April 21, 1959 A. LOSFELD ET AL 2,882,825

INSTANTANEOUS AND TIME-LAG PERCUSSION FUSE FOR GUN AND SMALL-ARM PROJECTILE

Filed April 10, 1957 2 Sheets-Sheet 1

Fig. 1.

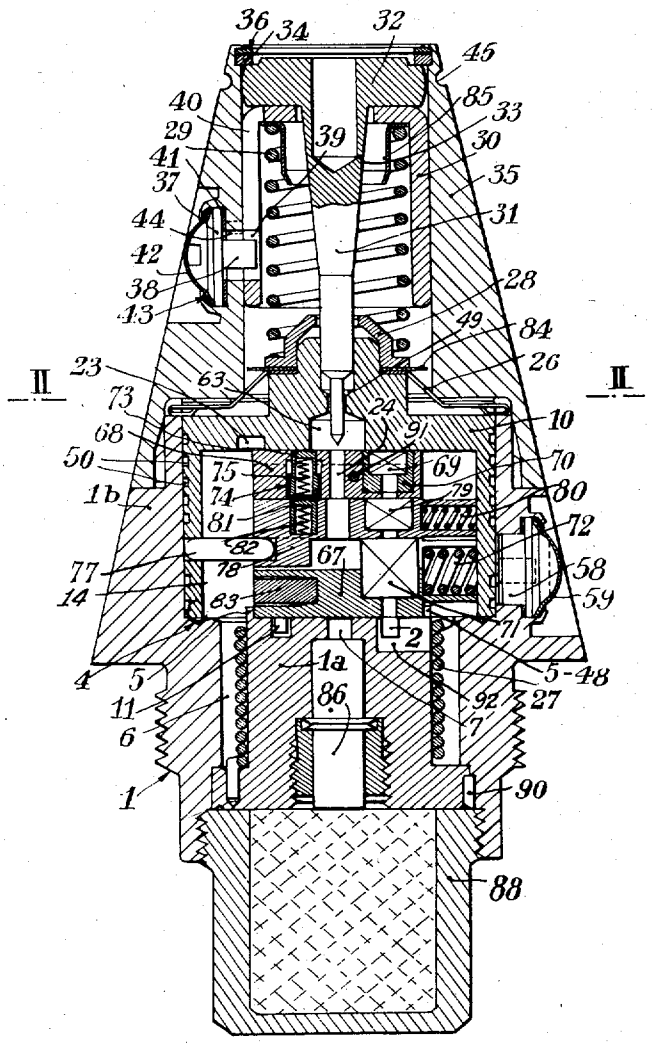

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Fig. 2.

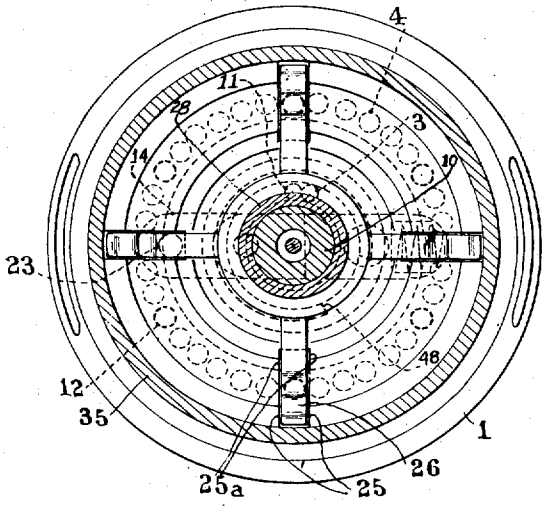


Fig. 3.

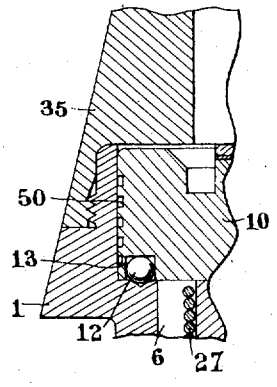


Fig. 4.

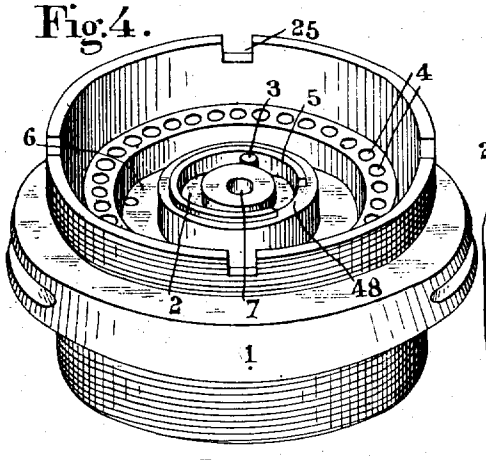


Fig. 5.

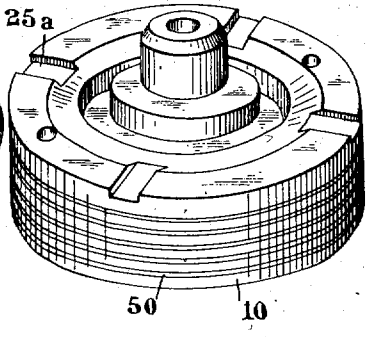
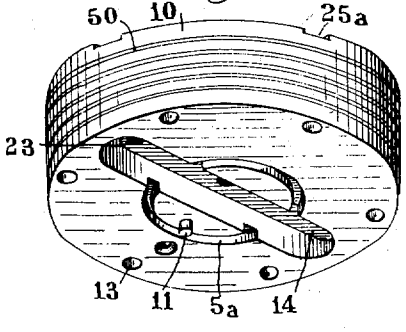


Fig. 6.



