Feb. 4, 1958 C. VARAUD 2,821,925

DOUBLE-ACTING PERCUSSION FUZE PROVIDED WITH A SAFETY DEVICE FOR PROJECTILES

Filed April 16, 1956 3 Sheets-Sheet 1

Fig. 1

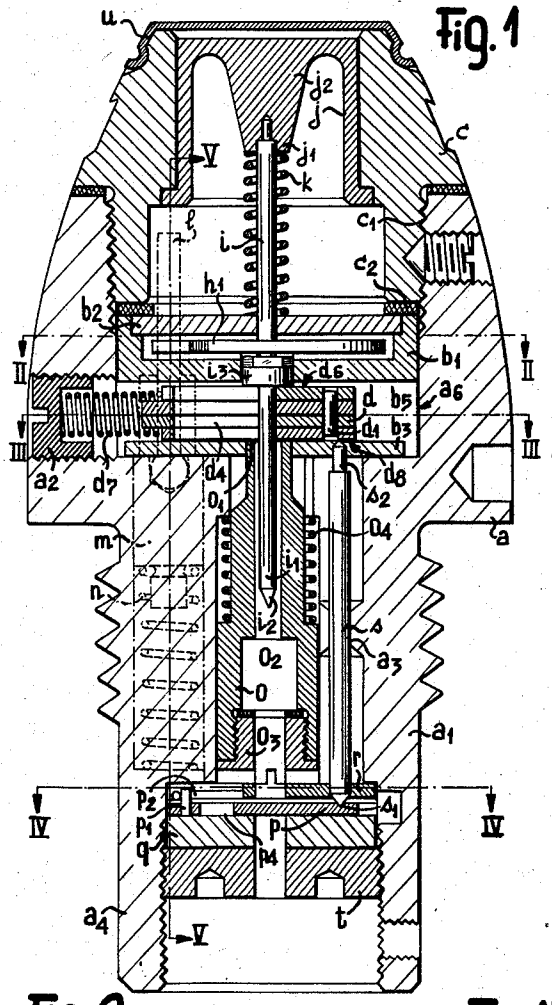


Fig. 2

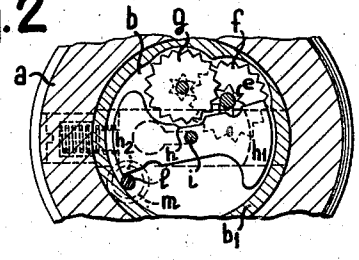


Fig. 3

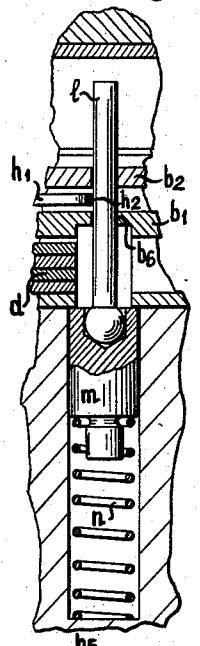
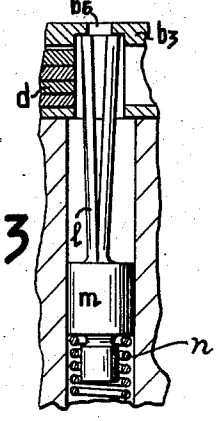


Fig. 13



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DOUBLE-ACTING PERCUSSION FUZE PROVIDED WITH A SAFETY DEVICE FOR PROJECTILES

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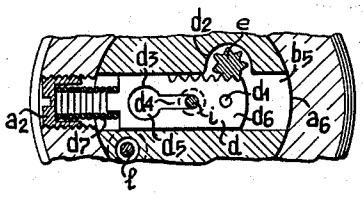


