April 4, 1961 J. R. JASSE 2,977,882

PROJECTILE FUZE

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Fig. 1

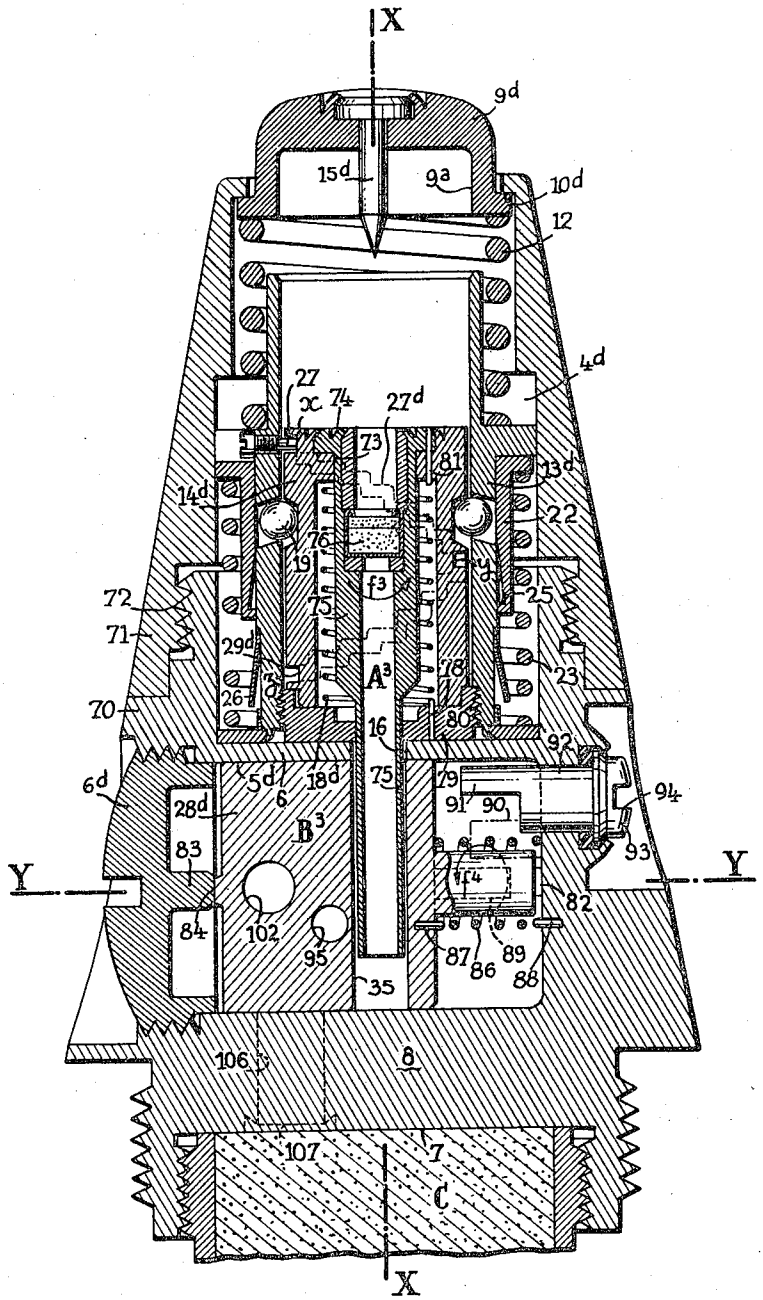

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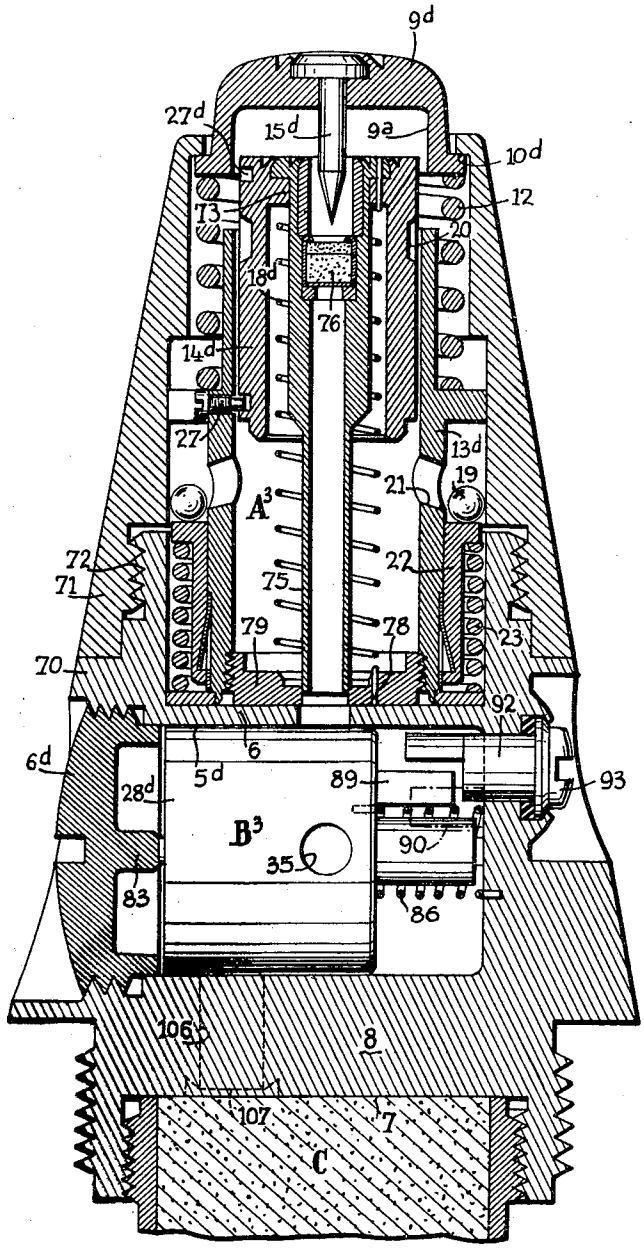
Fig. 2



