Oct. 12, 1948. L. K. LILJEGREN 2,450,899

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Fig. 1.

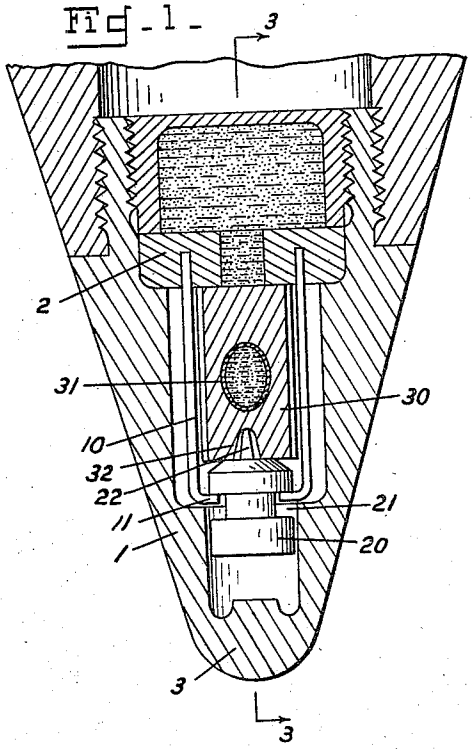


Fig. 3.

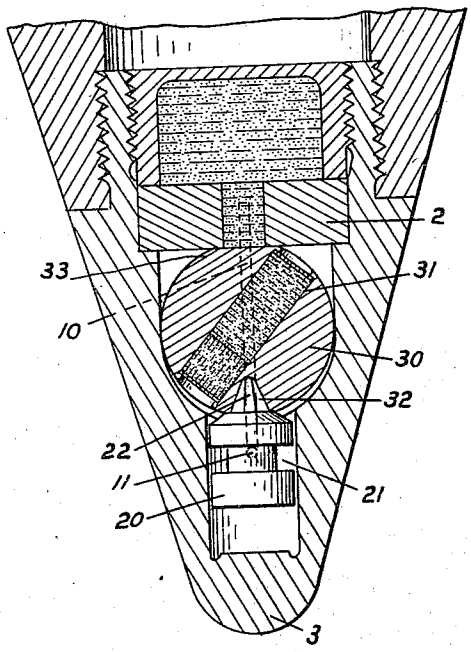


Fig. 2.

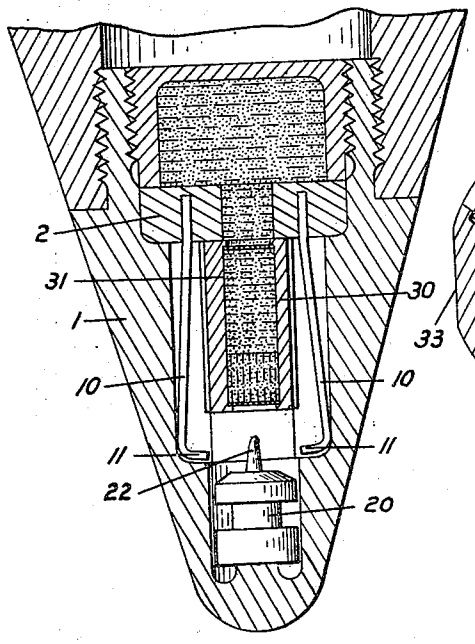


Fig. 4.

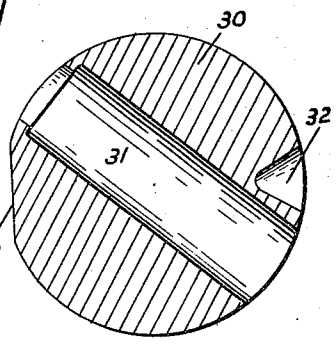
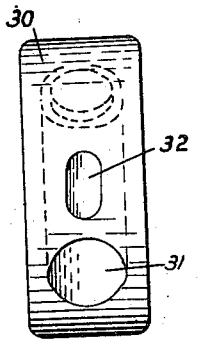


Fig. 5.



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Fig. 6.

