Nov. 2, 1971 F. BERGER 3,616,757

IMPACT FUSE FOR A SPINNING PROJECTILE

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Fig. 2

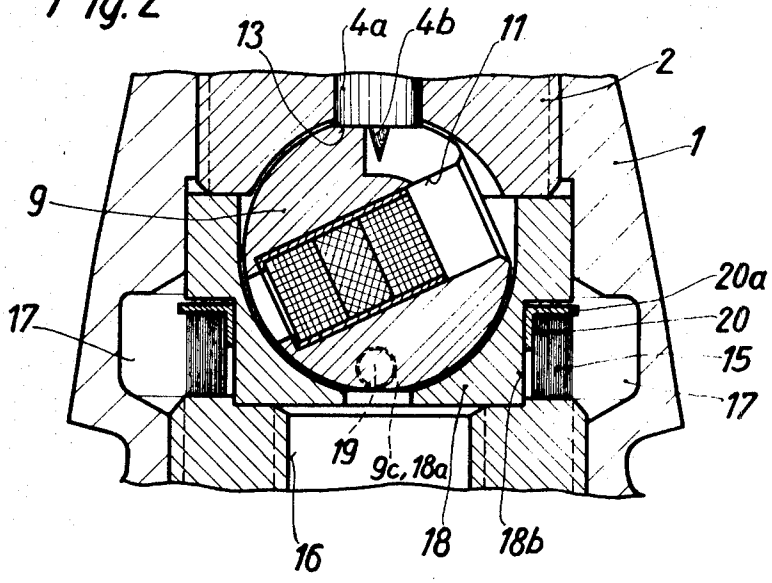
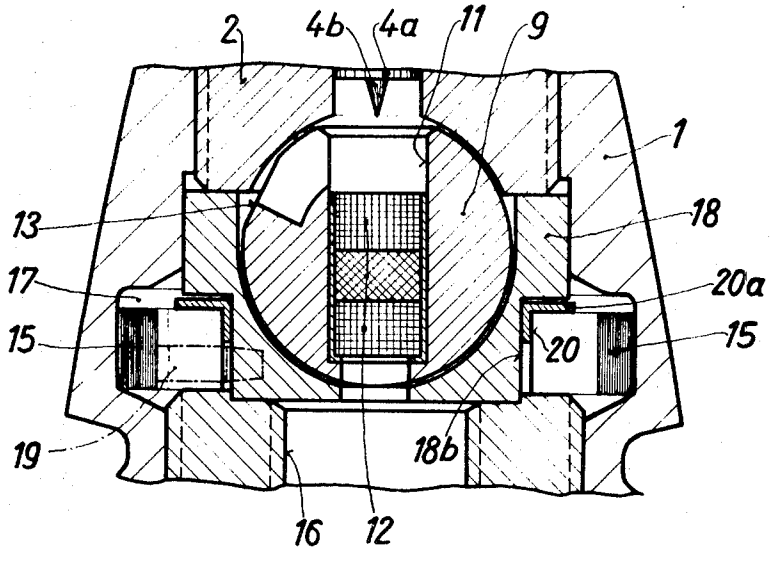


