

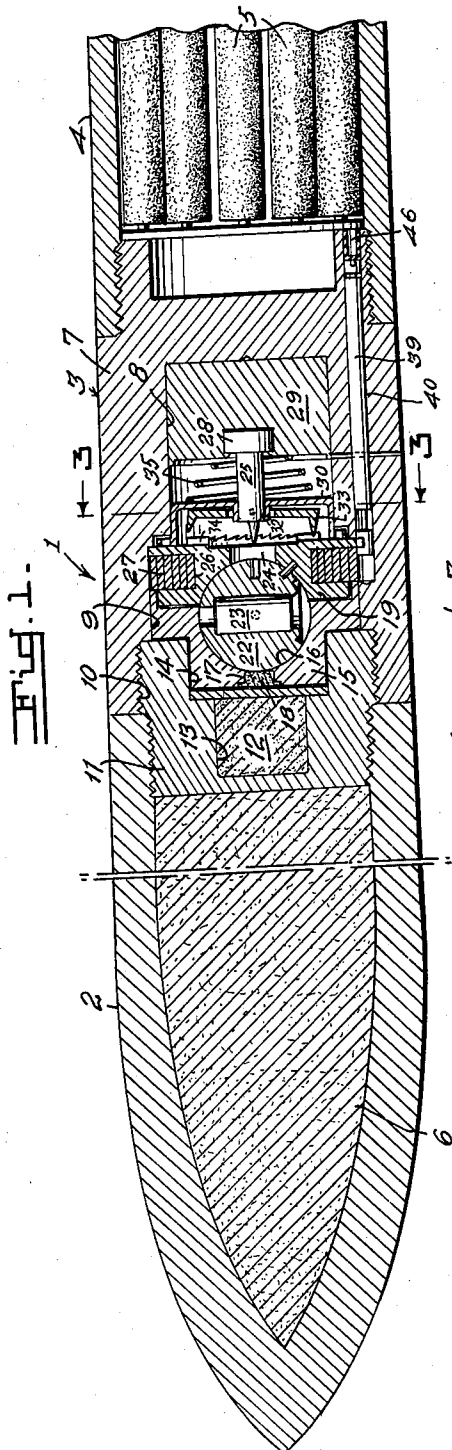
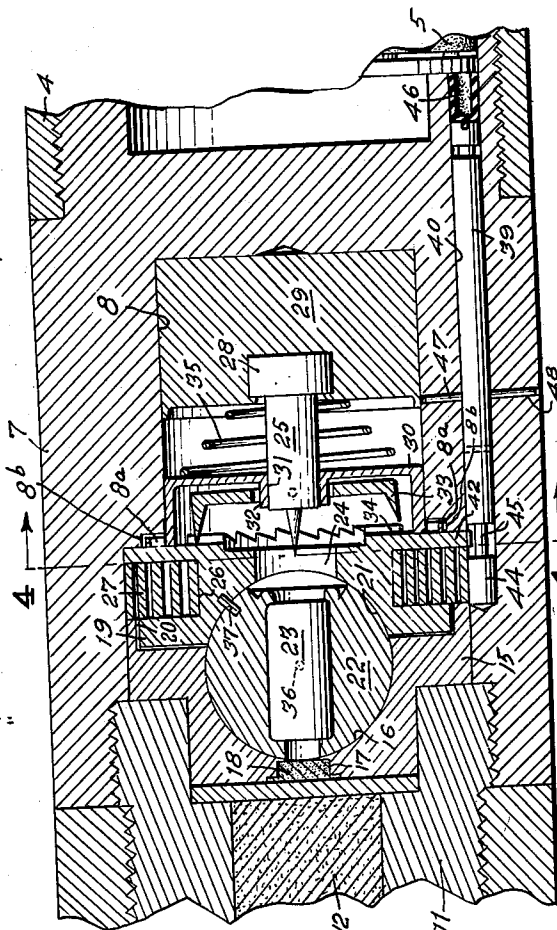
Dec. 29, 1959

J. MEISTER
FUZE PRESSURE ARMING

2,918,870

Filed April 21, 1958

2 Sheets-Sheet 1



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Fig. 3.

