

Nov. 28, 1961

F. J. PETERSON ET AL
VEHICLE PROPULSION MECHANISM

3,010,424

Filed Dec. 19, 1958

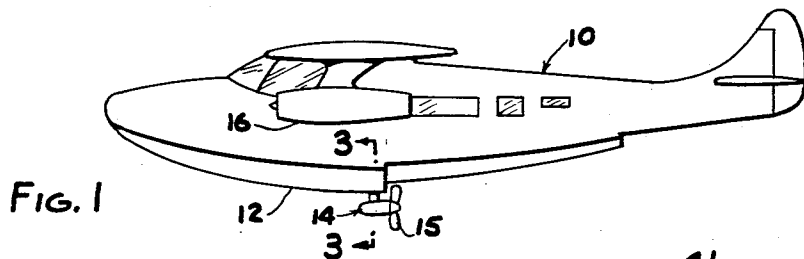


FIG. 1

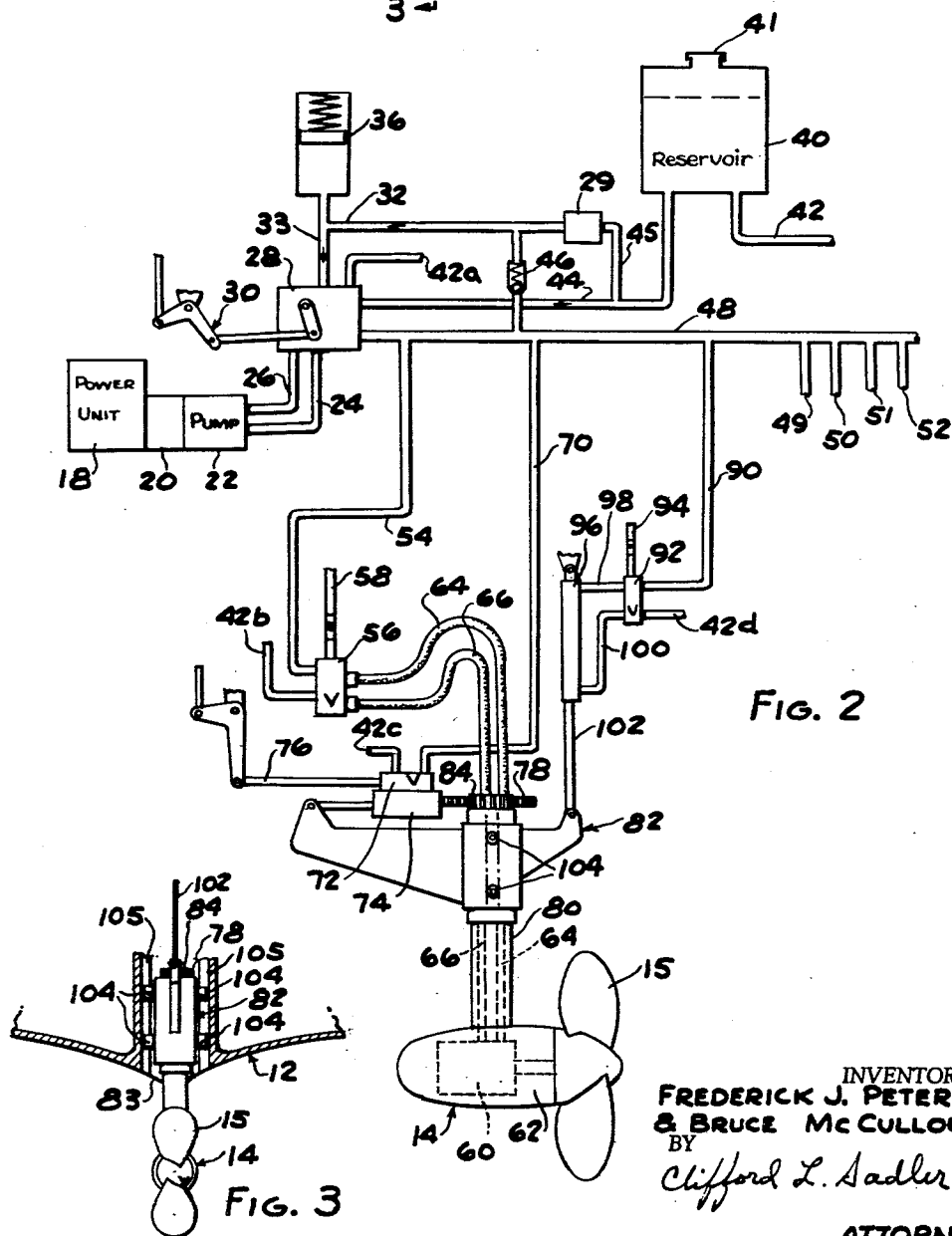


FIG. 2

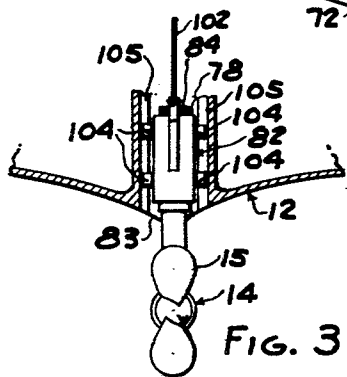


FIG. 3

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VEHICLE PROPULSION MECHANISM

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Filed Dec. 19, 1958, Ser. No. 781,546

1 Claim. (Cl. 115-41)

This invention relates to vehicle propulsion mechanisms and more specifically to such mechanisms for propelling and maneuvering a seaplane while on the water.

Seaplanes which have propeller engines for their principal means of propulsion in the air are usually adequately maneuverable while on the water due to the controllability of the thrust produced by the rotating propellers. Such propellers are commonly provided with mechanisms permitting the propeller pitch to be reversed so that the thrust produced by the propeller can accordingly be reversed. When a seaplane is of a multi-engine type, it can be maneuvered on the water by controlling the amount and direction of the thrust produced by each of the engine-driven propellers.

In modern seaplanes employing jet engines for air propulsion, maneuverability on the water is greatly limited because control of the engine thrust is limited. Except with expensive adapters, these engines cannot reverse their direction of thrust, and even then their control is not adequately responsive. It is for these reasons that jet powered seaplanes require additional or auxiliary means for maneuvering on the water.