Fig. 3



Inventor:
Fritz Berger
By James D. Hamilton
Attorney

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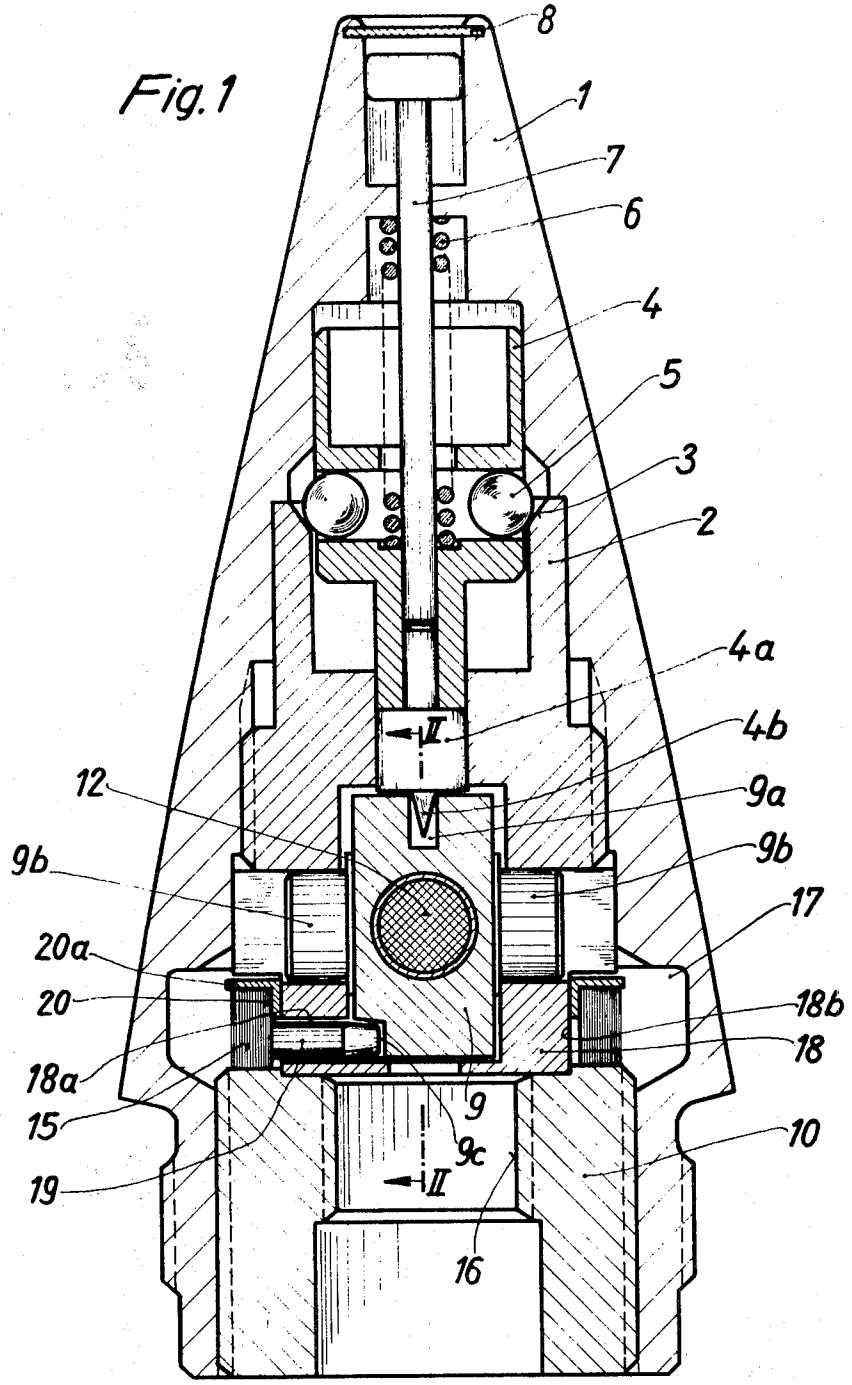
Fig. 1



Inventor:
Fritz Berger
By Edward L. Bouthagne
Attorney

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IMPACT FUSE FOR A SPINNING PROJECTILE

Fritz Berger, Dusseldorf, Germany, assignor to Firma Rheinmetall G.m.b.H., Dusseldorf, Germany

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The portion of the term of the patent subsequent to Nov. 21, 1984, has been disclaimed
Int. Cl. F42c 15/22, 15/26
U.S. Cl. 102—79 8 Claims

ABSTRACT OF THE DISCLOSURE

A percussion fuse for spinning projectiles which comprises a casing having a front part and a rear part and a sleeve secured in the rear part of the casing and having a bearing surface. A ball carrier with balls is mounted slidably in the casing and in the sleeve and has a striker pin thereon. A fuse body is secured in the rear part of the casing and spaced on the sleeve. A rotor is mounted to rotate between the fuse body and the sleeve and has a coiled band around the rotor and has a percussion cap therein. A fuse plunger is slidably mounted in the casing and extends into the sleeve. The rotor is normally held in inoperative position by the coiled band and when the projectile is fired a centrifugal spinning force will act on the band to hold the rotor in an unarmed position for a predetermined period of time, so that when the balls in the ball carrier force the latter away from the rotor, the striker pin will be in position to plunge into the percussion cap when the projectile strikes a target. The coiled band surrounds at a distance the rotor in its inoperative position, and a locking pin is disposed radially and bridging the distance engaging the inner coil layer of the coiled band and entering a recess of the rotor such, that the release and erection of the latter is possible only, when the innermost coil layer has expanded at least for the amount of depth of penetration of the locking pin into the recess.

The present invention relates to a percussion fuse for twisting or spinning projectiles, the fuse having a rotor to be righted into an ignition position under the effect of a centrifugal force and having an axially slidable striker pin bearing, in the transport position, against a supporting surface of the rotor and securing it against movement to ignition position and constitutes a further development of the subject matter of applicant's own prior Pat. No. 3,353,489, dated Nov. 21, 1961, according to which an additional locking device consisting of a radially coiled band is coordinated to the rotor.

