Aug. 22, 1961 A. B. LEAMAN 2,996,990

EXPLOSIVE ACTUATOR

Filed Oct. 15, 1953 2 Sheets-Sheet 1

FIG. 1.

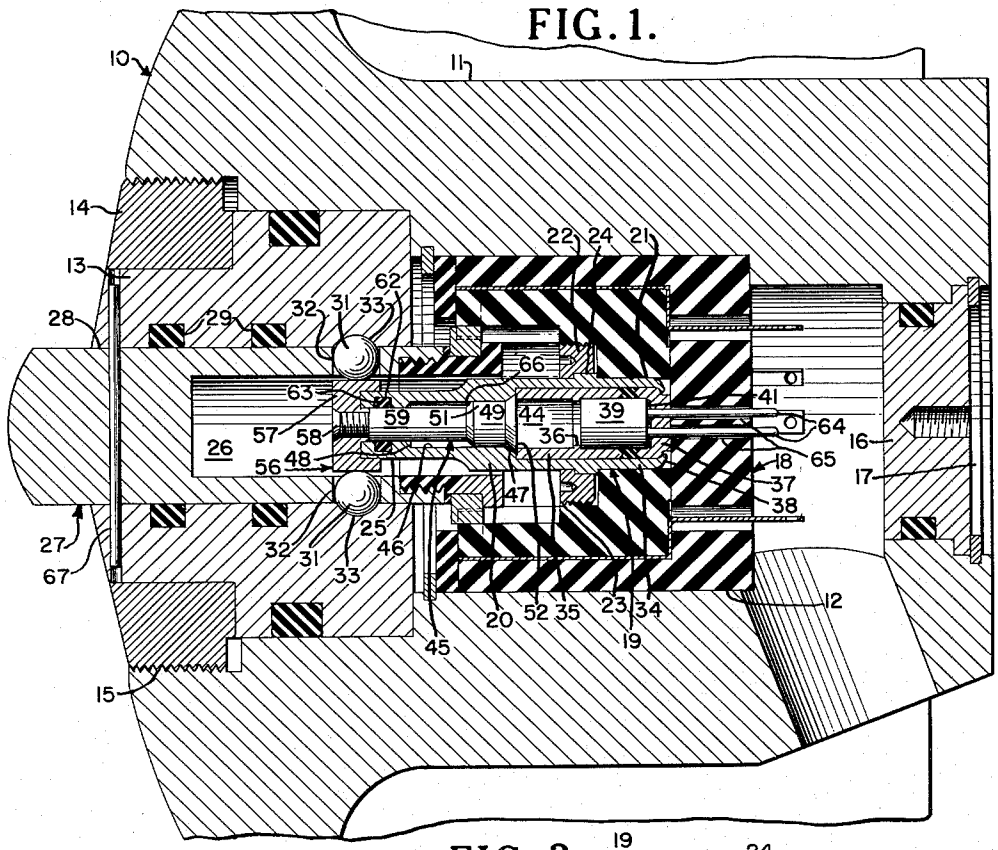
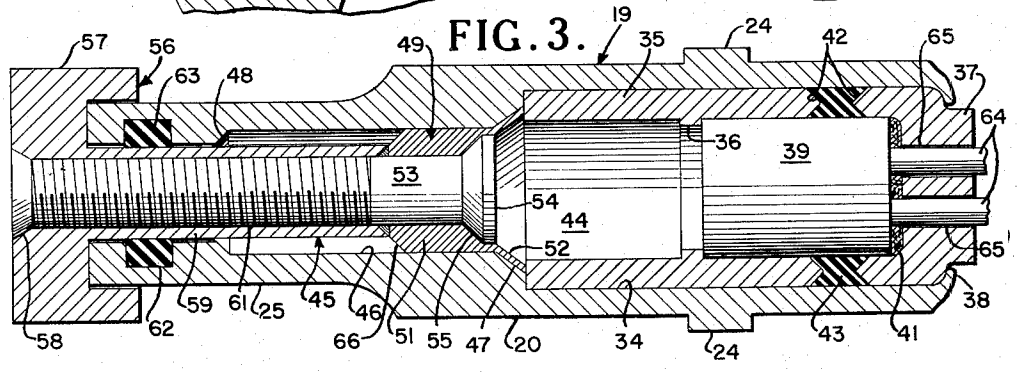


FIG. 3.



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FIG. 2.