In view of the foregoing state of the art, it is a principal object of the present invention to provide a device for use in seaplanes to increase their maneuverability on the water. This device constitutes a separately driven external marine propeller which is directionally controllable to propel and steer the vehicle. An additional feature of the present invention is the provision of means to retract the marine propeller mechanism into the hull of the seaplane when it is not needed and its presence might be a hindrance.

A more thorough understanding of the present invention will be achieved from the following detailed description and accompanying drawings in which:

FIGURE 1 is a side elevational view of a seaplane having an auxiliary marine propulsion unit of the present invention;

FIGURE 2 is a schematic drawing of the marine propulsion unit and its associated hydraulic controls; and
FIGURE 3 is a partial view in section taken along section lines 3-3 of FIGURE 1.

Referring now to the drawings for a more detailed description of the present invention wherein like reference numerals identify like parts:

FIGURE 1 discloses a seaplane 10 having a hull 12 with a marine propulsion unit 14 and an associated marine propeller 15 protruding downwardly from and through said hull. Seaplane 10 is also shown as having a jet engine carried in a pod 16 beneath its wing. While the present invention is particularly applicable to jet-powered seaplanes, it may also be used to advantage in seaplanes employing propeller-driven engines where greater surface control is desired. Further, although the control and propulsion system of the preferred embodiment of this invention is an hydraulic system, it is to be understood that a pneumatic system is equally adaptable and comprehended by the present disclosure.

