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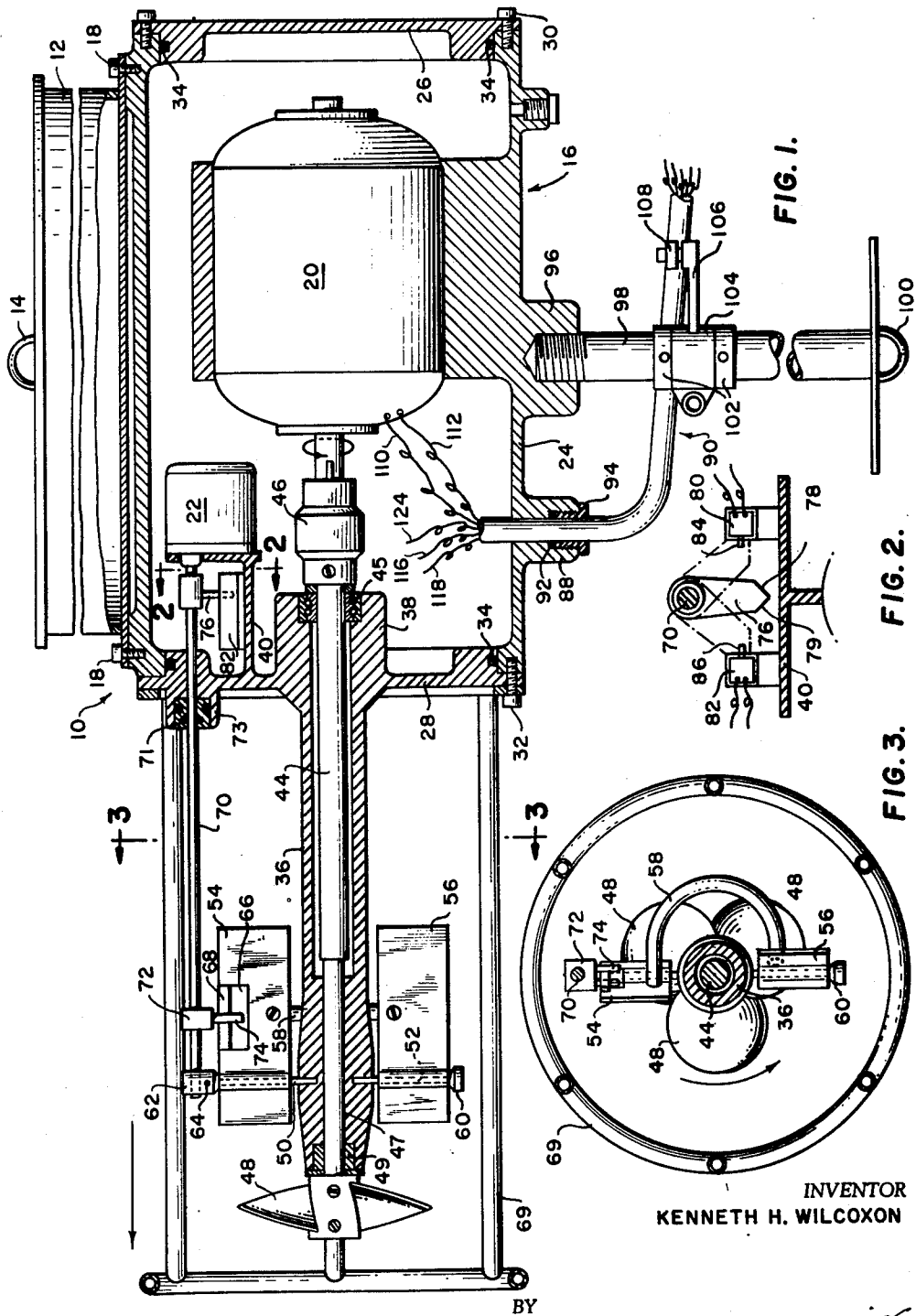
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SELF-PROPELLED REMOTELY CONTROLLED BUOY

