G. C. DAVISON.

FOLDING HYDROPLANE FOR SUBMERSIBLE BOATS.

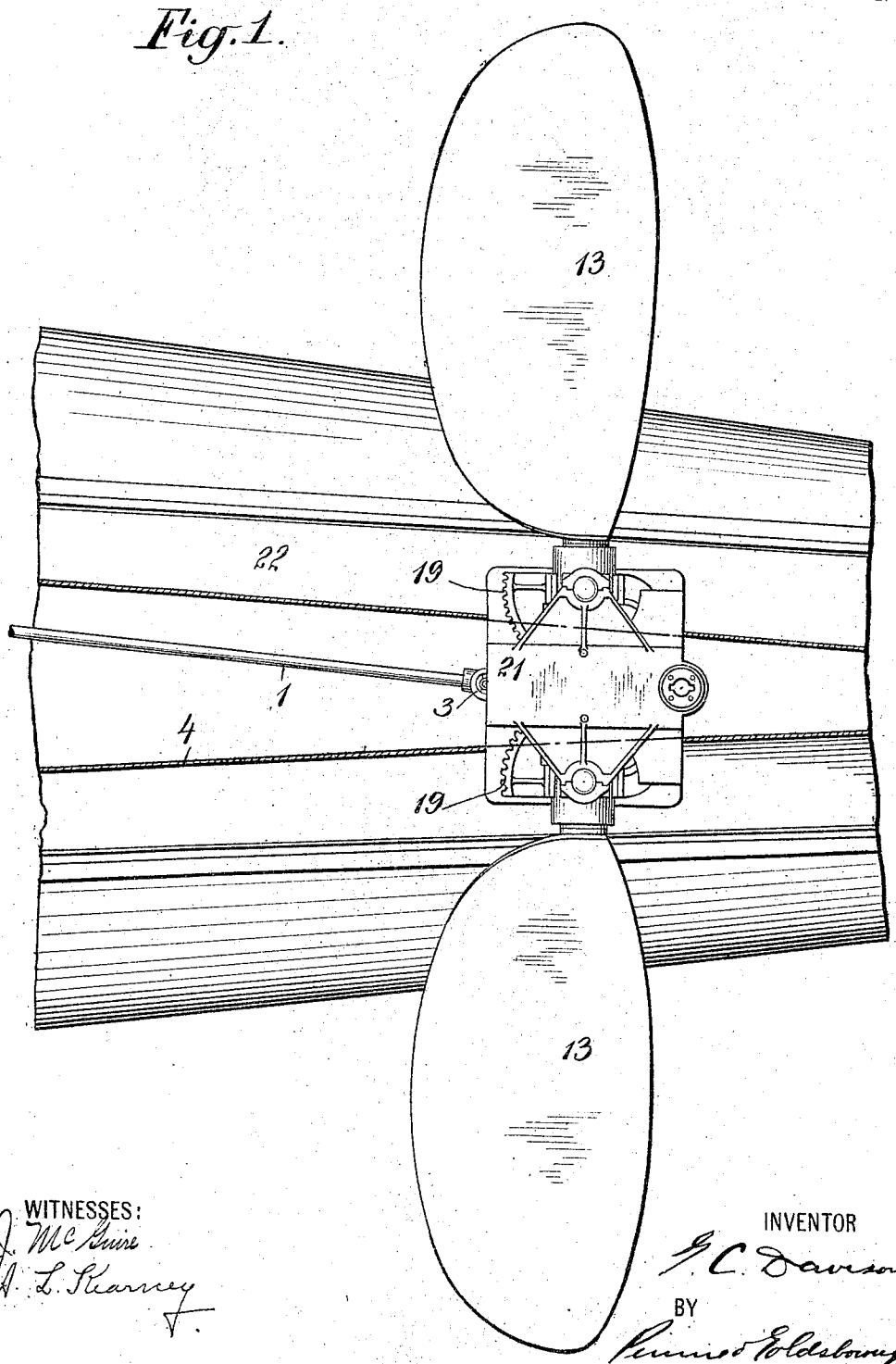
APPLICATION FILED NOV. 12, 1910.

1,073,100.

