33-236. OR 2,421,749 SR

Search Inc.

June 10, 1947. R. M. FREEMAN 2,421,749

TORPEDO DIRECTOR

Filed Aug. 10, 1942

Fig. 1.

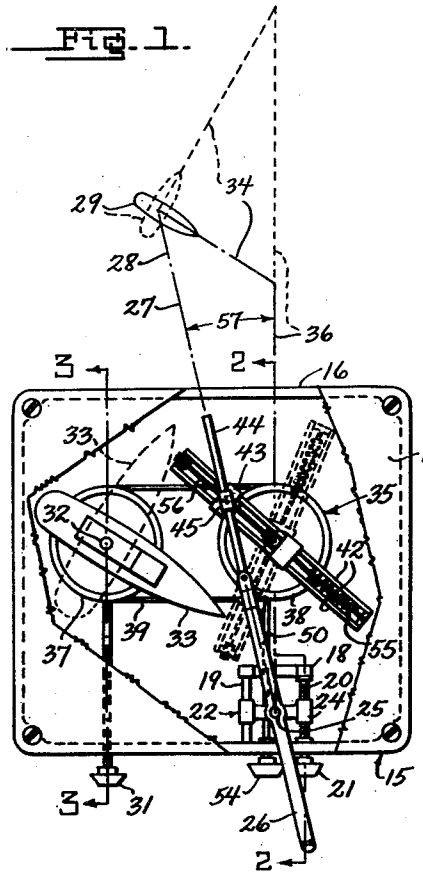



Fig. 2.

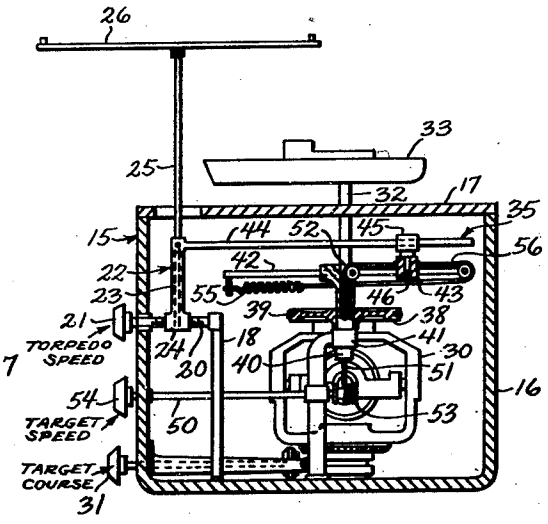
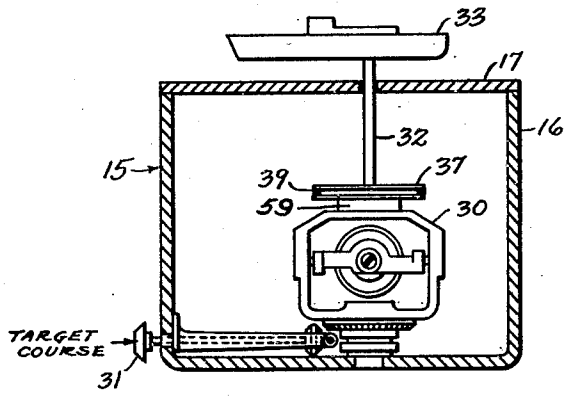



Fig. 3.




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# UNITED STATES PATENT OFFICE

2,421,749

## TORPEDO DIRECTOR

Robert M. Freeman, United States Navy

Application August 10, 1942, Serial No. 454,295

6 Claims. (Cl. 33—46.5)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention relates to improvements in torpedo directors for torpedo-carrying aircraft.

In existing torpedo directors, the solution of the vector triangle known as the torpedo triangle is accomplished on an angle solver. Into this device is introduced torpedo speed, target speed and target angle, which is the bearing of the aircraft from the target's course at the instant of release. The pilot operating the torpedo director must estimate the target angle at which he wishes to drop the torpedo and set this target angle on the director. He must also estimate the ship's speed and place this into the director. The torpedo speed is known in advance. In order to secure a hit, it is necessary that the plane be at the proper target angle relative to the target ship at the instant of drop. If, because of antiaircraft fire or other circumstances beyond the control of the pilot, the firing plane is unable to reach this predetermined target angle, or if the pilot makes a mistake in estimating this target angle, a miss will result.

It is an important object of the present invention to provide a torpedo director that continuously and automatically introduces the correct target angle in the director thereby giving the proper lead angle.

Another object of the invention is to provide a torpedo director into which the target angle is continuously and automatically introduced by stabilizing in azimuth that portion of the torpedo triangle known as the target course and speed vector.