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2,882,825

INSTANTANEOUS AND TIME-LAG PERCUSSION FUSE FOR GUN AND SMALL-ARM PROJECTILE

André Losfeld, Tourcoing, and Maurice Roustant, Paris, France

Application April 10, 1957, Serial No. 651,995

Claims priority, application France April 11, 1956

9 Claims. (Cl. 102—74)

This invention relates to percussion fuses and has particular reference to a percussion fuse designed to prime explosive projectiles fired from the bore of a gun or small-arm, the device of this invention providing the following advantages:

Absolute air-tightness;
Safety under all shipping conditions;
Safety in case of accidental fall (whether on the cap end or base end, with or without protection);
Safety in the muzzle;
Safety under double-feed conditions;
Very high gun safety;
High-incidence percussion;
Operation by driven-in and inertia-actuated striker;
Instantaneous or time-lag fire transmission;
Possibility of delivering the prime projectiles by parachutes;
Instantaneous or time-lag operation at will.

In the percussion fuse according to this invention an axially-mounted barrel adapted to rotate from an initial position and an armed position and held in its initial position by a locking bolt against the action of a power spring, is formed in its lower portion with a diametral passage in which an ignition primer carrier is slidably mounted between an initial position in which the ignition primer is offset relative to an axial striker and retained as long as said barrel is in its initial position, and an armed position in which said ignition primer is in axial alignment with, and positioned under, the striker, and towards which armed position said primer slides when said barrel is in its armed position, whereas an arming system operated during the initial part of the projectile travel in the gun, by the longitudinal forces of inertia, releases the aforesaid locking bolt and consequently said barrel which may then be rotated by the power spring to its armed position in which the ignition primer carrier completes the arming of the fuse by moving automatically to, and becoming locked in turn in, its armed position under the striker, this movement being produced by the centrifugal force or, in the case of a smooth or non-rifled gun bore, by the action of a suitable thrust spring.

Moreover, when the fuse is in its inoperative position the common axis of the ignition primer, time-delay device and detonator primer passes through a region of the circular groove of the body portion which has an extension in the form of a radial passage leading to an annular space between said portion and the body portion in which the power spring is housed. Thus, a satisfactory expansion of the combustion gases released from the priming and time-lag charges in case of accidental ignition of these priming and time-lag charges, for example in case of double feed.

The end of the primer carrier which is opposite to that enclosing the power spring is formed with a recess containing an inertia block of a high-density substance, for example lead, which is pulled by the centrifugal force if the projectile is fired in a rifled gun. In this type

of firing the arming movement of the primer carrier is thus controlled with greater force and more safety than by a single spring. The same arrangement is also applicable to the time-delay carrier.

A thin metal washer located beneath the lug-carrying locking member and adapted to be torn away by the arming ring together with this member when the projectile is fired will stiffen this member in its released position while avoiding any risk of accidental re-locking that may be occasionated by the action of the centrifugal force on the lugs of said member.

The regularity of the movement of rotation of the barrel is obtained by means of a sliding washer inserted between the arming ring and the spacer spring.

The primer cap is slidably mounted in its housing so that it can be thrown by inertia in the recess against the striker point, so that the fuse will be operated by inertia in case the striker were not driven back at the place of fall of the projectile.

The rotation of the barrel by the power spring is retarded and regularized by a special mounting of the barrel in the fuse; according to this mounting a few balls enclosed in the periphery of the lower face of the barrel providing the necessary bearing action on a peripheral race formed on the circular bearing surface of the body which has a corrugated profile resulting from differences in level that may be formed by spaced cavities and this barrel—the outer periphery of which is in smooth frictional engagement with the body—is enclosed therein with a slight longitudinal play by an inner shoulder formed in a conical fuse cap screwed on the body.

The characters and advantages of this invention will become evident from the following description if reference is made to the attached drawings forming part of this specification and illustrating diagrammatically by way of example a typical embodiment of the invention. In the drawings:

Figure 1 is an axial section showing the ignition primer carrier slidably mounted in the barrel.

Figure 2 is a cross-section taken upon the line II—II of Fig. 1.

Figure 3 is a fragmentary axial section showing the manner in which the rotary barrel is mounted.

Figure 4 is a perspective view showing the body in which the barrel is mounted.

Figure 5 is a perspective view showing the barrel as seen from above; and

Figure 6 is another perspective view showing the barrel as seen from below.

The percussion fuse according to a preferred embodiment of this invention, which is shown in the attached drawings, comprises a hollow body **1** consisting of two elements **1***a*, **1***b* assembled together by shrinking or caulking, these parts being locked by means of a peg **90**. The upper face of the portion **1***a* of this body **1** is formed with an annular guide groove **2** obturated by a peg **3**, and also with a circular race formed with cavities **4**, and a circular projecting guide **5** broken by an aperture **48**, and it comprises in addition an axial fire passage **7** communicating with a detonator-primer **86** of the detonator **88** for the explosive charge of the projectile on which the fuse is to be screwed. The other portion **1***b* of the body is formed with radial notches **25** adapted to be engaged by the radial lugs of a locking device **26** (see Fig. 2).

Mounted for rotation in this body **1** is a barrel **10** carrying on its lower face a fixed pin **11** extending in the groove **2** and a number of balls **12** retained in recesses **13**. The barrel is formed in its lower face with a circular groove **5***a* engaging the projecting guide **5** of the body and a diametral passage **14** in which is slidably mounted the rigid assembly of an ignition primer carrier **68** and

a detonator primer carrier **67**, these carriers being locked to each other at **91**.