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PROJECTILE FUZE

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Fig. 3

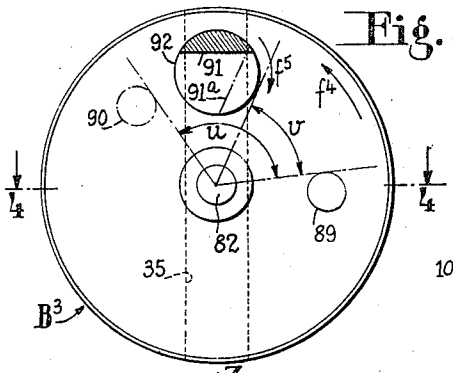

Fig. 7

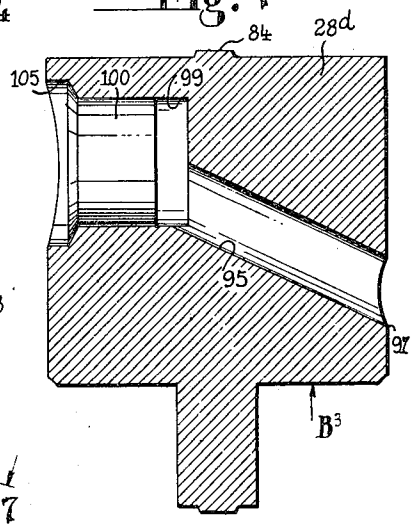

Fig. 5

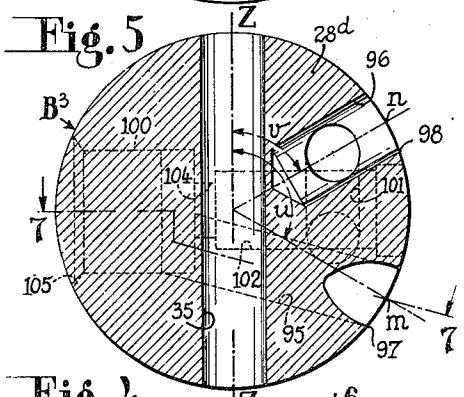

Fig. 4

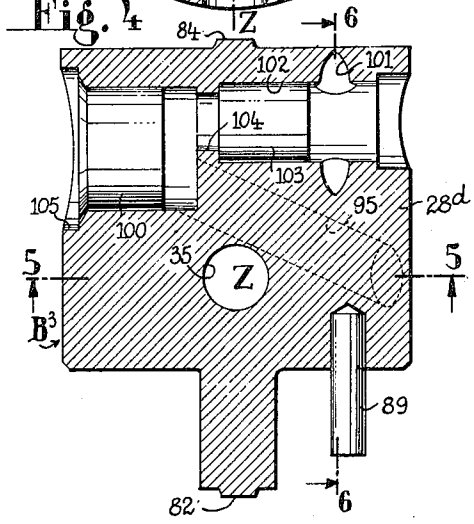

Fig. 6

