No. 806,026. PATENTED NOV. 28, 1905.

W. T. UNGE.

IGNITING MECHANISM FOR AIR TORPEDOES, &c.

APPLICATION FILED OCT. 2, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

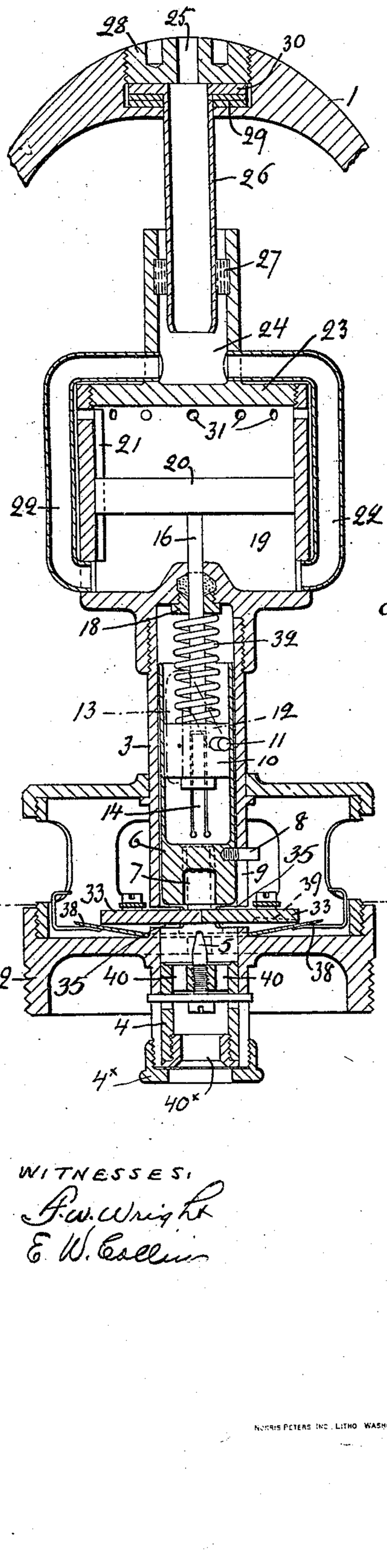


Fig. 2.

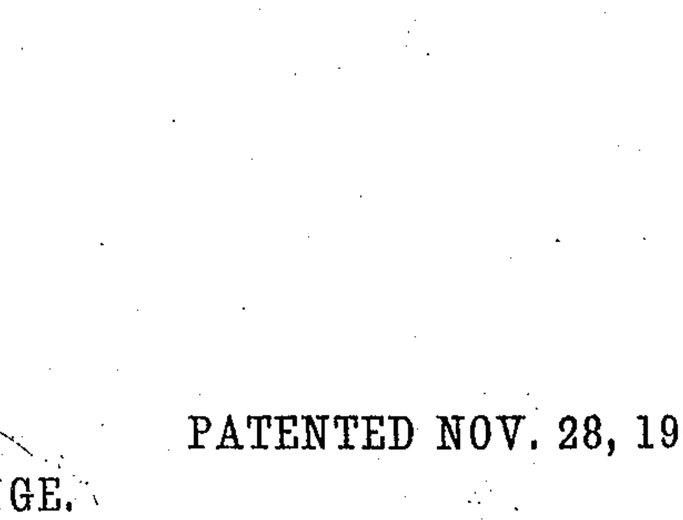


Fig. 3.