Means are provided for controlling and driving the propulsion unit 14. Such means are shown in FIGURE 2 in which a prime mover or power unit 18, preferably of the internal combustion engine type, is shown drivingly connected through a reduction gear 20 to an hydraulic

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pump 22. Pump 22 is the prime source of fluid pressure for controlling as well as driving the propulsion unit 14.

The inlet and outlet of pump 22 are respectively connected by means of conduits 24 and 26 to a starting control valve 28. Valve 28 is of conventional construction and is adapted to either direct fluid pressure from the pump 22 to the various controls or to direct fluid pressure from an auxiliary pressure source back to the pump 22 so as to drive it as a starting motor for purposes of cranking the power unit 18. The valve 28 is manually controllable by means of linkage 30 which is connected into the pilot's compartment for control by the operator of the seaplane to direct fluid pressure from or to the pump 22 as generally indicated.

The auxiliary pressure source includes a hand actuated pump 29 which is connected to control valve 28 by means of conduits 32 and 33. Interposed between conduits 32 and 33 is the outlet of an accumulator 36 which is provided to store fluid energy induced by either the hand pump 29 or the main pump 22.

A reservoir 40 is provided as a source of hydraulic fluid for the entire hydraulic system, including that portion of the hydraulic circuit containing the auxiliary pressure supply. Inlet 41 permits the replenishing of fluid to the reservoir 40 that may be lost during the normal operation of the system. Reservoir 40 also stores fluid received through a return conduit 42 which recirculates the hydraulic fluid from the return lines of the various motors and actuators in the over-all system. Conduit 44 conducts fluid from the reservoir 40 to the control valve 28 where it may be directed to the inlet of pump 22. Fluid is also conveyed by a conduit 45 to the auxiliary pressure portion of the circuit, more specifically to the pump 29 and the accumulator 36. Conduit 42a is connected to the control valve 28 and constitutes a return line for joining to the return 42 of the reservoir 40. Return line 42a functions only when fluid is flowing from accumulator 36 to the pump 22.

The just described auxiliary pressure portion of the hydraulic circuit provides a means for starting the power unit 18. Hand pump 29 is actuated to build up pressure in the accumulator 36. The pilot or operator opens valve 28 to the starting position by moving the lever mechanism 30 so as to direct the just built up hydraulic pressure to the pump 22. Acting under such pressure, the hydraulic pump 22 becomes a motor to crank the power unit 18 causing it to start. When the power unit 18 becomes self-sustaining, lever 30 is shifted and the hand pump circuit is cut out of the system. At this point pump 22 begins to deliver hydraulic pressure to the about-to-be-described-hydraulic control and actuating system through a pressure manifold conduit 48. Pump 22 also delivers pressure fluid to the accumulator 36 by means of the check valve 46 which joints conduit 32 to the pressure manifold 48. Accumulator 36 stores the pressurized fluid so that the engine 18 may be started directly therefrom without the use of the hand pump 29, unless such time has passed that the pressure build-up in accumulator 36 has escaped.

During normal operation pump 22 is driven by engine 18 and its output passes through conduit 26 and control valve 28 to a pressure manifold 48. Three principal control mechanisms are operated from the pressure manifold 48. In addition, conduits 49, 50, 51, and 52 may be provided and connected to the pressure manifold 48 to furnish power to other incidental and accessory equipment which are to be hydraulically actuated.

Conduit 54 connects pressure manifold 48 to a first servo valve 56 which controls the speed and rotational direction of the marine propeller 15 of the propulsion

unit 14. Valve 56 can be manually actuated by a control rod 58 which runs to the pilot's operating position.

Unit 14 contains, in addition to the propeller 15, an hydraulic motor 60 driven through a gear box 62 to effect the rotation of the propeller 15. Valve 56 is connected to the hydraulic motor 60 by means of conduits 64, 66. Hydraulic motor 60 is reversible and its rotation is dependent upon whether line 64 or 66 is pressurized (when one is pressurized the other carries a return flow of fluid from the motor 60). Valve 56 is controllable by rod 58 to direct the pressure fluid either through line 64 or line 66, and thus can be actuated by the pilot to effect the desired direction of rotation of the propeller 15. This control permits the pilot to maneuver the seaplane in either a forward or reverse direction. Valve 56 is also capable of controlling the amount of pressure fluid transmitted to the respective lines 64, 66. This capability permits a control of the speed of rotation of propeller 15 and the power transferred to it.

