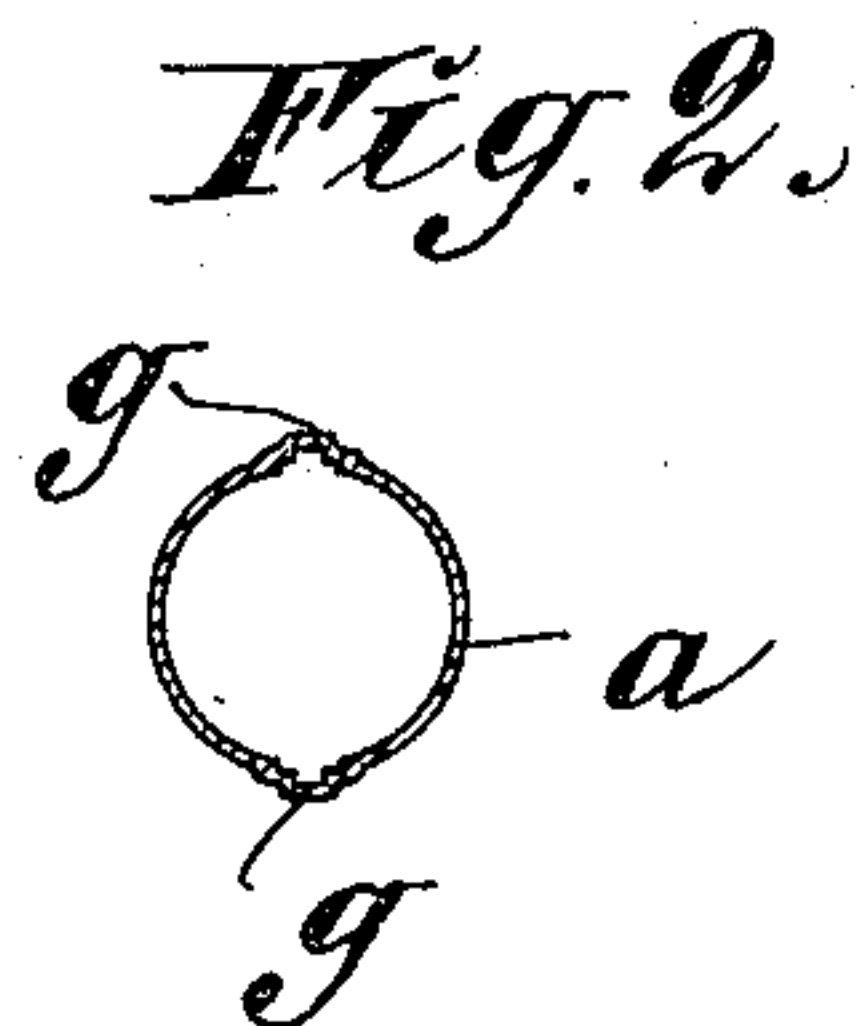
