

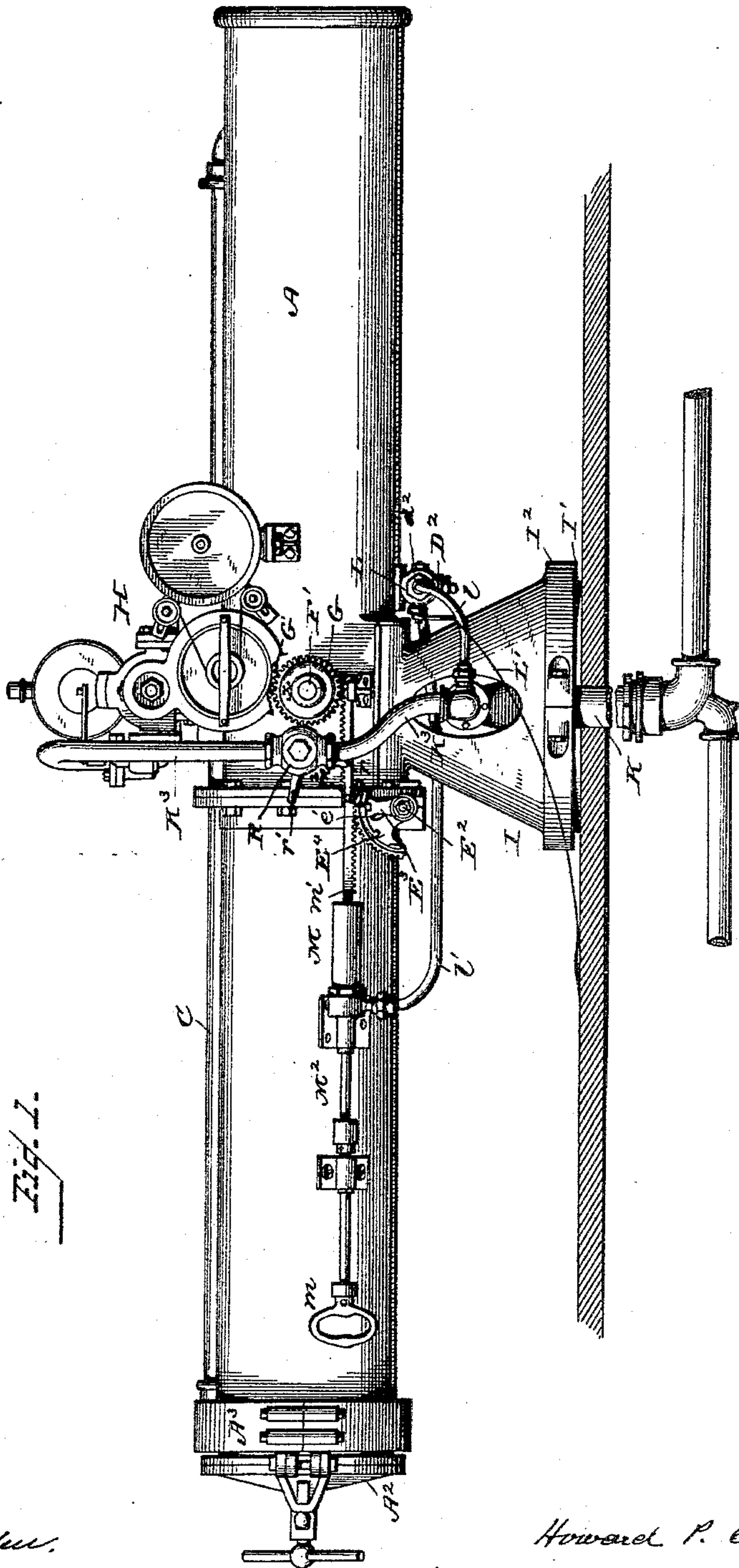
(No Model.)

5 Sheets—Sheet 1.

H. P. ELWELL.
TORPEDO LAUNCHING GEAR.

No. 414,386.

Patented Nov. 5, 1889.



Witnesses
Wm. H. Loomis.
Alfred M. Elwell.

Inventor
Howard P. Elwell
By his Attorney *Woodbury Lowrey*

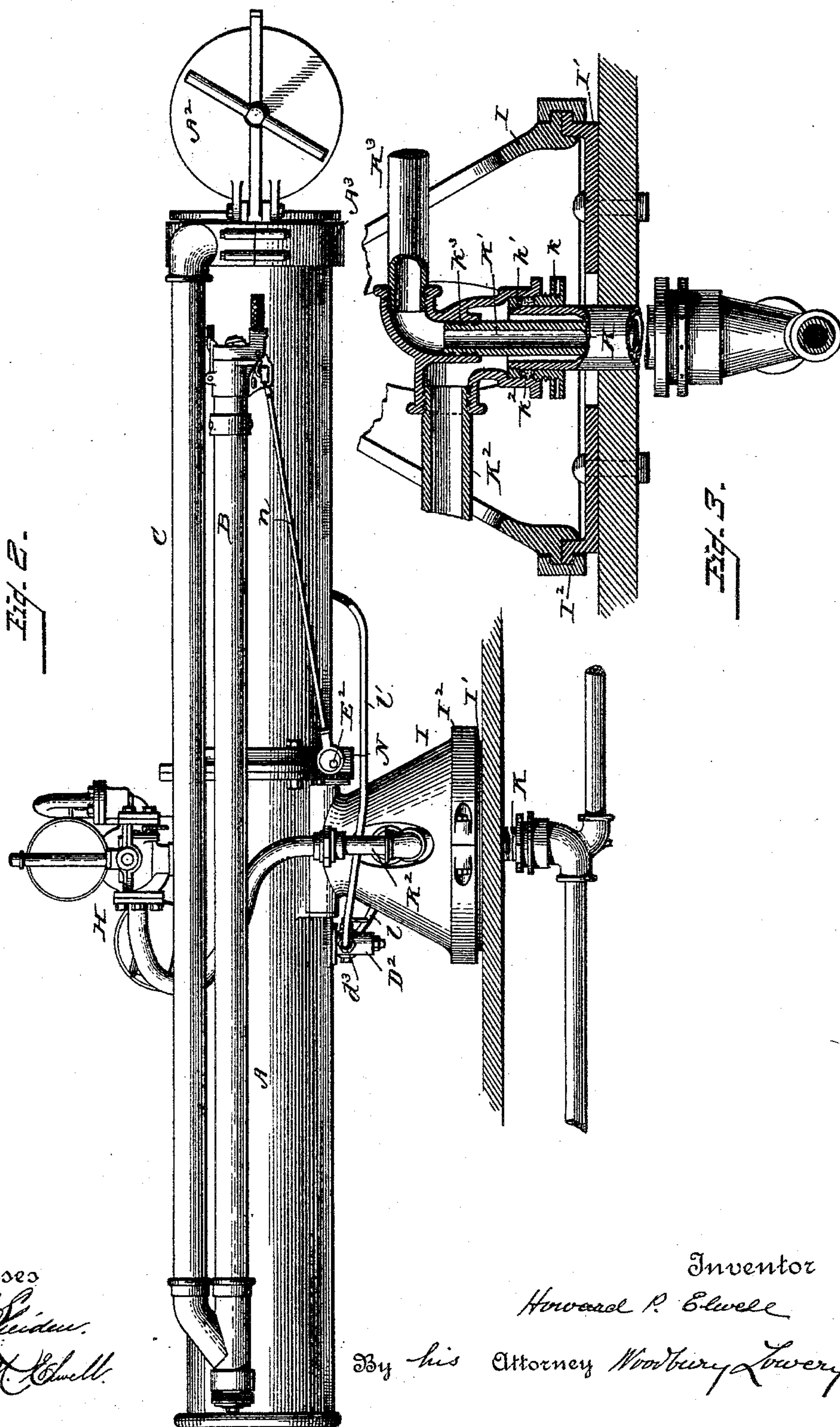
(No Model.)

