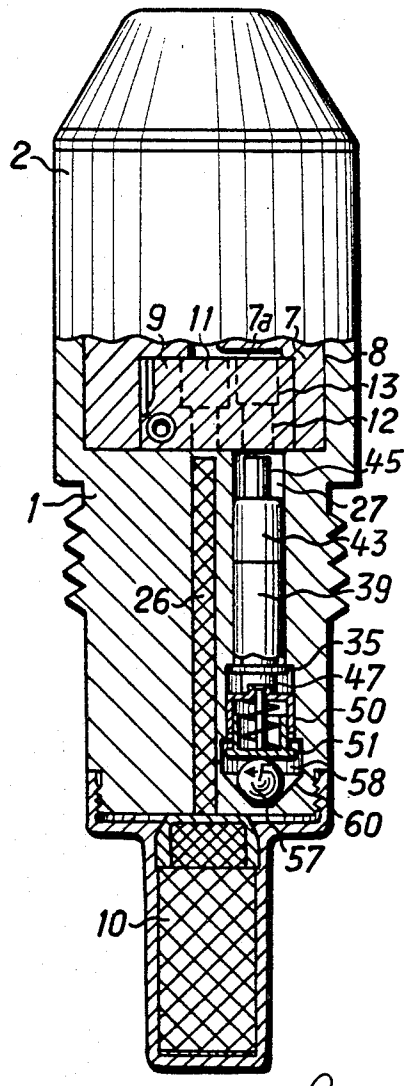
Nov. 12, 1968 R. APOTHÉLOZ 3,410,215

IMPACT FUSE FOR PROJECTILES

Filed June 20, 1967 4 Sheets-Sheet 1

Fig. 1



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IMPACT FUSE FOR PROJECTILES

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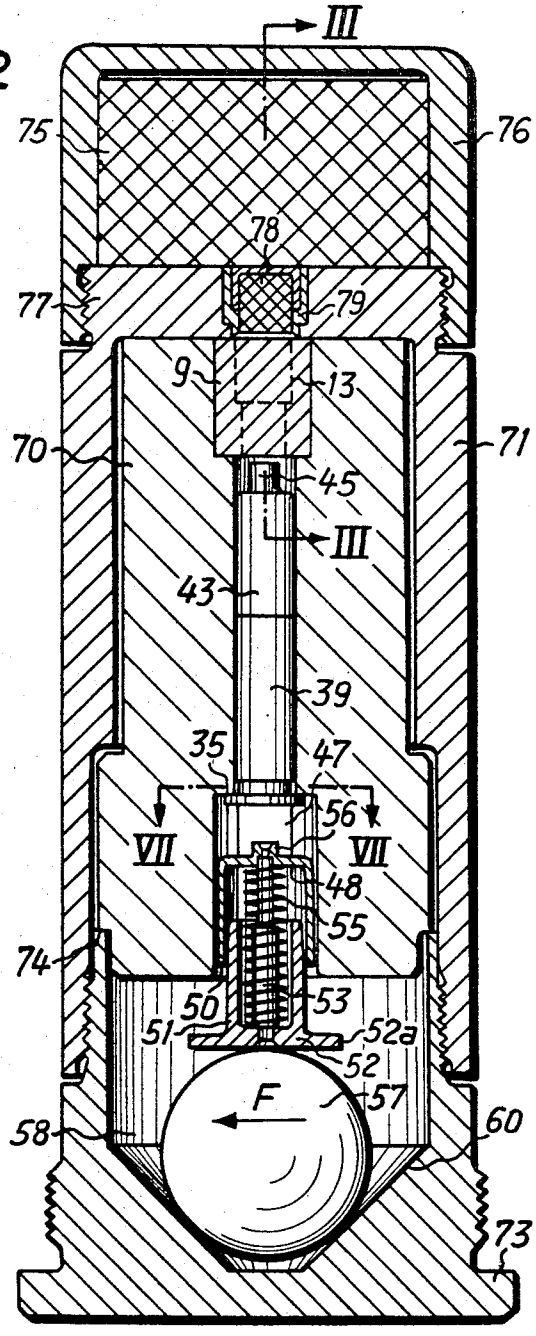
Fig. 2