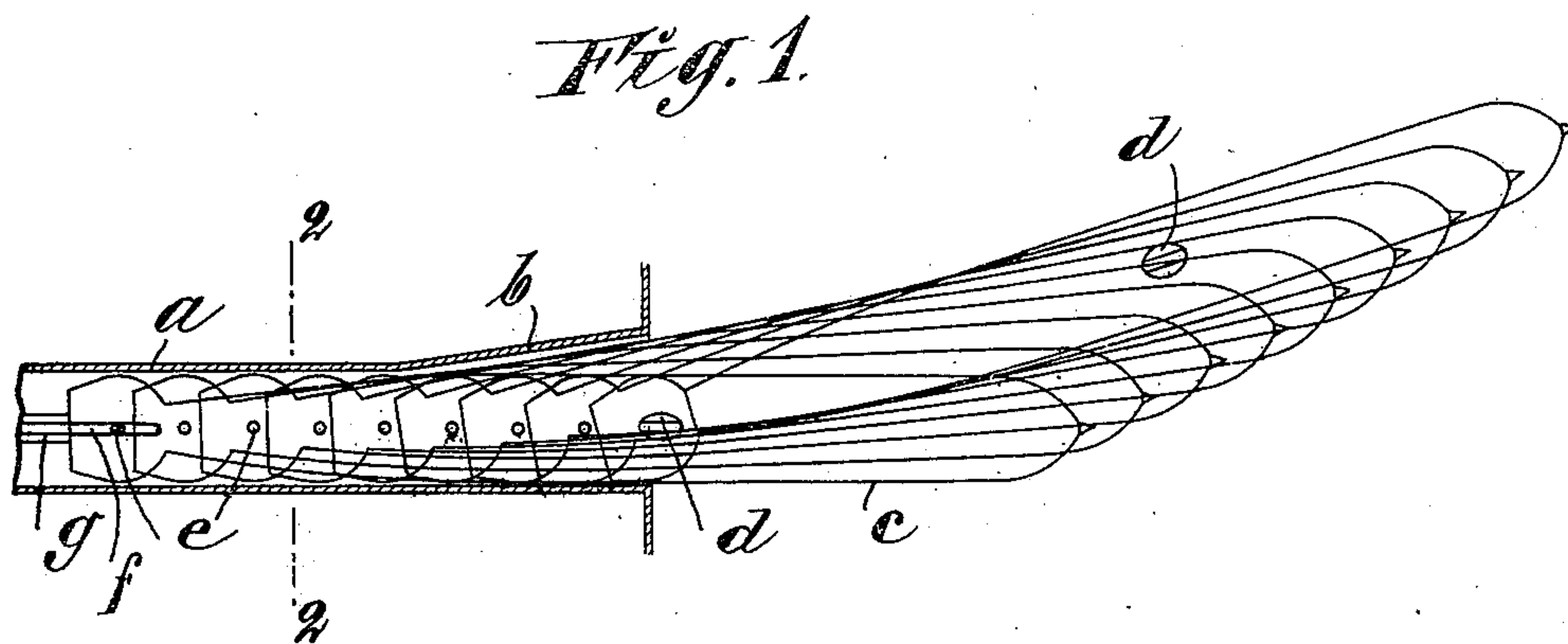


