F. ALIQUO.

STEERING MECHANISM.

APPLICATION FILED JUNE 25, 1921.

1,420,231. Patented June 20, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

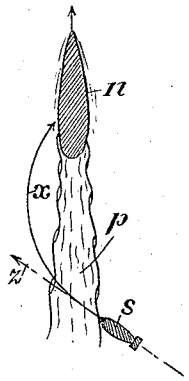


Fig. 2.

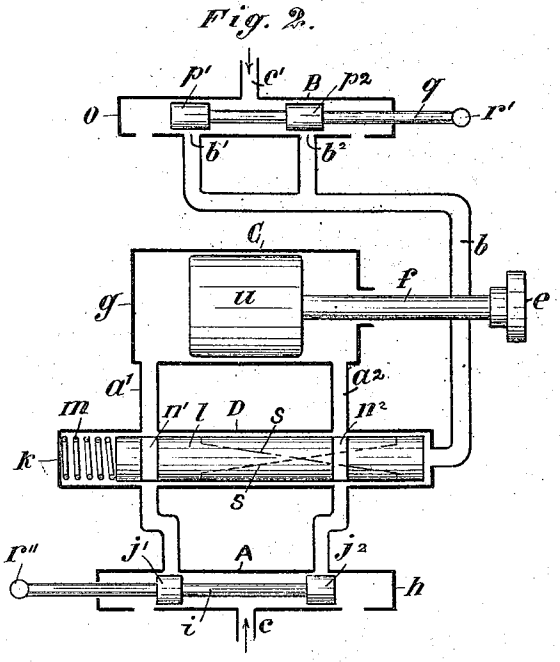
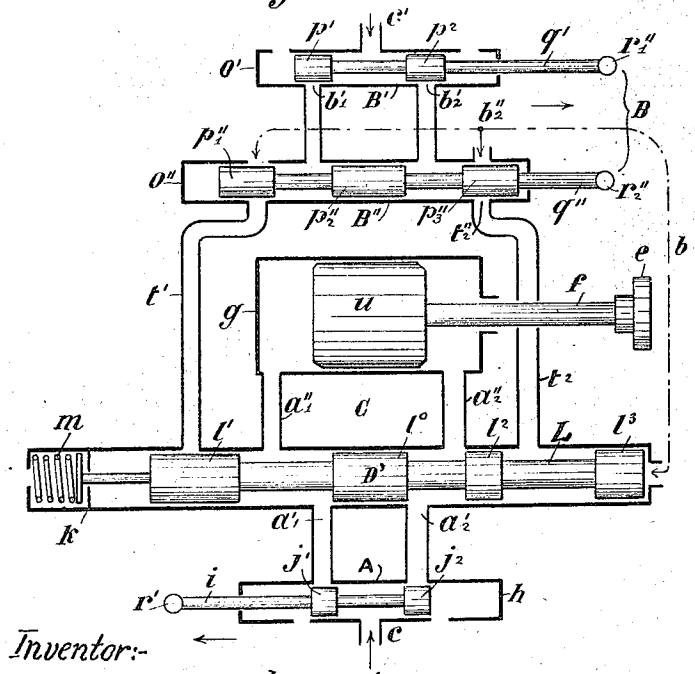


Fig. 3.