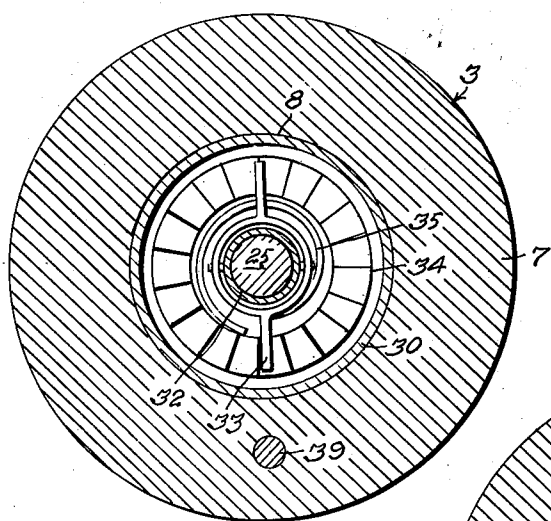


Fig. 7.

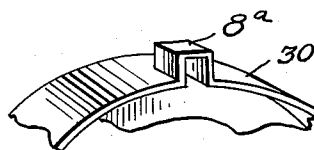


Fig. 4.

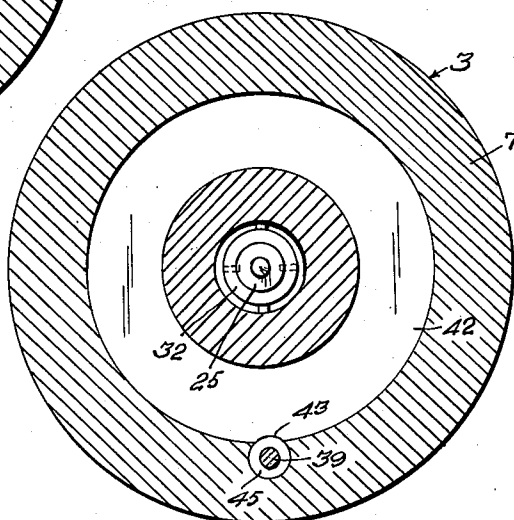


Fig. 5.

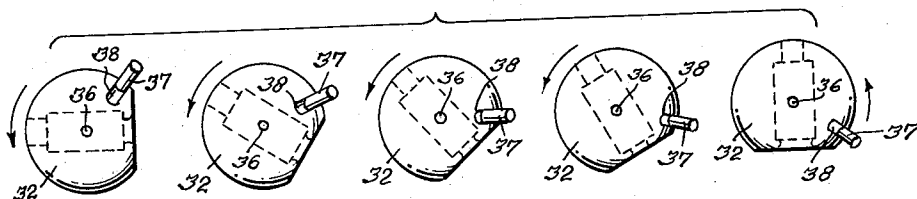
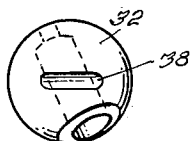


Fig. 6.



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FUZE PRESSURE ARMING

Jack Meister, Morristown, N.J., assignor to the United States of America as represented by the Secretary of the Army

Application April 21, 1958, Serial No. 730,028

2 Claims. (Cl. 102—49)

(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 Government purposes without the payment to me of any royalty thereon.

This invention relates to a pressure arming fuze, and more particularly to a fuze adapted to utilize the pressure resulting from the combustion of propellant gases in a rocket motor chamber to arm the fuze and also to provide detonator safety and arming delay.

At present in low chamber pressure weapons in order to achieve storage and transportation safety, it is necessary to employ safety clips, wires or bore-riding pins, which must be removed before firing or during flight. These operations are attendant with a certain degree of danger and are also time consuming. Also a problem of sealing off the elements against damage by moisture is present.

The present invention proposed to eliminate all of these disadvantages by providing a fuze achieving a delayed arming by the utilization of a simple one element escape-ment mechanism, powered by a clock spring. Detonator safety is accomplished without the use of an external bore-riding pin, thereby eliminating a lethal fragment which might injure personnel, and the provision of a fuze that will be moisture tight and present a smooth exterior. A plunger is employed to be driven forward by gas pressure from the rocket motor chamber to release the clock spring delay mechanism and arm the fuze.

