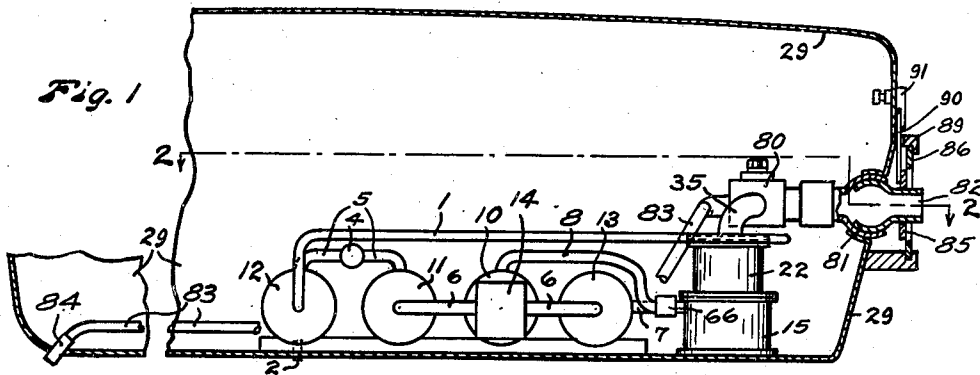
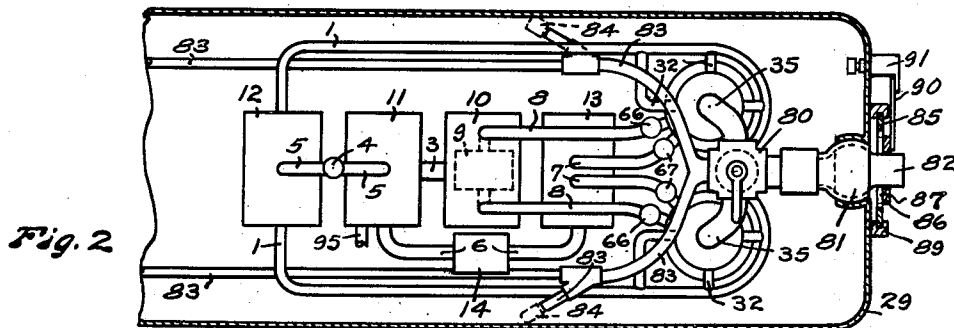
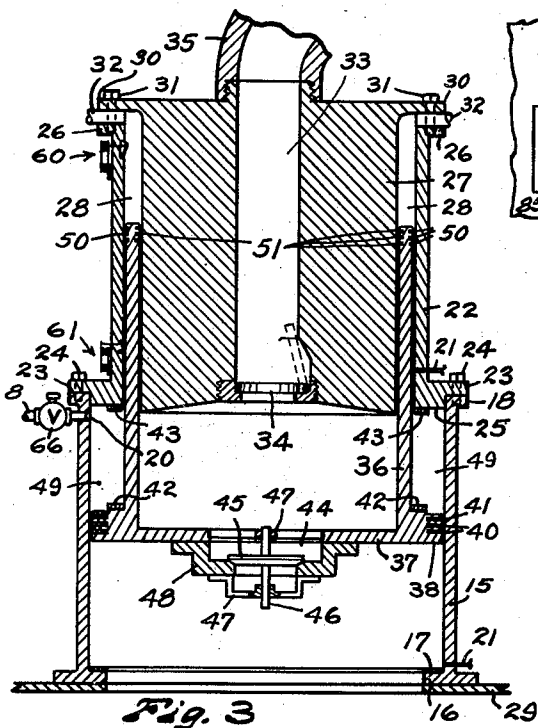
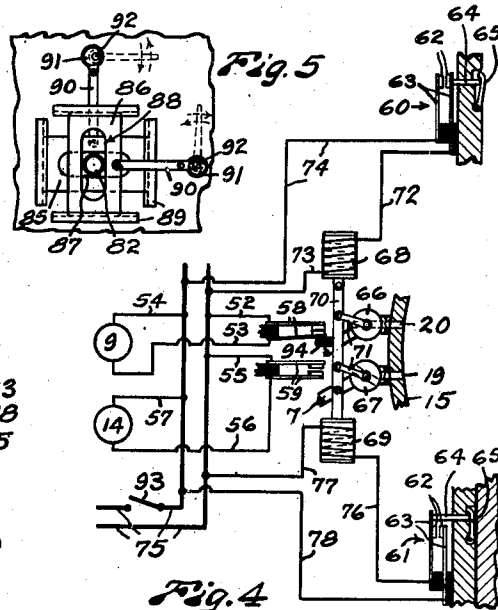


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G. R. MICUTA
JET PROPULSION ENGINE

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JET PROPULSION ENGINE

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6 Claims. (Cl. 115-15)

My invention relates to jet propulsion devices for use on water craft and particularly for use on submarines.