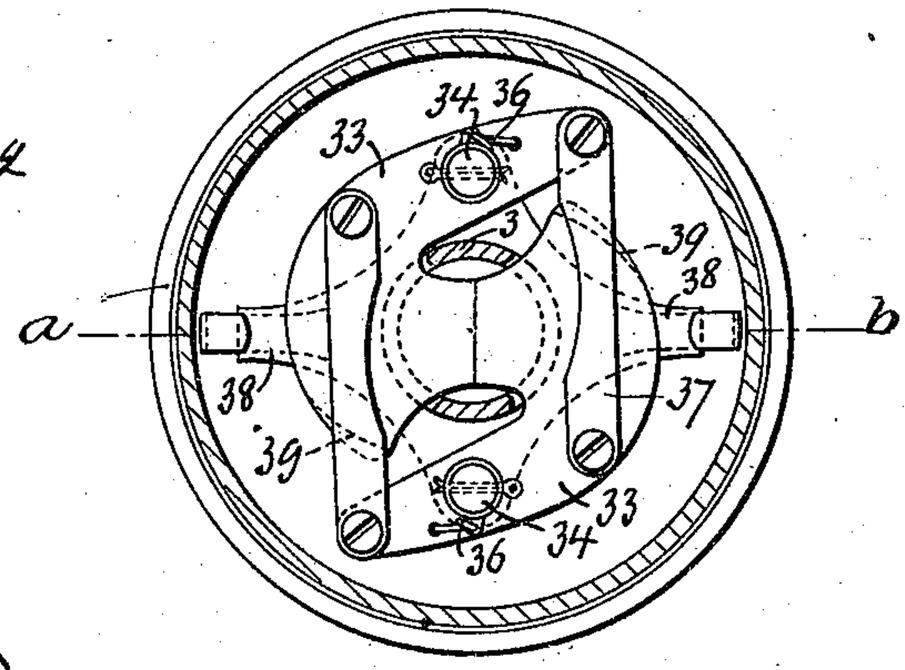


Fig. 4.

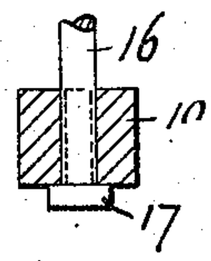
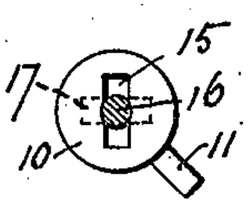


Fig. 5.



WITNESSES:
F. W. Wright
E. W. Eaton

INVENTOR
William Theodor Unge
BY
Howson and Howson
HIS ATTORNEYS.

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2 SHEETS—SHEET 2.

Fig. 6.

