

[54] PERCUSSION FUSE FOR PROJECTILES

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1,689,470 10/1928 Adelman.....102/76 P
2,870,713 1/1959 Saloranta et al.....102/78

FOREIGN PATENTS OR APPLICATIONS

342,099 6/1904 France 102/78

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[58] Field of Search.....102/76, 77, 78, 79,
102/80, 70

[56] References Cited

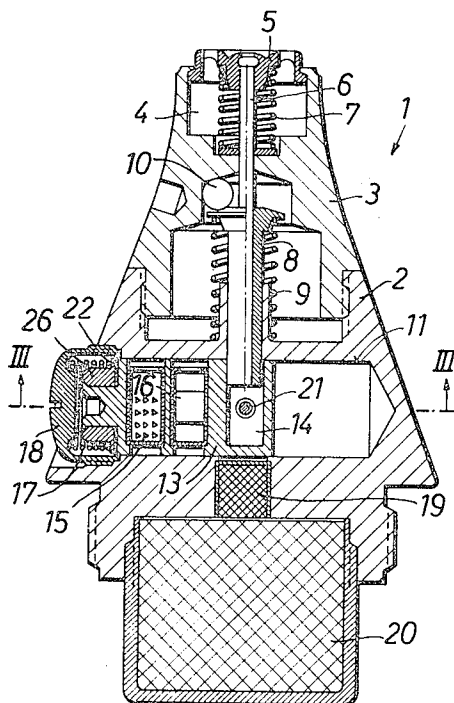
UNITED STATES PATENTS

2,705,921 4/1955 Moseman, Jr.....102/78
2,958,285 11/1960 Marshall.....102/76 R
1,848,355 3/1932 King.....102/76 P

[57] ABSTRACT

A percussion fuse for use in projectiles includes a cylindrical bore in a housing and a carrier in the bore for supporting at least one primer and which is moved to a fusing position where it may be detonated following firing of the projectile. A resilient deformable seal ring is attached to the carrier and is deformed by the walls of the bore during movement therethrough to retard movement of the carrier and delay fusing. A multiple position stop device may be used to stop a selected one of a plurality of different primers at the fusing position.

