No. 661,520. Patented Nov. 13, 1900.

# C. D. HASKINS.

## AUTOMATIC STEERING DEVICE FOR TORPEDOES.

(Application filed Aug. 2, 1897. Renewed Apr. 12, 1900.)

(No Model.)

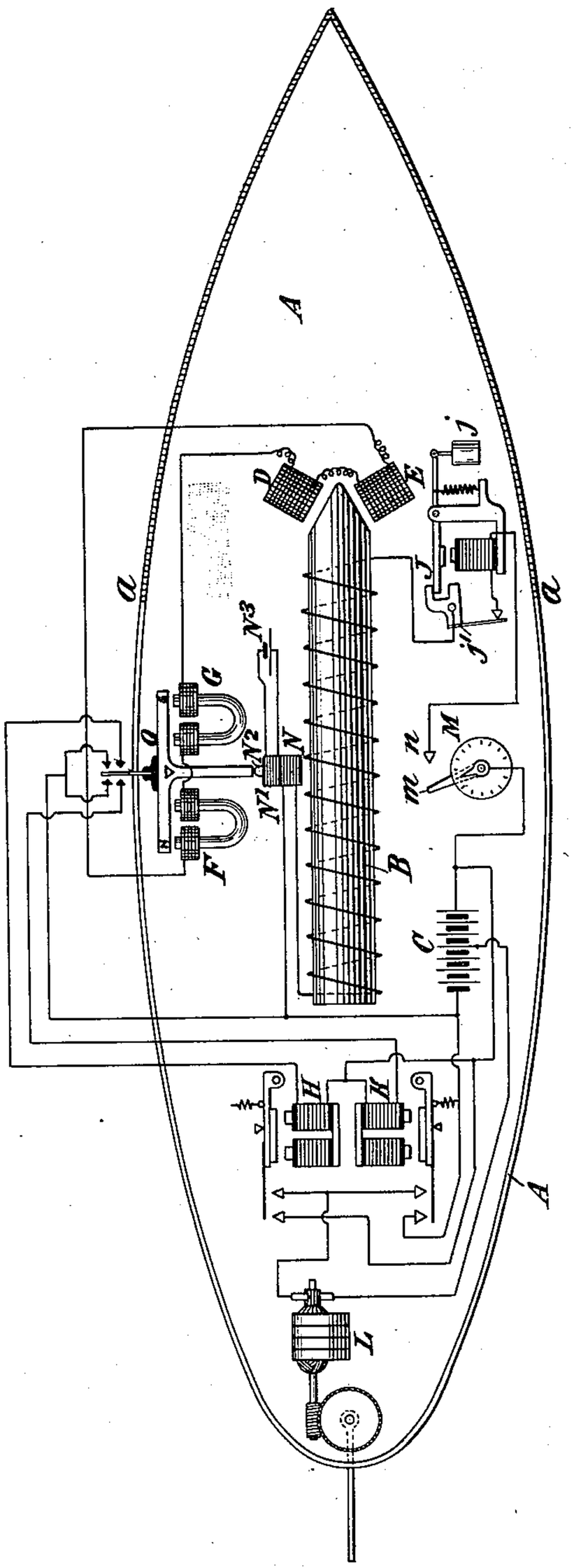


Fig. 1

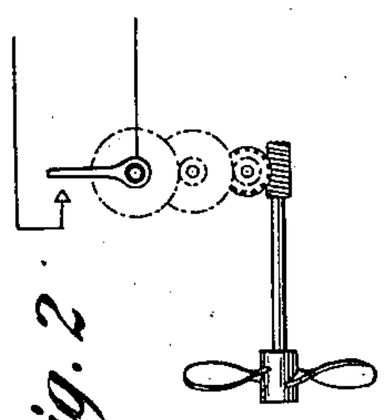

Fig. 2

Witnesses:
Raphael Netter
L. T. Shaw

Caryl D. Haskins, Inventor.
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# UNITED STATES PATENT OFFICE.

CARYL D. HASKINS, OF NEWTON, MASSACHUSETTS.

## AUTOMATIC STEERING DEVICE FOR TORPEDOES.

SPECIFICATION forming part of Letters Patent No. 661,520, dated November 13, 1900.

Application filed August 2, 1897. Renewed April 12, 1900. Serial No. 12,634. (No model.)

*To all whom it may concern:*

Be it known that I, CARYL D. HASKINS, residing at Newton, county of Middlesex, State of Massachusetts, have invented certain new and useful Improvements in Automatic Steering Devices for Torpedoes, of which the following is a specification.

My invention relates to automatic steering devices for torpedoes; and it consists in means for controlling the rudder of the torpedo by a magnetic device subject to the determining influence of the vessel or other object at which the torpedo may be aimed.

