(No Model.) 3 Sheets—Sheet 2.

W. S. SIMS.

TORPEDO BOAT PROPELLED AND STEERED BY ELECTRICITY.

No. 319,633. Patented June 9, 1885.

Fig. 3.

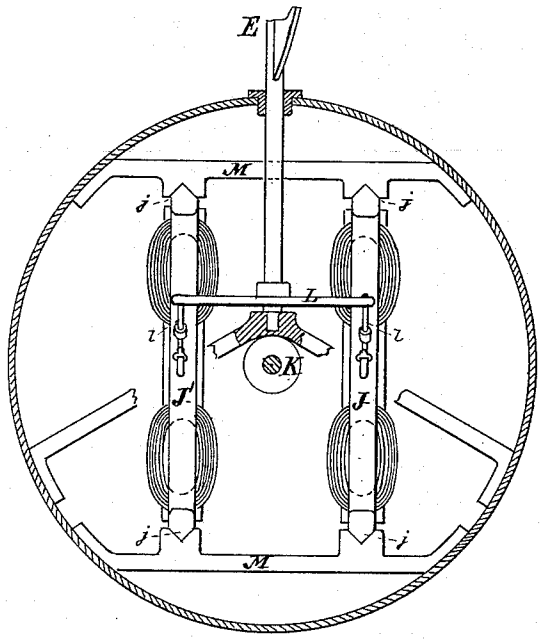
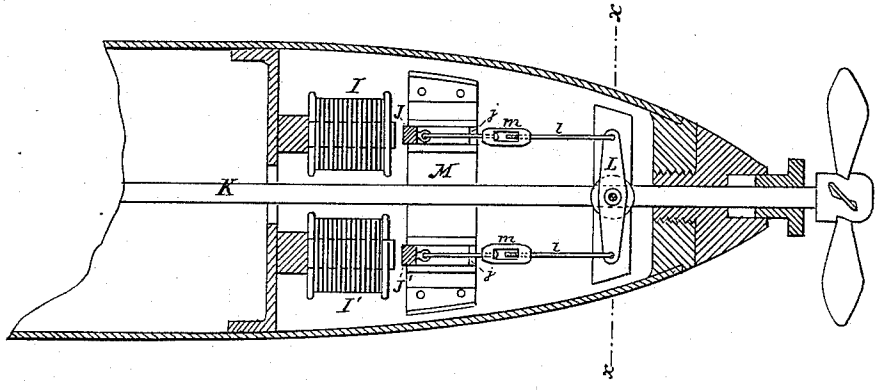


Fig. 2.



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(No Model.) 3 Sheets—Sheet 1.

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TORPEDO BOAT PROPELLED AND STEERED BY ELECTRICITY.

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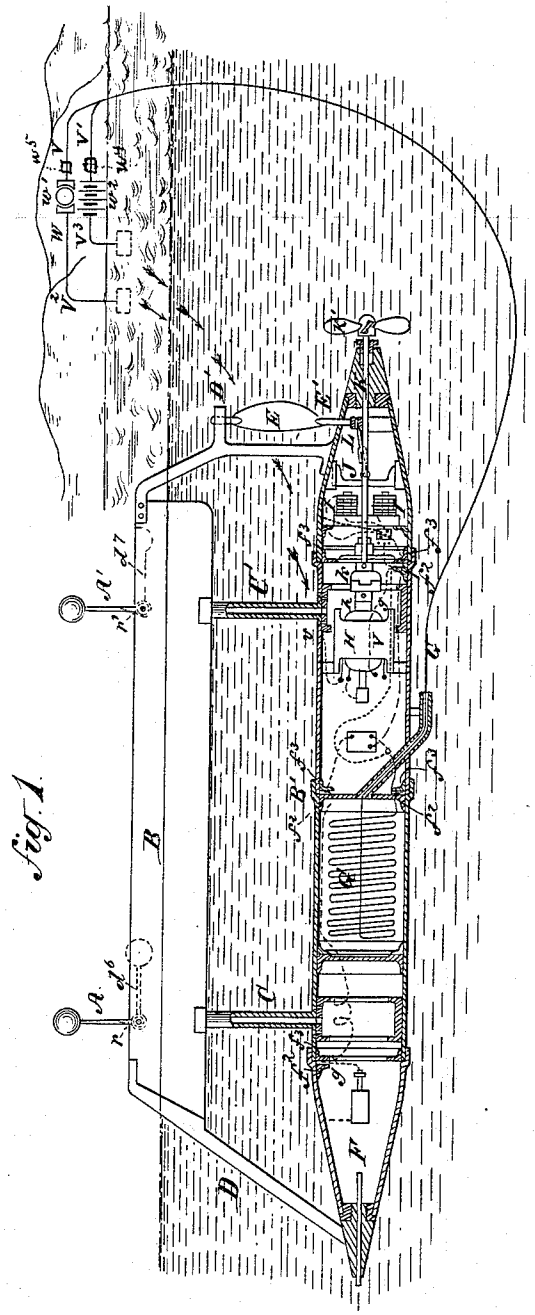

