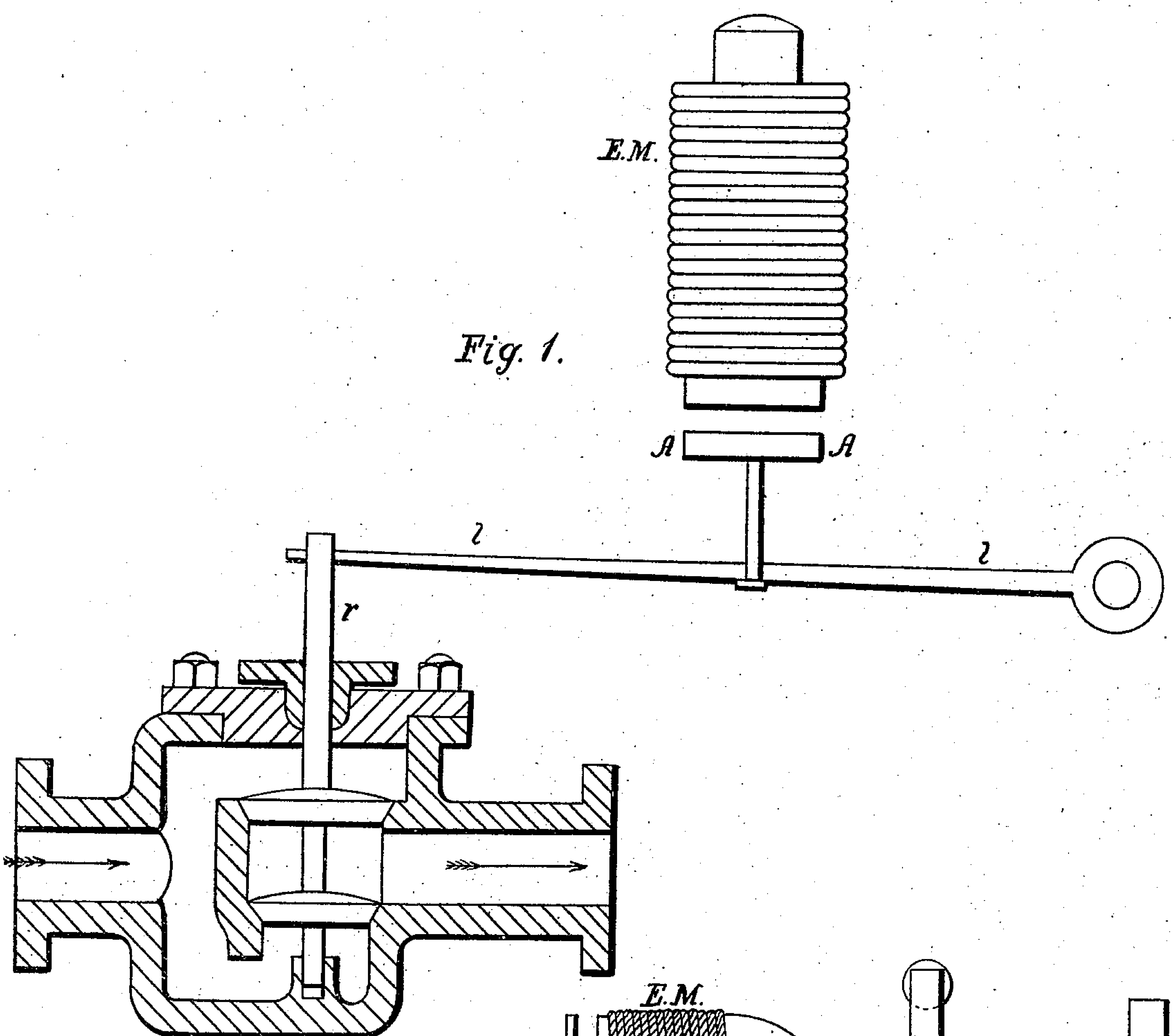
2 Sheets—Sheet 1.

J. A. BALLARD.

STEERING APPARATUS FOR TORPEDO BOATS, &c.

No. 107,326. Patented Sept. 13, 1870.

Fig. 1.



