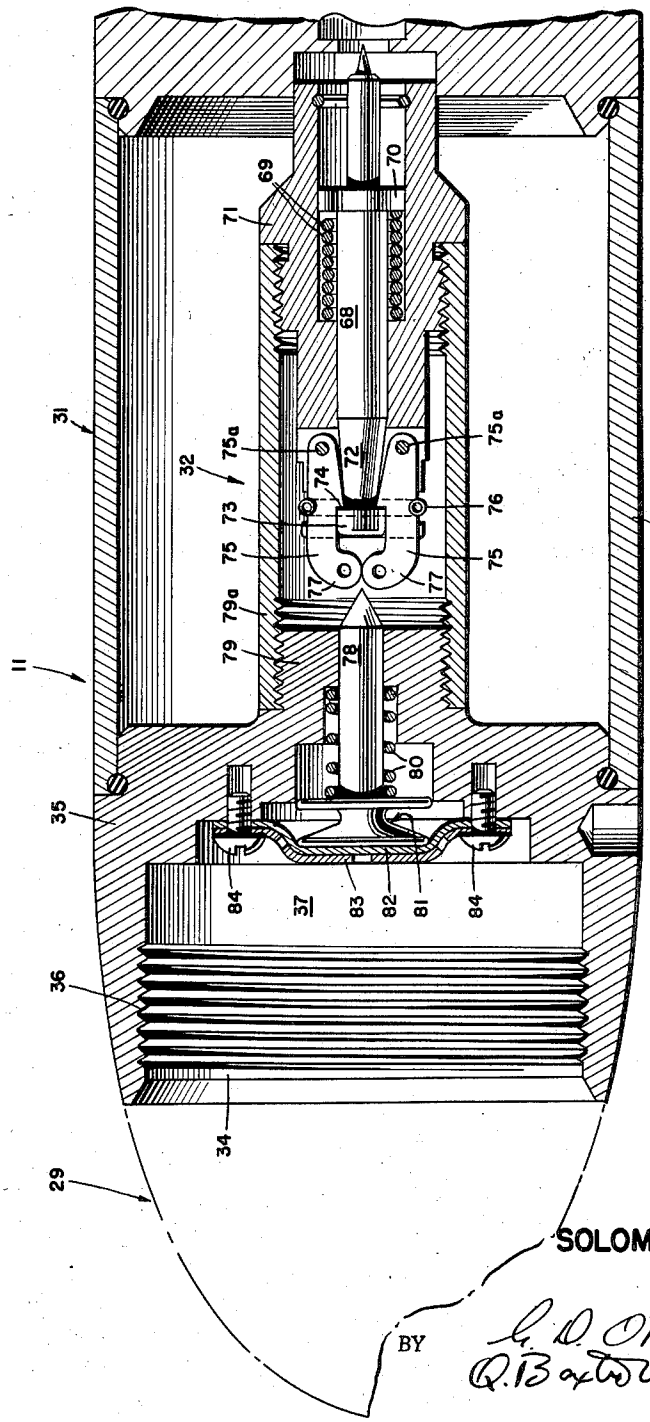
Nov. 11, 1958 S. BURG 2,859,696

HYDROSTATICALLY OPERATED FIRING DEVICE

Original Filed March 18, 1953



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United States Patent Office 2,859,696
Patented Nov. 11, 1958

2,859,696

HYDROSTATICALLY OPERATED FIRING DEVICE

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Original application March 18, 1953, Serial No. 343,208, now Patent No. 2,837,026, dated June 3, 1958. Divided and this application October 27, 1955, Serial No. 543,191

2 Claims. (Cl. 102—7)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This is a division of application Serial No. 343,208, filed March 18, 1953, which is now Patent No. 2,837,026, for Depth Charge Firing Control Mechanism.

This invention relates to a hydrostatically operated firing device, and more particularly to a hydrostatically operated firing device having a positive action release for the firing pin of a depth charge pistol.

Heretofore, firing pin devices for depth charge pistols have been subject to unintentional release by shocks and jars which occur through rough handling. By a unique constructional arrangement of the elements comprising the firing pin mechanism disclosed herein, such shocks and jars are utilized to tighten the grip upon the firing pin so as to insure holding it in the retracted position except when acted upon by definitely planned actuating means.

An object of the present invention is to provide a novel means for holding a firing pin in a retracted position, any effort on the pin to move it toward its firing position serving to grip it more tightly than before.