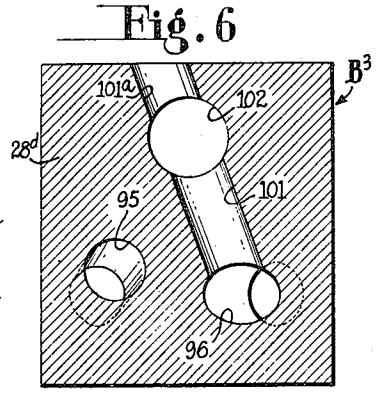

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Fig. 8

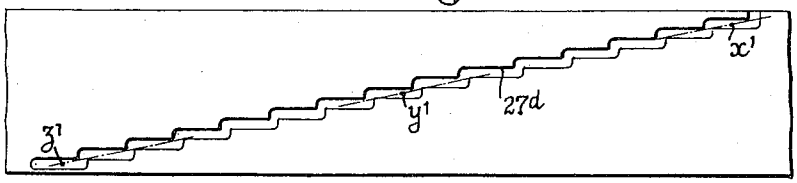

Fig. 11

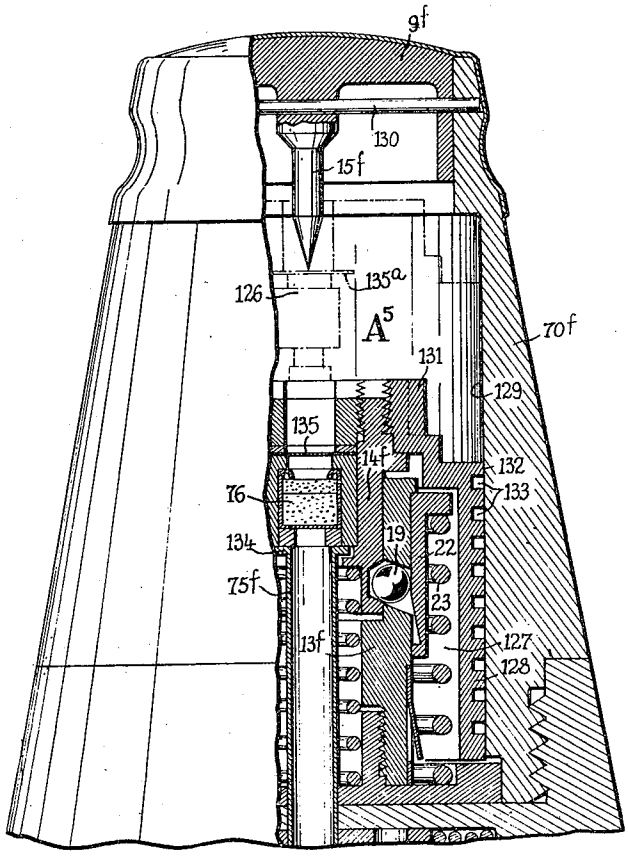

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Fig. 9

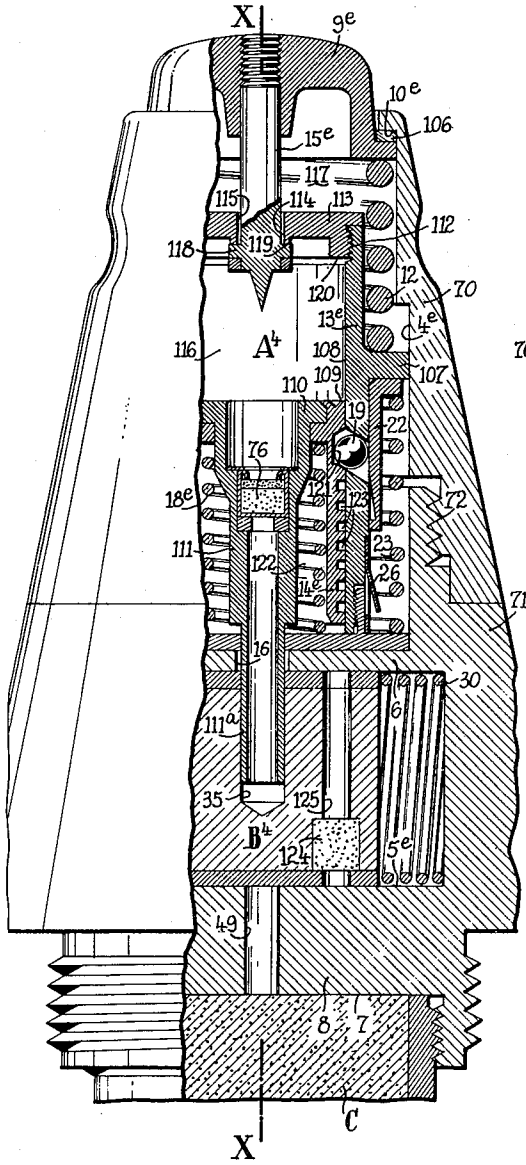
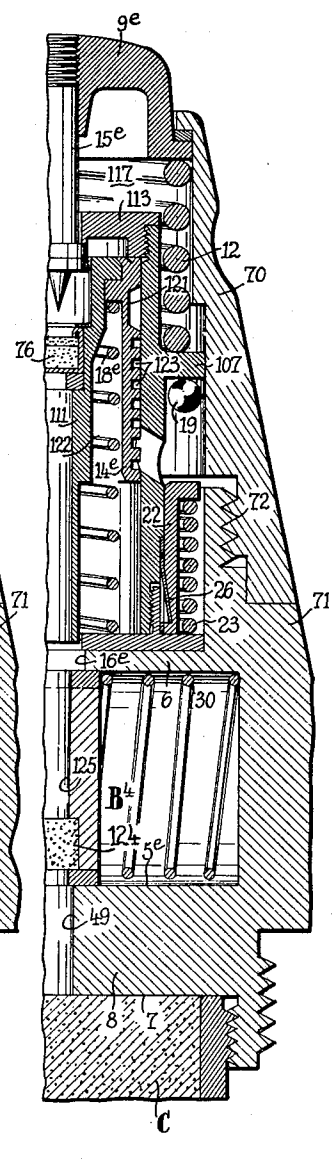


