H. W. SHONNARD.

METHOD OF FIRE CONTROL FOR TORPEDOES.

APPLICATION FILED APR. 19, 1912.

1,035,647.

Patented Aug. 13, 1912.

4 SHEETS—SHEET 1.

Fig. 1.

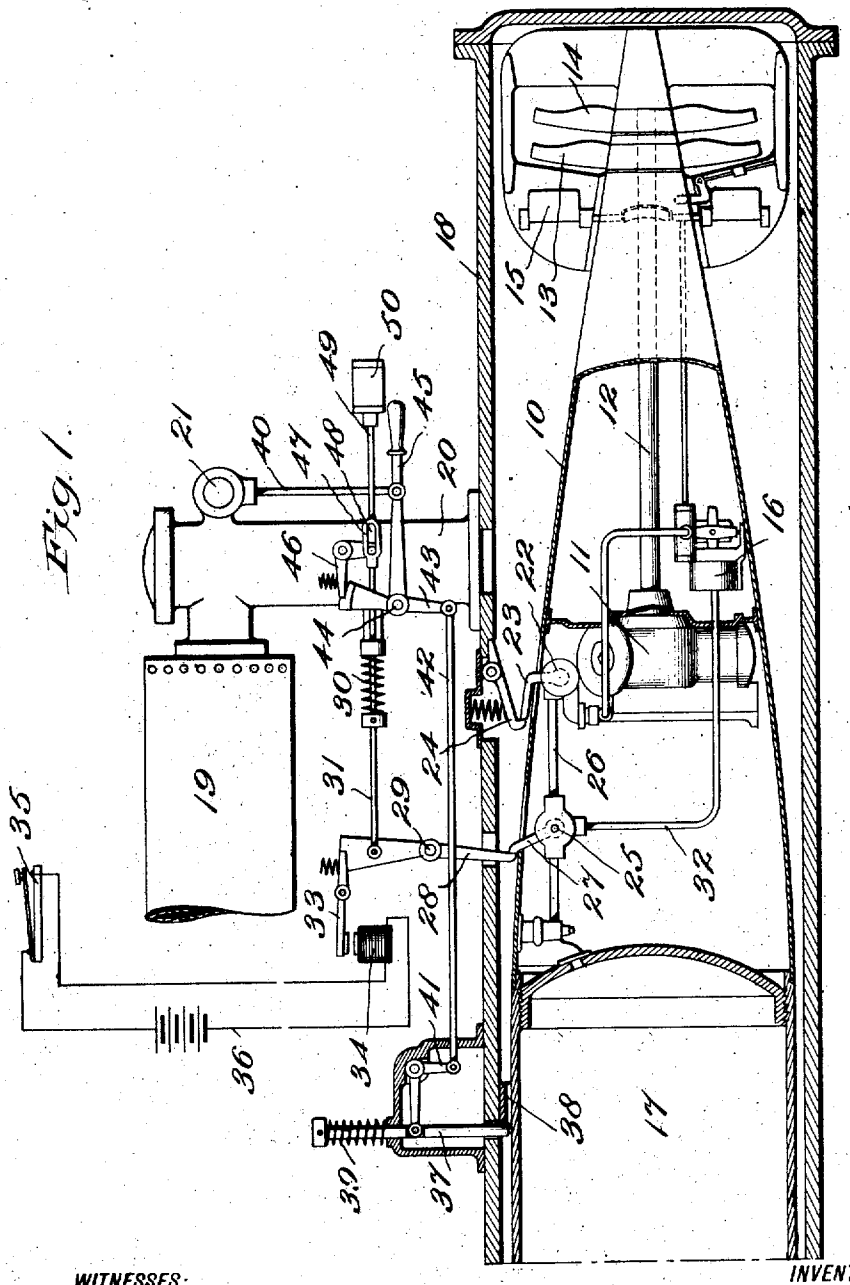

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Fig. 3.

