F. E. LANDER.

SAFETY DEVICE.

APPLICATION FILED NOV. 11, 1918.

1,313,546. Patented Aug. 19, 1919.

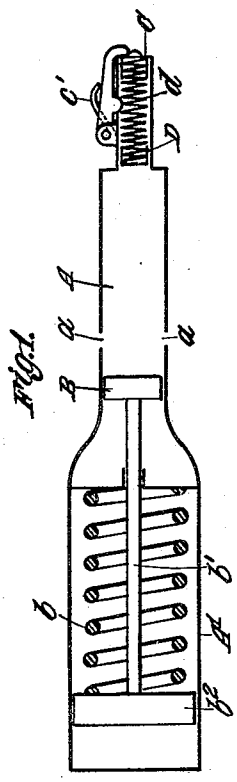


Fig. 1.

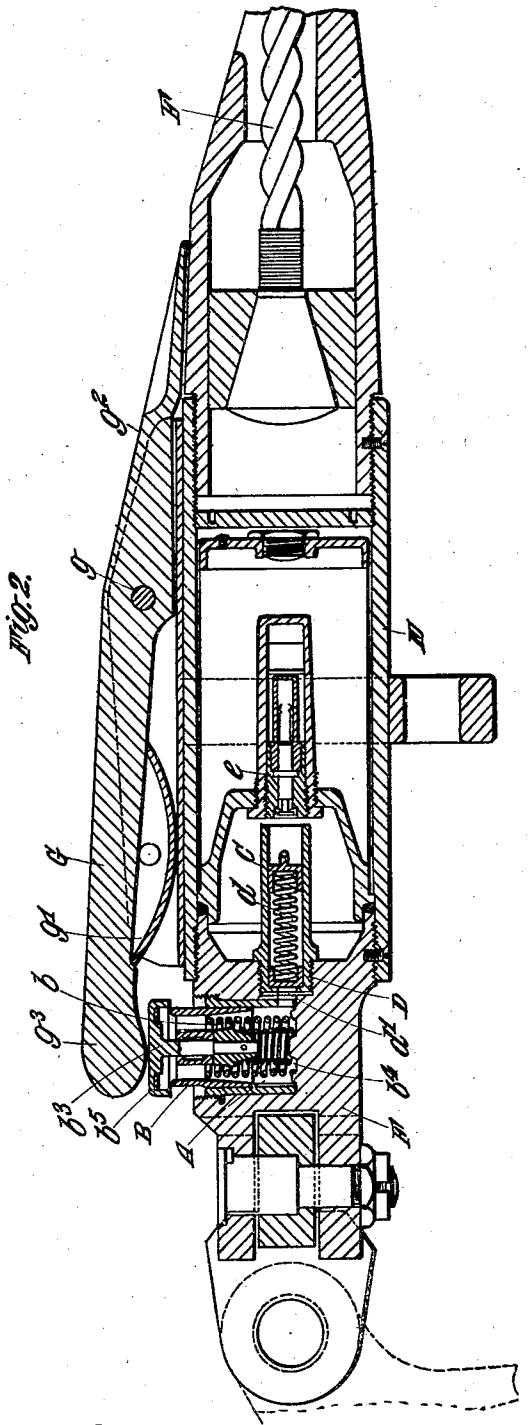


Fig. 2.

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UNITED STATES PATENT OFFICE.

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SAFETY DEVICE.

1,313,546. Specification of Letters Patent. Patented Aug. 19, 1919.

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To all whom it may concern:

Be it known that I, FRANK EATON LANDER, a subject of the King of Great Britain, residing at 25 Eliot Park, Lewisham, in the county of London, England, have invented certain new and useful Improvements in or Relating to Safety Devices, of which the following is a specification.

This invention relates to safety devices for use especially in connection with firing mechanism for mines, depth bombs and other submerged explosive bodies, but also applicable to various purposes in which an action is to be prevented until the safety device is submerged or supplied with liquid.

According to this invention the primary element of the operating mechanism is adapted to operate the secondary element by static pressure transmitted through liquid in a liquid trap or chamber normally empty of liquid but adapted to be filled automatically when the device is placed in condition for use, so that until the liquid is trapped there is no effective pressure transmitting medium between the two elements.

As applied for example, to firing mechanism for a submerged explosive body the firing pin spring may be normally unenergized and arranged so as not to be effectively energized by any operation of the primary element so long as the liquid trap is filled with air, but on submersion and trapping of the water movement of the primary element is transmitted through the incompressible water to the spring, energizing it until it is in condition for operation of the firing pin. In the case of a depth bomb pressure of the water upon a spring controlled piston provided with a plunger working in a small cylinder having a water inlet or inlets and open to the firing device may cause forward movement of the plunger, which first traps the water and then compresses the firing pin spring against a catch until at a predetermined depth, the firing pin is released by the catch and the charge is fired. Or a submarine mine may be rendered safe until submersion by energizing the firing device in this manner and releasing by any suitable mechanism on the mine being struck.

Instead of the water pressure energizing the spring or second element of the device the water may merely fill the trap cylinder or chamber and the primary element be operated mechanically by a lever or other member acted on by an external force.

In order that the said invention may be clearly understood and readily carried into effect, I will describe the same more fully with reference to the accompanying drawings in which:—

Figure 1 shows diagrammatically in section a device in accordance with this invention, in which hydrostatic pressure operates the device; and

Fig. 2 is a longitudinal section of an explosive link or body connected to a cable and provided with a safety device adapted to be actuated mechanically only when submerged.

