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S. LACAVALERIE.

STEERING APPARATUS FOR MARINE VESSELS.

No. 540,105. Patented May 28, 1895.

Fig. 1.

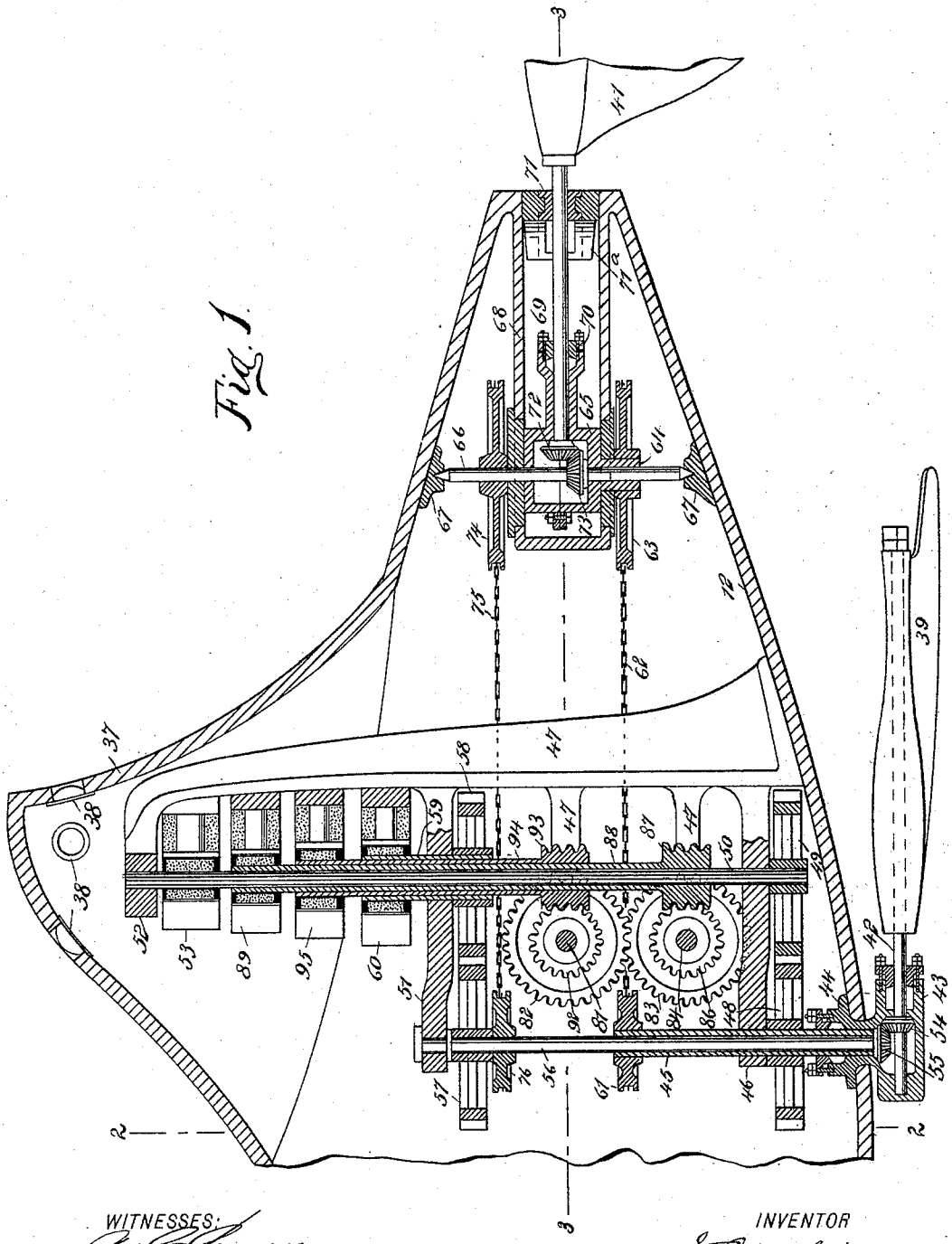

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