J. W. BUNKLEY.

TOY SUBMARINE.

APPLICATION FILED JAN. 18, 1917.

1,271,272.

Patented July 2, 1918.

3 SHEETS—SHEET 1.

Fig. 1.

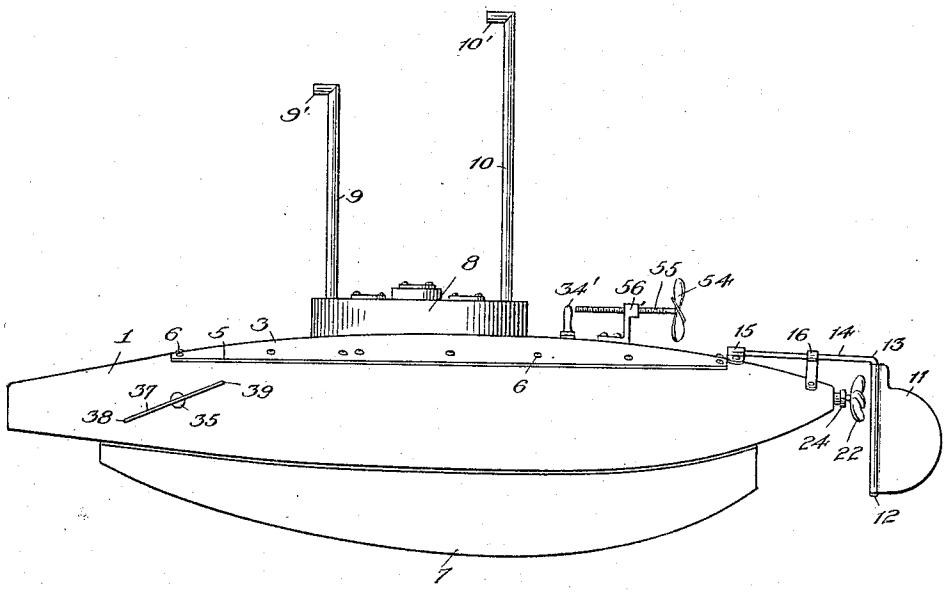


Fig. 2.

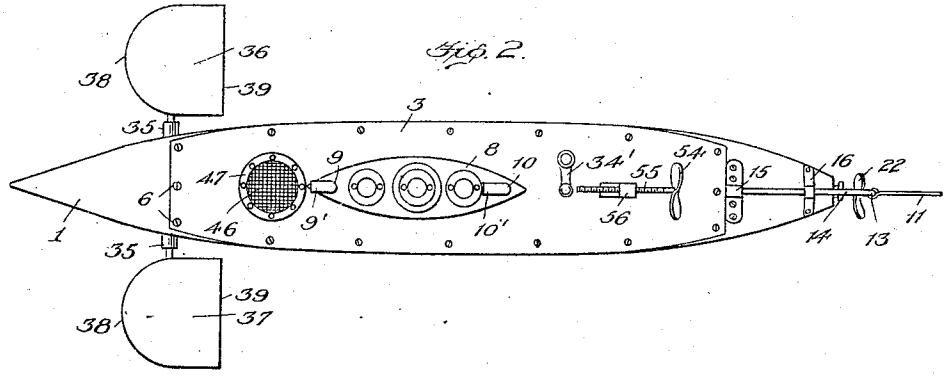
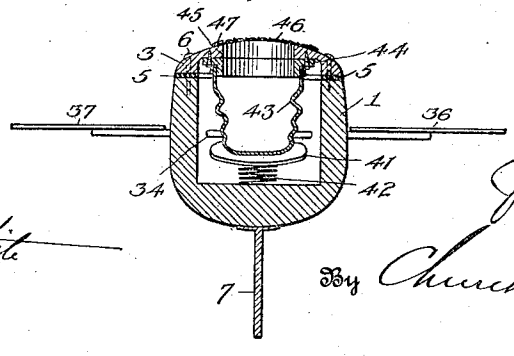


Fig. 5.



Witness

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3 SHEETS—SHEET 2.