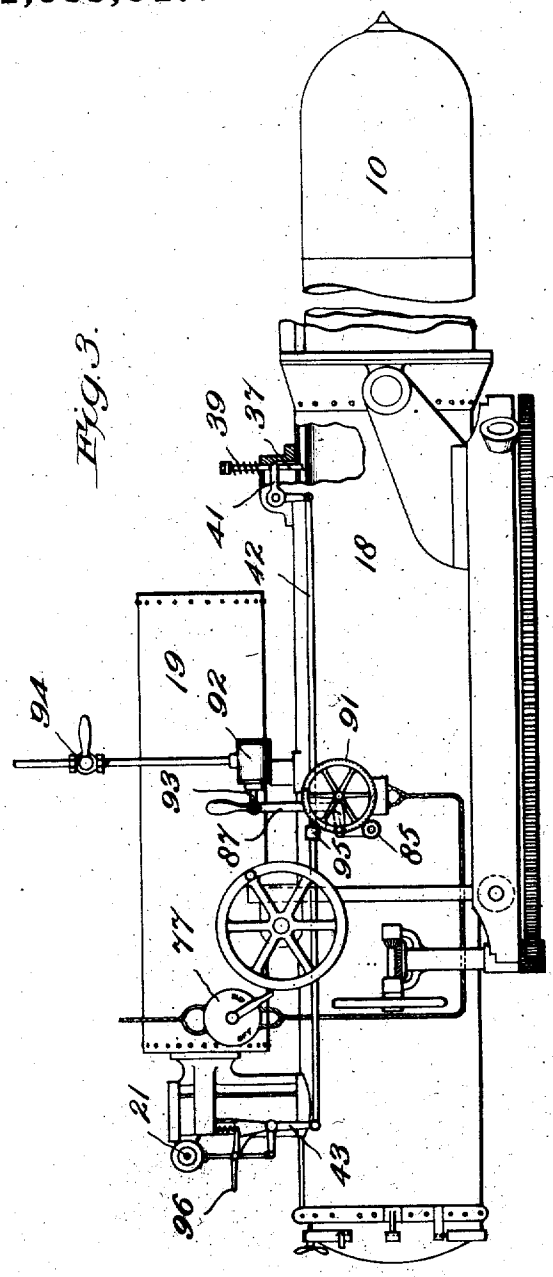


Fig. 2.

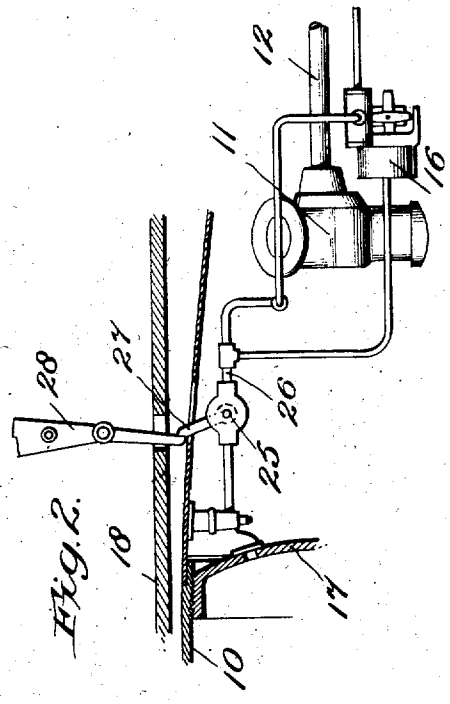
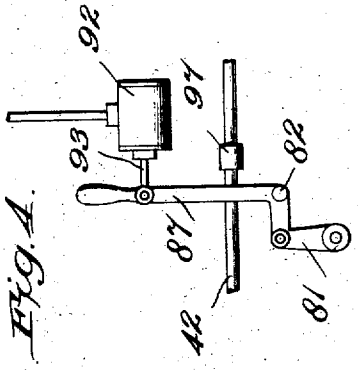


Fig. 4.



