G. M. LAGERGREN.

SUBMERSIBLE BOAT.

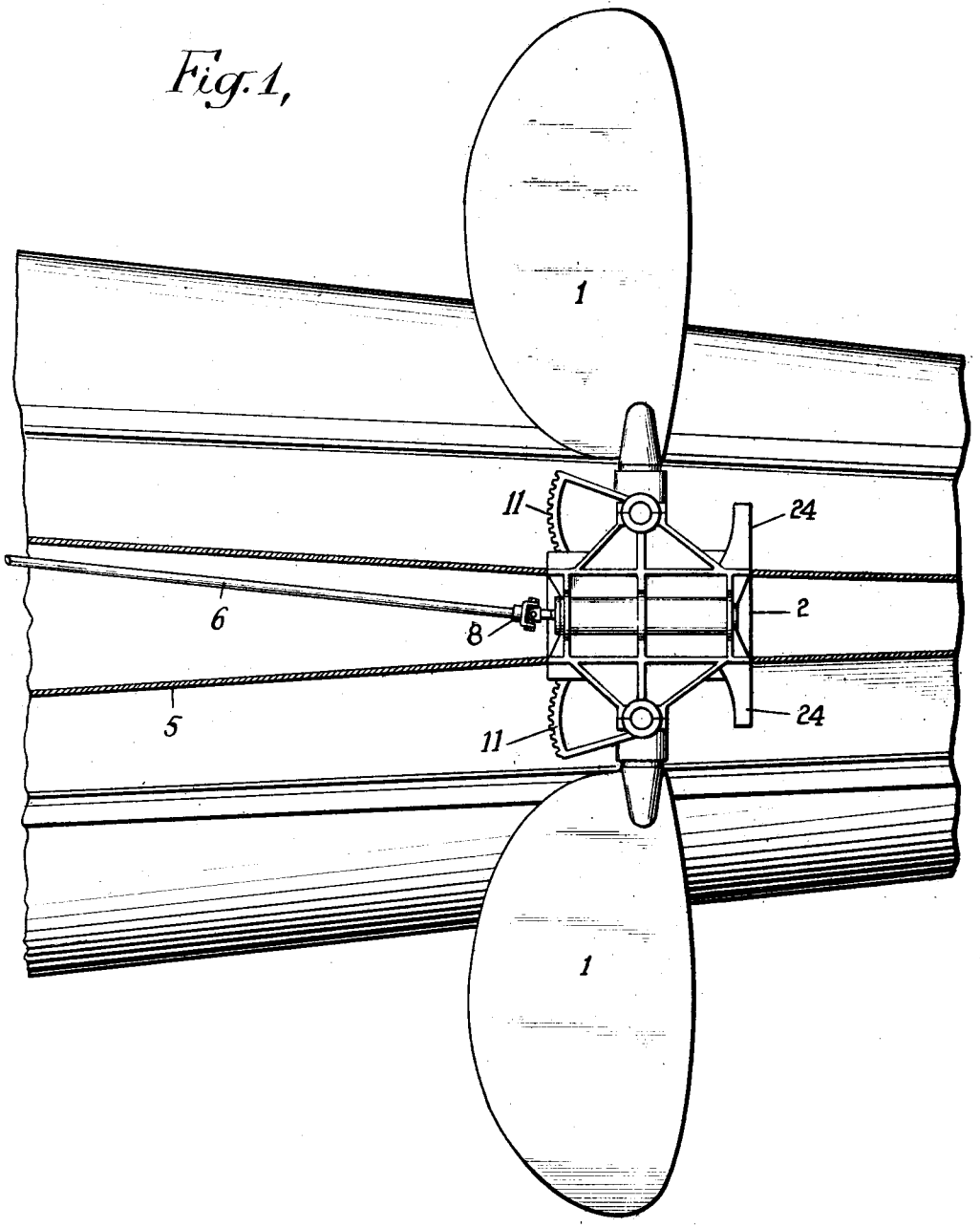
APPLICATION FILED APR. 29, 1914.

1,108,192.

Patented Aug. 25, 1914.

4 SHEETS—SHEET 1.

Fig. 1,




WITNESSES

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4 SHEETS—SHEET 2.

Fig. 2.

