Oct. 14, 1941. D. CALVO-MACKENNA 2,258,699

PROPELLER

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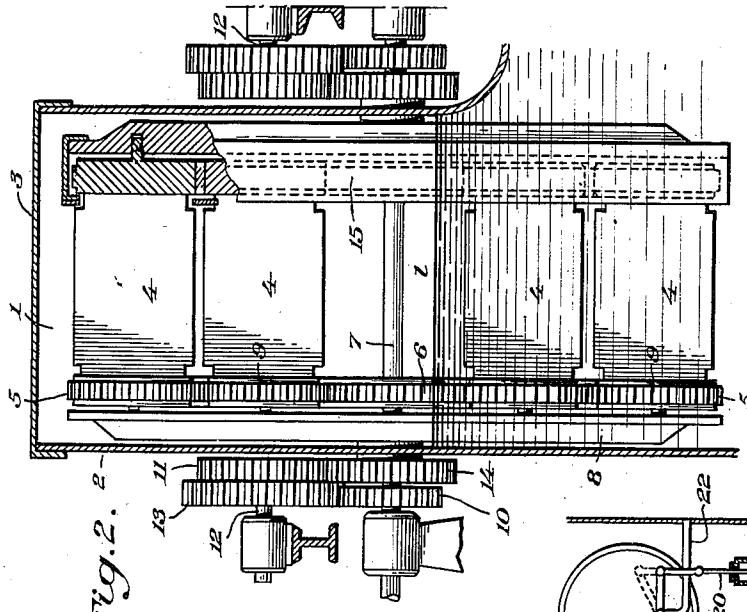

Fig. 2.

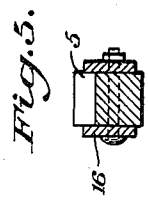

Fig. 5.

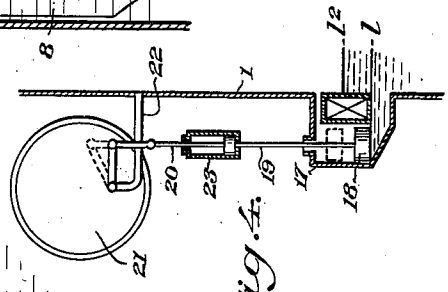

Fig. 4.

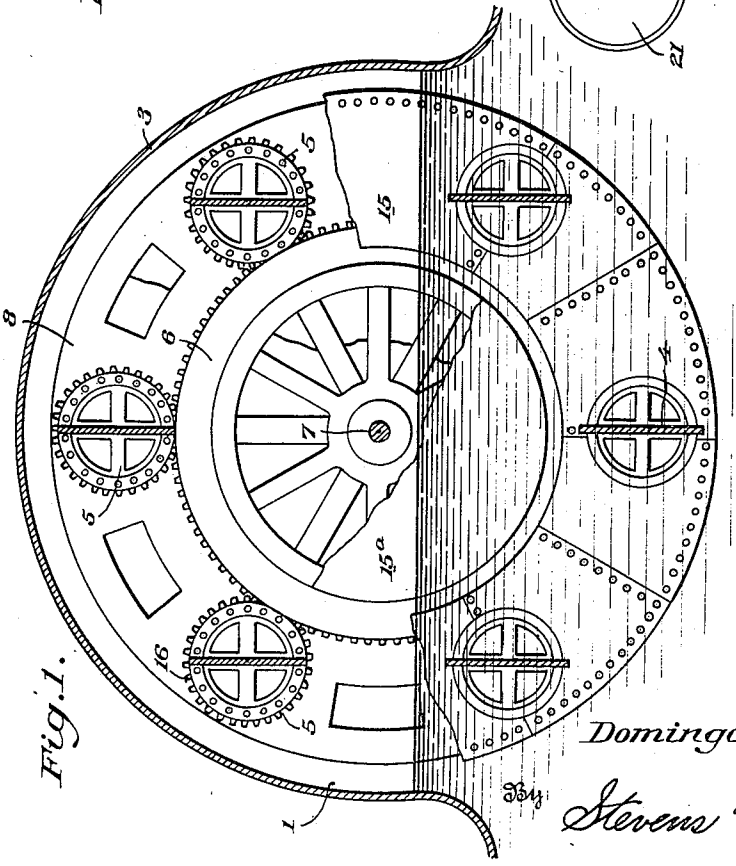

Fig. 1.

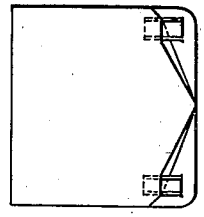

Fig. 3.

