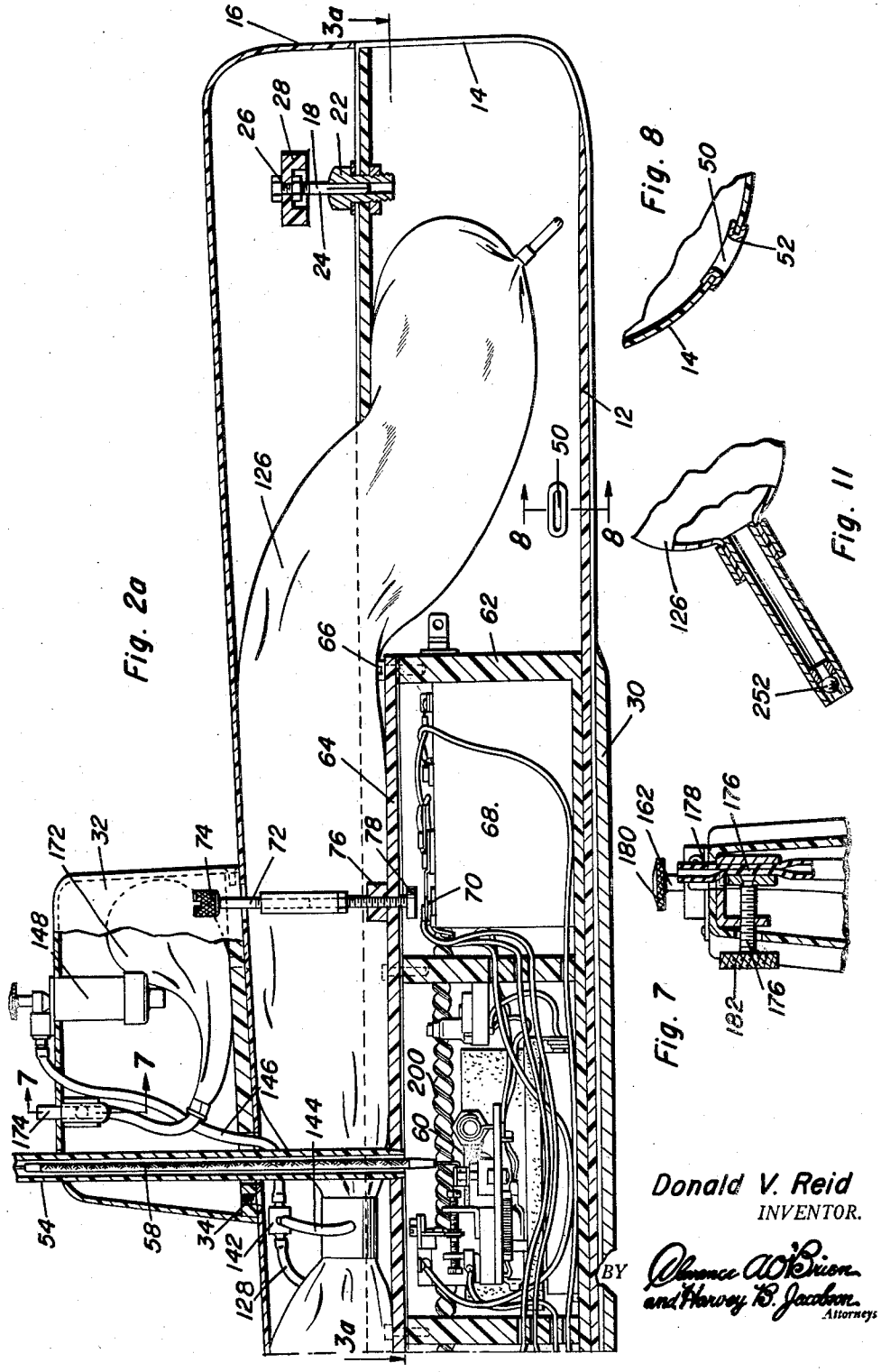

Donald V. Reid
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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RADIO CONTROLLED MODEL SUBMARINE