Fig. 10



United States Patent Office 2,977,882 Patented Apr. 4, 1961

2,977,882

PROJECTILE FUZE

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Claims priority, application France Nov. 2, 1955

9 Claims. (Cl. 102—74)

The present invention relates to an improved percussion fuze for a projectile and in particular a finned projectile, this fuze being absolutely safe to use and of the known type in which the forward part of the fuze body contains a firing device comprising a member longitudinally movable between an inoperative position, in which it is maintained, when launching the projectile, by an automatically retractable locking device, and an armed position to which it is brought by a resiliently deformable device as soon as the projectile ceases to accelerate on its trajectory, the percussion occurring upon impact.

The object of the invention is to provide a percussion fuze comprising a body, and, provided in this body at the rear of the firing device, fire connecting or igniting means movable between a first retracted, inoperative position, in which the projectile is inexplosive and safe to handle and in which the igniting means is locked by said movable member, and a second, firing position, and a resiliently yieldable device which urges the igniting means from the first to the second position thereof as soon as this means is unlocked when said movable member moves from its inoperative position to its armed position.

Owing to the locking of the igniting means in its inoperative position by the movable member of the firing device in the unarmed position of the latter, there is absolutely no danger of prematurely exploding the projectile before the firing device has been fully armed. Thus the fuze affords complete safety since there is absolutely no possibility of exploding the projectile in the course of handling the latter. Furthermore, there is no danger, when launching the projectile, of the latter exploding in the vicinity of the launching device, since it is essential for the projectile to travel along a certain part of its trajectory in order to arm the firing device.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings, to which the invention is in no way limited.

In the drawing:

Fig. 1 is an axial sectional view of an embodiment of the invention, the fuze being shown in its unarmed condition;

Fig. 2 is a similar sectional view of the fuze in its armed condition;

Fig. 3 is an end view of the igniting means;

Fig. 4 is a sectional view taken along line 4—4 of Fig. 3;

Fig. 5 is a sectional view taken along line 5—5 of Fig. 4;

Fig. 6 is a sectional view taken along line 6—6 of Fig. 4;

Fig. 7 is a sectional view taken along line 7—7 of Fig. 5;

Fig. 8 is a developed view of the sleeve comprising the zig-zag groove of the firing device;

Fig. 9 is a partly elevational and partly axial sectional view of another embodiment of the invention provided with an air dash-pot which delays the arming of the firing device, this fuze being shown in its unarmed condition;

Fig.10 is a half-axial sectional view of the fuze in its armed condition, and

Fig. 11 is a partial axial sectional view of another embodiment of the invention, the fuze being in its unarmed condition.

In the embodiment of the invention shown in Figs. 1 to 8, the fuze comprises a body of revolution about the longitudinal axis XX which consists of two parts **70** and **71** interconnected by a thread **72**. Provided in this body is a forward chamber **4***d* containing a firing device A^3, a transverse cylindrical chamber **5***d* which is separated from the chamber **4***d* by the transverse wall **6** and contains a flame guiding means B^3, and a rear recess **7** containing the relay C.