Fig. 1.

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(No Model.) 3 Sheets—Sheet 3.

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TORPEDO BOAT PROPELLED AND STEERED BY ELECTRICITY.

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Fig. 4.

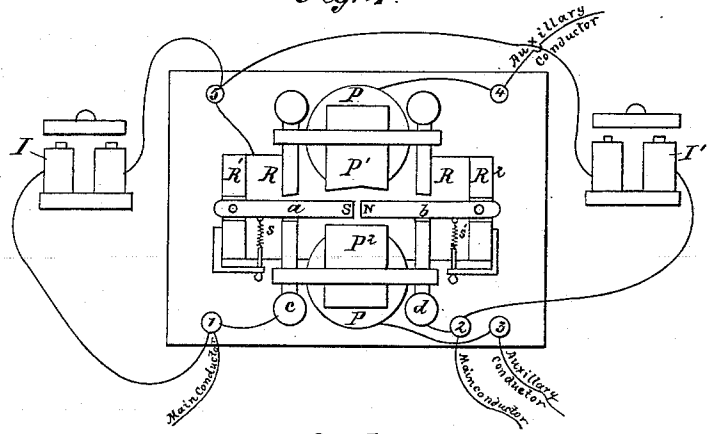


Fig. 5.

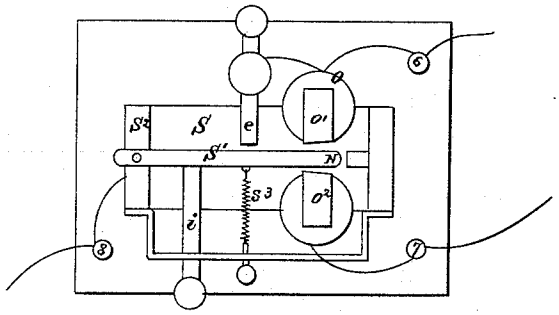


Fig. 6.

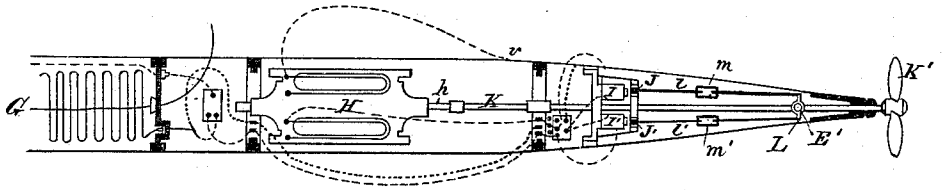


Fig. 7.

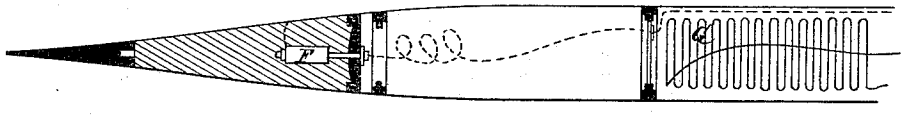
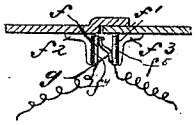


Fig. 8.



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UNITED STATES PATENT OFFICE.