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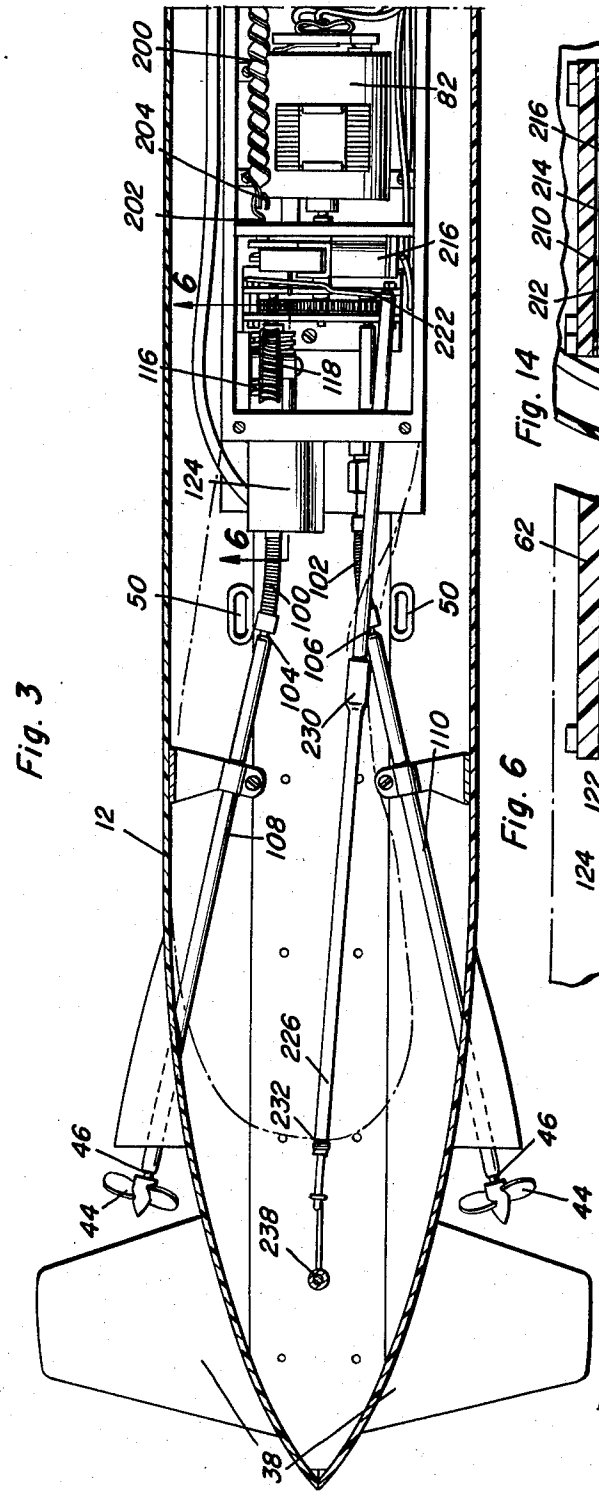

Fig. 3

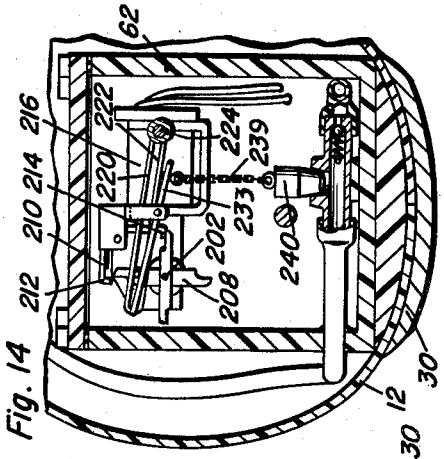

Fig. 14

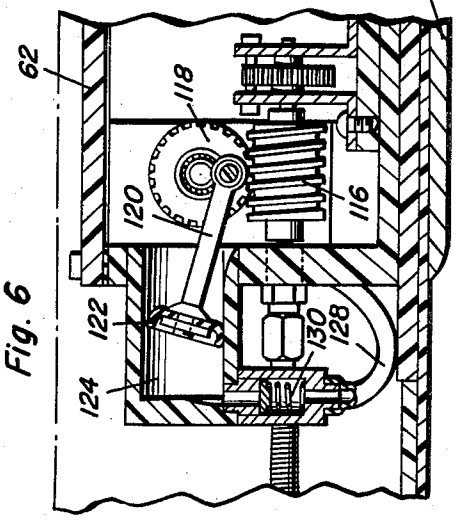

Fig. 6

Donald V. Reid
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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RADIO CONTROLLED MODEL SUBMARINE

