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(12) # EUROPEAN PATENT APPLICATION

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(71) Applicant: **HONEYWELL INC.**
Honeywell Plaza
Minneapolis Minnesota 55408(US)

(72) Inventor: **Strobush, Victor H.**
3508 Canterbury Drive
Bloomington Minnesota 55431(US)

(74) Representative: **Herzbach, Dieter et al,**
Honeywell Europe S.A. Holding KG Patent- und Lizenzabteilung Kaiserleistrasse 55 Postfach 184
D-6050 Offenbach am Main(DE)

(54) **Fuze for projectiles.**

(57) A fuze (11) is disclosed for projectiles to be discharged with spin about a first longitudinal axis. The fuze comprises a firing pin (16), a detonator (33) having an operative axis, a detonator holder (21) including a first portion (22) moveable along the first axis between forward and rearward positions, and a second portion (23) rotatable in the first portion in response to spin about the first axis about a second axis transverse to the first axis from a safe position to armed position in which the operative axis of the detonator is aligned with the firing pin. Furtheron, a crush cup (34) for initially maintaining the first portion in the forward position is provided to be permanently deformed by the holder upon discharge of the projectile to enable movement of the holder into the rearward position. Inertially releasable detents (35, 37) are effective in the rearward position to oppose movement of the holder to the forward position.

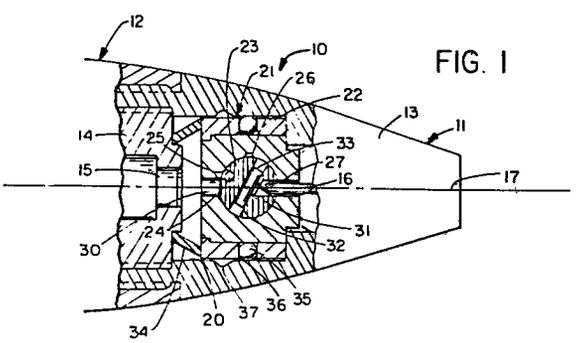


FIG. 1

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HONEYWELL INC.
Honeywell Plaza
Minneapolis, Minn.USA

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FUZE FOR PROJECTILES

TECHNICAL FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to a fuze for projectiles according to the preamble of claim 1. More particularly the present invention relates to fuzing mechanisms useable in rounds of ammunition in the size range of 20mm to 40mm.

It is conventional in explosive projectiles to provide a fuzing mechanism effective, when the nose of the projectile impacts a target, to initiate the firing of the explosive charge of the projectile. However, experience has shown that conventional fuze mechanisms do not reliably fire the projectiles when the target contact is grazing rather than direct.

It is therefore the object of the present invention to improve such conventional fuzes in such a manner that they may reliably fire the projectiles even when the target contact is grazing. This object is achieved by the characterizing features of claim 1. Further advantageous embodiments of the present invention may be taken from the subclaims.

In the figures of the attached drawing an embodiment of the fuze according to the invention is shown in which:

Fig.1 is a fragmentary view partially in axial section showing a firing mechanism

according to the invention before the projectile is discharged from a cartridge;

Fig.2 is a view of the firing mechanism during flight of the projectile ; and

Fig.3 is a view of the firing mechanism upon grazing impact.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing the inventive mechanism 10 is shown in a projectile including a forward fuze 11 and a rearward casing 12 for a warhead explosive, not shown. Fuze 11 includes an ogive 13 and a base 14 containing a lead explosive 15 effective to fire the warhead explosive. A firing pin 16 projects rearwardly along the longitudinal axis 17 of the projectile, about which the projectile moves and spins in flight.

A central chamber 20 is formed in ogive 13 and contains a detonator holder 21 comprising an outer portion 22 cylindrical about axis 17 and movable therealong in chamber 20, and an inner portion 23 cylindrical about a second axis orthogonal to axis 17 and rotatable in portion 22 about said second axis. A roller 24 is free to rotate in a groove 25, which extends along the periphery of portion 23 parallel to the second axis, and which is deeper than the diameter of roller 24, and a second groove 26 extends in member 22 parallel to the second axis, for reasons presently to be explained.

Portion 22 has a first axial opening 27 of small diameter, to pass firing pin 16, and a second, larger axial opening 30. Portion 23 has a short radial bore 31 to receive pin 16 in one rotated position, and a

cross-bore 32 to receive a detonator 33, bore 32 being in line with openings 27 and 30 in a second rotated position of portion 23.