WINFIELD S. SIMS, OF NEWARK, NEW JERSEY.

TORPEDO-BOAT PROPELLED AND STEERED BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 319,633, dated June 9, 1885.

Application filed May 29, 1882. (No model.) Patented in England May 25, 1883, No. 2,614.

To all whom it may concern:

Be it known that I, WINFIELD S. SIMS, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented a new, useful, and Improved Torpedo-Boat or Submarine Vessel, (patented in England May 25, 1883, No. 2,614,) of which invention the following is a specification.

My invention relates to torpedo-boats propelled and steered by electricity; and it consists in the construction and arrangement of the boat and propelling devices, whereby the boat is propelled by electricity generated by a generator located at an operating-station outside of the boat, and conducted to an electric motor in the boat by a conductor that is paid out from the boat as the boat moves from the station.

It also consists in devices and arrangements of parts whereby the steering of the boat is effected solely by the electricity generated by a generator located at such operating-station; also in the several minor combinations and devices hereinafter described and claimed.

I will proceed to describe an apparatus which embodies the principle of my invention, and by which that principle may be made practically operative, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical longitudinal section of my torpedo-boat, and a side elevation of the float from which the boat is suspended, together with a view of the shore-station at which is located the electrical generator. Fig. 2 is a horizontal longitudinal section of the after part of the boat, showing the steering mechanism. Fig. 3 is a transverse section on line *x x*, Fig. 2. Fig. 4 is a plan of the electro-magnets employed to operate the steering mechanism, and a relay for shifting the current into one or the other of the magnets at pleasure. Fig. 5 is the plan of another relay for shifting the current into the charge-exploder. Fig. 6 is a plan of the rear half, and Fig. 7 a plan of the front half, of the interior of the boat, showing the location therein of the several parts of the propelling, steering, and firing apparatus and of the wire conductor; and Fig. 8 is a view, partly in section, of a detached piece of the shell of the boat, showing the devices for establishing electrical connection between the sections of the boat.

The boat consists of a metallic water-tight shell, preferably of copper, cylindrical, or nearly so, in form, with pointed ends, and divided into suitable compartments for containing the explosive charge, the cable, and the apparatus and devices employed in propelling and steering the boat and exploding the charge. For convenience of handling and transportation the shell is preferably formed in sections, detachably secured together with water-tight joints by any suitable means, which sections may be readily and expeditiously attached to and detached from each other, this method of construction both facilitating the handling and the transportation of the boat, and allowing the convenient storing of the several parts until needed for use. By this mode of construction the corresponding sections of several boats may be interchangeable, the convenience and value of which arrangement are apparent. The boat may be made in such number of separate detachable sections as may be convenient, the ends of the sections being inclosed by water-tight bulk-heads where necessary for protection of the charge or proper insulation of the electrical devices or mechanism.

When it is intended that the boat shall be submerged when in use, I suspend it from a float, B, consisting, also, of a metallic shell of any desired form. It is preferably of a length somewhat less than the length of the boat, and is flattened in order to diminish its elevation above the water. It may be made comparatively indestructible by shot or puncture by being filled with any suitable buoyant material. It is connected to the boat by suitable rods or stanchions, C C', firmly secured to the under side of the float and the top of the boat.

At the bow of the boat I place a guard, D, extending between the boat and the float, for the purpose of protecting the boat and float against floating obstacles. In order to sever in two any slight obstacle—such as a rope, &c.—this guard should be sharpened to an edge in front. I preferably connect the guard to the float and boat so that it inclines rearward from

the boat to the float, as shown in Fig. 1, whereby the float and boat will be deflected downward and pass under any floating obstacle not severed by the guard.

The shell may be stiffened by any suitable means.

Provision is made for propelling the boat through the agency of electricity as the motive force, which is generated at the operating-station outside of the boat and conducted by a suitable conductor to an electric motor within the boat, by which motor a screw-propeller is actuated.