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2 Sheets-Sheet 1



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SELF-PROPELLED REMOTELY CONTROLLED BUOY

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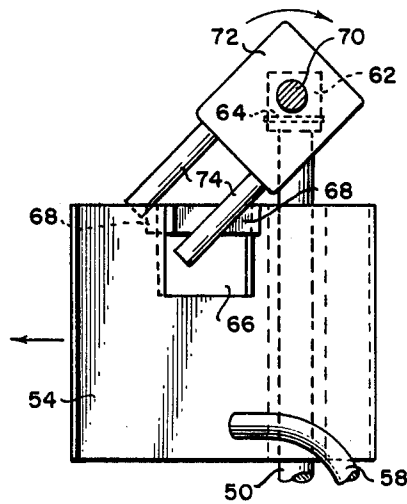


FIG. 4.

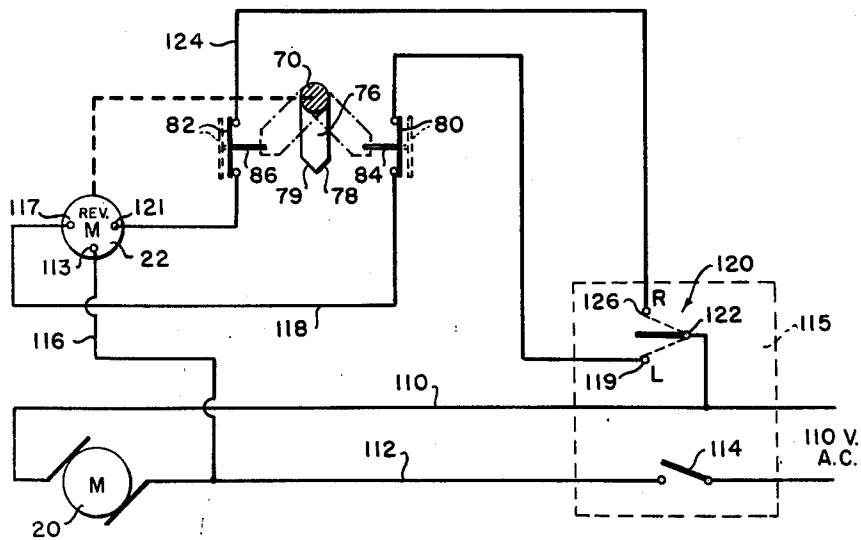


FIG. 5.

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SELF-PROPELLED REMOTELY CONTROLLED BUOY

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3 Claims. (Cl. 114—21)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to a self propelled, remotely controlled buoy and more particularly to a remotely controlled buoy for use in conjunction with the making of underwater sound measurements.

In accordance with a common prior art technique for making underwater sound measurements, it is customary to attach a hydrophone or the like to a buoy and place the assembly in proximity of the device whose sound emanations it is desired to measure. It is pointed out that this technique requires the use of a row boat or the like to tow the buoy and hydrophone into a desired position where it is left while making noise measurements; when it is desired to move the hydrophone past a noise producing device it is of course necessary to use said row boat to tow the hydrophone and buoy past the noise producing device.

The aforementioned prior art technique has the obvious disadvantage of being slow and laborious in addition to being inconvenient under many situations, as for example when the water is rough and/or when the hydrophone is located at some distance from the listening post. Another disadvantage of the prior art technique is that it requires more man power than is necessary when using the instant invention. Specifically, it is necessary to employ a crew to operate the rowboat or other buoy towing means in addition to having persons aboard ship or on a dock operating a listening post.

In accordance with the instant invention it is possible for one person to control the position of the self-propelled buoy, and at the same time observe the readings obtained from a hydrophone supported therefrom.

It is an object of this invention to overcome the aforementioned disadvantages inherent in the prior art.

It is an additional object of this invention to provide a self-propelled buoy.

Another object of this invention is to provide a steerable, self-propelled buoy.

It is still another object of this invention to provide a steerable, remotely controlled self-propelled buoy.

A further object of this invention is to provide a self-propelled by hydrophone moving means.

