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## (54) PERCUSSION FUSE FOR PROJECTILES


(71) We, OY TAMPELLA AB, a Finnish Company, of Tampere, Finland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—


The invention relates to a percussion fuse for projectiles.

Percussion fuses are known, whose transversely-movable primer carrier is movable into the fusing position by means of a propulsive spring, and can be secured in the fused position by a locking device movable in the fuses' longitudinal direction. In this case the primer is located outside the path of movement of a longitudinally-movable striker pin or the like arranged in front of the primer carrier. The movement of the primer carrier is initiated by means of a safety device only after the projectile has left the barrel. The propulsive spring can then act, pressing on the transversely-movable primer carrier, so that the carrier comes to rest in the extension of the axis of the striker pin. In order that, despite initiation of the transverse movement of the primer carrier, this movement does not take place so quickly, a method is known of incorporating an additional delay device. This consists, for example, in coupling the primer carrier by means of toothing with gearwheels whose rotation is delayed by incorporation of an escapement. This involves incorporating an entire mechanism made up of many separate mechanical parts. For this purpose not only is much space needed in the fuse casing, but such a delay mechanism is extremely expensive and demands high precision of the interacting parts. Furthermore, the incorporated propulsive mechanism is sensitive to shocks and blows. The drive-wheels must be perfectly mounted in a setting capable of withstanding any shock. In addition the assembly of such a fuse is costly.

The purpose of the invention is to make a percussion fuse with transversely-movable primer carrier, in which the delay mechanism for the transverse movement of said primer carrier is constructively simpler, and whose action is safer in design.

According to the invention there is provided a percussion fuse for projectiles, comprising a primer arranged in a primer carrier movable in a cylindrical bore transversely of the fuse from a safety position where the primer is outside the path of movement of a striker pin arranged in front of the carrier and movable longitudinally of the fuse, to a priming position where the primer is in the path of the striking pin, a spring urging the carrier from the safety position towards the priming position, a locking device movable longitudinally of the fuse for releasably holding the carrier in the safety position, and an elastic seal ring encircling the carrier and which elastic seal ring, when the primer carrier is released from its safety position, is deformed elastically and frictionally engages the wall of the cylindrical bore and so retards the movement of the carrier into the priming position.

By means of such a design a delay time is obtained which is much longer than that of the known mechanism. Furthermore, the construction is very simple and no additional space is needed to provide the delay. The invention functions perfectly, and is reliable. In particular, the invention even operates perfectly in extreme cold, e.g. −40°C, which is not the case with known delayed percussion fuses. The delay may be provided not only by the elastic deformation and frictional engagement of the projecting part of the seal ring, but also a pressure build-up in the bore in which the primer carrier moves, in front of the seal ring, the spring for the carrier having in addition to act against this pressure. Behind the seal ring, a vacuum may build up, also to be overcome by the spring. There therefore ensues a cumulative double delay effect. In this way the barrel safety of the fuse is considerably increased, and lengthend in duration. Assembly is simpler, and the fuse

body can be made shorter than before.

The cylinder bore advantageously opens out conically at the end facing the carrier's spring. The elastic deformation of the seal ring contributing the delay is thus more efficiently initiated. Furthermore, this increases the functional security of the effective delay.

The seal ring may have at least one seal washer of elastic material. Rubber or a rubbery elastic plastic may be used as a material, particularly on a polytetrafluoroethylene base. The seal washer is advantageously arranged between the carrier and a bush which is under the influence of the spring. This provides a simple setting and attachment.

If several seal discs are used, they should have different diameters. In this case the washer adjacent to the carrier is advantageously larger in diameter than the cylinder bore in which the carrier is movably arranged. A further washer can have a larger diameter than the carrier. Further, an intermediate washer can be provided which is smaller than the diameter of the carrier. In this way it can be brought about that the elastically-deformed projecting part of the largest seal washer is supported by the elastic deformation of the other seal washers in the direction of the pressure of the seal washer against the inner wall of the bore. Thus an absolute sealing effect is obtained between carrier and associated bore, which can effectively assist the build-up of high pressure on one side, and of a relative vacuum on the other side of the seal device. At the same time this gives rise to an increase in the delay effect.

The transversely-movable carrier may have more than one primer, the primers being spaced apart longitudinally along the carrier. In this case the carrier may be provided with a step-shaped groove in which a set-screw can engage. In this way the movement of the primer carrier can be limited in more than one position. One primer can be designed to act more slowly, and the other more quickly. By means of the creeping movement of the primer carrier resulting from the delay mechanism according to the invention, an exact detent of the carrier at the respective stages, reliably ensuring that only that primer comes into action which is selected as a stop by the set-screw, is obtained.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 shows a longitudinal section of a percussion fuse according to the invention;

Fig. 2 is a side view of the fuse in Fig. 1 with a partial section of the middle part in the transverse medial plane;

Fig. 3 shows a cross-section along line III—III of Fig. 1;

Fig. 4 shows a further embodiment of a percussion fuse according to the invention, in longitudinal section;

Fig. 5 shows a delay mechanism on a primer carrier, on a larger scale, in section, and before it becomes active;

Figs. 6 and 7 show the phases of the action of the delay mechanism when the primer carrier is moved;

Figs. 8 and 9 show further positions of the transversely-movable primer carrier according to the sectional view in Fig. 3.