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APPLICATION FILED AUG. 31, 1909.

990,429.

Patented Apr. 25, 1911.

4 SHEETS—SHEET 1.



Witnesses:
Henry Thorne:
Otto M. Holmgren.

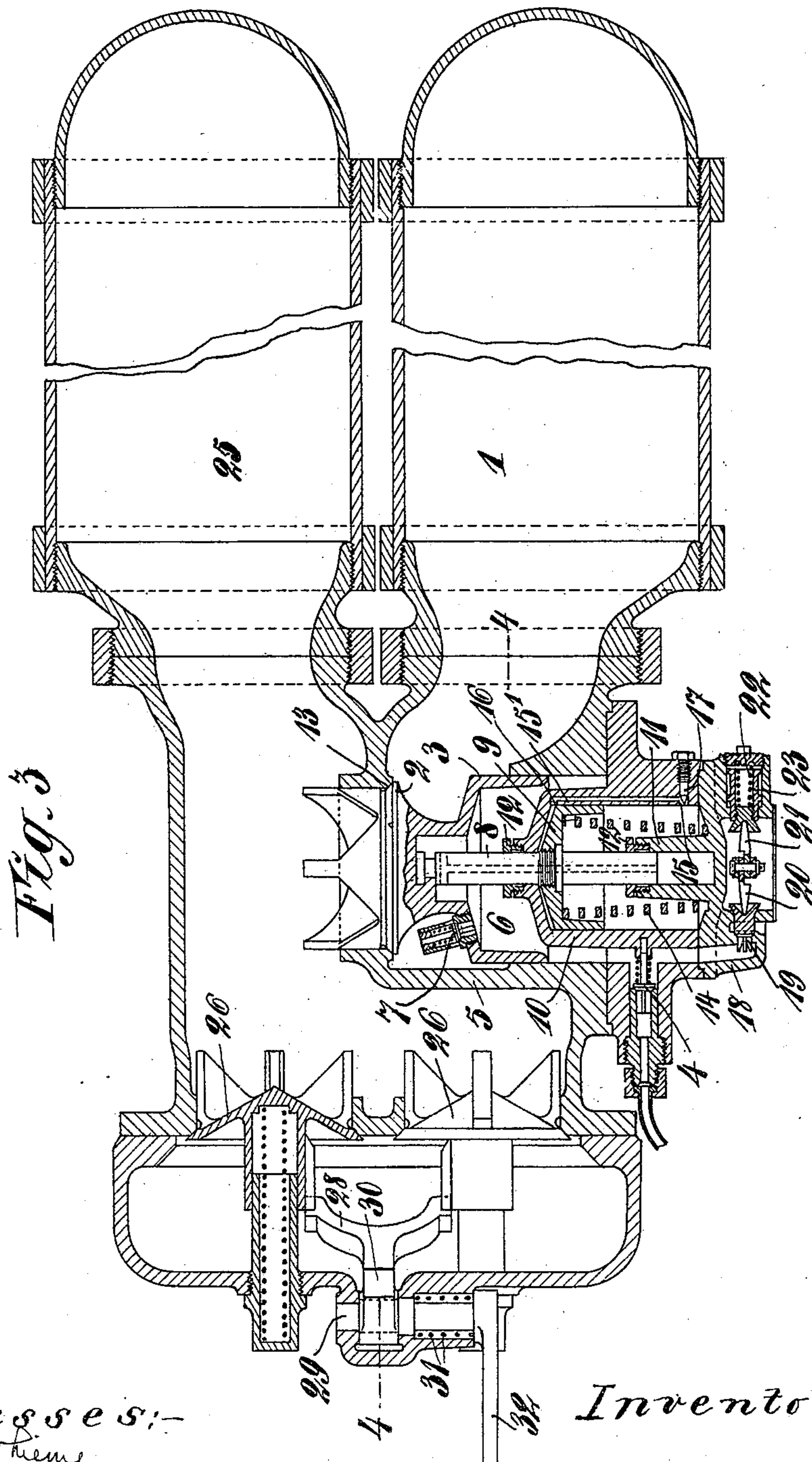
Inventor:
Olof Constantius Albert Fallenius
by his attorney
Brown & Shward

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4 SHEETS—SHEET 2.



