W. F. McMAHON.

TORPEDO TUBE AND TORPEDO FIRING MECHANISM.

APPLICATION FILED MAR. 4, 1920.

1,370,467.

Patented Mar. 1, 1921.

4 SHEETS—SHEET 1.

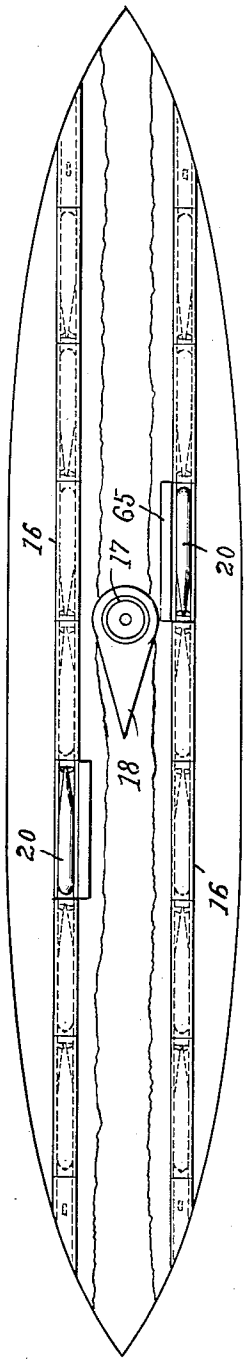


Fig. 1

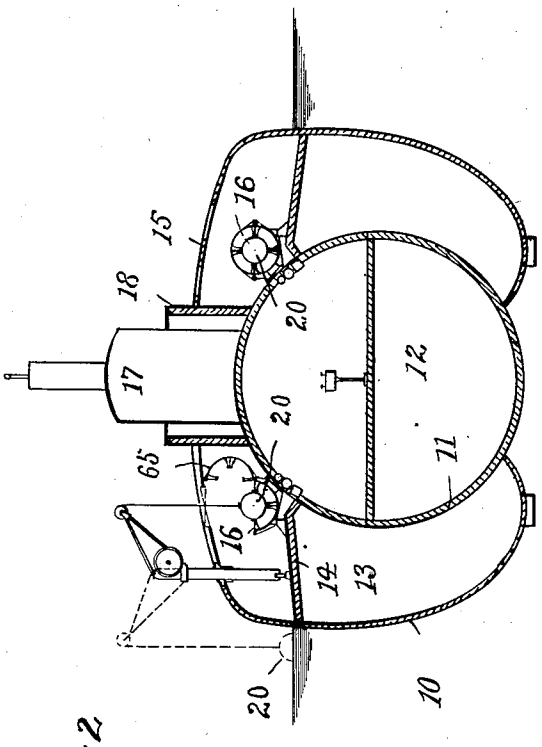


Fig. 2

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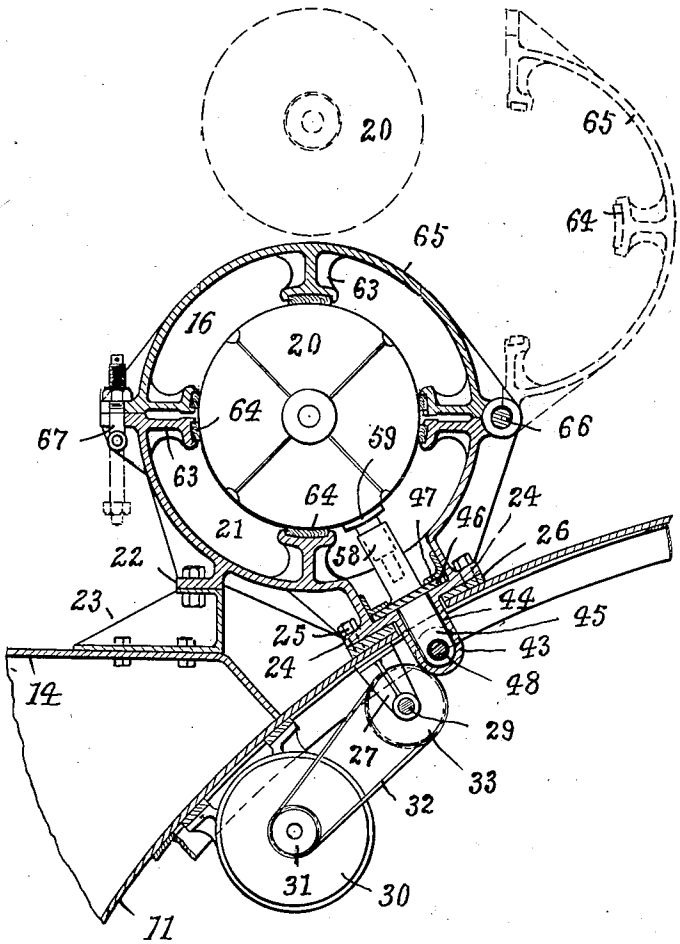
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FIG. 3



