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SAFETY ARMING DEVICE FOR EXPLOSIVE MISSILES

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2 Sheets-Sheet 1

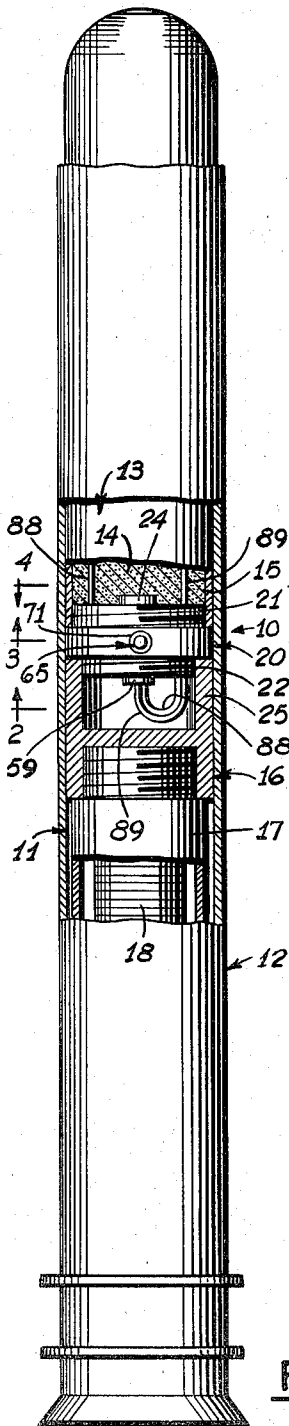


FIG. 1

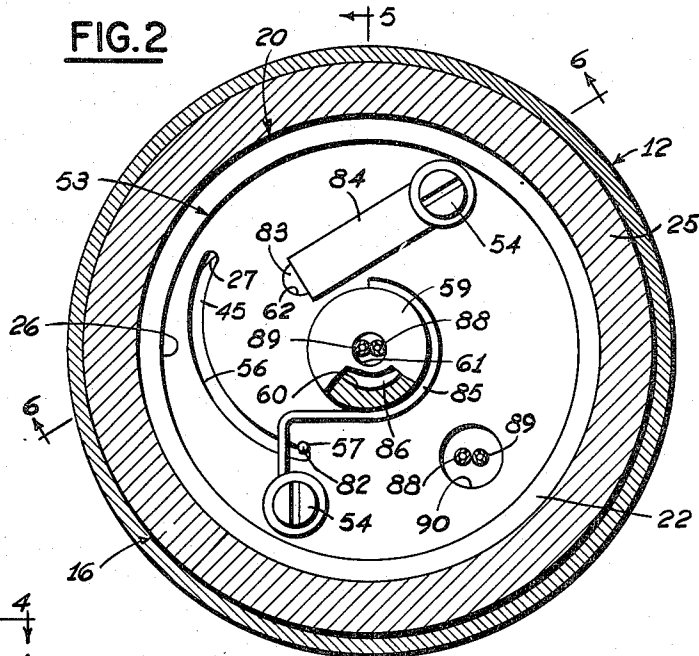


FIG. 2

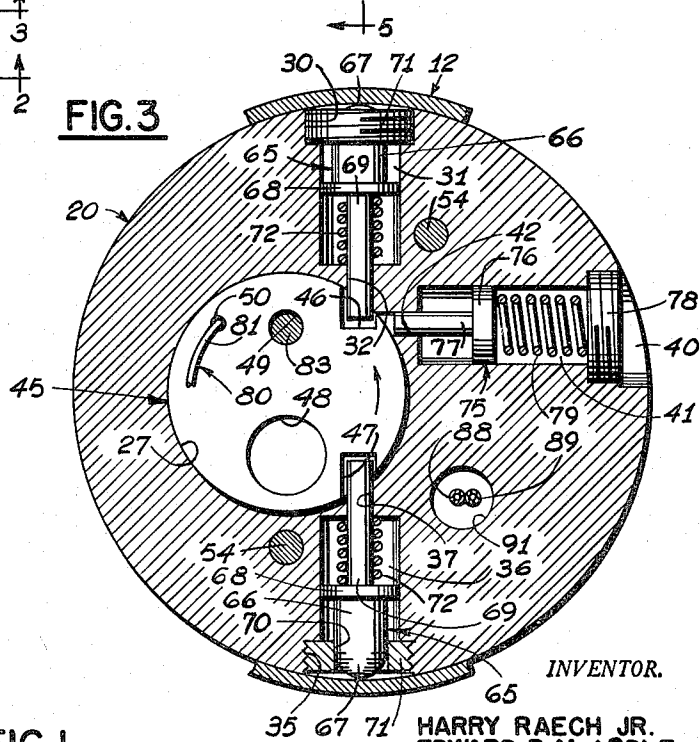


FIG. 3

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SAFETY ARMING DEVICE FOR EXPLOSIVE MISSILES

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2 Claims. (Cl. 102—76)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

Our invention pertains broadly to ammunition and explosive devices. In particular, it has reference to arming mechanisms incorporated in conventional artillery explosive projectiles, and in the war heads of explosive rockets such as those projected from the well-known "bazooka," to render the projectiles and the war heads incapable of explosion until after they have been fired and have traveled a predetermined distance from the gun.

In the past, it was common practice to have such arming mechanisms depend for their action upon the operation of a built-in, clock-like gear train mechanism driven by spring action, or by centrifugal force generated as a result of causing the projectile to spin in its flight. In many cases, the spring action or the centrifugal force relied, in turn, upon one or more shear pins or upon bore riding pins.

Gear train mechanisms of the size used in arming devices, whether driven by spring action or centrifugal force, were inherently delicate in nature and liable to malfunctioning for manifest reasons. In addition, they were expensive to manufacture and assemble and, when completed, they required careful handling to preserve their workability. This requirement placed an unnecessary, and sometimes impossible, task upon those responsible for their handling. Many times, too, it has been found that a gear train mechanism, thought to be in good working order, would fail to operate when subjected to the severe shock created at the time of firing the missile.

As those skilled in the art know, the use of arming devices whose actuation depended upon centrifugal force was limited to operation with guns having the use of a rifled bore. Recently, there has been an increased need for the use of smooth bore (i.e., unrifled) guns, especially in certain types of close range combat. Therefore, arming mechanisms driven by centrifugal force could not be used in ammunition for that type of gun.