Patented Sept. 16, 1913.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

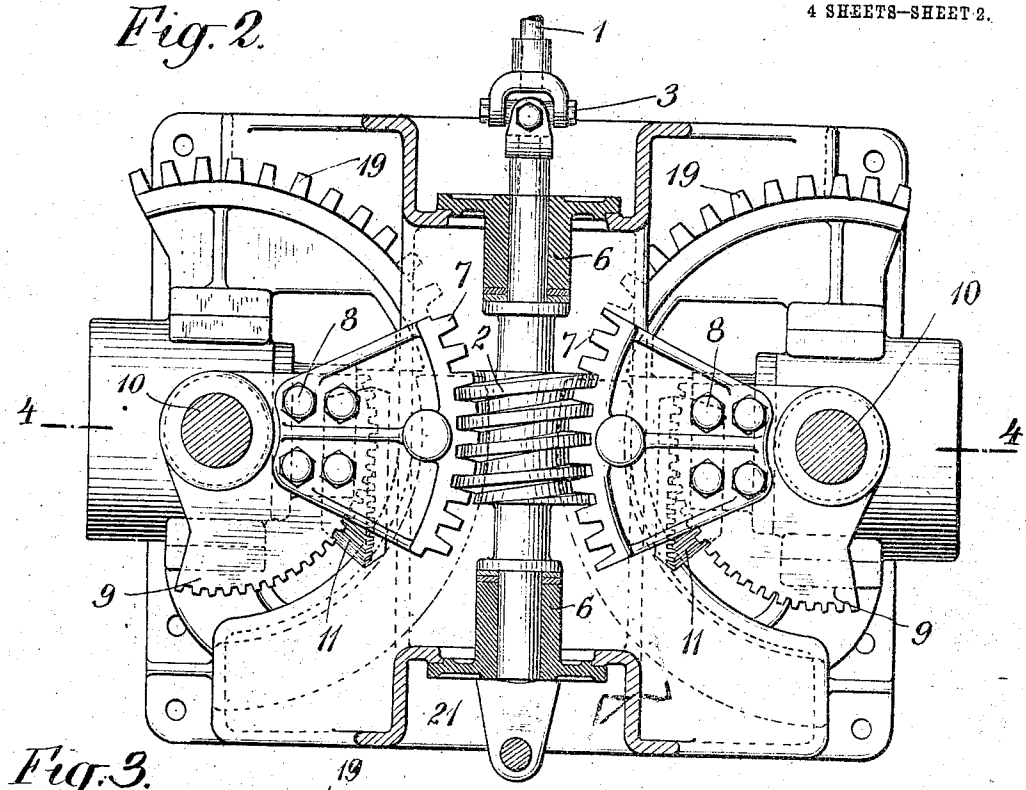
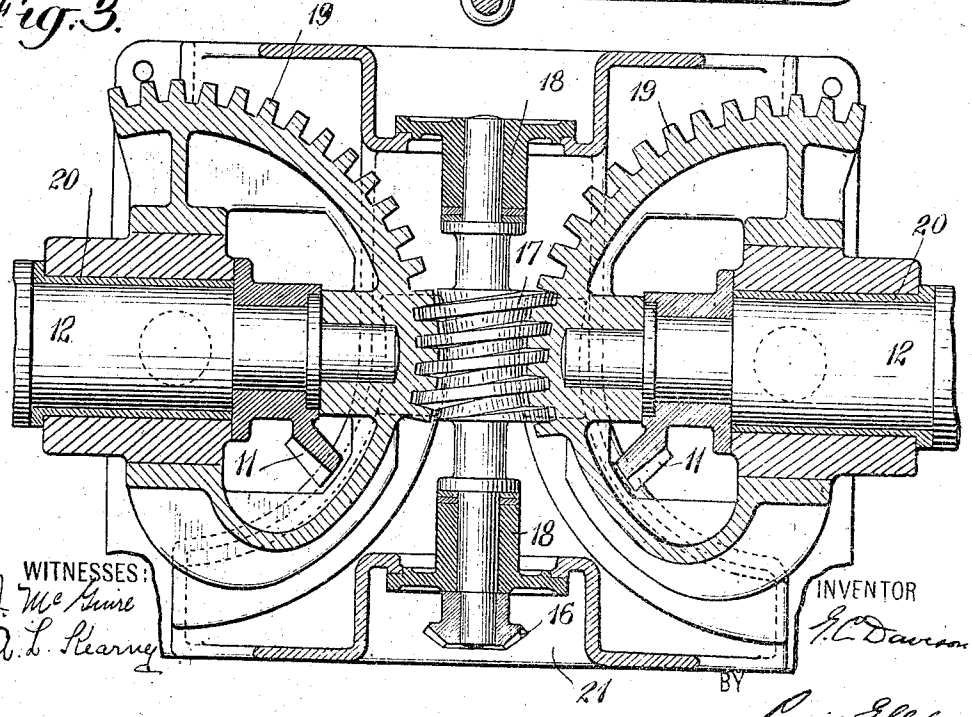