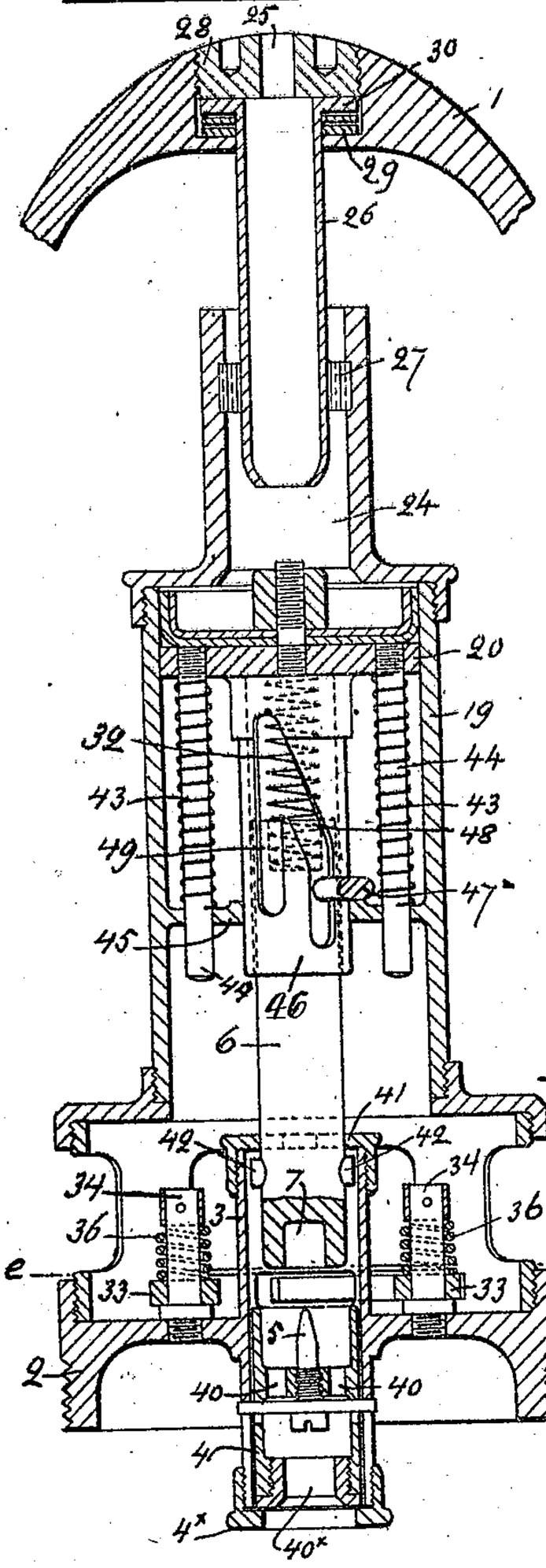


Fig. 7.

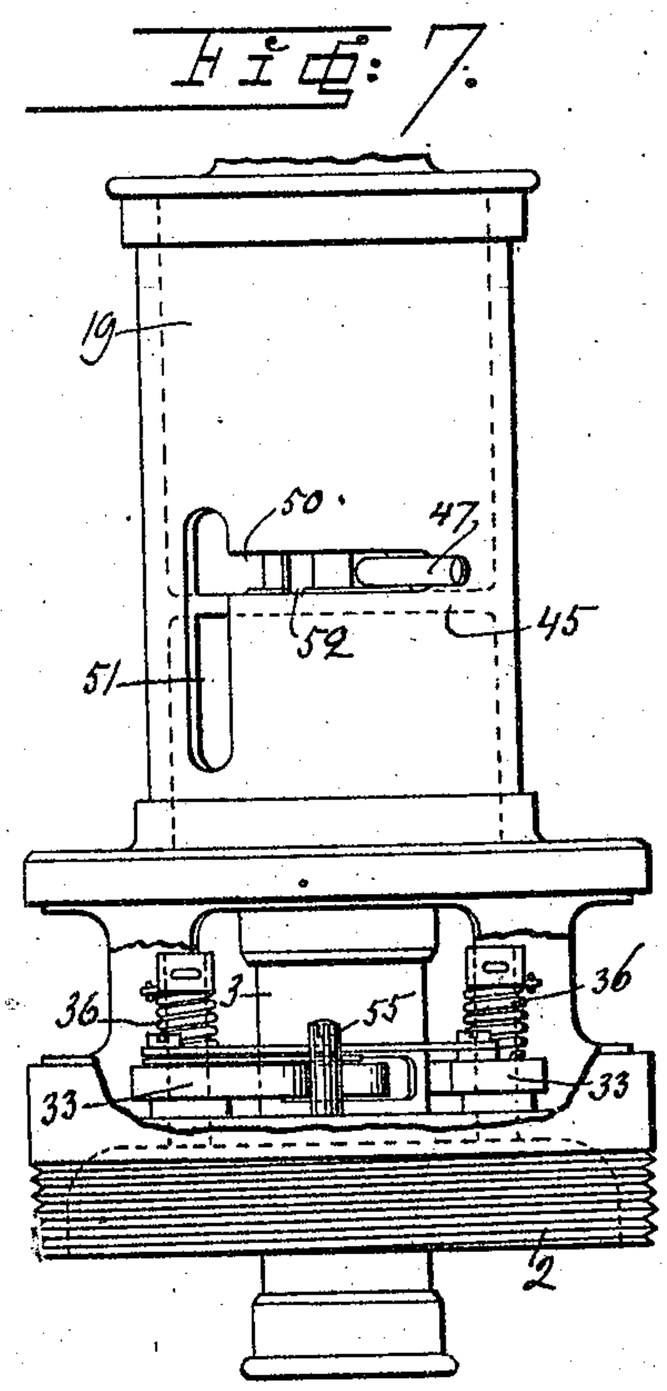
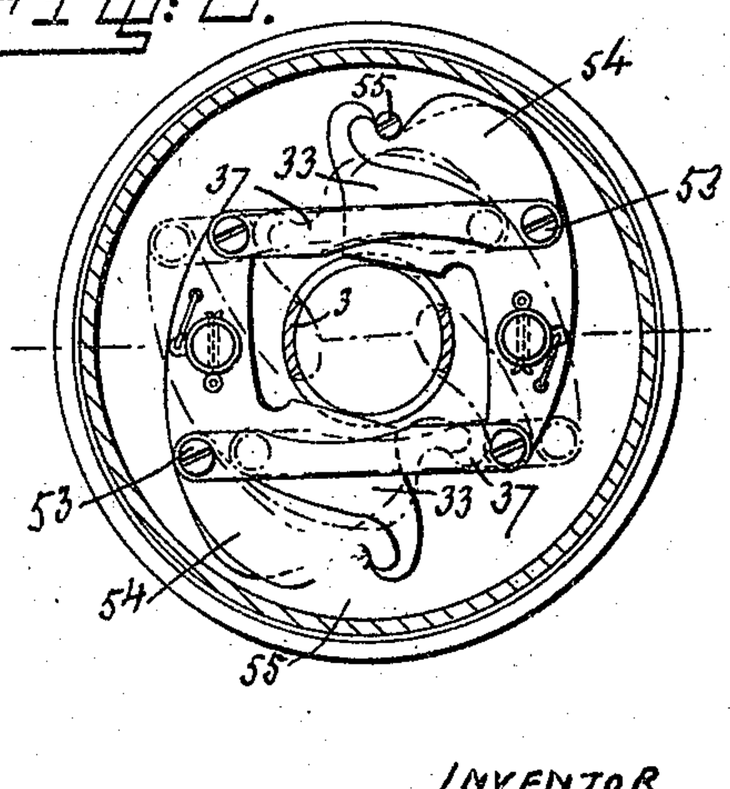