It is therefore, a primary object of this invention to provide a fuze that is self-contained and one that requires no safety wires, bore-riding pins, etc., to prevent premature detonation.

It is another object of this invention to provide a fuze utilizing the gas pressure from a rocket combustion chamber to achieve arming.

Another object is to provide a fuze having an improved delay arming means.

It is a further object to provide a fuze that will be impervious to the damage from moisture.

It is a still further object to provide a fuze incorporating a rocket motor inclosure into the fuze body, to achieve simplicity of design and reduction in weight.

The specific nature of the invention as well as other objects and advantages thereof, will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a longitudinal section taken through a fuze of the invention and illustrating a portion of a rocket motor combustion chamber attached to its rearward end,

Fig. 2 is a fragmentary section, greatly enlarged, of the fuze of Fig. 1 illustrating the elements being in their armed position,

Fig. 3 is a cross sectional view taken along lines 3—3 of Fig. 1, and looking in the direction of the arrows,

Fig. 4 is a cross sectional view taken along lines 4—4 of Fig. 2 and looking in the direction of the arrows,

Fig. 5 is a view showing the successive positions of

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the ball rotor from its unarmed position to its armed position,

Fig. 6 is a view illustrating the rotor ball cam groove, and,

Fig. 7 is a detail in perspective of one end of the cap washer and an ear.

Referring more particularly to the drawing wherein like reference characters designate like or corresponding views, reference character 1 indicates generally a projectile having a warhead 2, a fuze of the invention, generally indicated by 3, and a rocket motor combustion chamber 4 containing propellant increments 5. Warhead 2 contains an explosive charge, indicated by 6. Fuze 3 consists of a body 7 having an axial rearwardly disposed bore 8 and an intermediate counter bore 9. Bore 9 is of larger diameter than bore 8. A forwardly disposed counter bore 10 is internally threaded to receive one end of a booster cup 11 having its forward portion threadably engaged to warhead 2. A booster charge 12 is contained in an axial forward bore 13 in cup 11 and a rearwardly disposed counter bore 14, of larger diameter than bore 13, is provided in booster cup 11 for a purpose that will be obvious as the description progresses. The annular chambers that are provided by bores 14, 8 and 9 provide a housing for the delay arming elements of fuze 1. These elements comprise a cylindrical stator element 15 mounted in bores 9 and 14. Stator 15 is provided on its rearward face with an axially disposed substantially semi-spherical seat 16. Stator 15 is bored axially as at 17 to provide a housing for a detonating element 18. A rotor element 19 is disposed axially and rearwardly of the stator 15 and is arranged to rotate within a counter bore 20 provided in the rearward face of stator 15. Rotor 19 is provided with a substantially semi-spherical seat 21 which is disposed axially with respect to seat 16 and the two seats form a spherical housing for a ball rotor 22 containing a detonating element 23. A bore 24 is provided coaxially in rotor 19 to permit passage of a firing pin 25. Rotor 19 is provided with an annular reduced portion 26 to receive the windings of a clock spring 27 which is arranged to bias rotor 19 counterclockwise. Firing pin 25 is disposed axially within fuze body 7 and is provided at its rearmost end with an enlarged head 28 which is embedded in an anvil 29 slidably mounted within bore 8. A cap washer 30 is fitted over the forward end of bore 8 and is secured against rotation by a pair of diametrically opposed undulations or ears 8^a disposed about its rim thereof and adapted to fit loosely in a pair of grooves 8^b provided in body 7. (See Figs. 2 and 7.) This loose fit provides a slight axial movement to cap 30 which will enable cap 30 to bear against double-toothed pawl member 33 under bias of spring 35 and provide intermittent movement action of the pawl 33 on teeth 34, without, however, permitting complete disengagement of the pawl. Cap washer 30 is provided with a central opening 31 through which firing pin 25 slides. The cap washer 30 is further provided with an axially disposed tubular, forwardly extending portion 32 forming a bearing or guide for firing pin 25 and a support for mounting of a double-toothed pawl member 33. The rearward face of rotor 19 is provided with an axially arranged ring of serrations 34. A coil spring 35 is interposed between cap washer 30 and anvil 29 and biases the anvil and firing pin in a rearward position. Pawl 33 is adapted to intermittently mesh with serrations 34 when the rotor 19 rotates. Ball rotor 22 is mounted by a fixed pivot 36. A camming pin 37 is carried by rotor 19 and extends into a cam groove 38 provided on the outer surface of ball rotor 22.