Inventor:-

Francesco Aliquo by Paul Phillips, his attorney

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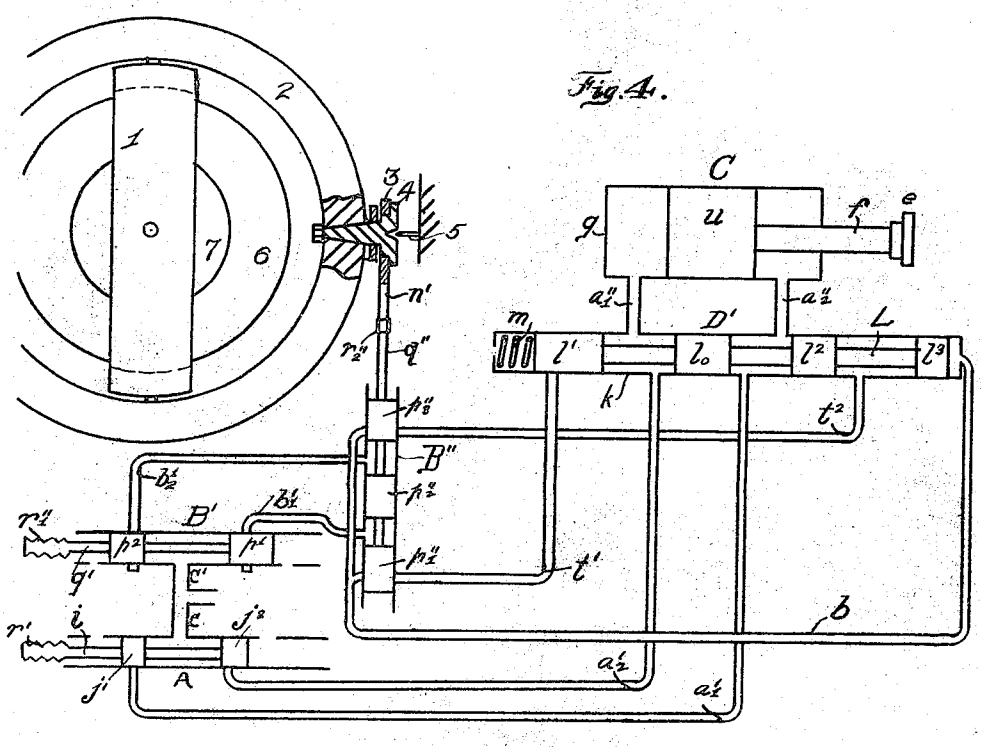
3 SHEETS—SHEET 2.

Fig. 4.



Francesco Aliquo INVENTOR.

BY

Paul E. Schilling ATTORNEY.

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3 SHEETS—SHEET 3.

Fig. 5.

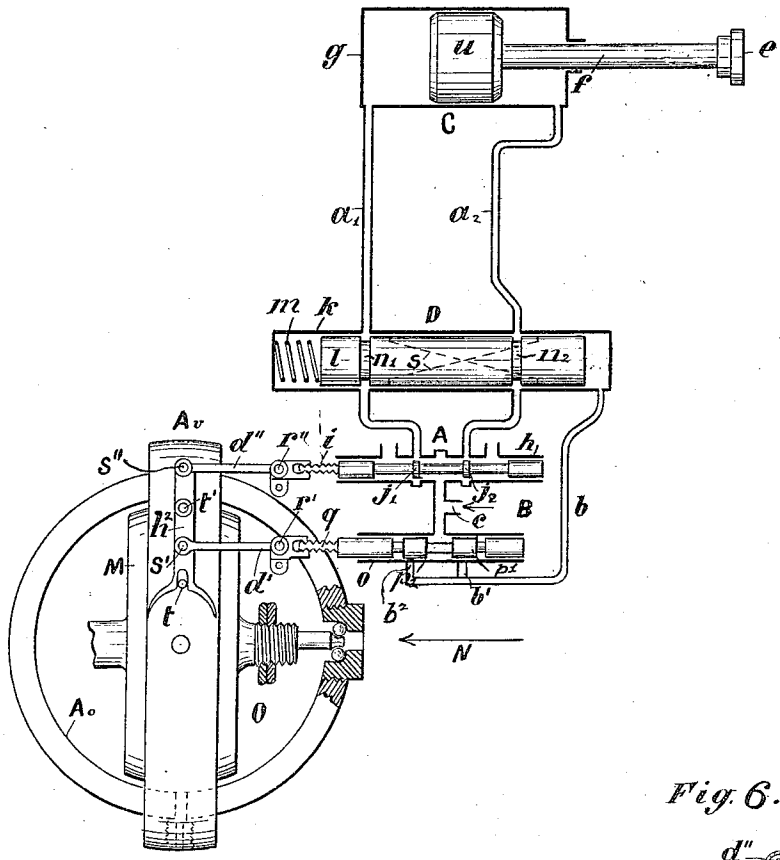
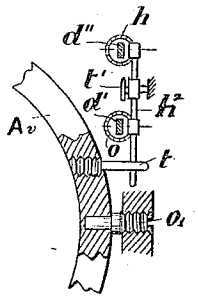


Fig. 6.



Francesco Aliquo Inventor

by Paul V. Schilling

Atty

UNITED STATES PATENT OFFICE.

FRANCESCO ALIQUO, OF ROME, ITALY.

STEERING MECHANISM.

1,420,231. Specification of Letters Patent. Patented June 20, 1922.

Application filed June 25, 1921. Serial No. 480,480.

To all whom it may concern:

Be it known that I, FRANCESCO ALIQUO, a subject of the King of Italy, residing at Rome, in the Kingdom of Italy, have invented certain new and useful Improvements in Steering Mechanism, of which the following is a specification.