A crush cup 34 is positioned so that one end bears against base 14, and the other bears against holder portion 22. A plurality of balls 35 spaced about axis 17 are carried in radial holes 36 in portion 22, and an inward peripheral groove or ramp 37 is formed in the wall of chamber 20, rearward of the normal axial location of balls 35. A light biasing compression spring 40 best shown in FIGURE 2 may be provided to act between holder 21 and firing pin 16, but is not strong enough to deform cup 34.

In the normal condition of the fuze shown in FIGURE 1 detonator 33 is completely enclosed within portions 22 and 23 of holder 21, which is held forward against ogive 13 by cup 34, firing pin 16 is received in bore 31, balls 35 are fully within holes 36 and forward of ramp 37, and roller 24 is fully in groove 25.

FIGURE 2 shows the projectile in flight. By its inertia during acceleration of the projectile at discharge, holder 21 has moved rearward, crushing cup 34, and the spin of the projectile about axis 17 forces balls 35 radially into ramp 37 and holds them there.

Bore 31 has been withdrawn from around firing pin 16. Inner portion 23 is not dynamically in balance about its axis of rotation, because of the presence of bore 31, and accordingly rotates in portion 22 to a new position of balance, in which the axis of detonator 33 coincides with axis 17, and roller 24 is centrifically forced outward into notch 26 to retain portion 23 in this position. This condition continues until the projectile impacts a target.

Upon direct impact with a target, the firing pin mechanism is forced into detonator 30, by crushing of fuze 11, sufficiently to initiate the warhead explosive.

Upon grazing impact with a target, the projectile experiences spin decay, deceleration and severe pitching or yawing motions, suggested by arrows 50, 51 and 52 in FIGURE 3. The combination of motions decreases the force holding balls 35 in ramp 37, thus reducing the along-axis component of deceleration necessary to overcome the ball restraining force and hence increasing the deceleration sensitivity of the device, so that even at small grazing angles the deceleration component is sufficient to release holder 21 and enable detonator 33 to move against firing pin 16.

From the above it will be evident that the invention comprises means including a specially mounted inertial mass for increasing the firing reliability of a projectile upon contact with a target at grazing angles.

Claims:

1. A fuze for projectiles to be discharged with spin about a first, longitudinal axis and including a rearward base (14) and a forward ogive (13) to receive said fuze with said fuze comprising a firing pin (16) and a detonator (33) having an operative axis, c h a r a c t e r i z e d b y
a detonator holder (21) including a first portion (22) movable in said ogive along the first axis between forward and rearward positions and a second portion (23) rotatable in said first portion in response to spin about said first axis about a second axis transverse to said first axis, from a safe position to an armed position in which said operative axis of said detonator is aligned with said firing pin;
a crush cup (34) between said holder and said base for initially maintaining said holder in said forward position, and for permanent inertial deformation by said holder (21), upon discharge of said projectile, to enable movement of said holder into said rearward position; and
inertially releasable detent means (35,37) effective in said rearward position to oppose movement of said holder to said forward position.

2. Fuze according to claim 1, c h a r a c t e r - i z e d b y means (16,31) effective in said safe position of said second portion (23) to prevent rotation thereof about said transverse axis.

3. Fuze according to claim 2, c h a r a c t e r - i z e d i n t h a t said means includes said firing pin (16).

4. Fuze according to claim 1, c h a r a c t e r i z e d i n t h a t the releasable detent means comprises a ramp (37) in said ogive (13) and a plurality of balls (35) carried by said holder (21) and centrifically displaceable into said ramp.

5. Fuze according to claim 1, c h a r a c t e r i z e d i n t h a t said second portion (23) is unbalanced about said second axis so as to rotate about said second axis into said armed position in response to spin about said first axis.

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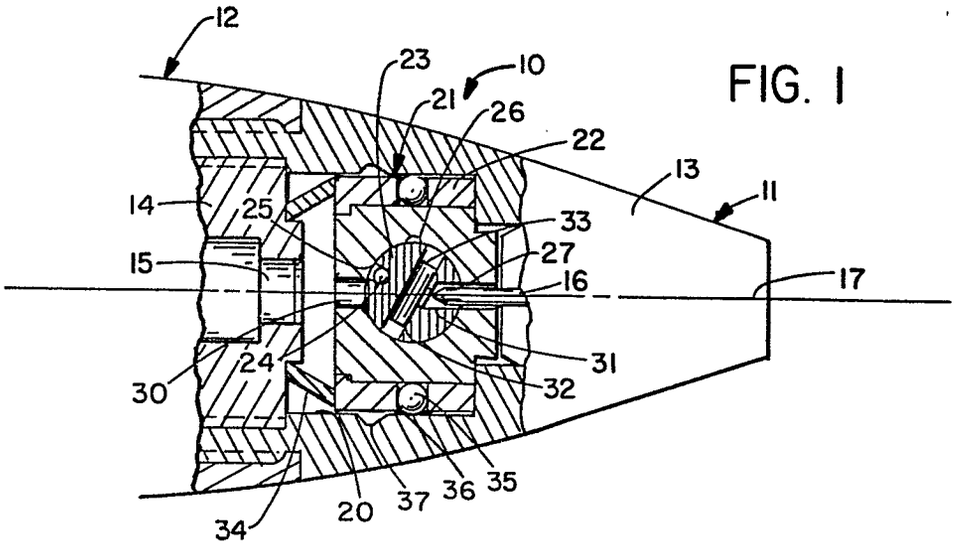