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IMPACT FUSE FOR PROJECTILES

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Fig. 3

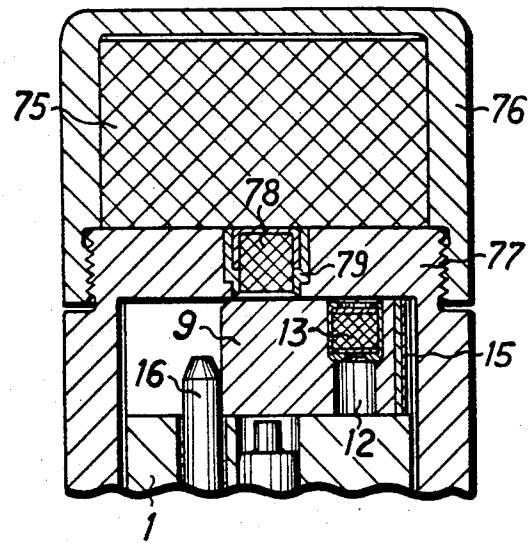
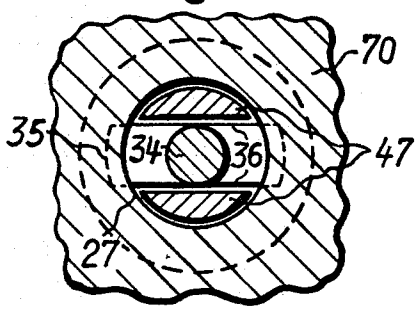


Fig. 7



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IMPACT FUSE FOR PROJECTILES

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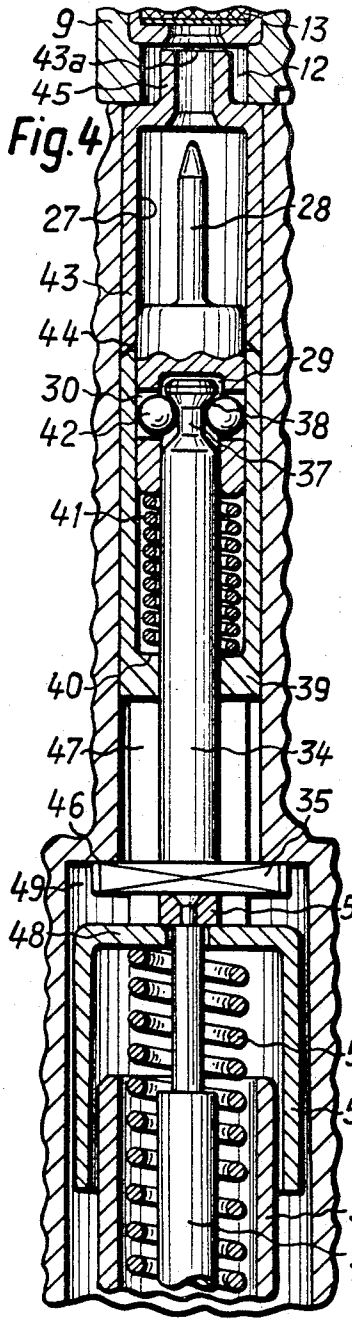

Fig.4

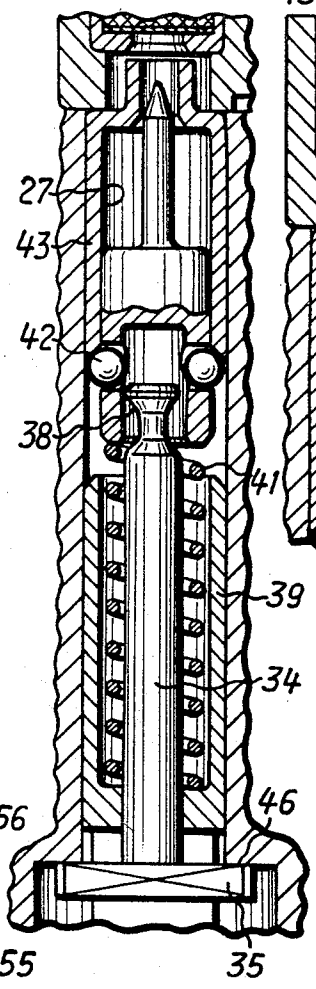

Fig.5

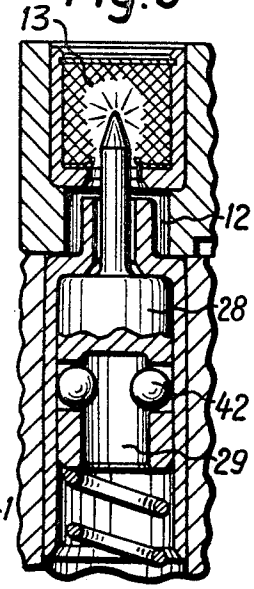

Fig.6

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3,410,215

IMPACT FUSE FOR PROJECTILES

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Claims priority, application Switzerland, June 21, 1966, 8,975/66
4 Claims. (Cl. 102—78)