H indicates an electric motor located in and properly secured to the shell of the boat in a water-tight compartment. As I do not intend to limit myself to any particular form or construction of motor, I do not deem it necessary to give a detailed description of the same. Any of the common forms by which a driving-shaft can be continuously rotated may be employed. K is the propeller-shaft properly journaled in bearings in the boat, and K′ the propeller. The driving-shaft *h* in the motor is properly connected to the propeller-shaft, so that motion from the motor is communicated to the propeller.

At the operating-station, which may be on shore at some suitable point, are placed the generators of electricity, that for generating the main current being preferably a dynamo-machine driven by steam-power. That for generating the auxiliary current may be a battery. Such a station and electric generators on shore are intended to be indicated at W, Fig. 1.

G is an insulated wire cable, made of two separate wire conductors suitably insulated from each other, one of which is intended to conduct the main current that is employed as the motive power in propelling and steering the boat and firing the charge, and the other of which is intended to conduct the auxiliary current for actuating a relay in the boat to switch the main current through the steering-magnet.

w' and w^2, Fig. 1, are intended to represent, respectively, the dynamo for generating the main current and the battery for generating the auxiliary current, and V and V′ represent, respectively, the larger or main conductor and the smaller or auxiliary conductor branching from the cable to the two generators.

The cable is carried in an apartment in the boat, which is separated from the adjoining apartments by water-tight bulk-heads, and is wound in a coil therein. One end of the main conductor V of the cable is electrically connected to one of the poles of the dynamo, and the other end of the same with the motor in the boat. The cable may be wound in a coil in its apartment in the boat and paid out through an orifice in the bottom of the boat as the boat moves from the station. A return-wire may be employed; but preferably a short ground-wire, V^2, is used at the dynamo and the current grounded in the boat by simple connection to the shell, as at *v*. It may, if preferred, be carried in the float, and the on-board end led down through one of the stanchions, C, made hollow for the purpose, or it may be carried in an independent case attached to the boat; but I prefer to carry it in the boat itself, as described. A common switch may be used at the station to make and break electric connection between the dynamo and the boat.

A considerable power is required to propel the boat at the requisite speed. The carrying on board of a torpedo-boat of an electrical generator of sufficient capacity to generate the requisite electricity to practically propel the boat at the speed required in this class of boats is, in the nature of things, impracticable. However the size of the boat may be varied within the limits of size to which this class of boats is necessarily confined, there will still exist an impracticable disproportion between the tonnage or carrying capacity of the boat and the size and weight of the electrical apparatus. By locating the generating apparatus on shore, as described, the desired amount of electricity may be generated and applied as a motive force directly to the propelling of the boat and the operation continued any desired length of time without intermission or interruption, while both the generation of the force and its application are under the immediate control of the operator at the station.

The electrical apparatus in the boat for operating the steering mechanism is placed in the same circuit with that for propelling the boat, so that the same shore-dynamo generates electricity for both. To this end two independent horseshoe electro-magnets, I I′, are placed in the boat, the cores of which are arranged horizontally, with their poles looking toward the stern of the boat.

The magnets are respectively provided with armatures J J′, each consisting of a bar of iron extending across the poles of the magnet, with its ends extending beyond the magnet and fitted to slide in grooves *j* in the frame M, that is secured to the shell of the boat. The armatures are thus supported by the frame, and can slide freely back and forth in the said grooves.

Rigid iron connecting-rods *l l′* connect the armatures respectively to the ends of the tiller L, fixed on the rudder-post E′, the said rods being preferably provided with screw-swivels *m m′*, whereby the armatures may be adjusted to and from the poles of the magnets, thus regulating the extent of the movement of the tiller communicated to it from the armatures. It is evident that the rudder will be turned to "port" or "starboard" as one or the other of the said magnets is charged, and that when released from the magnets and the rudder is brought to "steady" or straight astern by the action of the water when under way, the armatures will be brought into the position shown in Fig. 2, that of the magnet

