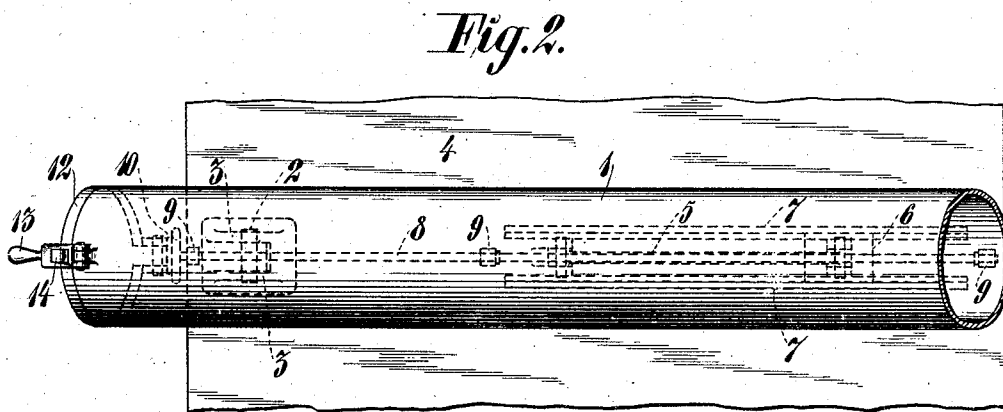
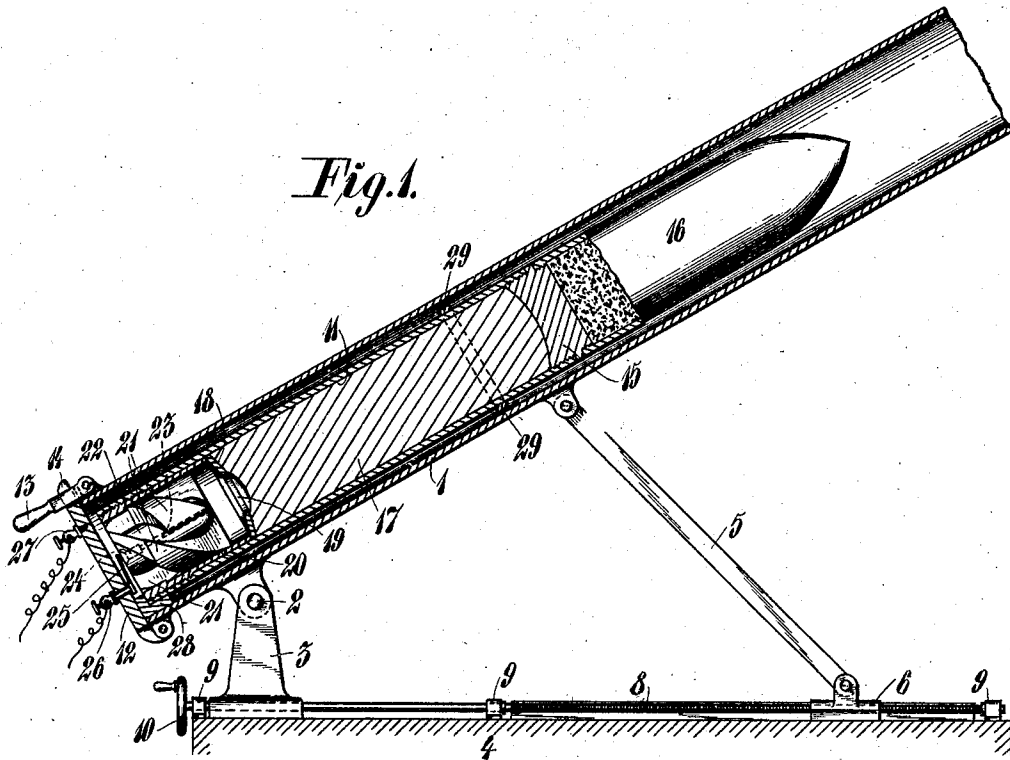


No. 785,644.