This invention has for its primary object to provide improved mechanism for steering torpedoes, or other self-moving weapons, against a ship or moving target after it shall have passed through a wake or a like abnormally disturbed condition of the water.

It frequently happens that torpedoes are lost by passing either in front of the bow or astern of the ship attacked. It is, therefore, an object of this invention to render all such torpedoes effective, especially those passing astern of a ship.

The invention also resides in an improved wake-controlled mechanism for increasing or accentuating a deviation in a particular direction to steer a torpedo against a moving target.

Further, the invention resides in the salient features of construction and the arrangements and combinations of parts hereinafter described and claimed, reference being had to the accompanying drawings wherein:

Figure 1 shows the path of a torpedo passing astern of a ship and returning upon it;

Figure 2 shows the improved self-steering device controlling the direction rudder under the influence of a rotary movement around an axis;

Figure 3, shows a self-steering device controlling the direction rudder under the combined effect of two concordant and contemporaneous rotations around two different axes;

Figure 4, illustrates the manner of connecting the construction of Figure 3 to a gyroscope;

Figure 5, shows the construction of Figure 2 connected with a gyroscope;

Figure 6 shows a detail of the connection with the gyroscope;

Assumed, as it is shown at Figure 1 that a torpedo S has been launched against a ship n and that its course, shown by the arrow passes astern of the ship n. When it begins to enter the perturbed space of the wake it undergoes a brusque deviation which causes the self-steering device controlling the rudder to become operative and put the rudder in such a position, to the right in Figure 1, so as to compel the torpedo to follow the curved path x, which brings it back against the ship.

A self-steering device of the type which operates under the effect of the rotations around one axis, for instance the course deviation, on entering the wake or the heeling movement, is shown in its general arrangement in Figure 2.

The device includes a fluid pressure or servo-motor C for controlling the direction rudder connected in the usual way with the slide valve A controlled by the gyroscope O (Figure 5) of the usual gyroscopic steering-gear.

Furthermore there is a second slide valve B which in connection with an auxiliary inverting device D, causes the torpedo to approach the ship after it has entered the wake.

The controlling gear of the direction rudder is connected at e to the rod f of a piston u operating in the cylinder g of the servo-motor C. The fluid pressure is admitted to this cylinder through the two conduits a_1, a_2, after passing through the inverting device D from cylinder h of the distribution valve A, in which latter cylinder operates, in the usual way, two valves j_1, j_2 connected by a rod 1 to the gyroscopic steering gear O. Of the latter, in Figure 5 is shown the horizontal ring A_o, the vertical ring A_v and the revolving mass M, the direction of movement of the torpedo being indicated by arrow N. Upon the body of the torpedo is pivoted at t', a forked lever h^2 which with its fork engages a pivot t borne by the vertical ring A_v, as is better shown in Figures 5 and 6 where O_1 indicates the rotation axis of the vertical ring. In s' and s'' on the forked lever h^2 are pivotally connected the two links d', d'' which by means of connections r', r'' transmit to rods q and i of the valves B and A the path oscillations.

The movements transmitted to rod i cause the shifting of the pistons j_1, j_2, with respect to the openings of the two conduits a_1, a_2, and accordingly as either one or the other is open the compressed air passes to either one or the other side of the piston u of the motor C thereby changing the position of the rudders so as to bring back the torpedo on its normal course.

According to the invention, between valve A and the motor C is inserted an inverting apparatus D consisting of a cylinder k in which operates a piston l held, for instance, by a spring m, in the normal position shown in Figure 2. In this position two circular grooves n_1, n_2, cut on the periphery of the piston l, establish communication between the two cylinders h and g of the distribution valve A, and of the motor C, through conduits a_1, a_2. The cylinder k communicates also through conduit b, b_1 and b_2 with the slide valve B of the self steering device said valve consisting of a cylinder o and the valve elements p_1 and p_2 operating therein through their connecting rod q which is articulated, as already stated, at r' to the link d' of the gyroscope.

As long as the course deviations of the torpedo do not exceed the normal only the two pistons j_1, j_2 of the slide valve A operate to place the compressed air conduit c in communication with conduit a_1 or conduit a_2, the pistons p_1 and p_2 covering the openings b' and b_2 of conduit b in the valve B. But when the torpedo enters the wake and undergoes a brusque and violent deviation either piston p_1 or p_2 uncovers also the respective port b', b_2 to admit compressed air from conduit c into conduit b and the cylinder k. This results in the piston l being forced to the left against spring m.