Another object is the provision of a novel release for a firing pin, according to which the wedge action of a hydrostatically-operated piston may separate the latches which otherwise grip the firing pin to hold it in the retracted position.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

The figure is a central longitudinal section of the nose and body portion of the depth charge showing the preferred modification of the invention in detail.

In the drawing the depth charge is commonly designated 11. Its intended use is in practice submarine warfare. This, however, is no limitation upon the use of the missile since the identical structure and principle of operation will obtain when produced for actual warfare. It may be hand-launched, or it may be started on its air trajectory by a mechanical or explosive projector of a chosen type. In the first instance the missile is simply dropped overboard or dropped from an aircraft. The missile housing the firing pin mechanism may take shapes other than that shown; for example, the firing mechanism may be utilized in a "potato-masher" type hand grenade.

For purposes of illustration the major structural components of depth charge 11 are shown to comprise only a spherical nosepiece 29 and a body section or casing 31. In practical application the depth charge is comprised of a plurality of additional parts to include a large explosive compound. The nosepiece is built up on an annular base, not shown, which may be affixed by means of a mutual thread course 36 to the socket 34 of a bulkhead 35 at the forward end of body section 31. Most of the socket is

filled by the base of the nosepiece and attachments, however, some space is left to define the chamber 37.

The nosepiece 29 houses a ball valve structure, not shown, which serves to release a firing pin in a manner to be explained hereinafter; the valve structure being shown and described in parent application Serial No. 343,208, which is now Patent No. 2,837,026. Sea water is admitted to the chamber 37 through suitable means such as a valve structure housed within the nosepiece 29, and this chamber 37 joins the bulkhead 35 which fronts the firing pin release mechanism 32 situated in the body section 31. The firing mechanism includes a firing pin 68 which is loaded by a spring 69, with one end of this spring abutting a collar 70 on the firing pin. Collar 70 has guidance in the bore of a fitting 71, the bottom of which bore serves as an abutting surface for the other end of the spring 69. A tapered portion 72 of firing pin 68, made by annularly and progressively turning the firing pin down, forms a head 73. The shoulders 74 of a pair of latches 75 engage the underside of the head, being made to do so by coil spring ring 76 that encircles the latches. The latter are pivoted to the fitting 71 and because of their shaping to form the shoulders 74, are accommodated adjacent the tapered portion 72. The rounded terminals 77 touch on the center line of the firing mechanism as shown, being held in that engagement by the spring 76.

Parting of the latches 75 as by the introduction of a prod between the rounded terminals 77 will displace the shoulders 74 from underneath the head 73, thus releasing the compressed spring 69 for a sharp drive of the firing pin 68 to the rear. The foregoing prod consists of a firing plunger 78 with a point directed toward the terminals 77. The plunger is guided in a bore in the externally threaded boss 79 of the bulkhead 35. A sleeve 79*a* screwed onto the boss houses the latches and carries the fitting 71. A spring 80 biases the plunger in the direction away from the firing mechanism, the spring having bearing on the bottom of a counterbore in the boss and against the shaped head 81 of the plunger.

One part of this head has bearing in a second counterbore in the boss. The other part of the head 81 has contact with a flexible diaphragm 82. The flexure of the diaphragm by expansion of the spring 80 is limited by a metal screen 83. The diaphragm and the screen are commonly secured to the bulkhead 35 by suitable fasteners such as screws 84.

The screen admits water from the chamber 37 to the front of the diaphragm, flexing the latter against the expansion of the spring 80 and driving the plunger 78 between the terminals 77. The separation of the latches releases the firing pin as has been explained.

At this point it is thought desirable to describe two aspects of the firing mechanism in addition to the features of it outlined immediately above. The first relates to the automatic seating of the latches 75. The spacing of the latches at the places adjoining their pivots is sufficiently ample and necessarily so, to admit the head 73 on an inward push of the firing pin. The spring 69 is compressed on that push, and on relaxation of the push such expansion as can occur is ended by the engagement of the head 73 against the shoulders 74 and by the mutual contact of the terminals 77. The pressure of the head occurs on lines inside of the latch pivots. There is thus a constant effort to swing the latches toward each other so that they automatically remain closed.