PATENTED MAR. 21, 1905.

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SELF ROTATING AIR TORPEDO.  
APPLICATION FILED MAY 18, 1904.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 3.

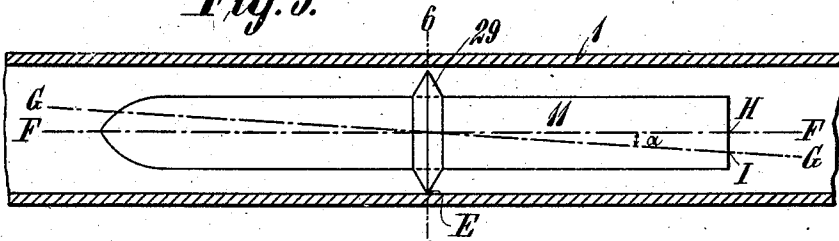


Fig. 5.

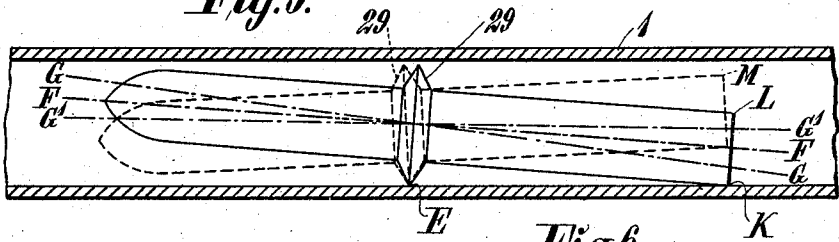


Fig. 4.

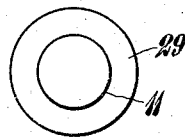


Fig. 6.

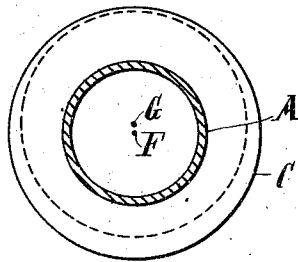


Fig. 7.

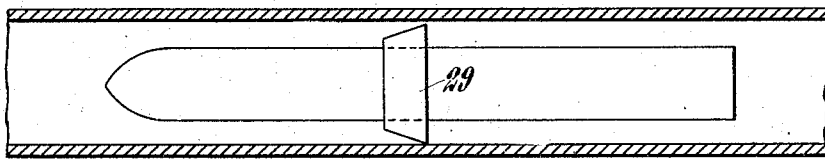
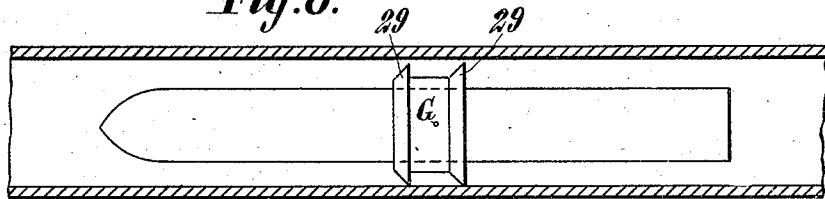


Fig. 8.



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# UNITED STATES PATENT OFFICE.

WILHELM THEODOR UNGE, OF STOCKHOLM, SWEDEN.

## SELF-ROTATING AIR-TORPEDO.

SPECIFICATION forming part of Letters Patent No. 785,644, dated March 21, 1905.

Application filed May 18, 1904. Serial No. 203,594.

*To all whom it may concern:*

Be it known that I, WILHELM THEODOR UNGE, a subject of the King of Sweden and Norway, and a resident of Skepparegatan 5, Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Self-Rotating Air-Torpedoes, of which the following is a specification, reference being had therein to the accompanying drawings.