Fig. 8.



WITNESSES:
F. W. Wright.
E. W. Collins

INVENTOR
William Pleador Unge
BY
Howson and Howson
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILHELM THEODOR UNGE, OF STOCKHOLM, SWEDEN.

IGNITING MECHANISM FOR AIR-TORPEDOES, &c.

No. 806,026. Specification of Letters Patent. Patented Nov. 28, 1905.

Application filed October 2, 1903. Serial No. 175,486.

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 Stockholm, Sweden, have invented certain new and useful Improvements in Igniting Mechanisms for Air-Torpedoes or the Like, of which the following is a specification.

The invention refers to a mechanism or fuse for igniting the charge in air-torpedoes, applicable also for other projectiles. An igniting mechanism or fuse for this purpose must be constructed so as to be quite safe if subjected to shock during transport or storage and so as not to be set for operation until after the air-torpedo has been propelled. Moreover, it must ignite the charge only at or after the descent of the air-torpedo into the water or at the impact if the torpedo strikes against a solid body. The fuse is set for operation or the air-torpedo is "armed," as it is called, not by the shock that may be imparted to the torpedo when it is propelled, but by the rotation of the torpedo, the centrifugal force removing the obstructions which protect the igniting material from too early contact with the firing-pin. By the present invention, the arming having thus been effected, the mechanism causes ignition not only on descent of the air-torpedo against a solid body, but also on descent into water into such a manner that in the first case a so-called "hammer" provided with a firing-pin is thrown against the igniting material, and in the latter case a similar hammer provided with the igniting material is thrown against the firing-pin, or the reverse. The collision between the firing-pin and igniting material when the air-torpedo strikes against a solid body occurs in the known manner by the inertia of the hammer which carries the firing-pin, or it may be the igniting material. On the descent of the air-torpedo into water the said collision is brought about by a rush of water through a hole in the point or front end of the torpedo into a closed chamber—for instance, a cylinder provided with a piston which is moved by the inrushing water. During the motion of the piston a spring acting on the hammer which carries the igniting material or the firing-pin, hereinafter called the "striking-spring," is compressed, and at the end of the motion of the piston is liberated, whereby the hammer is thrown forward and effects the ignition. The ignition of course also may occur at the end of the stroke of the piston if the latter throws the firing-pin directly into contact with the igniting material.

If the air-torpedo is intended only to strike down into water, as in countermining or the like, there may be a stationary firing-pin or a stationary igniting material instead of the hammer.