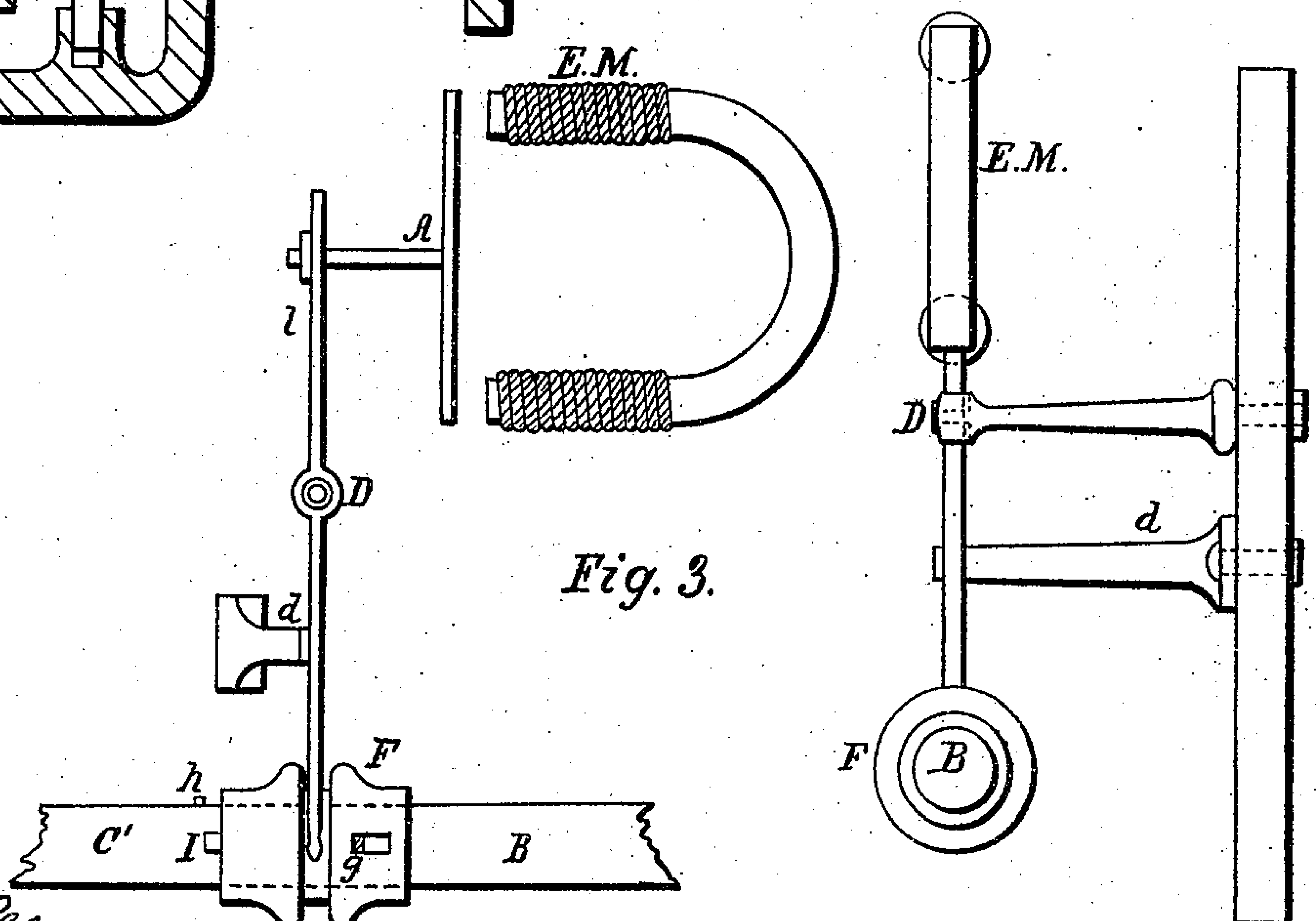


Fig. 3.

Witnesses.

Inventor.