5 Sheets—Sheet 2.

H. P. ELWELL.
TORPEDO LAUNCHING GEAR.

No. 414,386.

Patented Nov. 5, 1889.



Witnesses
Wm. S. [Signature]
Alfred M. Lowell

Inventor
Howard P. Ewell
By his Attorney Woodbury Lowrey

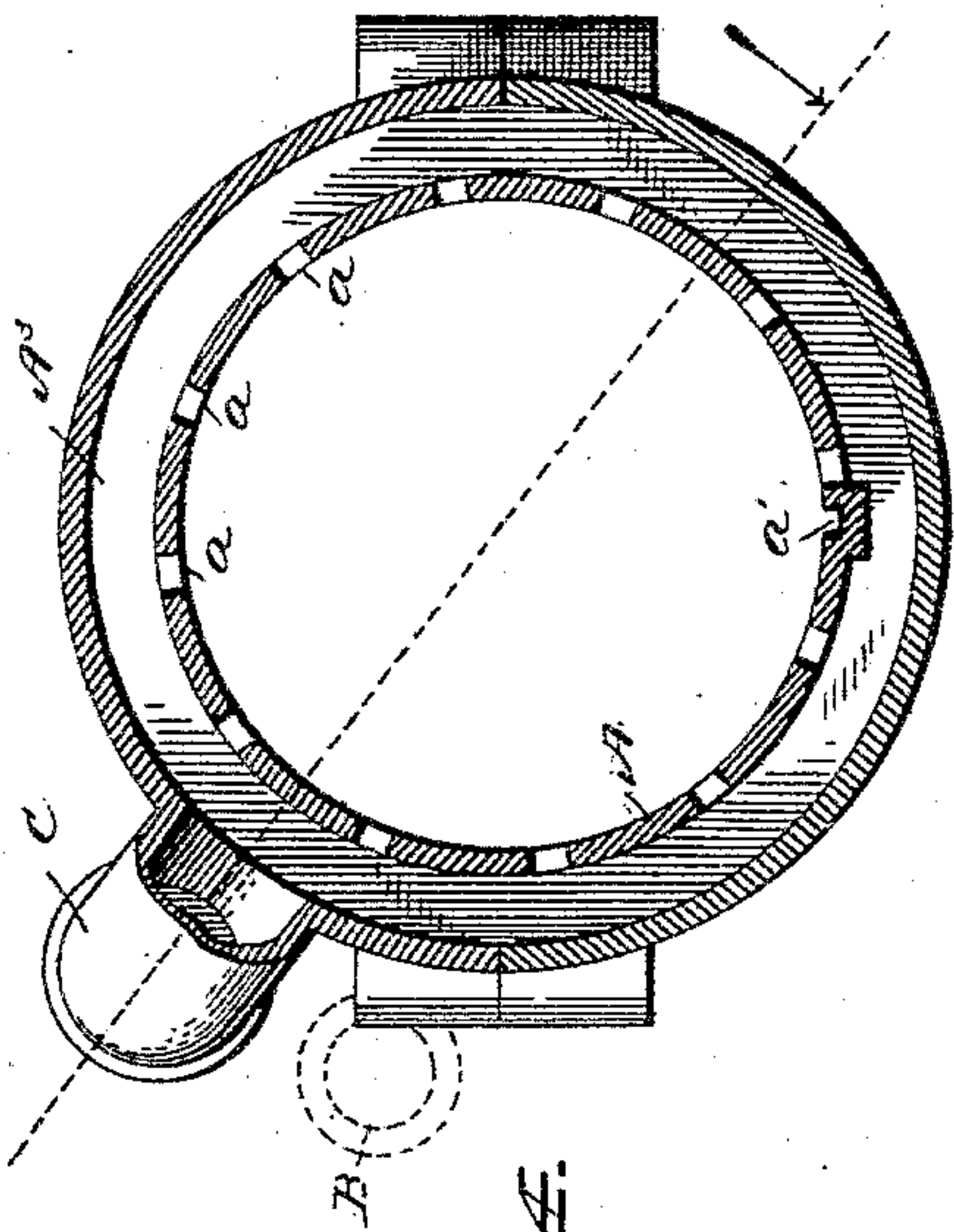
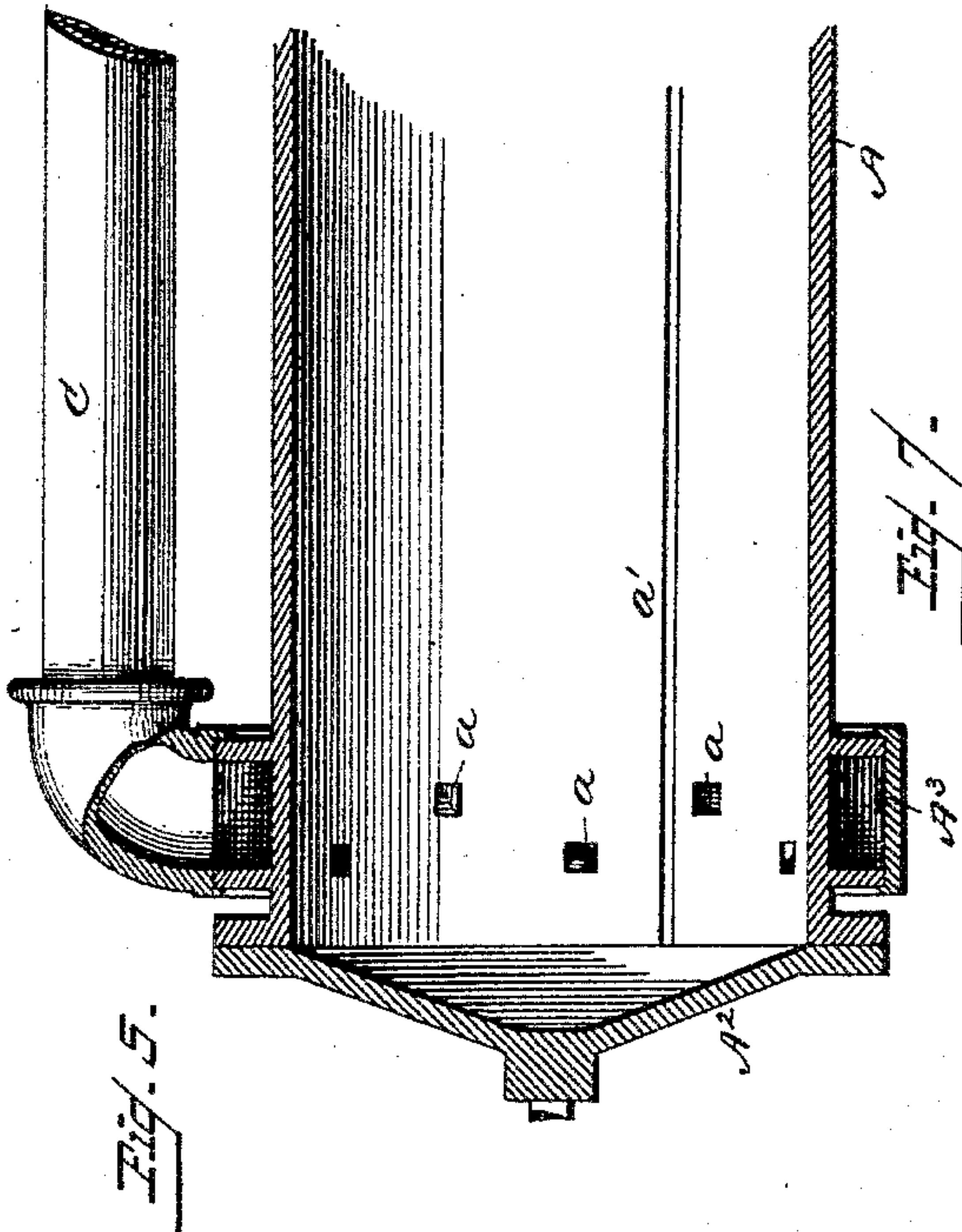
(No Model.)