A further object is the provision of a torpedo director of the character described which is adjustable to compensate for variations in torpedo speed, aircraft speed and altitude at the time the torpedo is released.

A still further object is to provide a torpedo director of the character described which is adjustable for different target speeds.

Other objects and advantages of the invention will become apparent during the course of the following detailed description, taken in connection with the accompanying drawing, forming a part of this specification, and in which drawing

Figure 1 is a top plan view of the torpedo director with its cover partly broken away to show enclosed parts, the relation between parts of the torpedo director and a torpedo triangle being diagrammatically illustrated.

Figures 2 and 3 are vertical sectional views through the torpedo director taken substantially on the lines 2—2 and 3—3, respectively, of Figure 1.

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In the drawing, which for the purpose of illustration shows only a preferred embodiment of the invention, and wherein similar reference characters denote corresponding parts throughout the several views, the numeral 15 generally designates the improved torpedo director which may be mounted in any suitable support, such as a case 16 provided with a cover 17.

Disposed within the case 16 is a bracket 18 supporting a fixed guide rod 19 and a rotatable threaded rod 20 provided with a knob 21. Slidable along the rod 19 is a bearing 22 including an upright tube 23 and a sleeve 24 in threaded engagement with the rod 20. Fixed transversely of the upper end of a vertical shaft 25 rotatably supported by the tube 23 is an elongate target sighting member 26 for alignment with the line of sight vector 27 of a torpedo triangle 28 including a real target, such as the ship diagrammatically shown at 29 in Figure 1.

Mounted in the case 16 is a gyroscope 30 whose setting may be changed by means of the usual caging and setting knob 31. In operation, this knob is first pushed in, operating a device which cages the gyro while at the same time it meshes the bevelled gears whereby the gyro may be set in the desired position, and then the knob is pulled out to uncage the gyro in its new position relative to the artificial target. The details of this mechanism are not shown because they are well known. An example of these details may be seen, e. g., in the patent to Zand No. 1,946,657, where the corresponding knob is designated by numeral 20. Devices of this type may also be seen in Patent Nos. 2,069,235 at 38 and 2,091,964 at 96. Fixed transversely of the upper end of a vertical shaft 32 connected to the gyroscope is an artificial target 33 to be disposed in paralleling relation to the target course and speed vector 34.

Motion transmitting means 35 are provided between the shafts 32 and 25 for disposing the target sighting member 26 at an angle relative to the torpedo track and speed vector 36 of the torpedo triangle 28 depending on the angular setting of the artificial target 33. In the example shown, motion is transmitted by pulleys 37, 38 and belt 39 between the shaft 32 and a tubular shaft 40 rotatable in a bracket 41. Fixed transversely to the upper end of the tubular shaft 40 are parallel guide rods 42 slidably supporting an eccentric block 43. By providing pulleys 37, 38 of equal size for transmitting motion between the shafts 32 and 40, the parallel relationship of the artificial target 32 to the guide rods 42, as shown in Figure 1, will be maintained

in all positions. Fixed to the shaft 25 above the tube 23 is an arm 44 having its free end portion slidably extending through a sleeve 45 pivoted at 46 to the eccentric block 43.

Compensating means 50 are provided for adjusting the motion transmitting means 35 to correct for variations in target speed. Extending through the tubular shaft 40 is a line 51 having one end portion trained over a pulley 52 and attached to the block 43, the line 51 at its opposite end portion being wound on a spool 53 so that when the line is reeled in, as by rotation of knob 54, the eccentric block 43 will be moved radially inward along the guide rods 42. When the line 51 is paid out, a contractile coil spring 55 connected to the eccentric block as by a line 56, will move the block outwardly along the guide rods 42.

In order to compensate for variations in torpedo speed, aircraft speed and altitude at the time of drop, the knob 21 may be adjusted to shift the target sight shaft 25 relative to the shaft 40 so that the throw of the arm 44 by the eccentric block 43 is varied.

To operate the director, the pilot of the aircraft adjusts the gyroscope 30 by rotating the knob 31 to bring the artificial target 33 into parallel relation to the target ship 29. The target speed knob 54 is set to conform with the estimated speed of the target. During the approach of the aircraft, the stabilized artificial target 33 will remain parallel to the target ship 29 regardless of changes in the course of the aircraft. If the aircraft is so flown as to keep the sighting member 26 trained on the target, the aircraft will follow a curved path that will make antiaircraft gunnery from the target more difficult. The torpedo may be dropped at any time that the aircraft is disposed at the proper lead angle 57 relative to the target 29, as indicated by alignment of the sighting member 26 with the target. Should the target change its course, the pilot of the aircraft merely resets the lead angle to the proper value by adjusting the gyroscope caging knob 31 so that the artificial target parallels the new course of the target.

