Feb. 26, 1963 D. G. STURROCK 3,078,802

MISSILE FUZES

Filed May 18, 1960 2 Sheets-Sheet 1

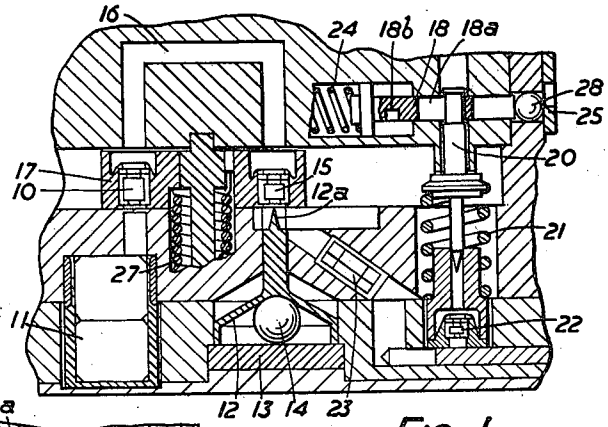

FIG. 1.

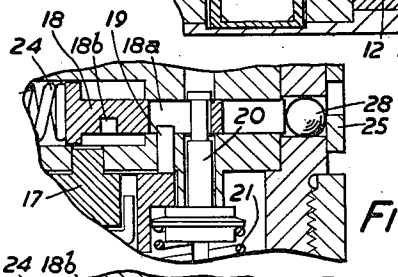

FIG. 2A.

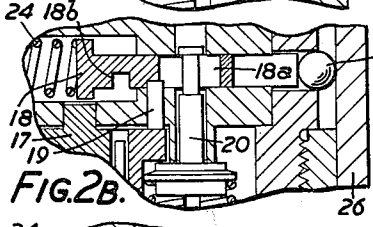

FIG. 2B.

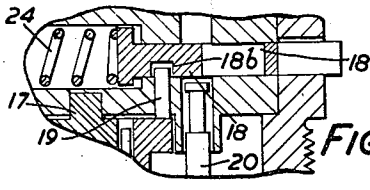

FIG. 2C.

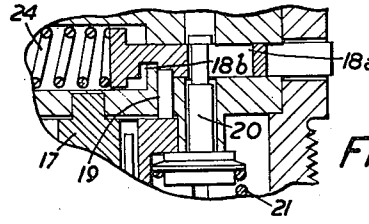

FIG. 2D.

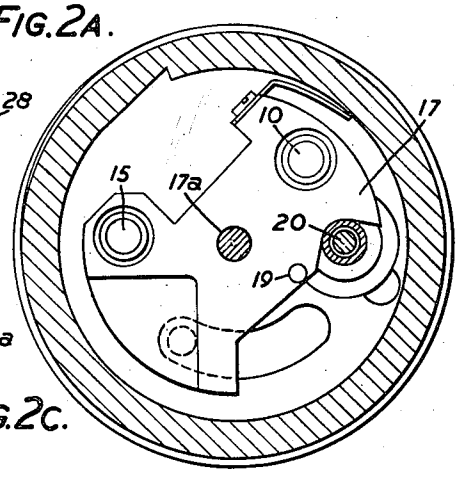

FIG. 5.