The firing device A^3 comprises at the forward end of the chamber **4***d* and movable therein, a percussion head **9***d* to which is fixed a short firing pin **15***d*, this head **9***d* being urged forwardly against an inner flange **10***d* of the body of the fuze by a spring **12** which bears at its rear end against a forward flange on a tubular guide **13***d*. Slidable and rotatable in the guide **13***d* is a sleeve or carrier **14***d* provided at its forward end with an inner flange **73** on which is fixed, by a formed-over portion **74**, an axial tube **75** carrying a primer **76**. This tube **75** extends rearwardly in the form of a thinner tubular portion which has such length that, in extending through the aperture **16** in the wall **6**, its rear end extends well into the chamber **5***d* when the tube **75** is in the position shown in Fig. 1. The head **9***d* carrying the firing pin **15***d* has, around the latter, a recess **9***a* which has such dimensions that, when the sleeve **14***d* moves forwardly, the tube **75** is capable of moving sufficiently forward for its rear end to withdraw from the chamber **5***d* in the armed position of the fuze shown in Fig. 2.

The sleeve **14***d* is urged forwardly and in rotation in the direction of arrow f^3 (Fig. 1) by a spring **18***d* whose rear end **78** is engaged in an aperture in a fixed washer **79** threadedly engaged at **80** in the guide **13***d*, whereas the forward end **81** of this spring is engaged in an aperture in the sleeve **14***d*. The assemblage **14***d*, **75**, **76** is in the unarmed position of the fuze, held locked in the position shown in Fig. 1 by balls **19** each of which is engaged partly in a recess **20** in the sleeve **14***d* and partly in an inclined aperture **21** in the guide **13***d*. The balls are ordinarily held in position by the arming ring **22** which is slidable on the guide and is urged forwardly to its ball-retaining position by the spring **23**. The ring **22** has an inner recess **25** adapted to engage the rear tabs of the ring **26** which is fixed on the guide **13***d* and rests against a shoulder formed on the latter.

The guide **13***d* carries a pin **27** which protrudes from the inner face thereof and is engaged in a zig-zag groove **27***d* formed on the outer face of the sleeve **14***d*. The various steps of the groove **27***d* are disposed along a helix represented in the developed view in Fig. 8 by the inclined line x^1, y^1, z^1.

The arming of the firing device A^3, that is, its passage from the position in Fig. 1 to the armed position shown in Fig. 2 is effected in two stages.

Upon launching the projectile, the effect of inertia causes the ring **22** to move rearwardly and compress the spring **23** and this ring engages under the tabs of the ring **26**. The balls **19** are thus released which releases the sleeve **14***d*. The head **9***d* only moves rearwardly until its end encounters the forward end of the guide **13***d* and this rearward movement is insufficient to allow the firing pin **15***d* to encounter the primer **76**.

When the projectile ceases to accelerate, the percussion head **9***d* assumes its initial position under the effect of the pressure exerted by the spring **12**, while the sleeve **14***d* moves forwardly by the combined actions of inertia and the axial thrust exerted by the spring **18***d* which furthermore, rotates the sleeve in the direction of arrow f^3. This permits the zig-zag groove **27***d* to slide along the pin **27** at a speed somewhat slowed down by the action of this pin, the sleeve **14***d* being prevented from moving in the opposite direction. With a delay corresponding to the number of steps in the groove **27***d* and the moment of inertia of the sleeve and the characteristics of the spring **18***d*, the sleeve reaches its armed position shown in Fig. 2, in which position, upon striking the head **9***d*, the firing pin **15***d* moves rearwardly with the latter and strikes the primer **76**.

The flame guiding means B^3 consists of a cylindrical block **28***d* mounted for rotation about axis YY in the chamber **5***d*. It abuts the end of the latter by a bearing face **82** of reduced diameter and abuts a central boss **83** of a plug **6***d* by another bearing face **84**. As the bearing faces **82** and **84** are of reduced diameter, the friction opposing rotation of the block **28***d* is reduced, which enables the latter to be rotated by a torsion spring **86** of which one end **87** is fixed to the block whereas the other end **88** is engaged in the body of the fuze.

The block **28***d* has a diametral aperture **35** in which, in the unarmed position of the fuze, the rear portion of the tube **75** is engaged, so that this block is held stationary in opposition to the action of the spring **86** which tends to rotate it in the direction of arrow f^4 (Figs. 1 and 3). The block **28***d* may assume one or the other of two angular positions determined by the abutment of a stud **89** (Fig. 3), carried by the block, with either a first abutment **90** rigid with the end of the chamber **5***d*, corresponding to instantaneous firing, or second abutment **91** by means of which a delayed or timed firing is obtained. The abutment **91** is retractable and formed by the eccentric end of a journal **92** rotatable in the end of the chamber **5***d*. This journal terminates in an outer head **93** having a slot **94** to receive a screwdriver or other means for rotating this journal (Figs. 1 and 2).