5 Sheets—Sheet 3.

H. P. ELWELL.
TORPEDO LAUNCHING GEAR.

No. 414,386.

Patented Nov. 5, 1889.



Witnesses
Wm. H. Shiden.
Alfred M. Elwell.

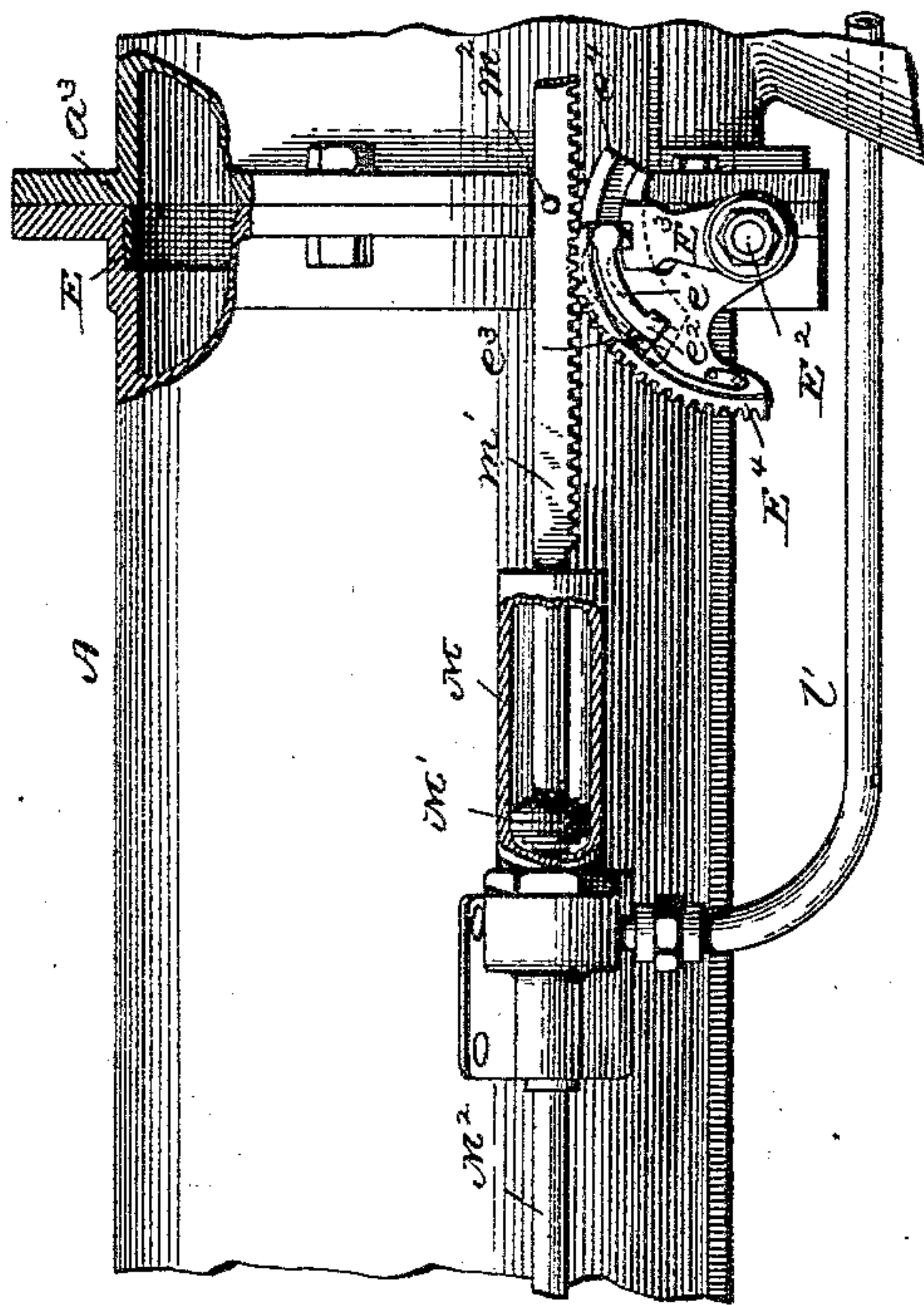
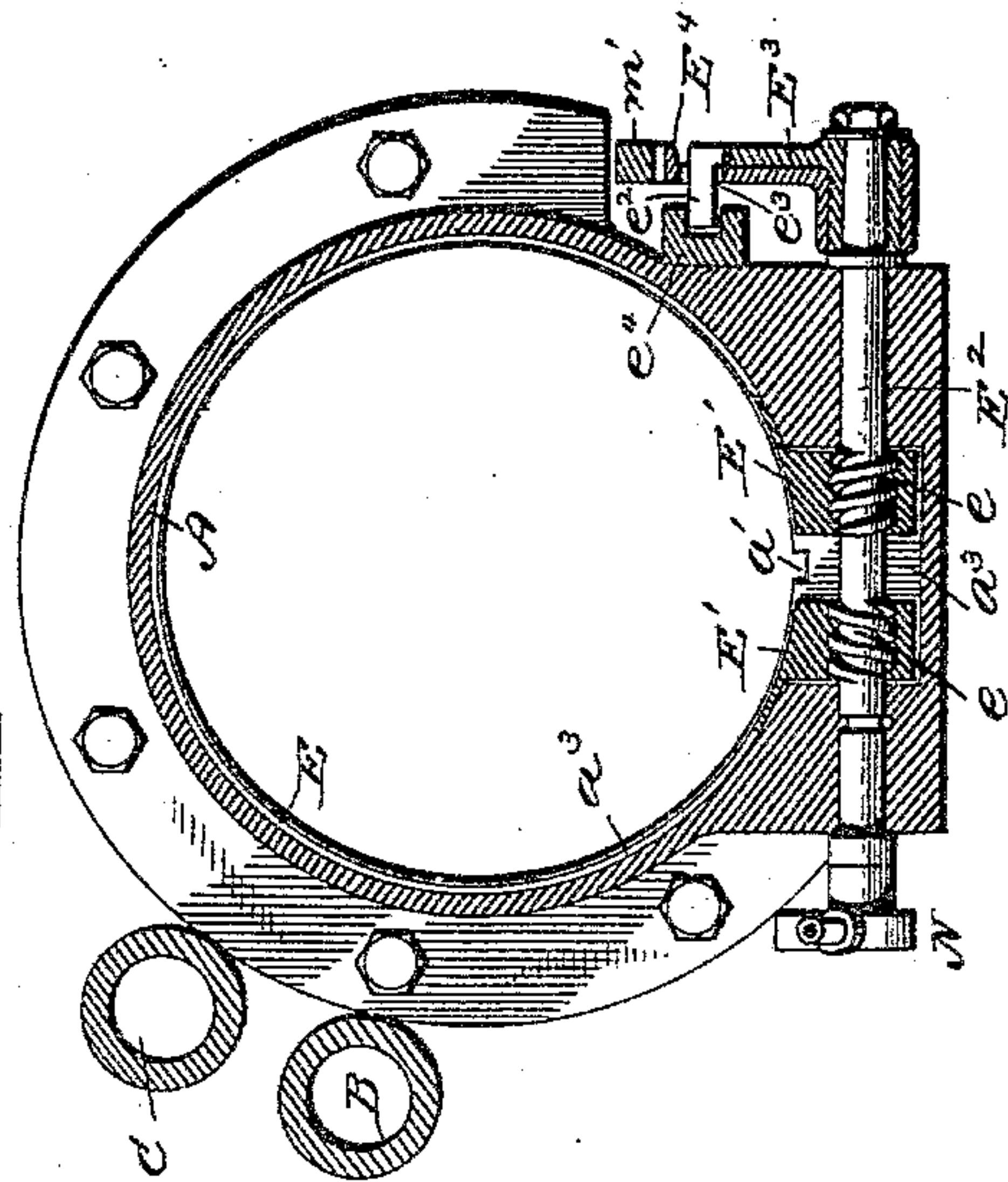