ABSTRACT OF THE DISCLOSURE

Mounted in an impact fuse for projectiles are two inertia members, one of which responds to a deceleration of the projectile in the axial direction and the other to a deceleration of the projectile transversely to the axial direction of the projectile. Through said two decelerations, two locking sleeves, which hold a striker pin in a locked position through locking members, are displaced into their forward position by the inertia members, and a spring is compressed which bears on the one hand against the striker pin and on the other hand against a locking sleeve. As soon as the deceleration ceases, the one locking sleeve is displaced into its initial position under the force of the spring and the striker pin is released for the firing.

This invention relates to impact fuses for projectiles.

An object of the invention is to provide an impact fuse which responds in the event of graze shots, such as when the projectile strikes the target at a very small angle or rebounds therefrom, the priming being delayed to such an extent that the detonation only takes place after the rebound.

With the above and other objects in view which will become apparent from the following detailed description below, two embodiments of the invention are shown in the drawings in which:

FIGURE 1 shows a partial axial section of a first embodiment through a point fuse in the secured position in which a device for the delayed detonation is in its initial position.

FIGURE 2 shows a similar view of a base fuse, of a second embodiment in the secured position.

FIGURE 3 is a sectional view of section line III—III in FIGURE 2.

FIGURE 4 shows an axial section through the device for the delayed detonation for the striker pin, which is of the same construction in both examples, in the position immediately after the impact.

FIGURE 5 shows the same device as in FIGURE 4 after the release of the striker pin.

FIGURE 6 shows the same device as in FIGURE 4 at the moment of detonation, and

FIGURE 7 shows a section through the impact fuse on section line VII—VII in FIGURE 2.

Like parts are designated by the same reference numerals in both embodiments. In order to avoid repetition, both embodiments are described partly at the same time.

According to FIGURE 1, a fuse casing **1** for a non-rotating projectile, for example a mortar projectile, is screwed to a warhead **2** and carries a booster **10** at its rear end. A guide **7** which is inserted in the fuse casing **1** is provided with a groove **8** which is rectangular in cross-section and directed transversely to the fuse axis and in which there is mounted a prismatic slide **9**. In one of two bores parallel with the axis of the fuse, the slide **9** contains a primer **11** and in the other bore **12** a primer **13** adapted for contact from the rear. A spring **15**, not illustrated, which bears against the fuse housing **1** and against the slide **9**, tends to displace the slide **9** into the armed position. Before the firing, however, this is prevented by a locking sleeve **16** which is only illustrated for the example shown in FIGURE 2 and which is mounted for displacement in a longitudinal bore in the fuse casing **1** and is urged forwards into its locking position by a spring not illustrated.

The slide **9** is connected to a delay mechanism which delays the displacement of the slide from its safety position into the armed position which leads to a certain bore safety of the fuse. Such a delay mechanism is described in the Swiss patent specification No. 360,927.

According to FIGURE 1, a powder train **26** which extends from the rear edge of the slide **9** to the booster **10** is inserted in a central longitudinal bore in the fuse casing **1**, and a device for the delayed detonation is contained in a further bore **27** parallel to this.

According to FIGURE 4, a cylindrical member **34** which projects into the bore **27** comprises at its rear end an extension **35** which is directed transversely to its longitudinal axis and the lateral faces **36** (FIGURE 7) have a spacing which is equal to the diameter of the member **34** and the length of which is greater than the diameter of the bore **27**. The front end of this member **34** is provided, over the whole circumference, with an annual groove **37** which is bounded towards the front by a chamfered surface **38**. A sleeve **39**, which is movable in the bore **27**, is inverted over the member **34**. Between the bore recess **40** in the sleeve **39** and the rear end of the striker pin **28** there is inserted a spring **41**.

The front end of the member **34** projects into a bore **29** in the striker pin **28**. This is coupled to and secured by the locking balls **42** which are contained in its bores **30** directed towards the axis and which are pressed against the chamfered surface **38** of the member **34** by the pressure of the spring **41**. A sleeve **43**, the bore of which has the same diameter as that of the bore of the front portion of the sleeve **39**, bears with its faceted end face **44** against the end face of the sleeve **39**.