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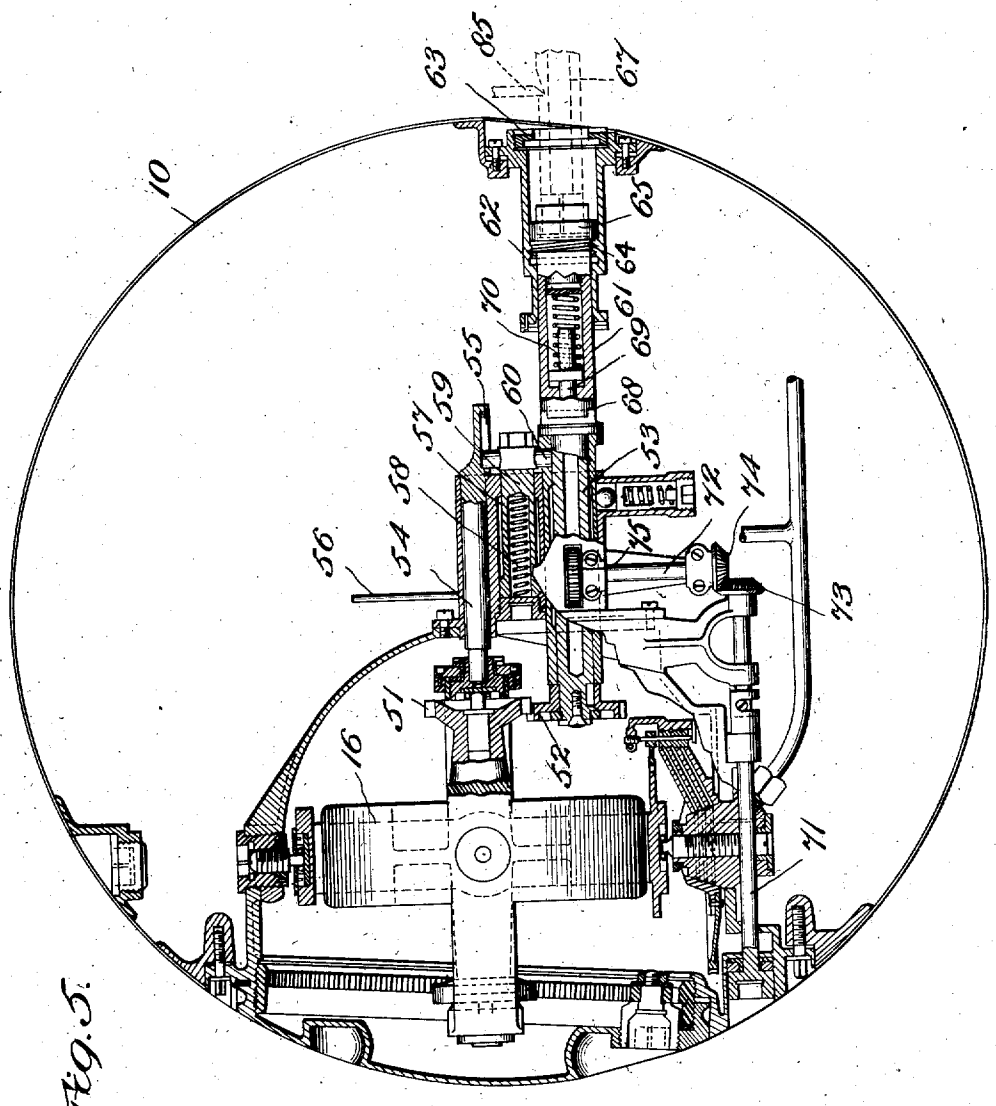

Fig. 5.

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4 SHEETS—SHEET 4.

Fig. 7.

