

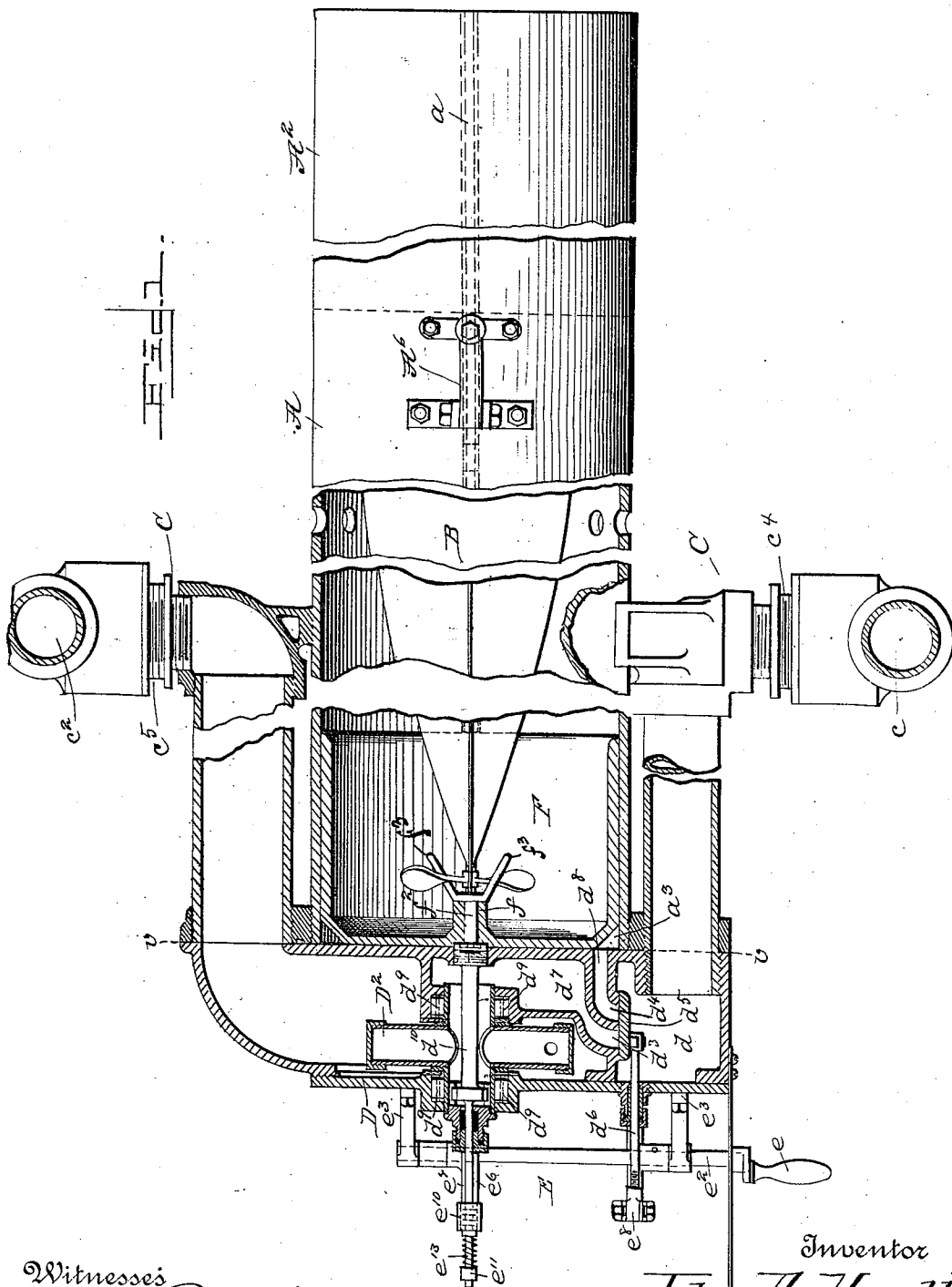
(No Model.)

4 Sheets—Sheet 1.

J. A. HOWELL.
TORPEDO LAUNCHING APPARATUS.

No. 484,658.

Patented Oct. 18, 1892.