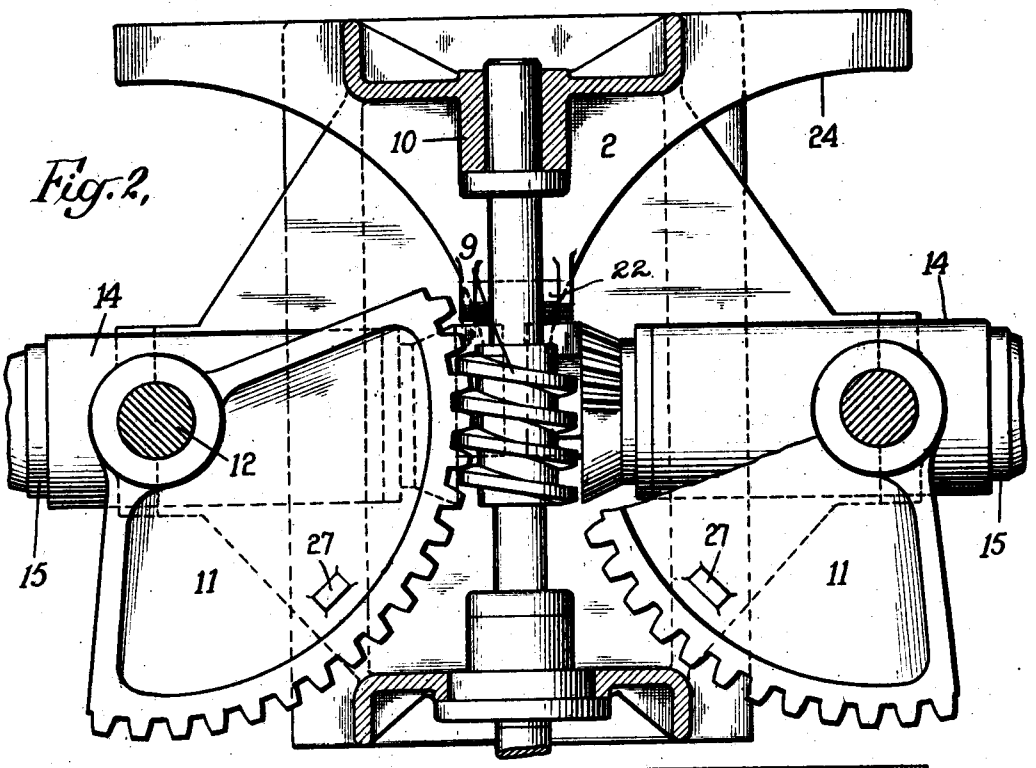
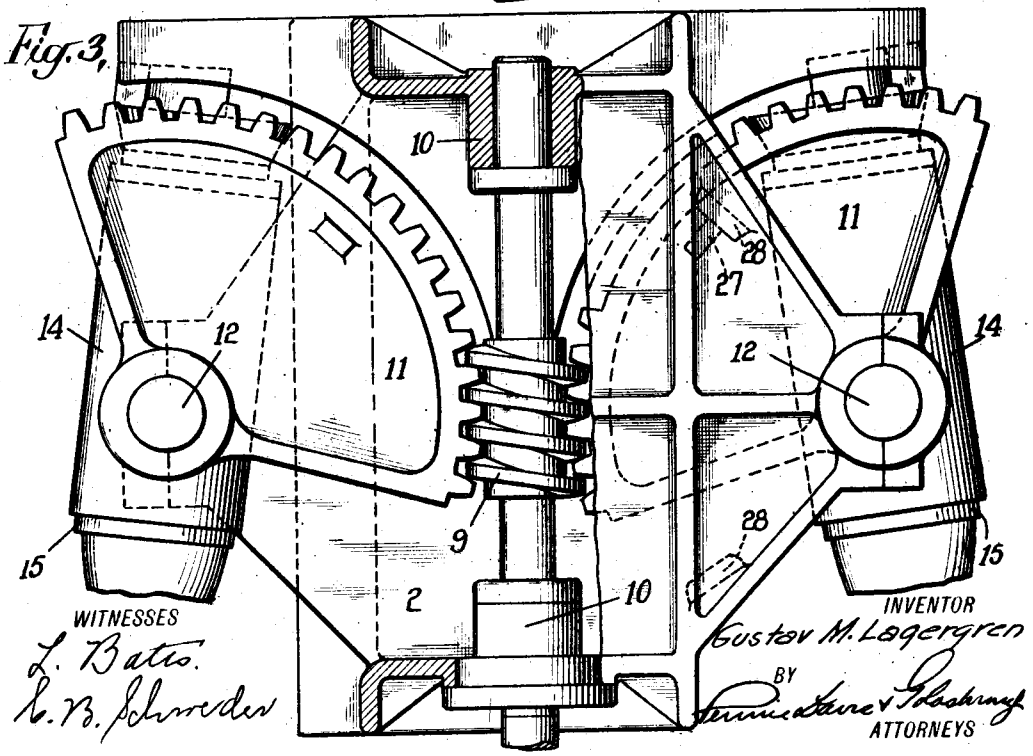