Provided in the block **28***d* are two passageways **95** and **96** (Figs. 1, 4, 6) which communicate with the outer cylindrical face of this block by way of two apertures **97** and **98** whose centers *m* and *n* (Fig. 5) are situated in the same transverse plane **5**—**5** (Fig. 4) as the axis ZZ of the aperture **35**. Lines intersecting these centers and the axis XX of the block **28***d* are inclined at angles *u* and *v* relative to the axis ZZ (Fig. 5) which are equal to those between the side of the stud **89** and the sides of the abutments **90** and **91** (Fig. 3), the latter being in its operative position **91***a*. Thus the aperture **97** substitutes itself for the aperture **35** on the axis XX (Fig. 1) when the block **28***d* is no longer locked by the tube **75** (at the end of the arming of the latter) and its stud **89** abuts against the abutment **90**, the abutment **91** being in the retracted position shown in Fig. 3 so as to allow the stud **89** free passage; and the aperture **98** substitutes itself for the aperture **35** when the stud **89** abuts the abutment **91**, previously brought, by rotation of the journal **92**, into its position **91***a* in the path of the stud **89**.

The passageway **95** is in direct communication with a housing **99** containing a detonator **100** and the passageway **96** is connected by a transverse passageway **101** with another passageway **102** which contains a timing or fire delaying means **103** and communicates, by way of an aperture **104** and the housing **99**, with the forward end, relative to the projectile, of the detonator **100**.

The housing **99** also communicates, by way of the aperture **105**, with the cylindrical face of the block **28***d* and, for the angular positions of this block corresponding to instantaneous firing or delayed or timed firing, the aperture **105** is in register with one or the other of two apertures **106** (Figs. 1, 2) formed in the wall **8**. Each of these apertures **106** contains an explosive charge **107** which forms a relay and permits igniting the relay C.

In the unarmed position of the fuze, the block **28***d* is locked by the tube **75** which is engaged in the aperture **35**. When an instantaneous firing is required, the journal **92** is brought to the position shown in Fig. 3, in which the abutment **91** is retracted from the path of movement of the stud **89**.

When the fuze is armed, which causes withdrawal of the tube **75** from the aperture **35**, the block **28***d* is released and rotates through an angle *u* in the direction of arrow f^4 until the stud **89** abuts the abutment **90**. In this position the tube **75** is in direct communication with the detonator **100** by way of the passageway **95**.

When the head **9***d* of the projectile strikes an object such as the target the firing pin **15***d* is thrust rearwardly, or the guide **13***d* and the primer **76** move forwardly under the effect of inertia, and the primer **76** is struck by the pin **15***d* which results in ignition of the detonator **100** which in turn ignites the relay C.

If it is required that the fuze be timed to operate with a delayed action, the journal **92** is rotated in the direction of arrow f^5 (Fig. 3). After the block **28***d* is unlocked, it rotates through an angle *v* until the stud **98** abuts the abutment **91** which is in its operative position **91***a*. In this position, the tube **75** is in communication with the delaying means **103** by way of the passageways **96** and **101**.

Preferably, the passage **101** communicates at **101***a* (Fig. 6) with the chamber **5***d*, so as to allow expansion of the gases due to combustion of the primer **76**; in this way breakage of the delaying means **103** is avoided.

In the embodiment shown in Figs. 9 and 10, the body of the fuze consists of two parts **70** and **71** interconnected by a thread **72**. The chamber **4***e* contains a firing device A^4 and the transverse chamber **5***e* contains a flame guiding means B^4. The rear recess **7** contains the relay C.

The firing device A^4 comprises movable in the entrance of the chamber **4***e*, a percussion head **9***e* to which is fixed an axial firing pin **15***e*. This head and firing pin are urged forwardly against an inner flange **10***e* of the body part **70** of the fuze body by a spring **12**, which bears at its rear end against an outer flange **107** disposed intermediate the ends of a tubular guide **13***e*. A gasket **106** is provided against the inner face of the flange **10***e*.

The guide **13***e* has an axial cylindrical bore **108** in which is slidable a unit comprising a sleeve **14***e* connected at its forward end, by means of a formed-over portion **109**, to the forward end **110** of a tube **111** which carries at its forward end a primer **76**. The tube **111** has at its rear end an extension **111***a* of smaller diameter whose length is such that it extends, through an aperture **16** in the wall **6**, well into the chamber **5***e* in the unarmed position of the fuze (Fig. 9).

Threadably engaged on the forward end of the guide **13***e* at **112**, is an annular member **113** whose central aperture **114** forms with the firing pin **15***e* an annular passage **115** through which a rear chamber **116**, formed in the bore **108** between the tube **111** and the member **113**, communicates with a forward chamber **117** formed in the part **70** of the fuze body between the inner face of the latter, the member **113**, the firing pin **15***e* and the head **9***e*.