An object of my invention is to provide a jet propulsion device for use on submarines and undersea craft which will be less noisy in its operation and which will give greater speed under water per unit of power consumed than will the driving equipment now in use on submarines.

Another object of my invention is to provide a jet propulsion device that is highly efficient in operation and economical in its consumption of power.

Another object of my invention is to provide jet propulsion means which employs a confined gas under pressure in combination with external water pressure in providing a high velocity water jet used for propulsion purposes.

Another object of my invention is to provide novel and efficient gas compression means in combination with a novel and efficient pump unit operated jointly by gas and water pressure.

Other objects of this invention will be apparent from the following description taken in connection with the accompanying drawing.

In the drawing

Fig. 1 is a somewhat diagrammatic side elevation of jet propulsion means constructed in accordance with my invention showing the same installed within a submarine, a fragment of the submarine being shown in section.

Fig. 2 is a somewhat diagrammatic view of the same, taken partly in plan and partly in section substantially on broken line 2-2 of Fig. 1.

Fig. 3 is a vertical mid-sectional view through the jet propulsion unit.

Fig. 4 is a wiring diagram, with parts in section, showing electrical control switch and valve means embodied in this invention.

Fig. 5 is a detached elevation showing one apparatus that may be used to control the angular positioning of a discharge jet tube.

Like reference numerals designate like parts throughout the several views.

This jet propulsion apparatus comprises one or more jet producing devices of a form shown in cross section in Fig. 3. I show two of these jet producing devices and it will be understood that, while one of said devices can be used to drive a ship, two or more of said devices will preferably be used in each installation. These jet producing devices are connected, by conduits 8 in the manner shown in Figs. 1 and 2, with a

compressor 9 in a hermetically sealed tank or receptacle 10.

A compressor lung 11 is connected with the receptacle 10 by a conduit 3. A gas and water dump receptacle 12 and a gas dump receptacle 13 are provided. An exhaust pump and compressor 14 is connected between the dump 13 and the compressor lung 11 by conduits 6.

The gas and water dump receptacle 12 is connected by conduits 1 with pump means, hereinafter described, and is connected with the lung receptacle 11 by a conduit 5 having a check valve 4 therein. The check valve 4 permits gas to pass from dump receptacle 12 to lung receptacle 11 if the gas pressure in receptacle 12 exceeds the gas pressure in receptacle 11. The dump receptacle 12 also has a normally closed water outlet valve 2, Fig. 1, that is adapted to be opened by the pressure of an excess amount of water in the dump receptacle 12 to discharge the water therefrom. The valve 1 may be float controlled and is arranged so that it will not permit the discharge of gas from receptacle 12.

The gas dump receptacle 13 is connected by conduits 7 with the cylinders of pump means hereinafter described.

The pump unit for producing the water jets, see Fig. 3, comprises a base disposed within a ship, preferably a submarine, and having one end portion rigidly secured to the hull 29 of the ship.

The base cylinder 15 is open to the sea pressure on the exterior, preferably the bottom of the ship, and preferably said base cylinder has an inwardly directed bottom flange 16 that serves as a piston stop and that has a ring 17 of cushioning material disposed thereon.

The upper end portion of the base cylinder 15 has an outwardly extending annular flange 18. The base cylinder 15 is provided, just below the flange 18, see Fig. 4, with an inlet opening or port 20 and an outlet opening or port 19. Adjacent its bottom end the base cylinder 15 is preferably provided with a plurality of grease inlet fittings 21. Similar grease inlet fittings are provided in an upper cylinder member 22.

The interior of the base member 15 is precisely machined to a true cylinder and is accurately polished.

The upper cylinder member 22 is provided with an outwardly extending base flange 23 that is secured by means, such as cap screws 24, to the upper flange 18 of the base cylinder 15. Preferably the upper cylinder 22 has a portion 25 that

projects a short distance within the base cylinder 15 to insure correct centering and alignment of the two cylinders.

The upper cylinder 22 has an outwardly extending top flange 26. A core member 27 of smaller diameter than the upper cylinder 22 is positioned coaxially therein so as to leave an annular chamber 28 between the inner walls of the upper cylinder 22 and the outer wall of the core member 27. The upper end portion of the core member 27 has an outwardly extending flange 30 which is secured by bolts 31 to the upper flange 26 of the upper cylinder 22. A plurality of fluid outlets 32 are provided between the two flanges 26 and 30 for the escape of gases and liquids from the chamber 28.