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PROPELLER

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Application February 9, 1940, Serial No. 318,145

4 Claims. (Cl. 115—49)

The following elements constitute the characteristic features of the invention:

(*a*) A system of propellers, which can be placed or not inside of compressed air-chambers.

(*b*) A compressed-air chamber, not always necessary, into which the propulsion devices are contained and wherein the water level equivalent to the water column corresponding to the depth is constant.

(*c*) A device, which, by means of a floating device, lets the compressed-air enter when, due to a cause whatever, the water level in the chamber rises.

Fig. 1 is a side elevation, partly in section, of the invention.

Fig. 2 is a front sectional elevation of the structure shown in Fig. 1.

Fig. 3 is a view of the invention as applied to a ship.

Fig. 4 is a sectional elevation of a device used to maintain the water level.

Fig. 5 is a sectional view of a detail of construction.

Description of the various organs

(*a*) *Propellers.*—The propeller I have invented essentially consists of a system of twin main-wheels which bear five or more rectangular-shaped planes or paddles.

The main feature of these paddles is the circumstance that they remain in vertical position during their whole turning. They are indicated in 4 on the Figs. 1 and 2 and are fixed, in their vertical ends, on gear-wheels 5 moved by the gear wheels 6 which we shall call stabilizing wheels and which serve to maintain the vertical position of the paddles. The wheels 6 are fastened on the main-shaft 7, this being directly moved by the ship's engine.

Wheels 5 which wear the paddles, are mounted on main wheels 8 by means of turning axles forming a single body with the wheels 5 and can freely rotate within holes bored in the rings of the main-wheels 8.

Wheels 8 rotate on the shaft 7 without adhering to it and are joined, in the opposite side of wheels 6, with the toothed-wheels 14, constituting a single body with them.

Wheels 14 rotate on shaft 7 without adhering to it and are moved by wheels 11 whose diameter is the same, fastened on shaft 12 and forming a single body with the wheels 13 fixed on the same shaft. These wheels 13 have their movement from toothed-wheels 10 fastened on the main-shaft, this being moved by the ship's engine.

Thus, the main-shaft transmits its movement directly to the stabilizing-wheels 6 and to the gear-wheels 10 due that it forms a single body with them, and indirectly to the main-wheels 8 by means of the gear-wheels 10, 13, 11 and 14.

The diameter of wheels 13 and 10 are different and inversely proportional to the speed of wheels 6 and 8. These speeds are determined as follows:

Let us call V the speed of wheel 6
Let us call v the speed of wheel 8
Let us call R the radius of wheel 6
Let us call r the radius of wheel 5

The relation between both speeds is deduced from the following formulas:

$$v=\frac{VR}{R+r} \quad V=\frac{v(R+r)}{R}$$

In the case of the machine illustrated on the drawing, assuming that V is equivalent to two turns per second:

$$v=\frac{2\times 1}{1+0,\,30}=1.54 \text{ turns per second}$$

Therefore, the speed of wheel 8 in this case, if we assume that motor shaft 7 and wheel 6 rotate at the rate of two turns per second, will be equivalent to 1.54 turns per second.

Also, the diameter of wheels 13 shall be 2/1.54 of the diameter of wheels 10.

In order to avoid that floating bodies may penetrate in the gearings, a protection 15 has been developed and which covers all the gearing exposed to the water and which is represented in Figs. 1 and 2.

Circular plates 15*a* cover the arms of wheels 6 and 8 on their external face (Fig. 1).

Ring-formed plates 16 laterally protect the cogs of wheels 5 and 6 (Figs. 1, 2 and 5).

The teeth of the stabilizing wheels 5 and 6 and their protection plates 16 will be made of inoxidable steel or any other similar material.

The main-wheels will rotate on shaft 7 by means of appropriate rollers.

The spindles of the main-wheels 8 will cross the walls 2 of chambers 1 through friction-boxes not shown in the drawing.

It must be once more remarked that wheels 5 and 6 only play the part of stabilizing-wheels, in order to maintain the paddles in vertical position, and that wheels 8, though rotating freely upon the main-shaft, are actually the propeller-wheels.

This propeller-work may or not be placed inside of compressed air-chambers, considering whether it will be used in sea-ships or in river- or lake-ships. In the first case, a propeller system will

be placed on each side of the ship, as indicated in Fig. 3, near and toward the main section. In the second case, a single system, situated in the back of the ship, will do.

(b) *The compressed-air chamber.*—This air-chamber is formed by two vertical plates **2** joined by a superior and lateral cover **3**. The chamber is open in its inferior part (Figs. 1 and 2).