INVENTOR

DONALD GEORGE STURROCK

BY

Mason, Mason & Albright

ATTORNEYS

Feb. 26, 1963 D. G. STURROCK 3,078,802

MISSILE FUZES

Filed May 18, 1960 2 Sheets-Sheet 2

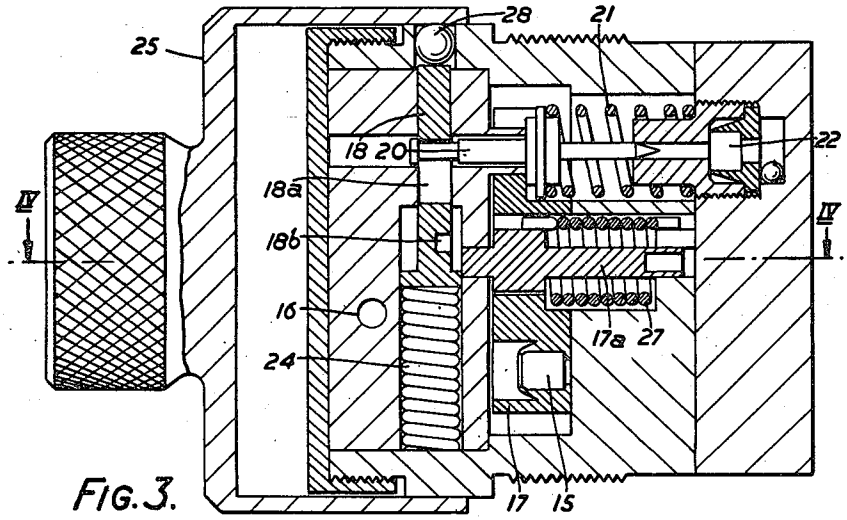

FIG. 3.

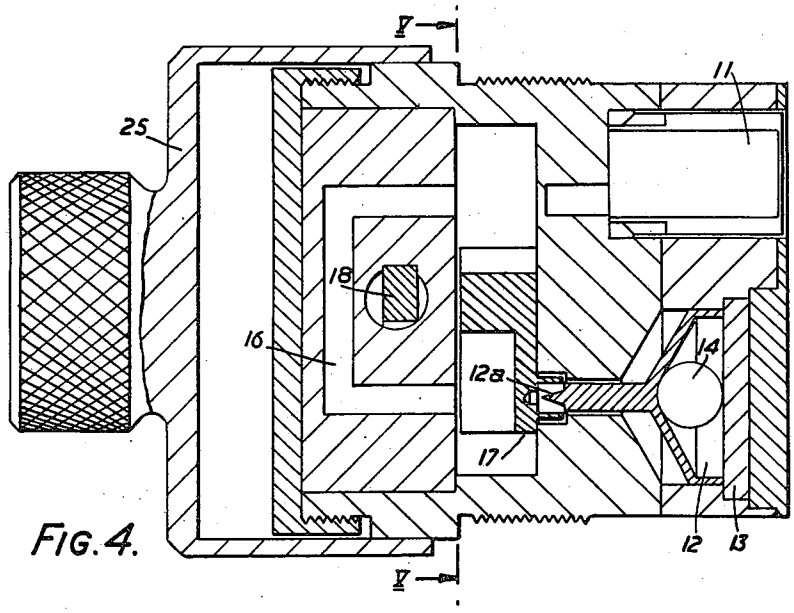

FIG. 4.

INVENTOR

DONALD GEORGE STURROCK

BY

Mason, Mason & Albright

ATTORNEYS

United States Patent Office

3,078,802

Patented Feb. 26, 1963

3,078,802

MISSILE FUZES

Donald G. Sturrock, Iver, England, assignor of one-half to Graviner Manufacturing Company Limited, and of one-half to Wilkinson Sword Limited, both of London, England, British companies

Filed May 18, 1960, Ser. No. 29,998
6 Claims. (Cl. 102—72)

This invention relates to missile fuzes.

According to the present invention there is provided a missile fuze comprising an explosive charge for initiating firing of the magazine of the missile, an inertia responsive member movable upon a predetermined change of inertia to ignite said charge, and means isolating said explosive charge from said inertia responsive member only until said missile has been projected.

The invention also provides a missile fuze, comprising an explosive charge, an inertia responsive member, a carrier for said explosive charge which is movable between a first position in which said charge is isolated from said inertia responsive member and a second position in which said inertia responsive member can move to ignite said charge as a result of a predetermined change of inertia, and means for preventing movement of said carrier from the first position to the second position until said missile has been projected.

The invention further provides a missile fuze for a projectile, said fuze being adapted to ignite an explosive charge, comprising a rotary carrier for said charge, means for preventing rotation of said carrier until the missile has been projected and the fuze has thereby been subjected to a predetermined acceleration, and an inertia responsive member including a firing pin, a predetermined change of inertia resulting from a strike by the missile causing the inertia responsive member to move the firing pin into engagement with the explosive charge which, after projection of the missile, has been moved by rotation of the carrier into the path of the firing pin.

