W. DIETER.

RECORDING DEVICE FOR TORPEDO LAUNCHING TUBES.

APPLICATION FILED DEC. 31, 1921.

1,430,800.

Patented Oct. 3, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

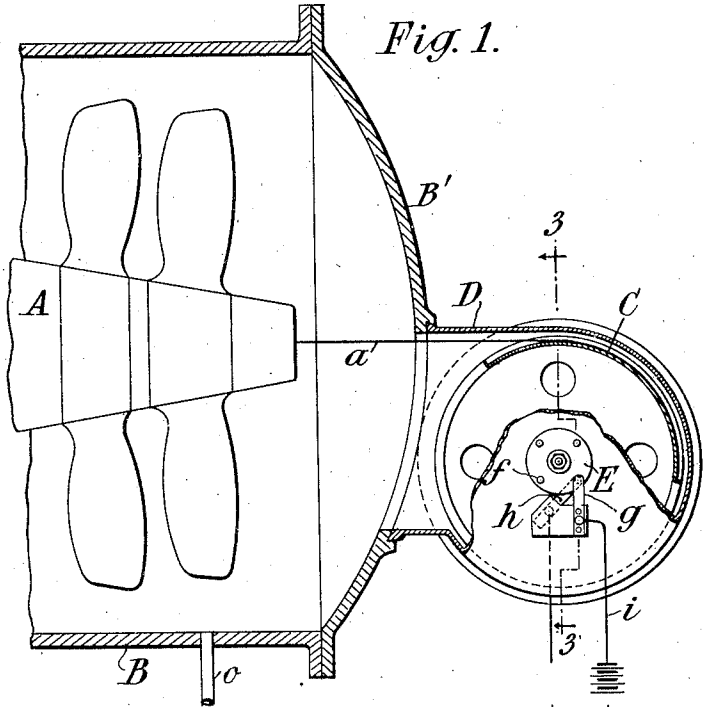


Fig. 3.

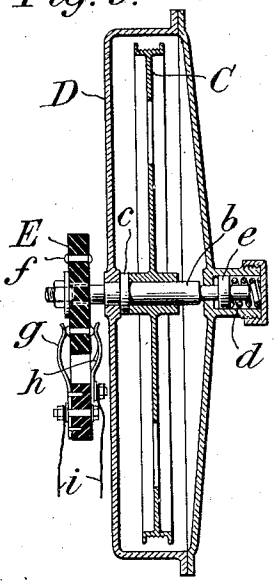


Fig. 2.

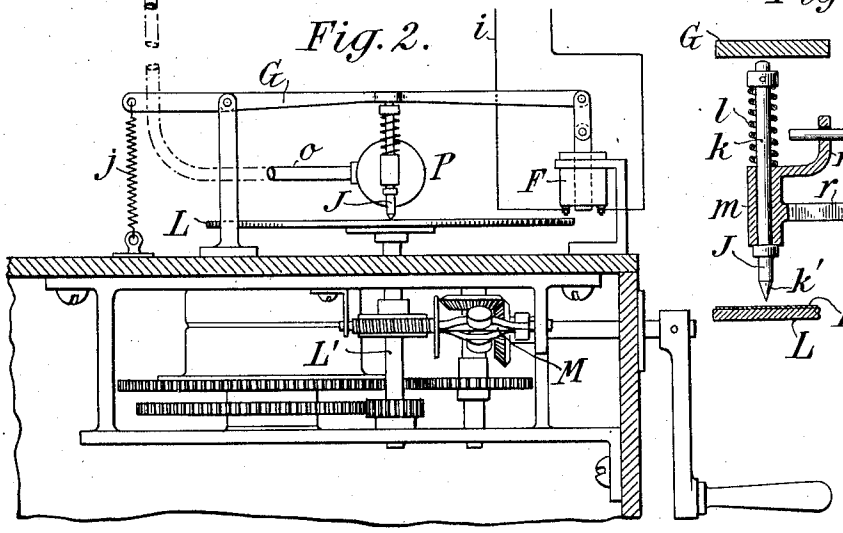


Fig. 5.

