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EJECTION DEVICE

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FIG. 1.

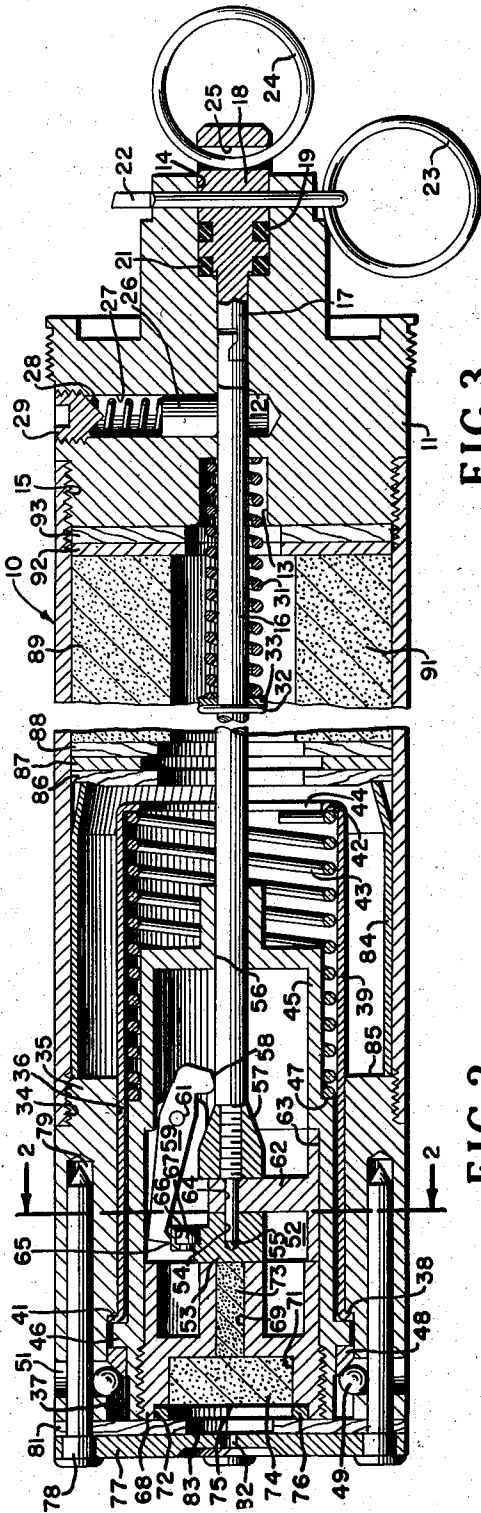


FIG. 3.

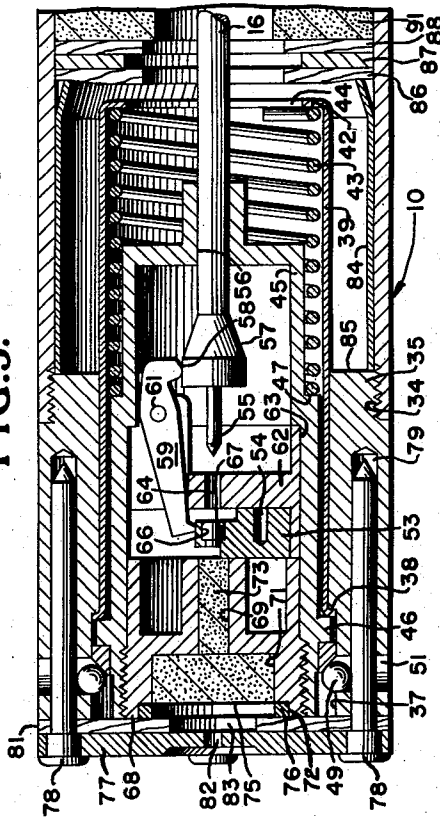
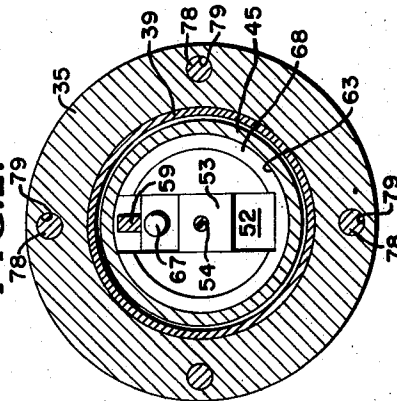


FIG. 2.