The use of one or more shear pins, whose failure at the time of firing allowed a gear train mechanism to begin its cycle of operation, also has left much to be desired. These pins sometimes have failed to shear off, or have been found to shear off in such a way as to prohibit or retard proper operation of the gear train mechanisms with attendant ineffective results.

Prior art bore riding pins used in arming mechanisms effected release of the mechanism's gear train by moving radially outward as soon as the missile passed from the gun barrel. However, no attempt was made to limit the outward movement of these pins. Consequently, they flew off into space in random paths, and presented a hazard to personnel and equipment in the vicinity.

We have eliminated the undesirable features of prior art arming mechanisms by providing one composed of comparatively few, easily manufactured and assembled components. At the same time, as will become evident, we

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have introduced to the art beneficial concepts not heretofore known.

In essence, our arming mechanism, which is applicable to missiles fired from either smooth bore or from rifled bore guns, comprises an electrically initiated detonator, a safety disc, and a booster powder charge. The detonator and the booster powder charge are separated from each other by the safety disc which is rotatable between them. The safety disc is constantly urged to rotate so as to move a fire hole contained therein into coincidence with the detonator and the booster, making ignition of the booster possible as a result of ignition of the detonator. Until the fire hole does move into coincidence with the detonator and the booster, ignition of the booster charge, and in turn the missile's main explosive charge, is prevented because the disc's fire hole provides the only means of passage between the detonator and the booster. Rotation of the safety disc to allow ignition of the booster is prevented from occurring until after the missile equipped with our mechanism has been discharged from the gun and has traveled a selected distance therefrom. Therefore, by restraining rotation of the safety disc until after the ammunition has been fired, it is impossible to detonate the booster, even if the detonator should accidentally be ignited.