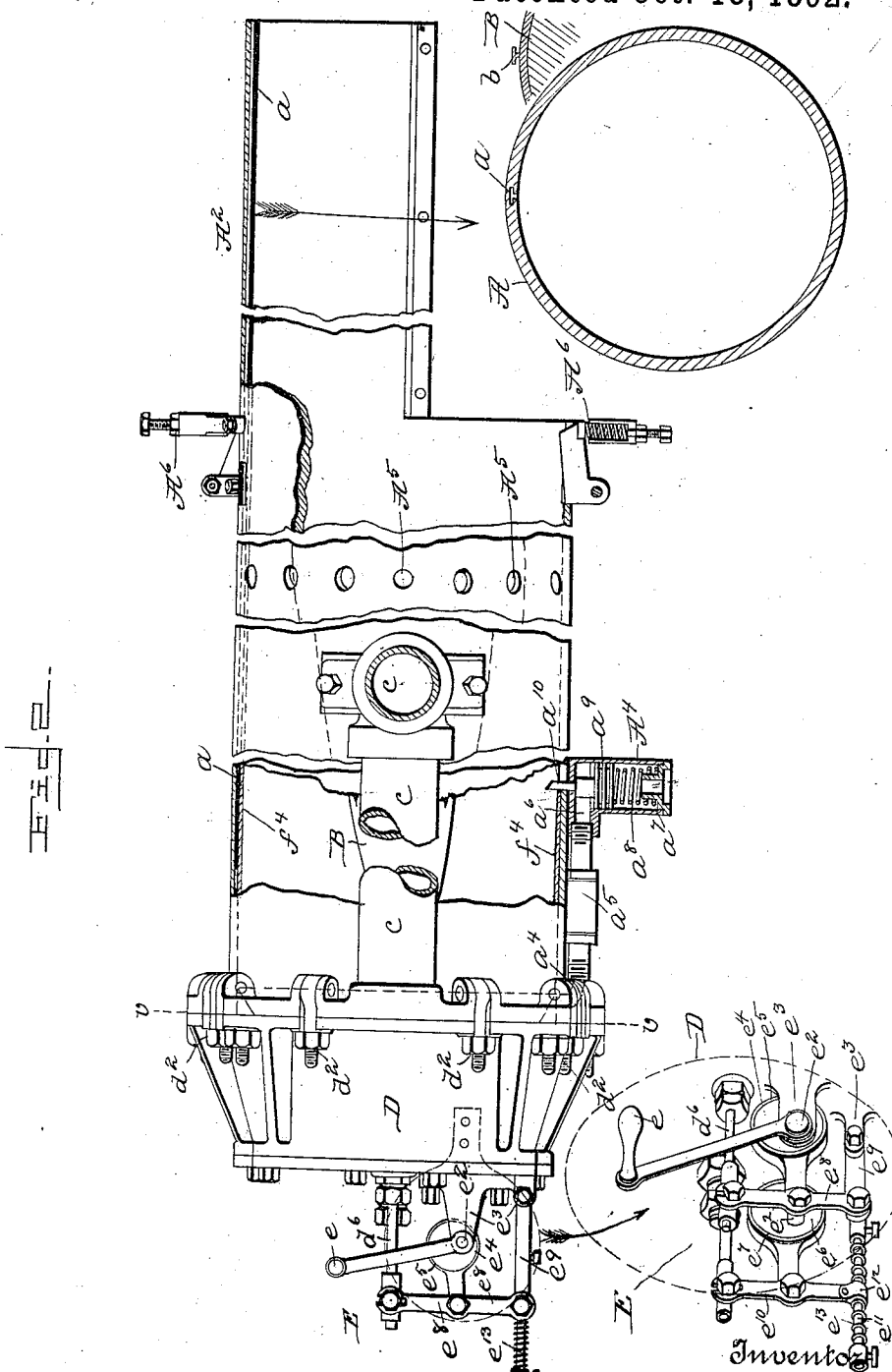
Witnesses
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4 Sheets—Sheet 2.

No. 484,658.

Patented Oct. 18, 1892.