Fig. 8.
Inventor
Howard P. Elwell
By his Attorney *Woodbury Lowrey*

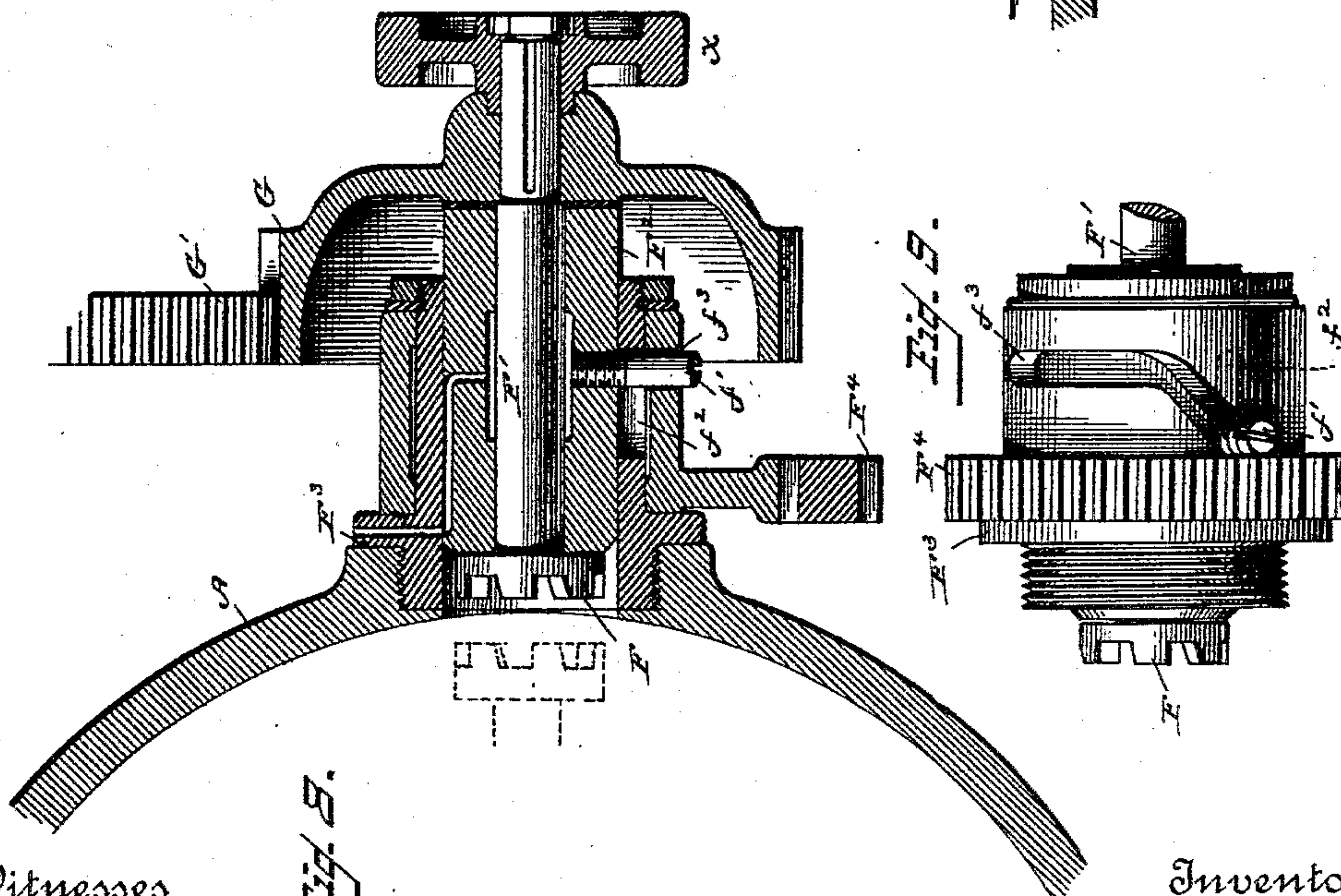
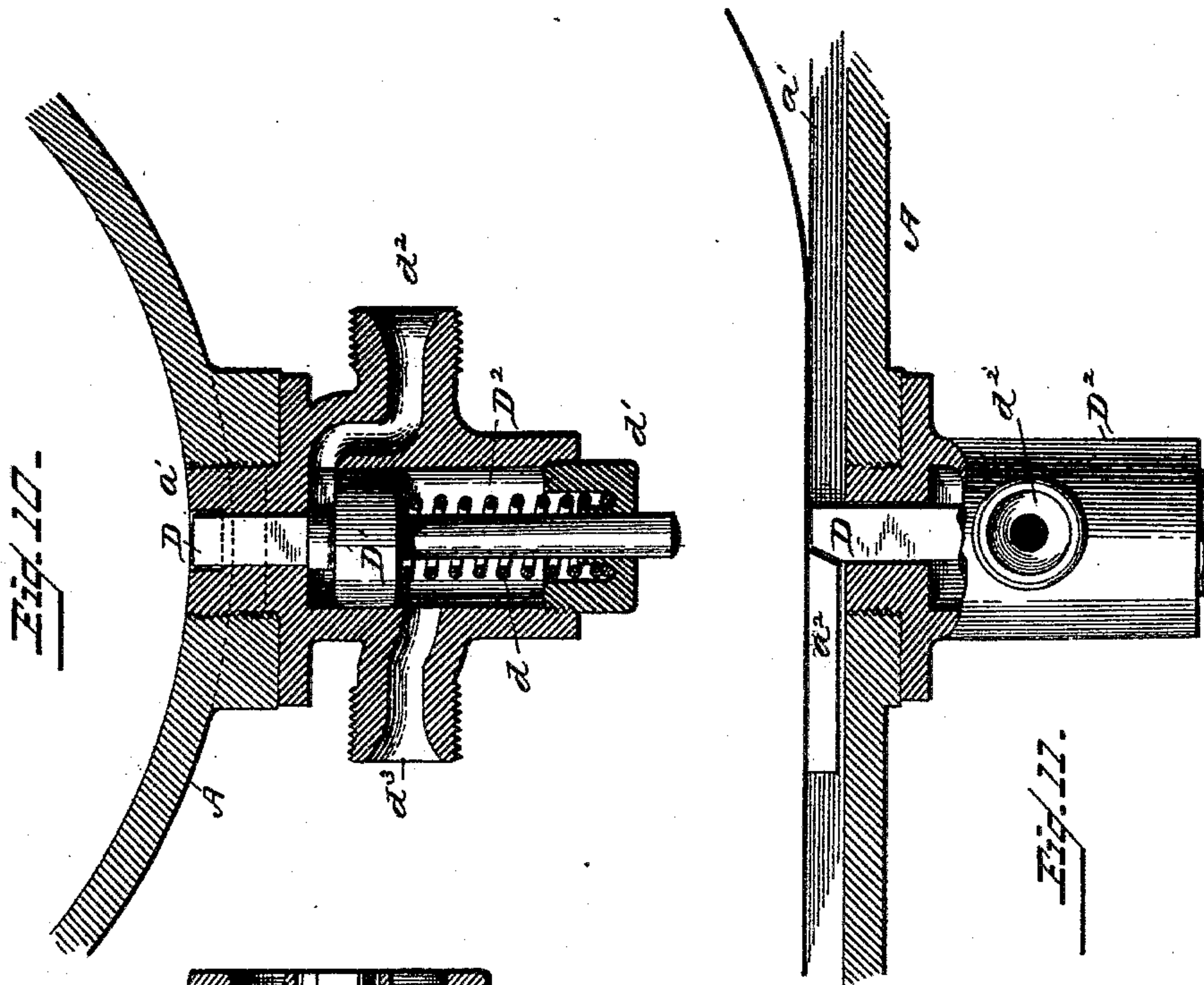
(No Model.)