The object of this invention is to provide means in self-rotating air-torpedoes whereby the torpedo when ejected from a launching-tube or a launching apparatus adapted to give the torpedo the desired direction can rotate, when being in the said tube and without being prevented in its rotation by the wall of the said tube, round its natural axis of rotation—*i. e.*, the line passing through the center of gravity—which axis never coincides with the geometrical axis of the torpedo, owing to imperfections in the manufacturing of the torpedo and the charge of the same. By this means the torpedo is at liberty to elect, even in the launching-tube, exactly the axis of rotation which it would elect when having left the mouth of the said tube. Owing to this fact the ability of the torpedo to hit will be the greatest possible, for if the bore of the launching-tube would determinate the axis of rotation, which in such a case evidently would be the geometrical axis of the torpedo, forces will arise when the torpedo has left the bore, which forces drive the torpedo out of its course. If, on the other hand, the torpedo can center itself automatically even in the launching-tube the said forces will evidently not arise.

My invention consists in providing the torpedo with a ring inclosing and supporting the same, which ring is termed the "balance-ring" in the following specification and is mounted at or near the center of gravity of the torpedo and has such a great outside diameter that when the torpedo is rotating in the launching-tube the nose and the back end of the torpedo during their oscillations, caused by the fact that the two axes men-

tioned above do not coincide, do not touch the wall of the tube, and consequently do not prevent the torpedo from rotating freely round its natural axis of rotation. Owing to imperfections in the manufacturing of the torpedoes, it may be supposed that the center point of the circumference of the said balance-ring is not situated on the axis of rotation of the torpedo, (the line passing through the center of gravity). For the said reason the balance-ring is preferably made of such a soft material (metal) or is so shaped that the bearing-surface of the same, pressed against the wall of the launching-tube by the torpedo and rotating with the latter, will be worn in such a manner that the said center point has moved to and coincides with the axis of rotation after a few revolutions of the torpedo.

In the accompanying drawings, which serve to illustrate the invention, Figure 1 is a longitudinal sectional view of the launching-tube and a torpedo mounted in the same, said torpedo being provided with a balance-ring. Fig. 2 is a plan view of the said tube. Fig. 3 is a longitudinal sectional view, on a reduced scale, of a part of the launching-tube and a side view of the torpedo. Fig. 4 is an end view of the torpedo. Fig. 5 illustrates different positions of a rotating torpedo provided with a balance-ring mounted at a short distance before the center of gravity. Fig. 6 is a section on the line 6 to 6 of Fig. 3, on a larger scale, and illustrates the wearing of the balance-ring during the rotation of the torpedo in the launching-tube. Figs. 7 and 8 show two modified forms of the invention. Figs. 3 to 8 illustrate schematically the invention and its manner of function.

1, Figs. 1 and 2, is the launching-tube. The said tube is swinging on a shaft 2, fixed in projections 3 on an ordinary platform 4, and is held in the desired inclined position by a support 5, hinged to the tube 1. The lower end of the support 5 is pivoted to a slide 6, movable in guides 7 on the said platform 4. A screw-spindle 8, journaled in brackets 9 on the platform and provided with a wheel 10,

passes through the said slide and is in threaded engagement with the same. By turning the said screw the tube is raised or lowered to the desired inclined position.