As the time required for the motion of the piston, and it may be for compressing and releasing the spring, depends on how fast the water rushes into the cylinder, the ignition may be timed by varying the area of the inlet for the water, so that the depth under the surface of the water at which the air-torpedo is to explode may be predetermined.

In the accompanying drawings there are shown, by way of example only, two forms of the invention—viz., one wherein the water rushing into the air-torpedo is led behind the piston into a cylinder and one wherein the water is led directly on the front end of the piston. In both cases a spring is used for effecting the contact between the firing-pin and the igniting material. Both the mechanisms shown are also arranged for ignition on striking against a solid body.

Figure 1 is a longitudinal section of the first-mentioned form on the line *a b* of Fig. 3. Fig. 2 represents an elevation of a detail of the apparatus. Fig. 3 is a transverse section of Fig. 1 on the line *c d*. Figs. 4 and 5 are detail views. Fig. 6 is a longitudinal section of the second form, and Fig. 7 is an elevation thereof in part broken away. Fig. 8 is a transverse section on the line *e f* of Fig. 6.

Referring to Fig. 1, 1 is a portion of the front part of the head of an air-torpedo.

2 is the bottom piece of the fuse, which piece is screwed on the detonator or on the casing of the main charge and is provided with a central cylindrical tube 3. In the rear end of this tube 3 a percussion-hammer 4 with a firing-pin 5 is arranged in the usual way.

$4^{\times}$ is a supporting-ring for the rear end of the hammer 4. In the front end of the tube 3 is a movable hammer 6, having a recess 7 for the igniting material. This hammer 6 is tubular at the front end and can slide but not turn in the tube 3, being guided rectilinearly by the pin 8, passing through a slot 9 in the tube 3. In the tubular part of the hammer 6 there is a piston 10, from which a pin 11 projects through an inclined slot in the wall of the tubular part and also through a similar inclined slot 12 in the wall of the tube

3. These slots also have a rectilinear rearward extension 13. (The slot 12 13 is shown in Fig. 2 and in dotted lines in Fig. 1.)

14 is a tongue cut out from the wall of the tubular part of the hammer 6 and pressed inward by spring action. The piston 10 has a rectangular perforation or hole 15, through which passes a rod 16, provided at its end with a cross-piece 17, capable of passing through the hole 15. (See Figs. 4 and 5.) The rod 16 extends through a stuffing-box 18 at the end of a hollow cylinder 19, fixed to the front end of the tube 3, and is rigidly fixed to a piston 20, movable rectilinearly in the cylinder 19, being guided by a rib 21 on the wall of the cylinder fitting a recess in the piston 20. Into the rear end of the cylinder 19 open two conduits 22, leading from a chamber 24 at the forward portion of the cover 23 of the cylinder, into which chamber enters a tube 26, communicating with the inlet-hole 25.

27 represents packing-rings.

The inlet-hole 25 is through a plug 28, screwed into the head of the air-torpedo.

29 represents packing-rings under the flange 30 of the tube 26.

31 represents air-holes in the front end of the cylinder 19.

32 is a helical spring between the piston 10 and stuffing-box 18.

33 33 are two pieces, herein called "safety-wings," which can rotate round pins 34 34, fixed into the bottom piece. Parts of these pieces project through openings 35 in the tube 3, and spiral springs 36 round the pins 34 tend to keep these parts against each other, as shown in Figs. 1 and 3. In their normal position they lie between the firing-pin 5 and igniting material, as shown in Fig. 1, thus preventing the former from firing the latter during transport or storage. The wings 33 are extended behind the point of rotation and are connected by two links 37 37, as shown, so that they must move outward or open simultaneously when the torpedo has attained a sufficiently-rapid rotation. In order to keep the wings in the open position, there are arranged on the bottom piece 2 under the wings two elastic tongues 38 38, and on the wings there are provided two notches 39 39, into which the tongues snap when the wings are open, so that the wings cannot close again.

