

Jan. 20, 1942.

L. E. RÉMONDY

2,270,342

SENSITIVE PERCUSSION FUSE

Filed March 30, 1938

2 Sheets-Sheet 1

Fig. 1.

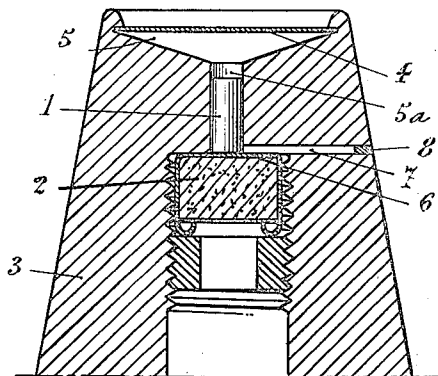


Fig. 2.

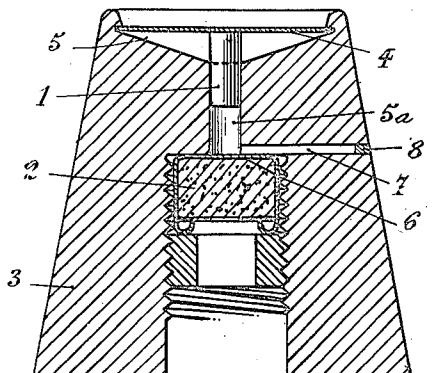
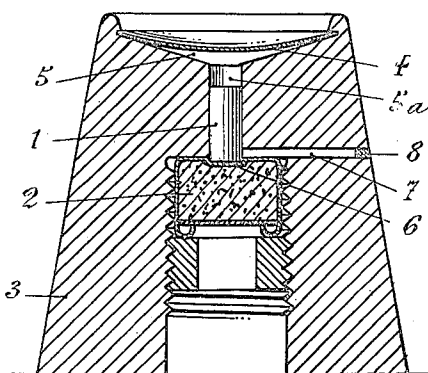


Fig. 3.



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2 Sheets-Sheet 2

Fig. 4.

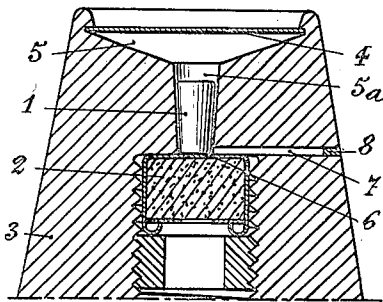


Fig. 5.

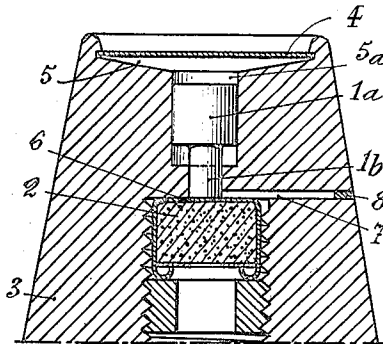


Fig. 6.

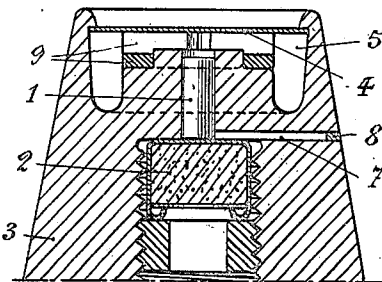


Fig. 7.

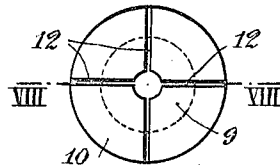


Fig. 8.

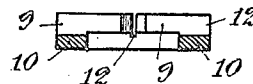


Fig. 9.

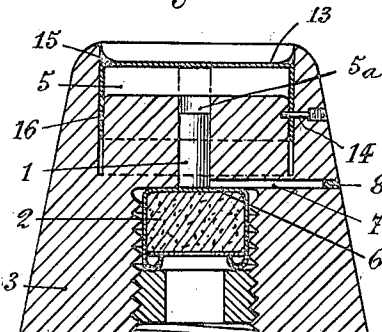
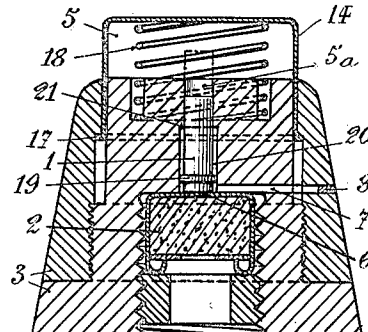


Fig. 10.