The detonator primer carrier **68** is formed with a central aperture and on either side of this aperture two recesses are provided; the left-hand recess in the drawing has fitted therein a stop bolt **73** urged upwards by a spring **75**, an inverted cap **74** being inserted therebetween; the bolt **73** engages the lower face of the barrel **10** in which a corresponding recess **23** is formed, as shown. In the right-hand recess of the carrier **68**, an ignition primer **69** mounted in a movable support **70** is arranged.

The detonator-primer carrier **67** is formed in its right-hand end (as seen on the drawing) by a radial cylindrical cavity containing a compression spring **72** bearing against the inner lateral face of the barrel **10** to urge the opposite end of this detonator-primer carrier in engagement with the circular guide **5** of the portion **1***a* of the body **1**. Laterally of the fuse axis a detonator primer **71** is mounted in a recess of this primer carrier **67** in front of the ignition primer **69** of the primer carrier **68**.

Slidably mounted in the interval between the ignition primer carrier **68** and the detonator primer carrier **67** is a time-lag device carrier **78** formed at one end with a radial cylindrical cavity enclosing a compression spring **80** bearing against the inner lateral face of the barrel **10** to urge the opposite end of said time-lag device carrier in engagement with one of the tips of a radial sliding bar **77** having its other tip extending through an aperture provided in the lateral wall of the barrel **10** to engage the inner lateral surface of the element **1***b* of body **1**. In this initial position a time-lage device **79** mounted in the carrier **78** is located exactly between the ignition primer **69** and the detonator primer **71**. Fitted in a circular aperture provided in the portion **1***b* of body **1** is a pin **58** protected by a dished cap **59**. The inner face of this pin **58** which engages the external side surface of the barrel **10** is formed with a cylindrical radial cavity the axis of which, by conveniently altering the angular position of the pin **58**, may be brought level with the axis of the bar **77**. The dimensions and location of this recess are such that the outer end of the bar **77** engages this recess when the barrel **10** has rotated through an angle slightly greater than required for placing the end of the detonator primer carrier **67** which is opposite to the spring **72** in front of the aperture **48** of the circular projecting guide **5**, thereby enabling the spring **80** to place this time-lag device carrier **78** in the transverse position required for aligning the time-lage device **79** with the fuse axis between the ignition primer **69** and the detonator primer **71**.

The locking of the time-lag device carrier **78**, although optional, may be effected by a stop bolt **81** urged by a spring **82**; in its initial position this bolt **81** is aligned with and urged against the other stop bolt **73** of the ignition primer carrier **68**, so that when cocked the bolts will lock their corresponding supports separately.

In addition, the ignition primer carrier **68** is formed with a central passage **24** adapted to be engaged by the point of the striker **31** so that from the very beginning of the projectile firing action this striker will lock this primer carrier in position.

Under the barrel **10** a fixed pin **11** projects and is adequately locked in position relative to the radial notches **25***a* formed in the upper edge of this barrel and in engagement with the peg **3**.

The barrel **10** is locked relative to the body **1** by a locking member or bolt **26** consisting of a washer provided with spaced lugs. A power spring **27** engaging with its lower end the base of the portion **1***a* of the body is coiled as a helix in this upward direction about this portion **1***a* in the annular space **6** separating this portion **1***a* from the other portion **1***b* up to a lower end secured under the barrel **10** and tending to rotate this barrel **10** relative to the body **1**.

Surrounding this upper end of the barrel **10** are a bearing ring **28** and a spacer spring **29** urging an arming ring **30** against the underface of the head of the striker **31**, the shank of the latter having a region of minor resistance **33** whilst the head **32** is formed with a part-spherical lateral surface and engages the lower face of a washer **34** crimped or otherwise secured on a conical cap **35** screwed in turn on the portion **1***b* of the body **1**. The necessary fluid-tightness of the assembly is obtained by inserting a gasket **36** on the washer **34**.

The conical cap **35** comprises an arrangement for locking the arming ring **30** (for parachuting and anti-sabotage purposes) in the form of a split-head stud **37** having a flat shank **38** constituting the bolt proper engageable in a circular hole **39** of the arming ring **30**. A slot **40** of a width slightly greater than the thickness of the flat shank of the bolt forms the extension of the circular hole **39** of the arming ring **30**.

Mounted under the bolt or stud **37** is a sliding washer **41**. A dished cap **42** secured by a crimped washer **43** covers the stud **37** which is held in an open or closed position by a stop consisting of a peg **44** fitted in the conical cap **35** under the stud **37**.

At its upper end the conical cap **35** is formed with a circular groove **45** providing a zone of reduced resistance which, when deformed by a shock, increases the percussion responsiveness of the fuse as well as a jamming of the striker after an untimely or voluntary shock so that the fuse will become harmless. By screwing the conical cap **35** on the portion **1***b* of body **1**, all the component elements of the fuse are assembled together.

The operation of this fuse is as follows:

Before charging the fuse-primed projectile the dished cap **42** is torn off by means of a screw driver or a coin and the stud **37** is moved to its open position. If it is desired to obtain the instantaneous operation of the fuse the dished cap **59** protecting the stud **58** is not tampered with. When the projectile is fired, the arming ring **30** strikes by inertia the locking lugs of the locking member **26** and upsets them, thereby releasing the barrel **10** for rotation.

During the travel of the projectile along the gun bore the barrel **10** which is initially locked in position by the balls **12** is pressed by inertia against the body **1** and does not rotate, while the striker **31** in its percussion position engages its point through the aperture **24** of the ignition primer carrier **68** to constitute by itself an additional safety device counteracting any tendency to an accidental displacement of the rigid assembly of the ignition primer carrier **68** and a detonator primer carrier **67**. Thus, the fuse is made core-safe.