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2 SHEETS—SHEET 2.

Fig. 4.

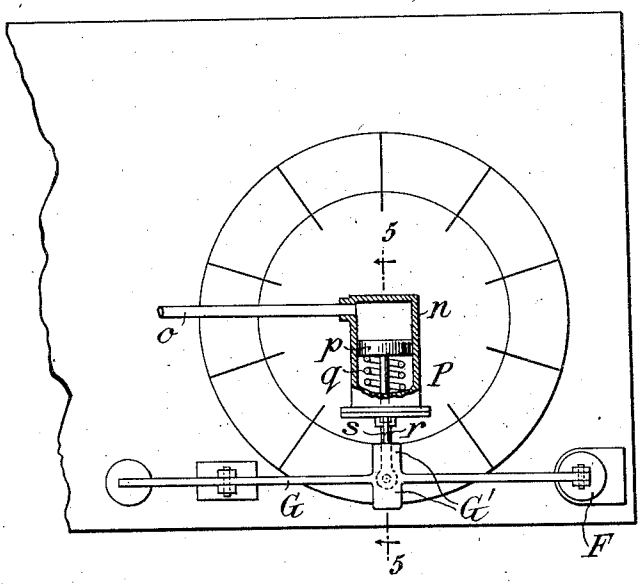
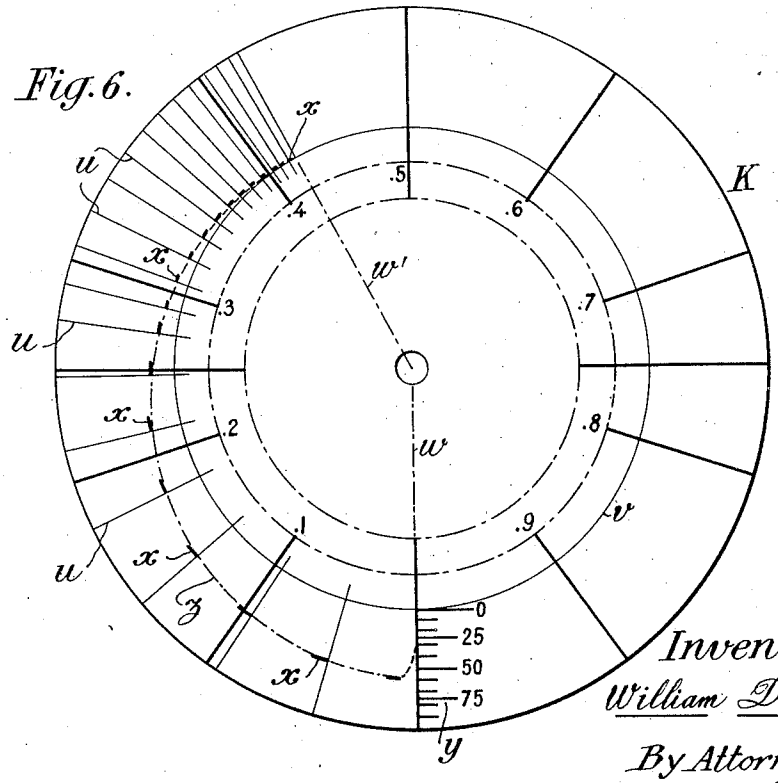


Fig. 6.



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Patented Oct. 3, 1922. 1,430,800

UNITED STATES PATENT OFFICE.

WILLIAM DIETER, OF NEWARK, NEW JERSEY, ASSIGNOR TO VITTLEA DEVELOPMENT CORPORATION, A CORPORATION OF DELAWARE.

RECORDING DEVICE FOR TORPEDO-LAUNCHING TUBES.

Application filed December 31, 1921. Serial No. 526,331.