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

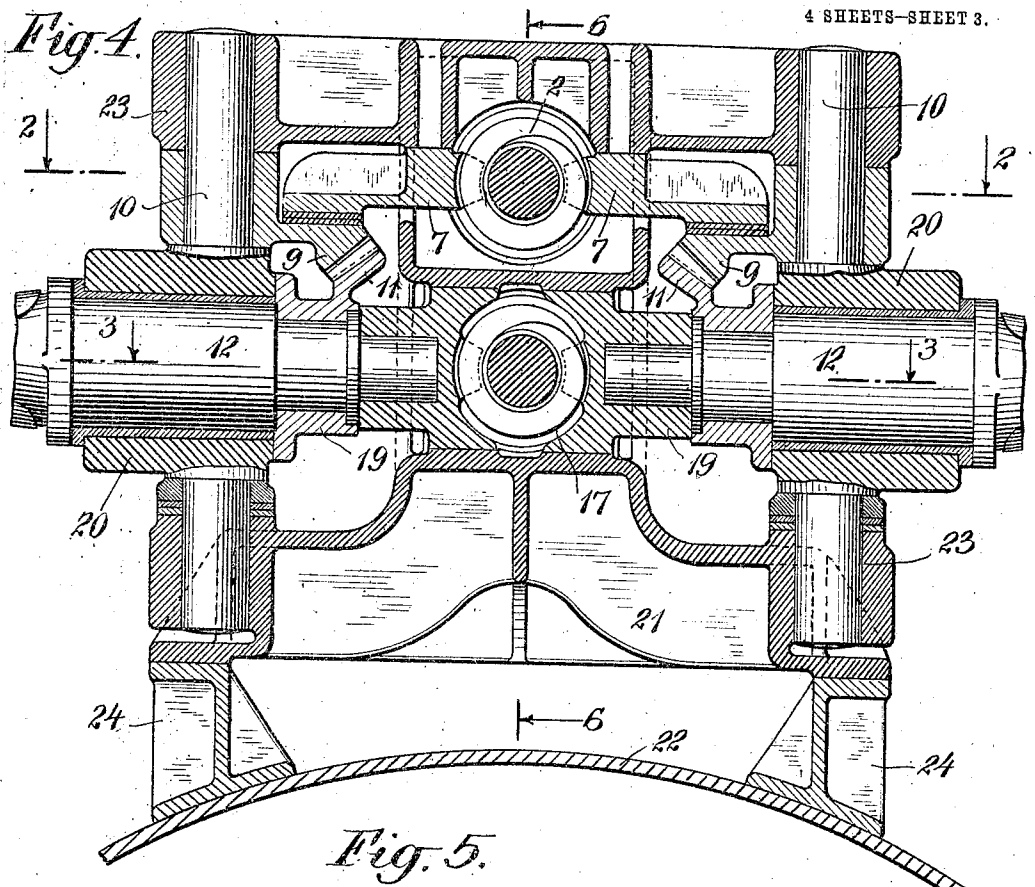
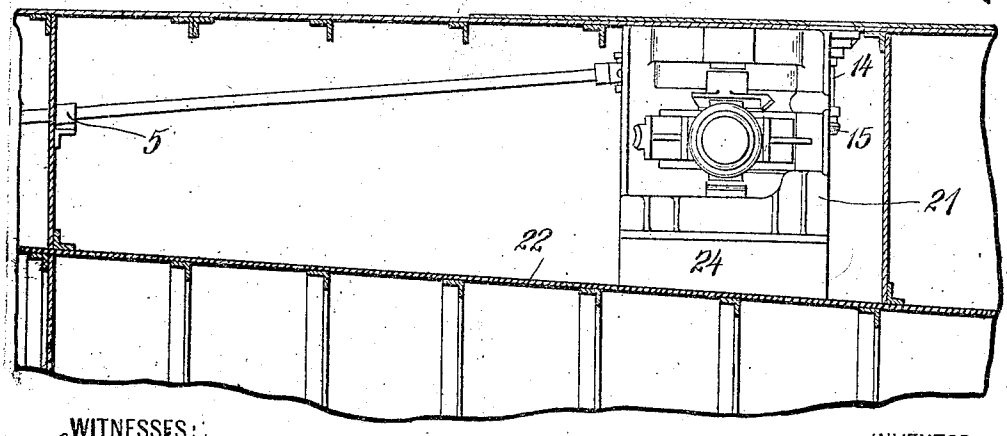