As the projectile emerges from the gun muzzle and when the acceleration of the fuse-primer projectile is no more positive, the barrel **10** is urged by the power spring **27** and starts rotating while jumping on the circular race formed with the cavities **4**, its movement being relatively slow and stopped when the pin **11** engages the other side of the peg **3**. This combination of movements ensures the muzzle safety. The duration of the barrel rotation which results therefrom is subordinate, of course, to the diameter and number of balls **12** mounted in the barrel **10**, to the section of the circular race of the body **1** which is engaged by these balls and corrugated by recesses **4** preferably of conical configuration and spaced along this circular race, as well as to the respective strength of the power spring **27** urging the barrel **10** for rotation and of the spacer spring **29** urging this barrel in the axial direction against the balls **12**. All these factors are determined by construction, so that the duration of the rotational movement of the barrel **10** may be adjusted by altering the longitudinal clearance of the barrel between

the race of the body 1 and the bearing shoulder of the conical cap 35 between which the barrel is housed.

When the pin 11 engages the peg 3 the rigid assembly consisting of the ignition primer carrier 68 and detonator primer carrier 72, complemented by the centrifugal force when a rifled bore is used, clears the passage 48 of the projecting guide 5 to reach a stopping position opposite the space 14. The ignition primer 69 and detonator primer 71 will then position themselves in axial alignment and in front of the point of the striker 31, whilst the time-lag device carrier 79—which remains in the position in which it is shown in the drawings—provides a communication through its central hole between the ignition primer 69 and the detonator primer 71. From this moment on the fuse is armed.

The percussion of the ignition primer 69 is caused by the direct sinking of the striker 31. The ignition primer 69 is thus stricken and transmits the fire to the detonator primer 71 which fires in turn the explosive charge of the projectile through the relay means 86 and 88.

If it is desired to cause the time-delay operation of the fuse, the stud 37 is also actuated as in the preceding case but in addition the dished cap 59 is torn off and the stud 58 rotated so as to place its cylindrical recess level with the axis of the small bar 77. When the shot is fired, as in the preceding case, the assembly comprising the primer carrier 68, 67 and time-lag device carrier 78 is rotated along with the barrel 10 while maintaining their transverse arrangement illustrated in the drawing. During this rotational movement when the detonator primer carrier 67 registers with the aperture 48 of the projecting guide 5 the primer carriers 67, 68 urged either by the spring 72 or, in the case of a shot in a rifled bore, by the centrifugal force, will take its armed position in which the ignition primer 69 and the detonator primer 71 are in axial alignment with the fuse and register with the point of the striker 31. Almost immediately thereafter, when the barrel stops, the outer tip of the small bar 77 becomes aligned with the cylindrical recess formed in the inner face of the stud 58 and engages this recess under the thrust of the spring 80 which will thus cause the time-lag device carrier 78 to move transversely to a position in which the time-lag device 79 is coaxial with the conical cap between the ignition primer 69 and the detonator primer 71. Then, the fuse is ready, that is, armed to operate with a time-lag and when the point of the striker 31 strikes the ignition primer 69 the fire produced therein is not transmitted to the detonator primer 71 except through the time-lag device 79.

The double-action fuse described hereinabove possesses remarkable safety properties. In fact, in this fuse the pyrotechnic chain contained in the primer carrier 68, 67 and time-lag device carrier 78, in their inoperative position shown in the drawings, is completely offset in the barrel and positioned in front of the bearing face of the fuse which is also the front face of the projectile on which the fuse is screwed. If, for any reason, for example a fire, the block 68, 67, 78 bursted under the influence of an intense heat, the transmission of fire to the explosive relays 86, and 88, would not occur. At the most an incomplete detonation of the explosive charge of the projectile would take place, but the fuse would remain inoperative.

The gas-tightness of the assembly is obtained by the provision of a tapered seat 49 adapted to be engaged by the corresponding tapered shoulder formed on the shank of the striker 31, and also by the provision of circular expansion grooves 50 formed in the cylindrical outer surface of the barrel.

As long as the fuse is in its inoperative position the common axis of the ignition primer 69, time-lag device 79 and detonator primer 71 passes through a region of the circular groove 2 of the body portion 1*a* which comprises an extension in the form of a radial passage 92 directed towards the annular space 6 between this portion 1*a* and the portion 1*b* of the body which contains the power spring 27. Thus, a satisfactory expansion of the combustion gases released by the primers 69 and 71 and time-lag charge 79 is obtained in case of accidental ignition of these primers and charge, for example in case of double feed.

The end of the primer carriers which is opposite to that receiving the spring 72 is formed with a recess containing an inertia weight 83 of a high-density substance such as lead, this weight being pulled by the centrifugal force if the projectile is fired from a rifled gun. Thus, under these conditions the arming movement of the primer carrier is controlled with a greater force than by the spring 72 alone. The same arrangement is applicable to the delay-action carrier 78.

A thin metal washer 84 positioned on the lug-carrying locking member 26 and pressed by the arming ring 30 together with this member 26 when the projectile is fired will stiffen this member in its released position to avoid any risk of accidental re-locking as may be caused by the action of the centrifugal force on the lugs of said member 26.

The movement of rotation of the barrel is regularized by a sliding washer 85 interposed between the arming ring 30 and the spacing spring 29.

The inverted cap 70 of the primer 69 is slidably fitted in its cavity to permit its engagement by inertia in the recess 63 underlying the point of the striker 31, so that the fuse will be operated by inertia in case the striker were not driven back at the place of fall of the projectile.

It will be readily understood that many modifications as to the relative dimensions, proportions and arrangement of the component elements of the percussion fuse of this invention, as exemplified in the attached drawings, may be contemplated without departing from the basic principles and without prejudice as to the specific features of the invention as set forth in the appended claims.