Witnesses
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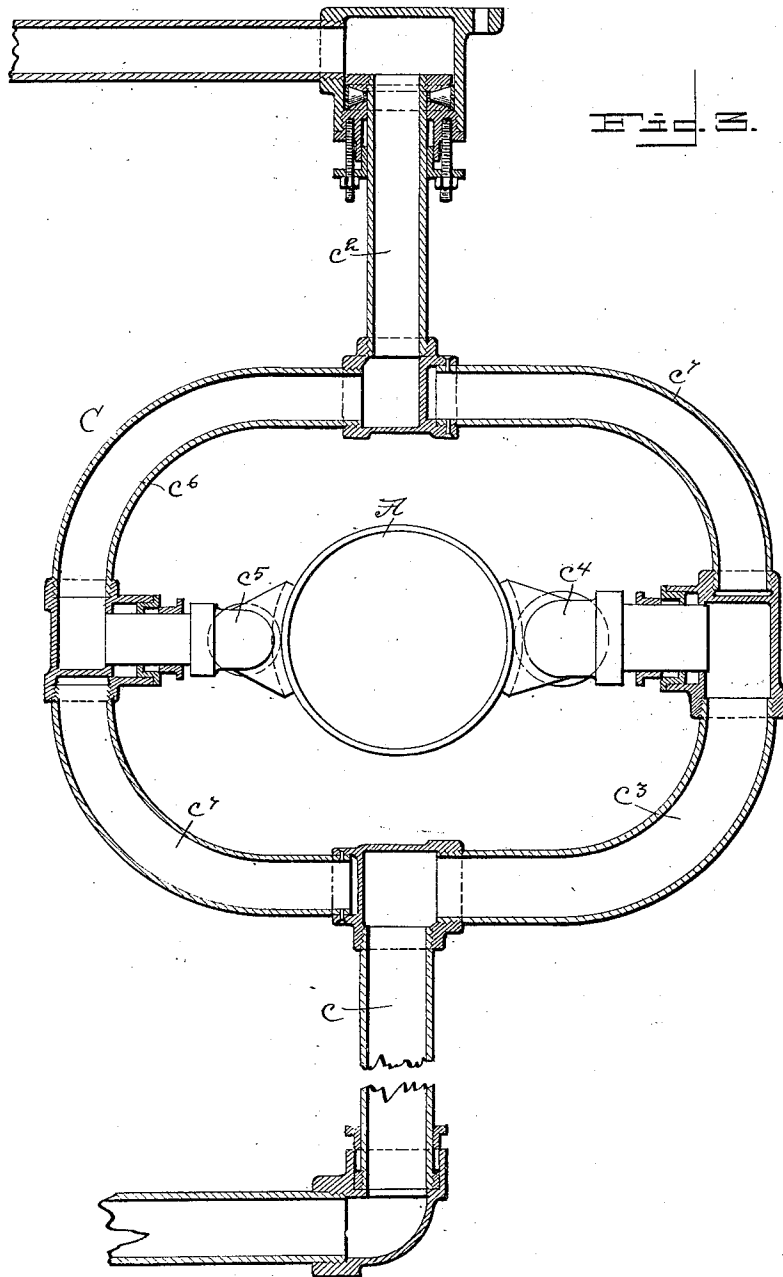
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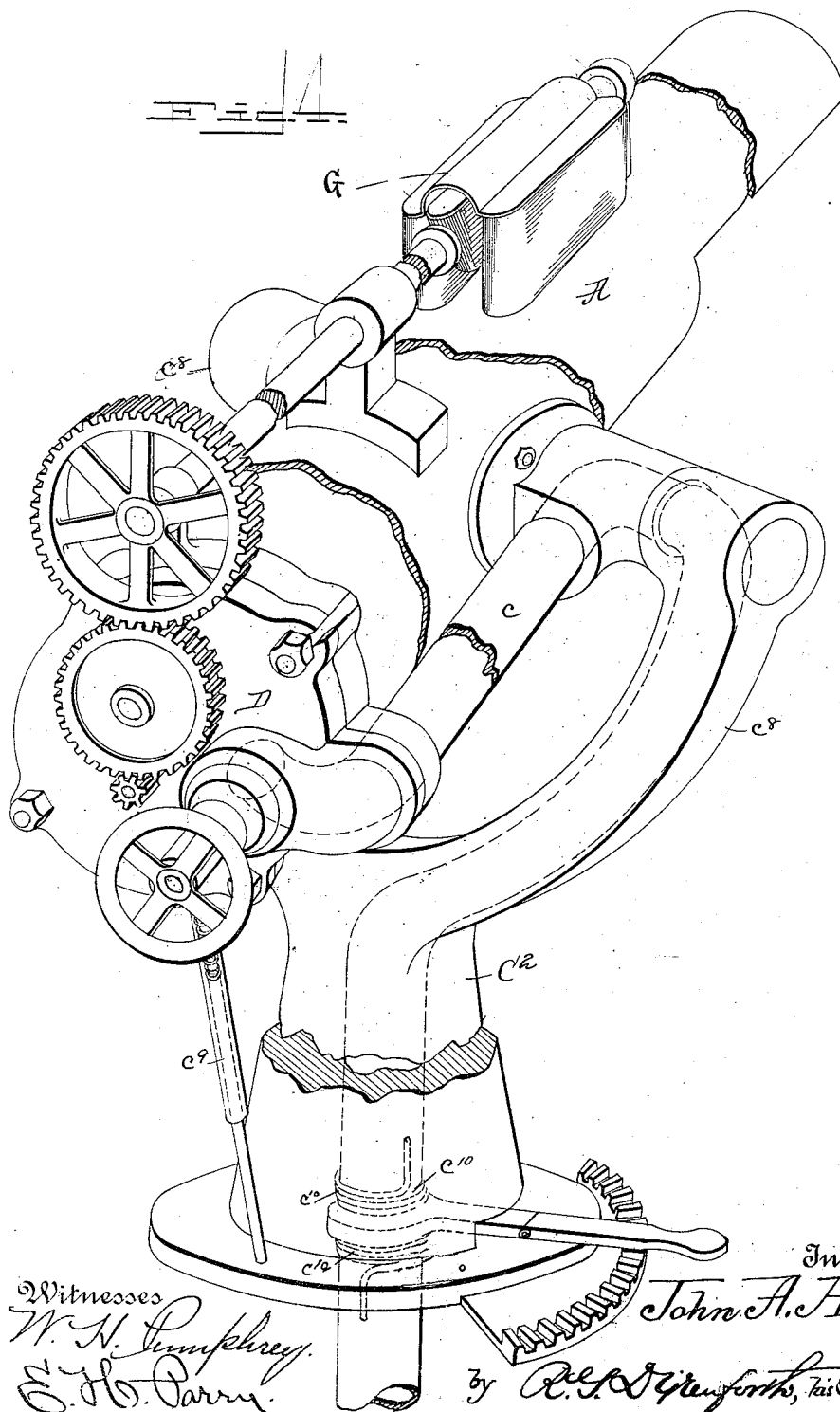
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UNITED STATES PATENT OFFICE.

JOHN A. HOWELL, OF WASHINGTON, DISTRICT OF COLUMBIA.

TORPEDO-LAUNCHING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 484,658, dated October 18, 1892.