Piston l is provided with two crossed channels s which when the piston is in its extreme left position, cross or invert the communications between cylinders h and g, so that piston u, instead of rectifying the torpedo, will act to amplify and maintain the direction taken by the torpedo, bringing it upon the path which will lead it back against the ship attacked.

This manœuvre, which is begun and accomplished in a normal way owing to the effect of the brusque and strong deviations of the torpedo caused by the action of the wake is very practical.

When it is desired to combine together the action of the contemporary rotations around two different axes, for instance around the vertical axis upon entering the wake and the longitudinal axis during the crossing of the wake, the arrangement shown in Figure 4 may be adopted.

In such case the apparatus, besides the inverting device D similar to that of Figure 2, the usual distribution valve A, and the rod i of whose double piston is connected to the gyroscope of the ordinary gyroscopic steering device as shown in Figure 2, includes also two slide valves of the self-steering device, one B', the piston rod q' of which is also connected to the gyroscope of the gyroscopic steering device in the manner already shown for slide valve B in Figure 2, and one B'' controlled by the rolling gyroscope 6. The internal vertical ring of the rolling gyroscope is 1 and 7 is its rotating mass which revolves around a vertical axis pivoted in ring 1, 2, being the horizontal outer ring revolving around horizontal pivots 5 and which is provided with an eccentric 4. The collar 3 of this eccentric is formed with a shaft h_1 articulated at r''_2 to q'' for controlling the double piston p''_1 p''_2 of slide valve B''.

Figure 4 shows that the two valves B', B'' are arranged in series in the compressed air conduits b'_1 and b'_2 from conduit c or c' and therefore both rods q', q'' must be simultaneously shifted to a sufficient extent in order that the compressed air may have free passage through this way. If, as it has been assumed rod q' together with rod i is connected to the gyroscope of the gyroscopic steering device in the manner shown by Figure 5, then a right-side movement of rod i corresponds to a movement towards the left of rod q'. On its turn the eccentric 4 is mounted in such a way on the horizontal ring 2 of the rolling gyroscope, that to said movement of rod i towards the right side, there corresponds a downward movement of rod q''. Piston p^2 and rod q' uncovers the opening b'_2 while plunger p''_3 lowers to uncover the openings t^2 and b and in this manner the compressed air which comes from supply conduit c through opening b'_2, reaches conduit b and then cylinder k to the right of piston L of the inverting device D' to move the latter to the left against the action of the spring m. In this way the compressed air is delivered through conduit t', which is uncovered by plunger l' and conduit A''_1 to the left side of the servomotor while the conduits a'_1 and a'_2 are closed by plungers l^2 and l^0 regardless of the action of valve A.

In conclusion it is apparent that the utilization of the wake, as a means of bringing back the torpedo towards a missed target, in practice is equivalent to a prolongation of the target towards the stern of the craft for a length equal to the efficacious length of the wake. It follows that by this means not only is ensured the effect of a shot carefully directed against the target from a distance at which by the sole effect of the normal swerving tolerated the torpedo would be lost astern, but also the shots delivered with less precision on account of defective aiming or mistaken reckoning of the speed and direction of the target, which permits in naval engagements a rapidity of execution and a launching distance which without the use of the devices according to this invention, would lead to an unprofitable loss of a greater number of torpedoes launched.

What is claimed is:

1. A torpedo steering mechanism com-

prising a rectifying motor and means operable by an abnormal deviation of the torpedo for reversing the action of the motor to increase and maintain the deviation.

2. In a torpedo steering mechanism, a rectifying motor, means for admitting compressed fluid thereto for operating the same upon a deviation of the torpedo, and a reversing gear operable upon an abnormal deviation to reverse the action of the motor.

3. In a torpedo steering mechanism a rectifying motor, a gyroscopic controlled valve for admitting fluid pressure to the motor for operating the same upon deviations of the torpedo to return the latter to its proper course, a reversing gear interposed between the valve and motor for reversing the action of the latter, and a gyroscopic controlled valve operable upon a brusque deviation of the torpedo for admitting air to the reversing gear to render the same operable.

In testimony whereof I have affixed my signature in the presence of two witnesses, at Rome, in the Kingdom of Italy, this 6th day of June, 1921.

FRANCESCO ALIQUO.

Witnesses:
LELLEN GAHRNELK,
WILHELM SCHMID.