5 Claims, 9 Drawing Figures



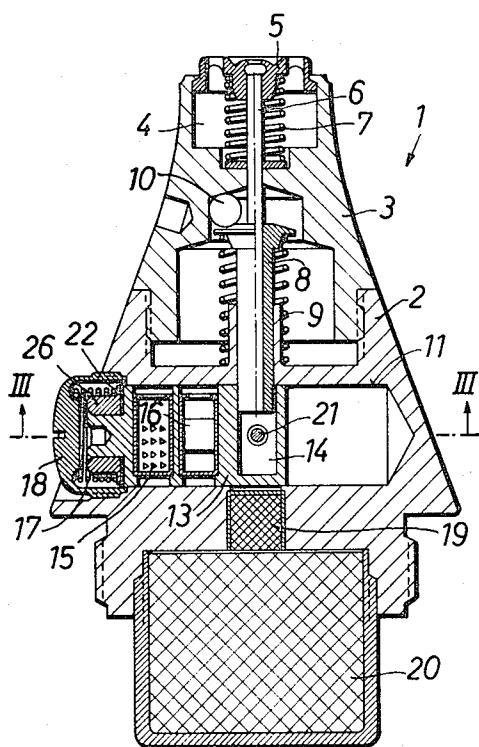


FIG. 1

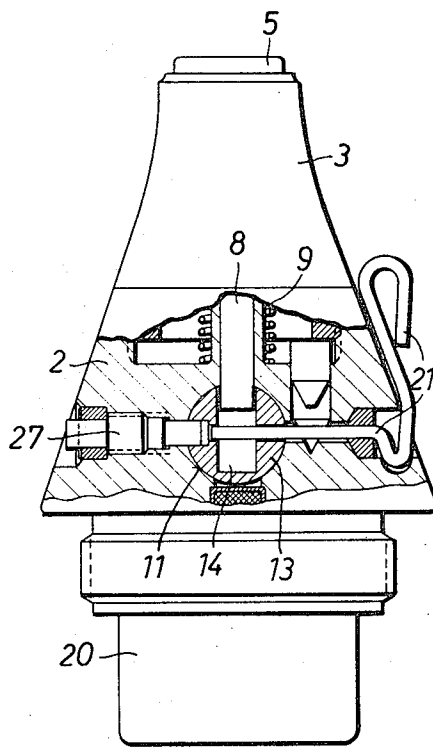


FIG. 2

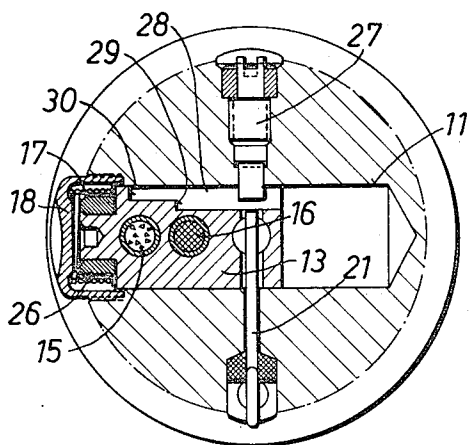


FIG. 3

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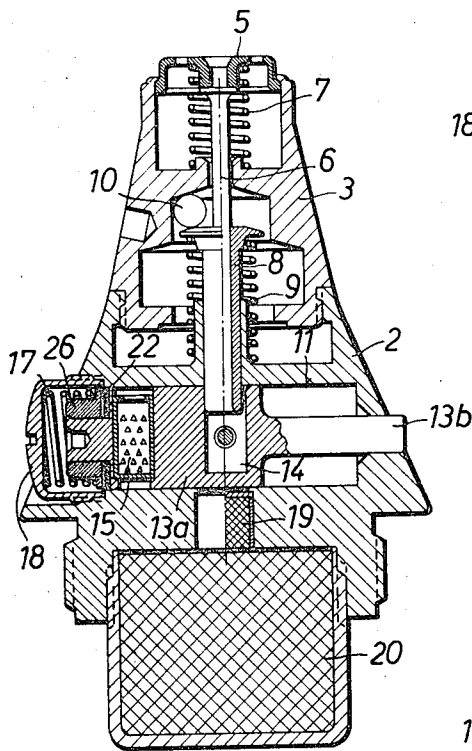