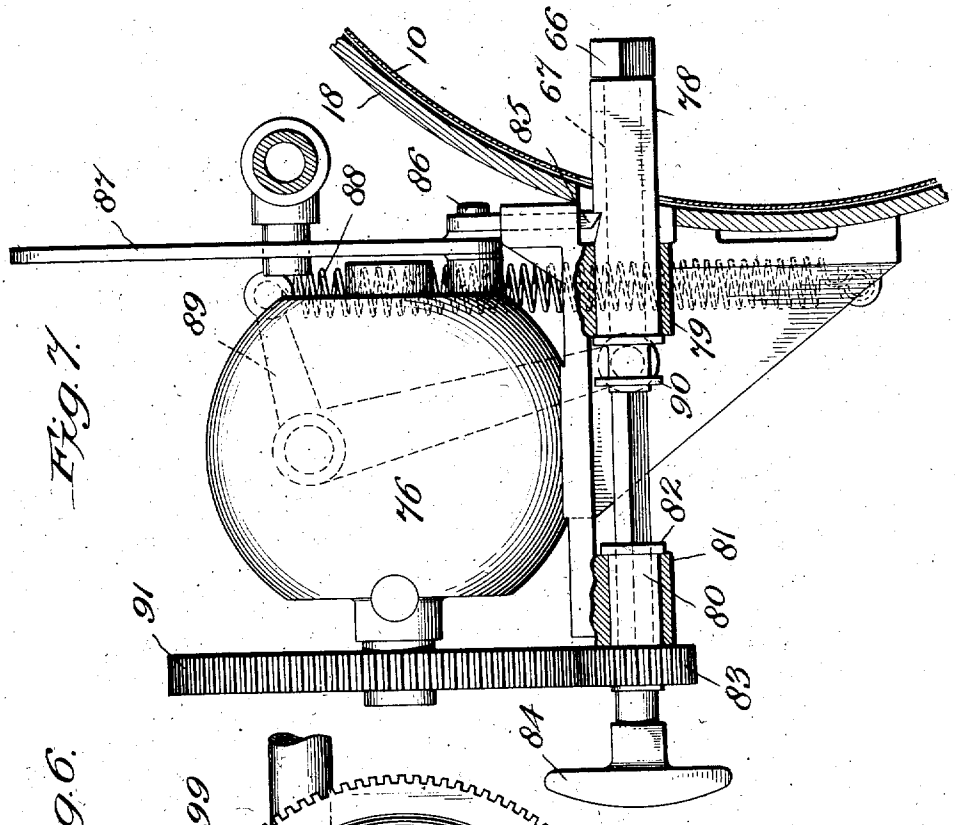
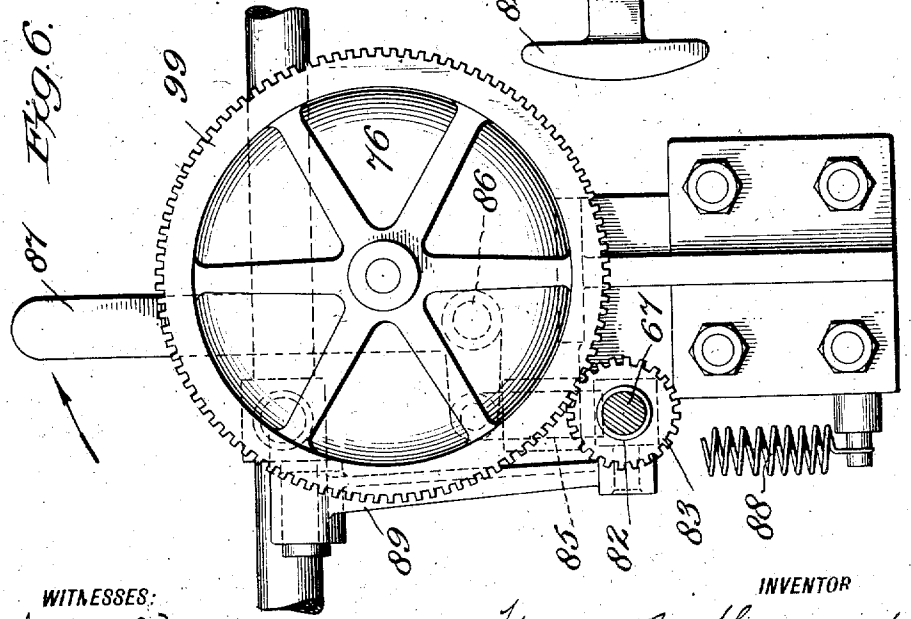


Fig. 6.



