2 Sheets—Sheet 1.

J. L. LAY.

Electro-Magnetic Steering Apparatus for Submarine Torpedo-Boats

No. 198,126. **Patented Dec. 11, 1877**

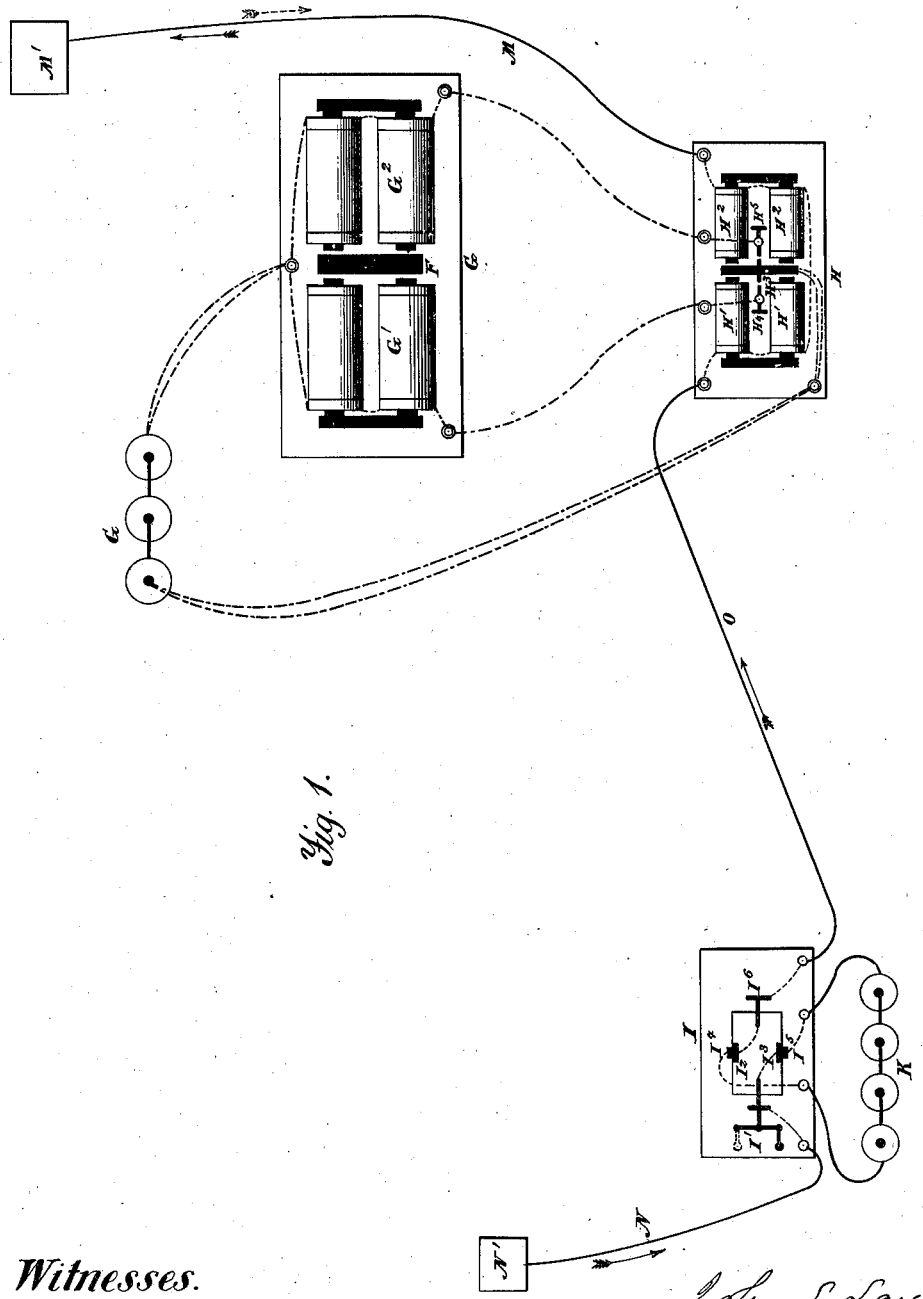

Fig. 1.

Witnesses.

A. Ruppert.

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2 Sheets—Sheet 2.

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Fig. 2.