Fuse 1 has a casing 2 with a screwed-on cap 3, in whose bore 4 the head 5 of a striker pin 6 is movably set, striker pin 6 and head 5 being held in the percussion position under the influence of a spring 7. Further, an inertia shell 8 is provided, under the influence of spring 9, and whose head section cooperates with retaining balls 10. The transversely-movable primer carrier 13, which has a closed bore 14, is located in a transverse bore 11 of casing 2; the inertia shell 8 engages in the secure position in said bore 14. Primers 15 and 16 are arranged in succession in carrier 13. One primer has a slower action than the other. Carrier 13 is under the influence of push-in spring 17, arranged inside a screw cap 18, which serves as an outer counter-surface for push-in spring 17. The preliminary percussion cap is designated by 19 and the main percussion cap by 20, both arranged in casing 2.

In the embodiment in Fig. 4 a primer carrier 13*a* is provided with a bolt-shaped extension 13*b*, guided in casing 2 and indicating externally the position of carrier 13*a*.

The primer carrier 13, 13*a* is secured against transverse movement by the engagement of inertia shell 8 in bore 14. For transport, the primer carrier is additionally secured by a wire clip 21, which is inserted from the outside. When the barrel is loaded with the projectile, transport safety device 21 is removed. When the projectile is fired, the inertia sleeve 8 moves contrary to the action of spring 9, deeper into bore 14, the retaining balls 10 being released and dropping aside. When the acceleration of the projectile has decreased sufficiently for the advance spring 9 to overcome the inertia of shell 8, the shell moves forward and releases primer carrier 13. The push-in spring 17 can now become active for the transverse movement of the primer carrier, a delay mechanism taking effect.

The delay mechanism 22 is arranged on the primer carrier 13 or 13*a*. It consists of a sealing device with at least one seal washer. In the embodiment shown, the washers 23, 24 and 25 are provided. These

are located between primer carrier 13 and a bush 26 pushed on to and attached to said carrier. The seal washers are stretched between the carrier body 13 and a bush 26. The washer 23, bearing on carrier body 13, has the largest diameter, and projects relatively far over the diameter of bore 11, in which the primer carrier 13 is movably arranged. In the direction towards the push-in spring 17, bore 11 widens conically at 11*a*, with the purpose of facilitating the penetration of elastic seal washer 23, as the latter deforms elastically. The seal washer 25, adjacent to bush 26, projects over the rear of primer carrier 13, while the intermediate washer 24 is smaller in diameter than the diameter of carrier 13. When the push-in spring takes effect, the projecting part of seal washer 23, deforming elastically, is bent down, and adopts an arcuate shape against the conical surface 11*a* and then in another arcuate shape, with increased elastic deformation, against the inner wall of bore 11. As all three washers 23, 24, 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. In this respect, the diameter of washer 25 should preferably be so chosen that this washer 25 comes to bear on the bent-down washer 23, thus reinforcing the pressure of the bent part of washer 23 on cylindrical bore 11. The same reinforcement results from the bending of the thicker intermediate washer 24. The washers consist of rubber or a rubbery elastic plastic, preferably polytetrafluoroethylene. In this case the elastic deformation makes the seal between primer carrier 13 and bore 11 so large that the air in bore 11 is compressed, forming a counter-pressure to the action of push-in spring 17. At the same time, a relative vacuum is built up in the space in front of seal device 22. Both contribute to extending the delay in the transverse movement of primer carrier 13. After carrier 13 or 13*a* has been released by the inertia shell 8, the delay mechanism 22 acts as a result of the elastic deformation of its washers. Push-in spring 17 only becomes effective slowly. In this way the barrel safety of the fuse is considerably increased and extended in time.

In order that, when the primer carrier moves, the primers 15 and 16 pass, depending on which is selected, into the necessary position below the axis of the striker pin 6, a set-screk 27 is provided, arranged perpendicularly to the direction of movement of primer carrier 13 in casing 2. Carrier 13 or 13*a* is also provided with a groove 28, which is stopped in design, giving stop surfaces 29 and 30. Set-screw 27 can engage at different depths in groove 28. In order to stop the slowly-acting primer 16, the set-screw 27 is set to project so far under striker pin 6 that the primer carrier 13 is stopped by set-screw 27 at stop 29 (Fig. 9). When set-screw 27 is in a further retracted position, stop surface 30 comes to bear on the set-screw, so that the faster-acting primer 15 is stopped in the position below striker pin 6. Because more than one primer is arranged in carrier 13, there is no need to exchange the primers. The fuse can be set to the fast or slow primer at any time before firing. In this case the set-screw 27 can be further designed as an additional safety device, if it is allowed to engage directly in carrier 13 when said carrier is in its retracted position. In this way the primer carrier has to be set to one of the primers in the carrier before loading.