Application filed September 18, 1891. Serial No. 406,129. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. HOWELL, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Torpedo-Launching Apparatus; 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.

This invention relates to torpedo-launching apparatus, particularly to launching apparatus for torpedoes of the description of my torpedo, wherein the driving-gear consists of a fly-wheel to be spun up to a high velocity, together with and acting through a shaft and screw or other propelling instrumentality, as set forth in my patent granted January 27, 1885, and bearing the number 311,325.

The object is to employ such a torpedo in connection with a tube, gun, or barrel, from which it is to be projected or fired by any suitable means; furthermore, in the employment of a tube, gun, or barrel to be able to give the same the requisite motions for training, and also present a convenient and efficient form of carrying the power-conveying means to their place of operation, at the same time protecting them from racking or other injury; furthermore, to center the torpedo in the tube and present it in position for certain engagement of the spinning mechanism with the driving-gear, holding the torpedo securely against turning while the fly-wheel is being spun up and be able to disengage spinning mechanism and driving-gear without stopping the spinning mechanism; furthermore, to maintain the torpedo in place in the tube and yet be able to release it at the proper moment, and, finally, to project the torpedo from the tube in a ready, certain, and efficient manner.

With these objects in view the invention consists in the combination and arrangement of parts, substantially as hereinafter described and claimed.

In the accompanying drawings, forming part of this specification, and in which like letters of reference indicate corresponding parts, I have illustrated forms of apparatus in which the fly-wheel torpedo is to be spun

up or speeded by application of the spinning mechanism through the longitudinal axis—that is, through the propeller-shaft to the fly-wheel through the end of the torpedo; but it will be obvious that without departing from the spirit of my invention I may spin up or speed the fly-wheel of the torpedo by application of the spinning mechanism through the transverse axis—that is, through a short shaft carrying the fly-wheel that is at the side of the torpedo.

In the drawings, Figure 1 is a view in horizontal longitudinal section, partly in plan, showing a torpedo-gun suitable for containing a fly-wheel torpedo—that is to say, a torpedo-gun with spinning attachment—whereby the fly-wheel of such a torpedo can be spun or speeded up, the gun being here shown as adapted to speed up a longitudinal-axis torpedo, (such a torpedo being shown in position in the gun,) though the gun may have its spinning mechanism arranged laterally to speed up a transverse-axis torpedo, as in my patent of January 27, 1885, No. 311,326, or otherwise; showing, furthermore, specific spinning mechanism and a clutch to connect with the torpedo-driving gear, in this instance with the propeller portion thereof; showing, furthermore, a form of mechanism whereby a torpedo-driving gear-clutch may be thrown into and out of operation, the disengagement occurring without necessarily stopping the spinning mechanism; showing, furthermore, the position of the safety device (appearing more fully in Fig. 2) to engage with the torpedo and keep it in place in the gun; showing, furthermore, a spoon or hood, and, by a broken line on the forward end or spoon or hood of the gun, where the figure is in plan, and also rearward, the position of the retaining-groove and on the torpedo the tenon; showing, furthermore, a form of torpedo-holding device located in the gun, the holding device being here a hollow piston provided with a groove at the bottom (seen central) and one at the top (not seen in this figure, but appearing in Fig. 2) showing, furthermore, a portion of the horizontally-revoluble mount (appearing more fully in Fig. 3) and the pivots at trunnions where the gun is held in the mount; showing, furthermore,

steam or other fluid conduit and exhaust passing through the pivot; showing, furthermore, a receptacle for the expelling agent at the rear of the gun and behind the piston; showing, furthermore, escape or relief ports around the gun in advance of the trunnions; showing, furthermore, the position of spring-latches in advance of the relief-ports, and appearing more fully in Fig. 2; showing, furthermore, a fluid-supply pipe leading from a pivot or trunnion of the gun to the receptacle for the expelling agent at the rear of the gun behind the piston, the expelling agent being in this instance steam or compressed air, and the expelling agent in the form of apparatus here selected for mere illustration of the broad invention being led to the receptacle through the breech-block, the breech-block being shown pivoted on the supply-pipe to swing laterally and provided with a receiving-chamber or steam-chest having two ports controlled and opened alternately by a valve, one port leading to the receptacle behind the piston and the other to a Barker's mill-motor; showing, furthermore, the motor journaled on friction-rolls and discharging into an exhaust-chamber connected by a pipe with the other pivot or trunnion, and showing, finally, hand-gear for operating both the valve and the mechanism whereby the driving-gear clutch may be thrown into and out of operation, there appearing a crank against a dial, the edge only of which is seen, a rod, upon which the crank is fixed, carrying two eccentrics, one at the valve-rod and the other at the rod of the spinning mechanism, for engaging and disengaging this with the rod of the clutch which turns the torpedo-driving gear, and a rod under the rod of the spinning mechanism for a block between springs, (more fully shown in Fig. 2,) to shift the fulcrum from the under rod to the rod of the spinning mechanism when this has completed its motion (its motion being shorter than that of the valve-rod) and let the valve-rod complete its motion. Fig. 2 is a view in side elevation, partly in vertical longitudinal section, with portions broken away to display some of the internal parts which then appear in vertical longitudinal section, the view showing the gun and attachments with torpedo indicated in position and representing in addition to what appears in Fig. 1, or more fully the spoon or hood, the spring-latches to act as brake-stops to the piston, the holding-grooves of the piston with the vertical fins of the torpedo in them, the safety-device pin projecting to keep back the hollow piston and engaging with the torpedo at a notch in the lower fin to keep it in place in the gun, showing, also, the means for operating and releasing the safety device, the projecting pin, with a piston-head working in a cylinder, upon an adjustable spiral spring, a port leading above the piston, and a pipe leading from the receptacle behind the piston for the expelling agent to the port; showing, furthermore, the

