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UNDERWATER CRAFT

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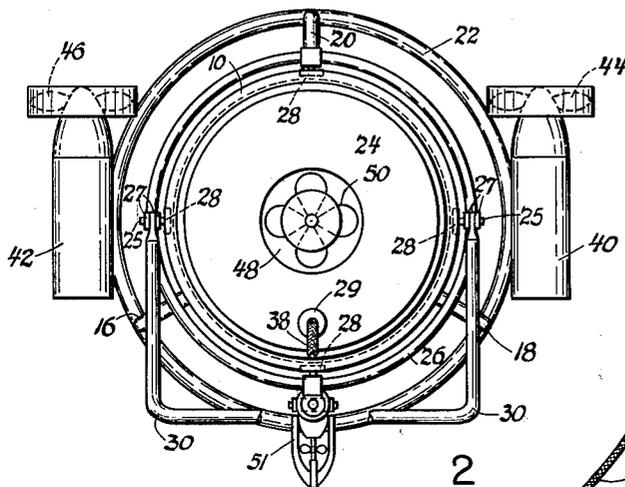


FIG. 3

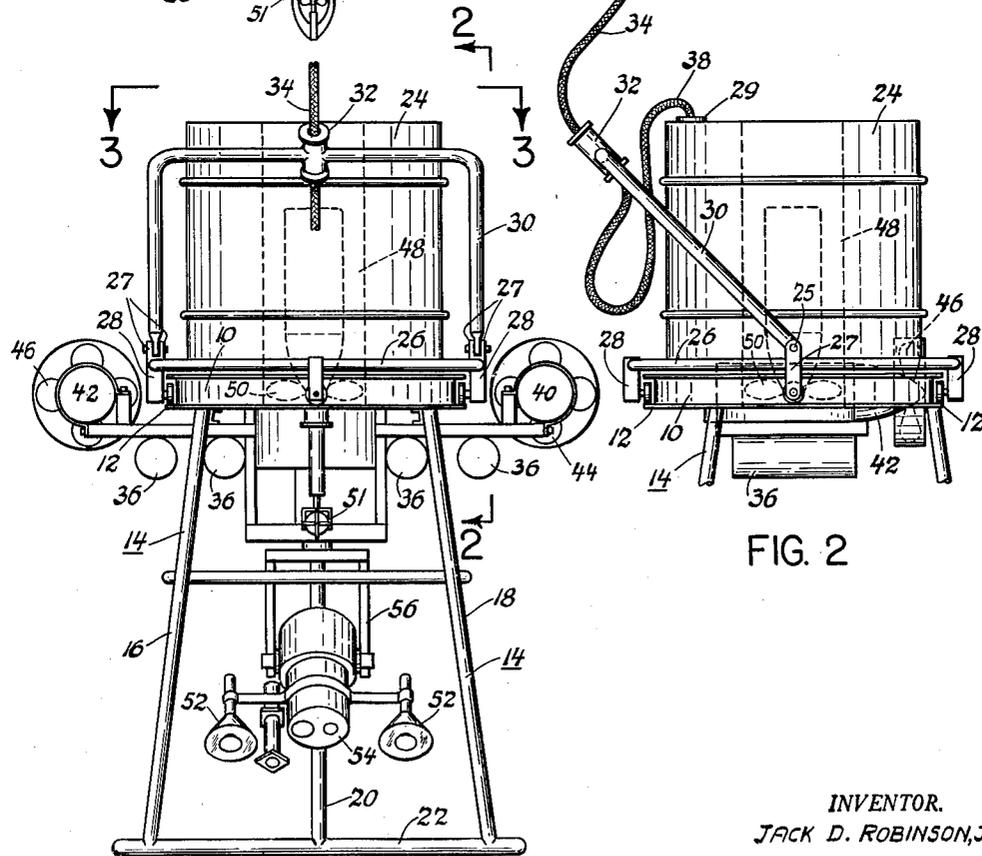


FIG. 2

FIG. 1

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UNDERWATER CRAFT

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6 Claims. (Cl. 61-69)

This invention relates to mobile underwater craft and more particularly to underwater television apparatus which may be remotely operated and controlled by a cable connecting the underwater craft with a remote control station.