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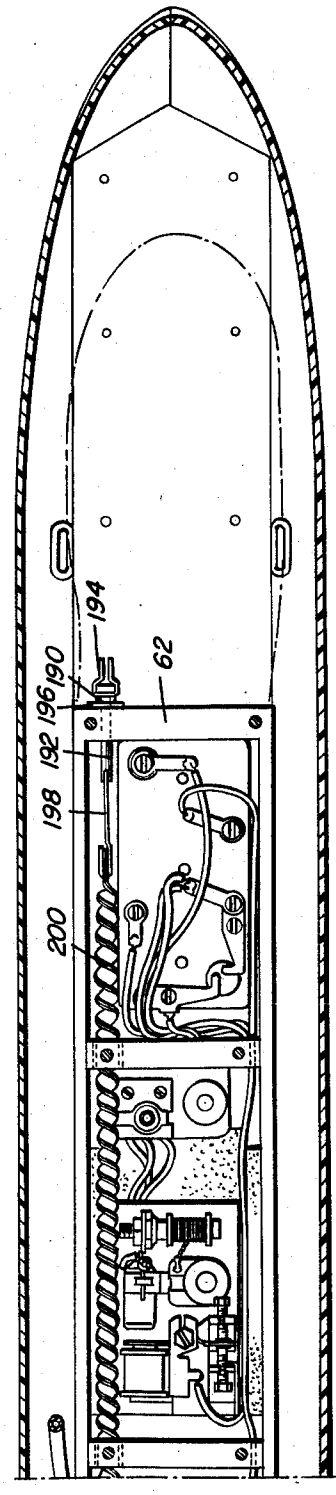

Fig. 3a

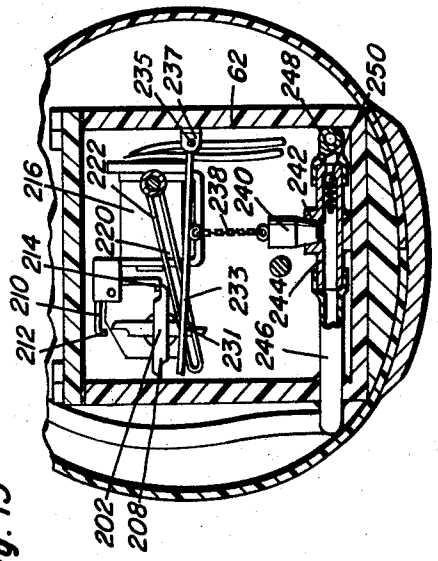

Fig. 13

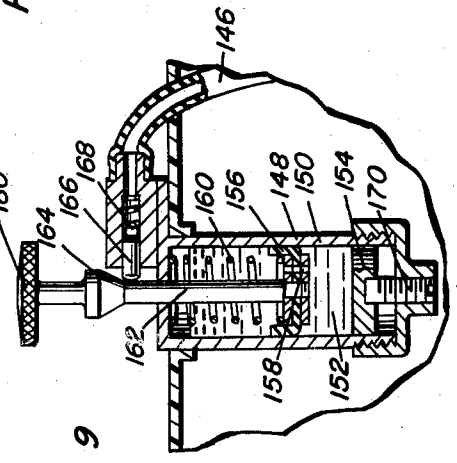

Fig. 9

Donald V. Reid
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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RADIO CONTROLLED MODEL SUBMARINE