What we claim is:

1. A percussion fuse for priming an explosive projectile thrown from a gun, said fuse comprising a body consisting of a central element of this body, in which an axial passage is formed, and an external element also formed with an axial passage, said central element being a force fit in said external element and forming in said external element an annular cavity, a detonating relay screwed axially in said central element of the body, another detonating relay screwed axially behind said external element of said body to contact said first detonating relay, a barrel formed with an axial passage and mounted for rotation in the front portion of said central element and in said external element of the body, a pin secured in and projecting from the rear face of the barrel so as to engage a circular groove formed in said central element of the body, a peg secured in this circular groove to limit the rotation of said barrel from an initial position in which said pin abuts on one side of said peg and a final position in which said pin abuts on the other side of said peg, a power spring having a rear end secured on said central element of the body in the bottom of an annular recess bound by said central element of the body in said external element of the body, said power spring being coiled around said central element in the aforesaid annular space and having a front end which is secured under said barrel so as to urge said barrel towards its final position, an annular locking member engaging the front portion of said barrel and having radially extending lugs, the front peripheral portions of said external element and barrel having spaced notches formed therein which register together when said barrel is in its final position in said body, the radial lugs of said annular locking member having end portions engaging said notches of said external

body element and said barrel to maintain said barrel in its initial position in said body against the action of said power spring, an ignition primer carrier having a through hole, an ignition primer mounted on said carrier, said carrier being mounted in turn for diametral sliding motion in said barrel and adapted to move in said barrel from an initial position in which said through hole is positioned in axial alignment with the axial passage of the barrel while the primer is offset relative thereto, and a final position in which the primer is co-extensive with said axial passage of the barrel, means for locking said primer in said barrel, said means being carried by the body and co-acting with said primer carrier to hold same in its initial position in said barrel but to release it when said barrel is in a predetermined position close to said final position in said body, resilient means urging said primer carrier to its final position in said barrel, a hollow conical cap screwed on said body and enclosing said barrel in said body, a striker mounted for axial sliding movement in said conical cap and formed with a front wider head and a rear point directed axially towards said primer carrier, an arming ring engaging said striker behind said head, a spacer spring bearing on said barrel and urging said arming ring and striker to a position in which the point of said striker is free from said primer carrier, said striker and arming ring effecting, when the projectile travels in the gun bore under the influence of the longitudinal forces of inertia and against the resistance of said spacer spring, a backward movement during which the point of said striker passes through said hole of said primer carrier, the arming ring, during said travel, bending said radial lugs of said annular locking member so as to free the ends of said lugs from the notches of the external body element of said barrel, and means for retarding and regularizing the rotational movement of the barrel in said body under the action of said power spring until said barrel is stopped in its final position before which said striker, being subjected after emerging from the gun bore to the only action of said spacer spring, resumes the position in which the point of said striker is released from said primer carrier and before which said means for locking said primer carrier in the barrel release said primer carrier to permit the operation of said resilient means urging said primer carrier to its final position in said barrel, said striker being thus properly positioned in alignment with said ignition primer and striking this primer by moving backwards as the projectile falls, thereby causing the detonation of the detonating relay means.

2. A percussion fuse for priming an explosive projectile thrown from a gun bore, said fuse comprising a body consisting of a central element of said body through which an axial passage is formed and of an external element of said body which is hollowed in the axial direction, said central element being a force fit in said external element and limiting in said external element an annular cavity, a detonating relay screwed axially in said central element of the body, another detonating relay screwed axially in the rear portion of said external element of the body and in contact with said first detonating relay, a barrel formed with an axial hole and mounted for rotation in front of said central element of the body and in said external element of the body, means for limiting the rotation of said barrel in said body between an initial position and a final position of said barrel in said body, a power spring having a rear end attached to said central element of the body in the bottom of the annular cavity bound by said central element in the external element of the body, said power spring being coiled as a helix in the forward direction around said central element of the body in said annular space and having a front end attached under said barrel to urge said barrel to its final position, means for locking said barrel in said body to hold said barrel in said initial position in said body against the action of said power spring, an ignition primer carrier formed with a hole, an ignition primer mounted on said primer carrier, said primer carrier being mounted for diametral sliding movement in said barrel and adapted to move from an initial position of said primer carrier in said barrel, wherein the hole of said carrier is in axial alignment with the axial hole of the barrel and the primer is in an offset position; and a final position of said carrier in said barrel, whereby said primer is in axial alignment with said axial hole of the barrel, means for locking said primer carrier in said barrel, which are carried by said body and adapted to co-act with said primer carrier to hold same in its initial position in said barrel and release same when said barrel attains a predetermined position in said body which is close to said final position of the barrel in said body, resilient means urging said primer carrier to its final position in the barrel, a conical cap formed with an axial hollow portion and screwed on said external element of the body, said conical cap being also formed with an inward shoulder enclosing said barrel in front of said central element of the body and inside said external element of the body with a predetermined longitudinal clearance, a striker slidably mounted in said conical cap and formed at the front with a widened head and at the rear with a point directed axially towards said primer carrier, a spacer spring bearing behind the head of said striker to urge said barrel axially against said central element of the body, said striker, during the projectile travel in the gun bore being subjected to the influence of the longitudinal forces of inertia against the action of said spacer spring and effecting a backward movement during which the point of said striker engages the hole of said primer carrier, means actuated by said backward movement of the striker to release said means for locking said barrel in said body, balls disposed on a circular row between the rear face of said barrel and said central element of said body, a circular race on the front face of said central element of said body, said race being formed with recesses having a corrugated profile and supporting said balls which are resiliently urged by said barrel towards said circular race by the action of said spacer spring, said balls being adapted when said barrel rotates to impart thereto a longitudinal hopping movement for retarding and regularizing said rotational movement which the barrel accomplishes in said body under the influence of said power spring until said barrel is stopped in its final position before which said striker, subjected after the projectile has emerged from the gun bore to the sole action of said spacer spring, resumes the position in which the point of said striker is released from said primer carrier and before which position the means for locking said primer carrier in said barrel release said primer carrier while enabling the operation of said resilient means for urging said primer carrier to its final position in said barrel, said striker under these conditions presenting its point in front of said ignition primer and striking same by moving backwards due to the fall of the projectile, thereby causing the detonation of the detonating relay means.