Fig.3

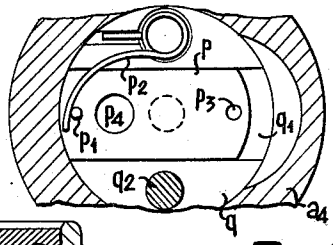


Fig.4

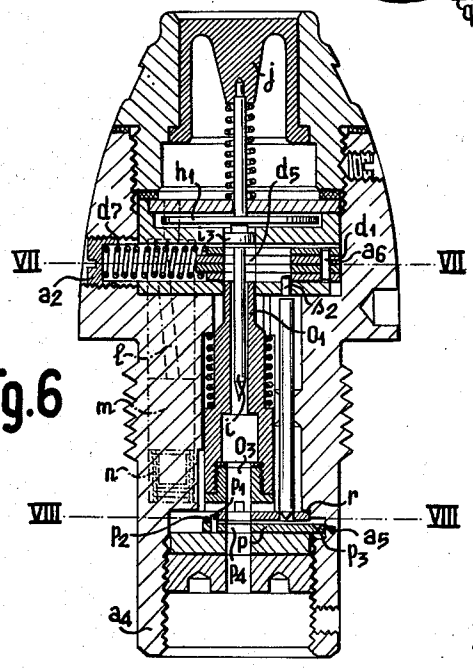


Fig.6

Fig.7

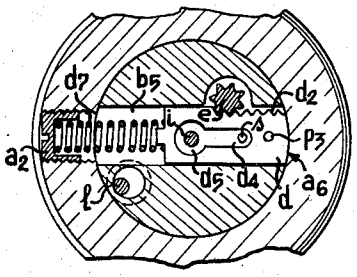
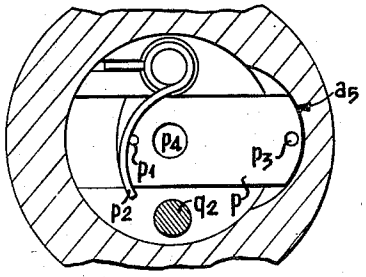


Fig.8



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Fig.9

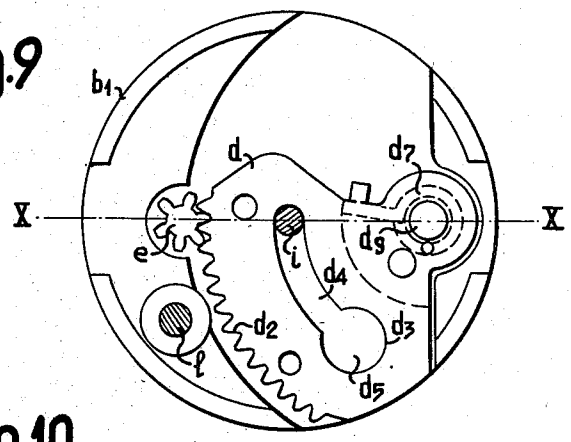


Fig.10

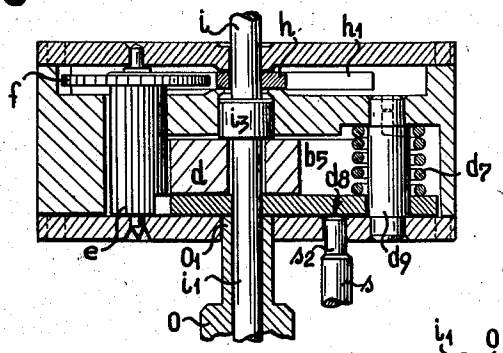


Fig.12

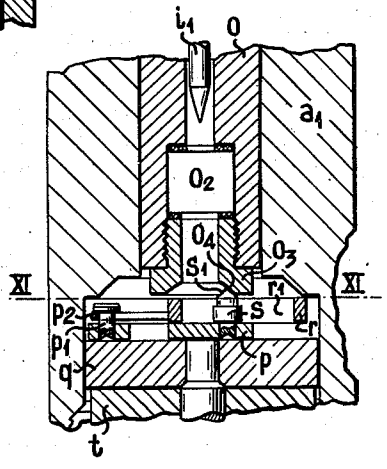
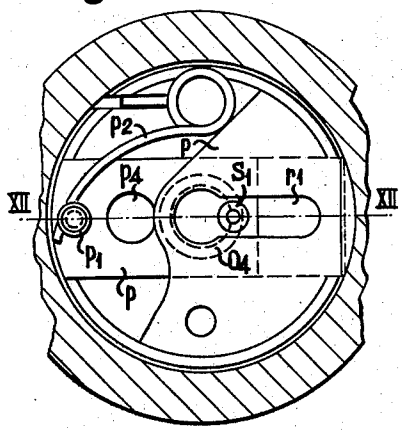


Fig.11



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DOUBLE-ACTING PERCUSSION FUZE PROVIDED WITH A SAFETY DEVICE FOR PROJECTILES

Claude Varaud, Geneva, Switzerland, assignor to Ufa Universal Finanzierungs Austalt, Vaduz, Liechtenstein

Application April 16, 1956, Serial No. 578,352

4 Claims. (Cl. 102—84)

The invention relates more particularly, but not exclusively to percussion fuzes for non-rotative projectiles such as those used in howitzers with smooth tube or by guns or other means which do not impart to the projectiles a rotative movement.