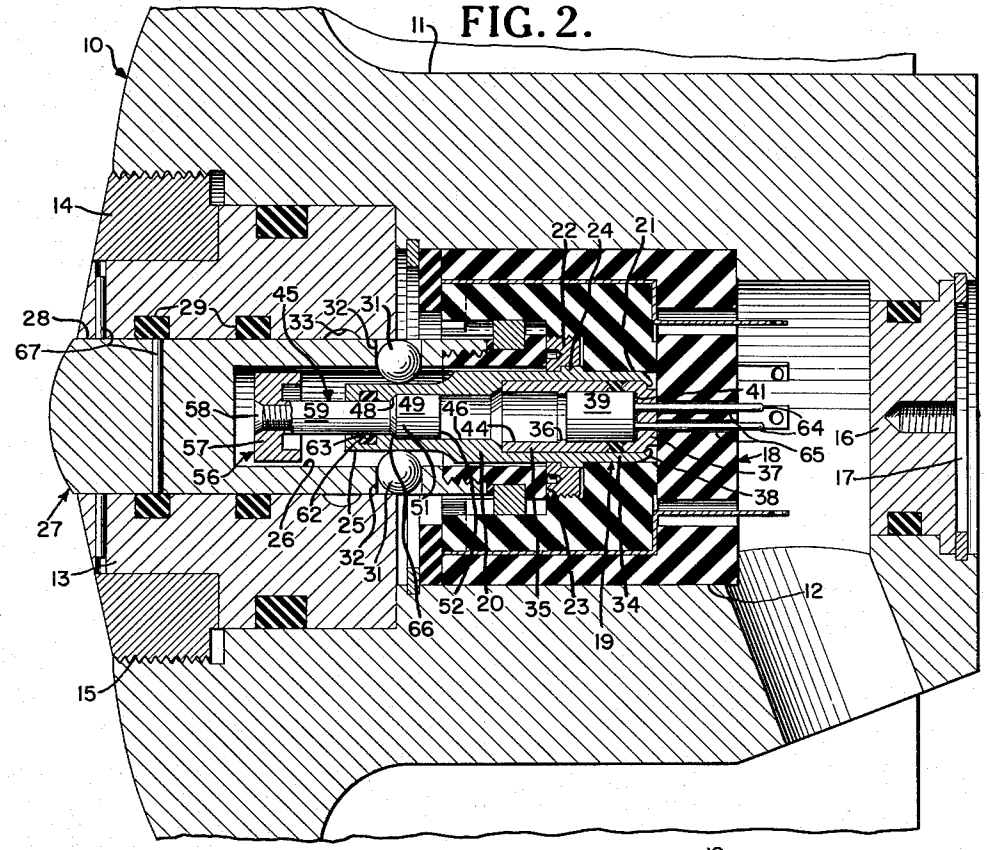
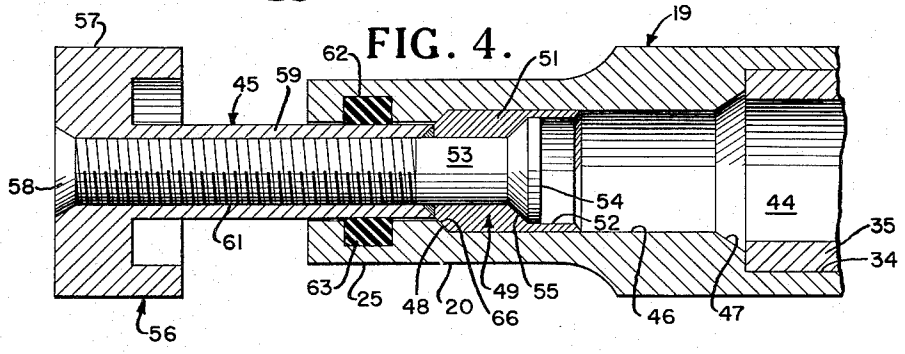


FIG. 4.



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EXPLOSIVE ACTUATOR

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3 Claims. (Cl. 102—70.2)
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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.

The present invention relates to a pressure operated device and more particularly to a new and improved pressure operated mechanism wherein the pressure is created by an explosion occurring within a sealed casing.

Furthermore, the invention contemplates the provision of an explosive actuated device for use in an ordnance missile such, for example, as a bomb, rocket, or torpedo wherein means are provided for releasing a conventional ball type locking means as an explosive charge sealed within the device is fired in response to an electrical impulse thereby to cause arming of the missile or to render an arming and firing means thereof effective upon impact of the missile with a target.