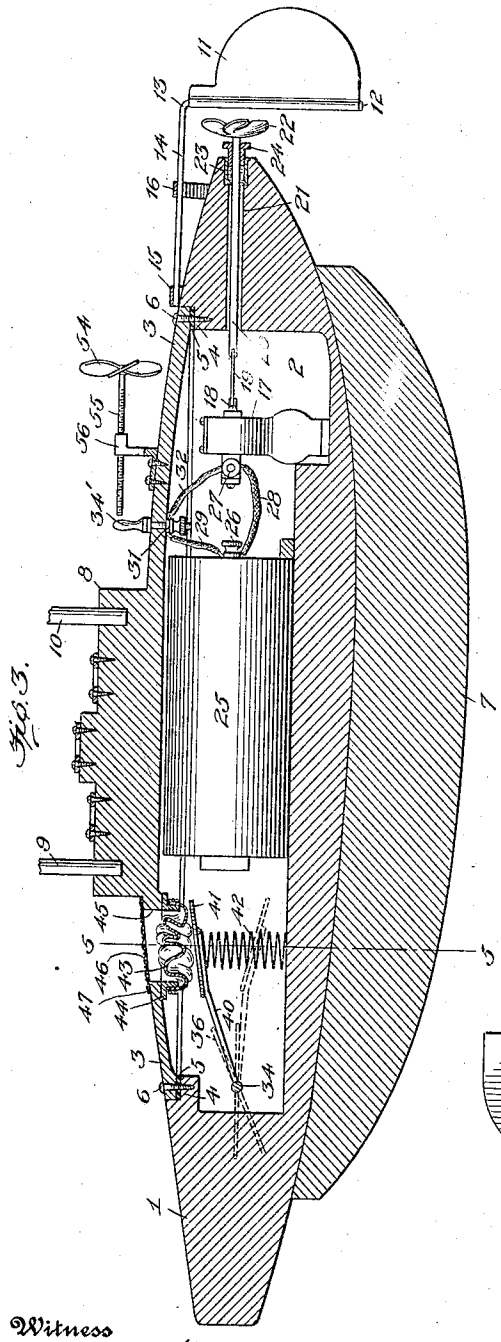


Fig. 3.

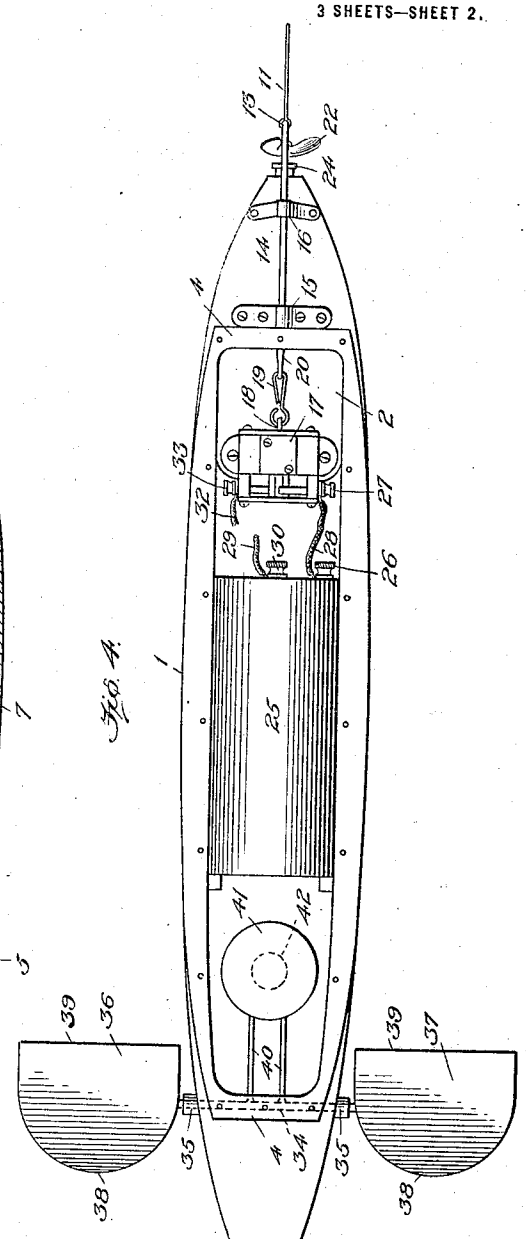


Fig. 4.

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3 SHEETS—SHEET 3.