In the embodiment in Fig. 4, the extension bolt 13*b* can be fitted into casing 2 in such a way that a certain counterpressure can build up in bore 11 against push-in spring 17 when carrier 13*a* moves. The main delay arises from the friction of the seal washers in the bore 11 as a result of the elastic deformation of the washers.

WHAT WE CLAIM IS:—

1. A percussion fuse for projectiles, comprising a primer arranged in a primer carrier movable in a cylindrical bore transversely of the fuse from a safety position where the primer is outside the path of movement of a striker pin arranged in front of the carrier and movable longitudinally of the fuse, to a priming position where the primer is in the path of the striking pin, a spring urging the carrier from the safety position towards the priming position, a locking device movable longitudinally of the fuse for releasably holding the carrier in the safety position, and an elastic seal ring encircling the carrier and which elastic seal ring, when the primer carrier is released from its safety position, is deformed elastically and frictionally engages the wall of the cylindrical bore and so retards the movement of the carrier into the priming position.

2. A percusion fuse according to claim 1, wherein the cylindrical bore has a conical widening at the end facing the spring for the carrier.

3. A percussion fuse according to claim 1 or 2, wherein the seal ring has at least one seal washer of elastic material and the seal washer is arranged between the carrier and a bush attached to the carrier.

4. A percussion fuse according to any one of claims 1 to 3, wherein the seal ring has seal washers of different diameters.

5. A percussion fuse according to claim 4, wherein the washer adjacent to the carrier has a larger diameter than the cylindrical bore, and a further washer has a larger diameter than the carrier, an intermediate

are located between primer carrier 13 and a bush 26 pushed on to and attached to said carrier. The seal washers are stretched between the carrier body 13 and a bush 26. The washer 23, bearing on carrier body 13, has the largest diameter, and projects relatively far over the diameter of bore 11, in which the primer carrier 13 is movably arranged. In the direction towards the push-in spring 17, bore 11 widens conically at 11*a*, with the purpose of facilitating the penetration of elastic seal washer 23, as the latter deforms elastically. The seal washer 25, adjacent to bush 26, projects over the rear of primer carrier 13, while the intermediate washer 24 is smaller in diameter than the diameter of carrier 13. When the push-in spring takes effect, the projecting part of seal washer 23, deforming elastically, is bent down, and adopts an arcuate shape against the conical surface 11*a* and then in another arcuate shape, with increased elastic deformation, against the inner wall of bore 11. As all three washers 23, 24, 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. In this respect, the diameter of washer 25 should preferably be so chosen that this washer 25 comes to bear on the bent-down washer 23, thus reinforcing the pressure of the bent part of washer 23 on cylindrical bore 11. The same reinforcement results from the bending of the thicker intermediate washer 24. The washers consist of rubber or a rubbery elastic plastic, preferably polytetrafluoroethylene. In this case the elastic deformation makes the seal between primer carrier 13 and bore 11 so large that the air in bore 11 is compressed, forming a counter-pressure to the action of push-in spring 17. At the same time, a relative vacuum is built up in the space in front of seal device 22. Both contribute to extending the delay in the transverse movement of primer carrier 13. After carrier 13 or 13*a* has been released by the inertia shell 8, the delay mechanism 22 acts as a result of the elastic deformation of its washers. Push-in spring 17 only becomes effective slowly. In this way the barrel safety of the fuse is considerably increased and extended in time.

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2. A percusion fuse according to claim 1, wherein the cylindrical bore has a conical widening at the end facing the spring for the carrier.

3. A percussion fuse according to claim 1 or 2, wherein the seal ring has at least one seal washer of elastic material and the seal washer is arranged between the carrier and a bush attached to the carrier.

4. A percussion fuse according to any one of claims 1 to 3, wherein the seal ring has seal washers of different diameters.

5. A percussion fuse according to claim 4, wherein the washer adjacent to the carrier has a larger diameter than the cylindrical bore, and a further washer has a larger diameter than the carrier, an intermediate

washer being smaller than the diameter of the carrier.

6. A percussion fuse according to any one of claims 1 to 5, wherein the transversely-movable primer carrier has more than one primer are spaced longitudinally along the carrier, and the carrier is provided with a stepped groove in which a set-screw engages.

7. A percussion fuse, particularly for projectiles, substantially as hereinbefore described with reference to Figs. 1 to 3 and 5 to 9 of the accompanying drawings.

8. A percussion fuse according to claim 7, but modified substantially as hereinbefore described with reference to Fig. 4 of the accompanying drawings.

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