3. A fuse as set forth in claim 1, wherein said arming ring is provided with a slot opening into the upper portion and terminating at its lower portion with a circular aperture in which the flat portion of a locking stud is located and set angularly in the position whereby said flat portion is disposed across said circular aperture to lock said ring in its released position, thereby permitting the delivery of the fuse-primed projectiles by parachuting, without any risk of arming the fuses.

4. A fuse as set forth in claim 3, wherein said stud of which the flat portion engages the slot of said arming ring is covered by a crimped, preferably transparent cap of which the unbroken condition will guarantee the locking of said arming ring, said cap before firing the projectile being torn off by means of a screw-driver or a coin which is then used for subsequently rotating the stud through one-fourth of a revolution to position said flat portion of the stud longitudinally of the slot of the arming ring to permit the longitudinal backward movement of said ring in the fuse.

5. A percussion fuse for priming an explosive projectile thrown from a gun, said fuse comprising a body consisting of a central element of this body, in which an axial passage is formed, and of an external element of this body which is formed with an axial cavity, said central element being force-fitted in said external element to form therein an annular recess, a first detonating relay screwed axially in said central element of the fuse body, another detonating relay screwed axially at the rear of said body which contacts said first detonating relay, a barrel mounted for rotation in the front portion of said central element and within said external element of said body, said barrel having a cylindrical outer surface formed with circular expansion grooves and in smooth frictional engagement with the bore wall of said external element, an axial passage formed in said barrel, a tapered seat in said axial passage which has its larger diameter at the front, a pin projecting from the rear of said barrel and engaging a circular groove in said central element of the fuse body, a peg fixed in said central element and emerging in said last-mentioned circular groove to limit the barrel rotation between an initial position in which said pin engages one side of said peg and an end position in which said pin engages the other side of said peg, a power spring having its rear end anchored to said central element of the body in the bottom of the annular recess defined by said central element in said external element of the body, said power spring being wound coilwise in the forward direction around the central element of said body and in said annular recess, the front end of said power spring being secured under said barrel to urge same to said end position, an annular locking member fitted on the front end of said barrel and formed with radial lugs, the front outer peripheral edges of said body and barrel having notches formed therein which register with one another when said barrel is in its initial position in said body, said radial lugs of the annular locking member having end portions engaged in said notches of said external element and barrel to keep said barrel in its initial position in said body against the force of said spring, an ignition primer carrier **68** formed with an axial hole, an ignition primer mounted on said carrier, said ignition primer carrier being mounted for diametral sliding movement in said barrel and adapted to move from an initial position of said primer carrier in said barrel wherein said hole is in axial alignment and co-extensive with said barrel and the primer is eccentric, and a position of said primer carrier in said barrel wherein said primer is in axial and co-extensive alignment with said axial hole of the barrel, means for locking said primer carrier in said barrel, said means being carried by said body and co-acting with said primer carrier to hold said primer carrier in said initial position in said barrel and release it for a predetermined position of said barrel in said body which is near said end position of the barrel in said body, resilient means urging said primer carrier to its end position in said barrel, a conical point formed with an axial cavity and screwed on said body to enclose said barrel in said body, a striker mounted for axial sliding movement in said conical point, said striker having a widened front head and a frusto-conical rear shoulder shaped to engage said tapered seat of said barrel, and a striker pin directed axially towards said primer carrier, an arming ring surrounding said striker behind the widened head of said striker, a spacer spring bearing with one end against said barrel and urging with its opposite end said arming ring and said striker to a position wherein said frusto-conical rear shoulder of the striker is released from said tapered seat of said barrel and said striker pin is released from said primer carrier, said striker and arming ring being adapted, during the travel of the projectile in the gun bore, under the influence of longitudinal forces of inertia and against the force of said spacer spring, to effect a rearward movement during which said frusto-conical shoulder of the striker engages said tapered seat of the barrel while said striker pin engages said hole of said primer carrier, said arming ring being adapted, during this movement, to bend said radial lugs of said annular locking member to release the end portions of said lugs from the notches of said external element and said barrel, and means for retarding and regularizing the rotational movement then imparted by said power spring to the barrel within said body until said barrel is stopped in its end position before which said striker, subjected when the projectile leaves the gun bore to the sole action of said spacer ring, resumes the position in which the striker pin is released from said primer carrier and before which said means for locking said primer carrier in said barrel release said primer carrier to permit the operation of said resilient means urging said primer carrier to its end position in said barrel, whereby said striker pin may register with said ignition primer and then strike same due to the backward movement of the striker which takes place at the fall of the projectile, thus causing the detonation of said detonating relays.