The chambers are placed in each side of the ship, the closest possible to the magistral section, that is to say, near the proper ship's engine.

The vertical placement will be calculated so that the lowest part of the paddles in their maximum inferior passage remains at a convenient distance from the bottom of the ship.

Besides, it will be necessary to consider, for its vertical position, that the inferior portion of the chamber might be at a convenient distance from the water surface to avoid that, because of rolling of the ship, the air in the interior of the chamber may escape. It is understood that the chambers will be impermeable to the air but also possible to be visible by means of hermetic doors communicating with visiting-chambers.

The chamber is full of compresed-air, in order to maintain the interior level of the water in it at the convenient height, so that the propelling elements are in the water only during the propelling period of the rotation.

The interior water column, whose objective is to maintain the water level in it, will be subject to change following the chamber's dimensions and it is determined by the effects of the ship's pitching and rolling, which we have calculated to be from 10% and 30%, respectively.

(c) *Device for injecting the compressed-air.*—The water level in the chamber, which is maintained by the interior column may rise, due to losses of the compressed-air, caused by rolling and pitching, whirl movements of the water and the air-dragging due to the action of the propellers.

With the purpose of maintaining invariable the said level, we have developed a little chamber **17** which communicates by its superior and its inferior portion with the principal chamber **1** (Fig. 4).

This little chamber has a floating device **18** which actuates a rod **19**. This rod, in its turn, opens the cock **20** of a compressed-air tank **21** which, by means of a pipe **22**, communicates this tank with the propeller's chamber and lets the lost air be immediately replaced. Inversely, the cock will be closed by the descent of the floating device.

In order to prevent that instantaneous oscillation of the water level, caused by sudden movements of the ship, without real escape of air, provoke an useless injection of air, between the rod **19** and the cock **20**, an air-shock absorber will be placed as to compensate these oscillations.

Having now described the nature of my invention and the means to realise the same, I declare that what I claim as my invention is:

1. A ship propeller comprising, a driven shaft, two similar axially aligned wheels, a transmission connecting said shaft and said wheels for driving the latter as a unit, paddles mounted for pivotal movement between said wheels but bodily movable thereby, a gear wheel attached at each end of each paddle for movement therewith, and two gears keyed to said shaft for unitary movement therewith, one of said gears engaging all of the gear wheels on one end of the paddles and the other gear engaging all of the gear wheels on the other end of the paddles, said gears serving to maintain each paddle in vertical position with respect to the surface of the water in which the propeller operates while the wheels bodily move the same for driving the ship.

2. A ship propeller comprising, a driven shaft, two similar axially aligned wheels, a transmission connecting said shaft and said wheels for driving the latter as a unit, paddles mounted for pivotal movement between said wheels but bodily movable thereby, a gear wheel attached at each end of each paddle for movement therewith, two gears keyed to said shaft for unitary movement therewith, one of said gears engaging all of the gear wheels on one end of the paddles and the other gear engaging all of the gear wheels on the other end of the paddles, said gears serving to maintain each paddle in vertical position with respect to the surface of the water in which the propeller operates while the wheels bodily move the same for driving the ship, and a housing for said paddles open to water, said transmission being located exteriorly of the same in protected position.

3. A ship propeller comprising, a driven shaft, two similar axially aligned wheels, a transmission connecting said shaft and said wheels for driving the latter as a unit, six paddles mounted for pivotal movement between said wheels but bodily movable thereby, a gear wheel attached at each end of each paddle for movement therewith, the diameter of each gear wheel being substantially equal to the width of the paddle to which it is attached, and two gears keyed to said shaft for unitary movement therewith, one of said gears engaging all of the gear wheels on one end of the paddles and the other gear engaging all of the gear wheels on the other end of the paddles, said gears serving to maintain each paddle in vertical position with respect to the surface of the water in which the propeller operates while the wheels bodily move the same for driving the ship.

4. A ship propeller comprising, a driven shaft, two similar axially aligned wheels, a transmission connecting said shaft and said wheels for driving the latter as a unit, paddles mounted for pivotal movement between said wheels but bodily movable thereby, a gear wheel attached at each end of each paddle for movement therewith, two gears keyed to said shaft for unitary movement therewith, one of said gears engaging all of the gear wheels on one end of the paddles and the other gear engaging all of the gear wheels on the other end of the paddles, said gears serving to maintain each paddle in vertical position with respect to the surface of the water in which the propeller operates while the wheels bodily move the same for driving the ship, a housing for said paddles open to water, and means for maintaining a constant water level within said housing.

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