Still a further object of this invention is to provide a steerable, self-propelled hydrophone moving means.

It is an additional object of this invention to provide a remotely controlled, steerable, self-propelled hydrophone moving means.

In accordance with the instant invention the self-propelled buoy includes a buoyancy chamber having a water-tight compartment attached to the lower end thereof. A propeller shaft is mounted in an elongated journal box extending outwardly from one wall of the water-tight compartment. The journal is so constructed that the propeller shaft extends from inside the compartment to a point beyond the outboard end of said journal,

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said shaft having a propeller attached to the outboard end thereof. The shaft is connected to an electric motor mounted within the compartment, said motor being connected to a suitable switch mechanism located remotely of the buoy. The direction of propeller rotation is such that the buoy is pulled through the water rather than pushed.

A second motor, of smaller size than the first motor, and hereinafter referred to as the rudder motor, is also mounted within the water-tight compartment. The second motor is connected by suitable linkage to a rudder located downstream of the propeller and rotatably mounted on the elongated propeller shaft journal box. The rudder motor is reversible for purposes hereinafter set forth, and a remotely located switch means is provided for reversing the direction of rotation of said motor, whereby, through the action of the aforementioned linkage, the rudder is rendered turnable, so that the direction of movement of the buoy may be varied.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood, by reference to the following detailed description when considered in connection with the accompanying drawings wherein;

Fig. 1 is a side elevational view, partially in section, and broken away, of a self-propelled buoy made in accordance with this invention;

Fig. 2 is a vertical sectional view taken on line 2—2 of Fig. 1 showing a rudder-motor stop mechanism;

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1 showing the rudder of the buoy turned to one extremity of its movement, and

Fig. 5 is a schematic diagram of the electrical control means utilized with the instant invention.

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1 the overall organization of the instant remotely controlled buoy 10. The buoy 10 comprises a water-tight buoyancy tank 12 having a lifting hook 14 at the upper end thereof, said buoyancy tank 12 having a waterproof compartment 16, hereinafter referred to simply as a compartment, attached thereto by a plurality of bolts or the like 18. The compartment 16 contains a propulsion motor 20 and a reversible rudder actuating motor 22, each of said motors being fixedly mounted in said compartment. It is pointed out that the compartment 16 is composed of a substantially cylindrical, open ended member 24 having aft and forward closure plates 26 and 28 respectively attached to the respective ends thereof by means of suitable bolts 30 and 32 respectively. Each of the plates 26 and 28 is provided with a suitable O-ring seal 34 located in an annular groove in the periphery thereof, said respective seal members being adapted to prevent entry of water into the compartment 16 between the outer periphery of the respective end plates and the adjacent wall of the cylindrical member 24.

The forward closure plate 28 is provided with an integrally formed, elongated tubular journal box 36 extending outwardly of the watertight compartment 16. The journal box 36 is provided with a boss 38 that extends into the compartment 16. The forward closure plate 28 is further provided with a motor supporting bracket 40 on the inner face thereof, for supporting the rudder motor 22.

In addition to the motor 20, the propulsion mechanism consists of an elongated propeller shaft 44 journaled in and extending through the elongated journal box 36 and connected by a suitable coupling 46 to the propeller driving motor 20. The inboard end of the shaft 44 is carried

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by a conventional ball bearing member 45, mounted in the boss 38. The outboard end of the shaft 44 is supported by a bearing area in the journal box 36. A sealing gland 49 is mounted in the outboard end of the journal box 36 for the purpose of preventing entry of water into the compartment 16 through said journal box.

A suitable propeller 48 is fixedly mounted on the outboard end of the propeller shaft 44. The propeller design and the direction of rotation thereof are such that the buoy assembly 10 moves from right to left, as viewed in Fig. 1.