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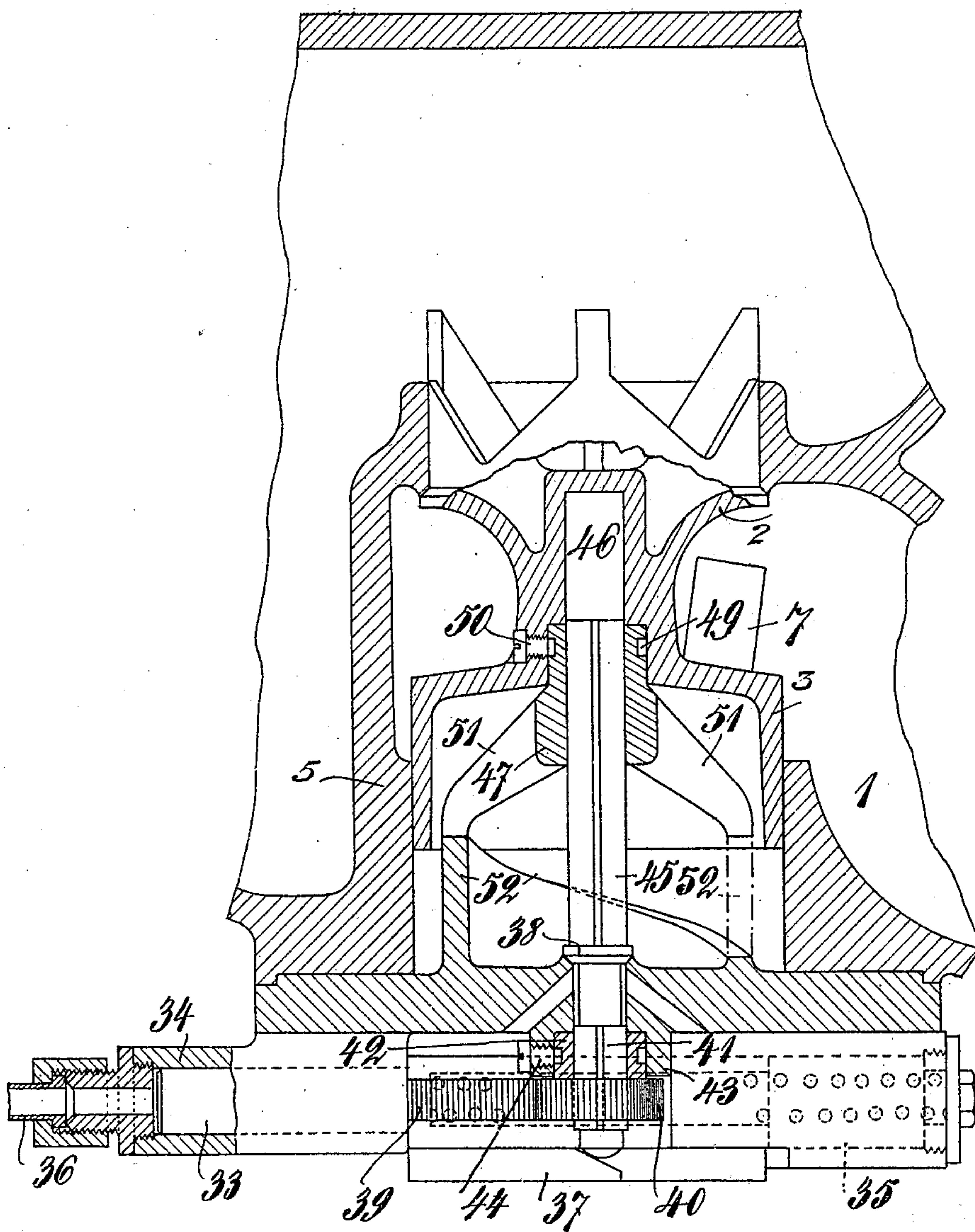
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4 SHEETS—SHEET 4.

Fig. 6.



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UNITED STATES PATENT OFFICE.

CLÆS CONSTANTIN ALBERT FALLENIIUS, OF KARLSKRONA, SWEDEN.

SUBMARINE BROADSIDE TORPEDO-LAUNCHING TUBE.

990,429.

Specification of Letters Patent.

Patented Apr. 25, 1911.

Application filed August 31, 1909. Serial No. 515,502.

To all whom it may concern:

Be it known that I, CLÆS CONSTANTIN ALBERT FALLENIIUS, a subject of the King of Sweden, and resident of Östra Amiralitetsgatan 6, Karlskrona, in the Kingdom of Sweden, have invented certain new and useful Improvements in Submarine Broadside Torpedo-Launching Tubes, of which the following is a specification, reference being had therein to the accompanying drawings.

Calculations as well as the practice have proved that torpedoes can be launched from submarine broadside tubes, while the ship is moving ahead, without any bar or shield being pushed outward from the shipside for protecting the torpedo, if a very great velocity up to about 24 meters per second is imparted to the torpedo when leaving the tube. The said great velocity is effected by subjecting the torpedo to a comparatively high ejecting pressure, which is constant or substantially constant the whole time the torpedo is in the tube. The deflection of the torpedo will then be of a very little extent, and may be still more reduced by arrangements stated below. In order to permit the said deflection the front part of the launching tube is conically enlarged toward the stern of the ship. The launching operation as well as the arrangement of the tube will be more clearly comprehended from the accompanying drawings.