Since the seleve **39** bears against a bush **50** described below, the extension **35** is urged, under the action of the pressure exerted by the spring **41** on the member **34** through the locking members **42**, against the bore recess forming the shoulder **46**.

The rear, forked end **47** of the sleeve **39** engages over the extension **35** on the cylindrical member **34** and bears against the cover **48** of the bush **50** guided in a bore **49**. Guided in this bush **50** is a further bush **51** to the bottom **52** of which there is connected a pin **53** which engages through an aperture in the cover **48** of the bush **50**. A spring **55** which bears on the one hand against the bottom **52** of the bush **51** and furthermore against the cover **48** of the bush **50** urges the two bushes **50**, **51** so far apart that a dog **56** which is connected to the pin **53** and is situated in front of the bush **50** bears against the cover **48** thereof.

The spring **41** (FIGURE 4), the force of which is less than that of the pressure of the spring **55** which is transmitted to the bush **51** through the rear end **47** of the inertial sleeve **39**, through the bush **50** and the spring **55**, urges the flange **52***a* of the bush **51** against an inertia member **57** constructed in the form of a ball. This inertia member **57** is mounted in a cavity **58** in the body **1** of the fuse, the front portion of which is a cylindrical cavity widened out in comparison with the bore **49**. The cavity **58** comprises a tapered portion at the rear. The diameter of the cavity **58** is greater than the diameter of the inertia member **57** which bears against the tapered boundary surface of the cavity **58**.

The mode of operation of the point fuse described as a first embodiment is as follows:

In the position of the fuse illustrated in FIGURE 1, the slide **9** is held in its unarmed position by the locking sleeve **16**. When the fuse is in the unarmed position, the front narrowed portion **45** of the sleeve **43** extends be-

yond the slide **9**. When the projectile carrying the fuse is fired, the locking of the locking sleeve **16** is released so that this releases the slide through its backward movement. Under the pressure of the leaf spring **15**, the slide then slides with a velocity corresponding to the required bore safety, into the armed position in which the primer **13** comes to lie coaxially above the striker pin **28** (FIGURE 4).

When the projectile strikes the target with a large angle of impact, the two sleeves **39** and **43** are thrown forwards, despite the braking force exerted successively by the locking members **42** on the sleeves **39** and **43** and against the force of the spring **41**, under the action of the inertia forces acting on them themselves and the further inertia force of the inertia member **57** which is transmitted forwards to the sleeve **39** through the bushes **50** and **51** and which is added to these forces. At the end of this movement, when the shoulder on the sleeve **43** bears against the rear face of the slide **9**, the joint between the two sleeves **39** and **43** is situated in front of the locking members **42**. The spring **41** is still further tensioned by this movement of the sleeve **39** (FIGURE 4).

When the deceleration of the projectile, and hence of the fuse, has dropped to a low value, the spring **41** can move the sleeve **39** towards the rear so that the balls **42** can emerge from the annular groove **37** under the pressure of the reaction forces transmitted by the chamfered surface **38** on the member **34** and enter the space now forming between the sleeves (FIGURE 5). As a result the striker pin **28** becomes free and is thrown forwards under the action of the spring **41**. In the course of this, the balls **42** are guided inwards by the chamfered surface **44** on the sleeve **43** into the bore **29** in the striker pin so that this now travels unhindered until it strikes the sleeve **43** and contacts the primer **13** through the bore **12** (FIGURE 6). When the slide **9** is in the armed position, this primer is in spatial communication, through the groove **7***a* machined in the guide **7**, with the primer **11** and fires this as a result of which the booster **10** is caused to detonate through the powder train **26**.

When the projectile strikes obliquely, for example when it ricochets on the ground with a very small angle of impact and so is subjected to a great acceleration which acts in the direction of the arrow F (FIGURE 1) and is directed transversely to the axis and which is initially negative and then positive, the inertia member **57** is thrust forwards by a reaction force transmitted from the tapered surface **60** of its guide, during its lateral displacement effected under the action of the inertia force acting thereon. During this movement, it pushes the bushes **50** and **51**, and hence also the inertial sleeves **39** and **43** in front of it to such an extent that the joint between the sleeves lies in front of the locking members **42** so that the detonation process already described is initiated (FIGURES 4 and 5). When the acceleration directed transversely to the axis of the projectile has dropped to that value at which the detonation can take place, the sleeve **39** together with the bushes **50**, **51** and the inertia member **57** are pushed back under the pressure of the spring **41**.