The fuze which forms the main object of the invention is provided with a safety device of the kind comprising a toothed member connected with a clock-work having a spring motor and an escapement balance-wheel, said toothed member being maintained in a locking position between a plunger provided with a shoulder and an inertia block carrying a primer, in order to prevent an ill-timed percussion of the primer, not only during the transport but also after firing during a given space of time along the trajectory of the projectile. Said fuze is characterized by the fact that the toothed member comprises a slot having the shape of a button-hole of which only the enlarged part allows the passage of at least one of the two percussion members (shoulder plunger and inertia block carrying the primer), said enlarged part coming in line with said percussion members, as a result of the displacement of the toothed member caused by the clock-work, only after the firing and after a given space of time during the trajectory of the projectile, in order that the percussion may happen at the time of the hit of the projectile, obturating means in connection with the toothed member being provided for, in order to prevent an ill-timed passage of the fire from the primer to the detonator, not only during the transport but also by the firing and during a given space of time along the trajectory of the projectile, locking means of the balance-wheel, being further provided for to lock said balance-wheel until the firing.

The attached drawing shows by way of example, three forms of execution of the fuze which forms the object of the invention.

Fig. 1 is an axial cross section of the first form of execution of the fuze, the members of said fuze being in locking position before the firing.

Figs. 2, 3 and 4 are cross sections on a smaller scale respectively along lines II—II, III—III, and IV—IV of Fig. 1.

Fig. 5 is a partial cross section along line V—V of Fig. 1.

Fig. 6 is an axial cross section of the fuze, its members being in unlocked position after the firing and after a given travel of the projectile along its trajectory.

Figs. 7 and 8 are cross sections along line VII—VII and VIII—VIII of Fig. 6, illustrating the members of the safety device in the unlocked position, i. e. in a position allowing the working of the fuze at the moment of the hit.

Figs. 9 and 10 illustrate on a larger scale, in top view and cross section, a second form of execution of the fuze in which the clock-work comprises a toothed sector.

Fig. 11 illustrates a cross section on a larger scale and along line XI—XI of Fig. 12 of a third form of execution of the fuze, the members of the safety device being in locking position.

Fig. 12 is a cross section on a larger scale along line XII—XII of Fig. 11 illustrating the members of the safety device in the locking position.

Fig. 13 is a partial cross section similar to that of Fig. 5 illustrating a variant of execution of the releasing device of the balance-wheel.

In the form shown in Figs. 1 to 8 of the drawings, a designates the body of the fuze, b (Fig. 2) the clock-work maintained in its position in the body a, by means of an elastic washer c_2 bearing on a cap c screwed by c_1, in the body a. The clock-work b is constituted by a frame b_1 comprising two mounting plates b_2 and b_3 provided with pins (not shown). The frame b_1 presents a diametral groove b_5 in which slides loosely a toothed member d constituted by a toothed rack, formed by several superposed small plates held together by means of rivets d_1. Each small plate is punched in one piece with a toothing d_2 and a slot d_3 having the shape of a button-hole, the small and elongated part d_4 of which serves as a guide, while the enlarged part or eye d_5 is of circular shape. The toothing d_2 meshes with a first pinion e of a gearing f and g pivoted in the mounting plates b_2 and b_3 and of which the last wheel g is constituted by the escapement wheel cooperating with a lever h made in one piece with the balance-wheel h_1. Said balance-wheel pivots, by its central hole, around the plunger i which constitutes its axis and which is located on the axis of the clock-work (Figs. 1 and 2). Said plunger comprises a rod i_1 which ends in a percussion tip i_2 and a shoulder i_3 of a greater diameter. Said shoulder lies on the upper face d_6 of the toothed rack d at the extremity of the guide d_4 (Figs. 1 and 3). In the transport position before the firing, the plunger i cooperates with the inturned central conical part j_1 of a piston j set under the action of a spring k, the action of which counterbalances the air pressure acting on the extremity j_2 of the piston j during the trajectory of the projectile.

The toothed rack d is maintained in the position represented in Figs. 1, 2, 3, against the action of a spring motor d_7 bearing on the bottom of a plug a_2 screwed radially in the ogive of the body a, by an oscillating pin l hinged, by means of a ball and socket joint, on a piston m (Fig. 5) having a certain inertia and submitted to the action of a spring n. The upper extremity of the pin l is located, before the firing, on the path of one of the arms h_2 of the balance-wheel and constitutes a stop preventing said balance-wheel to oscillate and consequently preventing any displacement of the toothed rack d. Said pin is maintained parallel to the plunger by a guide b_6.