Fig. 3.




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4 SHEETS—SHEET 3.

Fig. 4,

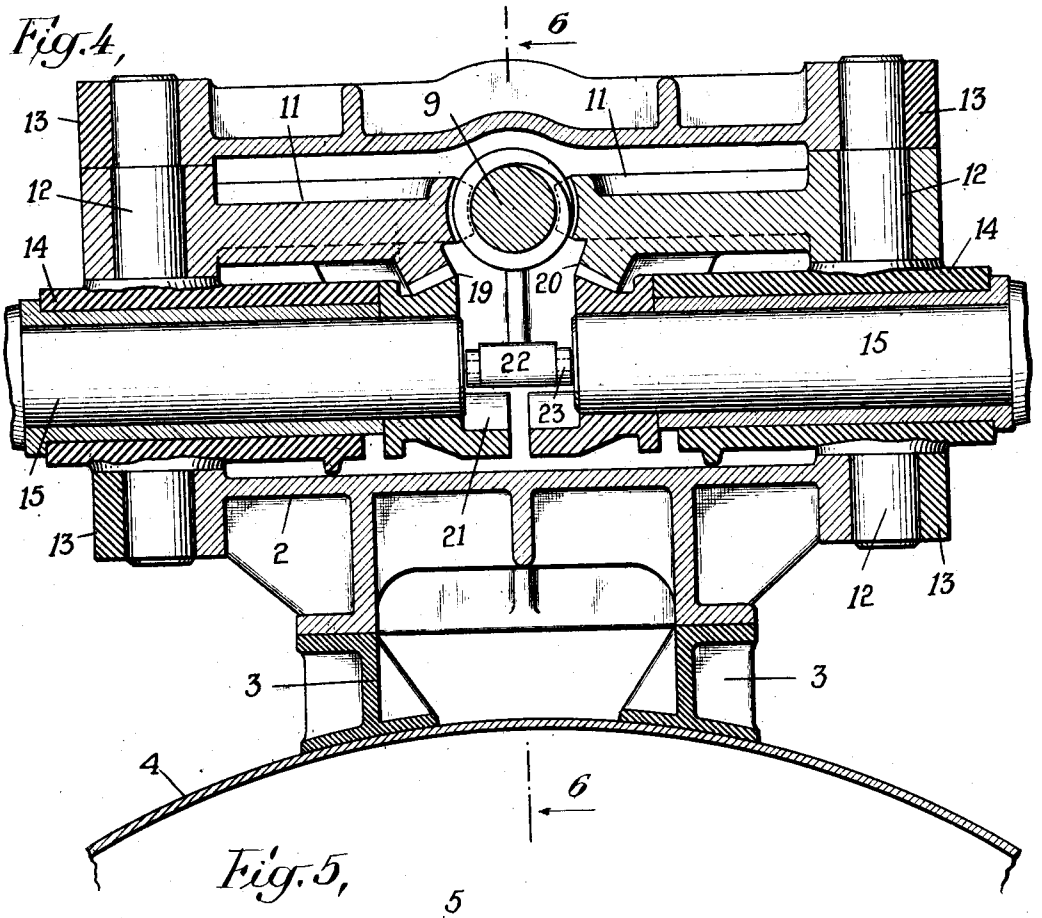
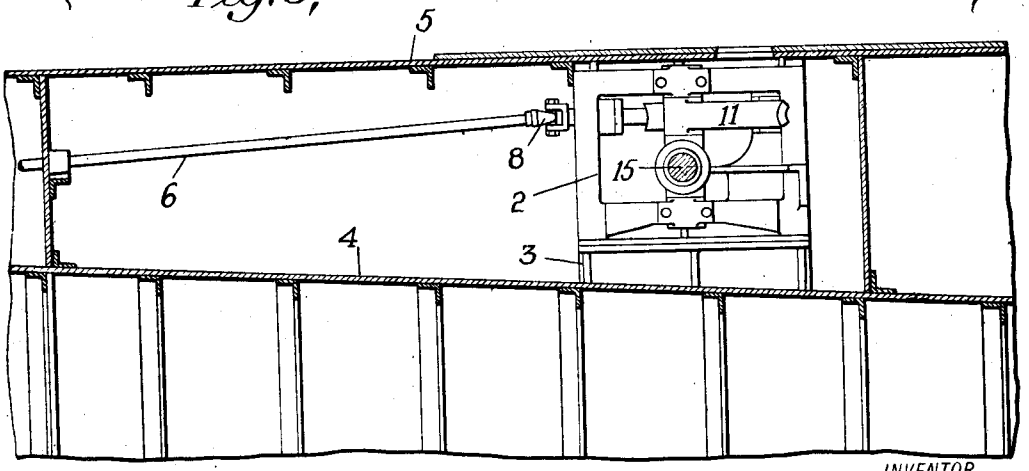