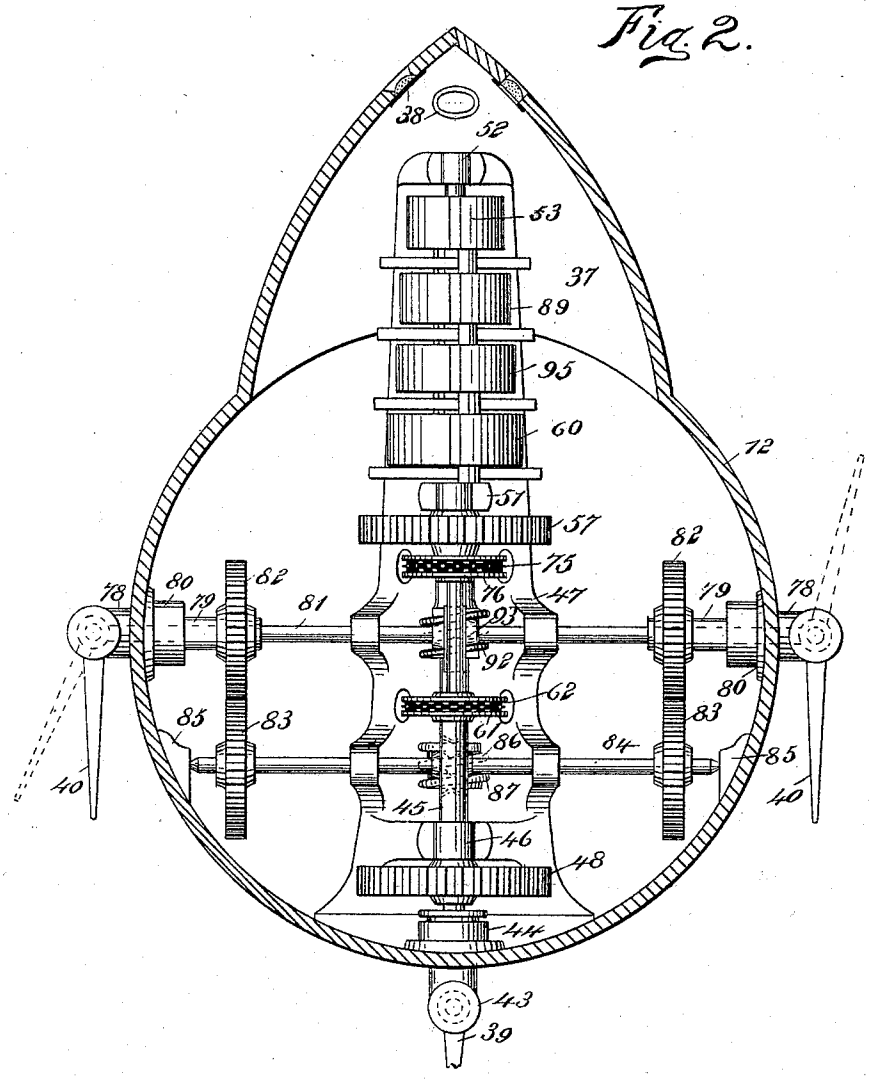
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

S. LACAVALERIE.

STEERING APPARATUS FOR MARINE VESSELS.

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Fig. 3.