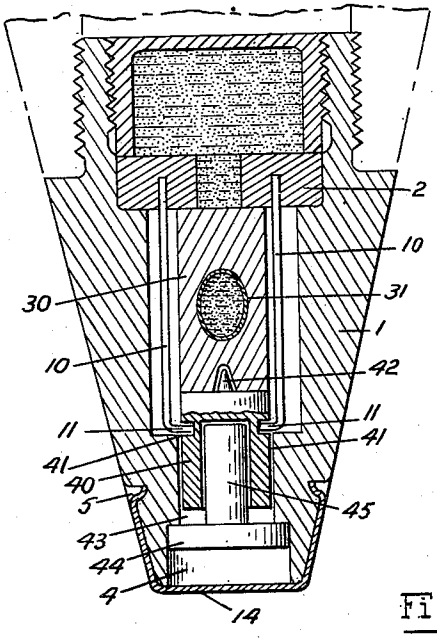


Fig. 10.

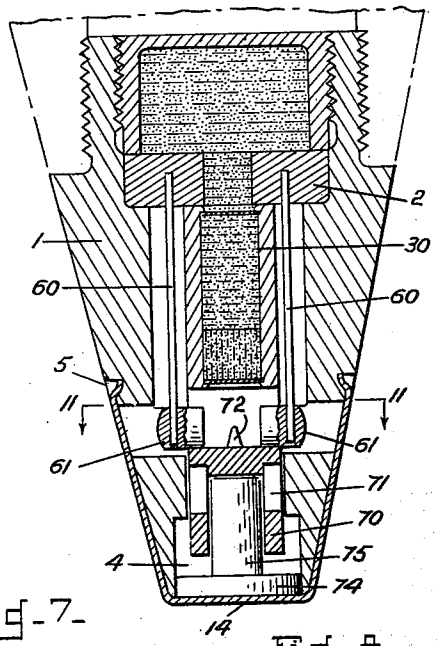


Fig. 7.

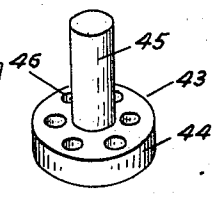


Fig. 8.

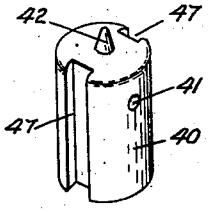


Fig. 9.

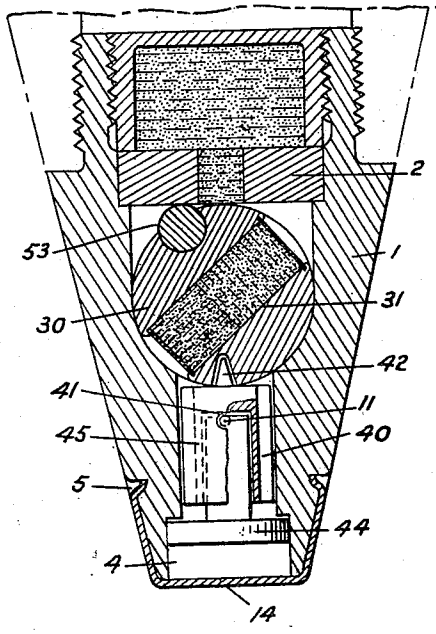
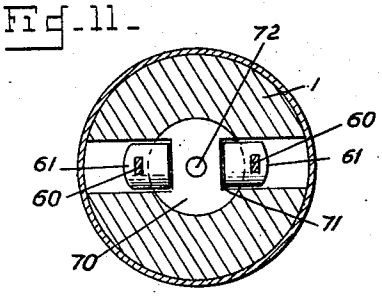


Fig. 11.



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Lyle K. Liljegren, Alexandria, Va.

Application February 14, 1944, Serial No. 522,289

1 Claim. (Cl. 102—79)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to fuzes of the point (nose) detonating type, and, more particularly, to a type of fuze implemented with a centrifugal, rolling block type of safety device. One of the objects of the invention is to devise a rolling block safety device which will have greater reliability and which may be economically produced in quantities. A further object is to provide a means for the disarming of an anti-aircraft shell to prevent explosion thereof in the event it should fall back to earth after having missed its target; this preventing means being incorporated in the rolling block type of safety device. A further object is to provide a more sensitive nose construction for a point detonating fuze having a rolling block safety device. For the attainment of these and such other objects as may appear or be pointed out herein, I have shown a number of embodiments of my invention in the accompanying drawing, wherein:

Fig. 1 is a longitudinal section through the fuze of a form of the invention having a one piece firing pin plug and spring wires;

Fig. 2 is a view similar to Fig. 1 but with the parts in arming position;

Fig. 3 is a longitudinal section taken on the line 3—3 of Fig. 1;

Fig. 4 is a section through the rolling block or disc, and

Fig. 5 is a front view of the same;

Fig. 6 is a longitudinal section of a form of invention having a two-piece firing pin plug;

Fig. 7 is a perspective view of the stud member of the two-piece plug, and

Fig. 8 is a perspective view of the thimble member thereof;

Fig. 9 is a longitudinal section of a form of the invention having a modified stop member associated with the rolling block;

Fig. 10 is a longitudinal section of a form of the invention provided with means for disarming an anti-aircraft projectile which had missed the plane target.