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

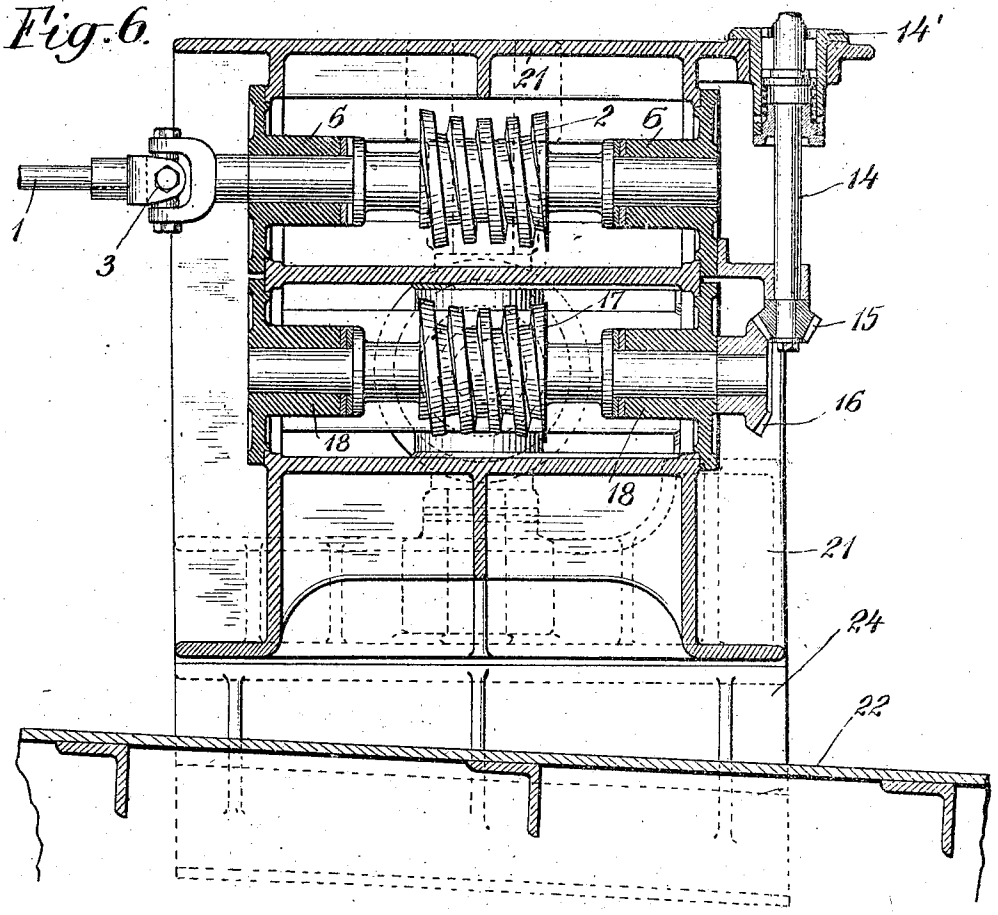


Fig. 7.