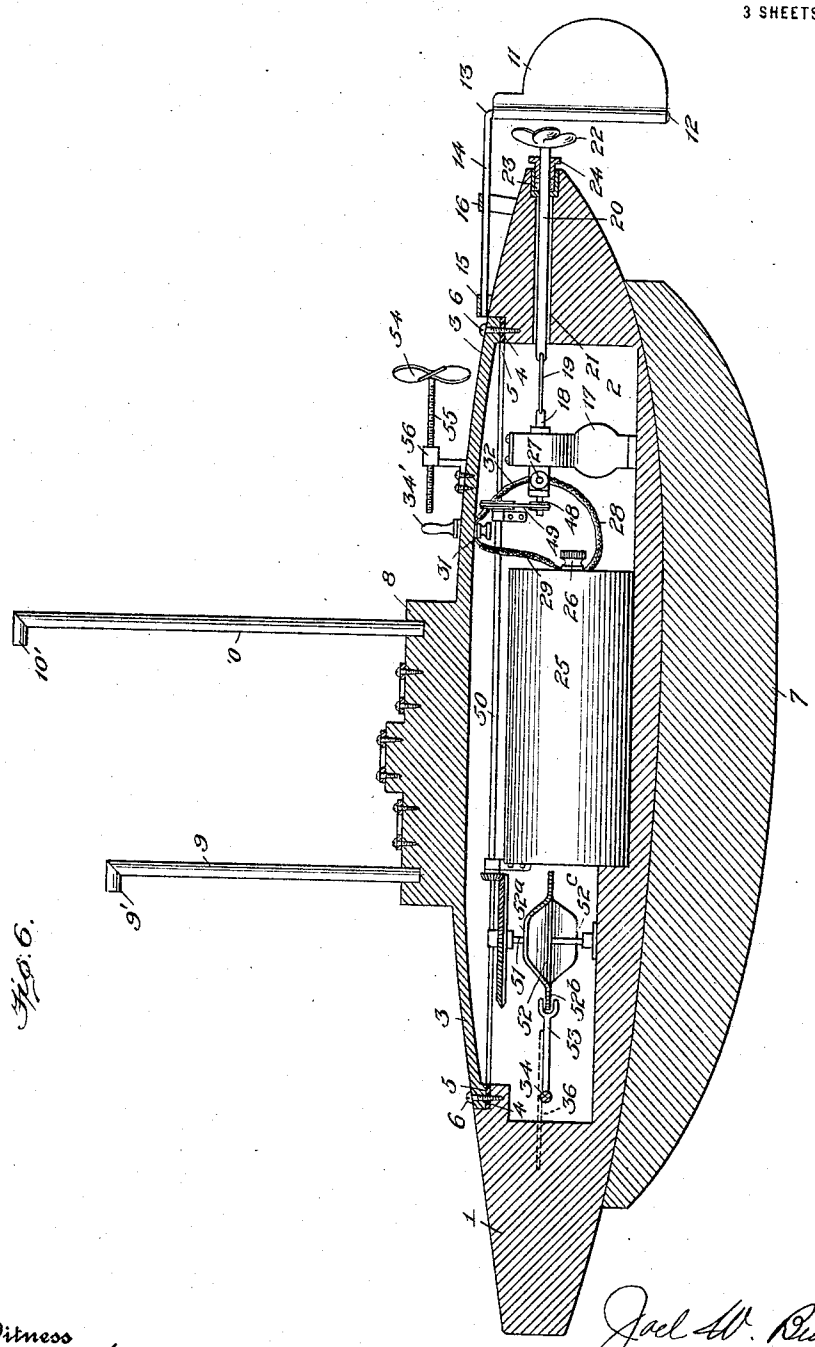


Fig. 6.

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UNITED STATES PATENT OFFICE.

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TOY SUBMARINE.

1,271,272. Specification of Letters Patent. **Patented July 2, 1918.**

Application filed January 18, 1917. Serial No. 143,063.

To all whom it may concern:

Be it known that I, JOEL W. BUNKLEY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Toy Submarines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

The primary object of this invention is the provision of an exceedingly simple and interesting toy vessel, which, when operated in the water, will simulate with remarkable exactness, the operation and movements of an actual submarine.

With this end in view, the invention consists in certain novel constructions, arrangements, and combinations of parts hereinafter described in a preferred form and particularly set forth in the claims at the end of the specification.

In the drawings,—

Figure 1 is a side elevation of a toy submarine constructed in accordance with the present improvements.

Fig. 2 is a top plan view of the same.

Fig. 3 is a vertical sectional elevation taken longitudinally through the hull of the vessel and illustrating the interior construction.

Fig. 4 is a plan view of the vessel with the top or cover plate of the hull removed.

Fig. 5 is a transverse section on the line 5—5 of Fig. 3, showing the parts in the position they assume when the vessel is running submerged.