To all whom it may concern:

Be it known that I, WILLIAM DIETER, a citizen of the United States of America, residing in Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Recording Devices for Torpedo-Launching Tubes, of which the following is a specification.

In launching torpedoes it is desirable, especially on submarines, to be able to determine and record the speed of movement of the torpedo through the launching tube, and also to be able to record the variations in pressure of the compressed air or other gas introduced into the tube to expel the torpedo. In the case of compressed air launching on a submarine, it is desirable to economize the compressed air, and a proper record of the variations of air pressure during the launching movement will enable an air-stop to be adjusted for shutting off the compressed air from the launching tube at the precise instant in the launching movement when further air is no longer needed to complete the launching.

The present invention provides a suitable means for accomplishing these objects. For this purpose a moving part is provided which is so connected with the torpedo as to move at a rate proportional to the movement of the torpedo during launching. A circuit closer is provided, to be operated at successive points in the movement of the torpedo, and which operates an electrically-actuated marker which makes successive marks on a record sheet which is driven at a uniform speed. A pressure-responsive device is also provided, which is connected to the breech portion of the launching tube so as to respond to the varying pressures therein, and this device controls a marker which marks upon a record sheet (preferably the same record sheet) a mark or marks which afford a record of the pressure variations during the period of launching. In the preferred embodiment a slender wire is attached to the tail of the torpedo aft the propellers, and this wire is wound upon a drum or reel which is contained in a chamber connected to the breech of the launching tube, so that as the torpedo moves out of the tube it unwinds the wire from this reel and consequently rotates the latter; and attached to the reel is a disk carrying the circuit-closing contacts. The record sheet is preferably circular and carried upon a rotary platen or turn-table which may be identical with those used in phonographs or talking machines. Preferably one marker is used for both records, the electric actuating device being a solenoid or electromagnet which at each closure of the circuit presses the marker instantaneously against the record sheet so as to mark a dot or dash thereon; and the marker is carried by the pressure-responsive device, which moves it radially of the record sheet according to variations in pressure, so that the radial position of each mark on the sheet indicates the pressure existing in the launching tube at that instant. The time element is determined by the speed of rotation of the platen carrying the record sheet, which may, for example, be adjusted to turn at 60 R. P. M., so as to make one revolution per second. The result is a record formed of a succession of dots or dashes, the angular spacing between which is determined by the successive positions of the torpedo in its movement through the tube, and the radial positions of which are determined by the gaseous pressure in the tube at such successive positions of the torpedo. The latter record affords a pressure curve, and the former gives the data from which a velocity or acceleration curve may readily be plotted. Thus the precise conditions of the launching operation are recorded in a manner which affords a useful guide for the officers directing the firing of torpedoes.

The present invention readily lends itself to use in connection with a torpedo finder according to the means set forth in my Patent No. 1,319,051, dated October 21, 1919, where a wire attached to the tail of the torpedo is initially wound on a drum, and unwinds therefrom during launching, and when fully unwound carries with it a buoy which is thus towed astern of the torpedo, and at the end of the run of the latter floats to the surface and indicates its position.

The preferred construction is shown in the accompanying drawings, wherein,—

Figure 1 is a fragmentary longitudinal mid-section of the breech portion of a launching tube to which the apparatus of the present invention is applied;

Fig. 2 is a vertical section of the recording mechanism illustrating suitable connections with the elements of Fig. 1, so that

the two figures together show the entire apparatus;

Fig. 3 is a vertical section of the reel or drum, and its appurtenant parts, on the line 3—3 in Fig. 1;

Fig. 4 is a plan of the recording mechanism shown in Fig. 2;

Fig. 5 is a fragmentary vertical section on the line 5—5 in Fig. 4, showing a suitable construction of marker;

Fig. 6 is a plan of a record sheet or disk.