When the fuze is unarmed, the annular passage **115** connecting the chamber **116** and **117** is closed by the pin **15***e* which carries a flange **118** forming a valve member adapted to bear against a valve seating **119** formed by a boss on the member **113** at the rear end of the passage **114**. The flange or valve **118** is urged against the seating **119** by the pressure exerted by the spring **12** which urges the head **9***e* forwardly. The length of the chamber **116** is such that, when the primer-carrying tube **111** and the mobile unit connected thereto move forwardly until the rear face **120** (Fig. 9) of the member

113 is encountered, the portion 111*a* is withdrawn into the aperture 16 and the fuze is armed.

The tube 111 is urged forwardly from the position shown in Fig. 9 to the position shown in Fig. 10 by a spring 18*e* but is, before arming of the fuze, held in the position shown in Fig. 10 by the locking balls 19 which are disposed in apertures 20 in the guide 13*e* and protrude into an outer recess 121 in the sleeve 14*e*. The balls 19 are held in their locking position by the arming ring 22 which is slidable on the guide 13*e* and is urged forwardly to its operative ball-retaining position by a spring 23. The ring 22 is provided with an internal recess 25 adapted to engage rear tabs of a ring 26 which is fitted on the guide 13*e* and bears against a shoulder formed on the latter.

A dash-pot adapted to retard the arming of the fuze that is, the forward movement of the movable unit 14*e*, 111, 76 consists of the combination of the chamber 116 and a third chamber 122 formed in the bore 108 behind the forward end of the tube 111 and the sleeve 14*e*. The two chambers 116 and 122 communicate with one another through the very small clearance between the sleeve 14*e* and the bore 108.

Preferably, the sleeve 14*e* comprises in its outer face grooves 123 adapted to retard the flow of air from the chamber 116 to the chamber 122 and thereby the forward displacement of the primer-carrying tube 111.

The flame guiding means B^4 in the chamber 5*e* is urged by the pressure of a spring 30 from the position shown in Fig. 9 in which it is held by the extension 111*a* of the tube engaged in the aperture 35, to the position shown in Fig. 10, in which, firstly, a passageway 125 formed in the block is in alignment with the tube 111, or more exactly the axial passageway of the latter and, secondly, a detonator 124 disposed in the passageway 125 is in alignment with an aperture 49 formed in the wall 8, which permits igniting the relay C through the medium of an explosive relay disposed in the aperture 49.

The connection between the axial passageway in the tube 111 and the detonator 124 has been shown to be by way of this passageway 125, but it will be clear that this connection may be by way of several passageways in parallel, one of which may include a powder charge forming delay or time means, the selection between these passageways being obtained by anyone of the above-described methods.

This fuze operates in the following manner.

When the fuze is unarmed, the various members are in their positions shown in Fig. 9 and the primer-carrying tube 111 is maintained in its rear position by the locking balls 19; the spring 18 is compressed.

When the projectile is launched, the head 9*e* and the ring 22 more rearwardly under the effect of inertia and the balls 19 and tube 111 are released.

When the projectile ceases to accelerate, the tube 111 moves forwardly relative to the latter due to the action of the spring 18*e*, but is retarded in this movement by the effect of the dash-pot. Although at the moment of launching the projectile the head 9*e* temporarily moves rearwardly under the effect of inertia and causes a part of the air contained in the chamber 117 to pass into the chamber 116 through the passage 115 (since the valve 118 is temporarily lifted off the seating 119), as soon as the projectile ceases to accelerate this valve returns to its seating and closes off the chamber 117 from the chamber 116, so that the latter contains air under a certain pressure.

Owing to the forward displacement of the tube 111, the volume of chamber 116 decreases and as the air contained therein cannot escape through the passage 115, since the valve 118 is closed against the seating 119, it passes into the rear chamber 122 between the sleeve 14*e* and the bore 108 of the guide 13*e* and thereby damps or retards the movement of the primer-carrying tube 111.

The armed position of the fuze shown in Fig. 10 is

only reached after a certain period of time, which depends on the dimensions of the slight clearance between the sleeve 14*e* and the bore 108. The delayed arming thereby obtained insures that the projectile does not explode in the vicinity of the launching apparatus. The locking action of the balls 19 rendered the fuze absolutely safe during the handling thereof before launching.