Fig. 6 is a view similar to Fig. 3, but illustrating a modification.

Like characters of reference in the several figures indicate the same parts.

The hull 1 of the vessel may, in both forms of the invention, be of any preferred construction, although, obviously, it is preferable to construct the hull in such manner that it will have as great a likeness to an actual submarine as possible. As shown, said hull is provided with a keel 7 and an interior chamber 2 within which the motor and other operating parts of the vessel are confined. The chamber 2 may be closed by a cover plate 3 adapted to seat over a flange 4 extending around the upper end of the chamber. Preferably, a packing member 5, consisting conveniently of an endless band of rubber, is interposed between the cover plate 3 and the flange 4, so that entry of water into the interior chamber 2 is effectually prevented when the cover plate is clamped down in position. The clamping may be effected by the screws 6 which permit ready removal of the cover plate when access to the interior chamber is desired.

In the form of the invention shown, the appearance of an actual submarine may be imitated by providing the cover plate 3 with a turret 8 from which the rods 9 and 10 extend vertically, the latter being preferably formed with bent upper ends 9′ 10′, as shown, in order to simulate periscopes and give the proper effect of submarine operation, when the toy vessel is running submerged, in the manner which will appear hereinafter. These details of construction, however, may obviously be varied indefinitely within the scope of the invention.

The course of the vessel through the water is determined by a vertical rudder 11 pivotally mounted on the vertically depending portion 12 of a bent rod 13. The horizontal portion 14 of said rod is rigidly secured to brackets 15, 16 mounted on the stern of the vessel.

In the present embodiment of the invention, propulsion of the vessel through the water is effected by electricity and, for this purpose, there is mounted within the chamber 2, near the stern of the vessel, an electric motor 17 of any preferred type. The shaft 18 of said motor is connected by a flexible coupling 19 with the propeller shaft 20, the latter extending through a channel 21 bored in the stern and provided at its outer end with the usual propeller 22. Preferably a gland, consisting of a grease cup 23 and a cap 24, is fitted in the outer end of the channel 21, the cup 23 and cap 24 surrounding the propeller shaft. Cup 23 will be filled with grease or other suitable packing, so as to prevent water from entering the chamber 2 through the channel 21. As shown, the flexible coupling 19 is in the form of a link 19 having its opposite ends bent over and inserted in eyes formed in the ends of the respective shafts 18 and 20. In practice, the use of this flexible coupling is advantageous, since the shafts are permitted to yield laterally at a point remote from their bearings and consequently friction between the wall of the channel 21 and the propeller

shaft 20 is reduced to a minimum. Current for driving the motor 17 is supplied by a suitable battery 25, preferably any ordinary type of dry battery mounted in the chamber 2 of the vessel substantially midway between the bow and stern so as not to disturb the equilibrium of the vessel when running through the water. One terminal 26 of the battery is connected directly with the terminal 27 of the motor by an insulated circuit wire 28. The circuit wire 29 from the other terminal 30 of the battery leads to a switch 31 which is in turn electrically connected with the motor by a circuit wire 32 leading to the second motor terminal 33. The switch 31 may be of any approved variety and is conveniently mounted in the cover plate 3 of the hull. There is provided the usual switch lever 34′ which is preferably located on the outer face of the cover plate, whereby the operation of the motor can be readily controlled from the exterior of the vessel. The above described mechanism provides an exceedingly simple arrangement for propelling the vessel, it only being necessary to close the switch 31 by manipulating the lever 34′ to start the motor and drive the propeller. Although any form of battery suitable for the purpose may be employed, a commercial type of dry battery will be most satisfactory, since a battery of this type can be readily purchased in the market and quickly substituted for an old battery when the latter is exhausted. The other parts of the propelling mechanism are practically indestructible.