Filed July 8, 1955 6 Sheets-Sheet 6

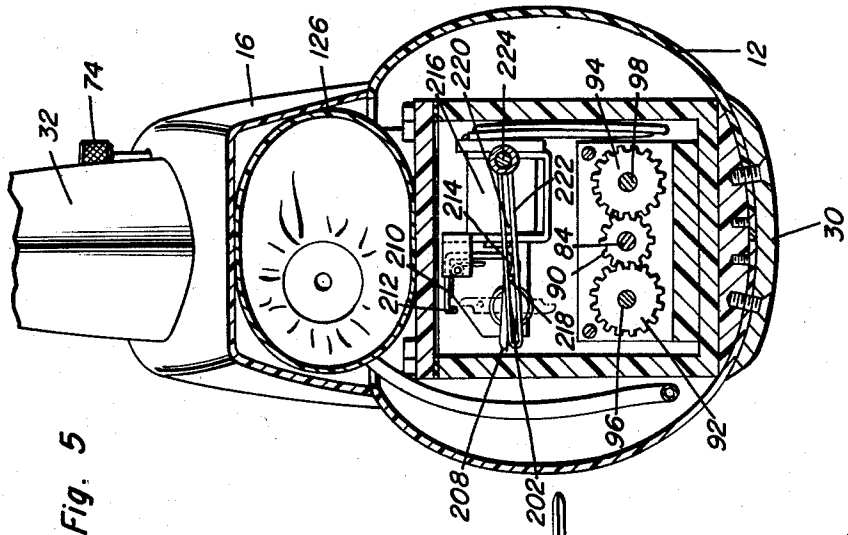

Fig. 5

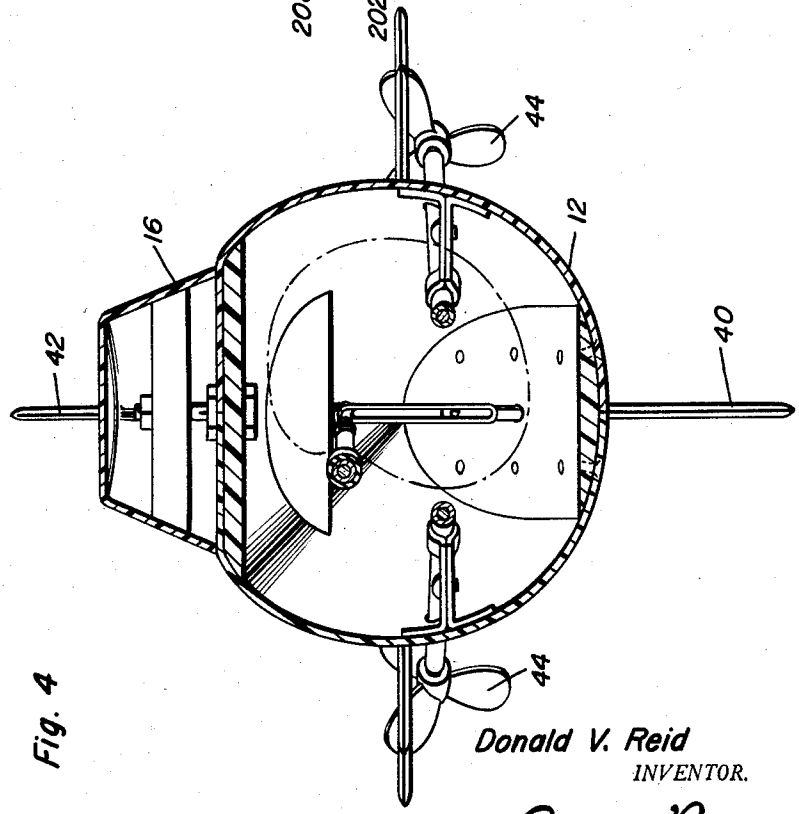

Fig. 4

Donald V. Reid
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

United States Patent Office 2,903,822 Patented Sept. 15, 1959

2,903,822

RADIO CONTROLLED MODEL SUBMARINE

Donald V. Reid, Asbury Park, N.J.

Application July 8, 1955, Serial No. 520,670

5 Claims. (Cl. 46—244)

This invention relates broadly to the class of maritime vessels and more particularly to a novel radio controlled model submarine.