By the installation of the coiled band with a plurality of coil layers which surround rigidly the rotor in its non-changed state like a compact spring package, an improved bore safety should be obtained.

Since the coiled band starts with the swinging only at the end of the projectile acceleration and upon full effect of the centrifugal force caused by the projectile twist, thus, only after the projectile has left the muzzle, the righting of the rotor is retarded as long, until its full peripheral face passes the innermost coil layer of the coiled band which did swing out. Now, far in front of the barrel, the rotor, which is likewise under the effect of a centrifugal force, can erect itself from its inclined position until its symmetrical axis coincides with the fuse axis. By this arrangement, the ready position for ignition is set.

It has been found that a coiled band, if it surrounds directly the rotor, is charged additionally with a friction force due to the large arc of wrap, which can affect to a disadvantage thereby a precise release of the ignition

mechanism, as the time point up to which the rotor should erect itself into the ignition position is subjected by these not always controllable friction forces to minimum timely variations. These fine time displacements in rendering the fuse sharp are, however, so minimal that they are without effect on the desired improvement of the bore safety.

It is one object of the present invention to provide a percussion fuse for twisting projectiles, wherein an error source, as small as it may be, is eliminated and a fuse type is created which is characterized not only by an improved bore safety, but also by an extremely exactly working releasing mechanism of the inner arrangement of the fuse.

It is another object of the present invention to provide a percussion fuse for twisting projectiles, wherein the coil band surrounds the rotor in its non-effected state with some distance, whereby a radially disposed locking pin bridging this distance engages, on the one hand, the inner layer of the coiled band and, on the other hand, projects into a recess of the rotor such, that the release and the erection of the same is possible only after the innermost coiled layer has swung out at least for the amount of the penetration depth of the locking pin into the rotor recess. Due to the fact that the coiled band, in accordance with the present invvention, does not engage directly the rotor, rather surrounds the latter with some distance, merely a distancing member connecting these two parts in form of a locking pin, capable of effecting the centrifugal force, is required with which locking pin, after a certain swing performance of the coiled band, the lock for the rotor is released.

In view of the point engagement between the coiled band and the rotor by means of the locking pin, the friction forces, disadvantageous for the exact fuse function, are as good as eliminated. Beyond that, by the engagement of the coiled band against a cylinder part, which does not, as the rotor, vary its position during the release of the ignition mechanism, the possibility results to guide the coiled band easily rotatable relative to this cylinder part by the use of a known running bush. This cylinder part belongs to an intermediate member disposed between the bush and a locking screw, which intermediate member receives on its collar, disposed adjacent the locking screw, the coiled band, and, furthermore, has a radial bore for reception of the locking pin, and finally serves also as a bearing for the rotor formed as a disc and equipped with lateral bearing pins.

On the other hand, in accordance with the present invention, provision has been made that the coiled band is equipped with a high friction force in axial direction, which friction force makes it possible to be maintained as long as a closed spring package under the effect of the projectile acceleration occurring during the shooting until towards the end of the acceleration, that means when the projectile has already left the muzzle, the centrifugal force can become fully effective. This is brought about such that the coiled band with the abutment edges of all coil layers opposite to the fuse point can press rigidly against the ignition body.

A fuse with a ball rotor swingably mounted in a housing has been known, which is secured by a plurality of radial pins relative to the housing. In order that the pins do not escape from the housing during transportation, and to be able to release the rotor in the ignition position, it is provided that all pins are held together by an open annular spring surrounding the housing.

Aside from the fact that the ring spring serves only the transportation safety of the fuse, this rotor safety is not only constructively very cumbersome, rather also not sufficiently reliable, since in view of the plurality of radial pins the simultaneous and uniform expansion

of the latter in order to release the rotor is not assured. Since, furthermore, the number of the radial pins expresses itself in a corresponding sum of the centrifugal force, through which again larger control forces onto the annular spring become effective, an early opening of the annular spring cannot be avoided. This should, however, just be avoided by the present invention directed to the improved bore safety.

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIG. 1 is an axial section of a percussion fuse with a self-destroying device in transport position;

FIG. 2 is a section along the lines II—II of FIG. 1; and

FIG. 3 is a section similar to that shown in FIG. 2 after completed bore safety with displaced arranged locking pin.