Fig. 5,




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4 SHEETS—SHEET 4.

Fig. 6,

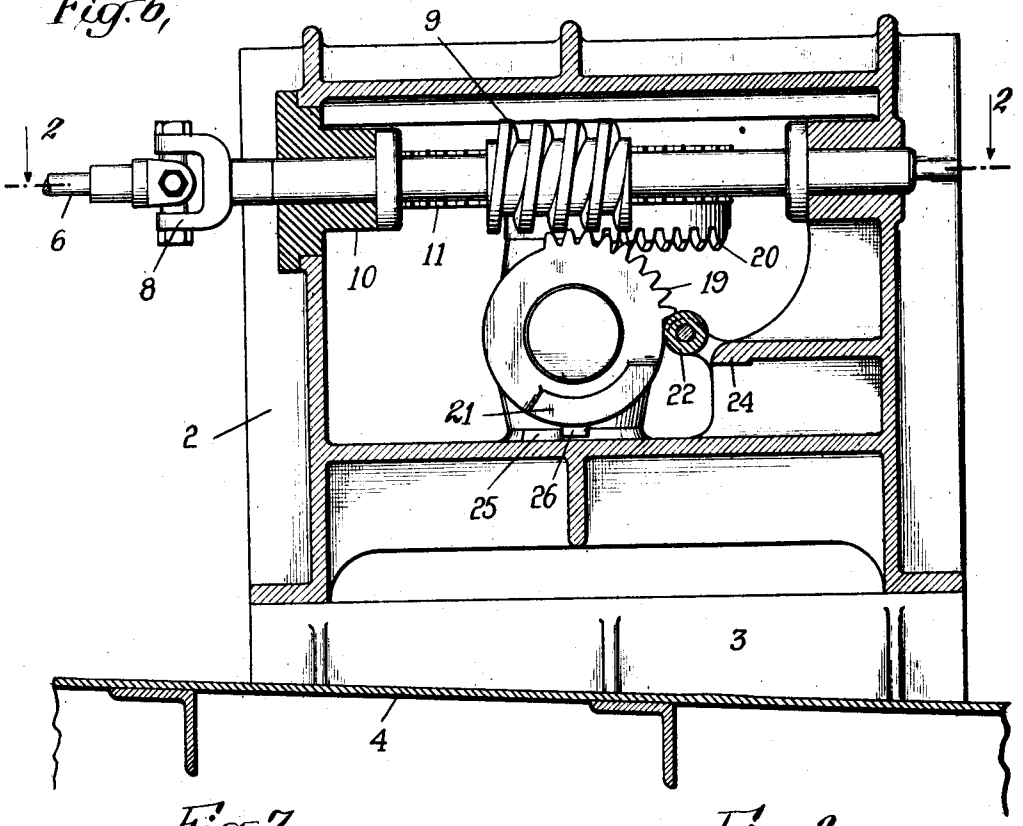



Fig. 7,

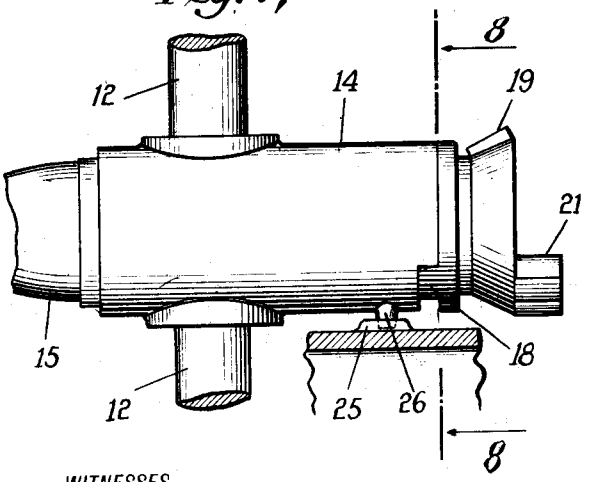
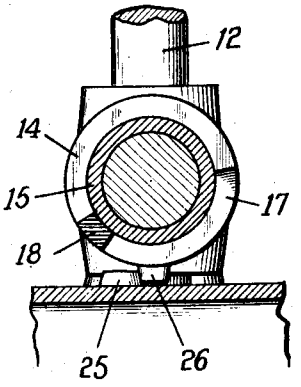



Fig. 8,




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# UNITED STATES PATENT OFFICE.

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## SUBMERSIBLE BOAT.

1,108,192. Specification of Letters Patent. Patented Aug. 25, 1914.

Application filed April 29, 1914. Serial No. 835,068.

*To all whom it may concern:*

Be it known that I, GUSTAV M. LAGERGREN, a citizen of the United States, residing in the city of New London, county of New London, and State of Connecticut, have invented certain new and useful Improvements in 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.

This invention relates to submersible boats and is directed to the provision of an improved mechanism for operating the hydroplanes or horizontal rudders of such vessels. Such hydroplanes should be capable of movement to an inoperative position parallel and close to the sides of the vessel or to an extended position at right angles to the sides of the vessel and when they are in the extended position, adjustment thereof to any desired angular position is necessary.

The primary object of the invention is to provide an improved operating mechanism whereby such hydroplanes or steering blades may be moved from a shipped position against the sides of the vessel to an extended position at right angles to the sides of the vessel and whereby a continued movement of the operating mechanism will turn the blades on their longitudinal axes into any desired steering position near the horizontal but tipped slightly up at the aft edge for downward steering or down at the aft edge for upward steering, the mechanism being so constructed that a reverse movement thereof will bring the hydroplanes back to a vertical position and then cause them to assume their inoperative position against the sides of the vessel.

A further object of the invention is to provide means for limiting the travel of the hydroplanes on their vertical and horizontal axes.

A still further object of the invention is to provide means for the purposes set forth, which shall be simple in construction and thoroughly reliable and effective in operation.

With the above and other objects in view the invention consists in the features of construction and combinations of parts hereinafter described and claimed.