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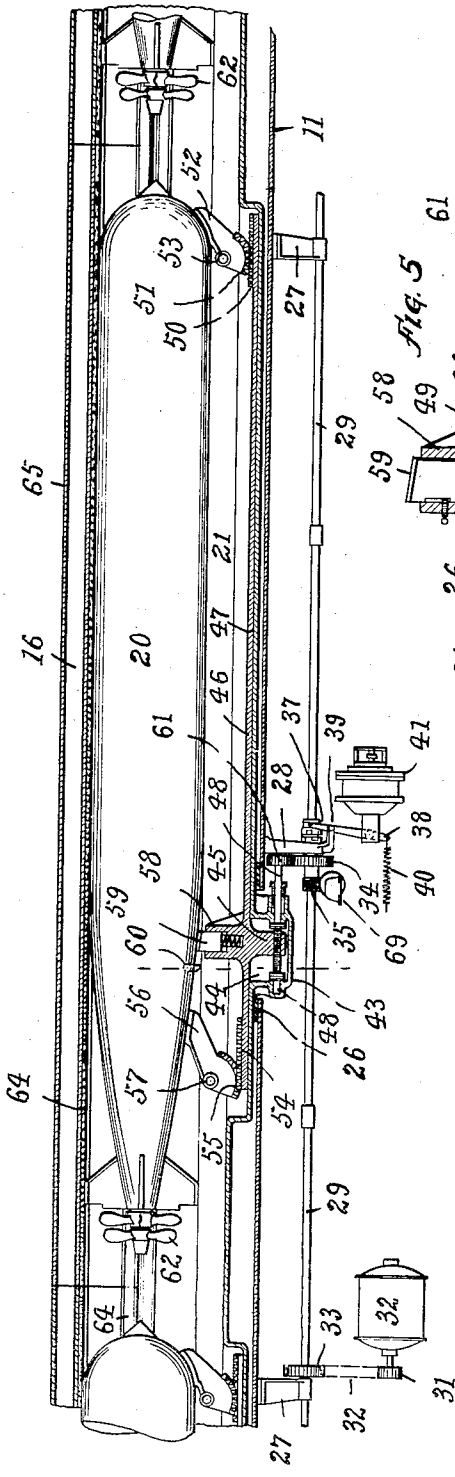


