Aug. 1, 1950 L. K. LILJEGREN 2,516,890

FUSE

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Fig. 1.

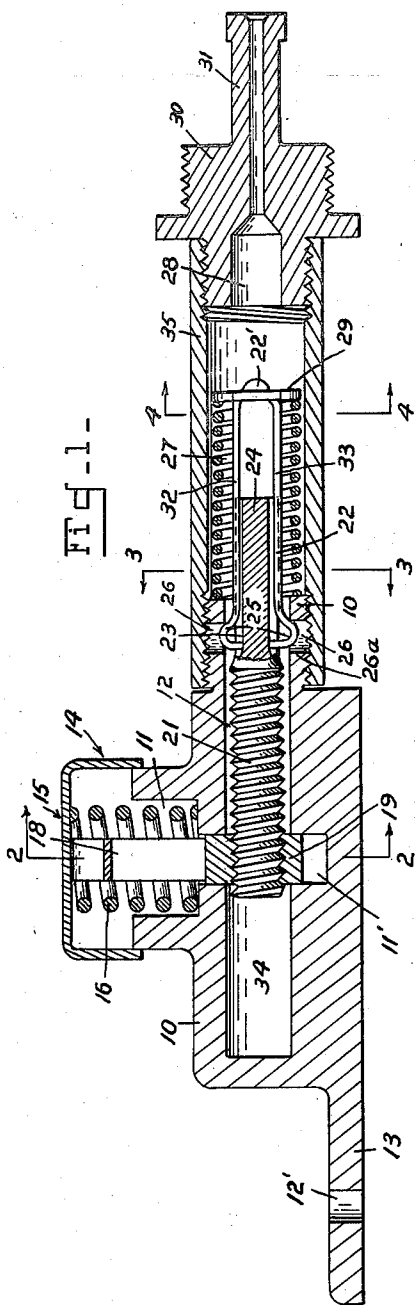


Fig. 4.

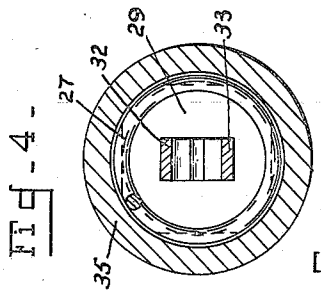


Fig. 5.

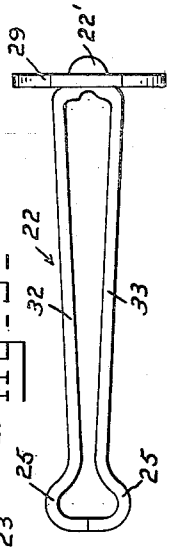


Fig. 3.

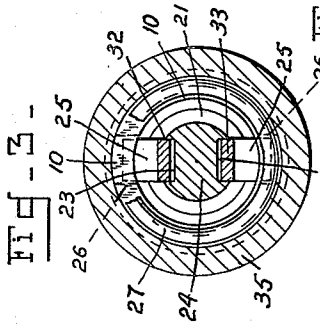
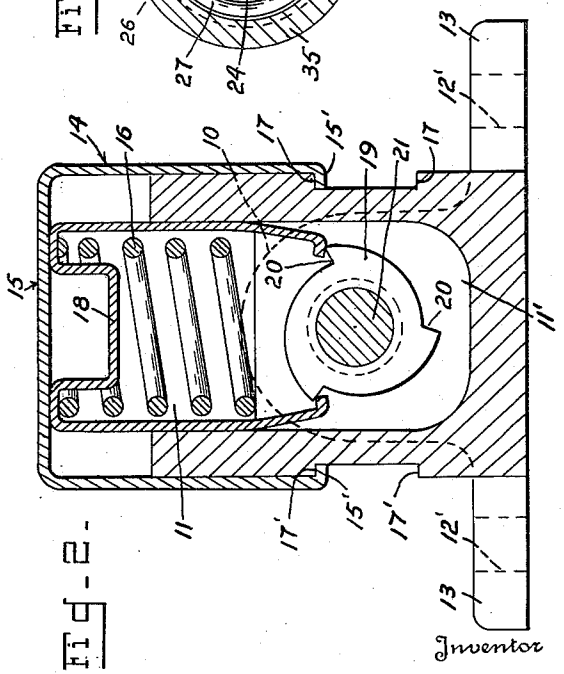


Fig. 2.