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EJECTION DEVICE

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7 Claims. (Cl. 89—1)

This invention relates to a device for ejecting a missile or material from a body under control of a small explosive charge and more particularly to a device employed for signalling purposes in the field of military pyrotechnics in which a body is released for ejection when a strong closure seal of a body is ruptured in response to the pressure generated by the combustion of a small propellant charge within the body without physical damage to other components carried interiorly by the body.

In certain types of military devices and particularly those employed for signalling purposes it has been found necessary to forcibly remove a cover such, for example, as a projectile nose or a torpedo nose while under water or any other type of missile nose by explosive means without damage to shock or heat sensitive inner components of the type relating to radio, radar, explosives or pyrotechnics or any sensitive devices or materials carried interiorly by the military devices or missile. It has also been found to be highly desirable to provide a relatively large opening establishing communication between the interior and the exterior of the missile or casing when the cover has been removed through which an inner component may be subsequently ejected or through which a pyrotechnic smoke or flare may burn. The manner in which this result is achieved will be more clearly apparent as the description proceeds.

One of the objects of the present invention is to provide an ejection device for a military application in which the release of the device is triggered in response to a small explosive force within the device.

Another object is the provision of explosively controlled means for removing a cover from a casing thereby to vent the casing for subsequent operation of heat sensitive materials disposed within the casing without damage to such materials.

A further object is the provision of new and improved means for unsealing the casing of a signalling device in response to a small explosive force from within the casing without injury or damage to highly sensitive signalling components disposed within the casing.

A still further object is to provide a new and improved explosively controlled ejecting mechanism for a signalling device in which there is no possibility of premature actuation of the signal as the result of the force of the explosion and in which means are provided for preventing fragmentation of the device in the event that the ejectable component thereof should explode or detonate before being completely ejected.

A still further object is to provide a new and improved ejection device for a military component which is economical to manufacture and possesses the desirable qualities of ruggedness, simplicity and reliability in operation.

Still other objects, advantages and improvements will be apparent from the following description taken in connection with the accompanying drawing of which:

Fig. 1 is a longitudinal view in section of the ejection

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device of the instant invention according to a preferred embodiment thereof;

Fig. 2 is a view taken along the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary view in section of the arming mechanism with the arming member in an armed position.

Referring now to the drawing on which like numerals of reference are employed to designate like parts throughout the several views and more particularly to Fig. 1 thereof there is shown thereon a device for ejecting a component therefrom in response to a small explosive force within the device, the device comprising a casing 10, preferably cylindrical in configuration and threaded interiorly at the ends thereof. A plug 11 having a bore 12 formed axially therein and a pair of bores 13 and 14 formed coaxially therewith is threaded into one end of the casing 10 as at 15. One end of a rod 16 is slideably disposed within the bore 12 and notched as shown to be releasably engaged by a complementary notch formed in pull rod 17. Rod 17 is provided with an enlarged cylindrical portion 18 disposed within bore 14 and adapted for sliding movement within plug 11. An O-ring 19 is disposed within a complementary circular groove formed on portion 18 of the rod to effect a water tight sliding seal between the rod and plug 11. A gasket or seal 21 is preferably provided to provide a seat for limiting the inward movement of the pull rod 17. The rod 17 is normally locked in the position shown on Fig. 1 by a cotter pin 22 or the like having a pull ring 23 secured thereto. A second pull ring 24 is secured to the pull rod at the portion projecting outwardly beyond plug 11, a bore 25 preferably being provided for this purpose.

A member 26 is slideably arranged within bore 27 of plug 11 and urged against rod 16 by spring 28 and plug 29, whereby bore 12 is closed by the member 26 when rod 16 has been expelled therefrom. The rod 16 is yieldably urged to the left as viewed on the drawing by spring 31 having one end thereof disposed within bore 13 and the other end secured to the rod 16 as by a cotter pin 32 and washer 33 illustrated.