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UNITED STATES PATENT OFFICE

2,270,342

SENSITIVE PERCUSSION FUSE

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Application March 30, 1938, Serial No. 199,034
In France December 20, 1937

10 Claims. (Cl. 102—36)

The present invention relates to a percussion fuse device for projectiles, characterised by the fact that the striker, that is to say, the element whereof the impact against the percussion cap produces the ignition of the latter, possesses normally and at any moment a certain faculty of free movement within the interior of the fuse.

It may be said in a way that the striker is "floating."

According to the constructions and to the conditions of use, the free movement under consideration may be temporarily limited and reduced for reasons of safety, but, of course, it is never completely suppressed; it is this latter fact that essentially differentiates the fuse device concerned from other already known fuse devices.

Due to the arrangement under consideration, the striker, which at the departure of the shot is applied to the percussion cap without percussion and simply by inertia, is capable of travelling freely towards the front in proportion as the velocity of the projectile in which it is mounted diminishes under the influence of the resistance of the air.

When, on the contrary, the projectile encounters an obstacle, the shock produced drives the striker by inertia towards the percussion cap with a force depending upon the relative value of the mass of said striker with respect to the mass of the obstacle encountered.

The striker in fact instantaneously loses its velocity, while the projectile and the percussion cap secured to the latter continue to travel forwardly at least for a certain time, however short.

In view of the fact that by reason of its constitution, however, the mass of the striker may be as low as is necessary, it will be appreciated that the ratio between this mass and that of any obstacle, of a magnitude as limited as it is possible to imagine (an aircraft fabric for example), may always and in any circumstance whatsoever be fixed a priori at a value such that the velocity with which the striker is projected rearwardly for a given minimum residual velocity of the projectile is sufficient to produce the violent impact of the striker against the percussion cap necessary to ensure in all cases the ignition of the latter.

It follows that the device according to the invention makes it possible to construct an extremely simple and sensitive fuse capable of being used in the most diverse cases.

Of course, the principal means indicated above may be combined, in the different forms of construction which may be contemplated, with any

other additional means for facilitating its operation or for additionally providing the desired safety conditions.

It is possible more particularly to so dispose the striker and determine its form as to benefit in the best manner by the non-negligible effects of the action of the air in the interior of the fuse.

It is possible, in addition, to provide, as accessory devices for limiting and temporarily reducing the free movement of the striker, auxiliary members which disappear on account of a rise in temperature or on account of a dislocation resulting from the action of the centrifugal force or from any other action.

Various constructions of the invention have been shown in the accompanying drawings and described hereinafter by way of example, but of course the constructions concerned may, if necessary, be completed by any useful accessory device or may be modified in their details of construction without departing for that purpose from the scope of the invention.

In these drawings, Figures 1, 2 and 3 are axial sectional views of one form of fuse embodying the present invention with the striker shown in full, these figures showing the positions which the members of the device occupy first of all at rest, then after a certain time of flight of the projectile on which the fuse is mounted, and finally on impact.

Figures 4 and 5 are similar sectional views of two analogous constructions in which, however, the strikers have forms different from the purely cylindrical form shown in Figures 1, 2 and 3.

Figure 6 is a sectional view similar to Figure 1 showing a modified form of the fuse illustrated in Figure 1, including a safety member.

Figures 7 and 8 are plan and sectional views, respectively, of the safety member of Figure 6, the section of Figure 8 being taken substantially on the line VIII—VIII of Figure 7.

Figure 9 is an axial sectional view of a construction in which the obturation diaphragm of the preceding constructions is replaced by a capsule fixed in position by a pin which ruptures on impact.

Figure 10 is a similar sectional view of a modified construction in which the said capsule is resiliently mounted on the front part of the fuse.

As will be seen in these figures, and particularly in Figures 1, 2 and 3, the striker 1, in the present case formed by a simple cylinder of suit-

able dimensions, is free to move between the percussion cap 2 lodged in the interior of the fuse body 3 and a flexible diaphragm 4 crimped in the front end of the fuse, said diaphragm closing the front of a cavity 5 which, at the moment of impact, permits the diaphragm 4 to deform freely and without appreciable resistance.

When at rest and in normal times, the fulminating composition of the percussion cap is protected from the friction of the striker either by the end 6 of said percussion cap, if the latter is placed as shown with its orifice directed towards the interior of the projectile, or by a light plate of suitable thickness and strength.

Furthermore, for preventing the fuse under consideration from operating under the action of a slow but continuous forcing back of the striker, such as may be produced for example during the handling of the projectile at the moment of impact of the latter against the ground, two indispensable precautions must, of course, be taken.