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UNITED STATES PATENT OFFICE.

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METHOD OF FIRE CONTROL FOR TORPEDOES.

1,035,647. Specification of Letters Patent. Patented Aug. 13, 1912.

Application filed April 19, 1912. Serial No. 691,886.

To all whom it may concern:

Be it known that I, HAROLD W. SHONNARD, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Methods of Fire Control for Torpedoes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to an improved system of fire control for self-propelled torpedoes, having steering gyroscopes capable of being spun independently of the internal propelling engine, while temporarily fixed in position with relation to the longitudinal axis of the torpedo, and adapted to be freed from this fixed relation at the proper time; the main object and effect of which is to increase the accuracy of aim, and the object of a preferred variant of the method is to extend the range over which accurate shots may be made.

As is well known to those skilled in this art, the direction in the horizontal plane which will be taken by a torpedo automatically steered by a gyroscope, will be that direction to which the axis of the gyroscope relates at the moment when the gyroscope is set free to exercise its governing influence, upon the steering mechanism of the torpedo and the course in the horizontal plane will be in said direction, only so long as the gyroscope is enabled, by its rotary action to maintain itself in its original absolute plane of rotation.

In aiming and firing self-propelled torpedoes, as hitherto accomplished, a gyroscopic wheel locked in a predetermined position with respect to the longitudinal axis of the torpedo, is set in motion upon release of the torpedo from its position, of rest within the torpedo tube, and simultaneously with the starting of the internal propelling apparatus; and the gyroscope is subsequently released, or set free to exercise its gyroscopic influence upon the steering mechanism of the torpedo. It is therefore, apparent that, where this old system of fire control is adopted, the time interval within which the wheel must attain its velocity and must be released, is the time that the torpedo still remains within the launching tube after the ejecting impulse has been exercised within said tube. In practice this period of time is found to be so short that very often the releasing of the fly wheel or gyroscope does not take place until after the torpedo is beyond the control of the sighted launching tube, resulting in a deflecting from the intended course, before the directing influence of the gyroscope can be brought into play. The deflected course is then preserved by the gyroscope and the shot is a failure. This disadvantage is particularly serious where shots are made from the side of an advancing vessel, since the surrounding water, which has a relative movement aft, catches the head of the torpedo and causes a serious preliminary deflection. If the gyroscope has been completely spun and unlocked before this deflection occurs, it will be corrected automatically; but this correction will not be made if the deflection should occur before the unlocking of the gyroscope, which often occurs under the old practice.

My present invention relates to a method of torpedo fire control involving the certain unlocking of the gyroscope before possibility of deflection from the course determined upon. In its preferred form this method also provides an indefinite time for bringing the gyroscope up to speed before the same is unlocked, thereby making it possible to use a heavier gyroscope and to impart a higher velocity thereto than has been possible hitherto. These advantages greatly increase the range over which torpedoes may be made available.

The broad method herein described and claimed was originally described and claimed in my prior application Serial No. 545,019, filed February 21st 1910, which resulted in my Letters Patent No. 1030134, granted June 18th 1912, wherein certain apparatus herein shown is set forth and claimed. The method claim was canceled from said original application, and the present application is a continuation of said original to the extent of such claim.

This invention is shown in certain illustrative embodiments in the accompanying drawings, wherein—

Figure 1 is a sectional and diagrammatic view of apparatus for practicing one variant of my system or method in connection with certain well known types of torpedoes,

Fig. 2 is a similar view of a modification of what is illustrated in Fig. 1, Fig. 3 is a side elevation of apparatus for practicing my method of fire control which employs an external spinning motor for the gyroscope, Fig. 4 is a similar view of a modification of a part thereof, Fig. 5 is a transverse section of a torpedo furnished with the apparatus for spinning by external motor, Fig. 6 is an end view of the external spinning device, and Fig. 7 is a side view of the same.