Attachment of a control cable has hitherto often caused instability of an underwater television vehicle because the control cable tended to create an overturning torque acting on the underwater vehicle when the cable was dragged behind the craft or when tension was applied thereto.

Underwater craft particularly when operating at great depths have also suffered failure because of water seeping into the control and electrical wiring compartments and they have had insufficient mobility and control over their movement than was desirable.

It is an object of this invention to provide means for improving the stability of remotely controlled underwater craft by reducing overturning movements exerted about the center of resistance of the vehicle caused by tension exerted by a control cable.

A further object of this invention is to provide an underwater television system which will be protected against water seepage particularly at great depths.

Another object of this invention is to provide an underwater viewing apparatus which can be accurately and easily controlled from a remote station.

A further object of this invention is to provide means for determining the velocity of movement of the underwater apparatus to facilitate precise control thereof.

Other objects and features of the invention will appear as the description of the particular physical embodiment selected to illustrate the invention progresses. In the accompanying drawing, which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which make up the drawings.

Figure 1 is a side elevation of my remotely controlled underwater craft.

Figure 2 is an end elevation taken on line 2-2 of Figure 1.

Figure 3 is a top view taken on line 3-3 of Figure 1.

In order to prevent the control cable tension from interfering with the stability of the underwater television craft, I have provided a cable connection for the underwater craft which will cause any torque exerted by the control cable to always act on the approximate center of resistance of the vehicle regardless of what angle the cable makes with the craft, as more fully described hereinbelow. As a result of employing this cable connection there are no overturning movements exerted on the underwater vehicle by the cable, which would cause it to tilt because the center of resistance is that point around which twisting of the body surrounding the point will not occur when the body is moved through the water.

A bearing ring 10 having a track 12 formed thereon

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is mounted on and surrounds the upper end of a framework 14. The framework 14 consists of three vertical legs 16, 18, and 20 and a cylindrical base 22.

A buoyancy compartment 24 is also connected to the upper end of the framework 14. A ring 26, having a plurality of trolley carriages 28 mounted thereon which tracking on track 12, is free to rotate relative to the track 12.

The ring 26 has a pair of lugs 27 formed thereon to which are pivotally connected the ends of the yoke 30. A cable connection 32 is formed at the center of the yoke 30 and has a control cable 34 connected thereto.

It will be noted that the swing of the yoke 30 is about the lugs 27 and that the lugs 27, being connected to ring 26 is free to rotate about the track 12. Since the ring connection 26 and the pivots 25 of the yoke 30 travels about the center of resistance of the entire underwater craft, there is no tendency for the craft to topple or tilt, regardless of what angle a pull or drag is exerted on the underwater craft, by the control cable 34.

The buoyancy compartment 24 contains the electrical control and operating components of the underwater craft and is pressurized to prevent water seepage. In order to provide pressure in the buoyancy compartment 24 slightly exceeding the ambient water pressure at all times, there is provided an automatic demand system which may be of any suitable design connected with the compressed air bottles 36 from which air is automatically drawn whenever it is necessary to increase the pressure inside the compartment 24 to slightly exceed ambient water pressure on the outside of the tank 24. In this way there is only a slight variance in the pressure exerted on the sealing rings 29 and the distribution cables 38 which pass through the buoyancy tank, and this slight pressure difference acts outwardly to positively prevent water seepage into the buoyancy tank.

Underwater forward propulsion and steering is provided by two variable frequency free flooding motors 40 and 42 which rotate their respective propellers 44 and 46 to move the craft horizontally through the water. The windings of the free flooding induction motors 40 and 42 are encapsulated in a suitable epoxy resin to seal these components from water. Suitable screens may be employed where ever water enters the motor to keep out foreign material which might have an abrasive effect on the resin.

A variable frequency supply of current for each motor is controlled from the remote control station to steer, drive, and control the apparatus under water to thereby control the speed and direction of propulsion of said craft under water. It will be appreciated that a constant speed propeller drive motor could be employed with a propeller having variable pitch blades instead of a variable speed motor described above. The angle of pitch would in such event be controlled from the remote control station to steer, drive, and control the apparatus when under water at the speed desired.