In the first place, it is necessary to limit the length of the striker to a value less than that of the cylindrical recess or bore 5a in which the striker is free to move.

In addition, it is likewise necessary to limit the diameter of the aforesaid recess and consequently that of the striker to a value such that any foreign body of really appreciable mass will be unable, after having destroyed and passed through the diaphragm, to enter the said recess 5a and continue to force back the striker against the percussion cap.

There is furthermore provided in the fuse body 3 an air escape passage 7 closed by a light airtight plug 8.

The operation of the device is extremely simple to understand.

Upon the departure of the shot (1st position) the striker 1, irrespective of the position which it occupies at rest in its recess, is applied by the action of the acceleration imparted to the projectile and by inertia, but without violent shock, against the percussion cap as shown in Figure 1.

In fact, in view of the extremely low mass which can be given to the said striker on account of its exceptionally simple form, the pressure of static order exerted by said striker on the percussion cap upon the departure of the shot is very low, even in the case of the maximum accelerations normally considered in practice.

From this point of view, it is necessary to consider that, at the departure of the shot, the acceleration is always gradual and cannot be compared with a true shock.

Furthermore, as a measure of safety, the striker has not been given a pointed form.

As soon as it leaves the gun-barrel and is free from the gaseous mass which accompanies it for several instants, the projectile gradually loses its velocity under the influence of the resistance opposed to it by the air.

The striker, on the contrary, which is not subject to any resistance on the part of the air, retains its velocity and travels slowly towards the front of the projectile until, as shown in Figure 2, its front end bears against the diaphragm 4 (2nd position).

Matters then remain as they are until the impact is produced.

The instant the latter takes place, the diaphragm 4 which is extremely flexible is deformed and instantaneously transmits to the striker a

true shock which by inertia drives it violently to the rear and produces on the percussion cap a percussion sufficient to cause the immediate deflagration of the latter.

In view of the low resistance of the diaphragm 4 and the low weight of the striker, the shock on impact, even against an extremely light obstacle of little resistance, such as the surface of an aeroplane wing or the fabric of a balloon, is sufficient as shown in Figure 3 for the striker (3rd position) to act on the base of the percussion cap or on the protecting plate above referred to after the manner of a veritable solid punch or even of a socket punch, and thus produce by local heating the deflagration of the fulminating substance of the percussion cap.

To facilitate the movements of the striker in its recess, it is possible if necessary to give to the latter a slightly conical form as shown in Figure 4.

Furthermore, since in such a fuse the relative values of the mass of the striker, the resistance of the diaphragm and the resistance of the base of the percussion cap, or of the protective plate which replaces it in certain cases, play an extremely important part, it is possible in order to adapt the mass of the striker to certain concrete cases to give it a form such as that in which it is shown in Figure 5, wherein will be seen a striker having its front part 1a of a greater diameter than that of the part 1b.

This arrangement furthermore favours the advantageous action exerted on the striker by the air which is situated in the cavity 5 and which, forced back by the diaphragm 4 at the moment of impact, escapes through the escape passage 7.

The action of the air under consideration may furthermore be accentuated by increasing the relative size of the cavity 5 in the desired manner, for example in accordance with what will be indicated below in connection with the constructions shown in Figures 9 and 10.

Figure 6 shows a construction similar to that just described, but wherein there has been provided by way of additional safety, between the striker 1 and the diaphragm 4, a washer 9, the detail of which is shown in Figures 7 and 8.

Said washer, which is adapted to break up very rapidly either under the action of heating due to the friction of the air or under the action of the centrifugal force after the projectile carrying the fuse has left the gun-barrel, is intended to reduce at rest the space within which the striker 1 may move freely and to prevent the said striker from coming prematurely into contact with the diaphragm 4.

Due to the presence of the washer under consideration, the said striker during the handling of the projectile, or during the first instants of the flight of the latter, can never assume even under the effect of a shock an acceleration sufficient to strike effectively against the percussion cap and produce the detonation thereof.

As will be seen in Figures 7 and 8, the washer 9, for facilitating its breaking up under the action of the centrifugal force, comprises a thickened edge portion 10 which so to speak acts as a flywheel and tends to increase the internal forces intended to produce the rupture of the piece as soon as the latter, driven by the projectile, rotates at a sufficient speed.

Finally, if necessary, the said washer may comprise slots 12 likewise intended for facilitating its rupture.