5 11 is the torpedo. After the torpedo has been inserted into the tube 1 the back end of the tube is shut by means of a bottom piece 12, hinged to the tube and held in closed position by means of a lever 13, pivoted to the  
10 tube 1 and embracing a projection 14 on the bottom piece. The torpedo consists of a cylinder 11, the front end of which is closed by a screw-plug 15, on which is fixed the head-piece 16, containing the explosive charge.  
15 The said cylinder 11 contains the motive composition 17, held in position by the screw-plug, and a bottom plate 18, provided with a central hole 19. In the rear end of the cylinder 11 a turbine is inserted. The  
20 said turbine consists of a casing 20, screwed into the cylinder 11, and of spiral wings 21, projecting from a central body 22 and made integral with the same. The said body 22, with the wings, is held in the casing in any suitable manner. In the central body a bore  
25 23 is provided, passing from its back end to its front end. In the enlarged rear portion of the said bore a cartridge 24 is mounted, containing gunpowder and a fine platinum wire. (Not shown.) One end of the said wire  
30 is connected with a plate fixed in the bottom of the cartridge, but insulated from the same. The other end of the wire is connected with the case of the cartridge. A spring 25, fixed  
35 on the bottom piece 12 and insulated from the same, bears upon the said plate. The spring is connected with a clamping-screw 26, another clamping-screw, 27, being fixed in the bottom piece 12, but not insulated from the  
40 same. Said clamping-screws are connected with an electric source, and when the circuit is closed current passes from the clamping-screw 26 through the spring 25, the platinum wire, the case of the cartridge 24, the turbine, the wall of the cylinder 11, the wall of  
45 the launching-tube 1, the bottom piece 12, and the clamping-screw 27. The wire is then heated by the current to such a degree that it ignites the gunpowder. The flame from  
50 the ignited gunpowder passes through the bore 23 and ignites the motive composition 17 in its turn. The gases from the burning composition act upon the wings 21, causing the torpedo to rotate and when leaving the  
55 torpedo drive the same forward.

28 is a piece fixed in the tube 1 and forming a support for the rear end of the torpedo..

29 is the balance-ring. The said ring is fixed on the torpedo at or substantially at the  
60 center point of the same and bears against the wall of the launching-tube 1 at the point E, Fig. 3.

F F is the geometrical axis of the torpedo,

and G G is supposed to be its natural axis of rotation. The axis last mentioned forms an angle  $\alpha$  with the axis F F.

H and I designate two points in which the geometrical axis and the axis of rotation cut a plane passing through the extreme back end of the torpedo.

It will be seen from Fig. 3 that the condition for the free rotation of the torpedo round the axis G G is that the distance between the circumference of the balance-ring and the cylindrical surface of the torpedo is at least as great as the distance between the points H and I—i. e., the height of the ring is dependent upon the width of the angle  $\alpha$ .

In Fig. 5 a torpedo is shown provided with a balance-ring 29, mounted at a short distance before the center point of the torpedo, so that the edge of its back end rests upon the bottom wall of the tube 1 at the point K. At the commencement of the rotation of the torpedo the point L, situated diametrically opposite to the said point K on the edge of the back end of the torpedo, will take the place of the point K after half a revolution, and the natural axis of rotation G G will have the position marked G' G'. As the torpedo tends to rotate round the natural axis of rotation the point L will take the place marked M after the next half-revolution, during which the whole torpedo will swing about the balance-point E and occupy the position shown in dotted lines. Consequently the front-end and the back-end plane of the torpedo oscillate between the positions shown by full and by dotted lines during the rotation of the torpedo in the launching-tube without the torpedo being prevented in its rotation by the wall of the said tube. Owing to the inertia of the torpedo and its great rotary velocity, the back edge of the torpedo will hit the wall of the launching-tube with only a slight force when being in its lowest position. If the balance-ring is mounted round the center of gravity, as shown in Fig. 3, and the outside diameter of the same is suitably adjusted, the edge of the back end will touch the wall of the launching-tube only lightly.

It will be seen from the above that the torpedo when leaving the launching-tube rotates round its natural axis of rotation and will have the direction forward in which the wall of the launching-tube compels the balance-ring 29 to move. It will also be understood from the above how the torpedo swings if the balance-ring is situated behind the center of gravity. It is assumed above that the natural axis of rotation of the torpedo is constant. In reality this is not the case, because the position of the center of gravity changes a little and continually, owing to the continuous and sometimes uneven combustion of the motive composition. By the arrange-

ment stated above the torpedo is able to adjust the position of its axis of rotation also to the said circumstances.