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FUSE

Lyle K. Liljegren, Silver Spring, Md., assignor to the United States of America as represented by the Secretary of War

Application September 1, 1944, Serial No. 552,351

7 Claims. (Cl. 102—70)

(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.

My invention relates to fuzes and particularly to pressure fuzes.

The present fuze is adaptable for many uses and especially advantageous in explosive devices used in connection with booby trap installations where actuations by pressure are desired, and in mine fields where numerous tanks or the like may enter the field a predetermined distance without harm or effect before the charges are set off. Ordinarily, a mine is exploded by the first contact therewith thereby warning the following tanks of a dangerous condition ahead. In the instant case means are provided whereby numerous tanks may be caught in a trap since a predetermined number of contacts or actuations are necessary before the mine is finally exploded. It is therefore a primary object of my invention to provide a repeated impulse type fuze which can be set to function an explosive charge after the actuating means has been subjected to a number of impulses for which the fuze was set.

Another object is to provide a fuze having a conventional screw threaded base plug or detonator holder for fitting a land mine, booby trap, grenade and the like which will safely permit a predetermined number of actuations and will not be rendered effective to explode a charge until a set number of impulses have been received.

A further object is to provide a fuze with an impulse receiver wherein same is set from its interior, the number of impulses for which it is set being not visible from its exterior.

A still further object is to provide novel coupling and releasing means for the firing pin or striker.

Still another object is to provide a simple, compact and fool-proof structure for firing an explosive charge at a predetermined time and one which is constructed to withstand the elements.

Other objects and advantages will be apparent from the following description, reference being had to the accompanying drawings forming a part of this application and in which like numerals designate like parts in all views.

In the drawings,

Figure 1 is a side sectional view of my improved fuze,

Figure 2 is a section taken on the line 2—2 of Fig. 1,

Figure 3 is a view taken on the line 3—3 of Fig. 1,

Figure 4 is a view taken on the line 4—4 of Fig. 1, and

Figure 5 is a side elevation of the firing pin.

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Referring to the drawing, 10 designates the housing or casing of the fuze which is provided with vertical and horizontal bores 11 and 12 respectively. Apertures 12' are provided in the base 13 of the body 10 to fasten the fuze to a support if desirable. A pressure element or impulse receiver is indicated at 14, and this element comprises a button or cap 15 and a resistance spring 16 which serves to urge the button outwardly. Retaining flanges 17 and 17' are provided to limit the vertical movement of the cap and are engaged by the cap fingers 15'. As will be appreciated this member 15 is operated by the weight or impulse of any object which passes thereover wherein the pressure on the cap overcomes the resistance of the spring. This movement provides the impulse means for operating the firing pin or striker arranged in the fuze since each time the cap is depressed one actuation or impulse is provided.

A substantially U-shaped pawl 18 is located in the vertical bore 11 and fixed to the cap 15 in any suitable manner and operates a ratchet nut 19 arranged in a reduced portion 11' of the bore 11 when pressure on the cap is provided. This member 19 is provided with ratchet teeth 20 and is threaded on a non-rotatable screw or shaft 21 longitudinally arranged in the horizontal bore 12. As pressure is applied to the impulse receiver 14 the cap 15 forces the pawl down to engage a tooth 20 whereby the nut 19 is advanced one step or notch in a clockwise direction as observed in Fig. 2. Since the nut is threaded on the screw rod 21 and since the screw cannot rotate, the turning of the nut 19 causes the screw to back away from coupling engagement with a firing pin or striker 22 carried on its end.

The screw may be adjusted or set for any number of turns of the nut 19 before it frees the substantially U-shaped spring firing pin 22 which is provided with the firing head 22'. Screw 21 is provided with an extension 24 having longitudinally extending channels or abutments 23 therein adapted to receive or seat the spring arms 32, 33 on the firing pin 22. The arms of the pin are provided with offsets or lugs 25 to seat in the two openings or abutments 26 formed by drilling a vertical bore through the fuze body at the position indicated. It will be noted that since the arms of the striker seat in these two openings 26 in the fuze body, the striker is prevented from rotation while the arms remain separated by remaining in the channels or grooves 23 of the screw extension, and necessarily prevent the screw from rotating since the arms slide in the grooves in the screw extension. Since the screw cannot rotate, the clockwise rotation of the nut 19 as seen in Fig. 2 necessarily causes the screw to move in a longitudinal direction backing away from engage-