After the missile equipped with our arming mechanism has been fired and has traveled a selected distance from the gun, the safety disc is caused to rotate so that its fire hole moves into alignment with the detonator and the booster. Then, after the detonator is ignited in the usual manner, fire from the detonator passes through the fire hole to ignite the booster charge. Ignition of the booster charge then explodes the ammunition's main powder charge.

One object of our invention is to simplify the design and to increase the reliability of arming mechanisms by providing a rugged, dependable mechanism composed of comparatively few, easily manufactured and assembled components.

Another object is to provide an arming mechanism which can be used with equal facility in smooth bore or in rifled bore guns.

A further object is to provide an arming mechanism in which the action is not dependent upon shear pins.

A still further object is to provide an arming mechanism in which no parts fly off into space when the ammunition including the mechanism leaves the gun's barrel.

The foregoing and other objects and advantages of our invention will become apparent from an inspection of the following description and the accompanying drawings wherein:

Fig. 1 is a view of a representative firearm and contained ammunition round, both partly broken away and partly in section to expose our novel arming mechanism;

Fig. 2 is a cross-section, partly broken away, taken along line 2—2 of Fig. 1 to show the appearance of the rear end (i.e., toward the firearm's breech) of our safety mechanism;

Fig. 3 is a cross-section taken along line 3—3 of Fig. 1 to show the internal construction of our arming mechanism. Note that a booster powder charge, later shown in Figs. 3A, 4, and 5, is completely inaccessible and does not appear in this drawing figure;

Fig. 3A is a cross-section similar to Fig. 3 but showing the mechanism at a later stage of operation such as happens after the ammunition is fired from the gun. Note especially that a safety disc within the mechanism has been rotated (compare with Fig. 3) so that an opening therein is in coincidence with the arming mechanism's booster powder charge which, until now, had been covered by the safety disc. The components shown in this drawing figure, with the exception of the booster powder charge, are common to Fig. 3, but some of the compo-

nents are in a different position as a result of the movement which has taken place. For brevity of drawing, a portion of Fig. 3A has been omitted but the parts removed have already been shown in Fig. 3;

Fig. 4 is a cross-section, partly broken away, taken along line 4—4 of Fig. 1 and showing the appearance of the forward end (i.e., toward the firearm's muzzle) of our arming mechanism as well as more details of internal construction;

Fig. 5 is a cross-section taken along line 5—5 of Fig. 2 to show further structural details; and

Fig. 6 is a cross-section taken along line 6—6 of Fig. 2 especially to show the mechanism's release pin and the pin's overload spring before the missile is fired.

For the purpose of explaining our inventive arming mechanism we have represented it as having been incorporated in the ammunition round for a "bazooka" type gun. Those skilled in the art know that this ammunition round is a type of rocket in that the whole round leaves the gun when fired and carries the propellant with it along its trajectory.

The practical embodiment chosen to explain our invention has been selected for illustrative purposes only and, therefore, it is not to be construed that our arming mechanism is applicable only to rocket type ammunition. Actually it can be incorporated with equal facility and effectiveness into explosive projectiles of conventional ammunition rounds in which the round's cartridge case remains in the gun barrel after firing.

As shown in Fig. 1, our arming mechanism 10 is illustratively incorporated in a rocket 11 which is shown in firing position within a representative launching tube 12. This rocket comprises the war head 13 containing the main explosive charge 14 and a detonating mechanism (not shown), earlier mentioned arming mechanism 10 which is threadedly attached to the rear end 15 (i.e., toward the launching tube's breech end) of the war head, the adapter 16 which is threadedly attached to the rear end of the arming mechanism, and the motor casing 17 which is threadedly attached to the rear end of the adapter and which contains the propellant 18.

In order to facilitate the comprehension of our novel arming mechanism and an appreciation of inventive concepts revealed therein, we shall first describe the components of which it is composed, then explain the mode of its operation.