last charged being drawn away from it and the armature of the other magnet being pushed toward it, and to accomplish this movement the said connecting-rods must be rigid, as stated. Obviously flexible ropes or chains will not answer the purpose. These magnets may be placed in the same circuit with the propelling-motor, so as to be charged from the same shore generator, and provision is made for switching the current into one or the other magnet at pleasure by the operator at the station. For this purpose a suitable relay located in the boat is employed, placed in the circuit of an auxiliary generator, which circuit is formed by one of the conductors of the cable. Such a relay is shown in Fig. 4. This consists of a large permanent horseshoe-magnet, R, of which R' R² are the poles, an electro horseshoe-magnet, P, of which P' P² are the poles, the pole-pieces *a b*, pivoted, respectively, at one end to the poles of the permanent magnet, so as to be polarized thereby, and the contact-screws and the springs. (Shown in the drawings.) These pole-pieces extend inward toward each other between the cores of the electro-magnet P, and the springs *s s'* hold said pole-pieces *a b* in contact with the contact-screws *c* and *d*, respectively. When a current of electricity is sent through the magnet P, one of the pole-pieces is drawn away from the contact-screw with which it is held in contact, and if the current be reversed the other pole-piece is drawn away from the other contact-screw and the first resumes its original position by means of the spring *s* or *s'*, as the case may be.

The circuit-connections and operations of this relay are as follows: It being understood that the direction of the main current from the shore generator *w* is through ground to boat, thence to the propelling-motor, through the propelling-motor and relay to the on-board end of the main conductor of the cable, back to the shore generator through the cable, this circuit, when the pole-pieces *a b* of the steering-relay are both drawn into contact with the contact-screws *c d*, is from the shore generator through ground to shell of the boat; thence through the motor to binding-post 2 in the relay; thence through contact-screw *d*, pole-piece *b*, magnet R, pole-piece *a*, contact-screw *c*, to binding-post 1; thence to the main conductor in the cable, and through it to the shore generator. The circuit from the auxiliary generator through the relay is as follows: through earth to shell of boat; thence to binding-post 4 in relay; thence through coil of magnet P to binding-post 3, to the auxiliary conductor in the cable, and through it to the generator. A wire connection is established between binding-post 1 through the coil of the port steering-magnet I and binding-post 5 in the relay, (which is connected to the magnet R,) and from said binding post 5 through the coil of the starboard steering-magnet I' to binding-post 2 in the relay. Now, if it is desired to charge the starboard steering-magnet I', a current of electricity to deflect the bar *b* is sent to earth from the auxiliary battery, which reaches the shell of the boat, thence to binding-post 4 in the relay, thence to the electro-magnet P, (charging it,) that is provided with the pole-pieces P' P², thence through binding-post 3 to the auxiliary conductor in the cable, and back to the auxiliary battery, whereby the pole-piece *b* is drawn away from the contact-screw *d* toward the pole-piece P' of magnet P, thus breaking the main circuit between *b* and *d*. Then the main current from the dynamo-machine, to reach the pole-piece *a*, is diverted from post 2 through the coil of the starboard steering-magnet I', charging it; thence through post 5, permanent magnet R, pole-piece *a*, contact-screw *c*, post 1, to the main conductor in the cable, and thence back to the dynamo. To charge the port-magnet I a reversed current is sent through the auxiliary conductor, whereby the pole-piece *a* is drawn away from contact-screw *c*, when the current from the dynamo, unable to reach the contact-screw *c*, is diverted from the permanent magnet R to post 5 through the coil of the port steering-magnet I, thence to post 1 and the main conductor. Now it is evident that by means of the described steering-relay the main current, while continuing to pass uninterruptedly through the propelling-motor in the boat, may be deflected or shifted from one steering-magnet to the other for the steering of the boat by the reversal of the auxiliary current, which may be effected by a suitable switch in the auxiliary circuit, as at w^4, Fig. 1, at the shore station. I do not deem it necessary to describe or represent in the drawings the special construction of a reversing-switch suitable for the above-named purpose, the same being a well-known device, which any one skilled in the art can make and use for said purpose without special instructions.