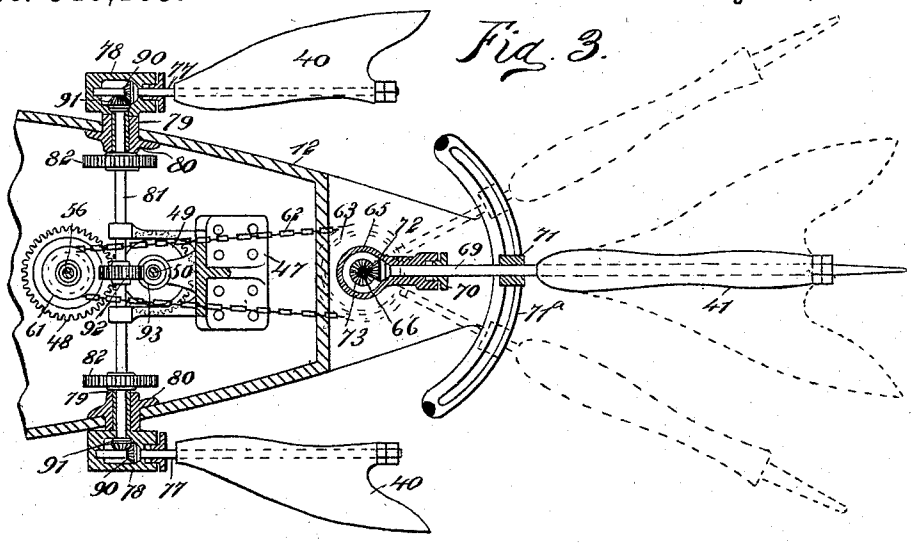
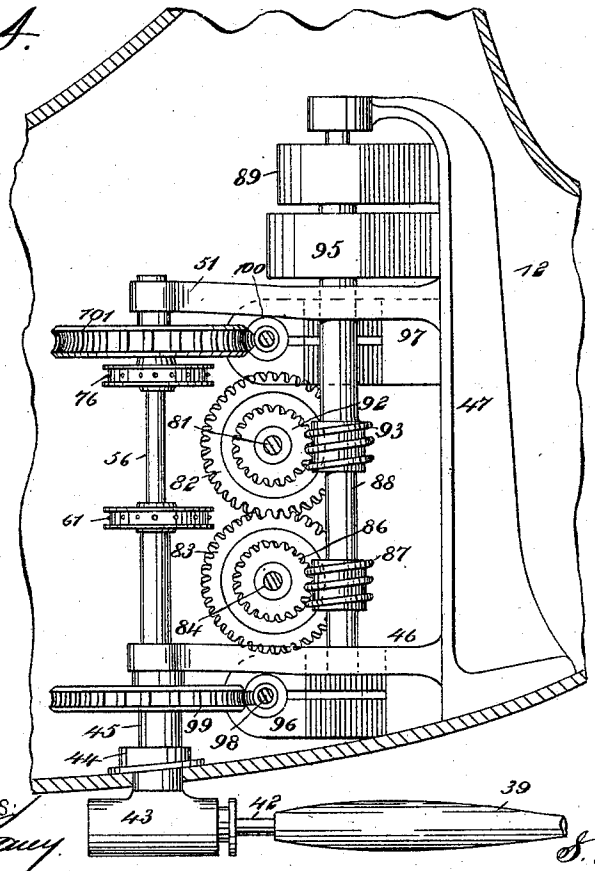


Fig. 4.



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UNITED STATES PATENT OFFICE.

SEBASTIEN LACAVALERIE, OF CARÁCAS, VENEZUELA.

STEERING APPARATUS FOR MARINE VESSELS.

SPECIFICATION forming part of Letters Patent No. 540,105, dated May 28, 1895.

Original application filed October 2, 1894, Serial No. 524,764. Divided and this application filed February 11, 1895. Serial No. 537,948. (No model.)

To all whom it may concern:

Be it known that I, SEBASTIEN LACAVALERIE, of Carácas, Venezuela, have invented a new and Improved Steering Apparatus for Marine Vessels, of which the following is a full, clear, and exact description.

My invention relates to improvements in steering apparatus for marine vessels and particularly to submarine vessels, being especially adapted for use in connection with a vessel of the kind shown in my application for Letters Patent of the United States, Serial No. 524,764, filed October 2, 1894, of which this application is a division.

The object of my invention is to produce a powerful and easily controlled steering apparatus, which is adapted to steer a vessel either up or down, to one side, or alternately to one side and then to the other so as to cause the vessel to progress in a sinuous line.

A further object of my invention is to produce a steering apparatus of this kind, which is compact and adapted to be secured in a vessel in such a way that it will not be displaced by the various evolutions of the latter.

To these ends my invention consists of certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a central vertical longitudinal section of the stern cone-section of the vessel, showing in sectional elevation my improved steering apparatus therein. Fig. 2 is a vertical cross-section on the line 2 2 of Fig. 1. Fig. 3 is a sectional plan on the line 3 3 of Fig. 1, and Fig. 4 is a broken vertical section of the stern-section of the vessel and shows in elevation a modified arrangement of the steering apparatus.