Figure 1 of the same shows schematically and in a longitudinal, horizontal section the fore part of the launching tube. The said figure also illustrates several positions of the torpedo while being launched. Fig. 2 is a cross section of the tube along the line 2—2 of Fig. 1. Fig. 3 is a section of the air accumulator, the air cushion and valves belonging to the discharging device. Fig. 4 is a section on the broken line 4—4 of Fig. 3. Fig. 5 is an end view of the discharging device and shows the launching tube in cross section. Fig. 6 shows a modification.

a is the launching tube, *b* its front end enlarged conically toward the stern of the ship in order to permit the torpedo *c*, when launched, to swing freely in the said direction for a certain, short time. Owing to the great velocity of the torpedo effected by subjecting the same to a comparatively great substantially constant ejecting pressure, the said swinging movement or deflection of the torpedo will be of a small extent and is reduced to a minimum by providing on the

torpedo, in addition to the ordinary guiding buttons *d* on the air vessel of the torpedo, another pair of guide buttons *e* on the vertical fins *f* of the tail piece of the torpedo. In the upper and lower inside walls of the tube *a* longitudinal guide-grooves *g*, Fig. 2, are provided, as usual, in which the said buttons *d*, *e* run. The effect of the said guide buttons is that the torpedo, when ejected, moves along the central line of the tube until the buttons on the air vessel have passed the mouth of the tube, whereupon the front end of the torpedo, while the ship is moving ahead, is caused by the resistance from the water to swing astern during the period which elapses until the buttons *e* of the tail piece which are still in the guide grooves of the tube and consequently in the central line of same, become free. Some positions of the torpedo *c* and the corresponding positions of the tail piece buttons *e* are shown in Fig. 1. Owing to the guiding of the torpedo, effected by the buttons *e*, and the great velocity of the torpedo, when ejected, the enlargement of the front end *b* of the tube *a* may be very small and need extend only for a short distance along the tube. Consequently the cylindrical shape of the tube can be maintained to the vicinity of the front end of the tube and, in consequence thereof, the distance is only slightly reduced, in which the air pressure in the tube acts upon the torpedo. According to calculations made and to the experience the deflection (which the gyroscope afterward corrects) does not exceed 15° for a torpedo of a length of 5 meters and a width of 45 centimeters at the velocity stated above, and consequently the torpedo, as regards the deflection, is substantially equal to broadside tubes hitherto employed. For effecting the said constant ejecting pressure a spring actuated differential valve has hitherto been employed, which is located in the conduit between the ordinary air accumulator and the tube and is opened for a greater or less extent, according as the pressure outside the same and in the tube decreases or increases, and in consequence thereof permits a greater or smaller quantity of air to pass to the tube. The inventor has found that the said differential valve, acting like a regulator, can be dispensed with and a considerably more uniform and advantageous result as to the ejecting pressure and consequently also the launching velocity can be attained, if the

said regulator is replaced by a chamber or receptacle, which communicates with the conduit between the ordinary discharging valve and the tube and into which the pressure air enters and expands, before entering the tube. The said chamber also acts like an air cushion during the launching operation which receives the surplus of pressure and supplies pressure, when the pressure in the tube is reduced, so that the pressure in the tube is practically constant during the whole launching operation; and even the great velocity, which is necessary can be imparted to the torpedo when the ship is moving ahead rapidly. With the said chamber or air cushion, according to this invention, is combined an arrangement of the discharging valve, which permits the valve to be opened only slowly and to transmit the pressure-air gradually. Owing to the said combination the pressure at the starting of the launching operation can surely never rise to a degree injurious to the torpedo.

A form of execution of the invention is shown as an example in Figs. 3 to 5 of the drawings.

1 is the air or ejecting accumulator and 2, 3 is the discharging valve of the differential type. The air necessary for the ejecting of the torpedo is forced through a return valve 4 into the normally closed chamber 6, provided in the valve casing 5 and located outside the larger part 3 of the valve 2, 3. A valve 7 is provided in the part 3 of the valve 2, 3, which valve 7 opens inward toward the accumulator 1 and permits the air to pass from the chamber 6 into the accumulator. When the forcing of air into the accumulator 1 has been completed, the same pressure prevails in the chamber 6 as in the accumulator. To the discharging valve a rod 8 is connected in suitable manner, supporting a piston 9, which is movable in a closed cylinder 10 provided in the casing 5 of the valve 3. The piston rod 8 extends into a guide 11, provided in the bottom of the cylinder 10, stuffing-boxes 12 being provided at the said guide and at the inner end of the cylinder. The discharging valve 2, 3, which is normally forced against its seat 13 partly by the pressure in the accumulator 1 partly by a spring 14 located in the cylinder 10 and acting upon the piston 9, prevents the air in the accumulator from escaping this way. In the ends of the cylinder openings 15, 16 are provided, which communicate through a channel 15¹ provided for instance in the side-wall of the cylinder. One of the said openings 15, 16 preferably the outer one 15 can be reduced to a greater or less extent by means of a plug 17, which is in screw-threaded engagement with the wall of the cylinder and accessible from outside.