In the constructions shown respectively in Fig-

ures 9 and 10, a means has been sought for increasing the driving action of the air on the striker.

For this purpose, in the construction of Figure 9, the diaphragm 4 has been replaced by a capsule 13 normally held in position by a pin 14 and provided in its upper part with an air-tight joint 15.

In order to escape, the air contained in the cavity 5 has certainly two outlets, on the one hand that offered to it along the striker and through the escape passage 7, and on the other hand that situated along the lateral wall 16 of the capsule 13; however, the baffle arrangement which this lateral wall 16 offers to the passage of the air diminishes, in regard to the latter, the possibilities of escape by that path.

Consequently, the air under consideration exerts its principal action on the striker and is associated with the shock applied to it through the medium of the capsule 13 for bringing it violently from the position in which it is shown in dotted lines to the percussion position in which it is shown in solid lines.

In the construction shown in Figure 10, the capsule or cap 13 is held on the fuse by a flange 17 which prevents it from coming out and which at the same time acts as an air-tight packing. A light spring 18 maintains it in its advanced position until the moment at which the impact is produced.

From the point of view of the action of the air, it is possible to repeat in this connection what was said above with reference to the construction shown in Figure 9.

As the movement of the striker would be excessive from the practical point of view if it was allowed in this particular case to come into contact with the capsule which is intentionally very remote from the head of the fuse in order to increase the volume of the chamber 5 and the quantity of air forced back, said movement is limited by means of a collar 19 which is movable in a bore 20 and which, during the flight of the projectile, is arrested by the flange 21.

At this moment and in accordance with what is shown in dotted lines in the figure, the front of the striker projects sufficiently into the chamber 5 in front of the fuse head to enable the capsule 13, upon impact, to apply to it the necessary shock.

What is claimed is:

1. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body having an axial bore extending rearwardly from the forward end thereof, a striker member movable in said bore, a percussion cap fixedly mounted in said fuse body adjacent the rear end of said bore, and a closure member associated with the forward end of said fuse body having at least a portion thereof movable rearwardly upon impact of the projectile with an obstacle while in flight to contact said striker member and at least momentarily decrease the forward velocity of the latter relatively to that of the projectile, whereupon the inertia of said striker member and the continued forward progress of said percussion cap at the residual velocity of the projectile bring said striker member and cap into contact with one another with sufficient force to effect ignition of the fuse, said striker member being at all times freely movable into contact with said percussion cap, but its length being less than the length of said bore, and said striker and cap members being so constructed and arranged, and the mass

of said striker member being such, that detonation of said cap member will not occur upon set back due to firing of the projectile.

2. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body having an axial bore extending rearwardly from the forward end thereof, a percussion cap fixedly mounted in said fuse body adjacent the rear end of said bore and having a deformable protective covering over the forward surface thereof, a striker member of a length less than that of said bore slidably mounted in the latter and free to move therein into contact with the protective covering of said percussion cap whether said projectile be at rest or in flight, and a deformable closure member associated with the forward end of said fuse body and operable upon deformation to contact said striker member and effect a relative movement between the latter and said fuse body such as tends to bring said striker member and percussion cap into contact with one another, the mass of said striker member and the extent of its free movement being so proportioned relatively to the resistances to deformation of said closure member and percussion cap covering that the force exerted by said striker member upon said percussion cap covering due to said movement is insufficient to effect ignition of the fuse except when said closure member is deformed by impact of the projectile with an obstacle while in flight.

3. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body having a cavity formed in the forward end thereof and an axial bore extending rearwardly from said cavity, a flexible diaphragm closing the forward end of said cavity, a percussion cap fixedly mounted in said fuse body adjacent the rear end of said bore, and a striker member of a length less than that of said bore slidably mounted in the latter and free to move therein into contact with said percussion cap and through at least a portion of the distance between said cap and said diaphragm whether said projectile be at rest or in flight, said diaphragm being deformable upon impact of the projectile with an obstacle while in flight to contact said striker member and at least momentarily decrease the forward velocity of the latter relatively to that of the projectile, whereupon the inertia of said striker member and the continued forward progress of said percussion cap at the residual velocity of the projectile bring said striker member and cap into contact with one another with sufficient force to effect ignition of the fuse, said striker and cap members being so constructed and arranged, and the mass of said striker member being such, that detonation of said cap member will not occur upon set back due to firing of the projectile.

4. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body having a cavity formed in the forward end thereof, a percussion cap fixedly mounted in said fuse body rearwardly of said cavity and having a deformable protective covering over the forward surface thereof, an axial bore in said fuse body of substantially smaller diameter than and leading from said cavity to said percussion cap, a striker member of a length less than that of said bore slidably mounted in the latter and free to move therein into contact with the protective covering of said percussion cap whether said projectile be at rest or in flight, and a closure member closing the forward end of said cavity and movable rearwardly upon impact to contact said striker member and effect a relative movement between the

latter and said fuse body such as tends to bring said striker member and percussion cap into contact with one another, the mass of said striker member and the extent of its free movement being so proportioned relatively to the resistances to movement and deformation of said closure member and percussion cap covering that the force exerted by said striker member upon said percussion cap covering due to said movement is insufficient to effect ignition of the fuse except when said closure member is moved rearwardly by impact of the projectile with an obstacle while in flight.

5. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body having a cylindrical bore extending rearwardly from the forward end thereof, a percussion cap fixedly mounted in said fuse body adjacent the rear end of said bore and having a deformable protective covering over the forward surface thereof, a non-pointed, cylindrical striker member of a length less than that of said bore housed within the latter and at all times freely movable therein into contact with the protective covering of said percussion cap, and a deformable closure member closing the forward end of said fuse body and operable upon deformation to contact said striker member and effect a relative movement between the latter and said fuse body such as tends to bring said striker member and percussion cap into contact with one another, the mass of said striker member and the extent of its free movement being so proportioned relatively to the resistances to deformation of said closure member and percussion cap covering that the force exerted by said striker member upon said percussion cap covering due to said movement is insufficient to effect ignition of the fuse except when said closure member is deformed by impact of the projectile with an obstacle while in flight.

6. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body having a cavity formed in the forward end thereof, a flexible diaphragm closing the forward end of said cavity, a percussion cap fixedly mounted in said fuse body rearwardly of said cavity, a cylindrical bore of substantially smaller diameter than and leading from said cavity to said percussion cap, and a non-pointed, cylindrical striker member of a length less than that of said bore slidably mounted in the latter and at all times free to move therein into contact with said percussion cap and through at least a portion of the distance between said cap and said closure member, deformation of said diaphragm upon impact of the projectile with an obstacle while in flight being effective to contact said striker member and at least momentarily decrease the forward velocity of the latter relatively to that of the projectile, whereupon the inertia of said striker member and the continued forward progress of said percussion cap at the residual velocity of the projectile bring said striker member and cap into contact with one another with sufficient force to effect ignition of the fuse. said

striker and cap members being so constructed and arranged, and the mass of said striker member being such, that detonation of said cap member will not occur upon set back due to firing of the projectile.

7. A percussion fuse according to claim 2, wherein both said bore and said stroker member are provided with forward portions of larger diameter than the rearward portions thereof which are adjacent said percussion cap.

8. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body, a flexible diaphragm closing the forward end of said fuse body and deformable upon impact with an obstacle, a percussion cap fixedly mounted in said fuse body rearwardly of said diaphragm, a striker member housed within said fuse body and at all times freely movable therein into contact with said percussion cap as well as toward said diaphragm, the length of said striker member being less than the distance between said cap and the maximum deformed position of said diaphragm, and means normally preventing forward movement of said striker member sufficiently to effect contact with said diaphragm at all times prior to the firing of the projectile, said means being so constructed and arranged as to be rendered inoperative under the influence of the forces to which it is subjected during the flight of the projectile.

9. In a percussion fuse for projectiles of the extra-sensitive type, a fuse body, a flexible diaphragm closing the forward end of said fuse body and deformable upon impact with an obstacle, a percussion cap fixedly mounted in said fuse body rearwardly of said diaphragm, a striker member housed within said fuse body and at all times freely movable therein into contact with said percussion cap as well as toward said diaphragm, the length of said striker member being less than the distance between said cap and the maximum deformed position of said diaphragm, and a safety member consisting of a washer normally interposed between the forward end of said striker member and said diaphragm for preventing forward movement of said striker member sufficiently to effect contact with said diaphragm at all times prior to the firing of the projectile, said washer having a peripheral portion of greater mass than its central portion and being so constructed and arranged as to rupture under the influence of the centrifugal force to which it is subjected during flight of the projectile.

10. A percussion fuse according to claim 4 wherein said closure member is bodily slidable rearwardly relatively to said fuse body to compress the air normally filling said cavity and thereby augment the forces tending to bring said striker member and percussion cap into contact upon impact of the projectile, and which includes yieldable means for normally holding said closure member in its foremost position until impact.

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