An inertia block o, carrying a primer o_2 and maintained in its position by a plug o_3, is mounted axially in the body a of the fuze, and is displaceable against the action of a return spring o_4, which maintains the front face of a neck o_1 of said inertia block, in contact with the under face d_8 of the toothed rack d.

As illustrated in Fig. 1, the toothed rack d is thus interposed between the shoulder i_3 of the plunger i and the front end o_1 of said inertia block o. In this manner the primer o_2 may not be fired untimely.

However a supplementary safety device, constituted by an obturating device, is located immediately under the primer o_2, in order to prevent an ill-timed deflagration of said primer at the time of the firing.

Said obturating device is constituted by an obturator formed by a metal tongue p (Figs. 1 and 4) of rectangular shape, located in a diametral groove q_1 made in a washer q mounted in the extremity a_4 of the tail a_1 of the fuze.

A pin q_2 determines the angular position of the washer q in the body a. A spring p_2, located in a groove made in the washer q, exerts a thrust on a pin p_1 fastened on the tongue p. A mounting plate r maintains said spring p_2 in position. The tongue p is provided with a hole p_4 constituting a passage allowing the fire of the primer to reach the detonator when, after a given space of time after the firing, the displacement of the toothed member d releases a locking device of the tongue p, which immobilizes said tongue in the safety position (Fig. 4) against the action of the spring p_2. Said locking device comprises a maintaining member constituted by a pin s, axially displaceable with respect to the body of the fuze and parallel to the axis of said fuze. Said pin s is guided on the one hand by its two extremities in corresponding holes made in the mounting plates b_3 and r and on the other hand in a bearing a_3 provided in the body of the fuze. The rear extremity of said pin s is provided with a conical tip s_1 cooperating with a countersink p_3 having the shape of a cup, made in the tongue p. The front extremity s_2 of said pin s abuts against the rear face d_8 of the toothed rack d. In this manner, the tongue p is locked in the safety position illustrated by Figs. 1 and 4, and for which purpose the hole p_4 is not located in line with the primer o_2. Finally a plug t, screwed in the extremity a_4 of the tail a_1, maintains the washer q in position against any ill-timed displacement.

The working of the described fuze is as follows:

The ogive cap u being withdrawn, the fuze is in readiness for the firing.

By the start of the shot, the inertia pin 1 and its piston m, as illustrated in Figs. 6, 7, 8, move back as a result of their inertia and compresses the spring n. The displacement of the pin 1 is of a sufficient amount to cause the disengagement of said pin from its guide b_6. Thus, the pin 1 releases the balance-wheel h_1, which then oscillates under the action of the spring motor d_7 and by the intermediary of the toothed rack d and the gearing f and g. Under the action of its weight, the pin 1 oscillates, so that its front extremity is no more located on the axis of the guide b_6 made in the frame b_1. Consequently, when the fuze, is no more submitted to the acceleration, the pin 1 may not come back again, under the action of the spring n, in its primitive locking position but remains in the position illustrated in dash and dot lines in Fig. 6.

After a given space of time (about ⅔ of a second) the toothed rack d, driven by the clock-work, abuts at a_6 in the inner groove b_5 of the body a, and takes the position illustrated in Figs. 6 and 7. It follows that the extremity of the guide d_4 is located, opposite the extremity of the pins s. Consequently, the spring p_2, causes a displacement of the tongue p, and the countersink p_3, acting on the conical tip s_1, drives suddenly the pin s upwards and its extremity s_2 enters in the guide d_4 of the toothed rack d.

The tongue p being released, follows its displacement under the action of the spring p_2 until said tongue abuts against the bottom of the groove a_5, made in the tail a_1 of the body a. In said position, Fig. 8, the hole p_4 is now in line with the central hole of the plug o_3 of the primer o_2, so that by the working of the fuze caused by the hit, either by means of the direction effect (driving in of the piston j and of the plunger i into the primer) or by means of the inertia block o carrying the primer and which drives said primer towards the plunger i, the fire of said primer may, through said hole p_4, reach the detonator (not illustrated).

It is to be noted that, for the safety position or transport position of the device (Figs. 1 and 3), the shoulder i_3 of the plunger i lies on the narrow part d_4 of the slot made in the toothed rack d. Consequently, for said position of the toothed rack d, the plunger i is locked in the position shown in Fig. 1, and hence may not strike the primer. Further, for this position of the toothed rack, the front extremity of the inertia block o carrying the primer, bears onto the face d_8 or said toothed rack, so that said primer may not be displaced towards the plunger.