In the form of the invention illustrated in Figs. 1 to 6, inclusive, spring pressure is employed for submerging the vessel and hydrostatic pressure for retaining the vessel submerged. Extending transversely through the hull near the bow end of the chamber 2 is a shaft 34, the outer ends of which pass through suitable glands 35 for preventing the entry of water into the interior of the vessel by way of the shaft. Mounted on the outer ends of said shaft 34 are horizontal blades or diving rudders 36, 37 which respectively project laterally from the opposite sides of the vessel. These rudders are formed with curved front or entering edges 38 and straight rear edges 39, as shown in Fig. 4, and they are adapted by their position with respect to the horizontal line of the vessel to control submergence and elevation of the hull of the vessel. When the forward edges of the rudders point downwardly, as shown in Fig. 1, the pressure of the water against the inclined surfaces of the rudders, while the vessel is being propelled through the water, will cause the hull of the vessel to be projected downwardly in the water and submerged beneath the water line. Secured to the transverse shaft 34 are longitudinal rods 40 mutually supporting a metal plate 41. Between the metal plate 41 and the bottom of the chamber 2 is a coil spring 42 which normally presses on the rear face of the plate and maintains the latter in the elevated position indicated by full lines in Fig. 3. When the plate 41 is in this position the rudders 36 are inclined with their forward or entering edges down and the vessel is thus in proper trim to be submerged. This position of the rudders is maintained normally by the pressure of the spring 42. Located above plate 41 is a collapsible water chamber or hydrostatic pressure device adapted by hydrostatic pressure to move the plate 41 and consequently the rudders in a direction opposite to the movement effected by the action of the spring 42. In the present embodiment said chamber is conveniently formed of a bag 43 of rubber or other elastic material secured to a ring 44 mounted beneath a port 45 in the cover plate 3 of the hull. Preferably the joint between the bag and the ring is made water tight so as to prevent water from entering the chamber 2 at this point. The port 45 may be covered by a screen 46 of open work or wire mesh secured by a ring 47 mounted on the cover plate of the hub, the wire mesh preventing the entry of solid substances into the bag.

In practice, the vessel is ballasted in such manner that, when first placed in the water, the port 45 will be located at just about the water line, this being the normal position of an actual submarine when running awash. The air within the chamber of the hull imparts a reserved buoyancy to the vessel which is sufficient to cause the vessel to rise to the surface when the propeller is stopped. As the spring 42 normally maintains the plate 41 in elevated position and the rudders are inclined with their entering edges down, as shown in Fig. 1, the vessel will begin to submerge as soon as it is placed in the water with the propeller 22 running. Submerging of the vessel, however, causes the upper end of port 45 to pass beneath the water line so that water enters through the wire mesh and begins to fill up the rubber bag 43 thereby exerting pressure on the plate 41 and compressing the spring 42. The hydrostatic pressure within the bag moves the plate 41 downwardly against the spring tension and thus, as the vessel submerges, the rudders 36 are slowly shifted into horizontal position, the greater the depth of submergence of the vessel the greater the hydrostatic pressure and the more completely the bag 43 is filled with water. As the hydrostatic pressure is utilized to shift the rudders 36 to horizontal position, such pressure also controls the depth at which the vessel may be submerged, since the vessel will cease submerging when the rudders are horizontal and any further hydrostatic pressure will lift the entering edges of the rudders which of course would

tend to elevate the vessel. In fact, it is desirable that the rudders have a wide enough range of movement to lift their entering edges at the point when the bag 43 is filled with water and the hydrostatic pressure is greatest. If the vessel starts to rise, the hydrostatic pressure in the bag is reduced, permitting the spring 42 to again exert its pressure on to the plate 41 and lower the entering edges of the rudders. Thus, while running, the vessel will remain submerged while there is a balance of the pressures exerted by the water in the bag and the spring, and the vessel will not rise to the surface until the propeller 22 ceases to run, whereupon the reserved buoyancy of the vessel will cause it to rise to the original awash position.

In the form of the invention illustrated in Fig. 6, the submerging of the vessel is effected by horizontal rudders similar in construction to those previously described. The movement of the rudders, however, is power controlled—*i. e.*, the control is effected by the motor itself instead of spring and hydrostatic pressures. For this purpose the motor shaft is provided with a pulley 48 having a belt connection 49 to a horizontal shaft 50 running longitudinally of the hull. The shaft 50 is geared with a vertical shaft 51, the gearing being of the proper ratio to permit an exceedingly reduced rotation of the shaft 51 relatively to the shaft 50. Mounted on the shaft 51 and driven thereby is a cam 52 which is engaged by an arm 53 secured to the transverse shaft 34 of the rudders. Cam 52 is provided with an elevated portion 52^a connected by level portions 52^b with a depressed portion 52^c. As the cam rotates it will elevate the arm 53 to lower the entering edges of the rudders, this taking place while said arm is in engagement with the elevated portion of the cam, next maintain the arm in horizontal position, wherein the rudders are horizontal, as the level portion of the cam comes into engagement with the arm, and next depress the arm to elevate the entering edges of the rudders when the depressed portion of the cam is rotated into engagement with the arm. In this manner the vessel submerges for a period determined by the shape and speed of rotation of the cam, runs submerged for a certain period, and then rises to the surface where it will run for a period of time before submerging again.