FIG. 4

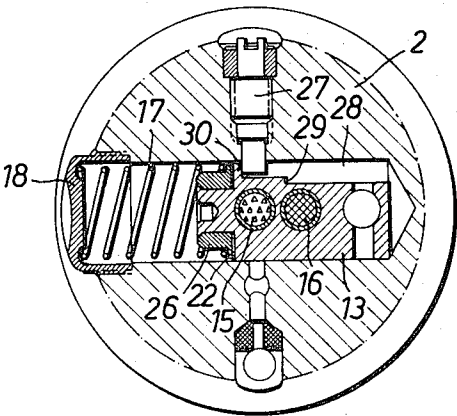


FIG. 8

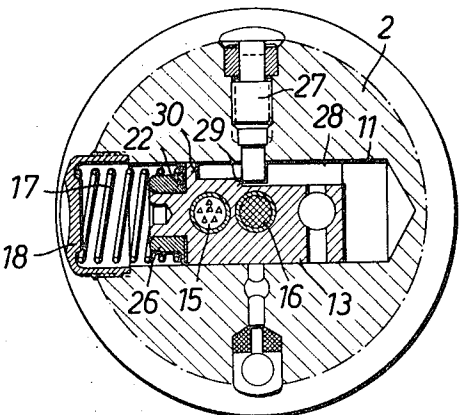
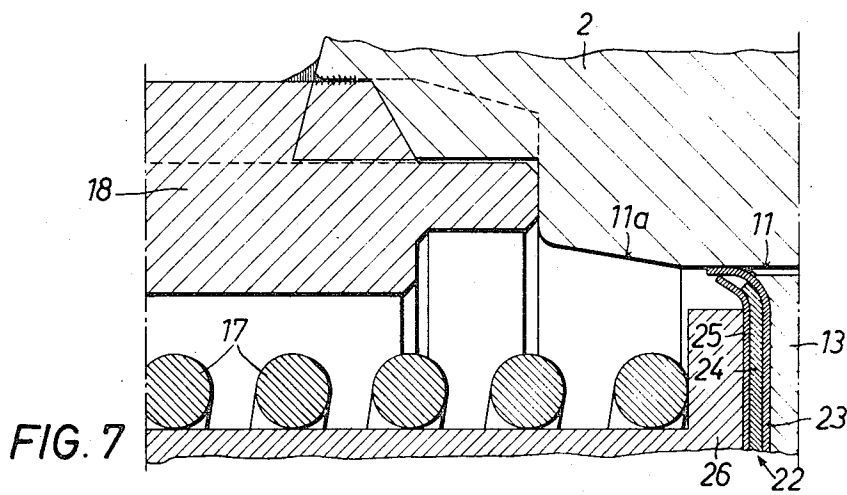
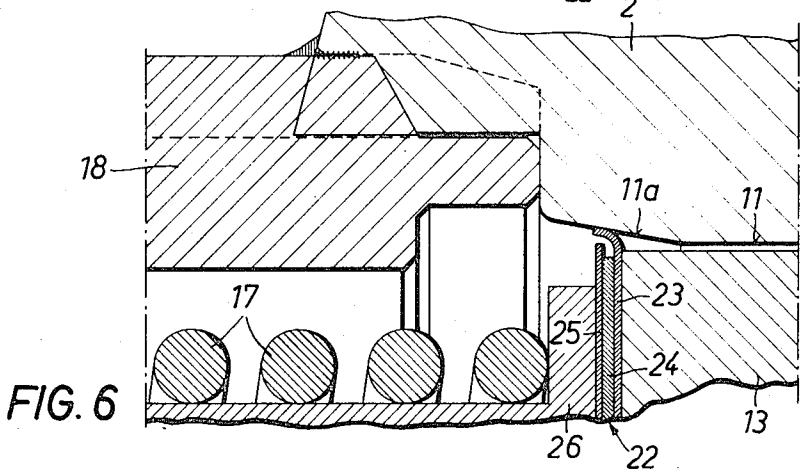
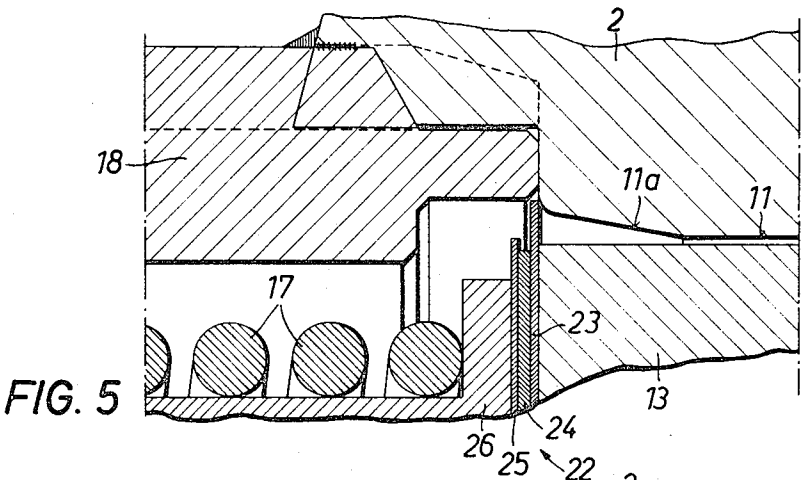


FIG. 9

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PERCUSSION FUSE FOR PROJECTILES

This invention relates to improvements in percussion fuses for use in projectiles and more particularly to a construction for a percussion fuse which retards movement of a primer carrier and moves any one of a plurality of primers to fusing position.