Threaded within the other end of the casing 10 as at 34 is a support block 35 having a bore 36 concentrically formed therein and a bore 37 of greater diameter forming a shoulder 38 therebetween. A tubular member 39 flanged at 41 for engagement with shoulder 38 is disposed within bore 36. The opposite end of the tubular member is flanged inwardly at 42 for engagement with the end of spring 43 disposed within the tubular member. An opening 44 of substantially the same diameter as the inside diameter of spring 43 is thus formed in tubular member 39. A circular main support block indicated generally by the numeral 45 comprises a circular flange 46 slideably disposed within bore 37 and a shoulder 47 for engagement with the other end of spring 43 when the support block is in the position shown on the drawing.

A circular cam element 48 encircling the block 45 in engagement with flange 46 is employed to retain the block in the position shown against the tension of spring 43 until balls 49 are unlocked and moved outwardly within radial bores 51 formed within the support block 35. Disposed within a recess 52 formed transversely within block 62 is an arming member 53 having a closed bore 54 formed therein adapted to receive the rod 16 at an end portion 55 thereof of reduced diameter. The rod 16 is disposed for sliding movement within a bearing 56 formed within the support block 45 substantially as shown. An annular tapered cam member 57 is threaded on the rod 16 adjacent end portion 55 thereon for coaction with a protruding portion 58 of lever 59 pivoted at 61 to member 62 carried within the bore 63 of member 45 and provided with an aperture 64 within which end portion 55 of rod 16 is slidably disposed.

The other end of lever 59 is formed as at 65 for en-

gement with a complementary surface on arming member 53 whereby the arming member is moved to an armed position as viewed on the drawing with bore 66 thereof in alignment with the firing pin carried by the end portion 55 of rod 16. A percussion cap 67 is carried by the bore 66 for firing by the firing pin when the arming member is in the armed position. A circular member 68 hereinafter referred to as the expelling charge block is threaded within the support block 45 substantially as shown and provided with three axial bores 69, 71 and 72 of progressively increasing diameter in the order named. An explosive train 73 is formed within bore 69 and bore 71 is filled with an explosive 74, preferably of the propellant type and retained therein by a thin sheet 75 composed of material suitable for the purpose, such for example, as cloth and retained by ring 76 fitted within bore 72.

The end of the support block 35 is normally closed by a plate 77 releasably secured thereto by a plurality of push pins 78 pressed into bores 79 formed within the support block 35, a suitable gasket 81 preferably being disposed therebetween. The plate 77 is provided with a small aperture 82 in communication with a larger aperture 83 formed within the gasket 81. Pins 78, it will be noted, are disposed within the path of movement of balls 49 in such manner that the balls are retained in contact with the conical surface of cam element 48 until the pins are withdrawn.

A circular sleeve member 84 is disposed within casing 10 in abutting engagement with an end surface 85 formed on support block 35, the other end of sleeve 84 being engaged by washer 86 made of a material somewhat compressible. Washer 86 is arranged in face adjacency with a metallic washer 87 on the other side of which is preferably another washer 88 of material somewhat compressible. Disposed within the casing 10 is a quantity of pyrotechnic material 89 such, for example, as smoke composition material having a bore therein within which the rod 16 is adapted to move. The composition 89 is thus enclosed within a chamber 91 formed within the casing 10 by compressible washers 88 and 92 backed by washer 93 against an end surface of plug 11. The pyrotechnic material 89 may be ignited by any suitable means, not shown, after the body has been expelled from casing 10 by spring 43, the particular composition of material 89 forming no part of the instant invention.