Fig. 4

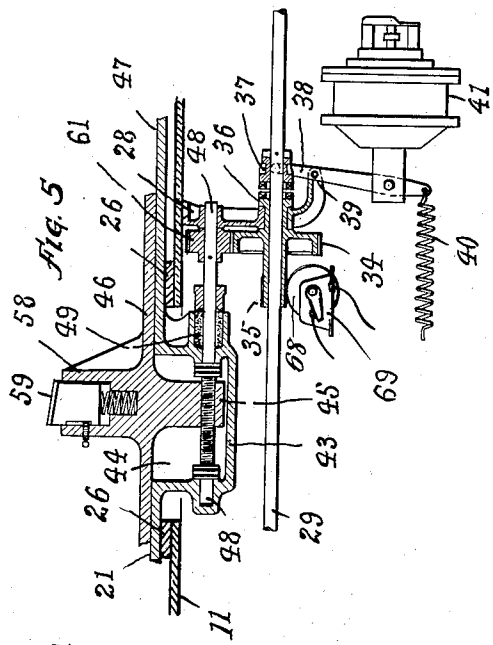


Fig. 5

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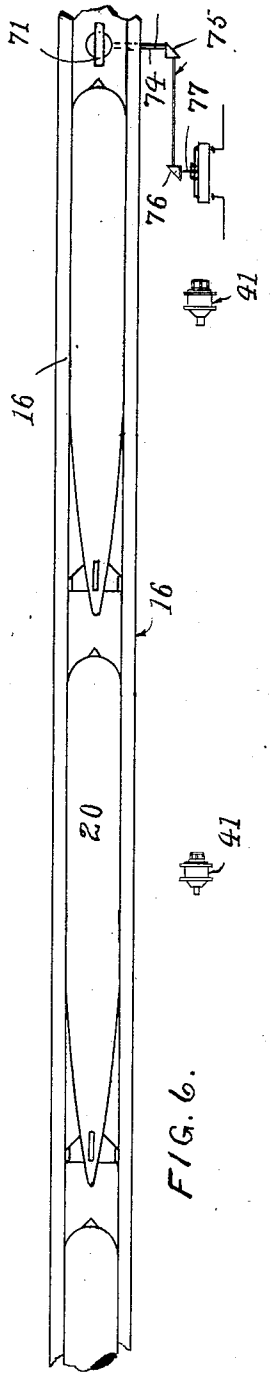


FIG. 6.

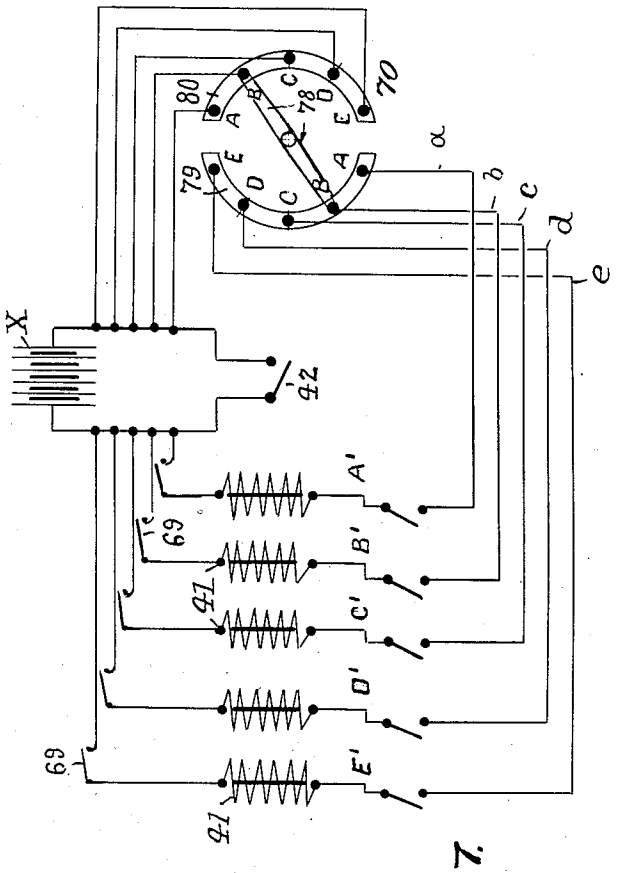


FIG. 7.

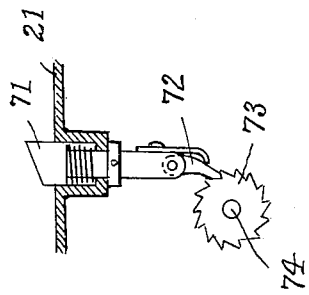


FIG. 8.