In order to provide up and down propulsion for the underwater craft there is provided a central water passageway 48 extending up and down through the buoyancy tank 24. At the bottom of this up and down passageway 48 is mounted a motor-driven propeller 50 which motor is of a design similar to free-flooding motors 40 and 42. Due to the vertical water passageway 48 extending through the center of the buoyancy tank 24 cavitation is prevented when the propeller 50 is operated.

A flowmeter 51 is mounted in front of the underwater craft to determine the velocity of movement of the craft to facilitate the exercise of control over said movement by an operator in the remote station.

In the lower portion of the underwater craft suitable apparatus such as lights 52 and a television camera 54 may be mounted to facilitate making underwater observations. It will also be appreciated that photographic equipment for taking still pictures can be mounted within the lower portion of the underwater craft which would be operated in a manner similar to the television camera. Suitable elevating means 56 are also provided for raising and lowering said lights 52 and television camera 54 relative to the framework 14 to enable close and exact observations to be made underwater.

From the foregoing description it will be apparent that I have provided an underwater craft which may be freely directed underwater for observation purposes. Also by connecting the control cables to the underwater craft so that they act on the craft through its center of resistance, there is no tendency to tilt the craft which would interfere with its use in observing underwater.

The underwater craft I have shown and described is of slightly less displacement than water so that it will barely float, and by driving the central propeller the craft may be easily pulled downwardly and submerged.

The invention hereinabove described may be varied in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. An underwater craft comprising a frame, a buoyant tank mounted on said frame, a track mounted around the circumference of the tank at the lower portion thereof, said track being located substantially on a horizontal plane passing through the center of resistance of the craft, a ring carrying rollers which are engaged within said track, a yoke pivotally secured to said ring, a cable connector secured to the center of said yoke and a control cable connected to said cable connector.

2. An underwater craft comprising a frame, a pressurized buoyant vessel mounted on said frame, a circular track mounted around the circumference of said vessel at a point substantially on a horizontal plane passing through the center of resistance of said craft, a ring carrying rollers engaged within said track, a free swinging yoke rotatably mounted on said ring, cable connecting means secured to the center of said yoke, a control cable connected to said cable connecting means, means for moving said craft vertically and means for moving said craft horizontally.

3. In combination with a remotely controlled underwater craft, means for preventing control cable tension from interfering with the stability of said remotely controlled underwater craft comprising a circular track mounted on a horizontal plane passing through the center of resistance of said craft, a ring carrying rollers engaged within said track, a yoke pivotally secured to said ring and a cable connector secured to the center of said yoke for connecting said control cable.

4. An underwater craft having the combination of elements provided for in claim 3 wherein there is provided a frame, a substantially cylindrical buoyant pressurized vessel mounted on said frame, said vessel having an open-ended channel extending vertically therethrough, a motor and a vertical shaft having a propeller mounted in said channel for moving said craft vertically by forcing water through said channel, variable frequency motors horizontally mounted on opposite sides of said frame, having shafts extending on a horizontal plane at a tangent to the periphery of said vessel, a free-swinging yoke rotatable on said frame, and a control cable connected to said vessel and to said yoke for regulating and controlling the operation of said craft.

5. In combination with an underwater craft remotely controlled through a control cable, means for preventing tension of said cable from interfering with the stability of said craft, said means comprising a circular track adapted for mounting on a plane passing through the center of resistance of said craft, a ring carrying rollers engaged within said track, a yoke pivotally secured to said ring and a cable connector secured to the center of said yoke for connecting said control cable to said craft.

6. A remotely controlled underwater craft comprising, in combination, a frame, terminating in a guard stand at its lower end, a pressurized vessel mounted on said frame, said vessel having an open-ended channel extending vertically therethrough, a motor vertically mounted in said channel for vertically moving said craft by forcing water through said channel; motors horizontally mounted on opposite sides of said frame, said motors having remotely-controlled propellers with variable pitch blades to steer and horizontally drive said craft; a circular track mounted around said frame on a plane passing through the center of resistance of said craft, a ring carrying rollers engaged with said track, a yoke pivotally secured to said ring, a cable connector secured to the center of said yoke for connecting a control cable; a supply of compressed air mounted on said frame and communicating with said vessel, an automatic demand system intermediate said vessel and said supply of air to maintain the pressure inside said vessel above ambient pressure outside said vessel.

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