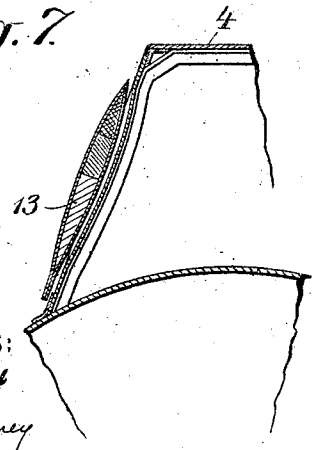
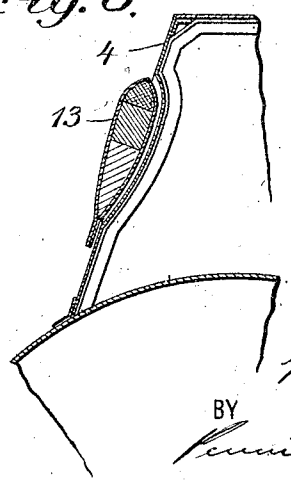


Fig. 8.



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UNITED STATES PATENT OFFICE.

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FOLDING HYDROPLANE FOR SUBMERSIBLE BOATS.

1,073,100. Specification of Letters Patent. Patented Sept. 16, 1913.

Application filed November 12, 1910. Serial No. 592,002.

To all whom it may concern;

Be it known that I, GREGORY C. DAVISON, a citizen of the United States, residing at Quincy, Massachusetts, have invented certain new and useful Improvements in Folding Hydroplanes for Submersible Boats; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Hydroplanes, or horizontal rudders, with a wide spread have been found desirable for operating a submarine or submersible boat under water, for the purpose of facilitating, or bringing about, the operations of diving and rising to the surface, but such projecting planes are seriously objectionable during the surface cruising periods, because of their liability to strike against other vessels, docks and the like, and because of the fact that in case they are so mounted as to be out of water when the boat is running light they are, in rough weather, likely to be struck by, and to dip into, the waves.

The object of the present invention is to provide hydroplanes of such character that, when in use, they will have the maximum effectiveness, as a result of their extension far beyond the sides of the boat to obtain a wide spread, and when out of use they may be shipped or swung inwardly, as, for example, against the sides of the boat, where they are entirely out of the way.

To this end I provide hydroplanes having a cross-section of proper outline to cut through the water with minimum friction, and of proper area and extent to give the requisite vertical movement to the boat, either with or without the aid of other means for the purpose, when they are adjusted to a suitable angle against the water in the direction of motion.

In the preferred form of the invention illustrated in the accompanying drawings, I have shown a pair of such hydroplanes arranged on the super-structure of the boat symmetrically with respect to the center line thereof, in order to maintain the boat on an even keel during the operation of submersion or during the period of submergence. It is possible, however, to use a plurality of pairs of hydroplanes. The hydroplanes may be located at almost any point along the boat, but, their most effective positions are near the bow or stern as will readily be understood. I provide hydroplanes of wide spread, which extend well beyond the sides of the boat and which are consequently effective to control the vertical movement of the boat with small angular movements against the water.

To the end that the hydroplanes may be quickly and conveniently shipped, I provide means for extending and retracting the planes in a simple, positive and rapid manner. When in use the hydroplanes must be approximately horizontal, and although it would be possible to ship them without turning them out of the horizontal, I greatly prefer mechanism whereby, during the projecting and retracting movements, the planes may be turned on their horizontal axes through approximately 90°, so as to lie flat against the side of the boat or super-structure; and although it is possible to turn them on their vertical axes for extending and retracting them, and on their horizontal axes for folding them against the side of the boat, by separate means, I have provided a safer and more advantageous arrangement in which the operation of extending or retracting the planes is automatically combined with the turning movement of the planes on their horizontal axes, thereby reducing the time and effort required to ship the planes, and also reducing the likelihood of damage to the planes by contact with the hull, which would occur if the two turning movements were not carried out in proper sequence and extent during projection and retraction.

In addition to the mechanism for turning the planes on their horizontal axes as they are extended or retracted, I provide supplemental means, controlled by a steering wheel within the vessel, for turning the planes on their horizontal axes to control the diving and rising movements of the boat. The normal position of operation of the planes is that in which they are fully extended, but the apparatus of my invention makes it possible to turn the planes on their horizontal axes, by means of the steering wheel, in any intermediate extended position; and I further provide means for automatically locking the planes in any of their adjusted positions.

Since the hydroplanes are only to be used during submergence, it will be apparent that the supplemental control for turning them on their horizontal axes should be located

within the boat and is not required on the deck. Furthermore, since the operation of extending and retracting the hydroplanes is to be performed only when the boat is on the surface just prior to submersion or just after the boat has risen to the surface, the controlling mechanism for this operation may conveniently be located on the deck of the boat, and need not extend within the boat. However, if in any case it is found desirable, the controls may be duplicated at either or both locations as will be readily understood.