Referring first to Fig. 1, A is the tail portion of a torpedo, and B is the launching tube, with its breech door B′. Attached to the tail portion of the torpedo in any suitable way (as by the means shown in said Patent No. 1,319,051) is a small flexible wire *a* which is wound on a drum or reel C enclosed in a casing D which is mounted in water and gas-tight manner upon the breech door B′. As shown in Fig. 2, the drum C is mounted on a spindle *b* which emerges from the casing D by a substantially water-tight and gas-tight joint, and carries on its outer end a disk E which carries the circuit closer to be described. To make a tight joint where this spindle emerges, it is desirable to form it with a collar *c* which is pressed against the margin of the opening in the casing by the action of a spring *d* mounted in a closed chamber and pressing upon a shoulder or collar *e* formed on the spindle.

The drum C is most conveniently made of such size that its circumference corresponds to some convenient unit of linear measurement, as, for example, the foot, yard or meter, so that as the torpedo moves, the drum will be turned by a pull of the wire at a circumferential rate equal to the movement of the torpedo, and at an angular rate corresponding to the linear unit chosen, or to fixed multiples or fractions thereof. For example, let it be assumed that the circumference of the drum equals two feet, and that it is desired to record each successive six inches in the travel of the torpedo; in such case the drum and the disk E will make one-half turn, or 180°, to each foot of travel of the torpedo, and by arranging the disk E as a circuit closer to close the circuit four times to each revolution, the successive closures will correspond to successive points in the travel of the torpedo spaced six inches apart.

A convenient form of circuit closer is that shown, wherein the disk E is of insulating material and carries four conducting pins *f* located 90° apart, their projecting ends or heads arranged to make simultaneous contact at opposite ends with springs *g h* connected to circuit wires *i* of a complete circuit, which is shown diagrammatically in Figs. 1 and 2, and which includes an electromagnet or solenoid F at the recording instrument. The circuit *i* being energized by a battery or other suitable source of electricity, the solenoid is excited at each circuit closure; that is to say, as each pin *f* bridges the two contact springs *g h*.

Referring to Fig. 2, the core of the solenoid F is connected to one end of a lever arm G which receives the contrary stress of a retracting spring *j*, and which at a suitable point is arranged to operate a marker J. This marker is best shown in Fig. 5, and may consist of an upright bar *k* pressed up by a spring *l*, so that its marking point *k′* (which may be a scribe, pencil, or pen, as desired) is normally out of contact with the record sheet K, which is supported and carried by the revolving platen or turn-table L. When the solenoid is excited it pulls down the lever G and strikes the top of the bar *k* and presses it down, so that its marking end shall engage and mark the record. The bar *k* is shown as sliding freely in a guiding sleeve *m*. In this manner, at each measured point in the advance of the torpedo, say, for example, every six inches, the marker is caused to descend upon and mark the paper record. These marks are shown in Fig. 6 at *x x*, and may constitute a dot or dash, according to the duration of the electric impulse.

The mechanism shown generally in Fig. 2 for rotating the record carrier or turn-table L, is or may be the same as that used with any standard construction of phonograph or talking machine. Such constructions are too well known to require description, it being understood that the mechanism shown is spring-driven, the spring being wound up by a crank as usual, and the spring pressure exerted through a train to drive at high speed the spindle L′ carrying the turn-table L, the speed of which is controlled by a governor M in the usual and well understood manner, this governor being adjustable in any customary way (not shown) for bringing the platen L to a prescribed speed. For the purpose of the present invention it is most convenient to have the turn-table driven at 60 R. P. M. in order to make one revolution per second. The adjustment to this speed should be made or verified shortly before each firing operation, as upon this adjustment depends the timing accuracy of the record to be made.