The cylinder 10 is filled with oil or any other suitable liquid. In the outer end wall or cover 18 of the valve casing 5, which also forms the cover of the cylinder 10, a valve 19 is provided, which can connect the chamber 6 with the outer air but is normally held in its closed position by a toggle-joint 20, 21, one member 21 of which bears against a piston 23, movable in a guide in the cover 18 and acted upon by a spring 22. The center of the said toggle-joint 20, 21 is connected with the discharging mechanism (not shown) by means of a suitable motion transmitting device.

A receptacle 25 communicates with the conduit between the discharging valve 2, 3 and the launching tube *a*, which receptacle acts like an air-cushion in the manner more particularly described below. 26, 26 are two spring actuated valves which normally close the conduit between the discharging valve with the receptacle 25 and the launching tube. The valves 26, 26, when being opened, act upon a lever 28, pivoted at 27 and normally engaging the safety cam 30 on a shaft 29, which is journaled in the launching tube, the said cam holding back in its turn the torpedo until discharging is effected. A spring 31 wound around the shaft 29 swings the cam out of its engaging position, as the arm 28 is disengaged. The cam 30 is turned into its engaging position by a hand lever 32 fixed on the shaft 29.

The discharging device now described acts in the following manner. When discharging is to be effected, the toggle-joint 20, 21 is moved laterally, thus permitting the valve 19 to be opened by the air pressure in the chamber 6, so that air escapes from the said chamber and the pressure in the same ceases. Consequently as there now is a pressure only in the accumulator 1, the pressure on the piston shaped part 3 of the discharging valve 2, 3 which part has a greater diameter than the part 2, prevails over the pressure on the said part 2, so that the discharging valve is forced outward *i. e.* from its seat. In order to permit the valve 2, 3 to move outward the liquid inclosed in the cylinder 10 must, however, be forced away and pass from the chamber at the outer side of the piston 9 to the chamber at the opposite side of the same through the channel 15¹. The velocity of the liquid when passing through the channel 15¹ and consequently the velocity of the piston 9 and the valve 2, 3 while being opened is adjusted by means of the screw plug 17. Consequently, the discharging valve 2, 3 can be caused to open only slowly and to admit gradually the pressure air from the accumulator 1. For that reason the air enters gradually the receptacle 25, which acts as a kind of air-cushion. When the pressure in the receptacle 25 has been raised sufficiently, the valves 26, 26 are

opened by the air, which now passes into the launching tube *a* and ejects the torpedo. At the moment before the entrance of the air into the tube the valves 26, 26 disengage the lever 28, so that the cam 30 releases the torpedo.

Owing to the provision of the receptacle 25, into which the air passes during the discharging operation before entering the launching tube, and which, as stated above, acts like an air-cushion, no sudden increasing of the pressure in the launching tube or the raising of the pressure to a degree injurious to the torpedo can take place at the beginning of the launching operation, which on the other hand sometimes is the case when a regulating valve of the class mentioned above is employed, which seems to be due to the fact that the said regulating valve owing to its inertia does not regulate immediately at the admission of the pressure air. As the pressure in the launching tube has been raised to the necessary maximum, it remains practically constant during the whole ejecting operation owing to the air-cushion in the receptacle 25. Owing to the said fact the great ejecting velocity of the torpedo is attained without the aid of a greater ejecting pressure than the torpedo can endure without inconvenience. The action of the retarding device 9, 10, 15¹ on the discharging valve 2, 3, evidently, also assists in the gradual raising of the pressure in the launching tube and by adjusting the position of the screw plug 17 the pressure in the launching tube may be caused to rise to the necessary maximum with the suitable velocity.