Bore safety means are provided and includes a restraining pin or plunger 39 riding in an elongated bore

40 provided in fuze body 7 parallel to the longitudinal axis of fuze 3. This bore is located in the portion of fuze body 7 between bore 8 and the outer peripheral surface of the fuze body, and rearwardly communicates with the rocket motor chamber 4. Bore 40 extends forwardly to a point somewhat forwardly of spring 27. Rotor 19 is provided with an enlarged annular flanged portion 42 along its rearward end. A semi-circular notch 43 is provided in the rim of flanged portion 42 which, when the pin 39 is in normal unarmed position, fits over the head portion 44 and prevents rotation of rotor 22. At a point near the forward portion of pin 39, there is provided an annular reduced portion 45 the purpose of which will become apparent during the description of the operation of the mechanism. Pin 39 terminates at a point substantially short of the rocket chamber 4 in bore 40 and a cup shaped seal 46, of rubber or like elastic material, is inserted in the mouth of bore 40.

A shear pin 47 in a radial bore 48 pierces pin 39 and restrains axial movement of the pin prematurely.

Operation

The fuze needs no attention from the operator in preparing the projectile for firing as it is self-contained and ready for firing, the clock spring 27 having been wound during assembly.

When the projectile is launched from a launcher, not shown, and the propellant charge 5 is burning, the gases of combustion will act to displace the plunger pin 39 in a forwardly axial direction, thereby moving the reduced portion 45 under the rim of flange 42. Flange 42 will be unlocked and, as it is integral with rotor 19, and due to the torque of clock spring 27, the rotor will rotate in a counter-clockwise direction. Rotation of rotor 19 will be slowed down to a predetermined speed due to the escapement mechanism consisting of the double-toothed pawl 33 intermittently engaging the serrations 34 of rotor 19. As the rotor continues to rotate, the ball rotor 22 will be rotated from unarmed position through to armed position, see Fig. 2, by virtue of the camming pin 37 riding in the peripheral groove 38 on the ball rotor. The powder train is now in axial alignment and the fuze is armed. Upon impact, the anvil 29 carrying firing pin 25 will be carried forward and the pin 25 will strike detonator 23 to set off the charge 5 in warhead 2.

The desired arming time of the fuze may be obtained by varying the moment of inertia of the pawl member 33, the number of serrations 34 and the size of coil spring 35.

It is readily apparent from the foregoing description and drawings that a highly efficient, safe and time saving fuze has been devised that is economical yet simple of manufacture. It is also a fuze that will present a smooth exterior surface due to the elimination of outside safety wires, bore-riding pins, etc.

While a preferred form of the invention has been shown and described, various modifications and substitutions of equivalents will occur to those skilled in the art after a study of the foregoing disclosure. Hence, the disclosures should be taken in an illustrative rather than a limiting sense, and it is the desire and intention to reserve all modifications within the scope of the subjoined claims.

What is claimed:

1. In combination with a projectile including an explosive charge containing warhead and a motor chamber, a pressure arming fuze for firing said explosive charge in said warhead adapted for attachment between said warhead and said motor chamber, said fuze comprising a fuze body provided with a series of axial bores accommodating the arming elements of said fuze, said arming elements comprising a booster cup containing a booster charge attached to the forward end of said fuze body, a stator axially mounted in said fuze body rearwardly of said booster cup, a spring-wound rotor axially mounted in said fuze body adjacent said stator, a ball rotor mount-