Broadly described the present improved system or method of firing consists in separating the functions of spinning and releasing the gyroscope, on the one hand, from the function of expelling the torpedo from the launching tube on the other hand; and, furthermore, this method involves beginning to carry out one or both of the former functions, before exerting the expelling or launching impulse. This priority of action may be carried to the point of completing the spinning and unlocking or releasing functions before commencing the expulsion of the torpedo, but it is sufficient for the purpose of the invention if the earlier functions are completed before the torpedo has time to be diverted from its true course by the operation of influences outside of the launching tube.

In Fig. 1 one variant of my improved system is illustrated in connection with a well known form of torpedo, wherein the external torpedo shell 10 contains a propelling engine 11 connected to the shaft 12 carrying the usual propeller blades 13, 14; and wherein the rudder 15 is controlled by a gyroscope 16 adapted to be spun and automatically unlocked by compressed air supplied from the flask or container 17 which supplies the air to drive the engine 11.

The torpedo may be ejected from the launching tube 18 by pressure created in any of the various well known ways, and I have shown for this purpose, by way of illustration, the compressed air flask 19, from which air to eject the torpedo is admitted into the tube 18 through the passage 20, when the valve 21 is opened.

As formerly used; the spinning and automatic unlocking means for the gyroscope 16 have always been set in operation by the pressure of the ejecting air or other gases in the launching tube, so that these operations were necessarily confined to the short interval of time during which the torpedo was still within the directing influence of the tube 18, after exertion of the expelling impulse.

The apparatus shown in Fig. 1 is adapted to automatically carry out my improved system or method, and to render the spinning and unlocking functions independent of the expelling function, so that they may be carried out in the order of sequence hitherto described herein. It is to be understood, however, that my invention is not confined to the use of apparatus which automatically governs the sequence of these functions.

The passage of the air from the flask 17 to the engine 11 is governed by the starting valve 22, which may be of any desired design, being operated by a lever 23 engaging with a starting latch 24 in a well known manner, when the torpedo is expelled or launched.

Passage of air for spinning the gyroscope is governed by the valve 25, which may or may not be placed in the pipe 26 leading to the valve 22 and is operated by a lever 27 engaged by a movable latch 28 pivoted at 29. A spring 30 acts normally with a tendency to push the rod 31 to the left in Fig. 1, and, as this rod is connected with the upper end of the latch 28, it tilts this latch, when released, so as to cause its lower end to push back the lever 27 and open the valve 25, thus admitting air through the pipe 32 to the gyroscope. Before firing, the latch 28 and the spring 30 are confined by the catch 33, which may be raised, so as to release the latch 28, by any well known means, as for instance by the magnet 34, controlled by a switch 35 on the electric circuit 36. It is to be understood that the use of any suitable means for independent spinning of the gyroscope 16 is within the scope of my improved method of firing.

The particular apparatus shown in Fig. 1 includes means whereby release of the latch 28 will set free the torpedo ejecting impulse at the proper time after the spinning of the gyroscope. For this purpose the valve 21 for liberating the ejecting air, and the usual torpedo-retaining lock are connected mechanically in a well known manner, and are arranged for operation by a common spring.

The bolt 37 of the retaining lock normally engages a suitable projection 38 on the torpedo shell. A spring 39 tends constantly to raise the bolt 37, and this tendency is transmitted to the operating rod 40, of the air valve 21, by means of the bell-crank lever 41, the rod 42, the locking lever 43 pivoted at 44, and the hand lever 45. The action of the spring 39 is resisted by the bent lever 46, one arm of which is furnished with a pin 47 projecting through the slot 48 in the rod 49 which is a continuation of the rod 31. A suitable dash pot or check cylinder 50 of well known character has its piston attached to the rod 49, and, after a preliminary quick movement sufficient to operate the valve 25, this check acts to slow up the further movement of the rod 49, so as appropriately to delay the action of the end of the slot 48, upon the pin 47, whereby the bent lever 46 is moved for releasing the locking lever 43. As soon as this locking

lever is released, the spring 39 unlocks the torpedo shell and admits compressed air to the tube 18. The torpedo is pushed forward, and, as it moves, the lever 23, being retained by the latch 24, is drawn backward in a well known manner, thereby opening the valve 22, and admitting air to the propelling motor 11, for driving the torpedo.