swinging breech-block securely closing the rear end of the gun by swing bolts and nuts, and showing, finally, the hand-gear in dotted lines, the dial, the crank, the valve-rod eccentric, the valve-rod, a rigid rod under it, and a connecting-bar pivoted at each end to a rod and in the middle to the strap of the eccentric, forming a lever of the second class, the rod of the spinning mechanism engaging and disengaging with the rod of the clutch to the torpedo-driving gear, being beyond in horizontal plane with the valve-rod and being connected by a bar like that connecting the rigid rod and the valve-rod with a block sliding between springs on a rigid rod underneath it, affording a movable or yielding fulcrum, or rather shifting the fulcrum from the movable rod to the fixed rod when the movable rod has completed its movement, thus permitting further motion of the bar without injury to either rod. Fig. 3 is a view in vertical cross-section showing a stand or mount by which power is supplied to the gun and exhaust taken therefrom through the pivotal support, on which the gun is mounted, the specific form here presented for illustration of the broad invention being a curved frame of pipe horizontally pivoted on a supply-pipe from above and an exhaust-pipe from below, and vertically pivoted on short pipes, which pass laterally inward to the trunnions of a gun held therein. Fig. 4 is a view in perspective showing another form of mount, one horizontally pivoted on a standard, through which the supply and exhaust lead, and having a yoke or Y-arms to take the lateral supports from the trunnions of the gun to pivot this vertically. The mount may be relieved from strain on any rolling or pitching of the vessel by spring-seating the traversing-lever and the elevating device, and instead of the fluid-motor for the spinning mechanism there may be the electric motor here indicated.

In the drawings, A indicates a torpedo tube, gun, or barrel suitable for containing either a longitudinal-axis or a transverse-axis fly-wheel torpedo, in the present illustration the invention being shown as adapted to a longitudinal-axis fly-wheel torpedo B.

The tube or gun is formed, preferably, with a hood or spoon A^2 , and has extending longitudinally along its top within from rear to front a groove a of suitable size and shape to receive and retain against vertical or lateral escape a tenon b on the back of the torpedo over its center of gravity. There may be grooves at the sides taking a tenon at each side of the torpedo. This is for the purpose of sustaining the torpedo and guiding it until its tail is clear of the gun.

The tube, gun, or barrel is mounted in or on a stand in a manner to permit it to be traversed or elevated and depressed—that is, trained—and is supplied with power and exhausts through the training-pivots, thus avoiding strain upon the means of convey-

ance of power or of discharge by locating them in the line or lines of least motion, at once protecting them from exposure.

The stand or mount may be either a frame C, composed of supply and exhaust pipes c^1 and c^2 , a length of curved pipe c^3 , into which the supply-pipe leads at one end, the other end opening into a pivotal pipe c^4 , connected with one hollowed trunnion of the gun, another pivotal pipe c^5 , connected with the other hollowed trunnion of the gun and opening into a further length of curved pipe c^6 diametrically opposite the first and leading into the exhaust-pipe c^2 , the frame being completed, by curved pipes c^7 and c^8 , diametrically opposite each other, closed at both ends, and the supply and exhaust pipes affording, with the frame, a vertical pivot for traversing the gun, and the pipes at the trunnions affording a horizontal pivot for elevating and depressing the gun; or the stand or mount may be a rotary standard C^2 , having a yoke or Y-arms c^9 , connecting with the pivotal pipes at the trunnions, and the supply and exhaust being again through the training-pivot, (see Fig. 4,) and with the stand or mount of any kind the tube, gun, or barrel may be spring-seated on its pivots for traversing and elevating and depressing to relieve strain from rolling, lurching, and pitching of the vessel. Thus the traversing device and the elevating and depressing device may be yieldingly held, as by the springs c^9 and c^{10} in Fig. 4. The supply may be electricity or other power, and in that case would lead to an electric motor G or any other suitable motor on or in the gun, as shown in Fig. 4, where an electric motor is shown on the gun in front of the trunnions and connected with gearing to speed up the fly-wheel; but the preferred construction is to employ steam or compressed air and bring the supply to a chest which feeds a motor that may be at the side of the gun to spin or speed up the fly-wheel of transverse-axis torpedo or be at the rear to spin or speed up the fly-wheel of a longitudinal-axis torpedo. In the present illustration, a longitudinal-axis torpedo being operated upon, it is preferred to locate the spinning mechanism at the rear. The supply-pipe c then leads to the breech-block D and supplies its pivot—that is to say, the breech-block is pivoted on the pipe c , parting on the line v , and is secured to the rear of the gun when shut by swing-bolts and nuts d^2 . The supply-pipe c enters the steam-chest d in the breech-block, and from this chest by two ports d^3 and d^4 , controlled by a valve d^5 , having a stem d^6 to be closed or to be opened and closed alternately, lead two ducts d^7 and d^8 , the duct d^7 to the hollow journal of a Barker's-mill motor D^2 and the duct d^8 to a receptacle d^9 for the expelling agent. The motor here is a common one and needs no further description. It runs on friction-rolls d^{10} at its journals and discharges into the exhaust-pipe c^2 . The shaft d^{10} of the motor is mov-