Fig. 11 is a cross-section through the line 11—11 of Fig. 10.

Referring first to the embodiment shown in Figs. 1–5, the nose 1 of the projectile is provided with a short cylindrical passage in which is slidably received firing pin plug 20 and a circular opening in which is rotatably mounted a rolling block or disc 30. The rolling block or disc 30, a

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detail of which appears in Figs. 4–5, has a central passage 31 which is filled with the desired detonating materials, and a detent cup 32 in which may be received the firing pin 22 which projects from the said plug 20. The detent cup 32 and central detonating passage 31 are so related that, when the safety disc or block 30 is placed in the fuze in its safe position (as in Fig. 3), the central detonating passage 31 is disposed at an angle to the longitudinal axis of the fuze and of the shell. In this inclined position of central passage 31, it is angularly displaced out of axial alignment with firing pin 22.

The firing pin plug 20, firing pin 22 of which is received in detent cup 32 of the rolling disc 30, serves to hold the disc in the angularly displaced position, shown in Fig. 3, with the detonating passage out of alignment with the firing pin. For the purpose of holding plug 20 in engagement with rolling disc 30, plug 20 is provided with an annular groove 21 in which is received the bent distal ends 11 of two or more spring wires 10 the other ends of which are secured in some part of the nose or, as shown in the figures, in the booster cap 2. The nose is provided with a passage, best shown in Figs. 1 and 2, in which the spring wires 10 may clear, both in the position of the wires in Fig. 1 and their position in Fig. 2. Spring wires 10 are shown in Fig. 1 in their normal, unflexed position in which their bent distal ends 11 are received in the annular groove 21 of the firing plug to hold the plug in engagement with the rotary disc 30.

Fig. 1 (and Fig. 3) show the parts in their position preparatory to the firing of the gun. As the projectile progresses through the gun barrel, centrifugal force caused by the rotation imparted to the projectile by the barrel rifling, spreads the spring wires apart to their position shown in Fig. 2 with their bent distal ends free of plug groove 21. However, due to setback, which is inertia during the acceleration of the projectile in the gun barrel, the firing plug 20 remains in its rearward position—i. e., towards the base of the projectile—with its pin 22 in holding engagement with the rotary block 30 (as shown in Fig. 1) and does not move forwardly—i. e., towards the nose of the projectile. When the projectile leaves the gun and starts to decelerate, inertia now causes the plug 20 to move forwardly (known as "creep") to the position shown in Fig. 2, withdrawing its pin 22 from detent cup 32 of the rotary disc 30. The rotary disc or block 30 is now free to rotate. Under the influence of centrifugal force caused by the gyratory motion of the pro-

jectile, the block or disc 30 (now freed from the pin 22, as above described) turns in a counter-clockwise direction to align the detonating passage 31 in the longitudinal axis of the fuze and shell and in alignment with the firing pin 22. The fuze is now in condition for detonation which occurs when the impact of the projectile with the target shatters the leading portion 3 of the nose and drives firing pin 22 into the detonating material contained in passage 31 of the rolling block 30. To provide a means for limiting the counter-clockwise turning of disc 30 to the described effective position, a flat surface 33 is provided on the disc which seats on the booster cap 2, Fig. 3, when the disc is in its normal blocking position (as in Fig. 3). The flat surface 33 is so designed and positioned that it will abut against the side wall—left, in Fig. 3—of the nose cavity when the disc reaches the end of its counter-clockwise turning into alignment with the fuze axis, to positively stop the disc in this position.

A modified form of firing pin plug is shown in Fig. 6 and detailed in Figs. 7 and 8. This plug is made of two pieces, a hollow thimble member 40 having a central passage in which is received the stem 45 which upstands from the base disc 44 of a stud member 43. Preferably, the thimble member 40 is fabricated of aluminum and the stud member 43, of plastic. The closed end of thimble member 40 has a firing pin 42. Two or more holes 41 are provided in the wall of the thimble member to receive the bent distal ends 11 of the spring wires 10. Instead of holes, an annular groove similar to 21 of Figs. 1–5 may be provided in the thimble member. The base disc 44 of the stud member 43 may be provided with holes 46, Fig. 7, to save material, lighten weight and to provide air passages. The thimble member 40 may be provided with longitudinal channels or grooves 47 to serve as air passages.