The rudder mechanism of the instant buoy comprises a pair of elongated pintles 50 and 52 having threaded end portions screwed into the elongated journal box 36; said pintles extend, respectively above and below said journal box. A rudder blade is rotatably mounted on each of the fixed pintle members thereby providing an upper rudder member 54 and a lower rudder member 56. The rudder members 54 and 56 are connected together by a U-shaped bar 58, extending therebetween and having its respective ends fastened to said respective rudder members, whereby when one rudder member is moved both move in unison. The lower rudder member 56 is held on the lower pintle 52 by an enlarged head portion 60 at the lower end of said pintle. The upper rudder member 54 is held on the upper pintle 50 by a removable head member 62 having an axially extending hole therein into which the upper end of the pintle 50 extends. The head member 62 is held on the pintle 50 by a pin 64 that extends through aligned holes in said head 62 and pintle 50 respectively.

The uppermost rudder member 54 is provided with a substantially rectangular cutout area 66 slightly spaced from its upper edge, whereby a portion of the rudder extends longitudinally across said cutout area at the upper edge thereof. A pair of bearing strips 68 are fixed to the opposite faces of the portion of the rudder extending across the cutout area.

It is pointed out that as shown in Fig. 3, the rudder is set in position for a straight ahead run of the buoy. It should be noted that the respective rudder members 54 and 56 are angularly offset relative one another and also relative to the longitudinal axis of the propeller shaft 44. The respective rudder members are offset relative to one another in the aforesaid manner for the purpose of obtaining a better alignment with the spiral flow of water from the propeller. It is however emphasized that even though the rudder members are offset in the manner shown and described, the apparatus will nevertheless move in a straight line when the rudder is in the position shown in Fig. 3.

The rudder assembly and propeller are protected by a cage-like structure 69 attached to the watertight compartment 16 and extending forwardly therefrom in propeller and rudder surrounding position as shown in Fig. 1 and Fig. 3.

The rudder actuating structure includes a rotatable shaft 70 coupled to the rudder actuating motor 22 and extending through a watertight bearing 71 in a boss 73 formed on the forward closure plate 28. The shaft 70 extends forwardly of the compartment 16, and has its forwardmost end rotatably located in a hole formed in the removable head 62 at the upper end of the pintle 50. Adjacent its forwardmost end the shaft 70 has fixedly mounted thereon a block member 72 having a pair of spaced detents 74 affixed thereto and extending downwardly therefrom, said detents straddling the bearing strips 68 that extend along the uppermost edge of the opening 66 in the upper rudder member 54. On the rear-most end of the rudder actuating shaft 70, and adjacent the rudder actuating motor 22, there is fixedly mounted a finger-like, switch actuating member 76 having slanted lowermost edges 78 and 79; said finger-like member is adapted to rotate with the rudder actuating shaft 70.

A pair of spaced microswitches 80 and 82 are fixedly

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mounted on the rudder motor supporting bracket 40 within the watertight motor compartment 16, said microswitches being arranged with their operating buttons 84 and 86 facing one another in the manner shown in Fig. 2.

The microswitch buttons 84 and 86 are in alignment with the respective lower sloped edges 78 and 79 of the switch actuating finger 76 attached to the rudder actuating shaft 70, said sloping lower ends being adapted to selectively contact and depress said respective buttons 84 and 86 for purposes hereinafter described.

It is pointed out that the watertight compartment 16 is provided with a downwardly extending boss 88 having an opening extending therethrough, whereby a group of electric cables 90 are brought into the compartment 16. The cable boss 88 is provided with a watertight sealing means consisting of a gland 92 and a plug 94 adapted to be screwed into said boss against said gland.

A second boss 96, having an internally threaded portion, extends downwardly from the watertight compartment 16. A tubular member 98 extends downwardly from the compartment 16 and has its upper end threaded into the boss 96. The tubular member 98 is provided with an attachment ring 100 at its lower end that is adapted to support a hydrophone or the like. Adjacent its upper end the tubular member 98 has fixedly attached thereto a pair of spaced collars 102. A cable supporting member 104 is rotatably mounted on the tubular member 98 between the spaced collars 102 and is supported thereby, said cable supporting member 104 is adapted to freely rotate about the hydrophone supporting tubular member 98.