The second aspect relates to the shock-proof feature of the firing mechanism. The mass of the firing pin 68 and both the masses and forces of springs 69 and 76 are so chosen as compared to the mass of the firing plunger 78 and the mass and force of spring 80, that when

inertia forces are applied, the torque exerted by the firing pin on the latches **75** about their fulcrums **75***a* is greater in normal usage than that produced by the firing plunger when brought in contact with the latches due to inertia. In other words, by energy of a shock the firing pin **68** including the force of the firing spring **69**, exert a greater effort to automatically close the latches than the firing plunger is able to exert between the terminals **77** to separate the latches from the firing pin.

When the depth charge **11** sinks in the water, for example, the inherent hydrostatic and dynamic pressures cause water to flow through the aforementioned valve structure, not shown, within nosepiece **29** of the depth charge and enter into the chamber **37**. As the pressure increases within this chamber, the diaphragm is flexed rearwardly and plunger **78** is forced between the terminals **77** to spread the latches **75**. The release of the head **73** allows the spring **69** to thrust the firing pin into a detonator which, by this time, is in an armed position to be detonated; better understood by reference to application Serial No. 543,192 for Safety and Arming Device for Explosive Charges, filed October 27, 1955. This explosion in turn sets off the main charge of the depth charge. The latch and spring mode of operation made possible by the structural arrangement of the instant firing pin mechanism permits rough handling as well as launching from projectors which create high initial shock to the elements comprising depth charges.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a hydrostatically operated firing device for use in a depth charge, the combination of a casing exposed at one end to a hydrostatic head, a sleeve secured to and disposed within said casing and having a fitting carried thereby, a normally locked spring-loaded firing pin disposed within and guided for axial movement by said fitting as the firing pin is released, a tapered portion formed on one end of the firing pin and terminating in an enlarged head having a pair of oppositely disposed planar surfaces normal to the longitudinal axis of the firing pin and a peripheral surface thereon parallel to the longitudinal axis of the firing pin, a pair of oppositely disposed latch members arranged within and pivotally mounted on said fitting, each of said latch members having an inclined portion in engagement with said tapered portion and terminating in a shoulder in engagement with one of said planar surfaces of said head and a straight portion bordering on said shoulder in engagement with the peripheral surface of said head for releasably locking said pin, spring means surrounding said latch members for maintaining said inclined portions in engagement with said tapered portion and said shoulders in engagement with said one planar surface, said spring means also maintaining said straight portions in engagement with said peripheral surface until said latch members are moved laterally to a release position to unlock said pin, an enlarged portion on each of said latch members and normally maintained in abutting engagement with respect to each other by said spring means, a plunger movably arranged within said casing, cam means carried by said plunger and movable thereby into engagement with said enlarged portions for moving said latch members laterally to said release position, and means sealed to said casing in engagement with said plunger and actuated in response to a predetermined hydrostatic pressure for moving said plunger.

2. In a hydrostatically operated firing device for use in a depth charge, the combination of a casing exposed at one end to a hydrostatic head, a sleeve secured to and disposed within said casing and having a fitting carried thereby, a normally locked spring-loaded firing pin disposed within said fitting and movable therein from an initial position to a firing position when the pin is released, a tapered portion formed on one end of the firing pin and terminating in an enlarged head having a pair of oppositely disposed planar surfaces normal to the longitudinal axis of the firing pin and a peripheral surface thereon parallel to the longitudinal axis of the firing pin, a pair of latch members pivotally mounted on said fitting and movable laterally to a release position, each of said latch members having an inclined portion in engagement with said tapered portion and terminating in a shoulder in engagement with one of said planar surfaces, and a straight portion in engagement with said peripheral surface for releasably locking the pin in said initial safe position, spring means surrounding and in engagement with said latch members for maintaining said inclined portions in engagement with said tapered portion, and said shoulders in engagement with said one planar surface, said spring means also maintaining said straight portions in engagement with said peripheral surface until said latch members are moved laterally to a release position to unlock said pin, means in engagement with said pin and fitting for forcibly driving the pin from said initial position to a firing position as the pin is unlocked, rigid means on each of said latch members and normally maintained in abutting engagement with respect to each other by said spring means, movable means supported within said casing, cam means carried by said movable means and movable therewith into engagement with said rigid means for moving said latch members laterally to said release position to unlock said pin, yieldable means in engagement with said movable means for maintaining said cam means in mutual spaced relation with respect to said rigid means until said movable means is moved a predetermined amount, and means sealed to said casing in engagement with said movable means and actuated in response to hydrostatic pressure for moving said movable means said predetermined amount when said pressure overcomes the force of said yieldable means.

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