In the accompanying drawings, 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 and horizontal position; Fig. 2 is a horizontal sectional view with the hydroplanes at right angles to the vessel; Fig. 3 is a similar view illustrating the mechanism when the hydroplanes are in their folded position; Fig. 4 is a vertical cross-sectional view showing the means for stopping the movement of the hydroplanes on their vertical axes, and the roller for preventing play or movement of the hydroplanes when in their extended position; Fig. 5 is a longitudinal section through a portion of the hull and superstructure showing in elevation the hydroplanes' actuating mechanism and controlling connections; Fig. 6 is a sectional elevation showing the means for turning the hydroplanes on their horizontal axes, and also the stop devices; Fig. 7 is a detail view of the inner end of one of the hydroplane shafts, and Fig. 8 is a cross-sectional view on the line 8—8 of Fig. 7.

The general arrangement of the hydroplanes with respect to the rest of the boat is shown in Figs. 1 and 5. The hydroplanes 1 and their actuating mechanism are supported in a casting 2, which is mounted on supporting beams 3, resting on the hull 4 of the vessel and extending lengthwise thereof. This casting interrupts the continuity of the walls of the superstructure 5 as shown, so that the casting is in fact built into the superstructure, and extends beyond the sides thereof a sufficient distance to permit the free movement of the planes on their vertical and horizontal axes. The steering operation is effected by means of the steering shaft 6, which extends lengthwise of the superstructure, supported in bearings not shown, and should be continued to a convenient point within the vessel, where it is connected with the steering wheel. This shaft 6 is connected through a universal coupling 8

to a worm gear 9 which is journaled in bearings 10 in the casting, and engages with the toothed sectors 11. These toothed sectors 11 are loosely mounted on pintles 12 having their bearings in boxes or journals 13 at the upper and lower ends of the casting 2, said pintles projecting from the casings or housings 14 in which the hydroplane shafts 15 are located and have their bearing, and forming the vertical axes on which said shafts are moved to their extended and their folded positions.