The cable supporting member 104 is provided with a radially extending arm 106 having a cable clamping member 108 at its outer end. The cable 90 is accordingly held in fixed relation to the outer end of the arm 106, but is free to rotate with said arm about the tubular member 98. Thus the cable supporting member 104 serves to relieve cable tension adjacent the cable entry boss 88.

Referring to Fig. 5, the electrical control mechanism for the aforementioned apparatus comprises a source of 110 volt A.C. current, one side of which is attached directly to one terminal of the driving motor 20 by a line 110, while the other side of said 110 v. source is attached to the second terminal of said motor by a line 112 having an on-off switch 114 therein at a remotely located control center 115. As previously pointed out, the rudder actuating motor 22 is a reversible A.C. type that is provided with three terminals, one of which is connected to the line 112 at a point between the main on-off switch 114 and the motor 20 by a line 116. A second terminal of the motor 22 is connected by a line 118, through one of the microswitches 80 to a post 119 of a double-throw single-pole switch 120, the common terminal 122 of which is connected to the line 110. The third terminal of the rudder actuating motor 22 is connected by a line 124 through the second microswitch 82 to the second terminal 126 of the switch 120.

Operation

In order to start movement of the buoy through the water, the main on-off switch 114 is closed, thereby setting the propeller motor 20 in operation. When switch 114 is closed, the common terminal 113 of the rudder motor 22 is connected to one side of the A.C. source through lines 116 and 112. At this point, assuming that both microswitches 80 and 82 are closed, as shown by solid lines in Fig. 5, the rudder motor 22 can be set in motion by throwing the switch 120 into contact with either terminal 119 or 126. The motor 22 is constructed, in accordance with conventional techniques, so that the direction of rotation thereof can be reversed by selectively connecting either terminals 113 and 117, or 113 and 121 across a source of A.C. current; of course the appropriate operation of the switch 120 serves to carry out this function. If it is desired to make the buoy turn to the right, after the main on-off switch 114 has been closed, the

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switch 120 is thrown to the right hand position 126 which connects the rudder motor terminal 121, through the microswitch 82 and line 124 to the main A.C. line 110.

When the control switch 120 is thrown to the right hand position 126, for purposes of making the buoy turn to the right, the rudder actuating shaft 70 is turned in a clockwise direction, as viewed in Figs. 3, 4 and 5, which in turn rotates the spaced detents 74 in a clockwise direction. As the spaced detents proceeds to rotate, the right hand detent, as viewed in Fig. 4, comes in camming contact with a bearing strip 68 at the upper edge of the uppermost rudder member 54 and proceeds to cause said rudder member to turn in the direction shown in Fig. 4. Since the water flows from left to right, as viewed in Fig. 1, the rudder position shown in Fig. 4 causes the buoy to turn to the right as it proceeds through the water.

The rudder motor 22 continues to rotate in a clockwise direction until the camming surface 79 on the finger 76 fixedly mounted on the shaft 70 comes in contact with, and depresses, the plunger 86 on the microswitch 82 in the manner shown in dotted lines in Figs. 2 and 5. At this point the microswitch 82 is opened which of course opens the line 124 extending to one side of the source of A.C. current, thereby stopping the motor 22, whereby further rotation of the rudder actuating shaft 70, the spaced detents 74 and the rudder member 54 is prevented. The buoy will now continue to turn to the right as long as the propulsion motor 20 remains in operation.

If on the other hand, it is desired to reverse the direction of movement of the buoy, the control switch 120 is thrown to the left hand position 119 in which case the current passes through lines 112 and 116 to the common terminal 113 on the motor 22, and through the lines 110 and 118, through the closed microswitch 80 to the terminal 117 of said motor 22. The motor 22 is so constructed that under this latter arrangement, it and the shaft 70 commence to rotate in the opposite, or counter-clockwise direction, as viewed in Figs. 2 and 5. As the shaft 70 rotates in a counterclockwise direction, the left hand rudder actuating detent, as viewed in Fig. 4, cams against the bearing strip 68, shown in dotted lines in Fig. 4, thereby causing said rudder member to be rotated toward the right, as viewed in Fig. 4, so as to reverse the direction of movement of the buoy.