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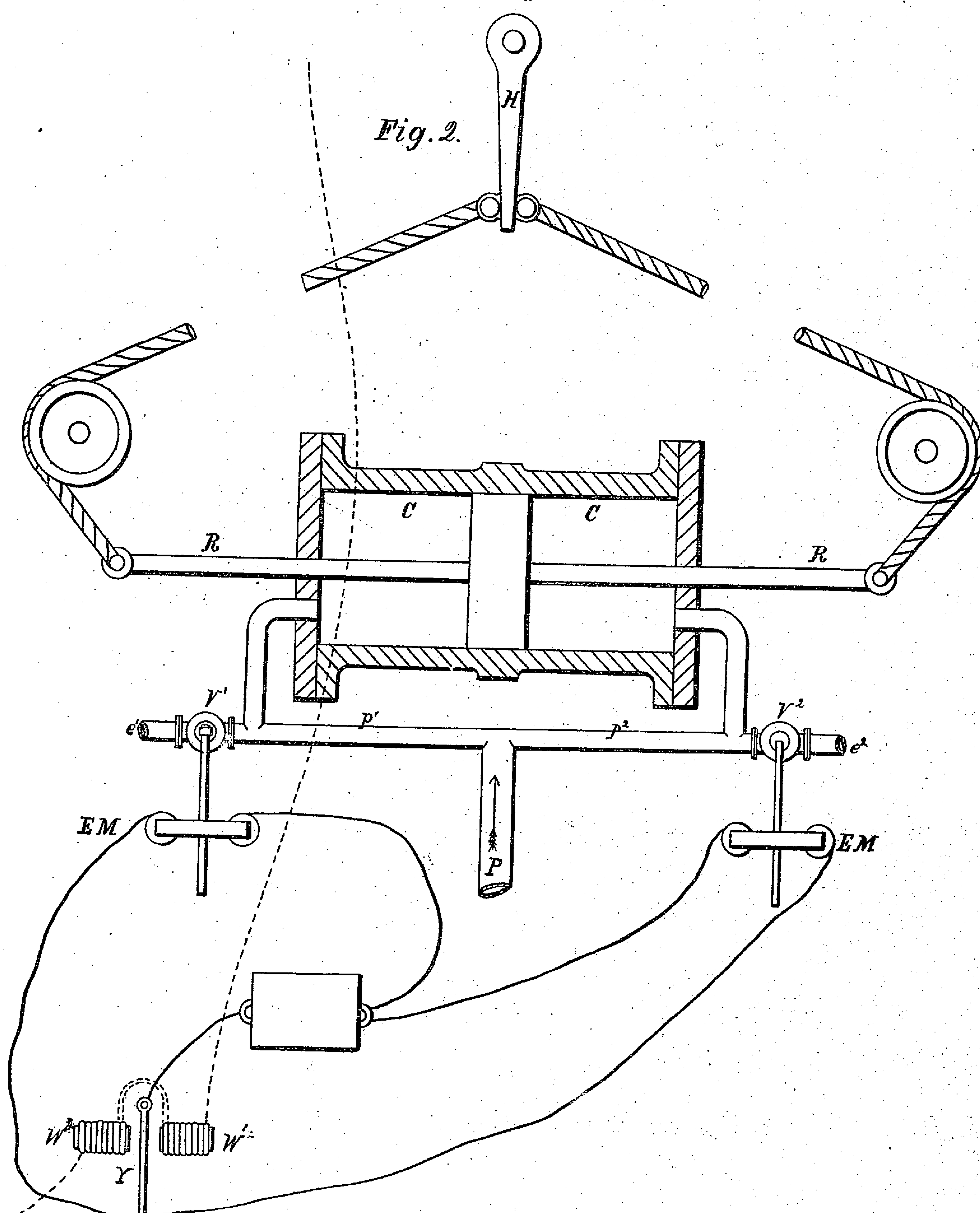
Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN A. BALLARD, OF BOMBAY, INDIA.

IMPROVEMENT IN STEERING APPARATUS FOR TORPEDO-BOATS, &c.

Specification forming part of Letters Patent No. 107,326, dated September 13, 1870.