At the end of the arming of the fuze, the extension 111*a* of the primer-carrying tube 111 is withdrawn into the aperture 16 in the wall 6 and the block of the igniting means B^4 is released. The pressure exerted by the spring 13 urges this block to the position shown in Fig. 10 so that the passageway 125 comes into alignment with the axial passageway in the tube 111. In the armed position of the fuze the sleeve 14*e* abuts the rear face 120 of the member 113.

The fuze may fire the projectile when the latter strikes an object such as the target, either by the firing pin 15*e* moving rearwardly or by the primer-carrying tube 111 and the guide 13*e* moving forwardly under the effect of inertia in opposition to the action of the spring 12.

Fig. 11 shows a modification of the fuze in its unarmed position, the firing device A^5 of this fuze comprising an air dash-pot. The latter is similar to the previously described dash-pot except that one chamber 126 of the dash-pot is formed in the part 70*f* of the fuze body and the other chamber 127 is formed between the fixed guide 13*f* and a sleeve 128 which is slidable in the cylindrical bore 129 in the part 70*f*.

The chamber 126 is closed at its forward end by the head 9*f* which carries the firing pin 15*f*. The head and pin are fixed to the part 70*f* by a pin 130. The primer-carrying tube 75*f* is connected to a sleeve 14*f* which is locked relative to the guide 13*f* by balls 19 which are in turn held in their locking position by the arming ring 22. The latter is urged to its ball-retaining position by the spring 23.

The sleeve 128 is fixed at its forward end 131 to the tube 75*f* and a very slight clearance is provided at 132 between the sleeve 128 and the bore 129. Grooves 133, similar to the grooves 123 of the least-described embodiment, serve to retard the flow of air through this clearance from the chamber 126 to the chamber 127.

When the arming ring 22 moves rearwardly and releases the balls 19, the movable unit 75*f*, 14*f*, 128 moves forwardly and the speed of this movement depends on the rate of flow of the air from the chamber 126 to the chamber 127 through the clearance 132.

To prevent the sliding of the tube 75*f* from hindering that of the sleeve 128, the forward flange 134 of the tube 75*f* is mounted with sufficient clearance in its housing in the sleeve 14*f*.

In the armed position of the fuze, the point of the firing pin 15*f* rests against a thin metal sheet 135 placed in front of the primer 76. This sheet assumes the position shown in dot-dash line at 135*a* in Fig. 11.

The projectile may be fired either by the firing pin 15*f* moving rearwardly after shearing of the pin 130 and perforation of the sheet 135 or by inertia by a forward displacement of the primer-carrying tube 75*f* with the sleeve 128 after perforation of the sheet 135.

Although specific embodiments of the invention have been described, many modifications and changes may be made therein without departing from the scope of the invention as defined in the appended claims.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. A fuze for projectile comprising an elongated body, a firing pin slidable in said body, a priming charge, support means supporting said priming charge in said body for displacement between an unarmed position whereat said charge is free of said pin and an armed position whereat said pin can engage said charge, said body having a chamber disposed rearwardly of said means, a relay charge positioned rearwardly of said chamber and adapted

for being ignited by flame passing through said chamber, said means including a rearwardly extending tube adapted for guiding flame from said priming charge toward said chamber; said tube, with said means supporting said priming charge in unarmed position, extending rearwardly into said chamber and, with the priming charge in armed position, being withdrawn from said chamber; flame guiding means displaceable in said chamber but being normally fixed in the latter by said tube, displacement means in the chamber to displace the igniting means with said tube withdrawn, said priming charge being independent of and spaced from said flame guiding means said flame guiding means being provided with instantaneous and delay passages for coupling said tube and guiding the flame from the priming charge to said relay charge in accordance with the displacement of said flame guiding means, and selection means for selectively controlling the displacement of said flame guiding means by said displacement means for selecting instantaneous and delayed firing.

2. A fuze as claimed in claim 1 wherein said chamber and flame guiding means are of cylindrical form, the flame guiding means being rotatable in said chamber and have a diametral bore for engaging said tube.

3. A fuze as claimed in claim 1 comprising an inflammable plug in the delay passage.

4. A fuze as claimed in claim 1, wherein said flame guiding means is rotatable in said chamber and includes an extension, said selection means comprising an adjustable interception device adapted to intercept said extension to terminate rotation of said flame guiding means.

5. A fuze as claimed in claim 1 wherein said displacement means is a spring engaging said flame guiding means.

6. A fuze as claimed in claim 1 comprising locking means holding said support means against displacement until said projectile is fired.

7. A fuze as claimed in claim 6 comprising retardation means to retard movement of said support means.

8. A fuze as claimed in claim 7 wherein the retardation means is a pin and zig-zag groove arrangement coupling said body and support means.

9. A fuze as claimed in claim 7 wherein the retardation means is a dashpot coupling said body and support means

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