Body

The basic component of our arming mechanism is the cylindrical body 20 (see Figs. 1 to 6). This body, as shown in Figs. 1 and 4 to 6, is provided with a forward portion 21 (i.e., toward the muzzle of launching tube 12) and, as shown in Figs. 1, 2, 5, and 6, with a rear portion 22 (i.e., toward the launching tube's breech).

Forward portion 21 is of somewhat reduced diameter and is externally threaded for attachment to the war head's rear end 15, as earlier mentioned. As shown in Figs. 1 and 4 to 6, the diameter of cylindrical body 20 is substantially the same as the diameter of the war head's rear end 15. Forward portion 21, moreover, is provided with an axial recess 23 from the center of which projects a frangible lug 24 (see Figs. 4 and 5).

The body's rear portion 22 is reduced more in diameter than forward portion 21, and is also externally threaded for attachment to the adapter's muzzle end 25 (see Figs. 1, 2, 5, and 6). As shown in Figs. 1, 5, and 6, the diameter of the adapter's muzzle end is substantially the same as the diameter of the body 20.

Extending axially into body 20 from rear portion 22 are a centrally located recess 26 (see Figs. 2, 5, and 6), a somewhat smaller diametered, eccentrically located recess 27 (see Figs. 3 to 6), and a still smaller centrally located recess 28 (see Figs. 4 and 5).

Extending radially inward from the periphery of body 20 are the concentric, stepped recesses 30, 31, and the opening 32 (see Figs. 3 to 5). Recess 30 is the outermost

and largest diametered member of the trio, and is threaded. Recess 31 is located between recess 30 and opening 32, and is somewhat smaller in diameter than recess 30. Opening 32 is the innermost and smallest in diameter of the three. As shown in Figs. 3 to 5, opening 32 enters eccentrically located recess 27 a short distance from the floor 33 of that recess, as best shown in Fig. 5.

Diametrically opposed to concentric, stepped recesses 30, 31, and opening 32, and also extending radially into body 20, are similarly dimensioned concentric, stepped recesses 35, 36, and an opening 37 (see Figs. 3 and 5). From those figures it is apparent that the common axis of stepped recesses 35, 36, and opening 37 is substantially a continuation of the common axis of stepped recesses 30, 31, and opening 32. Like recess 30, recess 35 is the outermost and largest diametered member of the trio, and is threaded. Recess 36, like recess 31, is located between recess 35 and opening 37, and is somewhat smaller in diameter than recess 35. Opening 37, like opening 32, is the innermost and smallest in diameter of those three. As shown in Figs. 3 and 5, opening 37 enters eccentrically located recess 27 a short distance from the floor 33 of that recess as does earlier mentioned opening 32 (see Fig. 5).

Also extending radially inward from the periphery of body 20 are the concentric, stepped, chordal directed recesses 40, 41 and the chordal directed opening 42 (see Figs. 3 and 3A). Recess 40 is the outermost and largest diametered member of that trio, and is threaded. Recess 41 is located intermediate recess 40 and opening 42, and is somewhat smaller in diameter than recess 40. Opening 42 is the innermost and smallest in diameter of these three, and, like openings 32 and 37 opens into eccentric recess 27 just clear of floor 33 of that recess. As best shown in Figs. 3, 3A, and 4, the axis of the chordal directed recesses 40, 41, and chordal directed opening 42 is located substantially perpendicular to the common axis through openings 32 and 37. Opening 42 enters recess 27 so close to the entrance therein by opening 32 that only a small space exists in the wall of the recess which separates the openings.

Safety disc

Rotatably accommodated in the body's eccentrically located recess 27 is the safety disc 45 (see Figs. 2 to 6). As shown in Figs. 3, 3A, and 5, this disc is provided with opposed chordal directed notches 46 and 47 which are cut into the disc's periphery and extend between the disc's flat faces, an axially extending fire opening 48 (see Figs. 3, 3A, and 4), a release pin opening 49 (see Figs. 3, 3A, and 6), and a spring opening 50 (see Figs. 3 to 4). Fire opening 48 and release pin opening 49 are spaced from each other, their centers being on a diametral line of disc 45 parallel to notches 46 and 47.