For recording the pressures used in launching, a pressure-responsive device P analogous to a pressure gauge is employed. As a suitable example, there is shown in Fig. 4 a cylinder and piston, the latter being pressed in one direction by a spring, and in the contrary direction by the gaseous pressure. For this purpose the cylinder *n*, which is mounted on any suitable support, is connected by a pipe *o* to the breech portion of the launching tube; the piston *p* is pressed by a spring *q* which may be adjustable in

any known manner, and a piston rod r is carried out through the head of the cylinder and carries on its end a suitable pressure marker. This marker is preferably the same marker J for marking space intervals, but might be a separate marker if preferred. In order to use one marker for both purposes, the sleeve m carrying the bar k is mounted on or otherwise connected to the outer end of the piston rod r, as shown in Fig. 5. To keep the bar k upright, the sleeve m may be guided in any suitable way, as by making the the rod r square, or by forming the sleeve with a guiding arm m' sliding on a guide pin s. When the torpedo is fired, the compressed air or other gaseous fluid which is introduced into the launching tube communicates its pressure through the tube o to the cylinder n and presses against the piston p, thus displacing it to a greater or less extent against the resistance of the spring q, and consequently communicating a like movement to the marker. The pressure-responsive device should be mounted to move the marker in a direction radially of the record K, so that the extent of movement of the marker from a zero position will correspond to the pressure in the launching tube. The record may be graduated or calibrated to indicate these pressures, as, for example, by the graduations shown at y in Fig. 6, where the numbers 25, 50, 75, may indicate pounds per square inch. In the precise construction shown the marker J, instead of marking a continuous line or curve as the piston moves under varying pressures, marks a succession of dots or dashes x x, the radial position of which indicates the pressure at the corresponding instant, according to the graduations y. For this purpose the marks x may be connected by tracing a line or curve z on the record, as shown in Fig. 6, which thus constitutes the pressure curve. The movements of the marker under varying pressures are frictionless, since normally its marking point k' is lifted from the record, and its upper end is out of contact with the lever G. This lever is widened at G' (Fig. 4) sufficiently to cover the entire radial path of the upper end of the bar k, so that in any position of this bar the downward movement of the lever will cause it to strike and depress the bar and mark the requisite dot or dash.

The record K is, as shown in Fig. 6, preferably graduated to indicate fractions of a second, the radial lines marked .1, .2, .3 etc. in the illustration, indicating tenths of a second. The record may be marked with concentric circles indicating pressures, the circle v indicating zero pressure. After each launching the record sheet may be taken off and radial lines u u drawn through the dots or dashes x, the distance between these lines indicating the time in which the torpedo passed through successive space units (six inch spaces in the example selected). From this indication an acceleration curve may readily be plotted.

The duration of launching is indicated by the successive dots x reaching coincidence with the zero curve v, resulting from the fall of pressure in the launching tube to zero at the instant of the emergence of the torpedo. In the case of a submerged launching tube, this zero pressure would correspond to the hydrostatic pressure determined by the depth of immersion; and this may be indicated as an absolute pressure or a relative pressure, according to the connection of the pressure-responsive device, as is well understood.

In the example shown in Fig. 6 the launching pressure was 60 pounds at its maximum, and diminished gradually to zero; and the period of launching was 0.425 second, approximately, being the time period between the radial lines w w'.

It will be understood that the drum continues to turn as long as the wire is reeling off from it; the wire may be made of varying lengths, according to the desired conditions. If a torpedo finder is desired, the construction will be modified according to the showing in my said Patent No. 1,319,051, so that the wire, on finally reeling off from the drum, will carry on its end a suitable buoy. To prevent any slip between the wire and drum in reeling off, the end of the wire may carry a bead or projection, as shown in said patent, which may be seated in a notch in the drum.

The mechanical construction of the mechanism may be suitably varied according to circumstances, whereby to adapt it for any given conditions or any desired modification in the form or character of record to be made. While an electric communication between the space-responsive element and the marker is preferred, yet any equivalent means may be substituted. The pressure-responsive device may also be differently constructed from that shown, any known means for registering pressures being available for the purpose.