5 Sheets—Sheet 4.

H. P. ELWELL.
TORPEDO LAUNCHING GEAR.

No. 414,386.

Patented Nov. 5, 1889.



Witnesses

Alfred M. Elwell
Alfred M. Elwell

Inventor

Howard P. Elwell

By his Attorney *Woodbury Lowrey*

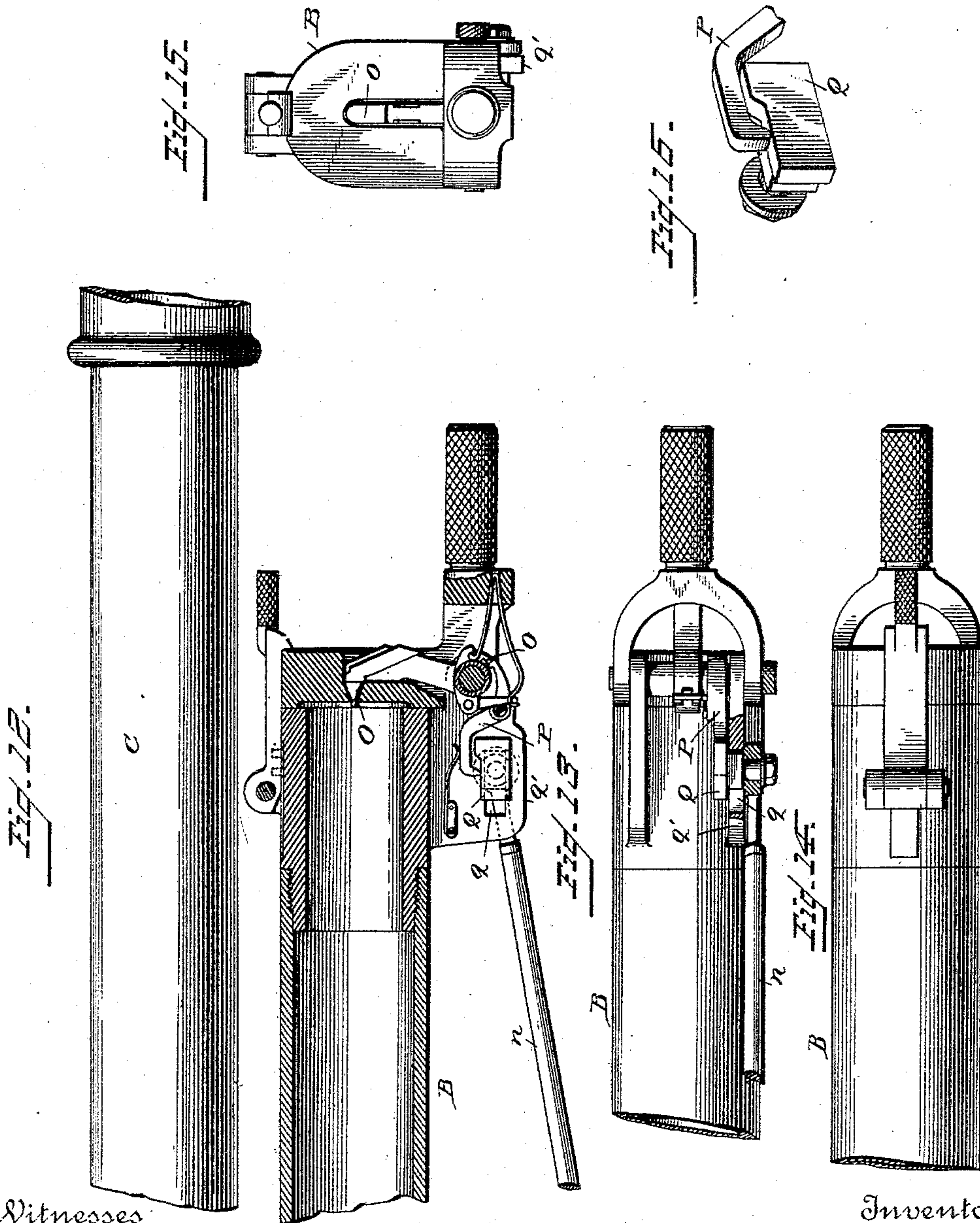
(No Model.)

5 Sheets—Sheet 5.

H. P. ELWELL.
TORPEDO LAUNCHING GEAR.

No. 414,386.

Patented Nov. 5, 1889.



Witnesses

Wm. H. Steadman

Alfred M. Elwell

Inventor

Howard P. Elwell

By his Attorney *Worbury Lowery*

UNITED STATES PATENT OFFICE.

HOWARD PARSONS ELWELL, OF GLOUCESTER, MASSACHUSETTS.

TORPEDO-LAUNCHING GEAR.

SPECIFICATION forming part of Letters Patent No. 414,386, dated November 5, 1889.

Application filed July 20, 1889. Serial No. 318,140. (No model.)

To all whom it may concern:

Be it known that I, HOWARD PARSONS ELWELL, a citizen of the United States, residing at Gloucester, in the county of Essex and State of Massachusetts, have invented new and useful Improvements in Torpedo-Launching Gear, of which the following is a specification.

My invention is shown as applied to that class of pneumatic guns in which the compression of the air is produced by an explosive, such as that described in Letters Patent No. 407,476, granted Dana Dudley July 23, 1889, and is in part designed more particularly for launching torpedoes of the description of the Howell torpedo, wherein the motor actuating the driving-gear consists of a fly-wheel spun up to a high velocity, as described in Letters Patent No. 311,325, granted John A. Howell January 27, 1885.