The devices and arrangements for exploding the charge at the will of the operator are as follows: In the main circuit, between the steering-relay and the dynamo on shore, there is placed within the boat another relay, Fig. 5. This second relay consists of a horseshoe electro-magnet, O, and a permanent horseshoe-magnet, S, having a pole-piece, S', pivoted to one of its poles, S², so as to partake of its magnetism, the free end N of which extends inward between the poles *o' o²* of the magnet O, the contact screws *e* and *i*, and the spring s^3, which acts to hold the pole-piece S' in contact with the screw *i*, and out of contact with the screw *e*. The coil of the said electro-magnet is in the main circuit. This relay is also provided with binding-posts 6, 7, and 8, with electrical connection between 6 and 7 through the coil of the magnet O, and an electrical connection between the said coil of the magnet and the binding-post 8, through the contact-screw *e* and pole-piece S', (when the two are in contact,) and through the magnet S. An electrical conductor extends from the binding-post 8, through the fuse of the

charge F, to the shell of the boat, and so to ground. With line-connections thus established, and with the connection broken between the pole-piece S′ and the contact-screw *e*, the course of the current is from steering-relay to binding-post 6, through coil of electro-magnet O to binding-post 7, then to the main conductor in the cable. If, now, it is desired to explode the charge, the current from the dynamo-machine is reversed at the operating-station by means of a suitable switch. The consequent change of polarity in the magnet O then deflects the pole-piece S′ into contact with the screw *e* and establishes a branch circuit, by which a portion of the current will now pass from the coil of the electro-magnet O, through the contact-screw *e*, pole-piece S′, permanent magnet S, binding-post 8, the fuse of the charge, and the shell of the boat, to ground, and thereby explode the charge.

On the top of the float I secure rods A A′, provided with flags or disks at their upper ends, to serve as guides to the operator at the operating-station in directing the boat. These rods are hinged at their lower ends to the shell of the float, which is provided on its upper surface with hollows or depressions d^6 d', into which the rods and guides may each independently of the other be depressed when the rods are swung upon their hinges down upon the float. The hinges are so made that the rods may swing upward and forward to a perpendicular position, and no farther, and they are provided, respectively, with springs *r r′* at their lower ends, which act to hold them erect, but which will permit them to be depressed, and, when released from the depressing force, cause them to automatically resume their perpendicular position. By this arrangement, if an obstruction should pass over the float, the guides, instead of being broken away, as they would be if rigid, will swing down out of its way and then be automatically erected. I do not limit myself to the precise device described by which these guides are made depressible, and, when depressed, automatically return to an erect position. Any equivalent device may be used.

When the boat is made in detachable sections, I establish the necessary connection between the electrical wires of the several sections by the following device: At one end of the sections I connect the wire or wires with contact-pieces *f f′*, formed, preferably, of small brass plates inserted in or affixed to the outer face of the bulk-head, and if no bulk-head, then on the outer face of inward projections, f^2 f^3, from the shell of the boat. Said contact-pieces are suitably insulated from the bulk-head or the projections f^2 f^3. The required insulation may be effected by inserting between one or both of the contact-pieces *f f′* and the part to which they are attached a piece of rubber or other insulating material, as shown at f^4 f^5, Fig. 8, the said parts f^4 f^5 representing such insulating material. The wire conductors in the boat are cut into sections corresponding to the sections of the boat, and the ends of the several sections of wire are severally connected to the said contact-pieces *f f′*. Then a spring, *g*, is connected to one of the contact-pieces, *f*, and is so formed and placed that when the sections of the boat are put together said spring will make contact with the opposite contact-piece. It will thus be seen that a continuous circuit may be thereby established throughout the boat, and yet the sections of the boat may be taken apart without disturbing the line-wires.

The stanchions by which the boat is connected with the float, as well as the guards, are detachable, and the float may also be constructed in detachable sections for convenience in storing or transportation.

I have now described and represented in my drawings an apparatus by which a torpedo-boat may be propelled and steered by a motive power derived from electricity that is produced by a generator located at a station on shore or other place outside of the boat, and conducted to the boat by a single main conductor, at which station the generation of the electricity and its application to such propulsion and steering is under the immediate supervision and control of the operator; but I do not intend to be limited to the precise apparatus described. This may, in many respects, be varied without departing from the spirit of my invention as above defined. For example, a separate generator and separate conductor may be employed to generate and conduct the electricity for actuating the steering-magnets, in which case a suitable relay in the boat is to be employed in this separate circuit to switch the current from one magnet to the other at the pleasure of the operator; or a separate generator and conductor for each of the steering-magnets, or a single separate generator with two separate conductors branching at the station therefrom, may be employed.