On the outer ends of the shafts 15 are provided sockets to receive the inner ends of the hydroplanes, which may be secured in place in any preferred manner. The inner ends of the housings 14 are formed with curved slots 17, in which fit lugs or pins 18, extending from the shafts 15. By this arrangement the play of the hydroplanes is limited from a vertical to a substantially horizontal position, and vice versa, the lugs or pins abutting against the ends of the slots when the extreme positions have been reached and preventing further movement. On the inner ends of the shafts 15 are provided gear segments 19, which mesh with toothed racks 20, located on the under faces of the toothed sectors 11, so that when the latter are moved, the shafts 15 are caused to turn on their horizontal axes to the extent permitted by the slots 17 in which the lugs 18 move. Extending laterally from the peripheral portions of gears 19 concentric with shafts 15, are curved flanges 21, the outer faces of which are adapted to engage a roller 22 mounted in bearings 23 projecting from the edges of walls or shelves 24 which are formed integrally with the casting 2, or secured thereto. This roller 22 bears against the outer faces of the flanges 21 when the hydroplanes have reached their extended position and begin their movement from a vertical to a horizontal position. This roller not only facilitates the partial rotation of the shafts 15, but also braces the hydroplanes in their extended position and prevents backward movement or chattering thereof.

To arrest the movement of the hydroplanes after they have reached their extended position, stops 25 are provided on the bottom of the casting 2, and these stops are engaged by projections 26, depending from the housings 14. Also stops 27 may be formed on gears 11 coacting with lugs 28 formed on the overlying member of frame 2.

When the hydroplanes are shipped, the upper ends of the flanges 21 bear against the under faces of the shelves 24. As the hydroplanes are moved to the extended position, the flanges 21 pass from under walls 24 just as the stops 25 are reached and then turning of the shafts 15 in bearings 14 is possible.

The operation of the mechanism will now be described. When it is desired to use the hydroplanes, the steering wheel is operated to turn the steering shaft 6 and thus revolve worm gear 9, and this worm gear meshing with the sectors 11 moves them on their vertical axes. The shafts 15 and the sectors 11 are locked together by reason of the fact that the racks 20 on sectors 11 are in mesh with the gear segments 19 on the shafts 15 and these gear segments 19 are prevented from rotating by the ends of the flanges 21, which bear against the under faces of the shelves 24. When the flanges 21 pass beyond the shelves 24, the stops 25 for limiting the movement of the hydroplanes on their vertical axes are reached, and further movement is prevented. At this period of the operation, the continued turning of the steering wheel causes the toothed sectors 11 to continue their turning movement and, as the shafts 15 are now free to rotate on their axis, they are partially rotated through the gear segments 19 and the toothed racks 20, thus causing the hydroplanes to be turned on their longitudinal axes toward the horizontal position. This movement may be continued until the hydroplanes have reached the desired steering position, which will be slightly short of the horizontal for upward steering and slightly beyond the horizontal for downward steering. When the hydroplanes reach the predetermined limiting position, the lugs or pins 18 engage the ends of the slots 17, and hence the further turning of the shafts 15 is prevented. During the period of use of the hydroplanes the steering angle may be altered at will by turning the steering shaft 6, as will be understood.

In the operation of folding the hydroplanes, a reverse movement of the steering wheel causes the shafts 15 to turn on their horizontal axis in the housings 14 until the lugs or pins 18 reach the opposite ends of the slots in the shafts 15. The ends of the flanges 21 projecting from the shafts have at this time cleared the roller 22, and further turning of sectors 11 causes the segments 19 to be moved bodily, carrying the flanges 21 under shelves 24. This locks shafts 15 against further turning movement through their gear connection with the sectors 11 and the hydroplanes assume their position against the sides of the boat.

