R. O. KING.

SUBMARINE BOAT.

APPLICATION FILED MAY 7, 1910.

1,017,103.

Patented Feb. 13, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

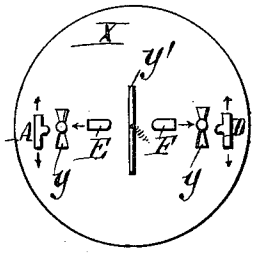


Fig. 2.

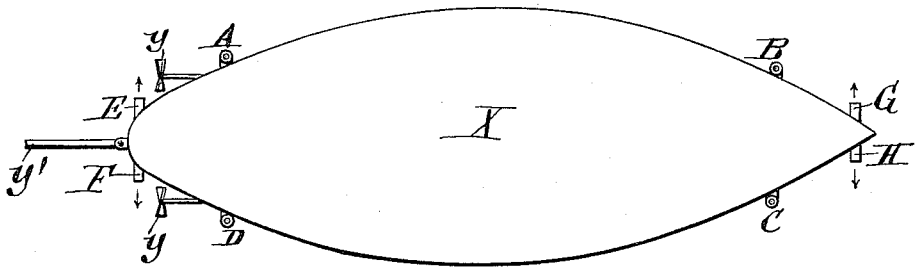
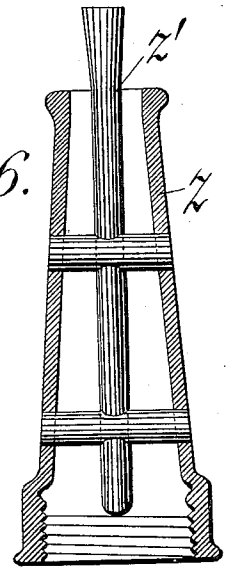


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 3.

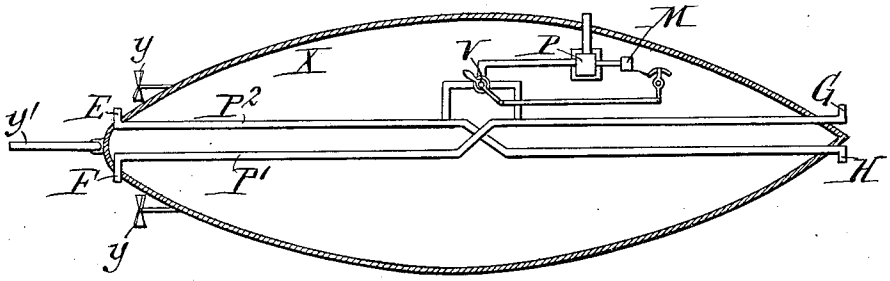
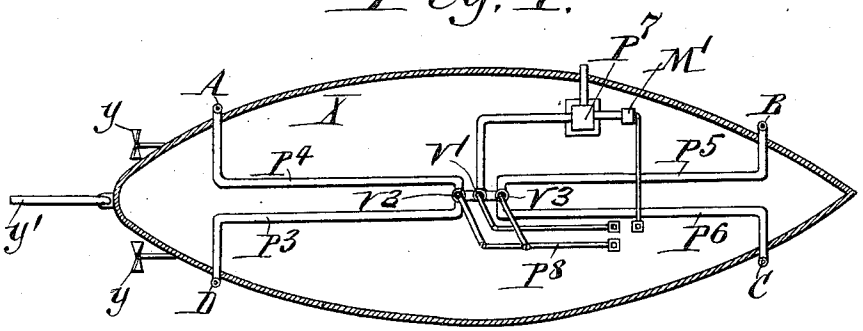


Fig. 4.



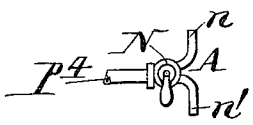


Fig. 5.

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UNITED STATES PATENT OFFICE.

ROBERT OWEN KING, OF BUFFALO, NEW YORK.

SUBMARINE BOAT.

1,017,103. Specification of Letters Patent. Patented Feb. 13, 1912.

Application filed May 7, 1910. Serial No. 559,941.

To all whom it may concern:

Be it known that I, ROBERT OWEN KING, a citizen of Canada, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Submarine Boats, of which the following is a specification.

This invention relates to a submarine boat and more particularly to means whereby the lateral and vertical movement of the same is controlled by water jets.