Each core member 27 has a longitudinal passageway 33 therein. A flap valve 34 is provided at the lower end of each passageway 33 and a jet delivery conduit 35 is connected with the upper end of each passageway 33.

Each conduit 35 is connected through a multiple way valve 80 and ball and socket joint 81 with a jet discharge pipe 82 which protrudes from the rear portion of the ship's hull 29 and preferably is adjustable into different angular positions, the ball and socket joint 81 permitting angular adjustment.

The valve 80 is also connected with forwardly extending divergent conduits 83, each of which, preferably, terminates in a jet tube 84 that extends in a generally forward direction and may also have a downward incline, or if desired, an upward incline. As many jet tubes 84 as desired may be provided on the submarine and each jet tube 84 may have any desired incline to thereby provide reverse or upward or downward thrust.

A hollow tubular piston member 36 is reciprocally disposed within the base cylinder 15 and chamber 28 of top cylinder 22. This piston member 36 is of cup shape, being open at the top end and having a transverse bottom end wall 37. An external flange 38 is provided on the tubular piston 36 and said flange 38 is annularly recessed for the reception of piston rings 40 and a packing ring 41.

Preferably resilient bumper means 42 is provided on the top of the flange 38 in a suitable position so that when the piston 36 is near the upper limit of its travel the bumper member 42 will engage with other resilient bumper means 43 which is supported by the upper cylinder 22.

The external diameter of the tubular piston 36 is substantially smaller than the internal diameter of the base cylinder 15 to thereby form a pressure chamber 49 into which fluid, such as an inert gas may be admitted to move the tubular piston downwardly.

The upper end portion of the tubular piston member 36 is provided with external rings 50 and internal rings 51, which respectively contact the upper cylinder 22 and the core 27 and help to prevent leakage of water and gas under pressure.

The bottom end wall 37 of the tubular piston 36 is provided with a water intake opening 44 controlled by a check valve 45. Obviously the form of this check valve may be varied. I have shown a valve 45 of disc shape positioned in a housing 48 and having guide stems 46 guided in spiders 47.

Two piston-controlled electric switches 60 and 61 are provided in connection with this device, one for operation when the tubular piston 36

reaches the uppermost limit of its stroke and the other for operation when said tubular piston 36 reaches the lowermost limit of its stroke. Each switch 60 and 61 may comprise contacts 62 preferably carried by spring means 63. In each switch one of the springs 63 is engaged by a push rod 64 that rests against a push member 65 positioned within the cylinder 22. When the piston member 36 overlaps the push member 65 the force of the springs 63 will be overcome and the switch opened or closed, depending on the switch arrangement.

The switches 60 and 61 control the operation of two valves 66 and 67. The valve 66 of each unit controls the inlet of gas under pressure to the chamber 49. The valve 67 of each unit controls the outlet or relief of gas under pressure from the chamber 49.

The switch 60, that I have shown in Fig. 4, will open when unrestrained and is adapted to be closed when the push member 65 thereof is contacted by the piston 36. The switch 61 has to be held open and will close automatically when the push member 65 thereof is released by the piston 36.

In Fig. 4, I have shown two solenoids 68 and 69 connected as by link means 70 and lever means 71 with the valves 66 and 67. The solenoid 68 is connected by conductors 72, 73 and 74 with the switch 60 and with a source of supply of electric current, such as main circuit wires 75, which may extend to suitable batteries, not shown. The solenoid 69 is connected by conductors 76, 77 and 78 with the switch 61 and with the source of supply wires 75. The compressor 9 in the hermetically sealed tank 10 is connected through a switch 58 with the circuit wires 75 by conductors 52, 53 and 54. The compressor 14 is connected through a switch 59 with the circuit wires 75 by conductors 55, 56 and 57. The switches 58 and 59 preferably are self opening switches that are adapted to be closed by a switch closing member 44 on the solenoid operated links 70.

One means for controlling the position of the jet discharge tube 82 to thereby control the direction of delivery of the jet is shown in Fig. 5. This means comprises two adjuster plates 85 and 86 provided respectively with two intersecting slots 87 and 88 positioned at right angles to each other and guided for movement in directions at right angles to each other by guide means 89, the plate 85 being movable vertically and the plate 86 being movable horizontally. Obviously vertical movement of the plate 85 will tilt the jet discharge tube 82 up or down to provide vertical steering of the craft while horizontal movement of the plate 86 will similarly provide horizontal tilting movement of the jet tube 82 to horizontally steer the craft. Obviously movement of both plates 85 and 86 can be used to position the jet tube at any desired angle.