The operation of the device will now be described. Let it be assumed, by way of example, that the signalling device is to be used on the deck of a submarine and that the device is in the condition shown on Fig. 1. Pin 22 is withdrawn by ring 23 thereby freeing rod 17 for movement. Ring 24 is now withdrawn to a position such that an end portion of rod 16 is brought into bore 14. When this occurs rod 16 is quickly disengaged from pull rod 17 and the propellant charge 74 is ignited in the following manner. As rod 16 is withdrawn from an initial position of rest by ring 24, lever 59 is rocked about its bearing 61 by cam member 57 sufficiently to move arming member 53 to the armed position, Fig. 3. The length of the portion 55 of rod 16 is such that this portion of the rod is withdrawn from bore 54 within the arming member just prior to actuation of lever 59. An arrangement is thus provided in which the arming member is moved by positive action in response to outward movement of rod 16 as ring 24 is pulled outwardly. Disengagement of rods 16 and 17 causes the firing pin to impinge on percussion cap 67 with a force sufficient to fire the cap and cause combustion of the propellant within bore 71. When this occurs the pressure within bore 71 is sufficient to dislodge plate 77 from the initial position thereof sufficiently to withdraw pins 78 from their bores and thereby release balls 49. Balls 49 now move outwardly through their bores in response to pressure of cam element 48 thereagainst. When the balls have moved outwardly sufficient to unlock the support

block 45, the block is quickly ejected from casing 10 by spring 43 carrying with it the expelling charge block, rod 16 and gasket 81. The casing 10 is now unsealed whereby an opening of generous size is provided for the emission of smoke or other pyrotechnic disposed within chamber 91.

One desirable feature of support block 45 is the internal air space which acts as a safety chamber by holding back the hot gases resulting from the firing of primer 67 and thus protecting the heat sensitive component or composition 91.

For the same reason a preferred improvement is to use for the ignition train composition 73 a readily ignitable gasless plug forming composition, which composition being essentially of the type, which while burning and hot forms a structurally cohesive mass capable of withstanding immediate gas pressure. Such compositions are known to those skilled in the art. In this manner it has been possible to prevent also any of the hot gases resulting from the functioning of the expelling charge 74 from reaching the heat sensitive component 91.

Whereas the device has been described with particularity with reference to an ejectable component comprising an expelling charge block, it is not so limited as it may be used with advantage to expel a rocket, if desired, and thereafter cause a large volume of smoke to be issued from the aperture within the casing which is made effective for such purpose when the rocket has been ejected. Furthermore in the case of such a signal during ejection, the combined burning of the expelling charge and the material comprising the rocket motor propellant results in a considerable back pressure with much heat and flame and this heat and pressure is prevented from igniting the smoke mixture until the rocket has been ejected and a sufficiently large orifice has been effected to allow proper venting of the smoke thereby to avoid the detonation and resultant shrapnel effect which would be most harmful to personnel within the vicinity of the device. If in lieu of the smoke composition it is desired to cause a flame to be emitted from the casing, such structure is within the purview of the instant invention. By employing the structure disclosed herein, a great ejection or rupture force may occur on one side of the device without harming highly sensitive components disposed on the other side. The term "sensitive components" as employed herein may be defined as any assembly or materials which cannot be subjected to much heat, pressure, shock or strain without damage or possible premature detonation.

Whereas the invention has been described with particularity with reference to a specific example which gives satisfactory results, it is not so limited as it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is our intention, therefore in the appended claims to cover all such changes and modifications.

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

1. A signalling device of the character disclosed comprising a tubular casing having a quantity of smoke signalling material disposed therein, a main support block threaded within one end of said casing and having a bore concentrically formed therein, a circular plate enclosing the outer end of said support block and detachably secured thereto, an expelling block assembly releasably locked within said support block and having an explosive filled chamber formed in one end thereof in communication with an inside surface of said plate, means including a plurality of balls controlled by said plate for locking the expelling block assembly within said bore until the plate has been detached, means including a resilient spring for expelling the expelling block assembly from said bore as the block assembly is unlocked, and manipu-

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lative means for firing said explosive thereby to suddenly detach the plate from said main support block and cause the expelling block to be ejected from said main support block and thus provide an egress for said smoke signalling material.

2. A signalling device according to claim 1 including a firing pin, a rod carrying said pin, means for withdrawing said rod from an initial position to a firing position and suddenly releasing the rod, an arming member disposed within said support block and removable from a safe position to an armed position, means including a circular cam on said rod for moving the arming member to said armed position as the rod is withdrawn, a percussion cap carried by said arming member and movable to a position in alignment with the firing pin when the arming member is moved to said armed position, and means for causing the firing pin to strike the percussion cap with sufficient force to fire the cap and thereby ignite said explosive as the rod returns to said initial position.