The self-destroying system disposed in the front portion of the fuse part corresponds with the device described in greater detail in applicant's own Pat. No. 3,353,489, and thus no further description of that part is required.

Referring now to the drawings, the device serving the bore safety is arranged in the rear fuse part and comprises a sleeve **2** receiving a stroker pin **4***a* and partly also a rotor **9** and an intermediate member **18** inserted between the sleeve **2** and a locking screw **10**, which intermediate member **18** supports itself, as can be determined from FIGS. 2 and 3, on the one hand, on the locking screw **10**, and, on the other hand, surrounding the rotor **9** by bearing towards the sleeve **2**. Suitably, the intermediate member **18** is rigidly connected with the sleeve **2** by pins or the like (not shown) and simultaneously also secured against rotation. The intermediate member **18** serves as a bearing for the rotor **9** formed as a disc and having lateral bearing pins **9***b*, as well as for reception of the coil band **15** and of a locking pin **19** arranged in a radial bore **18***a*. The radial bore **18***a*, which is disposed parallel to the rotary axis of the rotor and passes perpendicularly below the axis through the intermediate member **18**, is arranged in a recess **9***c* provided at the lower periphery of the rotor **8**. The locking pin **19** projects with its conical end into the correspondingly formed recess **19***c*.

Laterally and below the two bearing pins **9***b* is arranged the intermediate member **18**, formed as a body **18***b* set off towards the inside, which member **18** serves as abutment to the coiled band **15**. The latter, consisting of a plurality of coiled layers, engages no more directly the body **18***b*, rather engages a sleeve **20** and the opening of which is measured such that the sleeve **20**, jointly with the coiled band **15** mounted to form a slightly pretensioned compact spring package, surrounds easily rotatable the body **18***b*.

The characteristical feature of the sleeve **20** resides in an arrangement according to which, with its low height, which corresponds to about one half of the width of the coiled band **15**, only the half of the coiled band **15** which points to the fuse point is mounted thereon, whereby the corresponding abutment edges of all winding layers are covered by a broad rectangularly bent over flange **20***a*.

The abutment edges of the coiled band **15**, opposite to the fuse point, support themselves, however, on an end face of the locking screw **10**. The sleeve **20** terminates slightly above the radial bore **18**, so that the locking pin **19** comes into engagement without interference with the inner winding layer of the coiled band **15**. The length of the locking pin **19** is dimensioned such that it is movably guided in its non-effected state between the coiled band **15** and the recess **9***c* with slight play.

A hollow space **17** extending far into the ignition housing **1** is available for the coiled band **15** for expansion. By this arrangement, it is assured that the inner coil diameter of the open coiled band can assume a larger diameter, than the outer diameter of the closed coil shows.

The operation of the fuse takes place in the following manner:

In the transportation position, the rotor **9** assumes the position shown in FIGS. 1 and 2, in which the ignition channel is disposed jointly with the percussion cap **12** obliquely to the fuse axis. In this position, it is secured by the percussion pin **4***a* standing under the effect of the spring **6**, as well as above the locking pin **19** by means of the coiled band **15**.

Under the effect of the projectile acceleration during firing, the entire inner arrangement of the fuse remains in locking position, that means, what concerns the two rotor safeties, thus once the shoulder of the percussion pin **4***a* engages solidly the flat portion **13** of the rotor **9**, and, on the other hand, the rear abutment edges of all coil positions of the coiled band **15** opposite the fuse point, press against the end face of the locking screw **10**.

The acceleration of the projectile terminated only upon leaving the muzzle and the centrifugal force coming now to its full effect cause not only the release of the previously mentioned locking position, but also the start of the ignition mechanism up to sharp position of the fuse. Thus, in a succession of their movement, at first the balls **5** are displaced outwardly on the running face **3** of the bush **2**, whereby they lift the axially displaceable ball carrier **4** against the force of the spring **6** in the direction towards the fuse point. By this arrangement, also the percussion pin **4***a* is freed in the same axial direction, so that the rotor **9** is discharged.

Simultaneously, with the full effect of the centrifugal forces, also the opening of the coiled band **15** sets in for which, depending upon the length of the spring band and the number of the coil layers, an exact predetermined time period is required. Since outside of the non-essential point engagement by the locking pin **19** no friction forces affect from the outside the coiled band **15**, the predetermined opening time period for the coil band **15** can be very exactly determined and retained.

The locking pin **19** disposed in the radial bore **18***a* must remain in locking position in spite of the effect of the centrifugal force, as long until the innermost coil layer of the coiled band **15** starts its opening by setting off from the sleeve **20**.