The invention herein disclosed is shown adapted for use as a toy. It is to be realized that various adaptations of this radio controlled model submarine can be utilized in various commercial and military applications and while the embodiment of the maritime vessel is shown in the form of a model submarine, other shapes and types of vessels can be simulated or utilized without departing from the scope or concept of the combination of elements utilized in the radio controlled model submarine disclosed.

The primary object of the present invention resides in the provision of a radio controlled model submarine that is adapted to simulate submerged and surfaced operations of an actual submarine.

A further object of the invention resides in the provision of means for varying the amount of fluid in the hull of a model submarine so as to cause a change in its buoyancy thereby causing the submarine to surface or submerge as the condition of the inflatable member may dictate.

A further object of the invention resides in the provision of means for controlling the initial buoyancy of the vessel to thereby assure that the antenna thereof will always remain above the surface of the water.

The construction of this invention teaches the use of novel control means for the rudders of the submarine which include a flexible tube forming a water tight bearing for the rudder control means.

A further object of the invention resides in the provision of timer control means for controlling the inflation and deflation of the inflatable member.

An additional object of the invention resides in the provision of means for automatically controlling the inflation and deflation of the inflatable member by a suitable pump through a valve structure controlled by radio actuated control means.

An additional object of the invention resides in the provision of a battery powered radio controlled model submarine which has means for propelling the submarine either partially submerged or surfaced and in which the hull permits entrance of water to weight the hull to its partially submerged or otherwise surfaced position with the drive means and radio control means of the submarine encased in a water tight housing.

Still other objects and features of this invention reside in the provision of a radio controlled model submarine that is highly attractive in appearance, capable of functioning for a considerable period of time on a single battery, which may be molded out of suitable plastic material or otherwise constructed, and which may be made out of a minimum number of parts to permit easy assembly and disassembly.

These, together with the various ancillary objects and features of the invention which will become apparent as the following description proceeds, are attained by this

radio controlled model submarine, a preferred embodiment of which has been illustrated in the accompanying drawings, by way of example only, wherein:

Figure 1 is a perspective view of the radio controlled model submarine comprising the present invention;

Figures 2 and 2*a* comprise a longitudinal vertical sectional detail view of the vessel;

Figures 3 and 3*a* comprise a horizontal sectional view of the submarine as taken along the line 3—3 in Figures 2 and 2*a*;

Figure 4 is a vertical cross-sectional view as taken along the plane of line 4—4 in Figure 2 and illustrating in particular the position of the rudders, propellers, and associated shafts;

Figure 5 is a vertical cross-sectional detail view as taken along the plane of line 5—5 in Figure 2 and illustrating in particular the drive means for the vessel;

Figure 6 is a sectional detail view as taken along the plane of line 6—6 in Figure 3 and illustrating in particular the construction of the pump;

Figure 7 is a sectional detail view as taken along the plane of line 7—7 in Figure 2*a* illustrating the construction of the means for inflating the inflatable balloon used in the ballast tank;

Figure 8 is a sectional detail view on an enlarged scale as taken along the plane of line 8—8 in Figure 2*a* illustrating the eyelets at the openings of the hull to the sea;

Figure 9 is a sectional detail view on an enlarged scale showing the construction of the timer;

Figure 10 is an enlarged detail view showing the connection between the sections of the inflatable member;

Figure 11 is an enlarged sectional detail view illustrating the construction of the relief valve arrangement used in the inflatable member;

Figure 12 is a schematic wiring diagram of the various components of the invention;

Figure 13 is a sectional detail view illustrating means provided which are responsive to radio actuation for controlling the inflation and deflation of the inflatable member; and

Figure 14 is a sectional detail view of the construction shown in Figure 13 but illustrating the valve means in a different position.

With continuing reference to the accompanying drawings wherein reference numerals designate similar parts throughout the various views, reference numeral **10** generally designates the radio controlled model submarine comprising the present invention. This radio controlled model submarine as can be seen best in Figures 1, 2 and 2*a* includes a hull **12** constructed from a lower hull section **14** and an upper hull section **16** which may be secured to each other in any suitable manner such as by means of the pressure fitted plug-type clips **18** and **20**. The clip **18** as can be best seen in Figure 2*a* includes a female member **22** which receives a split rod **24** mounted in the upper section **16** therein so as to hold the upper hull section **16** in position. The rod **24** is threaded as at **26** for threaded adjustment in a bracket **28**. The clip **20** is of similar construction to the clip **18**.