FIG. 1

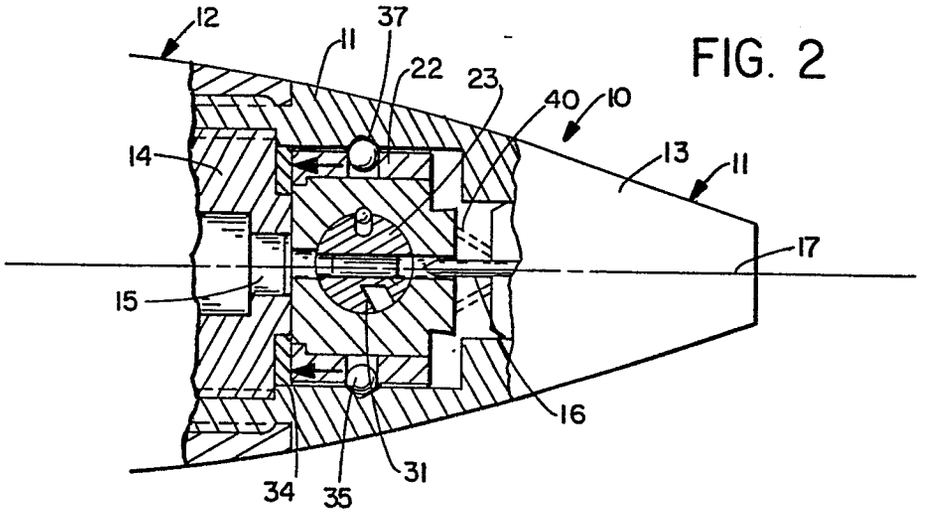


FIG. 2

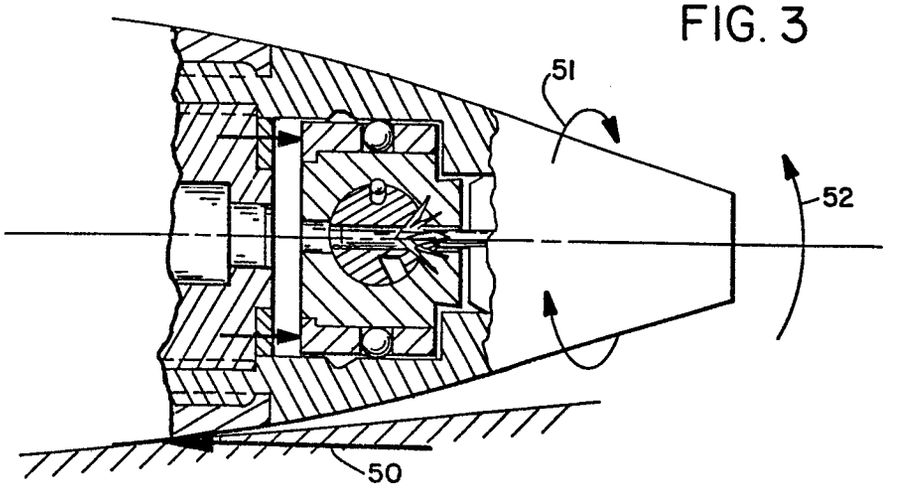


FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

0102633

Application number

EP 83108696.2

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US - A - 3 636 880 (ASKE) * Column 2, lines 16-26, 36-41, 53-61; fig. 1 *	1,2,3, 5	F 42 C 15/04 F 42 C 15/26
Y	US - A - 4 004 521 (ANDREJ-KOVICS) * Column 1, line 30 - column 3, line 20; fig. 1,2 *	2-5	
Y	US - A - 4 242 963 (ZIEMBA) * Column 2, line 16 - column 4, line 4; fig. 1,2,5,6,7 *	2-5	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

F 42 C 1/00
F 42 C 15/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	06-12-1983	KALANDRA

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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