A, Fig. 6, is the outer cylindrical surface of the torpedo; C, the outer edge or surface of the balance-ring; F, the position of the geometrical axis of the torpedo, and G the position of the center of gravity of the torpedo or the axis passing through the said point. During the rotation of the torpedo round the axis G the balance-ring bears upon the wall of the launching-tube with a varying pressure, owing to its eccentric position, and the said pressure will be at its maximum when the center of gravity G is at the greatest distance from the balance-point and at its minimum when the center of gravity is at the shortest distance from the balance-point. By making the balance-ring of a suitable soft metal or by suitably shaping the said ring the ring is so worn during the rotation of the torpedo in the launching-tube, owing to the said varying pressure, that the center of the periphery gradually comes nearer the line passing through the center of gravity of the torpedo, and the ring will finally have the contour shown by the dotted lines. In order that such a rapid adjusting wearing of the balance-ring may be effected during the rotation of the torpedo in the launching-tube, the bearing portion of the balance-ring may consist of an edge, as shown, for instance, in Fig. 7, in which figure the ring 29 consists of a blunt cone, the rear wider edge of which being easily worn or compressed during the rotation, so that its center point comes nearer and finally coincides with the natural axis of rotation of the torpedo.

In order that the torpedo may have a central position in the bore of the launching-tube before the igniting of the torpedo, it may be provided with two balance-rings, mounted on each side of the center of gravity. Such an arrangement is illustrated in Fig. 8. G is the center of gravity of the torpedo, and 29 29 are the balance-rings. During the oscillations of the rotating torpedo, Fig. 5, the torpedo is supported by the fore and rear balance-rings alternately, the said rings being mounted near the center of gravity, at a distance from the same of about half the diameter of the torpedo. The ring which for the moment does not support the torpedo is removed a very short distance from the wall of the launching-tube. Owing to this fact and the fact that the balance-rings bear upon the wall of the launching-tube by means of an edge of comparatively soft metal—as, for instance, copper or brass—both rings soon will be so worn through the rotation that the center of the periphery of each ring coincides with the natural axis of rotation of the torpedo and the torpedo leaves the launching-

tube supported by both rings simultaneously bearing against the wall of the said tube. 65

I am aware that in the manufacturing of projectiles the ordinary band round the projectile has been mounted at or near the center of gravity of the same for facilitating the manufacturing; but the said band has not been adapted to serve the same purpose as the balance-ring stated above, the band being adapted only to impart the rotary motion to the projectile by engaging the grooves of the bore and to prevent the gases behind the projectile from passing between the same and the wall of the gun. 70 75

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is— 80

1. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition and a balance-ring mounted round the torpedo at or near its center of gravity, substantially as described and for the purpose set forth. 85

2. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition and a balance-ring which is mounted round the torpedo at or near its center of gravity and the periphery of which is at a distance from the surface of the torpedo greater than the distance between the points in which the geometrical axis of the torpedo and the axis of rotation assumed to have the greatest deviation cut the back end plane of the torpedo, substantially as described and for the purpose set forth. 90 95

3. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition, a balance-ring mounted round the torpedo near its center of gravity and another balance-ring mounted round the torpedo on the opposite side of the said center and near the same, substantially as described and for the purpose set forth. 100 105

4. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition, and a balance-ring made of soft material and mounted round the torpedo at or near its center of gravity, substantially as described and for the purpose set forth. 110

5. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition and a balance-ring mounted round the torpedo at or near its center of gravity and having a sharp-edged bearing portion, substantially as described and for the purpose set forth. 115 120

6. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition, a balance-ring made of soft material and mounted round the torpedo near its center of gravity and another 125

balance-ring made of soft material and mounted around the torpedo on the opposite side of the said center and near the same, substantially as described and for the purpose set forth.

7. The combination of a self-rotating air-torpedo provided with continuously-burning motive composition, a balance-ring mounted round the torpedo near its center of gravity, and another balance-ring mounted round the torpedo on the opposite side of the said

center and near the same said balance-rings having a sharp-edged bearing portion, substantially as described and for the purpose set forth.

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

WILHELM THEODOR UNGE.

Witnesses:

ERNST SVANQVIST,  
ROBERT APELGREN.