An object of the present invention is to provide an explosive device capable of ignition, preferably in response to an electrical impulse but, if desired, also by percussion means, whereby a normally locked pressure responsive element is actuated to render an apparatus, mechanical or electrical device effective.

Another object of the invention is the provision of an explosive operated device for releasing a ball type locking mechanism as the device is actuated in response to a predetermined pressure.

A further object of the invention is the provision of a new and improved device operated by pressure generated therein, which device does not permit loss of pressure due to the escape of gases at the time of the explosion.

A still further object of the invention is the provision of a normally locked pressure operated device which is positive in action and simple in construction and operation.

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:

FIG. 1 is a sectional view of a fragmentary portion of an ordnance missile illustrating the manner in which the device of the present invention is employed in connection with a ball type locking mechanism thereof;

FIG. 2 is a view similar to FIG. 1 illustrating the device in a release position;

FIG. 3 is an enlarged longitudinal sectional view of the device of the present invention; and,

FIG. 4 is an enlarged fragmentary sectional view of the device of FIG. 3 with the pressure response element thereof actuated to a released position.

Referring now to the drawings and more particularly to FIG. 1 thereof, the numeral 10 indicates a fragmentary portion of an impact or nose end of an ordnance missile having an inwardly extending boss 11 formed thereon and a centrally disposed bore 12 extending therethrough.

A sealing plug 13 is disposed within one end of the bore 12 and maintained therein by a nut 14 in threaded engagement with the nose 10 as at 15, the other end of the bore having a plug 16 in sealing engagement therewith and maintained therein by a split ring 17. By the aforesaid arrangement, a contact assembly 18 is sealed within the bore 12 between the plugs 13 and 16, the

assembly having mounted therein the release device of the present invention generally indicated by reference character 19.

As more clearly shown on FIG. 3, the release device comprises a casing 20 composed of any material suitable for the purpose such, for example, as brass or the like. One end of the casing 20 is arranged within a centrally disposed recess 21 formed in the contact assembly 18 and secured therein by a nut 22 threaded into a well 23 formed in the assembly and into abutting engagement with an external flange 24 integrally formed with the casing 20. The other end of the casing 20 is reduced in diameter as at 25 and disposed within a bore 26 formed in the normally locked impact responsive device or plunger 27, the plunger being slidably arranged within a bore 28 formed in the plug 13 and maintained in sealing engagement therewith by a pair of mutually spaced O-rings 29 carried thereby. The plunger 27 is locked by a conventional ball type locking mechanism which includes a plurality of locking balls 31, disposed in a plurality of openings 32, respectively, formed in the plunger and seated in an annular groove 33 arranged in the plug 13, FIG. 1.

The casing 20 is provided at one end thereof with a well or bore 34 having arranged therein a sleeve 35 composed of brass or the like and provided with an annular internal flange 36. A cap 37 is arranged within the well 34 in sealing engagement therewith, the cap being maintained therein by a flange 38 formed on the casing and crimped into abutting engagement with the cap.

The aforesaid sleeve and cap enclose an electroresponsive detonator 39, one end of the detonator being in engagement with the flange 36, the other end thereof being in engagement with a gasket 41 composed of felt or the like and disposed between the detonator and cap, FIG. 3. It will be noted on FIG. 3 that one end of the sleeve 35 and cap 37 is provided with conical portions 42 in spaced relation with respect to each other and having a sealing gasket 43 composed of any suitable plastic material disposed therebetween in sealing engagement therewith and with the casing 20 and detonator 39. By the aforesaid sealing arrangement the detonator is sealed within the casing 20 and an expansion chamber 44 is provided between the detonator and a releasably locked actuating plunger generally indicated by the reference character 45. The plunger 45 is slidably arranged within a bore 46 in communication with bore 34 and is somewhat smaller in diameter than bore 34, the bore 46 being provided with a pair of conical seats 47—48 arranged at the terminal ends thereof respectively.

The plunger 45 comprises a sealing member 49 composed of any suitable ductile material such, for example, as aluminum, having a cylindrical body 51 in engagement with the wall defining a bore and a conical flanged portion 52 formed thereon and in sealing engagement with the seat 47. The conical portion 52 is maintained in sealing engagement with the seat 47 by the sleeve 35 and is constructed and arranged to yield readily in response to a predetermined pressure applied thereto. The ductile member 49 is mounted on one end of a shaft 53 and secured thereon by a flared head 54 formed on the shaft and seated in a flared recess 55 formed in the member. The plunger 45 includes a member 56 having a cylindrical head 57 secured to the other end of the shaft as at 58 and a sleeve 59 formed on the head in threaded engagement with the shaft as at 61. The aforesaid plunger arrangement is particularly adapted to facilitate the attachment of the plunger to the casing.