The spring **55** tensioned between the two bushes **50** and **51** serves to damp shocks which the inertia member **57** exerts on the sleeve **43** during transport and during the handling of the projectile and which cause the end face **43***a* of the inertial sleeve **43** to strike against the bottom of the slide **9**. This shock absorption prevents the extension **45** of the sleeve **43** from being plastically deformed in the vicinity of its end face **43***a* and the striker pin **28** no longer being able to pass through the bore in the extension **45** of the sleeve to contact the primer **13** on impact of the projectile.

The construction of the base fuse as a second embodiment is as follows:

According to FIGURES 2 and 3, a fuse body **70** of the base fuse is fitted into a fuse casing **71** and gripped from behind by the fuse base **73** which is screwed into the fuse casing **71** and which abuts against the shoulder **74** of the fuse body **70**. A sleeve **76**, which contains the booster charge **75**, is screwed on to the front end of the fuse casing **71** and a cap **79** which holds the propagation charge **78** is inserted in a central bore taken through the cover **77** of the fuse casing **71**.

Movably mounted in a groove cut in the body **70** of the fuse and directed transversely to the axis of the fuse is the detonator-cap slide **9** which contains the primer **13** in a bore **12** penetrating through it (FIGURE 3). The detonator-cap slide **9** is subject to the action of a leaf spring **15**; furthermore, in the transport state, that is to say in the unarmed position of the fuse, the locking bush **16** mounted in the body **70** of the fuse is pushed forward as a bolt in front of the end face of the detonator-cap slide **9**. This locking bush has already been described in detail with reference to the first embodiment.

The mode of operation of the base fuse described corresponds to the mode of operation of the point fuse. When the primer **13** is contacted, the explosive charge is caused to detonate through the propagation charge **78** and the booster charge **75**,

I claim:

1. In a projectile, an impact fuze comprising a casing, a firing pin displaceable into a safety position and an armed position, a first spring urging said firing pin into said armed position, a safety element displaceable into a first and into a second position, a slide movable from a safety position to an arming position, said slide when in safety position preventing a displacement of said safety element into said second position, locking means cooperating with said firing pin which in the first position of said safety element hold said firing pin in safety position and which locking means in said second position of said safety element release said firing pin, a conical surface in said casing, an inertia body cooperating with said conical surface so that during a deceleration of the projectile transversely to the projectile axis said body is displaced on said conical surface in the direction of the projectile axis, a second spring located between said inertia body and said safety element, said inertia body being supported via said second spring on said safety element when in said first position and said inertia body during an axial and radial deceleration of said projectile when said slide is in arming position displacing said safety element against the force of said first spring from said first to said second position for releasing said firing pin and when said slide is in safety position pressing together said second spring.

2. In a projectile, an impact fuze comprising a casing, a first spring in said casing, a firing pin subject to the pressure of said spring having a safety position and an armed position, locking means to hold said firing pin in said safety position, two sleeves located one behind the other for displacement in said casing, having a first position in which both sleeves are forward in said casing, a second position in which both sleeves are to the rear in said casing and a third position in which one sleeve is forward and the other sleeve is to the rear in said housing, said rear sleeve being subject to the pressure of said spring tending to urge said rear sleeve towards the rear of said casing and to displace said firing pin into armed position, said sleeves being in said second position after the projectile has been fired, an inertia member which can be deflected transversely to the axis of the projectile and against which said rear sleeve bears under said spring pressure, said inertia member displacing both of said sleeves into said first position in the event of a resistance acting on the projectile transversely to the axis of the projectile, a holding member against which said locking means hold said firing pin in said safety position which is held in one direction between said inertia member and said rear sleeve, said locking means being secured by said front sleeve when said two sleeves are in said second

position and by said rear sleeve when said sleeves are in said first position, and said locking means being released when said sleeves are in said third position and a second spring between said inertia member and said rear sleeve.

3. An impact fuze as set forth in claim 2 wherein two bushes are provided displaceable with respect to one another in which said second spring is mounted.

4. An impact fuze as claimed in claim 3 wherein the force of said second spring is greater than the force of said first spring acting on said rear sleeve.

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