The section 12 of the vessel is preferably of conical shape and it represents the stern end of a submarine vessel and is provided at the top with a lookout 37 which has sight holes 38 therein. The steering apparatus is designed to steer the vessel either vertically, laterally or alternately from one side to the other and to this end it is provided with a series of fin-shaped rudders 39, 40 and 41, the rudder 39 being placed centrally beneath the stern cone 12, the rudders 40 on opposite sides of the said cone, and the rudder 41 at the stern of the said cone. Each rudder is held substantially parallel with the vessel and is capable of either a rotary or oscillatory motion, as described below. To this end the rudders are mounted in a substantially similar way, and the rudder 39 is secured to a shaft 42 which is journaled in a movable box 43 so as to turn with the box and also revolve in it, and this box is formed on the end of a hollow shaft 45 which turns in a suitable stuffing box 44 on the under side of the cone 12, as shown clearly in Fig. 1, and the shaft 45 also turns in a supporting arm 46 of a bracket 47 which is erected in the cone 12 and supports various parts of the rudder-working apparatus. The shaft 45 is provided with a gear wheel 48 which is turned by a gear wheel 49 on a vertical shaft 50 which is supported in the arm 46 and also in the arms 51 and 52 of the bracket 47, and the shaft is driven by an electric motor 53 and when the shaft is turned, it, by reason of the gear connection just described, turns the hollow shaft 45 and box 43 so as to move the rudder 39 laterally and thus impart a lateral movement to the vessel.

To enable the rudder 39 to be oscillated or revolved on its own axis, the shaft 42 is provided with a pinion 54 meshing with a pinion 55 on the shaft 56 which extends upward through the shaft 45 and is provided with a gear wheel 57 meshing with a gear wheel 58 on the hollow shaft 59 which, together with other shafts to be described below, is mounted on the shaft 50 and is turned by an electric motor 60. If, therefore, in order to give a sinuous movement to the vessel it is desired to oscillate or revolve the rudder 39, the motor 60 is set in motion and by reason of the gear connection described, the shafts 56 and 42 are turned and the rudder 39 revolved.

It is desirable, in order to get quick steerage, that the main rudder 41 be given a movement similar to and coincident with the movement of the rudder 39, and to this end it is connected with the shafts 45 and 56 by the following mechanism: On the shaft 45 is a

sprocket wheel 61 which connects by means of a chain 62 with a sprocket wheel 63 on the sleeve 64 which forms a part of the box 65 which is journaled on the vertical countershaft 66 mounted in suitable bearings 67 on the top and bottom walls of the cone 12, and this box 65 is held in a suitable casing 68 and carries the shaft 69 of the main rudder 41, which shaft 69 is journaled in a stuffing box 70 forming a part of the box 65 and in a box 71 which slides laterally in a slideway 71ª at the rear of the stern cone section 12. It will thus be seen that when the shaft 45 is turned so as to impart a lateral movement to the box 43 and rudder 39, it will also, by means of the sprocket wheels and chains, turn the box 65 and move the shaft 69 and rudder 41 so as to give the same movement to the rudder 41 that is imparted to the rudder 39. The slideway 71ª is shown on the outside of the cone section 12, but by making the said cone section a little broader at the stern it will be unnecessary to run the slideway outside the stern.

To provide for revolving the rudder 41 in unison with the rudder 39, its shaft 69 is connected directly to the shaft 56, the shaft 69 being geared by the pinions 72 and 73 to the vertical shaft 66 and the latter is provided with a sprocket wheel 74 which is driven by a chain 75 connecting with a sprocket wheel 76 on the shaft 56, and when the shaft 65 is revolved to revolve the rudder 39 it will be seen that it also imparts similar movement to the rudder 41.