A commonly known form of percussion fuse includes a carrier for supporting a primer which is movable from a releasably locked position to a fusing position where it may be detonated by a needle-bolt. Movement of the carrier to the fusing position is accomplished by spring means. The primer carrier is released from its locked position by a safety device only after the projectile has left the gun barrel. The spring means then acts to press on the primer carrier moving the primer carrier and causing the primer to be positioned within the range of action of the needle-bolt.

To avoid sudden movement of the primer carrier to the fusing position following its release, a delay device is required. A common form of delay device is a gear and escapement mechanism which is coupled to the primer carrier. Such a mechanism includes a greater number of separate mechanical parts requiring a substantial amount of space in the fuse casing and also is expensive since the mechanical parts must be manufactured with high precision. Such a mechanism has the further disadvantage that it is sensitive to shock and blows, thus requiring a special mounting arrangement in the fuse casing. Assembly of a fuse requiring such a mechanism is costly.

It is an object of this invention to produce a percussion fuse with a primer carrier having a delay mechanism to delay movement of the primer carrier and which is more simply constructed and is safer in design.

According to the invention a bore is provided in a housing for containing a slidably mounted carrier means for supporting at least one primer. The carrier is movable between a position where it is retained by a releasable locking device and where the primer itself is outside of the range of action of a primer detonation device and a position where the primer may be detonated by the detonation device. Spring biasing means is provided to move the carrier between the locked position and the fusing position, but this movement is retarded by a resilient deformable means such as an encircling seal ring mounted on the carrier which cooperates with the cylindrical bore of the housing and is deformed during movement of the carrier.

A delay time which is much longer than has been obtainable with previously known mechanisms is possible with the delay mechanism of the present invention. At the same time, the construction of the delay mechanism is greatly simplified and all mechanically moving parts of previously known delay mechanisms are eliminated. The delay in movement of the primer carrier is effected solely by the deformation of the seal ring as the spring means pushes the carrier towards the fusing position. No additional space is required for the delay mechanism. Other advantages of the improved delay mechanism include its reliability even under conditions of extreme cold, e.g., -40°C which is not possible with previously known delay mechanisms.

Delay is not only caused by the deformation of the seal ring but also by the fact that air pressure builds up

in the bore in which the primer carrier is located in advance of the seal ring as it is being pushed towards the fusing position. Thus, the carrier and the spring means must overcome a back pressure as it moves forward. Furthermore, the seal ring causes a vacuum to be generated behind it as it moves towards the fusing position whereby a cumulative double delay effect is obtained. It will be appreciated that the safety of the fuse is considerably increased in view of the lengthened duration of travel of the primer carrier. Furthermore, since the overall assembly is simplified the fuse housing itself can be shortened.

Optionally, the cylinder bore in the fuse housing may be conically shaped whereby deformation of the seal ring producing the time delay is more efficiently initiated. Thus, the deformation progresses gradually as the carrier moves along the bore and there is less chance that the carrier movement might be stopped prematurely by the resistance caused by the seal ring in contact with the cylinder bore wall.

The seal ring itself comprises at least one seal washer of elastic material such as a rubber or elastic plastic. Polytetrafluorethylene known commercially as "Teflon" is a preferred material. The seal washer may be retained between the carrier itself and a bush mounted on the carrier. Optionally, several seal discs having different diameters may be used. In such instances the washer in the forward position with respect to the direction of movement of the carrier is larger in diameter than the cylinder bore. If there are two further washers, the one contiguous to and behind the first washer is smaller than the diameter of the carrier while the next adjacent washer has a larger diameter than the carrier. The deformed projecting part of the largest seal washer is supported by the deformation of the other seal washers as pressure is applied against the inner wall of the bore. Thus, a tight sealing effect is obtained between the carrier and the associated bore which effectively assists the build-up of air pressure on one side of the seal device and a vacuum on the other side. An increase in the delay effect is thereby obtained.