It will be seen that by the mechanism described the hydroplanes may be extended from a position substantially parallel with the sides of the boat to a position at right angles thereto, and that by the continued action of the mechanism, the hydroplanes may be caused to assume any desired degree of angularity. Furthermore, it will be noted that a single operating mechanism performs the two-fold function of shipping

or extending the planes and adjusting the angular position thereof as desired. This mechanism is such that the hydroplanes cannot be moved back against the sides of the boat except in such angular position as will cause them to lie flat against the sides of the boat. It will also be noted that the hydroplanes are locked in any position to which they are moved for the reason that while the worm gear may turn the sectors, the reverse operation of the sectors upon the worm gear is impossible.

What I claim is:—

1. A submersible vessel having a body, hydroplanes mounted thereon and movable to inoperative positions against the body and to extended positions and a single operating mechanism connected to the hydroplanes and operable to move them from the inoperative to the extended position and to move them to any desired angular position while in the extended position; substantially as described.

2. A submersible vessel having a body, a pair of hydroplanes mounted thereon and movable to inoperative position against the body and to an extended position and movable to different angular positions while extended, and operating mechanism connected to the hydroplanes for effecting movement thereof, the continuous operation of said mechanism causing the hydroplanes to be first moved from the inoperative to the extended position and then turned angularly while in the extended position; substantially as described.

3. A submersible vessel having a body, bearing mechanisms pivotally mounted thereon, hydroplanes pivotally mounted in the bearing mechanisms, a single operating device, and means intermediate said device and the hydroplanes for causing operation of said device to both turn the hydroplanes in the bearing mechanisms and turn the bearing mechanisms relatively to the body; substantially as described.

4. A submersible vessel having a body, a pair of hydroplanes mounted thereon and movable to an extended position at substantially a right angle to the length of the body and also to an inoperative position against the sides of the body, said hydroplanes being also movable to different angular positions while in the extended position, and a single operating mechanism connected to the hydroplanes which by its continuous operation first varies the angular relation of the hydroplanes while the latter are in the extended position and then moves the hydroplanes from the extended to the inoperative position: substantially as described.

5. A submersible vessel having a pair of hydroplanes, bearing mechanism in which the hydroplanes are mounted permitting lateral extension of the hydroplanes and also partial rotation thereof to vary their angular relation, operating mechanism for effecting the lateral extension of the hydroplanes and the rotational movement thereof and means for preventing rotational movement of the hydroplanes to vary their angular relation except when the hydroplanes are in the extended position; substantially as described.

6. A submersible vessel having a body, bearing mechanisms pivotally mounted on the body, hydroplanes pivotally mounted in the bearing mechanisms, a single operating mechanism connected to the hydroplanes for turning them in the bearing mechanisms and for turning the bearing mechanisms relatively to the body and means for preventing turning of the hydroplanes in the bearing mechanisms until the latter have been turned relatively to the body to carry the hydroplanes to the extended position; substantially as described.

7. A submersible vessel having a body, a pair of hydroplanes mounted thereon and movable to an inoperative position against the sides of the body and to an extended position, a single operating mechanism connected to the hydroplanes for moving them from the inoperative to the extended position and for turning them to different angular relations while in the extended position and means for arresting movement of the hydroplanes relatively to the body when the hydroplanes reach their extended position; substantially as described.

8. A submersible vessel having a body, bearing mechanisms pivotally mounted thereon, hydroplanes pivotally mounted in the bearing mechanisms, an operating mechanism connected to the hydroplanes for turning them in the bearing mechanisms and for turning the bearing mechanisms relatively to the body, means for preventing turning of the hydroplanes in the bearing mechanisms except when the bearing mechanisms have been turned to carry the hydroplanes to the extended position, and means for arresting movement of the bearing mechanisms relatively to the body when the hydroplanes are in their extended position; substantially as described.

9. A submersible vessel having a pair of hydroplanes, bearing mechanism in which the hydroplanes are mounted permitting lateral and angular adjustment of the hydroplanes, means for holding the hydroplanes against turning until their lateral adjustment has been effected, and stops for limiting the movement of the hydroplanes on their horizontal axis; substantially as described.

10. A submersible vessel having a pair of hydroplanes, bearing mechanism in which said hydroplanes are laterally and angularly movable, mechanism for preventing the

turning of the hydroplanes during lateral adjustment, stops for limiting the lateral movement of the planes beyond a position substantially at right angles to the vessel, and means for limiting the angular adjustment of said hydroplanes; substantially as described.