It further consists of detailed devices for carrying out the purpose indicated, including a differential induction-balance and also a timing device for bringing the apparatus into action only after such a lapse of time as will allow the torpedo to pass out of the range of magnetic influence of the discharging vessel or station and come into the range of magnetic influence of the ship or other object aimed at or attacked.

My invention is illustrated in the accompanying drawings, which show in diagram Figure 1 a plan of a torpedo provided with my automatic steering apparatus, and in Fig. 2 a modified form of timed circuit-closer.

Referring to the drawings, A represents the shell of the torpedo, which is understood to be provided with any desired form of propelling-motor—such, for instance, as a compressed-air motor—or which may even be projected by an explosive or by compressed air toward the object of attack. The shell may be of steel or iron from the stern up to the points *a a*, and from thence to the bow it is of brass or other non-magnetic material.

In the center of the vessel and parallel to its longitudinal axis I place a bar of iron B, which is to be intermittently magnetized—beginning at a definite time after starting of the torpedo—by means of a rheotome and an electric circuit derived from the terminals of a battery C. Adjacent to one end of the bar B and on opposite sides of the central line of the torpedo are placed two differential coils D and E, of exactly equal capacity, arranged in inductive relation to the bar B. It will be apparent that so long as there is no external disturbing magnetic influence the field of magnet B will be symmetrical and the inductive effect of the bar B will be exactly equal upon the two coils D and E, so that the coils will counterbalance each other and no current will be produced therein. In the event, however, of some magnetizing-body, like an iron ship, being present in the neighborhood of the torpedo such magnetic mass will disturb the symmetry of the magnetic circuit of bar B and decrease the resistance of the circuit upon one side or the other, so as to produce a preponderance of inductive influence on one or the other of the coils D E. There will then be an induced current in the circuit of the coils which will be in one direction or the other, according to the side upon which the external magnetic mass exerts its influence, and this current will energize one or the other of the magnets F and G of a peculiarly-sensitive polarized relay and cause the relay to close the circuit of one or the other of the magnets H and K, which in turn will send a battery-current into the rudder-motor L in one direction or the other, respectively. M is a timed circuit-closer controlling the circuit of the determining-magnet B.

Taking up in detail the apparatus which I have just described in general terms, the battery C may be a large one, capable of supplying current for all of the different circuits, or the said circuits may each have an individual battery. The timing device M may be of any description—such, for instance, as a clock-movement—which at a definite time will bring the pointer *m* into contact with the point *n* and close the circuit through magnet B, or it may be operated by the propelling-motor of the torpedo, as indicated in Fig. 2, so as to close the circuit after the propeller has made a definite number of revolutions; but any equivalent device may be used which will insure the closing of the circuit at a definite time or distance after the torpedo starts.

The rheotome consists, as usual, of a magnet arranged to break its own circuit at rapidly-succeeding periods. I provide, however, that the closed-circuit periods shall be longer than the open-circuit ones. To accomplish this, the armature of the magnet J is retarded in its movement to the magnet-pole by means of dash-pot *j*. The end of this armature plays between two extensions on the shorter

arm of the contact-lever *j*. By this means the circuit will remain closed during the downward excursion of the armature, which will take place slowly, and will be opened during the upward excursion, which will take place rapidly.

The circuit from battery C passes through the timed circuit-closer, thence through the rheotome, thence through the coils surrounding the main-bar magnet B, thence through the lower coil N of magnet $N^2$, and back to the battery. The magnet B is intermittently energized by the current impulses sent through it. At one end and close to the poles of the magnet are two coils D and E, which, as already stated, are oppositely wound, so as to be affected equally and oppositely by the normal inductive influence of magnet B. The circuit of these coils passes in series through the polarized relay-coils G and F and is then closed on itself.

The armature of the relay-magnets F and G is a permanent magnet O, and it is normally held in a central position by means of inagnet $N^2$, which is permanently energized by a small battery $N^3$, whose current passes through the coil N'. This method of retaining armature O in its normal central position is employed in preference to a spring for two reasons: First, it is capable of much finer adjustment, and, second, its retaining effect decreases as its armature is moved away, while the effect of a spring, on the contrary, would tend to increase. The retaining effect of magnet $N^2$ is strongly increased and its armature held firmly in position by the effect of coil N each time that the circuit of magnet B is closed, and this additional retaining force is removed each time that the circuit of magnet B is opened, this being the moment when the inductive effect of the said magnet on the coils E and D is designed to be exerted. The armature O is instantly drawn back by the strong current through coil N whenever the rheotome again closes the circuit of magnet B. It is obvious that owing to the mechanical vibration to which the entire mechanism is subject, and owing also to the fact that this mechanism is inclosed within a torpedo which must be capable of operating in a heavy sea, a comparatively weak balancing and retaining force through the coil $N^2$ $N^2$ would not be sufficient to retain the armature in its normal position for more than a brief period; but it is held firmly by the action of the strong coil N of magnet $N^2$.