According to another feature of the present invention, the carrier may be designed to support more than one primer, the primers being spaced apart longitudinally along the carrier. This is desirable where a selection of primers is desired which when detonated will act at different speeds. In such instances the carrier is provided with a step-shaped groove which may be engaged by a set screw mounted in the housing. Thus, by adjustment of the set screw movement of the primer carrier can be limited to one of a number of positions whereby the selected primer may be located at the fusing position when the carrier stops.

Having described the invention generally, a preferred embodiment will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a longitudinal section of a percussion fuse according to the invention;

FIG. 2 is a side view of the fuse of FIG. 1 partially in section to show the central part in the transverse medial plane;

FIG. 3 is a cross-section along the line III—III of FIG. 1;

FIG. 4 is a further embodiment of a percussion fuse according to the invention shown in longitudinal section;

FIGS. 5, 6 and 7 show the delay mechanism in detail at various stages during movement of the primer carrier; and

FIGS. 8 and 9 show the movable primer carrier of FIG. 3 in two further positions.

The fuse shown generally at 1 includes a casing 2 having a cap portion 3 which conveniently is screwed into place on the casing. The cap portion 3 includes a bore 4 in which a needle-bolt 6 is slidably mounted. The needle-bolt 6 includes a head 5 and is held in the percussion position by the helical and compressible spring 7. An inertia shell 8 surrounds the needle-bolt 6 and is retained in a normal position by helical and compressible spring 9 which presses against the head portion of the inertia shell 8 at the one end and against the casing 2 at the opposite end. The head portion of the inertia shell presses against and retains retaining balls 10 in position. A transverse bore 11 in casing 2 contains a transversely movable primer carrier 13 which itself includes a bore 14 having a closed end. The bore 14 is designed to receive one end of the inertia shell 8 which is normally positioned only a short distance into the bore 14. A plurality of primers 15 and 16 are arranged longitudinally in carrier 13, each of the primers having a different rate of action when detonated. Carrier 13 is biased towards the right as seen in FIG. 1 by helical spring 17 which engages at its one end a screw cap 18 and the carrier 13 at the opposite end. A preliminary percussion cap 19 is located adjacent the transverse bore 11 and a main percussion cap 20 is located on the opposite side of the preliminary percussion cap 19.

In the embodiment shown in FIG. 4 the primer carrier 13a is provided with an extension 13b which extends out of the casing 2 to indicate externally the position of the carrier 13a.

In both embodiments the primer carrier 13, 13a is secured against movement within the bore 11 by the engagement of the inertia shell 8 in bore 14. As an additional safety precaution, the primer carrier may be additionally secured by a wire clip 21 which is inserted from the outside. When the gun barrel is loaded with the projectile, the wire clip 21 is removed.

Upon firing the projectile the inertia shell 8 will be driven downwardly as seen in FIG. 1 compressing spring 9 and the end of the inertia shell 8 will extend more deeply into bore 14 in the carrier 13. The movement downwardly of the head of the inertia shell 8 releases the retaining balls 10 which drop aside into the space surrounding the spring 9. As acceleration of the projectile decreases the spring 9 overcomes the inertia of shell 8 and moves the shell upwardly beyond its original position since the head of the shell is no longer blocked by the retaining balls 10. The opposite end of the shell 8 moves out of the closed bore 14 in the carrier 13 thereby releasing the carrier. Spring 17 then pushes the primer carrier 13 towards the right as seen in FIG. 1.