A submarine boat must be controlled as to depth submerged, as to direction under water, and as to stability under water. This control is usually obtained by the use of horizontal and vertical rudders or hydroplanes. In this description a horizontal rudder will be taken to mean a rudder placed in a horizontal position to give vertical control. This horizontal rudder is sometimes called a diving rudder. Sometimes there are several of these rudders placed along the sides of the submarine like the fins of a fish. The vertical rudder is understood to mean the rudder placed in a vertical plane which is used to control the steering or the direction in a horizontal plane and is similar to the rudder used on an ordinary surface boat.

The present invention is designed to replace the horizontal rudder or rudders entirely by hydraulic jets and to use hydraulic jets as accessories to the vertical rudder to facilitate turning operations in constricted spaces. The impinging on the water of suitable hydraulic jets affords all the force necessary to perform the several evolutions required in submarine work. Any number of jets may be employed, but the arrangement which requires four jets for vertical control and four jets for horizontal control, will be considered here.

In the accompanying drawings consisting of 2 sheets: Figure 1 is an end elevation of a submarine boat equipped with my invention. Fig. 2 is a top plan view thereof. Fig. 3 is a horizontal section of the boat showing the means for steering horizontally. Fig. 4 is a similar view showing the means for balancing the boat and causing the same to dive or rise. Fig. 5 is a fragmentary cross section showing a jet having duplex nozzles. Fig. 6 is a longitudinal section of one of said nozzles.

Similar letters of reference indicate corresponding parts throughout the several views.

X represents the hull of submarine boats which may be of any suitable or approved form and provided with the accessories common to this type of boat. The horizontal longitudinal movement of the boat is preferably effected by means of screw propellers y arranged at the stern of the boat and driven by suitable means and a vertical rudder y^1 is also mounted on the stern of the boat and adapted to be operated from the interior of the boat for steering horizontally when there is ample sea room.

Referring to Figs. 1, 2, 4 and 5, A, B, C, D represent four duplex jets which are placed fore and aft on both sides of the hull of the boat. Each of these jets preferably has two branches n, n^1, one of which turns upwardly and the other downwardly, as shown in Fig. 5, the discharge of water through either branch being controlled by a valve N which is interposed between these branches and the pipe whereby water is supplied to the jet branches. Upon turning the valve N so as to permit water to issue through the upper jet branch n and toward the surface of the water the effect will be to sink the boat and upon operating the valve N so that the water is directed downwardly through the lower jet branch n^1 then an addition to the buoyancy of the boat is produced. This arrangement of jets also provides a simple means of trimming the boat in all directions, for instance, if on account of a change in position of weights inside the boat, there were a tendency to trim down at the bow or head, then this can be compensated for by increasing the downward power of jets B and C and diminishing the upward power of jets A and D. This could be done by regulating the distribution of the discharge water between the pair B and C and the pair A and D without changing the total amount of water discharged, thus the trim of the boat could be adjusted without changing the total submerging force. In a similar way the trim of the boat crosswise could be regulated by adjusting the distribution of the discharge water between the pairs A, B and C, D.

For the purpose of steering by jets in constricted places four jets E, F, G, H are provided, the jets E, F being on horizontally opposite sides of the hull at the stern and

the jets G, H at horizontally opposite sides of the bow. Each of these jets delivers water laterally from the hull. It is clear that by using jets E and H the boat will be given a turning movement in one direction and by using F and G a turning movement in the other direction.

As shown in Fig. 3, the jets F, G at opposite ends and on opposite sides are fed by the pressure pipe P^1, similarly the jets E, H are fed by pressure pipe P^2. Water is drawn from outside the hull by the pump P, and can be delivered through the valve V either into P^2 or P^1. The pump P is driven by the motor M. The valve V has three positions, a shut off, a discharge into P^1 and a discharge into P^2. The handle of the valve V is connected to the starting device of the motor M so that when the valve V is at the shut off position, the electricity supply of the motor is disconnected and when the valve is in position for discharging into P^1 or P^2, the motor is connected to the electricity supply.

Referring to Fig. 4, the jets A, B, C, D, are arranged to permit discharge of water in an upward direction so as to force the boat under water when required. For fore and aft trimming the jets A, D are connected as one pair by the pressure pipes P^3 and P^4 and the jets B and C are similarly connected by the pressure pipes P^5 and P^6. Water from outside the hull is drawn in by the pump P^7 and ordinarily discharges equally into the pressure pipes P^3, P^4, P^5, P^6. A three-way valve V^1 is interposed between the pump discharge and the four pressure pipes P^3, P^4, P^5, P^6. This valve controls the distribution of the water between the pair of pressure pipes P^4, P^3 and the pair P^5, P^6, that is to say, the pressure through jets A, D can be made greater or less than the pressure through the jets B, C, though A and D will receive equal quantities of water and B, C will also receive equal quantities of water. This arrangement affords the necessary means of controlling the fore and aft trim.