The plates 85 and 86 may be moved by connecting rod means 90 connected with eccentrics 91 on shafts 92 that extend to the inside of the ship's hull and that may be controlled manually or in any other suitable way.

Obviously a rudder may also be provided for steering purposes if desired.

To prepare this device for operation, preferably a non-explosive non-corrosive gas, such as helium, is introduced into the hermetically sealed gas receptacles 10, 11, 12 and 13 preferably under some pressure. I may introduce this gas into receptacle 11 through pipe 95.

When the device is not being operated the now

of current in the wires 75 is interrupted, as by opening switch 93.

If the piston 36 is at the upper limit of its movement with the switch 60 closed and the switch 61 open, at the time current is turned into the wires 75, as by closing switch 93, then the solenoid 68 will be energized. The energizing of solenoid 68 will open the valve 66, provided it is not already in an open position and will close the valve 67 provided it is not already in a closed position. At the same time the circuit through switch 58 will be closed and the compressor 9 will be operated. This will introduce gas under pressure into the chamber 49, force the piston 36 downwardly and cause the chamber within said piston 36 to fill with sea water.

As soon as the piston 36 begins to move downwardly the switch 60 will open but the valves 66 and 67 will remain in the same positions and the compressor 9 will continue to operate until the piston reaches the lower limit of its movement and releases the switch operating member 65 of the lower switch 61. The release of switch 61 will cause this switch to close thereby closing the circuit to the solenoid 69 and bringing about the opening of the circuit to the compressor 9. Also energizing of solenoid 69 opens valve 67 and closes valve 66 and closes switch 59. When this occurs the piston 36 begins to move upwardly due to the pressure of the sea water thereon and continues its upward movement as the compressor 14 withdraws the gas from the chamber 49 and returns this gas to the compressor lung 11.

Upward movement of the piston 36 expels the water past the flap valve 34 and provides a jet of water at relatively high velocity for propelling the ship.

My jet propulsion means is particularly well adapted for use on submarines but may also be used on surface vessels.

The usual submarine when on the surface has a choice of using either the power from its internal combustion motors or the power from its batteries. When submerged it can only use battery power.

My jet propulsion means contemplates the use of internal combustion motors to charge batteries which, in turn, furnish power to operate the motor driven compressors 9 and 14. Obviously provision preferably will be made to drive the compressors 9 and 14 directly from the internal combustion motors when the submarine is on the surface. This will make it possible to simultaneously drive the submarine and charge the batteries without, at the same time, using the batteries.

At all times it is desirable to maintain pressure in the compressor lung at least high enough to be operable efficiently at the maximum diving depths of the submarine. This pressure may be replenished from time to time from external sources, as desired.

The work done by the compressors to create the differential pressures in the lung 11 and air dump receptacle 13 is thus used in propelling the vessel. The propulsion means is very quiet in operation and will propel the vessel at relatively high speed. When a submarine that is equipped with my jet propulsion means is under water the batteries will readily maintain the pressures required in the lung 11 and air dump 13 and maximum operating efficiency will be assured.

The foregoing description and accompanying drawing disclose a preferred embodiment of my

invention but it will be understood that numerous changes in my device may be made within the scope and spirit of the following claims.

I claim:

1. Jet producing means for marine propulsion comprising a base cylinder secured to a ship hull and having a bottom end portion open to the exterior of said hull; an upper cylinder of smaller diameter than said base cylinder rigid with the top end portion of said base cylinder and positioned coaxially thereof; a cylindrical core of smaller diameter than said upper cylinder supported coaxially within said upper cylinder and cooperating therewith to form an annular chamber, said core having a liquid outlet passageway; a propulsion jet tube connected with said passageway and extending to the exterior of the hull; a tubular sleeve reciprocable in said annular chamber; a piston head of larger diameter than said sleeve on the lower end portion of said sleeve and reciprocable in said base cylinder; a check valve controlling the liquid outlet passageway in said core; another check valve in said piston head yieldable to pressure on the bottom side of said head; and gas pressure inlet means connected with the upper end portion of said base cylinder adapted to admit gas under pressure above said piston head to the chamber surrounding said sleeve.