At this point, the delay mechanism 22 begins to take effect. It consists of a sealing device having at least one seal washer. In the embodiment shown, the washers 23, 24 and 25 are secured between the primer carrier 13

and a bush 26 pressed onto the end of the carrier. The washer 23 which is contiguous to the carrier body 13 has the largest diameter which is greater than the diameter of bore 11 in which the primer carrier 13 is movably positioned. The seal washer 25 adjacent to bush 26 is greater in diameter than that of primer carrier 13 while the intermediate washer 24 is smaller in diameter than the diameter of carrier 13.

With reference to FIGS. 5, 6 and 7, the entry to bore 11 is conical at 11a, the purpose being to facilitate the entry of the elastic seal washer 23 as it is deformed during movement of the carrier 13. As the spring 17 pushes the carrier 13, the projecting part of the seal washer 23 begins to deform and is bent down adopting an arcuate shape against the conical surface 11a. The deformation increases as the carrier moves further along past the conical part 11a and then the deformation is stabilized as the carrier moves beyond the conical portion 11a. Since all three washers 23, 24 and 25 project over the flange section of bush 26, washers 25 and 24 are also elastically deformed when the primer carrier 13 is pushed further into bore 11. The diameter of washer 25 is preferably such that this washer 25 comes to bear on the bent-down washer 23 thus reinforcing the pressure of the bent part of washer 23 against the walls of cylindrical bore 11. The same reinforcement is obtained from the bending of the thicker intermediate washer 24. A substantially air-tight seal is maintained between the primer carrier 13 and bore 11 so that the air in bore 11 in advance of the washers is compressed causing a counter-pressure to the action of spring 17. At the same time, a vacuum is generated in the space on the opposite side of the washers. This also contributes to the delay in the movement of primer carrier 13. Thus after carrier 13 or 13a has been released by the inertia shell 8, the delay mechanism 22 is actuated as the result of the elastic deformation of the washers. The action of spring 17 becomes only slowly effective, and in this way the safety of the fuse is considerably increased and extended in time.

A set screw 27 is provided which may be regulated to adjust its extension into groove 28 in the carrier 13 or 13a. The bottom of the groove 28 is stepped to provide stop surfaces 29 and 30. By regulating the extension of set screw 27 into groove 28, the length of movement of the carrier 13 can be controlled depending upon which stop surface 29 or 30 the end of the set screw 27 contacts. For the slowly acting primer 16 to be moved into fusing position, the set screw 27 is adjusted to project far enough that the primer carrier 13 is stopped when stop 29 reaches the end of the set screw 27 (FIG. 9). With the set screw 27 in a less extended position, stop surface 30 will come into contact with the end of the set screw so that the faster acting primer 15 is stopped at the fusing position below needle-bolt 6.

With the arrangement of more than one primer in the carrier 13, there is no need to exchange primers when a different primer is required. The fuse can be set to the fast or slow primer at any time before firing. Also, the set screw 27 can be designed as an additional safety device if it is adjusted to contact the surface of the carrier 13 while the carrier is in its retracted position. Thus, before the projectile is loaded in a gun, the set screw must be adjusted to one of the predetermined positions depending upon the primer desired.

While a preferred embodiment has been illustrated and described, it will be understood by those familiar with the art that the invention is capable of numerous modifications without departing from the spirit of the invention.

I claim:

1. A percussion fuse for use in projectiles comprising
 - a. a housing,
 - b. primer detonation means movable along a first path in said housing,
 - c. a bore in said housing defining a second path intersecting said first path, said bore being closed at the opposite ends thereof and forming a closed chamber at said opposite ends,
 - d. carrier means for supporting at least one primer and movable along said bore between a retained position adjacent said one end of said bore and at least one fusing position,
 - e. means biasing said carrier means towards said fusing position, and
 - f. inertia actuated releasable locking means for retaining said carrier means in said retained position and against movement by said biasing means towards said fusing position,
 - g. said carrier means including sealing means engaging the surface of said bore to cause a vacuum to be created in said bore between one end thereof and said sealing means and increasing pneumatic pressure to be created in said bore between the opposite end of said bore and said sealing means as said carrier means, upon release of said locking means, moves from said retained position towards said fusing position,
 - h. whereby movement of said carrier means by said biasing means and fusing of said percussion fuse is delayed.
2. A percussion fuse as claimed in claim 1 wherein said bore is cylindrical and said sealing means comprises at least one deformable seal element mounted on said carrier means and having a greater peripheral diameter than said bore for engaging the surface of said bore.
3. A percussion fuse as claimed in claim 1 wherein said carrier means includes a plurality of stepped abutment means and means to support a plurality of primers arranged longitudinally thereon, said housing comprising adjustable stop means for engaging one of said stepped abutment means whereby any one of said primers can be preselected to automatically move to said fusing position by regulation of said stop means.
4. A percussion fuse for use in projectiles comprising
 - a. a housing,
 - b. primer detonation means movable along a first path in said housing,
 - c. a cylindrical bore in said housing defining a second path intersecting said first path, said bore being closed at at least one end, sssssss
 - d. carrier means for supporting at least one primer and movable along said bore between a retained position adjacent said one end of said bore and at least one fusing position,
 - e. means biasing said carrier means towards said fusing position, and
 - f. inertia actuated releasable locking means for retaining said carrier means in said retained position

- tion and against movement by said biasing means towards said fusing position,
- g. said carrier means including sealing means engaging the surface of said bore to cause a vacuum to be created in said bore between said one end thereof and said sealing means as said carrier means, upon release of said locking means, moves from said retained position towards said fusing position,
 - h. said sealing means comprising at least one deformable seal element mounted on said carrier means and having a greater peripheral diameter than said bore for engaging the surface of said bore, and
 - i. at least a portion of said bore having a conical configuration with a progressively decreasing cross-section in the direction of said fusing position to progressively deform the periphery of said seal element as said carrier means moves towards said fusing position,
 - j. whereby movement of said carrier means by said biasing means and fusing of said percussion fuse is delayed and at the same time the possibility of said carrier means being prematurely stopped during movement towards said fusing position is reduced.
5. A percussion fuse for use in projectiles comprising
 - a. a housing,
 - b. primer detonation means movable along a first path in said housing,
 - c. a cylindrical bore in said housing defining a second path intersecting said first path, said bore being closed at at least one end,
 - d. carrier means for supporting at least one primer and movable along said bore between a retained position adjacent said one end of said bore and at least one fusing position,
 - e. means biasing said carrier means towards said fusing position, and
 - f. inertia actuated releasable locking means for retaining said carrier means in said retained position and against movement by said biasing means towards said fusing position,
 - g. said carrier means including sealing means engaging the surface of said bore to cause a vacuum to be created in said bore between said one end thereof and said sealing means as said carrier means, upon release of said locking means, moves from said retained position towards said fusing position,
 - h. said sealing means comprising a pair of deformable seal elements mounted on said carrier means a spaced distance from each other, one of said seal elements having a peripheral diameter greater than that of said bore and the other of said seal elements having a peripheral diameter greater than that of said carrier means and an intermediate element mounted on said carrier means positioned between said one and other seal elements and having a peripheral diameter less than that of said carrier means whereby said other and intermediate elements reinforce the pressure of said one seal element against the surface of said bore to maintain a substantially airtight seal,
 - i. at least a portion of said bore having a conical configuration with a progressively decreasing cross

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section in the direction of said fusing position to progressively deform the periphery of said seal element as said carrier means moves towards said fusing position to further delay movement of said carrier means but at the same time reduce the possibility of said carrier means being prematurely

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stopped during movement towards said fusing position,
j. whereby movement of said carrier means by said biasing means and fusing of said percussion fuse is delayed.

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