In Fig. 6 the line-wires are shown as running outside of the shell of the boat. They are thus shown only for convenience of representation. In practice they are, of course, within the shell.

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

1. The combination, with the described torpedo-boat, provided with a screw-propeller and an electromotor therein, connected to said propeller, so as to communicate motion thereto, of a generator of electricity located outside of said boat and electrically connected by a suitable conductor with said electric motor, arranged in said boat to be paid out therefrom as the boat moves from the generator, whereby the force employed as the propelling-power may be derived from electricity generated outside of said boat and applied to actuate said propelling electric motor within said boat, all as and for the purpose described.

2. The combination, with the described torpedo-boat and an electric generator stationed outside of said boat, electrically connected

therewith by an electric conductor arranged to be paid out from the boat as the same moves away from the generator, of the described steering mechanism and the electro-magnets I I′, provided with armatures J J′, by the movements of which the said steering mechanism is actuated, all as and for the purpose described.

3. The combination, with the described main and auxiliary electric circuits, the main and auxiliary electric generators located at the operating-station outside of the boat, and the described propelling-motor and steering-magnets, of the described steering-relay, electrically connected to the auxiliary generator and in the circuit of the main generator, between the said motor and steering-magnets, together with the described accessory devices, whereby the main current, after passing through said motor, may, by means of the auxiliary current, be switched through either of the steering-magnets at the option of the operator, all as specified.

4. The combination, in a torpedo-boat, with the main conductor therein leading from a generator located at a station outside of the boat, and with a branch of said conductor leading to the explosive charge in the boat, of a relay in the circuit formed by said main and branch conductors, together with the described accessory devices in said relay, whereby, when the current through said main conductor is reversed, it is switched through said branch conductor to the explosive charge, all as and for the purpose described.

5. The combination, in the described torpedo-boat, of the two independent magnets I I′, the rudder E, tiller L, armatures J J′, arranged to slide in ways *j*, and the rigid tiller-rods *l l′*, as and for the purpose described.

6. The combination, in the described torpedo-boat, of the rudder E, tiller L, magnets I I′, and rigid connecting-rods *l l′*, provided with the adjusting screw-swivels *m m′*, as and for the purpose described.

7. The combination, with the described boat and float, of a guard secured to and extending between their bow ends, and inclining rearward from the boat to the float, for the purpose of causing the boat and float, when under way, to be deflected downward and pass under a floating obstruction, as described.

8. The combination, with the described boat and float, of a guard secured to and extending between their bow ends, and made sharp-edged in front, for the purpose of severing floating obstructions, as described.

9. The combination, with the described boat and float, of the guard D′, secured to and extending between the stern ends of the boat and float, and inclining rearward from the float to the boat, for the purpose of guarding the rudder of the boat from contact with any object that may pass over the float, as described.

10. The combination, with the described sections of a torpedo-boat, of the described sections of the line-wire electrical conductor therein, the insulated contact-plates *f f′*, and springs *g*, as and for the purpose described.

11. The combination, with the float B, provided with the hollows or depressions d^6 d^7, of the sight-rods A A′, one or more, hinged to the said float so as to be depressible into the said hollows, and provided with the described springs, which act to maintain the said rods yieldingly in an erect position, as and for the purpose described.

12. An electrically-propelled submarine torpedo-boat composed of detachable sections containing an electrical propelling apparatus in the circuit of an electrical generator, and a portion of the electrical conductor for transmitting the actuating electrical current through the boat and said apparatus, as and for the purpose described.

13. An electrically-propelled submarine torpedo-boat composed of detachable sections containing electrical propelling apparatus, each of two or more sections of the boat containing a detachable section of the electrical conductor, by which the propelling current is transmitted through the boat and said apparatus, whereby, upon detaching the sections of the boat, the said sections of the conductor may be detached.

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