The lower hull section **14** may be provided with a keel weight **30** to assure that the vessel will ride properly. A conning tower **32** is secured to the upper hull section **16** in any convenient manner as by fasteners **34**. Outwardly of the hull are bow planes **36**, stern planes **38**, rudders **40** and **42**, propellers **44** as on shafts as at **46**, an anchor **48**, and such other deck hardware as may be desired which will serve to conform the vessel to the details of an actual submarine.

The hull **12** is open to the sea by means of inlet means as **50** the construction of which can be best seen

in Figure 8. These inlet openings **50** are surrounded by eyelets 52 so as to prevent deterioration of the hull by forming weak points therefor. The hull **12** is preferably molded of suitable plastic material such as resin impregnated fiber glass or the like but may be made of any other selected material as may be desired.

A simulated snorkle tube **54** is provided which extends up through the conning tower **32** and an antenna **56** is mounted in the tube **54** and suitable conductors **58** connect the antenna **56** to a conventional radio receiver as indicated **60** mounted within a waterproof housing **62** secured to the bottom of the hull **12** of the vessel. This housing **62** may be formed with a removable top **64** held in place by fasteners **66** or, if desired, be formed as a replaceable unit and sealed permanently.

Mounted within the housing **62** is a conventional battery **68** of the wet cell variety. A switch as at **70** is provided for opening and closing an electrical circuit between the battery **68** and the other electrical components of the invention. This switch includes a rotatable rod **72** which has a head portion **74** extending above the upper hull section **16** of the vessel and is threaded into the gland block **76** and the housing **64** in a water tight manner and has an actuating head **78** adapted to close the switch **70** when desired.

Mounted in the housing **62** is a motor **82** which drives a shaft **84** providing the motive power for the vessel. The motor is adapted to be electrically operatively connected to the battery **70** through conductors **86** and **88** when the switch **70** is closed. The shaft **84**, see Figure 5, drives a gear **90** which in turn engages gears **92** and **94** mounted on shafts **96** and **98**. The shafts **96** and **98** are connected to flexible shaft members **100** and **102**, respectively, which in turn are connected to shafts **104** and **106** mounted within waterproof packing bearings **108** and **110** extending through the hull **12**. The bearings **108** and **110** are formed of tubing of rubber or like material and provided with suitable graphite packing. The portions of the shafting **104** and **106** which extend outwardly of the hull are designated by reference numerals **46** and have propellers **44** mounted thereon.

Rotation of the shaft **84** also causes rotation of the worm gear **116**, see Figures 2 and 6, which meshes with a gear **118** having a piston rod **120** of a piston **122** of pump **124** mounted in communication with the housing **62** for use in inflating the inflatable member **126** mounted above the housing **62** as can be best seen in Figures 2 and 2*a*.

The pump **124** is connected through a suitable conduit **128** and through a suitable check valve **130**, see Figure 6, to the intake port as at **132** of the inflatable member **126**, the inflatable member **126** being in the form of two balloon-like members **134** and **136** connected to an intake lock **138** provided with a T-passage **140** therein interconnecting the balloon-like members **134** and **136** with the fitting **132**. This can be best seen in Figure 10. The conduit **128** is connected to a T-fitting **142** to which is connected a conduit **144** connected to the fitting **132**. Also connected to the fitting **132** is a conduit **146** leading to a timer **148**. The construction of the timer can be best seen in Figure 9 and consists of a cylinder **150** which is filled with fluid as at **152** and provided with an adjustable bottom plate **154**. A piston **156** having an aperture **158** therethrough for a dashpot effect is mounted in the cylinder and is spring pressed as at **160**. The piston rod **162** connected to the piston **156** is provided with a cam surface at **164** which engages a check valve rod **166** of a valve member **168** so as to close the valve when in the lower position, the spring **160** urging the piston **156** to a lowered position so as to cause the valve member **168** to close. Hence, due to the dashpot effect through the aperture **158**, the timer permits the valve member **168** to remain in its open position for a selected period of time determined by the setting of the screw adjustment **170** of the plate **154** which determines the volume of the chamber defined by the cylinder **150**.