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TORPEDO-TUBE AND TORPEDO-FIRING MECHANISM.

1,370,467. Specification of Letters Patent. Patented Mar. 1, 1921.

Application filed March 4, 1920. Serial No. 363,277.

To all whom it may concern:

Be it known that I, WILLIAM F. McMAHON, citizen of the United States, and resident of Stratford, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Torpedo-Tubes and Torpedo-Firing Mechanism, of which the following is a specification.

This invention relates to new and useful improvements, in torpedo tubes as applied to submarine boats and other vessels, and means for firing torpedoes from said tubes.

While the invention is shown applied to a submarine boat, it may obviously be built into other forms of war craft and used to equally good advantage. In the illustration I have shown a pair of loaded torpedo tubes, one upon the port side and the other upon the starboard side of a boat between the inner and outer hulls, which tubes are alike in construction and arranged to be loaded and operated independently. In practice, a boat may be provided with one or more of these tubes though they are preferably arranged in pairs and designed to contain a series of self propelled torpedoes.

This invention includes several important objects among which may be noted that of a torpedo tube which extends entirely through the boat from bow to stern and arranged to fire the torpedoes from the forward and aft ends and to fire the torpedoes singly or in succession as desired. By my improved device I am also able to avoid the use of compressed air as an expelling medium and instead employ gear mechanism for releasing the torpedoes, so that the torpedo propelling mechanism is released and applied to carry the torpedo forward. Further to provide means whereby the torpedoes are handled and loaded into the tubes in a convenient and efficient manner.

Another feature of the invention is to provide a torpedo tube, with hinged side doors that are adapted to be opened to allow the torpedoes to be horizontally loaded and placed in the tubes, one behind the other and stowed in alinement ready for firing. The construction of my improved tube is such as to permit of a relatively large number of torpedoes being stowed therein and each in position for firing without any preliminary handling, it being obvious that the outermost torpedo in each end must be fired first and the others in their respective orders.

My present invention further includes means for holding the torpedoes in place within the torpedo tube, including gearing and operating mechanism whereby the torpedoes may be released singly or in succession through electrically operated mechanism from a central switch board.

The apparatus further comprises a torpedo tube that is open at both ends, and of a larger diameter than the torpedoes, so as to allow water to flow therethrough, and includes runways for guiding the torpedoes when released. The top side of the torpedo tube comprises a series of hinged doors, which aline with each other so that any particular portion of the tube may be opened, or if desired the whole series of doors may be opened and thereby opening the tube for substantially its whole length. Each torpedo is provided with a separate holding and releasing mechanism which is contained within the hull of the boat and is operated through separate solenoids that are controlled by a central switch.

With these and other objects in view, the invention resides and consists in the construction and novel combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended, it being understood that various changes in the form, proportion, size and minor details of construction within the scope of the claims may be resorted to without departure from the spirit or sacrificing any of the advantages of the invention.

Similar characters of reference denote like or corresponding parts throughout the several figures of the accompanying drawings forming a part of this specification, and upon which,

Figure 1 is a plan view of a submarine showing the general arrangement of a series of torpedoes stowed in the torpedo tubes ready for firing.

Fig. 2 is a section through the midship of a submarine of a large tonnage displacement type and showing the torpedo tubes and the means for loading torpedoes in the torpedo tubes.

Fig. 3 is a cross sectional view on a larger scale, of a portion of the submarine and one

of the torpedo tubes, illustrating the construction and operation of the same.

Fig. 4 is a longitudinal section through a portion of a torpedo tube, showing the torpedo in its loaded position ready for firing, and the arrangement of the connected firing gear.

Fig. 5 is an enlarged view of the firing gear shown in Fig. 4.

Fig. 6 is a plan view of a portion of one of the tubes and torpedoes to better illustrate the interlocking and fire control mechanism.