In the accompanying drawings illustrating the preferred embodiment of my invention, Figure 1 is a plan view of a portion of the bow of a submarine boat, the superstructure being shown with its top removed, and the hydroplanes being shown in their extended position; Fig. 2 is a section on the line 2—2 of Fig. 4, showing particularly the actuating mechanism for turning the hydroplanes on their horizontal axes for steering; Fig. 3 is a section on line 3—3 of Fig. 4, showing particularly the actuating mechanism for extending and retracting the hydroplanes, in combination with the device for simultaneously turning them on their horizontal axes; Fig. 4 is a vertical section of the actuating mechanism on the line 4—4 of Fig. 2; Fig. 5 is a longitudinal section through a portion of the hull and superstructure showing in elevation the hydroplane-actuating mechanism and controlling connections; Fig. 6 is a section on the line 6—6 of Fig. 4 showing in detail the controlling connections for operating the extending and turning mechanism; and Figs. 7 and 8 are cross-sections through parts of the hull and super-structure and the shipped hydroplanes at different points in the length of the hydroplanes.

The general arrangement of the hydroplanes with respect to the rest of the boat is shown in Figs. 1, 5 and 6, from which it will be seen that the hydroplanes 13 and their actuating mechanism are supported in a casting 21 which is mounted on supporting beams 24 resting upon the hull 22 of the boat and extending lengthwise thereof. This casting interrupts the continuity of the walls of the super-structure 4 as shown in Fig. 1, so that the casting is in fact built into the super-structure, and extends beyond the line thereof a sufficient distance to permit the free movement of the planes on their horizontal and vertical axes.

The steering operation is effected by means of the steering shaft 1 which extends lengthwise of the superstructure supported in bearings 5, and should be continued to a convenient point within the vessel, where it connects with the steering wheel. This shaft is connected through a universal coupling 3 to a worm gear 2 which is journaled in bearings 6 and engages with the toothed sectors 7 suitably fastened as by bolts 8 to the bevel gear sectors 9. These sectors 9 are loosely mounted on the pintles 10 which pintles are journaled in bearings 23 and constitute the vertical axles on which the hydroplanes are swiveled. The sectors 9 engage with bevel gear sectors 11 secured to the shafts 12 of the hydroplanes by keys or pins. By means of this connection the turning of shaft 1 results in a corresponding turning movement of the hydroplanes on their horizontal axes. By virtue of the fact that the worm is capable of turning the bevel sectors while the reverse operation is not possible, the hydroplanes are securely locked by the worm in any angular position to which they have been adjusted.

The hydroplanes themselves may be constructed of wooden sections covered with sheet metal as shown in Figs. 7 and 8, or they may be made entirely of metal or other suitable material, and as shown in these figures the superstructure 4 is preferably bent inwardly to form receiving pockets in which the hydroplanes lie in their shipped positions.

The connections for extending and retracting the hydroplanes in a lateral sweep comprise an upright shaft 14 extending into a socket 14′ in the deck of the boat and adapted to be engaged at its upper end by a spanning wrench or the like. The shaft carries at its lower end a bevel pinion 15 engaging a bevel pinion 16 rigidly mounted on the spindle of the worm gear 17, which is suitably journaled in the bearings 18 and engages with the toothed sectors 19 (see Figs. 3 and 4) which are rigidly mounted on the horizontal bearings 20 of the hydroplane arms. These toothed sectors 19 have flat bearing surfaces engaging corresponding surfaces on the casting 21 and the reduced extremities of the hydroplane shafts 12 are journaled in the sectors (see Fig. 4). The bevel sectors 11 are secured to the hydroplane shafts between this reduced extremity and the hubs. As the worm 17 is turned in response to the movement of the controlling lever or wheel on the deck of the boat the two sectors 19 are turned about the axis of the pintles 10, thereby turning the hydroplanes on their vertical axes and swinging them toward or away from the side of the boat, as the case may be. In consequence of this movement, the bevel gear sectors 11 move along the teeth of the bevel gear sectors 9, but since the sectors 9 are securely locked in position by the worm 2 and the toothed sectors 7, the bevel gears 11 are rotated simultaneously with the extending or retracting movement of the hydroplanes, and the hydroplanes are thereby turned on their horizontal axes. It will