My launching-gear consists of the tube containing the torpedo, provided with means whereby the fly-wheel of the latter is spun up to the required velocity; means for centering the torpedo in the tube, whereby the clutch of the spinning mechanism is enabled to engage with the clutch of the fly-wheel; means for clamping the torpedo securely in place while the fly-wheel is being spun up; means for discharging the torpedo, consisting in this instance of an air-compression tube connected to the torpedo-tube in the rear of the same for the introduction of the air, as in the Dudley patent already referred to, and releasing and firing mechanism, whereby, the centering, clutch, and clamp devices being successively withdrawn and released after the requisite velocity of the fly-wheel has been attained, the torpedo is expelled in this instance by the explosion of the cartridge in the air-compression chamber; and my launching-gear is further provided with a pivot or mount, whereby it can be trained in a horizontal direction.

In the accompanying drawings, which illustrate my invention, Figures 1 and 2 are views from opposite sides of the torpedo-launching gear, showing the relative locations of the centering, clutch, clamp, and firing devices. Fig. 3 is a detail view, partly in section, of the

mount, showing the induction and exhaust steam pipes for the spinning-gear and firing-cylinder. Fig. 4 is a section across the diameter, and Fig. 5 is a longitudinal cross-section on the line $x x$, Fig. 4, of the torpedo-tube, showing the air-ring and air-ports in the rear of the tube. Fig. 6 is a side view, and Fig. 7 a cross-section, of the torpedo-tube, showing the clamping device. Fig. 8 is a view in cross-section of the torpedo-tube, showing the clutch mechanism; and Fig. 9 is another view of part of the same. Fig. 10 is a section across the diameter, and Fig. 11 in part a longitudinal cross-section, of the tube and centering device. Figs. 12, 13, and 14 are views of the firing mechanism, and Figs. 15 and 16 details of the same.

A is the torpedo-tube; B, the air-compression tube, containing an explosive; and C, the connecting-tube between the two, as described in the Dudley patent, above referred to.

The rear of the tube A, which is closed by a door A^2 , is surrounded by the circular air-chamber A^3 , to which is connected the air-induction tube C. Air-ports $a a a$ lead from chamber A^3 into the tube A, and are so spaced around the latter that the air entering from tube C must be deflected before it can escape into A, thus equalizing the pressure around the inclosed torpedo. Moreover, the ports are directed rearwardly, so as to throw the blast against the door, in place of at right angles to the inclosed torpedo, whereby the steering-gear is protected from an unnecessary strain. Running the entire length of tube A is a groove a' , (see Figs. 7, 10, and 11,) into which fits the lug a^2 of the torpedo, Fig. 11, and by means of which the latter is inserted with the axis of its fly-wheel in a horizontal position.

D, Figs. 10 and 11, is the stop or safety-pin, placed immediately below the groove a' of tube A, against which the lug a^2 of the torpedo abuts, when the latter is inserted into the tube, and by means of which the clutch on the fly-wheel is brought opposite to that of the spinning mechanism.

The safety-pin D consists of a solid piece of metal having an enlarged piston-head D' , working in a box D^2 , secured to the bottom of tube A. A spiral spring d holds pin D in

its normal position somewhat above the level of the groove a' , (see Fig. 10,) the tension of which may be adjusted by the nut d' , closing the bottom of the box D^2 . Safety-pin D is withdrawn from the groove by the introduction of steam into the box D^2 through port d^2 , the steam being able to escape through port d^3 only after it has completely withdrawn the pin from the groove, the travel of piston D' to open port d^3 being somewhat greater than the height of the pin in groove a' . The end of safety-pin D which projects into the groove is beveled to the rear, in order to avoid friction in releasing the torpedo and to allow of a certain amount of play the instant that it is withdrawn.

E , Figs. 6 and 7, is the clamping-band, which is next brought into play after the torpedo has been inserted, and consists of a band E , having enlarged heads E' E' , both band and heads lying in a chamber a^3 , counterbored in the torpedo-tube. A shaft E^2 , having reverse screws e e , passes through the chamber and the heads E' E' of the clamping-band E , so that the revolution of the shaft in one direction tightens the band and in the reverse direction loosens it. Clamp-shaft E^2 is revolved in either direction in the following way: Rigidly mounted on one end of clamp-shaft E^2 is a tapper having a notched arm E^3 . A toothed segment E^4 is also loosely mounted on the hub of the tapper, and has pivoted to it a pawl e' , the head e^2 of which projects backward at right angles through a slot e^3 in the segment, (see Fig. 7,) where it rests against a cam-plate e^4 , bolted to tube A . On revolving segment E^4 far enough in the direction of the muzzle of the tube pawl e' falls clear of the cam-plate e^4 , engages with the notch in the tapper-arm E^3 , and thus locks it to the segment, causing the two to revolve together, loosening the clamp. On the reverse movement the clamp is first tightened and the pawl then lifted out of engagement by cam-plate e^4 , allowing the segment to continue its motion independently. After the torpedo has been clamped the clutch F is next thrown into engagement with the end of the shaft of the fly-wheel. Clutch F and its shaft F' revolve in a sleeve F^2 , which in turn slides into the clutch-box F^3 , bolted to the side of the torpedo-tube A . A gear-wheel G , in normal engagement with the intermediate gear G' of the spinning mechanism, is secured to the outer end of the clutch-shaft F' , as is also a milled handle f , for convenience in locating the teeth of the clutch in proper relation to the teeth of the clutch of the torpedo. The longitudinal thrust of the clutch F , which is sufficient to throw it into and out of engagement with the clutch of the fly-wheel shaft, is limited and controlled by a pin f' , secured to sleeve F^2 , and projecting through a longitudinal slot f^2 in the clutch-box F^3 , the toothed periphery of gear-wheel G being of sufficient width to remain in contact with the intermediate gear G' , whatever the position of the clutch. In

addition to this, another device for advancing and withdrawing the clutch F is also provided. It consists of a toothed segment F^4 , mounted on the clutch-box F^3 , and having in its hub a cam-slot f^3 , through which projects pin f' , the cam-slot f^3 being of such shape (see Fig. 9) that through part of its revolution no forward movement is given to the clutch. Clutch F having been connected with the fly-wheel, the latter is spun up to the requisite velocity by means of the gearing G G' , connected to any suitable spinning device, to which steam is supplied through pipe K^3 .

That which I have shown at H is a Parson's motor, patented October 20, 1885, of a well-known construction, described in Letters Patent No. 328,710, and therefore requires no further description.

The next movement is that of training the gun, for which purpose it is mounted upon a stand I , Figs. 1, 2, and 3, revolving upon a circular rail I' , to which it is held by means of the grooved band I^2 . Fig. 3 shows the universal joint which I have provided for the steam supply and exhaust system, by which the spinning and other mechanism is operated, it consisting of the vertical exhaust-pipe K , and within it the steam-supply pipe K' , both concentric with the stand I . Over these fits a double-elbow pipe of peculiar construction, the exterior or exhaust pipe K^2 being jointed to pipe K and the interior or steam-supply pipe K^3 connected to pipe K' , as follows: A collar k , threaded only on the outside, is passed over pipe K , and then a second collar k' , threaded only on the inside, is screwed to the pipe K . A packing k^2 is interposed between them. The elbow-pipe is now fitted over pipe K , screwing into the lower collar k , as shown, and steam-supply pipe K^3 simply slipping over the end of pipe K' , the latter having concentric grooves k^3 , forming a steam-packing, which is all that is required. It is thus seen that the upper system of pipes is free to turn upon the lower when the gun is trained. Below the mount the same construction of the joint and double elbow is followed.