On the contrary, for the position illustrated in Figs. 6 and 7, the eye d_5, the diameter of which is greater than the diameter of the shoulder i_3 and of the diameter of the neck o_1 of the inertia block o, is located on the axis of displacements of the percussion members (plunger i and inertia block o carrying the primer), so that said members are released and that the percussion may occur either by means of a displacement of the plunger, or by means of a displacement of the inertia block o carrying the primer o_2.

In the modification shown in Figs. 9 and 10, the toothed member d comprises a toothed sector pivoted along an axis d_9 and submitted to the action of a spring motor d_7. Said sector d presents a slot having the shape of a buttonhole, the narrow part d_4 of which is arcuated and ends in an eye d_5.

As in the form of execution described hereinbefore with reference to Figs. 1 to 8, the toothed sector d is interposed (Fig. 10) between the shoulder i_3 of the plunger i and the front extremity o_1 of the inertia block o carrying the primer o_2. The locking pin s of the obturator constituted by the tongue p, cooperates at d_8 with said toothed sector d. The movements of the members of the fuze are similar to the movement of the members of the form of execution represented in Figs. 1 to 8. The similar members and elements are designated by the same reference characters.

In the modification shown in Figs. 11 and 12, the locking device of the obturator comprises a pin S rigidly fastened to the tongue or obturator p. The conical tip S_1 of said pin S cooperates with a corresponding conical hollow chamfer o_4, made in the rear extremity of the plug o_3 screwed in the rear extremity of the inertia block o carrying the primer o_2. Said plug o_3 constitutes then the maintaining member of the locking device of the obturator.

After the firing, the toothed sector d, submitted to the action of its spring d_7, oscillates around its axis d_9 and the eye d_5 comes in line with the inertia block o and the plunger i. From this moment on, the front extremity o_1 of said inertia block is released and may be displaced upwards under the action of the thrust exerted by the conical tip S_1 of the pin S which is rigidly fastened to the obturator or tongue p. From then on, said obturator may be displaced under the action of the spring p_2 acting on the pin p_1, and come into the service position for which the hole p_4 is located in line with the primer o_2, so that the fire of said primer will be capable to reach the detonator (not illustrated).

Fig. 13 illustrates a modification of the locking device of the balance-wheel h_1. The pin l is rigidly fastened to the piston or inertia block m. Said pin l is split and its two arms present a self elasticity tending to spread said arms. When by the firing, the acceleration causes a backward movement of the pin, against the action of the spring n, and that consequently said pin disengages from its guide b_6, the two arms of said pin move aside one from the other. The elastical deformation of the extremity of said pin hinders a new engagement of said pin in its guide, so that said pin can not come back, under the action of its spring n, in locking position of the balance-wheel h_1.

It goes without saying that the split pin illustrated in Fig. 13 may be hinged on the inertia block m by means of a ball and socket joint.

I claim:

1. In a double-acting percussion fuse having a safety device of the kind comprising a toothed member provided with a slot having the shape of a buttonhole, a clockwork mechanically connected to said toothed member, a spring motor driving said clockwork, an escapement balance wheel controlling said clockwork, a shouldered plunger located at one side of said toothed member, a primer

located on the other side of said toothed member in a position whereby said plunger may reach said primer only when the enlarged portion of said buttonhole-shaped slot is brought by said clockwork coaxial to said plunger, the combination with said safety device of an inertia block carrying said primer and having an end facing said buttonhole-shaped slot, said end being coaxial to said plunger and being retained against movement towards said plunger by said toothed member until the enlarged part of said buttonhole-shaped slot is brought by said clockwork coaxial to said plunger, whereby said toothed member constitutes simultaneously a locking means for the plunger and a locking means for the inertia block carrying said primer; an obturator provided with an opening to allow the passage of the fire of the primer, and means for controlling said obturator by said toothed member.

2. A double-acting percussion fuze as claimed in claim 1 and in which said locking device comprises a pin axially displaceable, a conical tip carried by one end of said pin, a conical surface cooperating with said conical tip, a plate retaining said conical surface in engagement with said conical tip, said plate abutting against one of the faces of said toothed member whereby, after a given displacement of said toothed member, said slot made in said toothed member gives passage to the end of said plate,

the displacement of which under the action of the spring acting on said obturator, causes the releasing of said obturator.

3. A double-acting percussion fuze as claimed in claim 2 and comprising a guide for said pin locking said balance-wheel, the displacement of said pin caused by the acceleration being of a sufficient amplitude in order to disengage said pin from said guide.

4. A double-acting percussion fuze as claimed in claim 3 and comprising a ball and socket joint connecting said pin to said inertia block, whereby said disengaged pin oscillates under the action of its weight and comes out of line with the axis of said guide.

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