The invention may, evidently, be modified in many respects, especially with regard to the retarding device. The said device may for instance be arranged as illustrated in Fig. 6. In the said figure 5 is the cylinder, containing the wider, piston shaped part of the discharging valve 2, 3. The air, necessary in the accumulator, is forced into the cylinder 5, from which it passes through the valve 7 into the accumulator 1, as in the form of execution first described. 33 is a piston or plunger movable in a casing 34 and forced by a spiral spring 35 against the mouth of an air supply pipe 36. At the discharging operation pressure air is led into the pipe 36, which forces the plunger 33 backward against the tension of the spring 35. During the movement of the said plunger a cam piece 37 on the same acts upon a valve 38, normally closing a channel between the cylinder 5 and the outer air, and opens the same, so that the pressure air in the cylinder 5 escapes. A rack 39 is connected with the plunger 33, which rack engages a pinion 40, mounted on an extension 41 of the valve 38 in such manner, that the said extension can move longitudinally in

the pinion but is caused to rotate with the same. The hub 42 of the pinion 40 extends into a bearing 43 and the pinion is prevented from moving laterally by a pin 44, which is in screw-threaded engagement with the bearing and engages a groove provided in the said hub 42. A central rod 45 extends from the valve 38, which can pass into a recess or guide 46 provided in the valve 2, 3. A ring 47 is loosely mounted on the said rod 45 and connected with the same by means of a key and groove joint. The said ring can rotate in the valve 2, 3 and is connected with the same by a pin 50, which is in screw-threaded engagement with the valve and engages a groove 49 in the ring. One or more, preferably two arms 51, 51 extend from the ring 47 and bear against slanting cam pieces 52. As the pressure in the cylinder 5 is reduced, as the valve 38 is opened, the pressure in the accumulator 1 tends to open the discharging valve 2, 3. This is however prevented at first by the arms 51 bearing against the cam-pieces 52, but according as the ring 47 with the said arms 51 is rotated by the plunger 33 by means of the motion transmitting device 39, 40, 41, 45, 47 during the movement of the plunger 33, the arms 51 slide downward the slanting cam-pieces 52, so that the discharging valve 2, 3 is opened gradually and admits the pressure air into the accumulator 1 into the launching tube. By suitably adjusting the pressure of the air led into the pipe 36 and the tension of the spring 35 the velocity of the plunger 33 and consequently also of the discharging valve 2, 3 will be regulated. The device shown in Fig. 6 may be modified in such manner that the cam pieces 52, 52 are rotatable and are rotated by the plunger 33 instead of the arms 51, which are then firmly connected with the valve 2, 3, as will be easily understood by those skilled in the art.

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

1. In a submarine broadside torpedo launching device, the combination of the launching tube, a conduit, a receptacle in communication with the conduit, a discharging valve in connection with the conduit, a retarding device, mechanical means connecting the said discharging valve and the retarding device and an automatically operated releasing valve between the conduit and the launching tube, substantially as described and for the purpose set forth.

2. In a submarine broadside torpedo launching device, the combination of the launching tube, a conduit, a receptacle in communication with the conduit, a discharging valve in connection with the conduit, a piston acted upon by the discharging valve and movable in a cylinder filled with a

suitable liquid, a passage connecting the chambers of the said cylinder located at opposite sides of the piston, and an automatically operated releasing valve between the conduit and the launching tube, substantially as and for the purpose set forth.

3. In a submarine broadside torpedo launching device, the combination of the launching tube, a conduit, a receptacle in communication with the conduit, a discharging valve in connection with the conduit, a piston acted upon by the discharging valve and movable in a cylinder filled with a suitable liquid, a passage connecting the cham-

bers of the said cylinder located at opposite sides of the piston, means for adjusting the section of the said passage and an automatically operated releasing valve between the conduit and the launching tube, substantially as described and for the purpose set forth.

In witness whereof, I have hereunto signed my name in presence of two subscribing witnesses.

CLÆS CONSTANTIN ALBERT FALLENIOUS

Witnesses:

NILS STEE. THEORN,

ERNST GUSTAF WILHELM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