The side rudders 40 are mounted in a general way like the rudders 39 and 41, and their function is chiefly to steer the vessel up and down. These rudders are each secured to a shaft 77 which is held in a box 78 carried by a hollow shaft 79 which is journaled in a suitable bearing 80 in the side of the cone 12, and the hollow shafts 79 are supported on a transverse shaft 81 extending across the cone 12 and the shafts 79 are provided with gear wheels 82 meshing with and driven by gear wheels 83 on a shaft 84 which turns in bearings 85, see Fig. 2 and is held parallel with the shaft 81. The shaft 84 is provided with a worm wheel 86 which meshes with a worm 87 on the hollow shaft 88, see Figs. 1 and 4, which turns on the shaft 50 and is driven by an electric motor 89 and thus, by setting the motor in motion, the shaft 88 is turned and by means of the gear just described imparts a movement to both hollow shafts 79 and these move the boxes 78 up and down, as the case may be, while the boxes move the shafts 77 and the rudders 40, thus changing the angle of the rudders to the vessel and causing the latter to ascend or descend.

The rudders 40 are capable of rotary movement, and to this end the shafts 77 and the said rudders are connected by pinions 90 and 91 with the shaft 81, and the latter connects by a worm wheel 92 and worm 93 with the hollow shaft 94 on the shaft 50, the said hollow shaft being driven by an electric motor 95 which, on being set in motion, turns the shaft 94 and the latter by its gearing turns the shaft 81 which, by means of the pinions 91 and 90 imparts a rotary movement to the shafts 77 and rudders 40.

It will be seen from the above description that any necessary movement can be imparted to either rudder, and thus the direction of the vessel can be very easily regulated.

In Fig. 4 I have shown a slightly modified form of rudder-working apparatus, which has the same means as above described for moving the rudders 40 and 41, but two of the motors are taken from the shaft 50 and motors 96 and 97 used for working the rudder 39. The motor 96 is connected by a worm 98 and worm wheel 99 with the shaft 45 of the box 43, so as to move the box and its rudder when necessary, and the motor 97 is connected by a worm 100 and worm wheel 101 with the shaft 56 so that when necessary the motor 97 may be started, the shaft 56 turned, and the rudder 39 actuated in the manner already indicated.

I have not shown the electrical connections for the motors, as these are of the ordinary kind, as also are the motors, but it will be seen that the arrangement of the motors and gearing brings the vessel under perfect control and enables it to be moved like a fish in almost any direction.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A steering apparatus for marine vessels, comprising the combination of a box projected beyond the vessel and communicating with the interior thereof, said box being capable of revolving in its seat, an exterior shaft revolubly mounted in the box and capable of turning therewith, a rudder fixed to the shaft, and mechanism within the vessel for independently operating the box and shaft, substantially as described.

2. A marine vessel provided with rudders located upon its sides and operatively connected with each other, said rudders being mounted on shafts extending longitudinally of the vessel, and the shafts being mounted to turn about an essentially horizontal axis extending transversely of the vessel, substantially as described.

3. A marine vessel provided with a hollow transverse shaft carrying a box at its outer end, a longitudinal shaft rotatably mounted in the said box, a rudder on the said longitudinal shaft, and a transverse operating shaft extending through the said hollow shaft and having a driving connection with the rudder shaft, substantially as described.

4. A marine vessel having a bottom rudder and an end rudder mounted to rotate about vertical axes, and an operative connection between the said rudders to cause them to move simultaneously and in the same direction, substantially as described.

5. The combination, with the vessel, of the

boxes journaled at the stern and on the bottom of the vessel, the shafts carried by the boxes and adapted also to turn therein, the rudders on the shafts, and gear mechanism for either simultaneously moving the boxes or rotating the rudder shafts, substantially as described.

6. The combination, with the vessel, the rudders on the sides, bottom and end thereof, of the boxes journaled on the vessel to carry the rudders, the shafts secured to the rudders and journaled in the said boxes, a motor geared to the stern and bottom boxes to move them, a second motor geared to the shafts of the stern and bottom rudders to turn them, a third motor geared to the boxes of the side rudders to move them, and a fourth motor geared to the shafts of the side rudders to turn them, substantially as described.

7. The combination with the vessel and the box arranged to slide in its stern, of the rudder having a shaft carried in the said sliding box, and means for moving the rudder bodily and revolving it, substantially as described.

SEBASTIEN LACAVALERIE.

Witnesses:

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