able endwise, and at its inner end has any suitable construction or configuration which will enable it to engage with and turn another shaft, its outer end projecting beyond the rear of the breech-block. Motor and shaft constitute spinning mechanism.

At the rear of the breech-block D is the hand-gear E. This consists of a crank e , fixed on a shaft e^1 , extending laterally across the rear of the breech-block below the valve-stem and motor-shaft, and supported in brackets e^2 and e^3 on the block. In the vertical plane of the valve-stem the shaft has fixed upon it an eccentric e^4 , provided with a strap e^5 , and in the vertical plane of the motor-shaft another eccentric e^6 , provided with a strap e^7 . The strap of the eccentric e^4 is pivoted to about the center of a bar e^8 , which is in turn and at its ends pivoted above with a slot to the valve-stem and below to a fixed and rigid rod e^9 , projecting from the rear of the block. The strap of this eccentric e^6 is pivoted to about the center of a bar e^{10} , which is in turn and at its ends (the upper ones slotted) pivoted above to a link connected to the motor-shaft that it may turn, and below on a fixed and rigid rod e^{11} , projecting from the rear of the block somewhat farther than the other fixed rod to take springs. The bar e^{10} is not, like the bar e^8 , pivoted directly in its fixed rod, but is pivoted in a block e^{12} , which slides on the fixed rod e^{11} , and is held thereon between adjustable spiral springs e^{13} , which encircle the rod. It will be seen that turning the crank in one direction pushes both the valve-stem and shaft in, while turning it in the other direction pulls them both out; but it will be observed on inspection that the throw or capability of movement endwise of the motor-shaft is less than that of the valve-stem. Hence if the connections of the two were alike, after the motor-shaft had reached the end of its movement the valve-stem could not be moved farther without injury to the shaft. To adjust this the movable spring-seated block e^{12} on the rod e^{11} yields, transferring the fulcrum to the motor-shaft and allowing the valve-stem to complete its movement. The crank turns on the face of a dial; and this dial is provided with appropriate marks—such as "Shut," "Open," "Fire"—indicating the position to be given the crank to close both ports or to open either.

Within the tube or gun and fitting the same snugly and smoothly is a hollow piston F, with chamfered edge at its rear, to leave a circumferential chamber when inserted into a closed tube on its rear. The piston is provided centrally within with a hub or boss f , through which passes a short shaft f^2 , being on its outer end of any construction or configuration suitable to enable it to engage with and be turned from another shaft—in this case from the shaft of the motor, the two constituting engaging and disengaging mechanism—and on its inner end provided with a clutch f^3 to engage with the propeller of the

torpedo, and thus turn the fly-wheel to speed up the driving-gear. The hollow piston F has grooves f^4 at top and bottom, into which the vertical top and bottom fins of the torpedo enter, whereby the relative vertical position of the torpedo with respect to the shorter axis of the gun is maintained—that is to say, whereby the torpedo will be retained in the gun with its axis coincident with the axis of the gun.

About ninety degrees or at any suitable distance from the entrance of the duct d^8 into the receptacle a^3 for the expelling agent this receptacle communicates, by a duct a^4 , (shown in dotted lines, Fig. 2,) with a pipe a^5 , which leads to the port a^6 of the safety device A^4 . This safety device consists of a box or cylinder a^7 , holding an adjustable spring a^8 , upon which rests a piston a^9 , having for its stem the pin a^{10} , which normally, by pressure of the spring, projects upward through an opening into the gun just in advance of the front or open end of the piston, and when a torpedo is in place takes into a notch in the lower fin of the torpedo, this device serving as a safety device both to keep the piston in position before firing and to keep the torpedo from falling out. It also serves in a measure to center the torpedo. The port enters the box or cylinder of the safety device above its piston.

Circularly around the tube, gun, or barrel at any convenient distance from the breech are openings A^5 , serving as relief or discharge openings for any fluid of or from the expelling agent after the rear of the piston has advanced beyond them, and to stop the piston there are further provided spring-latches A^6 , constituting friction-brakes.