6. A percussion fuse for priming an explosive projectile thrown from a gun, said fuse comprising a body consisting of a central element of said body in which an axial passage is formed, and of an external element of this body which is formed with an axial cavity, said central element being force-fitted in said external element to form therein an annular recess, a first detonating relay screwed axially in said central element of the fuse body, another detonating relay screwed axially at the rear of said body and in contact with said first detonating relay, a barrel mounted for rotation in the front portion of said central element and within said external element of said body, said barrel having a cylindrical outer surface formed with circular expansion grooves and in smooth frictional engagement with the bore wall of said external element, an axial passage formed in said barrel, a tapered seat in said axial passage which has its larger diameter at the front, a pin projecting from the rear of said barrel and engaging a circular groove in said central element of the fuse body, a peg fixed in said central element and emerging in said last-mentioned circular groove to limit the barrel rotation between an initial position in which said pin engages one side of said leg and an end position in which said pin engages the other side of said peg, a power spring having its rear end anchored to said central element of the body in the bottom of the annular recess defined by said central element in said external element of the body, said power spring being wound coilwise in the forward direction around the central element of said body and in said annular recess, the front end of said power spring being secured under said barrel to urge same to said end position, an annular locking member fitted on the front end of said barrel and formed with radial lugs, the front outer peripheral edges of said body and barrel having notches formed therein which register with one another when said barrel is in its initial position in said body, said radial lugs of the annular locking member having end portions engaged in said notches of said external element and said barrel to keep said barrel in its initial position in said body against the force of said spring, an ignition primer carrier formed with an axial hole, an ignition primer mounted on said carrier, a detonator primer carrier rigidly secured at the rear of said ignition primer carrier, a free gap being left between said ignition primer carrier and said detonator primer carrier, a detonator primer mounted on said detonator primer carrier in alignment with said ignition primer, the rigid assembly of said ignition primer carrier and said detonator primer carrier being mounted for diametral sliding movement in said barrel and adapted to move from an initial position in said barrel in which said hole of said ignition primer carrier is in axial alignment with said axial

hole in the barrel and said ignition primer is eccentric, and an end position of said primer carrier in sad barrel, whereby said primer is in axial alignment with said axial hole in the barrel, means for locking said primer carrier in said barrel, said locking means being carried by said body and adapted to co-act with said primer carrier to keep same in its initial position in said barrel but release said primer carrier for a predetermined position of said barrel in said body which is close to the end position of said barrel in said body, resilient means urging said rigid assembly comprising said ignition primer carrier and said detonator primer carrier to its end position in said barrel, a time-lag device carrier housed in said free gap between said ignition primer carrier and said detonator primer carrier, a central fire-passage formed through said time-lag device carrier, a time-lag device mounted in said time-lag device carrier, said time-lag device carrier being adapted to slide from an initial position in which its central fire passage and its time-lag device, in the end position of said rigid assembly comprising the ignition primer carrier and the detonator primer carrier, register with said hole of the ignition primer carrier and of said ignition primer, and an end position wherein said time-lag device is in axial alignment with said axial passage of the barrel, locking means co-acting with said external element of the body to keep said time-lag device carrier in its initial position during the rotation of said barrel, resilient means co-acting with said barrel to urge said time-lag device carrier to its end position, a conical cap formed with an axial cavity and screwed on said body to enclose said barrel in said body, means operable before the firing of the projectile, from the outside of said conical cap, to permit when desired the release of said locking means of said time-lag carrier when said barrel attains its end position, a striker mounted for axial sliding movement in said conical cap, said striker having at its front end a widened head and at the rear end a frusto-conical shoulder shaped to fit on said tapered seat of the barrel, a pin directed axially towards said primer carrier, an arming ring surrounding said striker behind said widened striker head, a spacer spring bearing with one end against said barrel and urging with its other end said arming ring and said striker to a position in which said frusto-conical shoulder of said striker is released from said tapered seat of said barrel and said striker pin is released from said primer carrier, thereby permitting to said striker and said arming ring, during the travel of the projectile in the gun bore, under the influence of the longitudinal forces of inertia and against the resistance of said spacer spring, a backward movement during which said frusto-conical shoulder of said striker engages said tapered seat and said striker pin engages said hole of said primer carrier, while said arming ring bends said radial lugs of said annular locking member to release the end portions of said lugs from said notches formed in the external element of the body and in said barrel, and means for retarding and regularizing the rotation imparted to said barrel when said body rotates under the influence of said power spring, until said barrel is stopped in its end position before which on the one hand said striker, subjected when the projectile leaves the gun bore to the sole action of said spacer spring, resumes the position in which the striker pin is released from said primer carrier, and on the other hand said means for locking said primer carrier in said barrel release said primer carrier to permit the operation of said resilient means urging said primer carrier to its end position in said barrel, whereby said striker pin may register with said ignition primer and then strike same due to the backward movement of the striker taking place at the fall of the projectile, thus causing the ignition of said ignition primer of which the fire is transmitted to said detonator and said detonating relays due to the opening of said central fire passage of said detonator primer carrier when said means for releasing said time-lag carrier locking means have not been actuated before the firing, and of which the fire is transmitted to said detonator and to said detonating relays through the medium of said time-lag device when said means for releasing said time-lag carrier locking means have been actuated before the firing.

7. A fuse as set forth in claim 6, wherein said time-lag device carrier has a radial cavity formed therein and said barrel has a radial hole registering with said cavity, the locking means co-acting with said external element of said body to keep said time-lag device carrier in its starting position in said barrel during the rotation thereof consisting of a bar having an external tip extending through said radial hole in the barrel and bearing against said external element of the body and an internal tip fitted in said radial cavity of the time-lag device carrier to retain this carrier, during the barrel rotation and the subsequent sliding movement of said external tip of the bar against the external element of the body in the initial position of said time-lag device carrier.

8. A fuse as set forth in claim 7, wherein said external element of the body is provided with a circular aperture into which the radial hole of said barrel opens when said barrel is in its end position, the means to be operated before the firing from the outside of the conical cap to permit, when desired, the release of the locking means of said time-lag device carrier when said barrel attains its end position, consisting of a stud fitted in the circular aperture formed in the external element of the body, said stud being adapted to be actuated by angular shifting from an initial position, the inner surface of said stud forming the continuation of the inner surface of the external portion of the body and having formed therein a cylindrical cavity adapted to receive the outer tip of the rod and which, when said stud is actuated, is adapted to occupy, by angular shifting from its initial position to an operative position, a position with which said radial hole in the barrel registers when said barrel is in its end position.