Actually, fire hole 48 is displaced from the safety disc's axis by substantially the same amount that the axis of the body's eccentrically located recess 27 is displaced from the body's axis, and notches 46 and 47 are offset from the diametral line through the centers of fire opening 48 and release pin opening 49 by substantially the same amount that the axis of concentric, stepped, recesses 40, 41 and opening 42 is offset from the axis of body 20. Spring opening 50 extends through the safety disc parallel to the disc's axis and is conveniently located, preferably near the disc's periphery.

As best shown in Fig. 5, safety disc 45 is somewhat greater in thickness than the diameter of openings 32 and 37. The same is true relative to opening 42.

In the operation of our inventive arming mechanism, safety disc 45 is rotatable from an "unarmed" position best shown in Figs. 3 and 4 to 6 to an "armed" position shown in Fig. 3A.

When the safety disc is in the "unarmed" position, the body's centrally located recess 28 is completely covered by the safety disc; and, when that disc is in the "armed"

position, the disc's fire opening 48 is in coincidence with the body's centrally located recess. The significance of these conditions will become more apparent later in the description.

Cover plate

Accommodated in the body's recess 26 is the circular cover plate 53 (see Figs. 2, 5, and 6) which is secured to the body by means of screws 54 (see Figs. 2 to 6). Cut into the forward face (i.e., toward war head 13) of this plate is circular groove 55 (see Figs. 5 and 6), and extending from the bottom of groove 55 to the rear face (i.e., toward adapter 16) of the plate is an arcuate slot 56 (see Figs. 2 and 6) which has a notch 57 at one end (see Fig. 2).

Projecting from the forward face of the cover plate is an eccentrically located lug 58 (see Figs. 5 and 6) which extends part way into the body's eccentrically located recess 27 very close to safety disc 45. Projecting in an opposite direction from the rear face of the cover plate is the axially located lug 59 (see Figs. 1, 2, and 5). Cover plate 53 is also provided with a centrally located recess 60 which extends from lug 58 almost through lug 59 (see Figs. 2 and 5). Extending from the bottom of this recess to the outside of lug 59 is the opening 61. Somewhat offset from the axis of cover plate 53 is an opening 62 (see Figs. 2 and 6) which extends through the cover plate as shown in Fig. 6.

The components previously described are the major parts of our inventive arming mechanism. To these larger components are added various other, smaller components now to be described.

Bore riding pins, retaining rings, coil springs

Slidably accommodated in each of the body's diametrically opposed recesses 31 and 36 is a bore riding pin 65 (see Figs. 1 and 3 to 5). Each pin comprises a main portion 66 having a conveniently shaped rounded outer end 67, a flange 68, and a shank 69. Respective flanges 68 are accommodated in the body's recesses 31 and 36, respective shanks 69 are accommodated in openings 32 and 37, and main portion 66 of each pin is slidable in the central opening 70 of a retaining ring 71 which is threadedly attached to body 20 in the threaded recesses 30 and 35 (see Figs. 3 to 5). Fitting around shank 69 of each pin between flange 68 and the bottom of respective recesses 31 and 36 is the coil spring 72 (also see Figs. 3 to 5) which acts constantly to urge each bore riding pin radially outward from body 20. However, from the drawings, especially Fig. 3A, it is evident that the outward movement of each bore riding pin is limited by retaining ring 71 against which flange 68 abuts.

In practice, the length of each shank 69 is such that, when the bore riding pins are depressed inside body 20, the inner end of each pin engages the safety disc's notches 46 and 47, respectively, and thereby prevents the disc from being rotated; and, when the bore riding pins are pushed outward after leaving the gun barrel, the inner end of each pin is clear of the safety disc and thereby permits the disc to be turned.