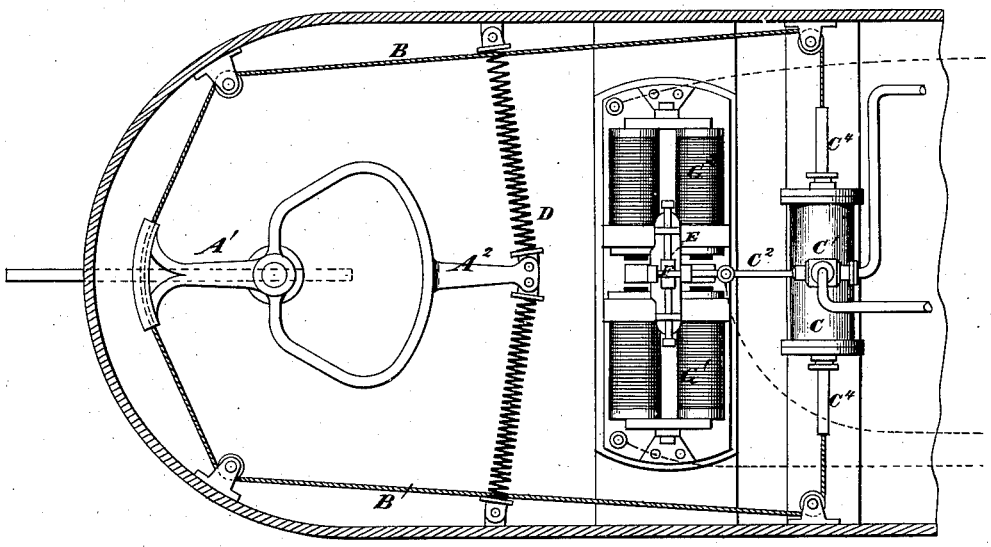
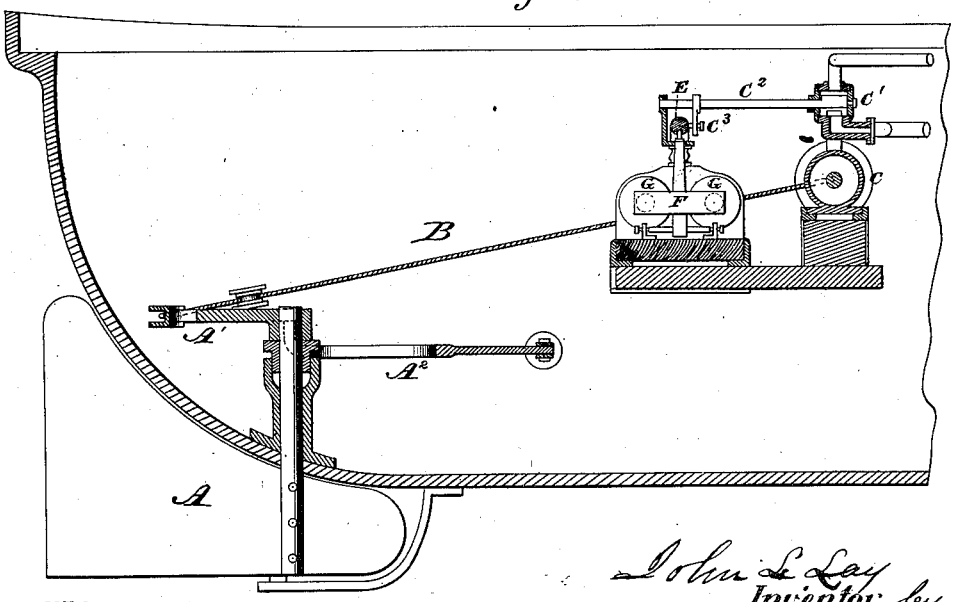


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN L. LAY, OF BUFFALO, NEW YORK.

IMPROVEMENT IN ELECTRO-MAGNETIC STEERING APPARATUS FOR SUBMARINE TORPEDO-BOATS.

Specification forming part of Letters Patent No. **198,126**, dated December 11, 1877; application filed March 25, 1872.

To all whom it may concern:

Be it known that I, JOHN L. LAY, of Buffalo, in the county of Erie and State of New York, have invented an improved mode of steering boats from a point outside of said vessel, of which the following is a specification:

This invention relates to a method of steering boats from a fixed point outside of the said boat or vessel, by means of electric currents transmitted from a shore-battery through an insulated telegraphic cable, acting, through the medium of a battery carried on the boat, upon the steering mechanism so as to bring the control of the direction of the boat under the influence of an operator on shore, or at some fixed point of departure.

My invention consists in combining, with an electro-magnetic apparatus on board the boat, and operated from the shore, mechanism for shifting the steering apparatus as the electric currents are reversed; also, in combining with the steering apparatus a cylinder and piston, the latter deriving motion from an expansible gas or vapor, and an electro-magnetic apparatus for shifting the valve of said cylinder, and thereby moving the piston from one part of the cylinder to another at the will of the operator.

I have illustrated in the annexed drawings one mode of carrying into effect the principle of my invention; but it is obvious that the parts may be variously modified without departing at all from said principle. Thus a great variety of electro-magnetic apparatus may be readily adapted to this service; so, also, may the mode of applying the power be varied. The valve-gear may be changed by any skillful mechanic, or the cylinder may be dispensed with, and the power applied to shifting the rudder by means of compound levers or other mechanical means of multiplying the motion imparted to the armature of an electro-magnet.