2. Jet producing means for marine propulsion comprising a base cylinder secured to the hull of a ship and having a bottom end portion open to the exterior of said hull; an upper cylinder of smaller diameter than said base cylinder rigid with the top end portion of said base cylinder and positioned coaxially thereof; a cylindrical core of smaller diameter than said upper cylinder supported coaxially within said upper cylinder and cooperating therewith to form an annular chamber, said core having a liquid outlet passageway; a propulsion jet tube connected with said passageway and extending to the exterior of the hull of said ship; fluid pressure relief means connected with the upper end portion of said annular chamber; a tubular sleeve reciprocable in said annular chamber; internal and external piston rings on the upper end portion of said sleeve; a piston head of larger diameter than said sleeve on the lower end portion of said sleeve and reciprocable in said base cylinder; a check valve controlling the liquid outlet passageway in said core; a check valve in said piston head yieldable to pressure on the bottom side of said head; and gas pressure inlet means connected with the upper end portion of said base cylinder adapted to admit gas under pressure above said piston head to the chamber surrounding said sleeve.

3. Jet producing means for marine propulsion comprising a base cylinder secured to a ship's hull and having a bottom end portion open to the exterior of said hull; an upper cylinder of smaller diameter than said base cylinder rigid with the top end portion of said base cylinder and positioned coaxially thereof; a cylindrical core of smaller diameter than said upper cylinder supported coaxially within said upper cylinder and cooperating therewith to form an annular chamber; said core having a liquid outlet passageway; a propulsion jet tube connected with said passageway and extending to the exterior of the hull; a tubular sleeve reciprocable in said annular chamber; a piston head of larger diameter than said sleeve on the lower end portion of said sleeve and reciprocable in said base cylinder; a check valve controlling the liquid outlet passage-

way in said core; another check valve in said piston head yieldable to pressure on the bottom side of said head; gas pressure inlet means connected with the upper end portion of said base cylinder; gas pressure outlet means connected with the upper end portion of said base cylinder; and valve control means adapted to alternately open and close said gas pressure inlet means and said gas pressure outlet means.

4. Jet producing means for marine propulsion comprising a base cylinder secured to the hull of a ship and having a bottom end portion open to the exterior of said hull; an upper cylinder of smaller diameter than said base cylinder rigid with the top end portion of said base cylinder and positioned coaxially thereof; a cylindrical core of smaller diameter than said upper cylinder supported coaxially within said upper cylinder and cooperating therewith to form an annular chamber, said core having a liquid outlet passageway; a propulsion jet tube connected with said passageway and extending to the exterior of the ship's hull; a tubular sleeve reciprocable in said annular chamber; a piston head of larger diameter than said sleeve on the lower end portion of said sleeve and reciprocable in said base cylinder whereby a pressure chamber is formed between said base cylinder and said sleeve above said piston head; a check valve controlling the liquid discharge outlet passageway in said core; another check valve in said piston head yieldable to pressure on the bottom side of said head; a compressor lung adapted to contain gas under pressure; a gas compressor having a discharge conduit connected with the upper end portion of said base cylinder and an intake conduit connected with said lung and another gas compressor having an intake conduit connected with the upper end portion of said base cylinder and a discharge conduit connected with said lung.

5. Jet producing means for marine propulsion comprising a base cylinder secured to the hull of a ship and having a bottom end portion open to the exterior of said hull; an upper cylinder of smaller diameter than said base cylinder rigid with the top end portion of said base cylinder and positioned coaxially thereof; a cylindrical

core of smaller diameter than said upper cylinder supported coaxially within said upper cylinder and cooperating therewith to form an annular chamber, said core having a liquid outlet passageway; a propulsion jet tube connected with said passageway and extending to the exterior of the ship's hull; a tubular sleeve reciprocable in said annular chamber; a piston head of larger diameter than said sleeve on the lower end portion of said sleeve and reciprocable in said base cylinder whereby a pressure chamber is formed between said base cylinder and said sleeve above said piston head; a check valve controlling the liquid discharge outlet passageway in said core; another check valve in said piston head yieldable to pressure on the bottom side of said head; a compressor lung adapted to contain gas under pressure; a gas compressor having a discharge conduit connected with the upper end portion of said base cylinder and an intake conduit connected with said lung, an air dump receptacle connected with the upper end portion of said base cylinder; and another gas compressor having an intake conduit connected with said air dump receptacle and a discharge conduit connected with said lung.

6. In jet producing pump means for use in a submarine, a pump housing formed of two coaxial cylindrical sections of relatively larger and smaller diameters adapted to be supported within the hull of a submarine with one end of said larger housing section open to the water pressure on the exterior of the submarine; a piston comprising a piston head fitted to and reciprocable in the cylinder section of larger diameter and a piston sleeve fitted to and reciprocable in the housing section of smaller diameter; a core member having an external diameter slightly smaller than the internal diameter of said piston sleeve and fitting snugly within said sleeve, said core member having a water passageway extending longitudinally therethrough, a check valve in said passageway, another check valve in said piston head; and gas pressure inlet and discharge means connected with the upper end portion of said larger housing section.

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