To all whom it may concern:

Be it known that I, JOHN ARCHIBALD BALLARD, of Bombay, India, Colonel in the Royal Engineers, have invented or discovered certain Improved Means or Apparatus for Controlling and Guiding, from a distance, the Movements of Torpedo-Boats, Rams, and other Vessels, which are truly and particularly described and set forth, and the manner in which the same are to be performed, in the statement following, reference being had to the annexed drawings—that is to say:

I propose to apply electricity to the purpose of maneuvering vessels, but more especially to torpedo-boats or rams, from a distance, so that the operator may be able to bring such vessels into the proximity of an enemy, but not himself be injured by the explosion or concussion. The torpedo-boats would be movable by steam, compressed air, or similar methods. I propose that the person guiding the vessel should send electric currents to it either through a telegraph submarine cable or suspended wire, and that these currents should, in the way hereafter described, magnetize the cores of electro-magnets on board; and I propose to apply the power obtained by alternately magnetizing and demagnetizing the cores of the magnets to the purpose of opening and shutting steam-valves, and of putting machinery into and out of gearing, and, generally, of doing such work as is necessary for guiding and maneuvering the vessel. The cable would be placed in a tank, or wound round a reel on board the torpedo, in such manner that it could run out easily as the boat advanced. One end would be fixed near the operator. With a pliant, light cable the vessel's motion would be but little affected, and, so long as there remains any cable on the reel, the torpedo-boat is free to move in any direction. Nothing retards it but the slight friction of the cable running off the reel. In a strong tideway the cable would form a bight, and run out more rapidly, but there would be no additional drag on the boat, except that caused by the reel making a few more revolutions per minute. In less water than fifteen or twenty fathoms, the cable would fall to the bottom, and could be subsequently recovered. For deep water it might be made of buoyant material, but it would then be much exposed to injury from an enemy. The cable would not come over the stern, but run out through a pipe in the bottom of the boat. The smallest size of torpedoes for short ranges need be no larger than a canoe. The larger torpedoes are made, the more easily they could be guided, so there is no limit to their size except convenience and expense.

The method by which the steam-valves would be opened and shut can be easily understood by reference to Figure I. E M is an electro-magnet—that is, a horseshoe-shaped piece of iron (the core) with an insulated copper wire wrapped around it. If an electric current is sent through the wire, the horseshoe becomes a magnet which will attract ordinary iron. A piece of soft iron, A A, (the armature,) is placed at a short distance from the electro-magnet, so that when a current is sent round the wire the armature is strongly attracted, and, rising, adheres to the magnet. This armature A A is attached to a lever, *l*, lifting the valve-rod *r*. If, now, an operator send a current through the wire, the magnet instantly attracts the armature and raises the valve-rod. When the current ceases the valve drops.

The vessel may be guided by a steam steering apparatus, one way of applying which is shown in Fig. II. C C is a cylinder, whose piston-rod R is twice the length of the cylinder, and projects on either side. To the extremities of the rod R are attached ropes, which move the helm H. P is a steam-pipe, dividing into two smaller branches, p^1 p^2, on which are valves v^1 v^2. When these valves are down, the steam passes to the cylinder, which is kept constantly filled; but if either valve is lifted, the steam passes out by the exhaust-pipes e^1 e^2, and the pressure on the piston is relieved; hence it will move in the direction of the valve which has been lifted, bringing the helm over. Each valve has one or more electro-magnets to lift it, in the way before described. The electric currents to magnetize the electro-magnets are provided by a battery on board. Three or four Grove's cells would usually suffice. The poles would be connected or disconnected by a relay, worked through the cable by the operator. Any ordinary system of relay would answer, Those used for train-signaling are generally simple and strong.

I give an illustration of one kind of relay in Fig. II.

The line of cable-wire through which the operator sends currents is connected with the straight electro-magnets W^1 W^2, whose opposite poles face each other. Between these poles the north pole of a permanent magnet, Y, swings on a vertical axis. When there is no current passing through the wire it is unaffected, and kept stationary in the center by a spring; but it moves to W^1 with a direct current, and to W^2 with the reverse current. The battery to work the relay may be ashore or on board. The local battery on board to work the large electro-magnets is placed in any safe part of the boat. The zinc pole is connected by a wire with Y. A wire from one end of the coil of each electro-magnet passes to the copper pole, and a wire from the other end to the points a^1 a^2, respectively. When Y is deflected by a line current, it completes the local circuit by touching a^1 or a^2, and, the cores of the large magnets being magnetized, the valves are lifted.