Fig. 7 shows a wiring diagram illustrating the method of operating the controlling device, and

Fig. 8 shows a sectional detail view of a ratchet feed mechanism for the controller.

Referring in detail to the characters of reference marked upon the drawings, 10 represents the outer hull of a submarine boat and 11 the inner hull which forms the inner compartment 12. The compartment 13 between the outer and inner hulls is used as a ballast tank and is further inclosed by a tank top 14 and over which the top portion 15 of the outer hull extends. This top portion of the outer hull is non-water tight, so that the water has access thereto, as well as to the torpedo tubes 16 mounted upon the tank top 14. 17 represents a conning tower through which access is had to the inner compartment, and 18 indicates a super structure acting as a fair-water for the conning tower. 19 indicates a portable crane used to pick up the floating torpedoes 20 from the water and place them sidewise in the open side portions of the torpedo tubes.

As before stated, I have shown two torpedo tubes, one upon each side and each extending from the bow to the stern of the boat so as to allow the torpedoes to be fired in a forward or aft direction. These two tubes are alike in construction and therefore I will describe in detail but one tube, and which may be of any desired length and to accommodate any required number of torpedoes.

As shown in the drawings these tubes are located in the upper portion of the submarine boat between the inner and outer hulls. In this particular instance the torpedo tubes are secured in part to the ballast tank top, and in part to the inner hull. The lower half 21 of the torpedo tube is provided on one side with one or more flanges 22 which are bolted to the angle irons 23 secured to the tank top, and the other side includes two flanges 24 through which studs 25 pass to tightly secure the tube to the reinforcing plate 26 riveted to the inner hull. The lower half of the tube would be made up of sections to facilitate machining, and assembling and to suit conditions in ship.

Each torpedo tube is constructed to accommodate two series of torpedoes, one series of which is positioned to be fired forward and the other series adapted to be fired aft. For each torpedo I provide separate holding and releasing mechanisms, including gearing, a solenoid and operating switch, while a single motor is used to operate the several series of holding and firing mechanisms for each tube. I will therefore first describe this motor and its connection for the several torpedoes and then describe but one holding and firing device as the others are of a like construction, and a duplicate description would be superfluous.

A series of hangers 27 and 28 are secured to the inside of the inner hull to accommodate a line shaft 29 extending longitudinally through the hull to connect with the several sets of holding devices. A motor 30 is connected by a sprocket 31 and a sprocket chain 32 with a sprocket 33 upon the said shaft 29 to drive the same. A series of gears 34 are loosely mounted on the shaft 29, one for each set of holding and firing mechanism, and are provided with extended hub portions, one including a worm 35 and the other a clutch member 36. A series of clutch members 37 are keyed on the line shaft 29 to engage the clutch member on the gear to drive the latter.

These movable clutch members are operated by arms 38 pivoted at 39, which are normally positioned by the action of a spring 40 to hold the clutches open, while the solenoid 41 serves to close the clutch when operated through the controller by one of the switches A′, B′, C′, D′ or E′.

Extensions 43 having pockets 44 are formed on the base 21 of the tube 16 and extend through an opening in the reinforcing plate 26 and the inner hull of the boat, see Figs. 3 and 5. The purpose of this extension and pocket is to accommodate a depending arm 45 on slide 46, mounted to reciprocate in a longitudinal guideway 47 in the bottom portion 21 of the tube. The connection of the extension portion of the tube, with the plate 26 and the hull is made perfectly water tight and the hole in the extension for the shaft 48 is also provided with a packing 49 to prevent the leakage of water therepast.

A rack 50 is formed upon the top side of the forward end of this slide 46 to engage the segment 51 of an arm 52 pivoted at 53 and adapted to be operated to engage and release the torpedo 21 by the movement of the slide and racks. The upper side of the arm 52 is shaped to conform to the round forward end portion of the torpedo so as to hold the same against forward movement when positioned as indicated in Fig. 4. A second rack 54 is formed upon the rear end of the slide and also serves to engage a segment 55 of the arm 56 that

is pivoted at 57 and serves to engage and hold the rear tapered end portion of the torpedo against backward movement. The slide 46 is provided with an upwardly disposed projection 58 in which is formed a socket to receive the hammer 59 that is held against the under side of the torpedo for the purpose of engaging the trigger 60 of the torpedo firing mechanisms.