After the assembly of our arming mechanism a band (not shown), which holds the bore riding pins depressed in the same manner as they are depressed when in the launching tube, or other gun (see Figs. 3, 4, and 5) is placed around the rocket. Thus, safety disc 45 is secured against rotation, in one respect, by means of the bore riding pins. This arrangement makes it impossible for war head 13 to be exploded prematurely. Later in the description we shall describe a second means by which the safety disc is prevented from rotating until the proper time.

Detent, detent spring, plug

Slidably accommodated in the body's recess 41 is the cylindrical detent 75 (see Figs. 3, 3A, and 4). This detent comprises the head 76 and the shank 77 which are

slidable in recess 41 and opening 42, respectively. Threadedly secured in the body's recess 40 is the retaining plug 78 (also see Figs. 3, 3A, and 4). Between the retaining plug and the detent's head is a coil spring 79 (see Figs. 3 to 4) which acts constantly to depress detent 75. As will later be shown, this detent engages notch 47 during operation of our arming mechanism.

Torsion spring, release pin, overload spring, retaining spring

Safety disc 45 is constantly urged to rotate in a counterclockwise direction, as viewed in Fig. 3, by means of a torsion spring 80 (best shown in Figs. 5 and 6). The forward end 81 (i.e., toward war head 13) of this spring is conveniently shaped for engagement with the safety disc's opening 50 (see Figs. 3, 3A, and 4), and the rear end 82 of the spring (i.e., toward adapter 16) is likewise conveniently shaped to engage in the arcuate slot's notch 57 (see Fig. 2).

Rotation of the safety disc, however, is prevented by a cylindrical release pin 83 until after firing. This pin is slidably accommodated partly in the safety disc's opening 49 and in the cover plate's opening 62 (see Figs. 2, 3, and 6). This restraint is in addition to, and independent of, that provided by the earlier mentioned bore riding pins 65 when they are depressed into body 20.

Release pin 83 is retained in place until firing of rocket 11 by means of an overload spring 84 (see Figs. 2, 5, and 6) which is held in place on cover plate 53 by means of one of the screws 54 which holds the cover plate to body 20 (see Figs. 2 and 6). As shown in the drawings, overload spring is a leaf spring, one end of which covers part of the cover plate's opening 62 and thereby interferes with the movement of release pin 83 past that point.

Overload spring 84 is carefully calibrated so as to exert only a certain amount of force against release pin 83. Actually, this force is such as readily to be overcome by its own and the release pin's inertia when the rocket is fired, so that the release pin moves backward (i.e., toward adapter 16) out of engagement with the safety disc's opening 49. The disengagement between release pin 83 and safety disc 45 will allow the safety disc to be rotated after the restraint afforded by bore riding pins 65 is removed.

In order to make certain that the rear end 82 of the torsion spring which is in notch 57 cannot escape from that end of slot 56 and thereby lose its tendency to rotate the safety disc, a uniplanar retaining spring 85 is placed across arcuate slot 56 (see Fig. 2). As there shown, one end of this spring is secured to cover plate 53 by screw 54, which also binds the cover plate to body 20, and the other end of the spring partly encircles the cover plate's lug 59. Thus, if for some reason spring end 82 should become dislodged from notch 57, it cannot escape past retaining spring 85 and thereby become unwound.

Detonator and booster charge

To complete the components of our arming mechanism, we have provided an electric detonator 86 (see Figs. 2 and 5) and a booster charge 87 (see Figs. 3A, 4, and 5).

The electric detonator, having the leads 88 and 89, is accommodated in the cover plate's central recess 60. The detonator's leads extend toward adapter 16 through opening 61 (see Fig. 5), then change direction (see Fig. 1) and extend through an opening 90 in the cover plate (see Fig. 2) and an opening 91 in body 20 (see Figs. 3 and 4) toward war head 13 where they are attached, in well-known manner, to any conventional electrical detonating mechanism (not shown). Although many such detonating devices are well known, an example of one may be found in co-pending application, Serial No. 141,802, now Patent No. 2,800,081, filed on February 1, 1950 by W. J. Kroegeer and G. E. Hirt for "Combined Electromagnetic Fuze and Electric Detonator." The

underlying principle of such mechanisms typically involves the use of a wire coil which encircles a reciprocating magnet, this apparatus generating electrical power when the projectile in which it is mounted strikes a target and causes rapid relative movement between the magnet and coil.