One construction of missile fuze in accordance with the present invention will now be described, by way of example only, reference being made to the accompanying drawings in which:

FIGURE 1 is a schematic sectional view of part of the fuze in which the parts are not shown in true physical relationship but which it is believed will help in the understanding of the operation of the fuze;

FIGURES 2A, B, C and D are detail sectional views showing the arrangement of the arming pin and self-destruction pin, FIGURE 2A being with the fuze in the stored condition, FIGURE 2B in the loaded condition, FIGURE 2C in the armed condition and FIGURE 2D in the safe condition;

FIGURE 3 is a sectional side elevation showing the parts in their true physical relationship, whilst

FIGURE 4 is a view taken along the line IV—IV in FIGURE 3, and

FIGURE 5 is a sectional plan view taken along the line V—V in FIGURE 4.

Referring firstly to FIGURE 1, this construction is designed to fire an explosive detonator **10**, which will be referred to as the final detonator, upon the impact with the target of the missile carrying the fuze. The final detonator **10** in turn fires the magazine **11** of the missile.

The impact sensitive mechanism of the fuze comprises a ball and cone striker mechanism. The cone **12** is formed with an integral striker pin **12***a* and is normally held with the rim of the cone resting on one surface of a disc magnet **13** by the magnetic attraction of the latter. A ball **14** is trapped in the space between the cone **12** and the disc magnet **13**. The magnet **13** is polarised across a diameter. When the fuze is subjected to a predetermined

deceleration on impact, the inertia of the ball **14** overcomes the magnetic attraction and the cone **13** is moved away from the magnet disc **13**. The striker pin **12***a* strikes a second detonator **15**, which will be referred to as the impact detonator, thereby firing this detonator **15**. The striker pin **12***a* is mounted so that its axis is parallel to the normal direction of movement of the missile, but the impact sensitive mechanism **12—14** operates with a predetermined minimum deceleration occurring in any direction within a wide solid angle, for example 110° of arc on either side of the longitudinal axis of the striker pin **12***a*. The flash from the ignition of the impact detonator **15** travels through a passage **16** in the fuze to ignite the final detonator **10** and thereby fire the magazine **11**. The time occupied by movement of the cone striker pin **12***a* provides a desired time delay between impact and explosion.

In order that the fuze is unarmed prior to firing, the impact and final detonators **15**, **10** are each mounted in a rotatable shutter **17** which is normally located in a rotary position at which the detonator **15** does not lie opposite the striker pin **12***a*. In this "safe" position of the shutter **17** a projection thereon prevents movement of the impact striker pin **12***a* away from the disc magnet **13**. The shutter **17** is prevented from rotating by an arming pin **18** which closes off the track of a shutter pin **19** (FIGURE 2), carried by the shutter **17**. Prior to the missile, with the fuze fitted, being inserted in the barrel from which it is to be projected, the arming pin **18** is also locking a self-destruction pin **20**, which is held up by a helical spring **21**. Once inserted in the correct size barrel (FIGURE 2B) the self-destruction pin **20** can be set back against the resistance of the helical spring **21** by the inertia resulting from firing of the missile and when set back fires a third detonator **22** (FIGURE 1), which will be referred to as the self-destruction deetonator. This detonator ignites a fourth delay-detonator **23** which after burning for a predetermined time will ignite the impact detonator **15** (which due to rotation of the shutter will now be in the armed position) if the impact detonator **15** has not already been fired by the impact striker pin **12***a*. The object of the delay-detonator **23** is to ensure that if the missile is not exploded due to impact with the target, it will be destroyed a predetermined time after firing.

The arming pin **18** has one end urged outwardly from the body of the fuze by a spring **24**, but prior to fitting of the fuze in the missile the arming pin is held in a retracted position by a safety cap **25** (FIGURES 1 and 2A) which fits over one end of the fuze. In this retracted position of the arming pin **18** the self-destruction pin **20** fits in a narrow end portion of a slot **18***a* in the arming pin **18** and is prevented thereby from being set back into the firing position. Thus, the self-destruction pin **20** cannot move to the firing position due to mishandling of the fuze. If the safety cap **25** is removed with the fuze outside the barrel from which it is to be projected (FIGURE 2D), the arming pin **18** moves to an outward position at which the detent is still held in a narrow portion at the opposite end of the slot **18***a* and is still prevented from movement to the firing position. However, when the missile with the fuze fitted is inserted in the barrel **26** (FIGURE 2B) from which it is to be projected and the safety cap **25** then removed (FIGURE 2B), the arming pin **18** is held in an intermediate partially extended position at which the self-destruction pin **20** is in a wider portion of the slot **18***a* intermediate the two narrow end portions. The pin **20** is then free to pass through the slot **18***a* when set back by the acceleration resulting from firing of the missile. A ball **28** is located at the end of the arming pin **18** to reduce friction between the barrel and the end of the arming pin **18** when the missile is projected.