thus be seen that if we start with the hydroplanes in the fully extended position, as shown in Fig. 1, and operate the shaft 14, the hydroplanes will be gradually swung in a lateral sweep toward the boat and simultaneously turned from a substantially horizontal position to a substantially vertical position, until they lie close to the boat, as shown in Figs. 7 and 8. Inasmuch as the worm 17 cannot be turned by the sectors 19, the hydroplanes are automatically locked in any position of extension to which they have been brought. In the normal operation the hydroplanes will be brought to the fully extended horizontal position and then given the proper angular adjustment to steer the boat by means of the steering wheel and connecting rod 1, but it will be observed that the planes may be turned on their horizontal axes by means of this connecting rod, whatever may be the position of projection or retraction, and it may sometimes be desirable to use the planes in a partially extended position.

I am aware that it has heretofore been proposed to equip boats of the character referred to with swinging hydroplanes in such a manner that the swinging movement takes place about an axis arranged horizontally and substantially parallel to the longitudinal axis of the boat, so as to move the hydroplane in a vertical sweep. However, it will be observed that the length of a hydroplane so mounted must as a practical matter be so restricted that when the hydroplane is out of service, that is, when it is in the up and down position, it will not extend above or below the contour of the hull. This is a serious limitation, because the most effective form of hydroplane is one which extends to a great distance from the side of the boat, thus obtaining a wide spread. Such a hydroplane is afforded by the present invention and so far as I am aware it is broadly new to mount hydroplanes of the character referred to in such manner that they may be retracted by turning them on a vertical axis and also on a horizontal axis so that the hydroplanes may be moved in a lateral sweep from an extended position in which their surfaces are substantially horizontal into a retracted position against the side of the boat, by a movement of combined rotation on horizontal and vertical axes, as distinguished from a rotation on a single horizontal axis parallel to the axis of the boat.

What I claim is:

1. A submarine or submersible boat having a pair of hydroplanes, and bearing members in which the hydroplanes are mounted for rotation on horizontal axes, said bearing members being swiveled in the sides of the boat on vertical axes, and mechanism for turning the hydroplanes on the vertical and horizontal axes to move them in a lateral sweep from an extended position in which their surfaces are substantially horizontal into a retracted position in which their surfaces lie against the sides of the boat.

2. A submarine or submersible boat having a pair of hydroplanes swiveled thereon on vertical axes, whereby they may be turned in a lateral sweep from an extended position of wide spread to a shipped position lengthwise of the boat, and mechanical connections between the hydroplanes whereby their simultaneous movement is assured, in combination with mechanism for adjusting the hydroplanes on their horizontal axes for steering.

3. A submarine or submersible boat, having hydroplanes swiveled thereon on vertical axes, whereby they may be turned in a lateral sweep from an extended position of wide spread to a shipped position lengthwise of the boat, in combination with mechanism for adjusting the hydroplanes on their horizontal axes for steering.

4. A submarine or submersible boat, having a pair of hydroplanes swiveled thereon on vertical axes, and mechanism for turning the hydroplanes on their swivels to project and retract them simultaneously in a lateral sweep, said mechanism including means for automatically locking the hydroplanes in any position to which they have been turned.

5. A submarine or submersible boat, having a pair of hydroplanes swiveled thereon, mechanism for turning the hydroplanes on their swivels to project and retract them, said mechanism including means for turning the hydroplanes on their horizontal axes.

6. A submarine or submersible boat, having a pair of hydroplanes swiveled thereon, mechanism for turning the hydroplanes on their swivels to project and retract them, said mechanism including means for turning the hydroplanes on their horizontal axes in combination with supplemental mechanism for adjusting the hydroplanes on their horizontal axes for steering.

7. A submarine or submersible boat, having a pair of hydroplanes swiveled thereon, mechanism for turning the hydroplanes on their swivels to project and retract them, said mechanism including means for turning the hydroplanes on their horizontal axes in combination with supplemental mechanism for adjusting the hydroplanes on their horizontal axes for steering, the two mechanisms for turning the hydroplanes on their horizontal axes being simultaneously operable.