The fuse that is being armed during the rotation acts in the following manner on descent of the air-torpedo into water: The water rushes through the hole 25 and tube 26 into the chamber 24, passing from there through the conduits 22 into the cylinder 19 behind the piston 20. The piston is thus pressed forward, carrying with it the piston-stem 16, whose cross-piece 17 lies in such a position relatively to the hole 15 in the piston 10 as to carry the latter along with it, thereby compressing the spring 32. Figs. 4 and 5 show the piston 10 in a vertical section and plan, respectively, with the stem 16 and cross-piece 17 in the said position. During the forward movement of the piston 10 the pin 11 must follow the slot 12, and consequently the piston 10 must rotate round the stem 16. As soon as the piston 10 has passed the end of the tongue 14 the latter springs inward beneath the piston 10. The piston 20 having been moved forward by the inflowing water so far that the piston 10 has been rotated by the slot 12 until the cross-piece 17 is coincident with the hole 15 and the pin 11 is in line with the straight slot 13, the piston 10 is pushed back over the cross-piece 17 by the spring 32 and strikes against the end of the tongue 14, thus throwing the hammer 6, with the igniting material, against the firing-pin 5 and causing ignition. On striking against a solid body the hammer 4, with firing-pin 5, is thrown against the igniting material in the hammer 6 in the usual way, the hammer 6 being held by the pin 8 in the slot 9. In both cases the fire produced in this manner rushes through the holes 40 40 and the opening $40^{\times}$ in the hammer 4 and extends to the bursting charge proper or its igniting device.

The other form of the invention, wherein the inflowing water is led directly to the front side of the piston, will now be described so far as its parts differ from those already described, reference being made to Figs. 6, 7, and 8, in which corresponding parts are indicated by the same numerals as in Fig. 1.

The central tube 3 in the bottom piece 2 in this case is not so long and is provided at the front end with a screwed sleeve with internal flange 41, against which projections 42 on the hammer 6 can rest. The hammer 6 is tubular only in the front end in order to receive the rear end of the striking-spring 32. The cylinder 19, supported on the bottom piece 2, is open at the front end and communicates there directly with the chamber 24. The piston 20 has guide-rods 44, surrounded by helical springs 43 and passing through holes in a partition 45. The rear end of the piston 20 has a sleeve 46 surrounding the front part of the hammer 6, which it guides. The sleeve 46 also surrounds the spring 32, that bears at its front end against the piston 20. The hammer 6, which is pressed rearward by the spring 32, has a laterally-projecting pin 47 resting against the partition 45 and passing through an inclined slot 48 in the sleeve 46. From the upper part of this inclined slot 48 a straight slot 49 runs rearward in the longitudinal direction, so that the entire slot has the same form as the slot 12 13 in the tube 3 of the form shown in Figs. 1 and 2. The pin 47 also passes through a transverse straight slot 50 in the wall of the cylinder 19, (see Fig. 7,) and this slot 50 ends in another straight slot 51, made in the wall of the cylinder in the longitudinal direction, with a slight forward extension, found to be necessary in putting

the parts together. These slots 50 51 are situated in relation to the slots 48 49 in such a manner that the pin 47 continues in the slot 50 as long as the pin is in the inclined slot 48; but when the pin is in line with the slot 49 it also enters the longitudinal slot 51. From this slot the partition 45 is cut out by a radial opening 52 of such a width that the pin 47 can pass through it. In this form of the invention another device is shown for holding the safety-wings 33 33 when by rotation of the air-torpedo they are turned into the open position. It consists of two plates 54, capable of being rotated round one of the pins 53 of each link 37, respectively, the said plates being also thrown outward during the rotation of the torpedo. They are of such a shape as to clasp a pin 55, fixed to the bottom piece 2, when the wings 33 33 have been sufficiently opened, (see the position shown in full lines in Fig. 8,) and thereby prevent the wings 33 from returning to the normal position between the firing-pin and igniting material, the said position being shown in dotted lines in Fig. 8. This fuse operates in the following manner on descent of the air-torpedo into water: The water rushes through the inlet-hole 25 and tube 26 into the chamber 24, filling the latter and forcing the piston 20 rearward. With the piston 20 moves the sleeve 46, and the front wall of the inclined slot 48 presses against the pin 47, forcing the latter, which bears against the partition 45, to turn in the slot 50. (See Fig. 7.) During the rearward movement of the piston 20 the spring 32 is compressed gradually. When the piston 20 has moved rearward so far that the pin 47 has entered the longitudinal slot 51, about which time the pin 47 has also arrived in line with the slot 49 in the sleeve 46 and right above the opening 52 in the partition 45, the spring 32 throws the hammer 6 rearward against the firing-pin 5, which bears against the ring $4^{\times}$, and ignition occurs.