Mounted in the conning tower **32** is an inflatable balloon **172** which is connected to an intake conduit **174** extending through the upper portion of the conning tower **32**. A clamp-like closure **176**, see Figure 7, is provided to close the otherwise open end **176** of the inlet **178** so as to assure a proper seal for the balloon **172** when inflated. While the piston rod **162** is provided with an actuating head **180**, the clamp member **176** is provided with a knurled wheel **182** or the like for enabling the ready rotation of the clamp member **176**.

Mounted on the housing **62** is a bracket **190** for a rotatable shaft **192** and having a fitting **194** engageable for rotation of the shaft **192**. A friction disk **196** is mounted on the shaft **192** and engages the housing **62** to prevent the rotation of the shaft **92** when it is not otherwise forced to rotate. This can be seen best in Figure 3*a*. Attached to the shaft is a hook-like member **198** having one end of a rubber band **200** all alike attached thereto as is generally conventionally provided for radio controlled model devices. This rubber band **200** is attached at its other end to a shaft **202** having a hook portion **204**, see Figure 3.

Mounted on the shaft **202**, see Figures 2 and 5, is a crank member **208** which is normally held from rotation by an L-shaped pawl **210** having lug portions **212** and **214** engageable with the respective ends of the crank member **208**. The pawl **210** is actuated by electromagnet **216** upon receipt of a radio signal from the radio receiver **60** thereby permit rotation of the member **208** one-quarter turn per signal due to the shape of the pawl **210** and member **208**. The crank arm or member **208** has a pin **231** riding in the slot **220** of member **222** mounted on a shaft **224**. The shaft **224** has a thin flexible tube **226** such as surgical catheter tube positioned thereabout and extends through an aperture **228** in the housing **62** in a watertight manner, the tube being formed in sections **230** as may be desired and bound with wire **232** at its outer end where it is connected to a suitable arm **234** which in turn, see Figure 2, is connected to an actuating arm **236** of a shaft **238** on which the rudders **40** and **42** are mounted. Hence, each actuation of the electromagnets **216** by a radio signal will cause rotation of the rudders **40** and **42** a preset and predetermined amount. The rudders will be turned through only a limited arc due to the action of the pin **218** in the slot **220** which causes only a relatively slight angular rotation of the shaft **224**.

There may be provided, as shown in Figures 13 and 14, an optional ballast tank radio controlled method wherein by means of radio control the pump **124** can be utilized for submerging and surfacing utilizing the crank arm or escapement member **208**.

The escapement **208** carries the pin **231**, the pin being engageable with a pivotally mounted lever **233** pivoted as at **235** to a bracket **237** mounted on the housing **62**. Depending from the lever **233** is a chain **239** or similar member carrying a valve member **240** engageable in a valve seat **242** formed in a fitting **244** to which the conduit sections **246** and **248** are attached. The conduit sections are a portion of the conduit **128** used in interconnecting the pump with the inflatable member **126**. A one way valve **250** may be provided at the pump end of the conduit section. Hence, upon actuation of the escapement due to actuation of the shaft **202** by the rubber band **200** at the signal exciting the solenoid **216**, the valve **240** will be lifted to thus permit air to exhaust into the housing **62** from the inflatable member **126** reducing pressure in the inflatable member **126** thus partially collapsing the inflatable member **126** and decreasing the volume it occupies thus reducing buoyancy. It is noted that this inflatable member **126** is provided with a check valve **252** as can be best seen in Figure 11. The check

valve is of conventional construction and allows air to be exhausted from the inflatable member when the inflatable member has been inflated and is still receiving air from the air pump thus preventing overinflation of the inflatable member.

The operation of this radio controlled model submarine is quite entertaining, amusing and instructing. When ready to sail the model submarine air is first removed by deflating the inflatable members **126** by submerging the submarine in water to the conning tower level. Drawing out the air may be hastened by using a rubber tube and drawing in air by the mouth thus deflating the inflatable member **126**. Of course, the timer **148** must be in an open position.