As the rudder actuating shaft 70 proceeds to rotate in a counterclockwise direction, the microswitch actuating finger 76 with its sloped lowermost edge 79 moves out of contact with the button 86 on the open microswitch 82, thereby allowing the latter switch to close. In time the edge 78 contacts and depresses the button 84 on the switch 80, thereby opening said switch and causing rotation of the rudder motor 22 to cease.

At this point, in order to again reverse the direction of movement of the buoy, it is merely necessary to reverse the control switch 120 in which case the first above mentioned cycle will be repeated.

It is pointed out that the slot 66 is provided in the uppermost rudder member so that the detents 74 may be placed as close together as possible, thereby making it possible to minimize the amount of shaft rotation necessary for maximum rudder movement. The rudder actuating apparatus is so arranged that there is a maximum rudder movement of 45° from one extremity to the other.

It is pointed out that with the structure described above, it is possible to remotely control the operation of the aforementioned self-propelled buoy 10, without danger of jamming of the rudder operating mechanism so that operation of the apparatus is rendered foolproof.

Thus the instant invention provides a relatively simple and novel means for remotely controlling the movements of a self-propelled buoy, and more particularly a hydrophone supporting buoy, whereby said hydrophone may be moved about in the water with a minimum of manpower, equipment and time. This invention eliminates the prior art need for manually moving a hydrophone about by a number of men operating in a rowboat or the like.

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Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A remotely controlled, self-propelled buoy comprising a buoyant member, a water-tight compartment connected to said buoyant member, an open ended elongated tubular member connected to said watertight compartment and having one end thereof in communication with the interior of said compartment, a propeller shaft rotatably mounted within said tubular member and having one end thereof within said watertight compartment and the opposite end thereof extending beyond the end of said tubular member, a propeller connected to said rotatable shaft at the outermost end thereof, a first rotary electric motor mounted within said watertight compartment, means coupling said motor to said propeller shaft, a rudder attached to said tubular member adjacent said propeller and downstream therefrom, said rudder comprising a pair of rudder blades fixedly connected to one another, said rudder blades being pivotally connected to said tubular member at diametrically opposed points thereon; a second rotary electric motor mounted within said compartment, said second motor being provided with reversing circuitry, a shaft coupled to said second motor and extending outwardly of said compartment through a wall thereof, a pair of spaced detents fixedly connected to said second rotatable shaft and adapted to rotate therewith, said spaced detents being situated in straddling relation with an edge of one of said rudder blades, whereby rotation of said second shaft causes rotation of both rudder blades, stop means located within said compartment for limiting rotation of said second shaft to a predetermined number of degrees whereby rotation of said rudder is limited to a predetermined number of degrees, an on-off switch connecting both of said motors to a source of electrical current, said switch being located remote of said compartment, remotely located means for selectively reversing rotation of said second electric motor thereby varying the rudder angle relative to said tubular member, whereby movement of the buoy through the water may be started and stopped and the direction of said movement controlled from a position remote relative to the buoy.

2. A remotely controlled, self-propelled buoy as set forth in claim 1 wherein said stop means comprises a downwardly extending finger fixedly attached to said second shaft, a pair of normally closed, laterally spaced microswitches fixedly mounted within said compartment, said microswitches having their respective actuating buttons in alignment with and adapted to be selectively depressed to switch opening position by the lower end of said finger during rotation of the latter, said microswitches connecting said second motor to said source of current, whereby rotation of said second motor is adapted to be stopped after rotation of a predetermined number of degrees in either direction, thereby limiting movement of said rudder member to a predetermined number of degrees.

3. A remotely controlled buoy as set forth in claim 2, wherein said microswitches are respectively located in separate parallel circuits connected to the respective reversing circuits in said second motor, a control switch means for selectively connecting said parallel circuits to said source of current, whereby the direction of rotation of said second motor may be reversed, thereby reversing the direction of rudder movement.

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