It will be understood that, with reference to Fig. 6, the marks x x upon the record sheet may commence at any point in the rotation of the sheet, such point being indicated by the line w. The scale or graduations indicated at y may be at any suitable point on the sheet itself, or at successive points, or may be in the form of concentric circles, or may be marked upon a transparent disk which is to be laid over the record sheet for reading the record. Equally, the radial marks indicating fractions of a second (.1, .2, etc.) may be marked upon the sheet itself or upon such a transparent sheet. The advantage in the use of a transparent

sheet is that the radial mark corresponding to zero may be brought to the actual starting point of the curve traced by the dots *x x*.

What I claim is:—

1. The combination with a torpedo tube of recording means comprising a sheet carrier having means for moving a record sheet at a determined speed, a marker and marker-operating means responding to movement of the torpedo in the tube for operating said marker to record on the sheet successive positions of the torpedo during launching.

2. The combination with a torpedo tube of recording means comprising a sheet carrier having means for moving a record sheet at a determined speed, a marker, and marker-operating means responding to movement of the torpedo in the tube, operative at successive points in the movement of the torpedo for operating said marker to record on the sheet the positions of the torpedo at such successive points.

3. The combination with a torpedo tube of recording means comprising a sheet carrier having means for moving a record sheet at a determined speed, a marker, and marker-operating means responding to movement of the torpedo in the tube, comprising a drum and a wire wound thereon and connected to the torpedo, and means for actuating said marker at successive points in the rotation of said drum.

4. The combination with a torpedo tube of recording means, comprising means for moving a record sheet at a determined speed, a marker movable against said sheet, and means responding to movement of the torpedo in the tube operative at successive points in such movement to communicate motion to the marker to record on the sheet the respective positions in the advance of the torpedo during launching.

5. The combination of claim 1, the marker being electrically operated, a circuit closer controlled by said marker-operating means, and a connecting circuit.

6. The combination of claim 1, the sheet carrier being a revolving support, the marker movable against the sheet on said carrier, and the marker-operating means adapted to communicate movements to the marker at successive points in the advance of the torpedo during launching.

7. The combination with a torpedo tube of a casing applied to the breech door thereof, a drum in said casing, a wire wound on said drum and connected to the torpedo to revolve the drum during the launching movement, a controlling part connected to and driven by said drum, and recording means operated from said controlling part.

8. The combination of claim 1, the marker comprising a longitudinally-movable bar normally out of contact with the record sheet, and the marker-operating means movable to displace said bar into contact with said sheet.

9. The combination with a torpedo tube of recording means comprising means for moving a record sheet at a determined absolute speed, a marker, and pressure-responsive means connected with the launching tube and adapted to operate said marker during the launching movement to record on the sheet successive pressures in the launching tube during launching.

10. The combination of claim 9, the marker being normally inoperative, and means for actuating it intermittently during the launching movement to mark successive pressures on the sheet.

11. The combination with a torpedo tube of recording means comprising a sheet carrier having means for moving a record sheet at a determined absolute speed, means responding to movement of the torpedo in the tube adapted to record such movement on said sheet by successive marks at intervals corresponding to successive points traversed by the torpedo in its progress, and pressure-responsive means connected with the launching tube and adapted to record on said sheet the successive pressures in the launching tube during launching.

12. The combination with a torpedo tube of recording means comprising a revolving circular sheet carrier having means for rotating it at a determined speed, means responding to movement of the torpedo in the tube adapted to record such movement by successive marks upon said sheet angularly spaced in accordance with the successive positions of the torpedo during launching, and pressure-responsive means connected with the launching tube and adapted to record pressures on said sheet by movements in directions radially thereof.

13. The combination with a torpedo tube of recording means comprising a revolving sheet carrier having means for moving it at a determined speed, a marker, means responding to movement of the torpedo in the tube adapted to operate said marker at successive points traversed by the torpedo during launching, and pressure-responsive means connected with said marker to displace it relatively to the sheet, said means connected with the launching tube and adapted to record on the sheet the successive pressures in said tube during launching, whereby a single marker records both the movements of the torpedo and the pressures in the tube.

In witness whereof, I have hereunto signed my name.

WILLIAM DIETER.