The shaft 48 is journaled in the extension 43 and has its inner end portion threaded to engage a threaded hole through the depending arm 45 for moving the latter and its slide backward and forward by the turning of the shaft. A gear 61 is mounted on the outer end of this shaft to engage with and be driven by the gear 33 on the line shaft 29 before mentioned.

The torpedo tubes include outer casings which are of a cylindrical formation and are of a sufficiently large diameter to provide ample space between the torpedo and walls of tube to insure a free flow of water around the propellers 62 of the torpedoes to efficiently operate the same.

These tubes are further provided with inwardly disposed guides 63 having longitudinal plates 64 of suitable non-corrosive antifriction material, to form a bearing and running fit for the torpedo. There may be three or more of these guides in each tube including those on the hinged door 65. In width the doors represent one-half of the diameter of the tube and are slightly longer than the torpedoes so that when the door is laid open the torpedoes can readily be laid in the lower half. The doors are hinged at 66 to one side of the lower section and are provided with a flange along the front side for the connection of clamping bolts 67 hinged to the lower section.

The worm 35 on the gear 34 serves to operate a worm gear 68 of a limit switch 69 which is connected in one of the controller circuits to automatically cut out the solenoid 41 and permit the spring 40 to open the clutch 37 when the slide has been moved sufficiently to release the torpedo.

Referring to Figs. 6 and 7 it will be seen that I have provided a device for operating the controller 70 through which the electrical connections are made, for magnetizing the solenoids 41. In this connection it should be borne in mind that there would be two controllers for each tube, one being connected with each end portion and each controller would include as many separate lines of wire connections as there were spaces for torpedoes in the end portions of the tube with which it is connected.

The mechanical part of the controller mechanism will be best understood from Figs. 6, 7 and 8 and includes a spring actuated plunger 71 that is mounted in a socket of the bottom of each outer end portion of the tube, and normally extends up, in the path of the torpedo, which engages and presses it down against the action of the spring, as it is shot out of the tube. This plunger carries a spring actuated pawl 72 that engages and operates a ratchet wheel 73 on a shaft 74 connected by bevel gears 75 and 76, with a shaft 77 carrying a contact bar 78 of the controller proper. The controller includes a pair of circular plates 79 and 80 having corresponding contact points A, B, C, D and E on the two plates, to form a separate circuit for each set of holding and releasing mechanism. The circuits are connected with solenoids 41 before mentioned and are provided with selective switches A′, B′, C′, D′ and E′. They are also connected with the battery X and include one main switch 42. The limit switches 69 before mentioned are also included in each of the circuits *a*, *b*, *c*, *d*, and *e*, and are adapted to be opened in their respective orders when the slide 46 has been moved back sufficiently to release the torpedo.

The loading of the tube is readily accomplished by first loosening the nuts on the bolts 67 and swinging the bolts out of engagement with the pockets in the flange of the door so as to permit the same to be swung open as indicated by dotted lines Fig. 3. In this way it is possible to load any section of the tube without disturbing the other portions and also to remove a torpedo from any section without interfering with other torpedoes. After the door is swung open the torpedoes are readily laid in on the ways of the tube whereupon the door is again closed and fastened. The holding mechanisms may then be operated to secure the tube against endwise movement, which operation is effected from the drive of the shaft 29 when the clutch 37 is engaged through the operation of the solenoid when the switch B of the controller is normally closed. With the closing of the clutch the shaft 29 will drive the gear 34, its worm and the screw 48 in a manner to move the slide to the right as shown in Fig. 4, to operate the clamping arms. The limit switch 69 being connected through the worm 35, is timed to cut out the circuit *b*′ relieving the solenoid the instant the clamping arms have been operated. This permits the spring 40 to throw the arm 39 to release the clutch permitting the gear 34 to stop.