As shown more clearly on FIGS. 3 and 4 the casing 20 is provided with an internal annular groove 62 having an O-ring 63 arranged therein in engagement with the sleeve 59 thereby to dampen the vibration when the

detonator **39** is fired and the plunger is released and moved in response thereto.

Referring now to FIG. 1 it will be noted that the cylindrical head **57** is normally in engagement with the locking balls **31** thereby maintaining the impact plunger **27** locked to the plug **13** and thus preventing premature arming or firing of the missile, as the case may be. The plunger **56** is normally locked to the casing **20** by the conical flange **52** carried by the member **49** and arranged within the seat **47** and movement of the plunger **56** is prevented until the detonator **39** is fired, the external electrical connection being established by way of a pair of mutually spaced terminals **64**. The terminals are secured to the detonator in the conventional manner and extend through a pair of mutually spaced openings **65** respectively, formed in the contact assembly **18**. When the detonator **39** is fired a sufficient amount of gas pressure is generated within the sealed expansion chamber **44** to cause release of the conical flange from the seat **47** and to forcibly move the plunger **56** a predetermined amount. When this occurs the conical end **66** on the ductile element **51** is forcibly driven into engagement with the seat **48** and concurrently therewith the conical flange **52** is forcibly driven into engagement with the wall defining the bore **46** with sufficient force to lock the plunger in an extended position, FIG. 2. When this occurs the cylindrical head **57** carried by the plunger is moved out of engagement with the balls **31** and concurrently therewith the balls move out of engagement with the locking groove **33** by reason of alignment of the balls with the reduced portion **25** and movement of the balls in engagement therewith. Such movement of the balls is sufficient to release the impact responsive device **27** for operation, however, a shear element **67** prevents movement of the device until the missile strikes a target and the element is sheared by the force of the impact.

While the release device of the present invention is shown in connection with an electric fuze for releasing the arming plunger for operation it will be understood that the device may be advantageously employed with a mechanically actuated fuze such, for example, as the type wherein the firing pin is releasably locked by a plurality of balls.

From the foregoing, it will be apparent that a new and improved release device has been devised wherein a normally locked plunger is released and moved a predetermined amount in response to a predetermined pressure applied thereto, the pressure being generated in a sealed casing as an electroresponsive detonator therein is fired in response to an electrical impulse.

Whereas, the invention has been described in detail in connection with a release device particularly adapted for use in an ordnance missile, it will be understood that it may be employed, if desired, in an apparatus, mechanical or electrical device wherein a ball type locking device is employed.

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 as new and desired to be secured by Letters Patent of the United States is:

1. An exposive operated device comprising, in combination, a casing, a plunger normally releasably locked to said casing, a shearable member interposed between said casing and said plunger whereby the plunger is rendered movable after release thereof to shear said member upon the subsequent application of an impact force thereto, means including a plurality of balls releasably arranged within the casing for locking said plunger thereto, an initially fixed actuating member normally in engagement with said balls for releasing said balls as the actuating member is operated in response to a predetermined pressure thereby to release said plunger for operation upon subsequent impact applied thereto, and explosive means responsive to an electrical impulse for generating said pressure.

2. An explosive operated device for an ordnance missile comprising, in combination, an impact responsive arming member releasably locked to said missile in an initial safe position, means including a plurality of balls for releasably locking the impact member in said initial safe position, a normally sealed casing arranged within the missile, a pressure operated plunger releasably locked to said casing and movable a predetermined amount when released, retaining means on said plunger in engagement with said balls for maintaining the impact member in said safe position, a yieldable conical member on said plunger in sealing engagement with the casing for maintaining said retaining means in engagement with said balls and the plunger locked to the casing until the conical member has yielded suddenly in response to a predetermined pressure applied thereto and the plunger is moved said predetermined amount thereby, and explosive means sealed within the casing and fired in response to an electrical impulse for applying said pressure to said conical member.

3. In an explosively actuatable release device comprising a normally sealed casing, a plunger releasably locked to said casing and movable a predetermined amount when released, a yieldable conical head on the plunger for maintaining the plunger locked to said casing and constructed and arranged to yield and release the plunger in response to a predetermined pressure applied thereto, an electroresponsive detonator fired in response to an electrical impulse for applying said pressure to said conical head, stop means on said head, and complimentary means on said casing for limiting the movement of said plunger.

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