If the magnetic balance is disturbed by the presence of an external magnetic mass, there will be generated by induction an impulse in the coils D or the coil E which will preponderate over the similar induced current in the other coil, according to the location of the disturbing mass. This will send a current in one direction or the other through the polarized relay-coils and throw the armature O to one side or the other, it being unlocked simultaneously by the opening of the circuit of coil N by the rheotome. The magnet O will close a branch circuit from battery C through the relay-magnet H or K, which in turn will operate to send current from the battery through the rudder-motor L in one direction or the other, and thus steer the torpedo in the proper direction, with its bow pointed toward the magnetic mass forming the object of attack. Any deviation from this course will be instantly corrected by the differential action just described. This apparatus is extremely delicate, and a very slight induced current will operate the polarized armature O, which is set on fine bearings. The magnet B and the induction apparatus, which operates to control the rudder or other steering apparatus, may be designated as a "magnetic determining device," whose action is controlled by the magnetic mass of the object to be attacked. I would also observe that the magnetic circuit of magnet B may be formed in part by the magnetic part of the torpedo-shell—that is, the part in the rear of the points *a a*—and, if desired, the rear end of magnet B may be positively connected magnetically with the iron portion of the shell at its rear end, its forward end being of course left free, so that the coils D and E may come in the line of the said magnetic circuit. It will be understood, however, that in no case should the amount of iron present in the shell of the torpedo or its relation to the magnet B be such as to interfere with the effect of the object aimed at in disturbing the inductive balance between coils D and E, this being a matter of adjustment and proportions, to be determined in each case by the particular conditions presented.

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

1. The combination with a torpedo of steering apparatus therefor and a magnetic determining device for said apparatus controlled in its action by the magnetic mass of the object to be attacked.

2. The combination with a torpedo of steering apparatus therefor comprising an operating electric motor and a magnetic determining device in the circuit of said motor, controlled in its action by the magnetic mass of the object to be attacked.

3. The combination with a torpedo of steering apparatus therefor, an electric motor for said apparatus, a circuit for said motor, a determining device for the said circuit, controlled by the magnetic mass of the object to be attacked, and a timing device governing the action of said determining device.

4. The combination with a torpedo of steering apparatus therefor, an electric motor for operating it, a double circuit for the motor, a double-circuit closer in said circuit and a magnetic determining device controlled by the magnetic mass of the object to be attacked.

5. The combination in a torpedo, of steering apparatus, a magnetic determining device therefor controlled in its action by the

magnetic mass of the object to be attacked, and a non-magnetic casing inclosing the said determining device.

6. The combination with a torpedo, of steering apparatus therefor and a magnetic determining device for said apparatus, having included in its magnetic circuit the shell or casing of the torpedo composed of magnetic material and controlled in its action by the magnetic mass of the object to be attacked.

7. The combination with a torpedo having a shell composed partly of magnetic and partly of non-magnetic material, of steering apparatus therefor and a magnetic determining device for said apparatus, including in its magnetic circuit the magnetic portion of the casing or shell and controlled in its action by the magnetic mass of the object to be attacked.

8. The combination with a torpedo, of an intermittently-energized magnet, differential inductive devices placed symmetrically in the field of the said magnet, so as to become active when the said field is disturbed by the magnetic mass of an object to be attacked, and steering apparatus for the torpedo controlled by the said inductive devices.

9. The combination with a torpedo, of a magnet therein intermittently energized, differential induction-coils in the field of said magnet, a polarized relay in the circuit of said coils, and a steering apparatus for the torpedo controlled by the said relay when energized by a differential current in the said coils, arising when the magnetic circuit of the magnet aforesaid is disturbed by the magnetic mass of the object to be attacked.

10. The combination with a torpedo, of steering apparatus therefor and a magnetic determining device for said apparatus controlled in its action by the magnetic mass of the object to be attacked and consisting of a magnet intermittently energized from a source of current beginning at a definite time or distance after starting, and having in its magnetic field opposing coils located one on each side of the longitudinal axis of the torpedo, so as to be affected differentially by the induction of the magnet aforesaid when its magnetic circuit is disturbed by the magnetic mass of the object to be attacked and including in their circuit a polarized relay controlling the steering apparatus.

In witness whereof I have hereunto set my hand this 21st day of July, 1897.

CARYL D. HASKINS.

Witnesses:

GERTRUDE M. BALL,

FRED. M. KINCHAY.