ed for rotation between said stator and said spring-wound rotor, a detonator carried by said ball rotor, detent means carried by said ball rotor and said spring wound rotor to rotate said ball rotor from an unarmed position to an armed position upon rotation of said spring-wound rotor, means preventing premature rotation of said spring-wound rotor comprising a circular flange integral with the rear-most end of said spring-wound rotor, said flange being provided with a notch in its rim thereof, an elongated cylindrical plunger slidably mounted within an elongated longitudinally disposed bore in said fuze body, said bore communicating at its rearward end with said motor chamber and extending forwardly to a point substantially forward of said flange on said spring-wound rotor, said plunger provided with a head portion normally engaging said notch in said flange when said fuze is in an unarmed condition and an annular reduced portion disposed rearwardly of said head portion on said plunger, said plunger to be moved axially forwardly in said longitudinal bore in said fuze body upon combustion gas pressure in said combustion chamber to slide said reduced portion under said flange and release said spring-wound rotor for rotation, an escapement mechanism mounted axially in said fuze body, comprising an annular cap having an axial opening mounted axially in said fuze body, a pawl having a pair of diametrically disposed teeth pivoted in said opening in said cap, said teeth on said pawl intermittently engaging a centrally disposed ring of serrations provided on the rearward face of said spring-wound rotor, an anvil slidable in the rearmost bore of said series of axial bores in said body, and means for firing said detonator in said ball rotor comprising a firing pin member fixed axially in said anvil, spring means normally holding said anvil and said firing pin in a rearward position said firing pin adapted to slide forward in said fuze body upon target impact and fire said detonator in said ball rotor to initiate firing of said explosive charge in said warhead.

2. In a pressure arming fuze for firing a projectile upon target impact including a fuze body for attachment between a warhead containing an explosive charge and a rocket motor chamber carrying a propulsion charge, a booster cup containing a booster charge attached to the forward end of said fuze body and the rearward end of said warhead, means arming said fuze housed in a series of coaxial bores provided in said fuze body, said means comprising a stator element mounted to the rearward end of said stator element in said fuze body, a spring wound rotor element mounted adjacent the rearward end of said stator element in said fuze body, said spring-wound rotor having a series of circularly arranged teeth on its rearward face, an arming ball rotor containing a detonating element rotatably housed in a pair of axially opposed semi-spherical seats formed in said stator and said spring-wound rotor, detent means integral to said spring-wound rotor adapted to permit rotation of said ball rotor from an unarmed to an armed position upon arming of said fuze, a delay escapement mechanism in said fuze body rearwardly of said spring-wound rotor and adapted to regulate the rotation of said spring-wound rotor, said escapement mechanism comprising an annular cap having a forwardly extending tubular portion axially therein, said cap being disposed in the rearmost bore of said coaxial bores, a pair of diametrically opposed integral ears on the peripheral surface of said cap, said ears adapted to be received in a pair of grooves in said fuze body for preventing rotation of said cap in said rearmost bore, a double-toothed pawl pivotally mounted forwardly in said tubular portion in said cap, said pawl adapted to engage said teeth on said spring-wound rotor to provide intermittent movement thereof, said cap acting to prevent complete disengagement of said teeth on said pawl and said spring-wound rotor, impact responsive means disposed in said fuze disposed rearwardly of said arming means, said impact means comprising an anvil slidable in said rearmost bore, a coil spring normally biasing against said

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cap and said anvil whereby said anvil is held rearwardly in said rearmost bore, a firing pin fixed axially in said anvil, said anvil and said firing pin adapted to slide forward upon target impact whereby said firing pin will pass through said tubular portion on said cap to detonate said detonating element in said ball rotor when said ball rotor has rotated to said armed position, and means responsive to combustion gas pressure in said rocket motor combustion chamber to release said spring-wound rotor for arming said fuze upon burning of said propulsion charge in said rocket motor chamber, said means comprising an elongated cylindrical pin slidably mounted in a bore in said fuze body, and communicating with said rocket motor chamber at its rearward end, there being an annular flange integral to the rearward end of said spring-wound rotor, said flange having a semi-circular notch in its rim thereof, said notch normally engaging the forward portion of said

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pin when said fuze is in unarmed condition, said pin being provided with an annular reduced portion disposed substantially rearward of said forward portion, said reduced portion being adapted to slide under said flange upon forward axial displacement of said pin in said bore to release said spring-wound rotor for rotation to said armed position.

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