The disc base 44 is made as wide as possible so as to occupy a large area of the tip of the nose, as will be seen in Fig. 6. The tip of the nose casing 1 is open by reason of the fact that the cavity or passage for the firing plug extends into an open mouth 4 in which is slidably received the base disc 44 of the firing plug. The open mouth 4 is closed by a cap 14 made of aluminum or other suitable material which is held in place by the rolling or crimping of its edges in an annular groove 5 provided around the nose casing 1. The nose or point detonating construction of Fig. 6 although shown in conjunction with a two-piece firing plug, may be used with a solid firing plug, such as the plug 20 of Figs. 1–5.

Instead of employing a flat surface (33) on the rolling block or disc 30 to stop its turning in the arming position, as in Figs. 1–5, an alternate arrangement is shown in Fig. 9. A partial circle is drilled near the edge of rolling block or disc 30 in which is forced a small disc piece 53, so that a portion thereof projects beyond the edge of rolling block 30. The small stop disc 53 is so placed on the rolling block 30 that its projection is effective to stop the counter-clockwise turning of block 30 in its armed position with detonating passage 31 aligned with firing pin 42. The rolling block 30 is made of brass or steel, while the stop 53 is made of lead. The use of the heavier metal for stop 53 increases the centrifugal forces operating to turn the rolling block to arming position, by increasing the value of the radius of gyration of the block.

When a shell provided with point detonation fired by an anti-aircraft battery fails to hit the plane target it very often causes havoc by exploding when it falls to the ground with its nose pointed forwardly or downwardly. It is the purpose of the modification shown in Figs. 10–11 to disarm the fuze of a projectile which had missed the plane target, before it reaches the ground. Instead of wires or rods 10 such as has been employed in the modifications of Figs. 1–9, thin strips 60 of flexible or spring material are secured in the booster cap 2 (or other part of the fuze casing). At the distal end of the strips 60 are secured buttons 61 which are receivable in holes 71 provided in the firing pin plug 70. Two spring strips 60 and two holes 71 are shown, see Fig. 11, merely by way of illustration. Instead of holes, an annular groove may be provided, as in the form of invention shown in Figs. 1–5. Although a two-piece firing pin plug is shown in Fig. 10, it is clear that this modification may have a solid plug, as in the form of invention shown in Figs. 1–5.

The buttons 61 and the firing plug 70 are so dimensioned and positioned that, when the firing plug 70 is in its forward position against the nose covering or cap 14 (as in Fig. 10), the buttons 61 will be positioned—i. e., when their spring strips 60 are not flexed outwardly, due to centrifugal force—to prevent rearward movement of the plug towards the detonating block 30. As a projectile which had missed its target, more particularly an anti-aircraft projectile which had missed its plane target, continues on its trajectory, the gyratory or rotary motion of the projectile becomes less and less, until the centrifugal force of its rotation becomes too weak to spread or flex the spring straps 60, whereat their distal buttons 61 snap behind the firing plug (the plug having been advanced to its forward position as a result of "creep," as described above). It is thus seen from Fig. 10 that the buttons 61 prevent the motion of the firing pin 72 towards the detonating charge 31 held in rolling block 30. Hence when the nose of the projectile impacts the ground firing pin 72 will be blocked from impinging against the detonating charge 31 to fire the same.

I claim:

In a point detonating fuze for a rotating projectile, a nose having a cylindrical axial passage opening rearwardly into a circular opening, a cylindrical block rotatably mounted in said circular opening, said block having a detonating passing diametral thereof and a peripheral detent cup disposed at an angle relatively to the central axis of said passage, a plug slidably mounted in said passage for movement therein in response to deceleration thereof, a projection on said plug to be received in said cup in a first rotational position of said block to prevent rotation thereof, and to be aligned with said passage in a second rotational position of said block, a plurality of spring wires each anchored at one end to said fuze and provided with stop means at its free end adapted to be received in an annular groove in said plug to hold said plug with said projection in said cup, said circular opening having a flat end wall remote from and transversely across the axis of said passage, said block having a flat surface adapted to seat on the flat end wall of said opening to locate said block in first position and

to abut the side wall of said opening to locate said block in second position when the block is moved thereto in response to centrifugal force after release by movement of said projection out of said cup.

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