Booster charge 87 is accommodated in the body's recess 28. This charge (as shown in Fig. 5) is separated from the detonator by the safety disc when that disc is in the "unarmed" position. As will later be shown, when the safety disc is in the "armed" position, the safety disc's fire opening 48 will lie between the detonator and the booster so that fire from the detonator can pass directly to the booster.

Operation of arming mechanism

Having presented and described the components incorporated in our inventive arming mechanism, its operation in the illustrative practical application to a rocket will now be explained. Previously we pointed out how, by virtue of the fact that the safety disc in our novel device acts as a barrier between the electric detonator and the booster charge, it is impossible accidentally to detonate the war head of a rocket, or an explosive projectile of a conventional round, in which our device is incorporated. Now we shall explain how the thus equipped rocket, or other missile is made capable of exploding upon firing.

The rocket incorporating our arming mechanism is thrust into launching tube 12 (see Fig. 1). In inserting the rocket the storage ring (not shown), which was put circumferentially around the rocket at assembly to hold bore riding pins 65 depressed before use, is stripped off the rocket by the launching tube's inside diameter which is substantially the same as the inside diameter of the storage ring. As soon as the bore riding pins are inside the launching tube, they are depressed by the tube so that their inner ends engage the safety disc's notches 46 and 47 (see Figs. 3, 4, and 5). In other words, the rocket is "unarmed" because the safety disc is fixed in position to act as a barrier between the detonator and the explosive charge.

When the gun is fired, the inertia of release pin 83 overcomes the restraint imposed upon it by overload spring 84 and the pin becomes disengaged from the safety disc. However, as long as the rocket is in the barrel of the gun, bore riding pins 65 remain depressed, thereby preventing rotation of safety disc 45 and thus maintaining the rocket in the "unarmed" condition.

As soon as the rocket leaves the gun's barrel, the bore riding pins are forced fully outwardly by springs 72 until the pins' flanges 68 abut retaining rings 71. At that time, the pins' inner ends are clear of the safety disc, and torsion spring 80 acts to rotate the disc until the disc's fire opening 48 is in coincidence with detonator 86 and booster charge 87. Thus the rocket becomes "armed." When this alignment is established, notch 47 is in alignment with detent 75 which is promptly urged into that notch by spring 79, thereby locking the safety disc in the "armed" position.

When the rocket strikes its target (not shown) electricity is generated in well known manner, as was previously explained. This electricity travels through leads 88 and 89 to heat detonator 86 to the ignition point. Fire from this detonator then passes through fire hole 48 to ignite booster charge 87. Energy from this action blows frangible lug 24 apart and ignites main explosive charge 14.

The rate of rotation of safety disc 45 from the "unarmed" to the "armed" position can be controlled, depending upon the pressure exerted against the safety disc by detent 75 which acts as a brake on the safety disc and also by the calibration of torsion spring 80. In this manner it is possible to adjust the time and distance from the launching tube until the rocket becomes armed.

From the foregoing it will be apparent that we have

simplified the design and increased the reliability of arming mechanisms by providing a rugged, dependable mechanism composed of comparatively few, easily manufactured and assembled components; that we have provided an arming mechanism which can be used with equal facility in smooth bore or in rifled bore guns; that we have provided an arming mechanism in which the action is not dependent upon shear pins; and, that we have provided an arming mechanism in which no parts fly off into space when the ammunition including the mechanism leaves the gun's barrel.

Those skilled in the art will realize that our arming mechanism is adaptable to numerous variations and modifications without departing from its original spirit and scope. For that reason, we do not wish to be limited in patent coverage to the narrow limits inherent in the particular embodiment here disclosed for illustrative reasons only, but rather only by the breadth and scope of the appended claims.