A is the liquid trap chamber. B is a piston with spring b, through which the external force is enabled to operate, the piston forming the primary operating element. C is a firing pin provided with catch c and operative piston D under the control of a firing spring d.

Referring to the device shown in Fig. 1, which is suitable for use with a depth bomb or for other mechanism to be operated on reaching a predetermined depth of submersion the piston B is on the end of a rod b' on the other end of which is a plunger b^2 placed in the cylindrical extension A′ of the trap chamber and adapted to be acted upon by the external water pressure, which causes the spring b to be compressed. The trap chamber A is provided with apertures a through which water can enter on submersion but until submersion the chamber is filled only with air and in the event of pressure acting on the plunger b^2 the air would be compressed and the strength of the firing spring d acting against the piston D is sufficient to prevent operation of the firing pin under such pressure as can be obtained by the compression of air by the piston B.

When the device is submerged the chamber A fills with water through the openings a and as the depth bomb or other body to which the firing and safety device is applied sinks, the hydrostatic pressure on the plunger b^2 increases, compressing the spring b until the piston B passes the apertures a when the water is trapped in the chamber A and the pressure is transmitted through the incompressible water to the piston D.

The piston D is moved forward and energizes the firing spring d until the piston meets the nose c' on the spring catch c which holds back the firing pin C. When the piston D has moved forward sufficiently

to press back the catch c the firing pin C is released and springs forward under the pressure of the now energized spring d. The firing pin is shown merely as an illustration but may of course be replaced by any other device which it is desired to operate at a predetermined depth.

The apparatus shown in Fig. 2 illustrates the application of the device to a case in which the firing mechanism is actuated mechanically; or instead of the firing pin shown any mechanically operated device may be used, where operation is to be prevented before submersion. The specific apparatus shown is an explosive link E connected to a cable F and adapted to explode on the passage over it of an opposing cable, for example, the cable of a mine or a mine sweeper. The mechanical device for actuating the firing mechanism is the lever G pivoted at g on the body of the link and arranged to continue the slope of the link surface over which the opposing cable is led, the pressure of the cable as it passes over the rear end of the lever compressing the spring g' and causing the lever nose to bear upon the piston cap b^3 belonging to but detached from the piston B, which slides in the cylinder or trap chamber A, in this case provided in the body of the link E.

When the link is out of the water the position of the firing mechanism is as shown, the spring d being uncompressed so that by no possible action of the mechanism can the detonator e of the explosive link be fired, owing to the fact that the cylinder A contains air at atmospheric pressure so that even if the piston B and cap b^3 be pressed in, the air would not be compressed to a pressure sufficient to actuate the firing pin, which moreover is separated from the cylinder space by the small diaphragm d' of metal foil, celluloid, rubber or other suitable material which is clamped in place and protects the inner mechanism from contact with the water. A valve with coned seat or any other type of valve may be used instead of the diaphragm.

The link is so connected up that if an opposing cable—either the mooring or the mine sweeping cable—meets it, the cable is caused to slide up the sloping face of the end link and thence over the sloping tail g^2 of the lever G. When it passes the pivot g it begins to press down the lever against the spring g', causing the rounded end g^3 to meet the piston cap b^3. The cylinder A has already been filled with water on submersion of the link and the first action of the lever is to press the cap b^3 down against the pressure of its light spring b^4 until the lead ring or washer b^5 meets the upper end of the open piston B, closing its outer end and so trapping the water within the cylinder. The closed piston is then compressed against its spring b and the pressure of the water increases until the copper diaphragm d' yields, when the firing pin spring d is compressed through the small terminal piston D. The firing pin is held back by a spring catch until the compression reaches a predetermined amount when the catch is overcome and the firing pin freed, moving forward under the pressure of the now energized spring and striking the detonator cap.

The firing lever G may be regarded as representing any mechanical device for operating the piston B. In a submarine mine for instance, its place would be taken by the ordinary firing mechanism which would remain inoperative until effective communication had been established with the firing pin through the entry of water into the trap chamber.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In a safety device, an operating mechanism comprising primary and secondary elements normally without operative connection between them, a liquid trap normally empty of liquid interposed between the said elements, and provided with an inlet by which it is filled automatically with liquid when the device is placed in condition for use, and means by which the entering liquid is retained in the trap, which liquid then forms a pressure transmitting medium between the primary and secondary elements.

2. In a safety device, operating mechanism comprising a primary element and a secondary element provided with a spring normally unenergized, a liquid trap interposed between the primary and secondary elements and normally empty of liquid, which trap is provided with an inlet by which it is filled with liquid automatically when the device is placed in condition for use, and means by which the entering liquid is retained in the trap, the said liquid forming a pressure transmitting medium between the primary and secondary elements which are otherwise without operative connection.

3. In a safety device for firing mechanism, a firing pin provided with a catch and a normally unenergized spring, a liquid trap chamber, normally empty of liquid but provided with an inlet for automatic admission of liquid, means by which the entering liquid is retained in the said chamber, an operating piston adapted to transmit power only through the trapped liquid so as to energize the firing spring, and means for operating the said piston.

In testimony whereof I affix my signature.

FRANK EATON LANDER.