Various changes may be made in the form of the several elements of the invention herein shown and described without departing from the spirit and scope of the invention, as defined in the following claims.

The invention described herein may be manufactured and/or used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What I claim is:

1. In a torpedo carrying aircraft, a torpedo director comprising a firing sight mounted at one end on a horizontally adjustable vertical pivot, a horizontal arm mounted on a second vertical pivot aligned with said horizontal adjustable pivot and having a pivoted guide radially adjustable thereon, the other end of said firing sight being slidably connected in said guide, a vertically pivoted artificial target offset from said firing sight and adapted to be manually adjusted parallel with an objective target by eye, a belt connecting pulleys connected to said arm and said artificial target for maintaining parallel alignment therebetween, and gyroscopic means for automatically stabilizing the artificial target in any selected position relative to the target course.

2. In a torpedo carrying aircraft, a torpedo director comprising a first shaft, a radially adjustable eccentric carried by the first shaft; a second shaft spaced from said first shaft in the direction of torpedo discharge, an arm carried by the second shaft and having its free end portion slidably connected to said eccentric, a rotatable firing sight slidably connected to said eccentric for movement with said second shaft; a third shaft to one side of said other shafts, an artificial target carried by said shaft, pulleys on said first and third shafts, a belt connecting said pulleys, whereby rotation of the third shaft correspondingly rotates the first shaft to maintain said target in parallel alignment with said arm and adjusts the eccentric and the firing sight synchronously, and gyroscopic means maintaining the artificial target in a preset direction in space.



3. In a torpedo carrying aircraft, a torpedo director comprising a first shaft having an axial passageway, an arm carried by the first shaft, an eccentric slidable on the arm, a line extending through the passageway and connected to the eccentric, a spool for reeling in and paying out the line, resilient means maintaining tension on the line; a second shaft, an arm carried by the second shaft and having its free end portion slidably connected to the eccentric; a third shaft, an artificial target carried by said shaft, pulleys on said first shaft and third shaft, a belt connecting said pulleys whereby movement of the third shaft moves the first shaft to maintain said target and arm in parallel alignment and moves the eccentric and the firing sight synchronously, and gyroscopic means maintaining the artificial target in a preset direction in space.

4. In a torpedo carrying aircraft, a torpedo director comprising first, second, and third shafts, the first shaft carrying an arm, an eccentric connected to the free end of said arm, means for adjusting the distance between the first and second shafts in the direction of a torpedo discharge, a sight bar carried by the second shaft and slidable in said eccentric, pulleys on the first and third shafts, a belt connecting said pulleys, gyro stabilizing means for the first and third shafts to directionally stabilize said shafts, an artificial target carried by the third shaft, whereby movement of the third shaft synchronously moves said artificial target, sight bar, eccentric and arm.

5. In a torpedo carrying aircraft, a torpedo director comprising a firing sight mounted at one end on a horizontally adjustable vertical pivot and having its other end slidably connected in a pivoted guide, an arm having said guide radially adjustably mounted thereon and said arm having a vertical axis spaced forwardly from said vertical pivot in the direction of said horizontal adjustment, an artificial target mounted on a second vertical pivot to one side of the firing sight, an operating connection between said guide arm and said second vertical pivot for simultaneous turning movement to maintain parallel alignment between said artificial target and said arm, a directional stabilizing gyro means for directionally stabilizing the artificial target, equipped with manual setting means for said target operative to cage said gyro means during the setting operation whereby said artificial target, having been once set manually parallel to an actual target by eye, after the radial distance of the guide and the distance between said first vertical pivot and said arm axis have been set in accordance with the estimated target and torpedo speeds respectively, will maintain its parallel relationship to the actual target, so that upon mere sighting of the target after any fur-

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ther maneuvers of the aircraft the torpedo may be sent on its proper course to score a hit.

6. In a torpedo carrying aircraft, a torpedo director comprising a firing sight mounted at one end on a horizontally adjustable vertical pivot, a vertically pivoted artificial target offset from said firing sight and accessible for manual alignment parallel with an observed target, a horizontal arm mounted on a second vertical pivot forwardly of said first pivot and operatively connected to said artificial target for maintaining parallel alignment therewith, said arm having a pivoted guide radially adjustable thereon, the other end of said firing sight being slidably mounted in said guide, and means for directionally stabilizing said artificial target when once manually set parallel to an observed target, whereby automatic movement of said artificial target thereafter synchronously moves the firing sight angularly with respect to the fore and aft line between the first and second pivots to vary the angle of advance when sighting on the observed target in accordance with changes in the range of the observed target.



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