The innermost coil layer must at least be capable of swinging for the amount of the penetration depth of the locking pin **19** into the rotor recess **9***b*, so that the rotor **9** becomes free relative to the locking pin **19** and can erect itself due to its own erection moment from the oblique position such that the percussion cap **12** is disposed directly opposite to the percussion pin **4***a* with the precussion point **4***b*.

In order to assure that the locking pin **19** releases in each case the rotor **9**, it is suitable to dimension the hollow space **17** such that the inner coil layer can open up for a larger degree relative to the rest position of the coiled band than the locking pin **19** for releasing of the rotor.

Thus, in accordance with FIG. 3, the flight length of the projectile designated as bore safety is terminated. This position shows the locking pin **19** which is set off for 90°. If the fuse now hits the target object, during impression of the percussion point and the fuse plunger **7** with the striker point **4***b*, the percussion cap **12**, freely disposed in the rotor **9**, is pierced, which, in turn, brings about a transmission load (not shown) and thereby the explosive charge detonation.

This fuse, to be used universally with an abutment- and self-destroying device and with a real improvement of the bore safety, which fuse has an extremely simple structure and a remarkable function safety, can be dimensioned with the same precision such that it is applicable for large

caliber, as well as for small caliber projectiles, down to 2 cm. projectile caliber.

The overwhelming advantage of this fuse resides in the fact that now, with this fuse, also the 2 cm. ammunition equipped with this fuse is available to a more manifold range of applications than possible before.

I claim:

1. A percussion fuse ofr spinning projectiles, comprising

a casing having a front part and a rear part,

a sleeve secured in the rear part of said casing and having a bearing surface,

a ball carrier with balls mounted slidably in said casing and in said sleeve, and having a striker pin thereon,

a fuse body secured in the rear part of said casing and spaced from said sleeve,

a rotor mounted to rotate between said fuse body and said sleeve and having a coiled band around said rotor and having a percussion cap therein,

a fuse plunger slidably mounted in said casing and extending into said sleeve,

said rotor being normally held in inoperative position by said coiled band and when said projectile is fired a centrifugal spinning force will act on said band to hold said rotor in an unarmed position for a predetermined period of time, so that when said balls in said ball carrier force the latter away from said rotor, said striker pin will be in position to plunge into said percussion cap when said projectile strikes a target,

said coiled band surrounds at a distance said rotor in its inoperative position, and

a locking pin disposed radially and bridging said distance engaging the inner coil layer of said coiled band and entering a recess of said rotor such, that the release and erection of the latter is possible only, when the innermost coil layer has expanded at least for the amount of depth of penetration of said locking pin into said recess.

2. The percussion fuse, as set forth in claim 1, wherein

said rotor comprises a disc having lateral bearing pins, and includes

an intermediate member disposed between said sleeve and a fuse body,

said rotor being mounted in said intermediate member,

said intermediate member having an end face set off laterally and inwardly below said two bearing pins, and

said end face is an abutment for said coiled band and

is equipped with a passing radial bore for receiving said locking pin.

3. The percussion fuse, as set forth in claim 2, wherein

said radial bore for said locking pin is disposed parallel to the rotary axis of said rotor and passes perpendicularly below the latter through said intermediate member, as well as arranged opposite said recess provided at the lower periphery of said rotor.

4. The percussion fuse, as set forth in claim 3, wherein

said recess is of a configuration complementary to the conically set off end of said locking pin.

5. The percussion fuse, as set forth in claim 4, wherein

the length of said locking pin is measured such, that it is movably guided with slight play between said coiled band and said recess in the inoperative position of said locking pin.

6. The percussion fuse, as set forth in claim 5, wherein

said coiled band is mounted with pretension on a sleeve, which in turn engages easily rotatable the outer face of said intermediate member.

7. The percussion fuse, as set forth in claim 6, wherein

said sleeve corresponds with its height to about half of the width of said coiled band,

said sleeve received the half of said coiled band pointing towards said ignition point, and

said locking pin is freely passable directly below said ignition point.

8. The percussion fuse, as set forth in claim 6, wherein

said sleeve is rectangularly bent to form a wide flange, which overlaps the abutment edges, pointing towards said ignition point, of all layers of said coiled band, and

the abutment edges of said coiled band, pointing opposite the ignition point, support themselves against an end face of said fuse body.

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BENJAMIN A. BORCHELT, Primary Examiner

J. J. DEVITT, Assistant Examiner

U.S. Cl. X.R.

102—71