In Fig. 2 is indicated a modification of what is shown in Fig. 1, wherein the valve 25 is so used as to start both the gyroscope and the propelling engine 11, when the operating catch 28 is suitably moved. In the form shown in Fig. 1, the starting of the gyroscope takes place first (with well known automatic release not shown), then the ejecting impulse is applied, and lastly the internal motor is started. In the form shown in Fig. 2, the internal motor is started together with the gyroscope. Either form is within the scope of the present invention. Operation of the apparatus by separate manual movements is also within the scope of the invention.

The apparatus shown in Figs. 3 to 7 inclusive, and the mode of its operation are also within the scope of my present invention. In these figures is shown apparatus wherein an external prime mover is made available for spinning the gyroscope. In Fig. 5 are shown the details of one preferred form of apparatus suitable for carrying out this variant of my improved system or method.

The flywheel of the gyroscope 16 carries on its axis a gear 51, and a pinion 52, on a longitudinally movable shaft 53, is adapted to mesh with said gear 51 for the purpose of spinning said flywheel. The gyroscope as a whole is properly locked by a sliding pin 54 having a flange 55 at its rear end. Air is constantly admitted by the pipe 56 to the cylinder 57, and coöperates with the spring 58 (which is not absolutely essential) to drive the plunger 59 outward. This plunger carries a transverse pin 60, one end of which engages a sleeve 61 in which the shaft 53 rotates, while the other end finally strikes the flange 55, and removes the pin 54, so as to release or unlock the gyroscope. A second longitudinally slidable shaft 61 is carried in a long bearing tube 62, having a water-tight valve seat 63, at its outer end, and threaded at 64 to coöperate with a threaded portion on the shaft 61, just behind the water-tight plug or head 65. This head has a polygonal cavity in its end to receive the squared end 66 of the external spinning shaft 67 (see Fig. 7).

The shaft 61 is in line with the spinning shaft 53 and is normally connected therewith by an appropriate clutch 68. End play between the shafts is prevented by an internal pin 69, pressed outward against the end of the shaft 53 by the spring 70. The shafts 71 and 72 and gears 73, 74 and 75 are used in a manner which need not be here set forth in detail to draw the shaft 53 to the left and insert the locking pin 54 while causing the gears 51 and 52 to engage. This normal position is then made secure by pushing the shaft 61 inward and giving it a couple of turns to cause it to engage with the thread 64, whereby the automatic disengagement of the gears 51, 52 and removal of the pin 54 are prevented until the proper time.

In order to spin the gyroscope an external engine 76 is used, which is preferably an electric motor governed by the switch 77. The external spinning shaft 67, has its bearing in the squared sleeve 78 adapted to slide in the guideway 79. Behind this rounded portion, the external spinning shaft 67 is squared and slides through a sleeve 80, squared internally to fit the shaft 67, but cylindrical externally so as to rotate within a bearing 81. This sleeve carries a shoulder 82 and a pinion 83, which prevent longitudinal movement thereof within the bearing 81. The outer end of the shaft 67 carries a handle 84, whereby it may be pressed inward, together with the sleeve 78, to occupy the position shown in Fig. 7. Here the whole is locked by the plate 85, pivoted at 86 to a bell-crank lever whose longer arm 87 preferably stands upright as shown. On tilting the arm 87 in the direction of the arrow in Fig. 6, the plate 85 will be lifted, releasing the external spinning shaft 67 and the sleeve 78. When this occurs, the shaft is instantly withdrawn from the torpedo and launching tube by the spring 88, acting through the bell-crank 89, one arm of which engages in a well known manner with the socket 90 attached to the sleeve 78.