Thus, firing of the missile sets back the self-destruction pin **20** to fire the self-destruction detonator **22**. When the fuze clears the barrel **26** from which it is being projected the arming pin **18** is driven outwards by its spring **24** (FIGURE 2C), and the shutter pin **19** can pass through a groove **18***b* in the arming pin **18** which groove **18***b* now lies opposite the shutter pin **19**. The shutter **17** is then rotated on a spindle **17***a* by a torque spring **27** to a position at which the impact and final detonators **15**, **17** are in the armed positions shown in FIGURE 1. The time taken for rotation of the shutter **17** provides a desired time delay between firing of the missile and its arming. Impact of the missile with its target will then result in the impact firing pin **12***a* igniting the impact detonator **15** and thereby firing the final detonator **17** to fire the magazine. Should the impact firing pin **12***a* not operate due to the missile missing its target or other malfunction, after the predetermined time interval the delay-detonator **23** will ignite the impact detonator **15** to fire the final detonator **17** which bursts an adjacent thin portion of the wall to ignite the magazine **11**.

Preferably, the shutter **17** is balanced so that flight inertias will not affect the ability of the torque spring **27** to move the shutter **17** to the armed position. Means may be provided for latching the shutter in the armed position after it has been moved thereto by the torque spring.

A latch is provided to hold the self-destruction pin **20** in the set-back position in order that once set back it will remain clear of the shutter **17** to allow rotation thereof.

What I claim is:

1. In a missile fuze for use in a missile having a magazine, said missile being projected from missile projecting means, a ferromagnetic inertia member, a firing pin, said firing pin being formed integrally with said inertia member, a magnet, said inertia member having a surface normally held by magnetic attraction in contact with a surface of said magnet but being movable over a predetermined distance away from said magnet against said magnetic attraction when subjected to a change of acceleration resulting from a strike of the missile, a first explosive squib, said squib being mounted at said predetermined distance from said firing pin and being ignited when struck by said firing pin, a second explosive squib, said fuze having a first passage for flash transmission from said second squib to said magazine, a rotatable carrier, said first and second squibs being mounted in said carrier at a predetermined distance from one another, said carrier being rotatable from a first position in which said first squib is remote from said firing pin and said first and second squibs are isolated from one another to a second position in which said first squib is struck by said firing pin when the firing pin is subjected to said change of acceleration, said fuze having a second passage for flash transmission from said first squib to said second squib when said carier is in said second position, whereby firing of said first squib ignites said second squib, ignition of said second squib firing said magazine, resilient means, said resilient means urging said carrier from said first position to said second position, an arming pin, a spring, said spring engaging said arming pin for urging said arming pin to move from a first location to a second location, said arming pin normally being prevented from moving to said second location by engagement of the pin with the missile projecting means prior to projection of said missile, said carrier having a shutter pin which engages said arming pin when said arming pin is in said first location only for preventing said carrier from rotating from said first position to said second position when said arming pin is in said first position only, a self-destruction pin, said self-destruction pin having a shank with an enlarged head and said self-destruction pin being formed integrally with an igniter pin, a third explosive squib mounted at a predetermined distance from said igniter pin, and a delay detonator, said delay detonator burning with a predetermined delay, said fuze having a third passage for flash transmission in which said delay detonator is mounted with said third squib mounted adjacent one end of said third passage, said first squib lying adjacent the other end of said third passage when said carrier is in said second position, said arming pin having a slot with narrow end portions and a wider central portion, said enlarged head being narrower than said central portion but wider than said end portions, said shank being accommodated in said central portion of said slot when said missile is loaded on its projecting means, said self-destruction pin being movable by the change of acceleration resulting from projection of the missile in a direction which moves said head through said central slot portion and moves the arming pin of said inertia member into contact with said third explosive squib to cause ignition thereof whereby said delay detonator is ignited and ignites said first squib after expiry of said predetermined delay.