3. A device according to claim 2 including a plug threaded in the other end of said casing and having an axial bore therein within which said rod is slidably disposed, and means in said plug for sealing said last-named bore when the rod has been withdrawn therefrom thereby to prevent the issuance of said smoke signalling material through the plug after the expelling block assembly has been expelled.

4. A signalling device of the character disclosed for ejecting a component thereof in response to a small explosive force within the device comprising a cylindrical casing, a plug sealing one end of said casing, a circular plate, a plurality of push pins for releasably securing the plate to the other end of said casing, a block member having an explosive filled cavity therein releasably locked within said casing with the cavity opposite the inner surface of said plate, means including a helical spring for forcibly ejecting said block member when the member is unlocked, an arming member disposed within said casing and movable from an initial safe position to an armed position, an igniter carried by said arming member and movable into an operative position with respect to said explosive when the arming member is moved to said armed position, a pivoted lever having one end thereof in engagement with said arming member for moving the arming member to said armed position as the lever is rocked about the pivot, a pull rod having a conical cam surface carried thereby for rocking said lever as the rod is pulled, a firing pin on said rod for firing said igniter as the rod is released from a firing position, and means connected to said plate for unlocking said block member as the plate is detached from the casing in response to the firing of said explosive whereby the block member and pull rod are suddenly ejected from said casing by said spring.

5. A signalling device according to claim 4 in which said pull rod comprises a releasable portion effective to suddenly release the rod when the rod has been moved to a firing position, said rod being ejected simultaneously with said block member.

6. A device according to claim 5 including a plug se-

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cured to the other end of said casing and having a bearing therein in which the pull rod is slidably arranged, and means including a plunger slidably disposed within a transverse bore within said plug for sealing the bearing when said pull rod has been expelled.

7. In a device of the character disclosed for removing a cover while under water, the combination of a cylindrical casing having a sensitive component therein, a plug having a bore therein and sealing one end of said casing, a baffle member having a central circular aperture therein arranged transversely within said casing, said plug and baffle member forming a chamber within which the sensitive component is arranged, a cylindrical main support block threaded within the other end of said casing, an annular spacing member in engagement with said block at an inner transverse surface thereof for maintaining said baffle member in fixed position within said casing, a plurality of radial bores arranged circumferentially within said block, a plurality of locking balls slidably carried within said bores respectively, a plurality of longitudinal bores within said block intersecting said radial bores, a plate for sealing the outer end of said block, a plurality of push pins carried by said plate for frictional engagement with said longitudinal bores to hold the plate detachably secured in sealing relation with said block, the pins additionally maintaining the balls in an inner locking position, an expelling block assembly slidably fitted within said main support block and having a circular inclined cam surface for engagement by said balls when the balls are in said inner locking position thereby to releasably lock the expelling block assembly within said main support block, a cup-like elongated spring retaining member secured to said main support block with respect to which said expelling block assembly is slidable, said cup-like member having an aperture formed in the bottom surface thereof of greater diameter than the aperture in said baffle member, a helical spring disposed within said spring retaining member for ejecting said expelling block assembly when the balls are unlocked in response to removal of said push pins from said longitudinal bores as said plate is detached from said main support block, an explosive filled chamber formed within said expelling block assembly in substantial abutting relation with an inner surface of said plate, a slidable arming member disposed within said expelling block assembly and carrying an initiator, a pull rod supported for reciprocal sliding movement by said expelling block assembly and by the bore in said plug, means including a tapered cam surface on said rod for moving said arming member to the armed position as the rod is withdrawn to a firing position, means for suddenly releasing the pull rod when the pull rod has been moved to said firing position, a firing pin formed on the end of said pull rod, and means for yieldably urging said rod in a reverse direction from said firing position to a fired position such that the initiator is fired by said firing pin to explode the explosive and quickly detach said plate in response to the force of the explosion without damage or injury to said sensitive component.

No references cited.