The foremost torpedo mounted in the tube is necessarily the first to be fired, and this is done in the same way the others are released by the manipulation of the different switches A′, B′, and C′, etc. and through the charging of the solenoids. In this connection it will be seen that the switch A′ controls the firing of the first torpedo while

switch B′ controls the second torpedo and switch C′ the third. In order to insure the firing of these torpedoes by the switches in the order mentioned it is necessary that the contact bar 78 be in position to connect the terminals AA, BB, CC, etc. for the wires *a*, *b*, *c*, etc. on the plates 79 and 80. As explained, this contact bar is automatically operated by the discharge of the torpedoes so that when the foremost torpedo of the series is launched, the plunger 71 and its connections, including the contact bar, are operated, to move the contact bar 78 from the terminals AA of the circuit *a* for the fired torpedo to the terminals BB for the circuit for the next torpedo ready for the second firing. This controller thus makes it possible to fire only the foremost torpedoes first and the others in their respective orders.

Having thus described my invention, what I claim and desire to secure by Letters Patent is,

1. In a double hull submarine, a torpedo tube located between the inner and outer hulls, having a series of doors in its side to permit torpedoes to be loaded at different places.

2. The combination with a double hull submarine of a tube in the space between the inner and outer hulls for stowing and firing torpedoes, and means for firing torpedoes from said tube in opposite directions.

3. A torpedo tube extending through a boat from bow to stern and adapted to fire torpedoes in a forward and aft direction from a boat.

4. A torpedo tube extending through a boat from bow to stern and adapted to contain two series of torpedoes and means for firing the same in opposite directions.

5. A torpedo tube extending through a boat from bow to stern, one end portion adapted to be used to fire in one direction and the other half portion adapted to fire in the opposite direction.

6. A torpedo tube extending through a boat from bow to stern, one end portion adapted to be used to fire in one direction and the other half portion adapted to fire in the opposite direction, separate holding and firing mechanism for each end portion of the tube.

7. A torpedo tube having a series of openings in its side portion constructed to receive torpedoes in a sidewise horizontal position, and doors for closing the said openings, and separate firing mechanisms for each torpedo.

8. A torpedo tube positioned below the water line of a boat and having a series of inwardly disposed runways to support a torpedo in from the wall of the tube leaving a water space between the tube and torpedo substantially as described.

9. The combination with a torpedo tube of a longitudinal slide therein and means connected with each end position of the slide to engage and hold a torpedo, gearing to operate the slide to release the torpedo including a solenoid and switches.

10. The combination with a torpedo tube of a longitudinal slide therein and means connected with each end portion of the slide to engage and hold a torpedo, a hammer carried by the slide to engage the trigger on the torpedo to fire the same, and gearing to operate the slide including a solenoid and switch connections.

11. A torpedo tube adapted to contain a series of torpedoes spaced one behind the other, separate holding devices for each torpedo, separate releasing means for each holding device, and operating means whereby the holding devices can only be released in their successive orders.

12. The combination with a torpedo tube adapted to contain a series of torpedoes spaced one behind the other, of a holding device for each torpedo, an operating means for the several holding devices, mechanism for connecting and disconnecting the operating means to engage and release the torpedoes.

13. The combination with a torpedo tube adapted to contain a series of torpedoes spaced one behind the other, of a holding device for each torpedo, including a slide, a driven shaft geared to operate the slide, a clutch to engage and disengage the shaft and gearing, a solenoid to operate the clutches, a controller and switch to manipulate the solenoid.

14. A torpedo tube adapted to contain a series of torpedoes and including a longitudinal base portion and an inclosing member hinged thereto, each having inwardly disposed guide ribs to support a torpedo central of the tube, and means for engaging the opposite end portions of the torpedo to hold the same.