The torpedo-launching apparatus here shown is operated as follows: The stop or throttle valve on the steam-pipe (not shown) being closed, the swing-bolts are loosened and the breech-block is swung downward on the supply-pipe as a pivot until the entrance to the tube is clear. The torpedo is then inserted into the tube from the rear, with the tenon in the groove in the top, and is pushed forward until the pin a^{10} of the safety device takes into the notch in the vertical bottom fin of the torpedo. The hollow piston F is then pushed in from the rear, its grooves taking upon the vertical fins of the torpedo until it strikes the pin of the safety device. The breech is then closed and bolted. The hand-gear should be in position "Shut" before the stop or throttle valve is opened. Then, by moving the crank to the position "Open" the steam or compressed air passes to the motor and the engaging device connects the clutch-shaft, turns the clutch, and speeds up the fly-wheel of the torpedo. Now by turning the crank to the position "Fire" the valve cuts off supply to the spinning mechanism, the connecting device is disengaged and the steam, compressed air, or the like enters the chamber behind the piston and also passes through

the pipe over the piston of the safety device, releasing the pin a^{10} . As the piston of the safety device is set to be more easily moved than the large hollow piston in the gun, the pin will recede before the large piston moves. The large piston then shoots forward and the torpedo is blown out; but pressure falls as soon as the piston passes the opening A^5 , and the piston is caught by the friction-brake stops.

By the employment of the spinning mechanism in connection with the tube or gun with or without a piston any projectile—for example, particularly, a rocket—may be given a rotary motion, as from a rifled gun, and by the employment of the piston in a tube, gun, or barrel direct blast upon the projectile, which in some cases by greater escape above or below or on one side or the other of the projectile tends to cause the projectile to deviate from the path intended for it, is avoided. If it is desired merely to center the projectile, the piston may be supplanted by a sleeve.

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

1. The combination, in apparatus for giving motion to projectiles, of a tube, gun, or barrel suitable for containing a projectile, spinning mechanism, and means for connecting the spinning mechanism and the projectile, substantially as described.

2. The combination, with any tube, gun, or barrel suitable for containing a fly-wheel torpedo, of means for spinning or speeding up the fly-wheel of the torpedo, as and for the purposes set forth.

3. The combination, in torpedo-launching apparatus, with a torpedo tube, gun, or barrel for fly-wheel torpedoes, of spinning mechanism and a clutch to connect the spinning mechanism with the torpedo-driving gear, whereby the fly-wheel of an inserted torpedo can be spun up to the requisite velocity, substantially as described.

4. The combination, in torpedo-launching gear or apparatus, with a torpedo-barrel, of a fly-wheel torpedo contained therein and a clutch for engaging with the driving-gear of the torpedo, substantially as set forth.

5. The combination, with a tube, gun, or barrel suitable for containing a fly-wheel torpedo, of a clutch for engaging with the driving-gear of the torpedo, spinning mechanism whereby the fly-wheel can be spun up, and mechanism for engaging and disengaging the spinning mechanism with the clutch, the disengagement occurring without necessarily stopping the spinning mechanism, as and for the purposes set forth.

6. The combination, with a torpedo-barrel, of a fly-wheel torpedo contained therein, a clutch for engaging with the fly-wheel, spinning mechanism whereby the fly-wheel can be spun up, and mechanism for engaging and disengaging the spinning mechanism with the

clutch, the disengagement occurring without necessarily stopping the running of the spinning mechanism, substantially as described.

7. The combination, with a tube, gun, or barrel, of a horizontally-revoluble stand or mount on which the tube, gun, or barrel is placed, whereby the tube may be traversed, as and for the purposes set forth.

8. The combination, with a tube, gun, or barrel, of a horizontally-revoluble stand or mount on which the tube, gun, or barrel is pivoted, whereby the tube, gun, or barrel may be traversed and also elevated and depressed, thus is trained, as set forth.

9. The combination, with a tube, gun, or barrel, of a horizontally-revoluble stand or mount on which the tube, gun, or barrel is pivoted, whereby it may be trained, and conduits or conductors which pass through the pivot at the tube carrying power to the tube, gun, or barrel to drive the spinning mechanism and perform other operations as and also exhausting through the training-pivot, whereby the conveyers or conductors will be free from strain and be protected.

10. A stand or mount for a torpedo tube, gun, or barrel, consisting of a frame composed of supply and exhaust pipes, a curved pipe into which the supply-pipe leads at one end, the other end opening into a pivotal pipe connecting with one hollowed trunnion of the tube, gun, or barrel and opening into a further curved pipe diametrically opposite the first and leading to the exhaust-pipe, the frame being completed by curved pipes diametrically opposite each other, closed at both ends, and the supply and exhaust pipes supplying, with the frame, a vertical pivot for traversing, and the pipes at the trunnions, a horizontal pivot for elevating and depressing, as and for the purposes set forth.

11. The combination, with the torpedo tube, gun, or barrel, of a latch safety device to engage with the torpedo, substantially as described.

12. The combination, with the torpedo-barrel, of a torpedo contained therein and a latch safety device located on the torpedo-barrel and engaging with the torpedo notched to take the latch, whereby the relative longitudinal location of the torpedo with respect to the longitudinal axis of the torpedo-barrel is maintained, as set forth.

13. The combination, with a torpedo tube, gun, or barrel, of a safety device located on the torpedo tube, gun, or barrel and a fluid-pressure device for operating and releasing it, substantially as described.

14. The combination, with the torpedo-barrel, of the torpedo contained therein, a safety device located on the torpedo-barrel and engaging with the torpedo, whereby the relative position of the torpedo with respect to the longitudinal axis of the torpedo is maintained, and a fluid-pressure device for operating and releasing the safety device, substantially as described.