15 We claim:

20 1. A safety arming device for an explosive missile comprising, a body, a cover plate attached to said body, an explosive charge in said body, a detonator located in said cover plate, a safety disc rotatably mounted in said body so that when in its "unarmed" position a portion of the disc can selectively separate said explosive charge and said detonator but upon rotation to its "armed" position another disc portion having an opening there-
25 through can provide a communicating passageway between said explosive charge and said detonator, a release pin slidably accommodated in said cover plate and in said safety disc for securing the safety disc against rotation, an overload spring for holding said release pin in position to bar rotation of the safety disc until the explosive missile has been fired and thus given a predetermined minimum forward thrust, a bore riding pin movably mounted in a recess in said body and adapted when depressed into the body's recess to engage said safety disc so as to prevent rotation thereof but when sufficiently expressed from the body's recess to become disengaged from the safety disc to allow the disc's rotation, a coil spring constantly tending to express said bore riding pin from said body's recess, a retaining ring in said body's recess for limiting the outward movement of said
30 bore riding pin from said body so as to prevent the pin's separation from the body after the missile leaves the gun from which it is fired, a torque spring for rotating said safety disc from the "unarmed" to the "armed" position after said release pin and said bore riding pin are disengaged from said safety disc, a detent frictionally operable as a brake on said safety disc to control the speed of the disc's rotation from the unarmed to the armed position and also operable to lock the disc in the armed position, and means constantly urging said detent toward said rotating disc with a preselected braking force, whereby said safety device prevents arming of the explosive missile until after it has been fired from the gun and has traveled a predetermined minimum distance therefrom and then positively maintains the "armed"
35 condition of the missile while in flight.

2. The combination, in a safety arming device for an explosive missile comprising, a body, a cover plate attached to said body, an explosive charge in said body, a detonator located in said cover plate, a safety disc rotatably mounted in said body so that when in its "unarmed" position a portion of the disc can selectively separate said explosive charge and said detonator but upon rotation to its "armed" position another disc portion having an opening therethrough can provide a communicating passageway between said explosive charge and said detonator, a release pin slidably accommodated in said cover plate and in said safety disc for securing the safety disc against rotation, an overload spring for holding said release pin in position to bar rotation of the safety disc until the explosive missile has been fired and
40 45 50 55 60 65 70 75

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thus given a predetermined forward thrust, a bore riding pin movably mounted in a recess in said body and having a flange, said bore riding pin being adapted when depressed into said body's recess to engage said safety disc so as to prevent rotation thereof but when sufficiently expressed from the body's recess to become disengaged from the safety disc to allow the disc's rotation, a first coil spring constantly tending to express said bore riding pin from said body, a retaining ring filling a portion of said body's recess for preventing movement therepast of said bore riding pin's flange and thereby preventing the pin's separation from the body after the missile leaves the gun from which it is fired, a torque spring for rotating said safety disc from the "unarmed" to the "armed" position after said release pin and said bore riding pin are disengaged from said safety disc, a detent frictionally operable as a brake on said safety disc's circumferential surface to control the speed of the disc's rotation from the unarmed to the armed position and also operable to lock the disc in the armed position, said detent being movable in a direction substantially perpendicular to the

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axis of the disc's rotation, a second coil spring constantly urging said detent toward said safety disc with a pre-selected braking force, and a retaining plug for said second coil spring, whereby said safety device prevents arming of the explosive missile until after it has been fired from the gun and has traveled a predetermined minimum distance therefrom and then positively maintains the "armed" condition of the missile while in flight.

References Cited in the file of this patent

UNITED STATES PATENTS

1,547,599	Lukens	July 28, 1925
1,561,687	Brayton	Nov. 17, 1925
2,030,085	Woodberry	Feb. 11, 1936
2,118,062	Woodberry	May 24, 1943
2,336,514	Teitscheid	Dec. 14, 1943

FOREIGN PATENTS

20 257,335	Great Britain	Aug. 27, 1926
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