On descent against a solid body the percussion-hammer 4, from its inertia, is thrown against the igniting material in the hammer 6, the latter being held by its projections 42, bearing against the flange 41, and ignition occurs, the fire being led in the above-described way to the charge of the torpedo.

If it is desired to insure greater certainty of ignition, two or more similar devices, each with an inlet-hole for the water, may be provided. In the forms shown this inlet-hole is arranged in a screw-plug, and by providing several plugs with holes of different size the area of the inlet-hole may be differed by changing the plugs. The necessary change, however, may be effected in any other way.

I claim as my invention—

1. An igniting mechanism for air-torpedoes, and the like, comprising a fuse-body supporting an inertia-operated percussion-hammer adapted to be operated on striking a solid body, in combination with a cylinder having a piston therein and hammer therefor, said piston being open to outside influences whereby upon plunging into water, the water will operate the piston and hammer.

2. An igniting mechanism for air-torpedoes or the like, comprising a fuse-body supporting a firing-pin, a hammer and a cylinder having a piston therein for the said hammer, said piston being open to outside influences, whereby upon the torpedo plunging into water, the water will operate the piston.

3. An igniting mechanism for air-torpedoes and the like, comprising a cylinder, a fuse-body supporting a firing-pin, a hammer and a piston for the said hammer, said piston being mounted in said cylinder and open to outside influences on the side away from the nose of the torpedo, and means whereby the piston will be moved forwardly upon the plunging of the torpedo into water.

4. An igniting mechanism for air-torpedoes and the like, comprising a cylinder, a fuse-body supporting a firing-pin, a hammer and a piston within said cylinder for the hammer, said piston being open to outside influences, an opening in the nose of the torpedo, a removable plug therein, and means to vary the area of the opening between the piston and the outside influences.

5. An igniting mechanism for air-torpedoes and the like, comprising a fuse-body supporting a firing-pin, and a hammer, in combination with a cylinder, a piston working therein, said cylinder being in communication with a hole in the fore end of the projectile open to outside influences, means for varying the area of said hole, a spring for actuating the hammer and compressed by the piston, and means for releasing the hammer when said spring has been properly compressed.

6. An igniting mechanism for air-torpedoes and the like, comprising a cylinder, a fuse-body supporting a firing-pin, and a hammer provided with a recess for the igniting material within said body, in combination with a piston working in said cylinder, said piston being open to outside influences, for operating the same, a spring for actuating said hammer adapted to be compressed by said piston, and means for releasing said hammer when said spring has been sufficiently compressed.

7. An igniting mechanism for air-torpedoes and the like, comprising a cylinder and a fuse-body supporting firing means therein, in combination with a piston working in said cylinder, said piston being open to outside influences adapted to actuate the said piston in said cylinder for releasing said firing means.

8. An igniting mechanism for air-torpedoes and the like, comprising a cylinder, a fuse-body supporting firing means therein, and a piston within said cylinder for actuating said means, said piston being open to outside influences through a hole in the forward end

of the torpedo, and means for varying the area of said hole.

9. An igniting mechanism for air-torpedoes and the like, comprising a cylinder, a fuse-body supporting a firing-pin therein, and a spring-actuated hammer provided with a recess for the igniting material, in combination with a piston working in said cylinder, a hole in the end of the projectile in communication with said cylinder and with external influences adapted to actuate said piston and compress the spring of said spring-actuated hammer on entering the water, and means for releasing said hammer when its spring has been sufficiently compressed.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILHELM THEODOR UNGE.

Witnesses:

A. HELJESTRAND,

S. SOMMAR.