The gun having been charged and trained, to discharge the gun all of the operations already described must be performed in the inverse order, in order to release the torpedo before firing—that is to say, the safety-pin must be first withdrawn, then the clutch released, next the clamp loosened, the explosive in the air-compression chamber discharged, and as these operations are being performed the steam is shut off from the motor. For this purpose I have devised mechanism which automatically performs the reversals in the order named at one operation. A steam-pipe l leads from K^3 to the port d^2 of the safety-pin box D^2 , and a valve L , operated by a lanyard L' , is provided in this tube. Another steam-tube l' leads from the port d^3 to the firing-cylinder M , Figs. 1 and 6. To the piston M' of the firing-cylinder M is secured a rod M^2 ,

having at one end a handle m , at the other a rack-bar m' , which gears with the teeth on segment E^4 of clamp-shaft E^2 and those on segment F^4 of clutch F . When the clamp and clutch are in operation, the position of the rack m' is that shown in Figs. 1 and 6—that is to say, with the clutch F thrust forward and its pin f' in the position shown in Fig. 9, and clamp E having been tightened, and the pawl e' then lifted out of the notch in taper-arm E^3 , leaving segment E^4 free to complete its movement unimpeded.

The discharge of the torpedo is brought about as follows: Pulling the lanyard L' the firing-valve L is opened and steam is admitted into the safety-pin box D^2 , Figs. 10 and 11, through port d^2 , and, pressing down the piston-head D' , withdraws safety-pin D from groove a in front of the torpedo-lug a^2 . Passing then through tube b^2 it enters cylinder M , Figs. 1 and 6, where it drives the piston M' forward, carrying with it rack-bar m' . The latter causes segment E^4 , Figs. 6 and 7, to revolve, but without releasing clamp E , because pawl e' is prevented from interlocking with taper-arm E^3 by cam-plate e^4 . Segment F^4 of clutch F , Figs. 8 and 9, is at the same time revolved; but pin f' being in the position in slot f^2 shown in Fig. 9, the sleeve F^2 , and with it clutch F , is at once withdrawn from the fly-wheel without interfering with the revolution of either. After the clutch has been released clamp-segment E^4 has revolved sufficiently for the pawl e' to fall free of its cam-plate to interlock with the notch in taper-arm E^3 , revolve clamp-shaft E^2 , and release clamp E . An eccentric N , mounted on the other end of clamp-shaft E^2 , Figs. 2 and 7, in such relation to the shaft as to operate only after the torpedo has been unclamped, has at this moment been revolved far enough to actuate the firing mechanism of the air-compression tube B by means of the connecting-rod n . At the moment the clutch F is detached a pin m^2 , properly located on the side of the rack m' , comes into contact with a lever r on the throttle-valve R in the steam-pipe to motor, and during the balance of the forward movement of rack the valve is closed, shutting off steam from the motor.

The firing mechanism consists of a hammer and mainspring of the form used in the well-known Hotchkiss system of rapid-firing guns, arranged in the manner described below, and (see Figs. 12 and 15) has the hub of its hammer O provided with a lug o , interlocking, when the breech is opened for loading, with one end of a centrally-pivoted sear P , the other arm of which bears upon a cam Q , Fig. 12, to which a reciprocating movement is given by the connecting-rod n , pivoted to it through a slot q in plate q' , secured to the gun, and not partaking of the movement of the breech. When the breech is thrown open for charging the air-compression chamber, the sear P hooks into the lug o , and on closing the breech holds

the hammer O in the firing position, the other end of the sear resting on the lower part of the beveled face of the cam Q . When the gun is fired, the connecting-rod n , actuated by the eccentric-cam N on the clamp-shaft E^2 , draws the cam Q far enough to raise the arm of the sear P , releasing the other arm from the lug o . The hammer which has been holding the mainspring under tension flies forward, exploding the charge. The compressed air passing through tube C enters through ports a , and, impinging against the torpedo, expels it in the manner already described. Various advantages follow from the interrelation of the devices and the necessary order in which they are caused to act.

The act of discharging the torpedo is accomplished in one movement.

It is impossible to discharge the torpedo before every impediment to its exit is removed. Each obstacle is and must be completely removed before the next is touched, thus obviating any danger that would arise from the stoppage of one part while the others were acting.

The hammer of the air-compression chamber cannot be cocked until the torpedo-tube has been loaded, the torpedo clamped, and the clutch in place. These last two operations are performed in one movement by pulling backward the rack-bar m' . The clutch is released without the necessity of turning off the steam from the spinning mechanism, and thus retarding the fly-wheel, except in the automatic manner as hereinbefore described.

It is evident that the clutch, the clamp, and the safety-pin can be used alone or in combination, and with other mechanisms than that which I have shown for discharging the torpedo, and that either clamp or safety-pin may be used with torpedoes propelled by other means than a fly-wheel—where, for example, it is necessary to maintain the torpedo in place against the lurching of the ship. Neither do I limit myself to the particular details of the devices shown, as they can be widely varied without departing from the spirit of my invention, which consists, broadly, in providing means whereby the torpedo can be securely clamped while its motor, whatever its description, is being set in operation, and again automatically unclamped prior to firing; in the automatic centering of the torpedo; in the clutch for the Howell torpedo, automatically thrown into and out of engagement, and in means whereby any or all of these devices, together with the mechanism for discharging the torpedo, may be caused to operate consecutively, automatically, and in one movement.

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

1. In a torpedo-launching gear, the combination, with the torpedo-barrel, of the torpedo contained therein and a centering or safety device located on the torpedo-barrel and en-

gaging with the torpedo, whereby the relative longitudinal location of the torpedo with respect to the longitudinal axis of the torpedo-barrel is maintained, substantially as and for the purpose described.

2. In a torpedo-launching gear, the combination, with the torpedo-barrel, of the torpedo contained therein, a centering or 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-barrel is maintained, and a device for automatically operating and releasing the centering device, substantially as described.

3. In a torpedo-launching gear, the combination, with the torpedo-barrel, of the torpedo contained therein and a clamping device located on the torpedo-barrel and engaging with the torpedo, whereby the relative vertical position of the torpedo with respect to the shorter axis of the torpedo-barrel is maintained, substantially as and for the purpose described.

4. In a torpedo-launching gear, the combination, with the torpedo-barrel, of the torpedo contained therein, a clamping-device located on the torpedo-barrel and engaging with the torpedo, whereby the relative vertical position of the torpedo with respect to the shorter axis of the torpedo-barrel is maintained, and a device for automatically operating and releasing the clamp, substantially as described.

5. In a torpedo-launching gear, the combination, with the torpedo-barrel, of the torpedo contained therein, a centering device and a clamping device, both located on the torpedo-barrel and engaging with the torpedo, whereby the relative position of the torpedo with respect to the longer and shorter axes of the barrel is maintained, substantially as set forth.

6. In a torpedo-launching gear, the combination, with the torpedo-barrel, of the torpedo contained therein, a centering device, a clamping device, both located on the torpedo-barrel and engaging with the torpedo, and devices for automatically operating and releasing the centering and clamping devices, substantially as described.

7. In a torpedo-launching gear, the combination, with the torpedo-barrel, of a fly-wheel-actuated torpedo contained therein, a clutch for engaging with the fly-wheel, and spinning mechanism whereby the fly-wheel can be spun up to the requisite velocity, substantially as set forth.

8. In a torpedo-launching gear, the combination, with the torpedo-barrel, of a fly-wheel-actuated torpedo contained therein, a clutch for engaging with the fly-wheel, spinning mechanism whereby the fly-wheel can be spun up, and mechanism whereby the clutch can be thrown into engagement with the fly-wheel and withdrawn from the same, the disengagement occurring without necessarily stopping the running of the spinning mechanism, substantially as and for the purpose described.