If desired, provision may be made for shutting off the motor when the vessel has been running for a time in the water, permitting the vessel to rise immediately to the surface if submerged, by reason of the reserve buoyancy of the vessel. For this purpose, there is mounted on the cover plate 3 a propeller 54 having a screw-threaded shaft 55, which extends through a screw-threaded hole in a bracket 56 on the cover plate. The forward end of the shaft 55 is adapted to engage the handle of the switch lever and throw the latter to open position, after the screw threaded shaft has been advanced sufficiently by the motion of the propeller produced by the water flow, while the vessel is running under its motive power.

What is claimed is:

1. In a toy submarine embodying a hull, a propeller with means for driving the propeller, diving rudders mounted on the hull and adapted to assume different angular positions with respect thereto, and means operable continuously by the driving means for varying the angularity of said diving rudders.

2. A toy submarine embodying a hull, a propeller, a motor for driving the same, diving rudders mounted on the hull and adapted to assume different angular positions with respect thereto, and a continuously-operating power driven means for varying the angularity of said diving rudders.

3. A toy submarine embodying a hull, a driving propeller, diving and elevating rudders, and means for periodically changing the angularity of said rudders with respect to the hull, whereby the vessel is alternately submerged and elevated, and run elevated or submerged between the periods of elevation or submergence.

4. A toy submarine embodying a hull, a driving propeller, movable lateral rudders adapted when moved into one angular position with respect to the hull to submerge the latter, and when moved into a reverse angular position to elevate said hull, and a power-driven means for periodically reversing the angularity of said lateral rudders.

5. A toy submarine embodying a hull, a propeller, an electric motor for driving the same, and means in continuous driving relation with said electric motor for submerging the hull of the vessel.

6. A toy submarine embodying a hull, a propeller, a motor for driving the same, and connections operable continuously by the motor for periodically submerging the hull of the vessel and retaining the latter submerged.

7. A toy submarine embodying a hull, a propeller, a motor for driving the same, and connections operable by the motor for alternately submerging and elevating the hull of the vessel and for causing the vessel to run elevated or submerged for periods between the periods of elevation or submergence.

8. A toy submarine embodying a hull, a propeller, an electric motor for driving the same supported within the hull, a battery

also supported within the hull, circuit connections between said battery and motor, and connections operable by the electric motor for alternately submerging and elevating the hull of the vessel and for causing the vessel to run elevated or submerged for periods between the periods of elevation or submergence.

9. A toy submarine embodying a hull, a propeller, an electric motor for driving the same supported within the hull, a battery also supported within the hull, circuit connections between said battery and motor, a switch interposed in said circuit connections, means operated by the flow of the water for opening said switch, and means for submerging the hull of the vessel beneath the surface of the water.

10. A toy submarine embodying a hull, a propeller, an electric motor for driving the same supported within the hull, a battery also supported within the hull, circuit connections between said battery and motor, and power operated means for submerging the hull of the vessel beneath the surface of the water.

11. The combination, in a toy vessel, of a propeller, a motor for driving the same supported by the vessel, and means operated by the flow of the water for rendering inoperative said motor.

12. The combination, in a toy vessel, of a propeller, a motor for driving the same supported by the vessel, means operated by the flow of the water for rendering inoperative said motor, and means for submerging the hull of the vessel beneath the surface of the water.

13. A toy submarine comprising a hull, a propeller, a motor for driving the same, and an automatically operating mechanism for alternately submerging and elevating the hull of the vessel and for causing the vessel to run elevated or submerged for periods between the periods of elevation or submergence.

14. A toy submarine comprising a hull, a propeller, a prime mover for driving the same, and continuously-operating means controlled directly by the prime mover for alternately submerging and elevating the hull of the vessel and for causing the vessel to run elevated or submerged between the periods of elevation or submergence.

15. The combination, in a toy submarine vessel, of a propeller, a prime mover for driving the propeller, a diving rudder carried by the vessel and adapted to assume different angular positions with respect to the longitudinal axis of the vessel, a cam driven by the prime mover for varying the angularity of said diving rudder, and an operative connection between the cam and the diving rudder.

JOEL W. BUNKLEY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."