If the operator wishes to put the helm to starboard he sends a direct current along the cable-wire. This deflects the south pole of Y toward a^2, and completes the circuit round the electro-magnet, which opens the valve r^2, the steam escapes at e^2, and, the pressure on that side of the piston being relieved, it draws the helm to starboard.

Another way in which I propose to use the magnetic force is, by applying it to put different parts of machinery into and out of gearing with each other. This is illustrated in Fig. III. Suppose it is desired to have the power of putting the screw-propeller shaft into and out of gearing with a shaft constantly moving, and thus to start or stop the boat: Let B be the shaft in motion, and C′ the screw-shaft. On B is an ordinary clutch, F, carried round by a pin, g, in a slot. On F is the projection I, which, when F is pushed forward, catches the pin h on the shaft C′, and causes C′ to revolve. The armature A, when attracted by the electro-magnet, pulls back one end of the lever L, moving on the fulcrum D; the other end pushes forward F, and puts the shafts in gearing. When the armature is released, a spring, d, pushes back the clutch, and disconnects the shafts; or the clutch can be made self-disconnecting by sloping off the points of contact between it and C′.

This action may, of course, be reversed. The two shafts may be always in gearing, and the vessel in motion, unless the armature is pulled back by the electro-magnet, which would be simply placed on the other side of the lever, and push the clutch back.

This system may be applied to steering the boat in various ways. For instance, the periphery of the steering-wheel might be cogged, and the wheel turned by an endless screw. This screw might receive direct motion by being geared by one electro-magnet and clutch with a shaft revolving from right to left, and it might receive a reverse motion by another electro-magnet and clutch putting it in gear with a shaft revolving from left to right.

Whether we use the electro-magnet to open a valve, or to push a clutch backward and forward, the principle is the same. We know that the magnetic force, in itself, could not conveniently be applied direct to pulling the helm to one side or another, for it only acts at short distances, and with comparatively small power; but the force required to lift an equilibrium-valve, or to push forward a clutch, was nothing compared to the power possessed by the flow of steam which issues through the valve when open, or to the force with which the clutch pulls round the machinery into which it gears.

By thus applying the magnetic force, we obtain as much power as the flow of steam or the revolutions of an engine can give.

It is not absolutely necessary that the signaling-wires should be insulated or rolled up on board the boat, and uncoil from that side. If not insulated it must, of course, be kept above the water. In most cases, however, the best arrangement seems to be to roll up an insulated cable on board, and let it pay out in the way a submarine-telegraph cable is laid.

I consider it doubtful if any relay yet invented could be trusted to perform with absolute certainty more complicated work than a right and left movement, such as I have described. If it is merely desired to guide the torpedo-boat, or to guide a ram, one wire and one relay will suffice. Another wire and relay could give the additional power of starting and stopping the boat with one movement, and of firing the charge on board the torpedo by another movement. It would always be safer, however, to have a separate wire for the charge.

In the case of small boats, where it was an object to save the weight of extra wires, a relay of a more complicated nature—such as a dial-instrument—might be used, and worked through a single wire; but a small steam-launch could easily carry a three-wire cable. Three wires of small gage could be well insulated by a cable three-eighths of an inch in diameter, and, if the wires are well annealed, the cable would be quite pliant. Hooper's insulating material is very suitable for this purpose.

The shape of the torpedo-boat or ram, or the manner of firing the explosive material, has nothing to do with this invention, which is applicable to all kinds of vessels, and merely relates to a method of maneuvering them from a distance by means of electricity. For instance, this invention might be applied to guiding steam-launches from the shore to vessels in distress, when boats with persons on board could not venture to put to sea; or it might be used to guide a steamer dragging an enemy's channel for stationary torpedoes.

What I claim is—

1. The employment of electricity for actuating the steering mechanism of torpedo-boats, rams, and other vessels, in the manner herein described and set forth.

2. The combination of an electric apparatus with the steering device of a torpedo-boat, ram, &c., substantially as described.

In witness whereof I, the said JOHN ARCHIBALD BALLARD, have hereunto set my hand this nineteenth day of May, one thousand eight hundred and seventy.

J. A. BALLARD.

Witnesses:

EDW. F. BARKER,

JNO. FIDO, Jr.,

Of Bombay.