9. In a torpedo-launching gear, the combination, with the torpedo-barrel, of a fly-wheel-actuated torpedo contained therein, a clutch for engaging with the fly-wheel, spinning mechanism whereby the fly-wheel can be spun up, and mechanism for automatically engaging and disengaging the clutch, the disengagement occurring without necessarily stopping the running of the spinning mechanism, substantially as described.

10. In a torpedo-launching gear, the combination, with the torpedo-barrel, of a motor-actuated torpedo contained therein, a driving device exterior to the torpedo for setting the motor in operation, a device for connecting and disconnecting the motor from its exterior driving mechanism, a centering device and a clamping device, both located on the torpedo-tube and engaging with the torpedo, and devices whereby the centering and clamping devices and the motor-connection with its exterior driving mechanism are automatically and successively operated and released, substantially as described.

11. In a torpedo-launching gear, the combination, with the torpedo-barrel provided with a receptacle containing the expelling agent, of the torpedo contained therein, a 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 discharged, substantially as described.

12. In a torpedo-launching gear, the combination, with the torpedo-barrel provided with a receptacle containing the expelling agent, of the torpedo contained therein, a clamp located on the torpedo-tube for clamping the torpedo, a device located on the torpedo-tube for operating and releasing the clamp, and connections between said receptacle and clamp whereby on the release of the clamp the torpedo is automatically discharged, substantially as described.

13. In a torpedo-launching gear, the combination, with the torpedo-barrel provided with a receptacle containing the expelling agent, of the torpedo contained therein, a centering device located on the torpedo-barrel for centering the torpedo, a device for operating and releasing the centering device, a clamp located on the torpedo-barrel for clamping the torpedo, a clamp operating and releasing device and suitable connections between said receptacle, and centering and releasing devices whereby on the release of the centering device the torpedo is automatically unclamped and discharged, substantially as described.

14. In a torpedo-launching gear, the combination, with the torpedo-barrel provided with a receptacle containing the expelling agent, of a motor-actuated torpedo contained therein, driving mechanism exterior to the

torpedo for setting the motor in operation, a clutch for connecting and disconnecting the torpedo-motor and its exterior driving mechanism, a centering device located on the torpedo-barrel for centering the torpedo, a device for operating and releasing the same, a clamping device located on the torpedo-tube for clamping the torpedo, a device for operating and releasing the same, and suitable connections between said receptacle, clamp, clutch, and centering device, whereby on the release of the centering device the torpedo is automatically and successively released from the centering device, the driving mechanism, and the clamp and is finally discharged, substantially as described.

15. In a pneumatic torpedo-launching gear, the combination, with the torpedo-tube A and air-induction tube C, of the circular air-chamber A³, having the rearwardly-inclined air-ports *a a a*, substantially as and for the purpose described.

16. In a torpedo-launching gear, the combination, with the torpedo-tube A, having the groove *a'*, of the torpedo having the lug *a*², whereby the torpedo is inserted in a determined position with respect to the tube A, substantially as described.

17. In a torpedo-launching gear, the combination, with the torpedo-tube A, of the projecting safety-pin D, having the piston-head D', working in the cylinder-box D², ports *d*² *d*³, spring *d*, and adjusting-nut *d'*, substantially as and for the purpose set forth.

18. In a torpedo-launching gear, the combination, with the torpedo-tube A, having the counterbored chamber *a*³ on the inner circumference of the tube, of the clamping-band E, located in said chamber and having enlarged heads E' E', clamping-shaft E², having reverse-screws *e e*, passing through the said heads E' E', the taper having the notched arm E³, mounted on said shaft, the toothed segment E⁴, loosely mounted on said shaft and having the pivoted pawl *e'*, its head *e*², projecting through slot *e*³ in the segment, cam-plate *e*⁴, and rack-bar *m'*, whereby, when the rack is pulled backward, the clamping-band is tightened and when drawn forward the clamping-band is released, substantially as set forth.

19. In a torpedo-launching gear, the combination, with the torpedo-tube A and a fly-wheel-actuated torpedo contained therein, of the clutch F, mounted on the clutch-shaft F', the sleeve F², having the pin *f'*, the clutch-box F³, having the longitudinal slot *f*², the toothed segment F⁴, having the slot *f*³, and the rack-bar *m'*, whereby, when the rack-bar is pulled backward, the clutch is thrown into engagement with the hub of the fly-wheel and when thrust forward is released, substantially as described.

20. In a torpedo-launching gear, the combination, with the torpedo-tube A and a fly-wheel-actuated torpedo, of the clutch, as de-

scribed, means for revolving the clutch, connecting mechanism, and the milled handle *f*, whereby the clutch and fly-wheel can be revolved and thrown in and out of engagement, substantially as described.

21. In a torpedo-launching gear, the combination, with torpedo-tube A, of the clamping device, the eccentric N, mounted on the shaft E² of the clamp, the connecting-rod *n*, the plate *q'*, having the slot *q*, the cam Q, pivoted to the connecting-rod *n* and reciprocating in the slot *q* in connection with the eccentric N, the pivoted lever P, and firing mechanism actuated by the vibration of the lever, substantially as set forth.

22. In a torpedo-launching gear, the combination, with the torpedo-tube A and a fly-wheel-operated torpedo, of the clamping device, as described, having the toothed segment E⁴, pawl *e'*, and cam-plate *e*³, the clutch F, as described, having the toothed segment F⁴, the eccentric N, mounted on the shaft of the clamping device, having the connecting-rod *n*, the cam Q, and the lever P, as described, firing mechanism released by the lever P, and the rack-bar *m'*, whereby, when the rack-bar is pulled backward, the clamp and clutch are successively tightened and the firing mechanism set, and when thrust forward are successively released, substantially as described.

23. The combination, with a steam-actuated torpedo-launching gear, of the revolving stand or mount having the pivoted steam-connections consisting of the exhaust-pipe K, the concentric steam-supply pipe K', concentrically grooved at the joint, the double elbow consisting of the exhaust-pipe K² and the interior steam-supply pipe K³, the collars *k* and *k'*, threaded as described, and the packing *k*², substantially as described.

24. In a torpedo-launching gear, the combination, with the torpedo-tube A and the fly-wheel-actuated torpedo contained therein, the air-compression tube B, the connecting-tube C, and the air-chamber A', of the firing-cylinder M, the piston-head M', rod and rack-bar M² *m'*, the centering device, the clamping device, the clutching device, and spinning device, all constructed and operated as described, the pivoted stand, and the pivoted steam supply and exhaust pipes and their connections, pipes K³ *l l'*, the eccentric N, mounted on the clamp-shaft E², its link-connection, the plate *q'*, having the slot *q*, the cam Q, the sear P, the hammer O, having the lug *o* and operating mechanism, and the firing-valve L, substantially as and for the purpose set forth.

25. In a torpedo-launching gear, the combination, with the torpedo-tube A and the fly-wheel-actuated torpedo contained therein, the air-compression tube B, the connecting-tube C, and air-chamber A', of the firing-cylinder M, piston-head M', rod and rack-bar M² *m'*, the centering device, the clamping device, the

clutching device, the spinning device, all constructed and operated as described, the pivoted stand, the pivoted steam supply and exhaust pipes and their connections, pipes K³ l
5 l', valve R, having lever-arm r', stop m² on rack-bar m', the eccentric N, mounted on clamp-shaft E², the firing device operated thereby, and the firing-valve L, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set to my hand in the presence of two subscribing witnesses.

HOWARD PARSONS ELWELL.

Witnesses:

JOHN ALLAN,

EDWARD E. GISBURNE.