8. A submarine or submersible boat, having a pair of hydroplanes swiveled thereon, mechanism for turning the hydroplanes on their swivels to project and retract them, said mechanism including means for turn-

ing the hydroplanes on their horizontal axes in combination with supplemental mechanism for adjusting the hydroplanes on their horizontal axes for steering, the said turning and adjusting mechanism including means for automatically locking the hydroplanes in any position of adjustment to which they have been brought.

9. A submarine or submersible boat, having hydroplanes swiveled thereon, and mechanism for turning the hydroplanes on their swivels to project and retract them and for simultaneously turning them on their horizontal axes, so that when retracted they will lie against the sides of the boat and when projected will extend in a substantially horizontal position.

10. A submarine or submersible boat having hydroplanes swiveled thereon, and mechanism for turning the hydroplanes on their swivels to project and retract them and for simultaneously turning them on their horizontal axes, so that when retracted they will lie against the sides of the boat and when projected will extend in a substantially horizontal position, and supplemental mechanism for adjusting the hydroplanes on their horizontal axes for steering.

11. A submarine boat having a recess in its side forming a pocket for the reception of a hydroplane adapted to lie lengthwise in said pocket, a bearing member in which the hydroplane is mounted for rotation on its horizontal axis, said bearing member being swiveled in the side of the boat in such position with relation to the pocket that when the hydroplane is turned on the horizontal and vertical axes from an extended position in which its surface is substantially horizontal it will be brought into a retracted position in which it lies in the pocket against the side of the boat.

12. A submarine boat having a pair of symmetrically placed hydroplanes and bearing members in which the hydroplanes are mounted for rotation on their horizontal axes, said bearing members being swiveled in the sides of the boat on vertical axes, and mechanism for simultaneously turning the hydroplanes on the vertical and horizontal axes to bring them into operative position and for locking them in such position.

13. A hydroplane-actuating mechanism comprising a pair of hydroplane shafts, swiveled supports for the shafts, shaft-swiveling gear sectors on the inner abutting ends of said shafts, and a worm gear meshing with said sectors and adapted to turn the shafts on their swivels and to lock them in any position to which they have been turned.

14. A hydroplane-actuating mechanism comprising a pair of hydroplane shafts, swiveled supports for the shafts, shaft-swiveling gear sectors on the inner abutting ends of said shafts, and a worm gear meshing with said sectors, in combination with a shaft-turning gear sector fixed to each shaft for turning it on its own axis, and relatively fixed gear sectors with which the shaft-turning sectors engage, whereby the actuation of the worm shafts turns the hydroplane shafts on their swivels and simultaneously turns them on their own axes.

15. Hydroplane supporting and actuating mechanism for submarine boats, comprising a pair of hydroplane shafts; bearing members mounted for rotation on vertical axes in the sides of the boat and in which the hydroplane shafts are mounted for rotation on their horizontal axes, shaft-turning gear sectors secured to said shafts and a worm gear and connections for turning said sectors to turn each of the hydroplane shafts simultaneously on the vertical and horizontal axes and to lock them in any position of adjustment to which they have been turned.

16. A hydroplane-actuating mechanism for submarine boats comprising a pair of hydroplane shafts, swivel supports to the shafts, shaft-swiveling gear sectors on the inner abutting ends of said shafts, and a worm gear meshing with the said sectors, in combination with shaft-turning sectors fixed to said shafts, relatively fixed gear sectors with which the shaft-turning sectors engage, and a worm wheel and connections for turning the relatively fixed gear sectors, whereby the turning of the shafts on their swivels simultaneously turns them on their own axes but the shafts may be turned on their own axes without swiveling.

17. A hydroplane-actuating mechanism for submarine boats comprising a casting supported on the boat and having flat bearing surfaces, a pair of hydroplane shafts, bearings for said shafts having pintles journaled in said casting, shaft-swiveling gear sectors on the inner abutting ends of said shafts and resting on the said flat bearing surfaces, a worm gear meshing with said sectors, shaft-turning sectors fixed to said shafts, additional gear sectors 9, swiveled on the pintles of the hydroplane shafts and with which the shaft-turning sectors engage, a second worm gear, and gear sectors 7, meshing with said second worm gear and connected to the gear sectors 9, for the purpose described.

In testimony whereof I affix my signature, in presence of two witnesses.

GREGORY CALDWELL DAVISON.

Witnesses:
F. L. BRAKE,
W. D. FESLER.