Then, the balloon **172** in the conning tower **32** is inflated so as to regulate the depth to which the submarine will submerge. This step is empirically tested by inflating the balloon **172** varying amounts as may be desired so that water will not enter the breather or snorkle tube **54** through which the antenna conduit extends. The balloon **172** may be then closed using the closure member **176**. It is not necessary to use excessive pressure on the balloon **172**. When ready to launch the submarine the timer **48** may be held in the open position and the inflatable member **126** may be inflated by detaching the conduit **146** and blowing into the inflatable member **126** by use of the breath or by any other suitable means. The submarine may then be placed on the water and engine and radio switch turned on with the timer **148** opened to full position for timing to shut off. As the ship travels through water air slowly leaves from the pump and ballast tank through the timer air escape unit valve **168** and the sub slowly sinks to near the top of the conning tower level as was previously adjusted leaving snorkle tube **54** exposed.

The timer finally snaps to the off position stopping the air escape and causing the air pump to inflate the ballast tank drawing air in through snorkle tube **54**, it being noted that the selected depth to which the submarine will submerge will not immerse the snorkle tube **54**. The pump is of course normally operating upon operation of the motor. This causes the submarine to resurface back to normal exposed running position with deck and superstructure again visible above the surface of the water.

Of course, use of radio control for the rudder and the ballast tanks is achievable through the escapement mechanism including the escapement crank arms **208** and **220**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A vessel comprising a hull and a conning tower carried above said hull, said vessel having an opening therein to permit fluid entry into said hull and conning tower, an inflatable member in said hull, a motor in said hull, at least one shaft connected to said motor, a propeller on said shaft outside of said hull, a pump for inflating said inflatable member, means connecting said pump and said shaft for operation thereby, valve means for deflating said inflatable member, and means for controlling the volume of liquid in said conning tower.

2. A vessel comprising a hull and a conning tower carried above said hull, said vessel having an opening therein to permit fluid entry into said hull and conning tower, an inflatable member in said hull, a motor in said hull, at least one shaft connected to said motor, a propeller on said shaft outside of said hull, a pump for inflating said inflatable member, means connecting said pump and said shaft for operation thereby, valve means for deflating said inflatable member, means for controlling the volume of liquid in said conning tower, and timer means for controlling said valve means mounted on said conning tower.

3. A vessel comprising a hull and a conning tower carried above said hull, said vessel having an opening therein to permit fluid entry into said hull and conning tower, an inflatable member in said hull, a motor in said hull, at least one shaft connected to said motor, a propeller on said shaft outside of said hull, a pump for inflating said inflatable member, means connecting said pump and said shaft for operation thereby, valve means for deflating said inflatable member, and means for controlling the volume of liquid in said conning tower, said means including an inflatable balloon in said conning tower.

4. A vessel comprising a hull and a conning tower carried above said hull, said vessel having an opening therein to permit fluid entry into said hull and conning tower, an inflatable member in said hull, a motor in said hull, at least one shaft connected to said motor, a propeller on said shaft outside of said hull, a pump for inflating said inflatable member, means connecting said pump and said shaft for operation thereby, valve means for deflating said inflatable member, means for controlling the volume of liquid in said conning tower, steering means on said hull, radio control means for actuating said steering means, and means connecting said valve means to said radio control means for actuating said valve means by said radio control means.

5. A vessel comprising a hull and a conning tower carried above said hull, said vessel having an opening therein to permit fluid entry into said hull and conning tower, an inflatable member in said hull, a motor in said hull, at least one shaft connected to said motor, a propeller on said shaft outside of said hull, a pump for inflating said inflatable member, means connecting said pump and said shaft for operation thereby, valve means for deflating said inflatable member, means for controlling the volume of liquid in said conning tower, a rudder movably mounted on said hull, a rudder shaft, means connecting said rudder shaft with said rudder, radio control means for actuating said shaft, and a flexible tube about said rudder shaft forming a water tight bearing between said radio control means and said rudder shaft.

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