15. A sliding sleeve or vessel within the tube, constituting a torpedo-holding device located in the torpedo-barrel to engage with the torpedo, whereby the relative vertical position of the torpedo with respect to the shorter axis of the torpedo-barrel is maintained, that is to say, whereby the torpedo will be retained in the tube with its axis coincident with that of the tube, as set forth.

16. The combination, with the torpedo-barrel, of a torpedo-holding device located in the torpedo-barrel to engage with the torpedo, whereby the torpedo will be retained in the tube with its axis coincident with that of the tube, and a latch safety device to engage with the torpedo, assist in retaining it in proper position, and restrain it from falling out of the tube, as described.

17. The combination, with a torpedo-barrel having a longitudinal retaining-groove at its top within, of a torpedo contained in the tube and provided with a tenon at its top of suitable form to be retained in the groove, as described.

18. In a torpedo-launching apparatus for fly-wheel torpedoes, a torpedo gun, tube, or barrel provided with a longitudinal retaining-groove at its top within, as set forth.

19. The combination, with the torpedo-barrel having a longitudinal retaining-groove at its top within, of the torpedo contained in the tube and provided with a tenon at its top of suitable form to be retained in the groove, of a holding device in the tube and a safety-pin therein.

20. The combination, with the torpedo-tube having the longitudinal groove, of the torpedo having the lug or vertical fin, whereby the torpedo is inserted in a determined position with respect to the tube, substantially as described.

21. The combination, with the torpedo-tube, of the projecting safety-pin having the piston-head working in the cylinder-box, a port, a spiral or other suitable spring, and an adjusting-nut, as set forth.

22. The combination, with the torpedo-barrel provided with a receptacle for the expelling agent, of the torpedo contained in the barrel, a safety device located on the torpedo-tube for centering the torpedo, a device for operating and releasing the centering device, and connections between said receptacle and the centering device, whereby on the release of the centering device the torpedo is automatically fired, as described.

23. The combination, with a torpedo tube, gun, or barrel, of a removable internal vessel for holding the projectile, the vessel in use being always wholly within the tube, substantially as described.

24. The combination, with a tube, gun, or barrel, of a piston provided with a clutch for engaging with and turning the projectile or a part thereof.

25. The combination, with a tube, gun, or barrel containing a piston open at its front

end and provided at its rear end with a clutch for engaging with and turning the projectile or a part thereof, of means for engaging and disengaging with the clutch, substantially as described.

26. The combination, with a tube, gun, or barrel containing a piston open at its forward end and provided at its rear end with a clutch for engaging with and turning the projectile or a part thereof, of means for engaging and disengaging with the clutch and a spinning device for turning the shaft of the engaging and disengaging means with the clutch, the engagement and disengagement occurring without necessarily stopping the spinning device, substantially as described.

27. The combination, with a tube, gun, or barrel, of a piston provided with a clutch and having a chamber behind it, means for engaging and disengaging with the clutch, means for spinning the engaging and disengaging means, and fluid-pressure ports connected with the spinning mechanism and with the chamber, whereby a contained projectile may be spun and then driven out or fired, substantially as described.

28. The combination, with a tube, gun, or barrel, of a piston provided with a clutch and having a chamber behind it, engaging and disengaging means to the clutch, spinning mechanism, fluid-pressure ports to connect with the spinning mechanism and with the chamber, and hand-gear for opening and shutting off supply of fluid to the spinning mechanism, to the chamber, and to both, substantially as described.

29. The combination, with a shaft e^2 , of eccentrics or cranks, bars e^{8x} e^{10} , to which the eccentrics or cranks are suitably connected, rigid supports e^9 e^{11} , in one of which a bar at one end is fixedly pivoted and in the other of which a bar is also at one end movably pivoted, the other ends of the bar being pivoted, respectively,

to rods set at an angle to the bars from the same shaft and from the same eccentric or crank or from eccentrics and cranks of the same size, whereby when a rod having a shorter length of movement has completed its movement a rod having a greater length of movement may move on, substantially as described.

30. A tube, gun, or barrel provided with an opening or with openings in its body in advance of the original receptacle for the expelling agent, whereby pressure will be diminished upon a projectile fired from it before the projectile leaves the tube.

31. The combination, with a tube, gun, or barrel provided with an opening or with openings in its body, of a piston adapted to be projected outward by fluid pressure and to push a projectile, and a stop or catching device for the piston, the stop being in advance of the openings and these being in advance of the position of the piston before firing, whereby pressure will be diminished upon the piston and this will be arrested before it reaches the end of the gun and the projectile will continue onward by its inertia, substantially as described.

32. In a mount or stand for a tube, gun, or barrel, the traversing device, in combination with spring e^{10} , attached to the movable standard and to a stationary plate, substantially as described.

33. In a mount or stand for a tube, gun, or barrel mounted upon a rotatable support, a spring-support, as e^9 , attached to the tube, gun, or barrel and to the support, substantially as described.

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

JOHN A. HOWELL.

Witnesses:

R. G. DYRENFORTH,
F. B. KEEFER.