For balancing crosswise three-way valves V^2 and V^3 are employed to distribute the water between P^3 and P^4 and between P^5 and P^6 and it is seen that these valves V^2 and V^3 can be arranged so that the total amount of water discharged is not altered, that is, they simply enable the jets on one side of the boat to get more water than the jets on the other side, and in this way the crosswise trim of the boat can be controlled.

The controlling valves V^2 and V^3 are connected by a rod P^8 so that they are opened or closed simultaneously. For instance, if the valves are set at the central position the water is equally divided between P^3 and P^4 and between P^5 and P^6, then a movement of the controlling rod P^8 would open or close both valves equally which would have the effect of giving the jets on one side an equal increase or decrease in power.

The jets A, B, C, D being preferably made double, as shown in Fig. 5, enable water to be discharged either toward the surface or downward. Directing the jets downward would be equivalent to adding buoyancy in case of emergency, if for any reason, an unusual quantity of negative buoyancy should occur. Also in case of this extra negative buoyancy occurring in such a way as to seriously affect the fore and aft or the crosswise trim, then the arrangement of jets discharging either up or down would double the trimming effect of the jets discharging only upward.

The outlet of each jet is preferably provided with a nozzle or nipple such as that shown in Fig. 6, the same comprising a forwardly-tapering tubular body z and a spreading core or cone z^1 arranged lengthwise in the center of the body.

For the purpose of comparison let it be assumed that a submarine has been prepared for diving by having the ballast tanks filled in the usual way until the vessel is just awash and has only a small amount of buoyancy. An ordinary submarine in the above condition controlled by diving rudders requires to attain considerable speed before the diving rudders will force it below the surface, whereas by using jets the boat can be submerged at once from a standing position.

A boat controlled by hydroplanes can maintain a fixed position under water only by adjusting the amount of ballast until the weight of the boat equals the weight of water displaced and thereafter by continual adjustment to maintain a fixed depth. By using jets it would be a simple matter to maintain a fixed position under water, as the power and the distribution of the force of the jets is adjustable instantly.

Using the jet method of submerging, it is obvious that the direction of motion may be changed at will, without affecting at all the depth of submergence, whereas when using diving rudders it is obvious that they go out of action while the direction of motion is being changed, this introducing complications.

With rudder control, the shortest turn that can be made requires more room than would be available in some constricted spaces where submarines would be likely to operate. With the jet method, however, using the horizontal jets, the boat could be rotated on a vertical axis through its center.

Using the jet method of control the boat can be rotated about a vertical axis, the fore and aft trim can be altered quickly as desired and the depth can be easily controlled, all while the boat has no ahead or astern mo-

tion. In other words, the boat, and therefore the torpedo tube, can be readily pointed in any direction. The accomplishment of these maneuvers with rudder control would be at all times difficult, and often impossible.

Using the jet system, the submergence depends only on the force of the jets and this can be automatically regulated by the depth itself. The balancing can be regulated in the same way. That is the making of the depth and balance control independent of the speed allows the introduction of mechanical and automatic devices to take care of these factors.

Using jets, no projections on the sides of the hull are required which will retard the speed. The gain in power by the saving of the hydroplane resistance will more than compensate for the power required for the jet pumps. In addition, for surface running the drag of the hydroplanes will be entirely saved for then the jets would, of course, not be required and a considerable increase of surface speed could be obtained. The jets unlike the hydroplanes can not become foul of docks, hawsers or ships.

I claim as my invention:

A submarine boat having a pair of horizontal front jets projecting in opposite directions from the bow, a pair of vertical front jets projecting in opposite directions from the bow, a pair of horizontal rear jets projecting in opposite directions from the stern, a pair of vertical rear jets projecting in opposite directions from the stern, means for supplying water to said jets and a valve mechanism for controlling the flow of water through said jets.

Witness my hand this 6th day of May, 1910.

ROBERT OWEN KING.

Witnesses:
THEO. L. POPP,
ANNA HEIGIS.