The electric motor 76 carries upon its armature shaft a gear wheel 91, which coöperates with the pinion 83 to impart a very rapid revolution to the external spinning shaft 67. This revolution is transmitted to the head of the shaft 61, and by it to the internal spinning shaft 53, whose pinion 52 drives the flywheel of the gyroscope. The first two or three turns thus imparted free the shaft 61 from the threads 64 in the bearing tube 62, thus leaving the piston 59 free to move the two shafts 53 and 61 to the right in Fig. 5, when the external spinning shaft is withdrawn. This movement frees the gyroscope from the pinion 52 and from the locking pin 54, and at the same time drives the water tight plug or head 65 against the seat 63, so as to shut off entrance of water from the sea.

It will be seen, that, by the means just described, the spinning of the gyroscope may be carried on as long as desired, and the same may be unlocked, all quite independently of exertion of the expelling impulse

which launches the torpedo. In most cases, however, this apparatus may be successfully combined with mechanism for combining appropriate successive action of the spinning, unlocking and expelling means. In Fig. 3, for instance, the spinning is first accomplished by manipulation of the switch 77 so as to start the electric motor, and then the unlocking may be accomplished in either of two ways. One means for this purpose would involve the use of a cylinder 92 containing a piston connected by the rod 93 to the lever 87, whereby, on admission of compressed air to said cylinder the lever 87 would be moved to the right in Fig. 3, thereby raising the plate 85, and freeing the spinning shafts in the manner heretofore described. The valve 94, for controlling admission of air for this purpose could be located wherever found convenient. Also, if desired, the handle on the lever 87 could be used for unlocking.

The second automatic means capable of optional use is a collar 95 on the rod 42, joining the ordinary firing latch 43 to the torpedo lock 37 as heretofore described. After the gyroscope has been brought up to full speed by the electric motor, and the proper aim is secured, the locking bar 96 is struck. This liberates the expelling air, and, movement of the rod 42 and collar 95 moves the lever 87, so as to simultaneously unlock the gyroscope.

In Fig. 4 is shown a modification, wherein the collar 97 on the rod 42 is struck by the lever 87 when the latter is moved by hand or otherwise. The modified operation which results is obvious. I prefer the employment of means whereby the final unlocking of the spinning gyroscope is accomplished before exerting the expelling impulse. The advantage of this system is that the unlocking can be accomplished instantaneously at the precise moment when the proper aim is secured. This eliminates error introduced by rolling of the vessel from which the shot is made or similar causes; which error is unavoidable where the expelling impulse is first applied and the gyroscope is unlocked a moment or two later, as in the old practice.

What I claim is—

1. The method of torpedo fire control whereby accurate long range fire is facilitated in connection with a self propelled torpedo having a steering gyroscope adapted to be rotated independently of the internal propelling means while temporarily fixed in position with relation to the longitudinal axis of the torpedo, which consists in spinning the gyroscope while so fixed, initiating the final ejecting impulse for launching after beginning the spinning operation, and freeing the gyroscope from its fixed relation before the torpedo leaves the directing influence of the launching tube.

2. The method of torpedo fire control whereby accurate long range fire is facilitated in connection with a self-propelled torpedo having a steering gyroscope adapted to be rotated independently of the internal propelling means while temporarily fixed in position with relation to the longitudinal axis of the torpedo, which consists in spinning the gyroscope while so fixed, initiating the ejecting impulse after the gyroscope has reached substantially full speed, and freeing the gyroscope from its fixed relation before the torpedo leaves the directing influence of the launching tube.

3. The method of torpedo fire control whereby accurate long range fire is facilitated in connection with a self-propelled torpedo having a steering gyroscope adapted to be rotated independently of the internal propelling means while temporarily fixed in position with relation to the longitudinal axis of the torpedo, which consists in spinning the gyroscope while so fixed, initiating the ejecting impulse after the gyroscope has reached substantially full speed, and freeing the gyroscope from its fixed relation not substantially later than the moment of initiating the ejecting impulse.

In testimony whereof, I affix my signature, in presence of two witnesses.

HAROLD W. SHONNARD.

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