15. A torpedo tube having inwardly disposed guide ways to support a torpedo centrally of the tube, and to form a water space between the outside diameter of the torpedo and the inside diameter of the tube so that the propeller of the torpedo may be operated to expel the torpedo from said tube under its own power.

16. A torpedo tube extending from bow to stern of a boat, means for stowing torpedoes therein in a loaded position, and means for firing said torpedoes from said position and tube.

17. A torpedo tube having inwardly disposed guide ways to support a torpedo centrally of the tube and forming a space between the outside diameter of the torpedo and the inside diameter of the tube and

guide ways constructed to support and form a running fit for the torpedoes.

18. The combination with a torpedo tube and a torpedo firing means, of means installed in the torpedo tube whereby a torpedo passing over the last mentioned means will engage and automatically set a torpedo firing control.

19. In a torpedo boat, a torpedo supporting means adapted to contain a series of torpedoes having separate holding and firing means for each torpedo, and means for firing torpedoes from said torpedo supporting means under their own power.

20. A torpedo supporting means adapted to contain a series of torpedoes spaced one behind the other said supporting means having a cylindrical casing and inwardly disposed guide ways to support and form a running fit for torpedoes, the cylindrical casing made separable along a central longitudinal line in the way of each torpedo spaced therein and formed of an upper and a lower section hinged one to the other in the way of each torpedo spaced therein, whereby single torpedoes may be positioned in the torpedo supporting means in a horizontal sidewise position and removed from said torpedo supporting means without disturbing the other torpedoes spaced therein, substantially as described.

21. The combination with a torpedo tube and a torpedo firing control, means whereby a series of devices in a central control may be adjusted for firing a series of torpedoes and as each torpedo passes out of the torpedo tube it will automatically fire the next following torpedo from its original position in the torpedo tube.

22. A torpedo firing control adapted to fire a torpedo from the bow of a boat and a torpedo from the stern of a boat from a single torpedo tube.

23. A torpedo supporting means of a length extending from the bow to the stern of a torpedo boat and adapted to contain a series of stowed torpedoes one behind the other, and means for firing torpedoes from their stowed positions in the torpedo supporting means.

24. The combination with a holding and firing mechanism for a torpedo, of a solenoid that is controlled by a central switch for operating the holding and firing mechanism, and a limit switch adapted to cut off the current from the solenoid after the torpedo is fired.

25. In a torpedo boat, means for firing a torpedo from the bow of the boat and a torpedo from the stern of the boat from a single torpedo supporting means located in said torpedo boat.

26. In a torpedo tube adapted to contain a series of torpedoes spaced one behind the other, means for firing each torpedo from its original position in the torpedo tube.

27. A torpedo tube adapted to contain a series of torpedoes spaced one behind the other, separate firing devices for each torpedo, and means installed in the torpedo tube whereby a torpedo passing over the last mentioned means will engage and automatically set a torpedo firing control so that the firing devices can only be operated in their successive orders.

28. The combination with a torpedo tube, of a mechanical controller adapted to adjust a torpedo firing control, said mechanical controller adapted to be actuated by means of torpedoes passing out of said torpedo tube.

29. The combination with a torpedo tube, of a longitudinal slide therein, means connected with each end portion of the slide to engage each end of a torpedo, and an upwardly disposed member carried by the slide to engage a trigger on a torpedo to fire same.

30. In a double hull submarine, a torpedo supporting means held in the non-watertight space between the inner and outer hulls for stowing and firing torpedoes, and means for firing torpedoes from said supporting means in opposite directions.

31. A torpedo supporting means adapted to contain a series of torpedoes spaced one behind the other, separate holding and firing means for each torpedo, and means whereby the holding and firing means can only be operated in their successive orders.

Signed at Bridgeport in the county of Fairfield and State of Connecticut this 1st day of March A. D., 1920.

WILLIAM F. McMAHON.

Witnesses:
C. M. NEWMAN,
WM. A. REDDEN.