11. A submersible vessel having a body, a pair of hydroplanes mounted thereon, means for moving the hydroplanes from an inoperative position against the sides of the body to an extended position and for turning the hydroplanes to various angular positions while in the extended position and means for bracing the hydroplanes while in their extended position, which bracing means is made effective by the angular movement of the hydroplanes after the latter have been moved into the extended position; substantially as described.

12. A submersible vessel having a body, bearings pivotally mounted thereon, hydroplanes pivotally mounted in the bearings, a single operating mechanism connected to the hydroplanes for turning them in their bearings and for turning the bearings relatively to the body, and a brace for the hydroplanes which is rendered effective or ineffective by the turning of the hydroplanes in their bearings; substantially as described.

13. A submersible vessel having a body, bearings pivotally mounted thereon, hydroplanes pivotally mounted in the bearings, operating mechanism for turning the hydroplanes in their bearings and for turning the bearings relatively to the body, projections on the inner ends of the hydroplanes and a wall with which said projections coact to prevent turning of the hydroplanes in their bearings except when the bearings have been moved to carry the hydroplanes to their extended position; substantially as described.

14. A submersible vessel having a body, bearings pivotally mounted thereon, hydroplanes pivotally mounted in the bearings, an operating mechanism for turning the bearings relatively to the body and for turning the hydroplanes in their bearings and coacting parts on the bearings and hydroplanes for limiting the extent of turning movement of the hydroplanes in their bearings; substantially as described.

15. A submersible vessel having a body, bearings pivotally mounted thereon, hydroplanes pivotally mounted in the bearings, operating mechanism for turning the bearings relatively to the body and for turning the hydroplanes in their bearings, parts on the inner ends of the hydroplanes presenting curved surfaces and a part with which said curved surfaces coact when the hydroplanes are turned in their bearings; substantially as described.

16. A submersible vessel having a body, hydroplanes mounted thereon, operating mechanism for moving the hydroplanes to an inoperative position against the sides of the vessel and to an extended position at substantially a right angle to the vessel and for varying the angular relation of the hydroplanes while in the extended position and means for preventing movement of the hydroplanes from the extended to the inoperative position except when the hydroplanes are in a definite angular position relatively to the body of the vessel; substantially as described.

17. A submersible vessel having a pair of hydroplanes, mechanism in which said hydroplanes are laterally and horizontally movable, shoulders on the shafts of the hydroplanes, shelves against which said shoulders bear to prevent the turning of the shafts until the limit of their lateral extension has been reached, and stops for limiting said lateral extension; substantially as described.

18. A submersible vessel having a pair of hydroplanes laterally and angularly movable, shoulders on the shafts of the hydroplanes, shelves against which the shoulders bear, stops for limiting the lateral extension of the hydroplanes, and a roller for engaging said shoulders when the hydroplanes are laterally extended; substantially as described.

19. A submersible vessel having a pair of hydroplanes laterally and angularly movable, shoulders on the shafts of the hydroplanes, shelves against which said shoulders bear, and lugs on the hydroplane shafts fitting in slots in the shaft housings to limit the rotation of said shafts; substantially as described.

20. A submersible vessel having a pair of hydroplanes laterally and angularly movable, shoulders on the shafts of the hydroplanes, shelves against which said shoulders bear, a roller for engaging the shoulders, stops for limiting the lateral extension of the hydroplanes, and means intermediate the shafts of the hydroplanes and the shaft housings for limiting the movement of the hydroplane shafts on their horizontal axis; substantially as described.

21. A submersible vessel having a pair of hydroplanes laterally and angularly movable, a worm gear, means for rotating the gear, sectors engaging the worm gear, segment gears on the shafts of the hydroplanes, toothed racks on said sectors with which said segment gears mesh, means for limiting the lateral extension of the hydroplanes, and means for preventing rotation thereof until their lateral adjustment has been accomplished; substantially as described.

22. A submersible vessel having a body, bearing mechanisms pivotally mounted on the body, hydroplanes pivotally mounted in the bearing mechanisms, operating devices

for turning the bearing mechanisms relatively to the body and for turning the hydroplanes in their bearing mechanisms, and means for arresting the turning movement of the bearing mechanisms relatively to the body when the bearing mechanisms have been turned to carry the hydroplanes from positions adjacent to the body to their extended positions at substantially a right angle to the body; substantially as described.

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

GUSTAV M. LAGERGREN.

Witnesses:
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C. H. BEDELL.