9. A percussion fuse for priming an explosive projectile thrown from a gun, which comprises a body consisting of a central element of this body which has an axial passage formed therethrough, and an external element of said body which is formed with an axial cavity, said central element being force-fitted in said external element and defining in said external element an annular recess, a first detonating relay screwed axially in said central element, another detonating relay screwed axially in the rear end of said central element and contacting said first detonating relay, a barrel formed with an axial hole and mounted for rotational movement in said external element at the front end of said central element, said barrel having a cylindrical outer surface in which circular expansion grooves are formed, said outer surface being in smooth frictional engagement with the inner cylindrical surface of the axial cavity of said external element, an axial hole formed in said barrel, a tapered seat having its larger diameter forwards formed in said axial hole of said barrel, a pin projecting from the rear end of said barrel and engaging a circular groove formed in said central element of the body, a peg secured in said circular groove to limit the rotation of said barrel between an initial position in which said pin engages one side of said peg and an end position in which said pin engages the other side of said peg, a power spring having its rear end anchored to said central element of the body in the bottom of the annular recess defined by this central element in the external element of the body, said power spring being wound coilwise in the forward direction around said central element and within said annular recess, said power spring having its front end secured under said barrel and urging said barrel to its end position, an annular locking member fitting on the front end of said barrel and having radially-extending lugs, the

front peripheral edges of said external element and said barrel having spaced notches formed therein which register with one another when said barrel is in its initial position in said body, said radial lugs of said annular locking member having end portions engaging said notches of said external element and said barrel to keep said barrel in its initial position in said body against the force of said power spring, an ignition primer carrier formed with an axial through hole, an ignition primer mounted on said primer carrier, a detonator primer carrier rigidly secured at the rear of said ignition primer carrier, a free gap being left between said ignition primer carrier and said detonator primer carrier, a detonator primer mounted on said detonator primer carrier to register with said ignition primer, the rigid assembly which comprises said ignition primer carrier and said detonator primer carrier being mounted for diametral sliding movement in said barrel and adapted to move from an initial position in said barrel wherein on the one hand said through hole of the ignition primer carrier is in axial alignment with said axial hole of the barrel, and on the other hand said ignition primer is in an eccentric position, to an end position of said primer carrier in said barrel, wherein said primer is in axial alignment with said axial hole of said barrel, means for locking said primer carrier in said barrel, said locking means being carried by said body and co-acting with said primer carrier to keep said primer carrier in its initial position in said barrel while releasing, for a predetermined position of said barrel in said body which is close to the end position of the barrel in said body, resilient means urging said rigid assembly comprising the ignition primer carrier and the detonator primer carrier to its end position in said barrel, a time-lag device carrier housed in said free gap between said ignition primer carrier and said detonator primer carrier, a central fire-passage formed through said time-lag device carrier, a time-lag device mounted in said time-lag device carrier, said time-lag device being slidingly displaceable from an initial position in which its central fire-passage and its time-lag device register respectively, in the initial position of said rigid assembly, with said ignition primer carrier hole and said ignition primer hole, and an end position in which said time-lag device is in axial alignment with the axial hole of said barrel, locking means co-acting with said external element of the body to keep said time-lag device in its initial position during the rotation of said barrel, said central element of the body having a radial passage formed therein whereby, in the initial positions of said rigid assembly, of said detonator primer carrier and said time-lag device carrier, said line of fire transmission of the ignition primer, time-lag device and detonator primer communicate with said annular recess formed between said central element and said external element of the body, resilient means co-acting with said barrel and urging said time-lag device carrier to its end position, a conical cap formed with an axial cavity, screwed in said body and enclosing said

barrel in said body, means adapted to be actuated from outside said conical cap before firing the fuse to permit, when desired, the release of said time-lag device locking means when said barrel attains its end position, a striker mounted for axial sliding movement in said conical cap and formed at its front end with a widened head and at the rear with a frusto-conical shoulder shaped to engage the tapered seat of said barrel, a striker pin pointing axially towards said primer carrier, an arming ring fitting on said striker behind said widened head of the striker, a spacer spring bearing against said barrel and urging said arming ring and striker to a position in which said frusto-conical shoulder of the striker is kept off said tapered seat of said barrel and said striker pin is released from said primer carrier, said striker and arming ring being adapted, during the travel of the projectile in the gun bore, under the influence of the longitudinal forces of inertia and against the force of said spacer spring, to perform a backward movement during which on the one hand said frusto-conical shoulder of the striker engages said tapered seat of the barrel and said striker pin engages the hole of said primer carrier, and on the other hand said arming ring bends said radial lugs of said annular locking member to release their end portions from the notches of the external element and of said barrel, and means retarding and regularizing the rotational movement imparted by said power spring to said barrel until said barrel is stopped in its end position before which said striker, responsive to the action of said spacer spring alone when the projectile has left the gun bore, resumes its position in which said striker pin is released from said primer carrier and before which said locking means co-acting with said primer carrier to lock same in said barrel release said primer carrier to permit the operation of said resilient means urging said primer carrier to its end position in said barrel, whereby said striker pin will register with said ignition primer and strike same due to its backward movement performed at the fall of the projectile so as to ignite said ignition primer of which the fire is transmitted to said detonator and to said detonating relays as a consequence of the opening of said central fire passage of said detonator primer carrier when said means for releasing the locking means associated with said time-lag device carrier have not been operated before the firing of the projectile, and of which the fire is transmitted to said detonator and detonating relays through the medium of said time-lag device when said means for releasing said locking means associated with said time-lag carrier have been actuated before the firing of the projectile.

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