2. A missile fuze according to claim 1, comprising a removable storage cap, said storage cap being adapted to engage said arming pin for preventing said arming pin moving to said second location prior to loading of said missile on its projecting means.

3. In a missile fuze, for use in a missile having a magazine, which missile is projected from missile projecting means, a self-destruction safety device for initiating firing of the missile magazine within a predetermined time after projection of the missile from said missile projecting means, said self-destruction safety device comprising an arming pin, said arming pin having a slot with narrow end portions and a wider central portion, a spring, said spring urging said arming pin from an initial location via an intermediate location to a final location, a storage cap, said storage cap when fitted engaging said arming pin to retain it in said first location, said arming pin being engaged by a surface of said missile projecting means when the missile is loaded therein and thereby retained in said intermediate location, said arming pin being free to move to its final location after firing, a self-destruction pin, a second spring and an explosive delay charge, said explosive delay charge firing the missile magazine after a predetermined time delay, said self destruction pin having a shank at one end which terminates in an enlarged head and having a firing pin at the other end, said second spring urging said self-destruction pin into a position at which said firing pin is located at a predetermined distance from said explosive delay charge and at which said shank lies within said arming pin slot, said enlarged head being greater in width than the width of the narrow end portions of said slot and of less width than the width of the wider central portion of said slot, said shank lying within one narrow end portion when said arming pin is in said initial location and in the central portion when said arming pin is in said intermediate location, the acceleration of said missile resulting from projection of said missile moving said self-destruction pin against the reaction of said second spring whereby said enlarged head passes through the wider portion of said slot when said arming pin is in said intermediate position and said arming pin is freed to move under the action of said spring to its final location, the movement of said self-destruction pin bringing said firing pin into engagement with said explosive delay charge to effect ignition thereof.

4. In a missile fuze, for use in a missile having a magazine, which missile is projected from missile projecting means, a self-destruction safety device for ensuring that the missile magazine is fired at most a predetermined time after projection of the missile, said fuze being fitted with a removable cap during storage which cap is removed when the missile is loaded in said missile projecting means, said safety device comprising an arming pin, said arming pin having first and second abutment means, first resilient means urging said arming pin for axial

movement in a predetermined direction, a self-destruction pin, second resilient means, and an explosive charge, said second resilient means engaging said self-destruction pin for urging said self-destruction pin for axial movement away from said explosive charge, the axis of movement of said arming pin intersecting the axis of movement of said self-destruction pin, said arming pin being held by said removable cap in a first position in which said first abutment means prevents movement of said self-destruction pin towards said explosive charge, said first resilient means engaging said arming pin to move said arming pin towards a second position when said arming pin is free to move following removal of said cap, said second abutment means preventing movement of said self-destruction pin towards said explosive charge when said arming pin is in said second position, said arming pin being held in an intermediate position intermediate said first and second positions by said missile projecting means, in which intermediate position said self-destruction pin does not engage said first or second abutment means whereby said self-destruction pin strikes said explosive charge when the missile is fired, the inertia of said self-destruction pin overcoming the opposing force of said second resilient means, said arming pin moving to said second

position if said removable cap is removed prior to loading of the missile in said missile projecting means.

5. A fuze according to claim 1, wherein said magnet is of disc shape and said inertia member has a conical surface which terminates in an annular face normally held by magnetic attraction in contact with said magnet, said fuze further comprising a ball trapped between said conical surface and said magnet.

6. A fuze according to claim 5, wherein said magnet is magnetised across a diameter.

References Cited in the file of this patent

UNITED STATES PATENTS

1,089,994	Van Essen	Mar. 10, 1914
1,318,098	Midgley	Oct. 7, 1919
1,523,073	Junghans	Jan. 13, 1925
2,378,626	Fanger	June 19, 1945
2,664,822	Hale	Jan. 5, 1954
2,692,557	Wales	Oct. 26, 1954

FOREIGN PATENTS

38,739	Sweden	May 23, 1914
257,333	Great Britain	Aug. 27, 1926
548,039	Great Britain	Sept. 23, 1942