I do not, therefore, propose to limit my claim to the mechanism employed; but desire to cover other modes of reaching the same end by means which are substantially the same.

In the drawings, Figure 1 is a plan, showing the shore-battery, relay, and electro-magnet for controlling the steering mechanism. Fig. 2 is a plan of the mechanism for controlling the steering apparatus. Fig. 3 is a vertical section of the same.

The same letters in all the figures indicate identical parts.

I have illustrated my invention as applied to a rudder, A, having attached, on opposite sides of the rudder-post, two tillers, A^1 A^2. The ropes B B′ are attached to the tiller A^1, and, extending on proper pulleys, are respectively attached to the opposite ends of the piston-rod C^4, which extends through both heads of the cylinder C. It is obvious that as the piston is forced from one end of the cylinder to the center, or to the other end, the rudder will be brought to one of the three positions of "steady," "port," or "starboard." The normal position of the rudder is at "steady," where it is held by the tension of the springs D attached to the tiller A^2, the piston being in the center of the cylinder, and both eduction-ports of the rotary valve C^1 open. This valve is on a three-ported valve-seat, and is made to oscillate so as to admit the steam, condensed air, or gas used for actuating the piston, to one end of the cylinder or the other, by means of a valve-rod, C^2, on which is a slotted crank-arm, C^3, engaging a pin on the sliding bar E, which, in its turn, is actuated by the hinged arm F′ attached to an armature of soft iron, F, placed between the electro-magnets G^1 G^2, where it is held midway between the magnets, when they are inactive by the tension of spiral springs on the ends of the bar E. It is obvious that, if the magnet G^1 is electrized by passing a current through its induction-coil, the armature will be attracted to it, and, through the mechanism described, the valve C^1 will at the same time be so shifted as to admit the steam, &c., to one end of the cylinder, and force the piston to the opposite end, thereby shifting the rudder. When the current is cut off, and the magnet G^1 becomes demagnetized, the armature will be brought to its central position by its springs, and the eduction-ports opened so that the springs D may bring back the piston to its central position, and the rudder to "steady." If the magnet G^2 is in like manner charged, the armature will be drawn to it, shifting the valve so as to admit steam to the other end of the cylinder, and bringing the rudder into the

opposite position. It is only necessary, then, to provide means for shifting the electric currents so as to actuate one of the magnets or the other to bring the rudder under the control of the shore operator. No electrician would be at a loss as to the means. I have illustrated one of many different ways of doing this.

In Fig. 1, G is the actuating magnet operating the cylinder-valve. H is a relay, and I the pole-changer, under control of the operator on shore, the magnet and relay being on board, connected with the boat-battery G, while the pole changer is connected with the shore-battery K, the whole being united by insulated wires. The cable may be paid out as the boat progresses. The operator regulates the motions of the boat by means of the crank I. This crank turns a cylinder of vulcanite, on opposite sides of which are copper plates, respectively connected with the trunnions of the cylinder by insulated wires, the trunnion I^1 being connected with the ground-wire N, and I^6 being connected with the insulated cable O. Adjacent to the plates I^2 and I^3 are plates I^4 and I^5, respectively connected with the zinc and carbon poles of the shore battery K. When the crank is turned to the right, the pole-changer will transmit, say, a positive current through the cable O. If turned to the left the poles will be reversed, and an opposite or negative current transmitted.

The relay is of familiar construction. It is composed of two electro-magnets, H^1 H^2, having between them an armature of steel permanently magnetized, so that, the magnets having opposite polarity, it will be attracted by one and equally repelled by the other. If, by a positive current, it is drawn to magnet H^1, a connection will be formed through the point H^4, and the boat-battery G made to act on the magnet G^1, thereby drawing the armature F to it, and moving the valves, as already described. The reverse or negative current will give an opposite direction to the armature H^3 of the relay, so that when the crank I^1 of the pole-changer is turned to the left, the armature will be attracted to the magnet H^2, and the current from battery G caused to act on magnet G^2, reversing the valve. The electric circuit is completed through the ground-wire M, extending from the relay into the water.

Thus, by placing the crank I^1 vertically, and cutting off connecting-lines between the battery K and cable O, the helm will be held by the springs D at "steady." By turning the crank to the right, the helm may be brought to—say, port, and by turning it to the left it will be brought to starboard. Thus may the operator on shore guide it with the same certainty that he could if on board with his hand on the tiller.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with the steering apparatus of a vessel, an insulated conductor extending to a point outside of such vessel, and electro-magnetic apparatus for shifting said steering apparatus, substantially as set forth.

2. In combination with an apparatus for generating, conducting, and applying electric currents to the operation of electro-magnets on a boat from a point outside thereof, a valve operated by such magnets, a cylinder and piston and steering apparatus, operated substantially in the manner set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN L. LAY.

Witnesses:
R. MASON,
B. EDW. J. EILS.