Valve 56 has a return conduit 42b running from it which constitutes a return line to the reservoir 40 and is connected to conduit 42 at a point not shown. For example, when pressure is directed from conduit 54 by valve 56 to line 64, then line 66 becomes a return line and is connected by valve 56 to the return conduit 42a.

Means are provided to control the steering direction of unit 14. Such means comprise a pressure line 70 connected to pressure manifold 48 and joining thereto a control valve 72 and an associated actuating cylinder and piston actuator 74. Valve 72 is controlled by a manual linkage system 76 that is also actuated from the pilot's compartment. Valve 72 directs the application of hydraulic pressure to actuator 74 for actuating a reciprocable gear tooth rack 78 carried by its piston. Conduit 42c returns the working fluid to the reservoir 40 through return line 42.

The marine propulsion unit 14 is supported on a vertical shaft 80 which is rotatably carried by a reciprocable supporting structure 82 located within a trunk or well 83 in the hull 12 of the seaplane 10. The upper end of the shaft 80 has a gear 84 affixed thereto that engages the teeth of the rack 78. With the controlled application of pressure by valve 72 to actuator 74, rack 78 can be extended or withdrawn and by its engagement with gear 84 cause shaft 80 to rotate about its vertical axis. Thus means are provided, actuatable by the control 76, to change the angular direction of thrust of unit 14 to permit steering of the seaplane.

Control means are further provided to retract propulsion unit 14 into the well 83 in the hull 12 of seaplane 10 during takeoffs, landings, and air travel. Such means include a conduit 90 which connects the pressure manifold 48 to a valve 92. Valve 92 is controllable by linkage 94 operated from the pilot's compartment. Valve 92 has associated therewith an actuating piston and cylinder 96 and fluid pressure lines 98, 100. Valve 92 is of such a type that pressure may be selectively applied to either side of the piston within the actuator 96 to

cause a piston rod 102 to either extend or retract therefrom. When line 98 is pressurized line 100 has hydraulic fluid discharged therethrough and vice versa. The discharged fluid from actuator 96 is directed by valve 92 to return conduit 42d for communication back to the reservoir 40.

Piston rod 102 of actuator 96 is connected to the structure 82 which carries the power unit 14. Member 82 is provided with pin devices 104 which slidably engage a track 105 located on either side of the internal wall of the well 83 in the hull 12. When rod 102 is extended or withdrawn, structure 82 is carried therewith and slides on the aforementioned tracks 105 to withdraw or extend from the hull of the seaplane 10 as directed by the actuator 96.

The foregoing discloses the preferred embodiment of the present invention of auxiliary means for a seaplane capable of hydraulically controlling and driving a separate marine propulsion unit having speed and direction controls as well as means for retracting the propulsion unit into the hull of the seaplane with which it is associated. Obviously, variations of the present invention will occur to those skilled in the art which will come within the scope and spirit of the following appended claim.

We claim:

A marine propulsion system for use by marine craft having other means of main propulsion, and comprising: selectively operable manual and power driven fluid pressure supply means, said manual fluid pressure supply means being operatively connected to said power driven means for starter actuation thereof, a fluid pressure receptive manifold connected to said fluid pressure supply means, a marine propeller unit including a fluid pressure responsive drive motor having a marine propeller connected thereto, means operatively connected to said marine propeller unit for vertically raising and lowering said unit between retracted and operative dispositions, means operatively connected to said unit for selective oscillation thereof about a vertical axis to provide steering control, and said drive motor and operative means of raising, lowering and oscillating said marine propeller unit each including fluid pressure responsive means selectively connected to said fluid pressure receptive manifold.

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