ment with the striker 29. In this manner, successive step by step actuations will finally cause the screw to become entirely disengaged from the firing pin means. Since contact with the extension rod 24 holds the spring arms open and the lugs 25 in the retaining bores 26 a release of the striker from the rod causes the retraction of the spring arms and disengagement of the lugs from the retaining bores 26 and permits the firing pin to project forwardly to explode a charge in the space 28 carried by the conventional screw threaded base plug 30 having the usual stem 31 on which is crimped a U. S. non-electric cap. The compression spring for the firing pin is indicated at 27 and is normally held compressed between the end of the fuze body and the washer 29 carried by the pin 22.

The travel length of the screw is to be adjusted from the interior of the fuze as to the desired number of impulses or actuations it is to receive before the firing pin is disengaged therefrom. If desirable, the screw may be marked in any suitable manner to indicate the number of impulses or actuations necessary to release the firing pin at a certain given point thereon. For this purpose the fuze is provided with a removable screw threaded casing 35 whereby the working parts may be readily reached. A travel space 34 is also provided to receive the screw end as it is being set or uncoupled.

The pawl and ratchet assembly provides a simple means of operating the fuze. Pressure on the impulse receiver overcomes resistance of the cap spring whereby the ratchet thru the medium of the pawl is given a turn and after a predetermined number of step by step actuations the screw is forced out of engagement with the firing pin permitting the release of the pin and the subsequent firing action. Such a retarded or delayed means of operation is especially desirable in warfare and can be particularly destructive since the presence of a mine or trap is overlooked after a limited number of contacts or passages have been made thereover and no damage has occurred. However, upon a certain predetermined contact the mine or trap is exploded and the result may be more devastating.

It will thus be seen that I have developed a fuze which is simple, effective, and one which is able to withstand various weather conditions. When in position the impulse receiver is preferably placed just beneath the surface of the ground or otherwise camouflaged and objects may pass thereover a predetermined number of times without danger before the firing pin or striker is operable to set off a charge. It will be appreciated that each time an object passes thereover one impulse or actuation is given the fuze. If the fuze is set for say 20 impulses before exploding the charge the device may be rendered harmless for 19 impulses. but on the 19th impulse the striker is ready to be released on the next or 20th impulse whereby the charge is exploded. The fuze may be set to receive any number of impluses from 1 up to say 30 or more and the number of impulses may vary with the number of teeth carried by ratchet and the length of the stroke of the pawl and/or by the size or length of the screw.

The resistance of the impulse receiver spring may be varied such as to withstand a certain weight before being operable, that is the spring may be of such resistance as not to be affected by the weight of a man, or light weight vehicles,

or the spring resistance may be weak and operable by any light weight contact.

To set the fuze, the casing 35 is unscrewed and the cap 15, pawl 18 and spring 16 are removed from the body 10. If the firing pin 22 has not been assembled to the screw 21, then the latter must be threaded all the way through the ratchet 19 so it fills the space 34, and this is done by holding the ratchet stationary while the screw 21 is turned in a clockwise direction, moving it through the ratchet 19. The spring 27 is then placed over the firing pin 22 and compressed sufficiently to place the two projections 25 on the firing pin opposite and between the two holes 26 in the fuze body. The grooves 23 of the screw extension 24 are brought into engagement with the open ends of the firing pin 22 so that the separation of the firing pin arms 32 and 33 causes the lugs 25 to become engaged with the holes 26. Turning the ratchet nut 19 then moves the screw extension 24 up further between the arms or forks 32 and 33 of the firing pin. These are graduated to indicate the number of turns required to cause the fuze to release the firing pin. The ratchet 19 is turned until the end of the screw extension aligns itself with the desired graduation. The casing 35 is then screwed into place and the cap 15, pawl 18 and spring 16 replaced. The fuze is now ready to function as described herein. Where an entirely assembled fuze is to be set, the casing 35 and the cap 15, pawl 18 and spring 16 are removed, and the ratchet 19 rotated in the proper direction to align the end of the screw extension 24 with the desired graduation on the firing pin fork. The removed parts are then replaced and the fuze is ready to function.

I claim:

1. A fuze comprising a casing having vertical and longitudinal bores, a depressible member, a pawl mounted in said vertical bore and operable by said depressible member, a screw mounted in said longitudinal bore, a ratchet nut mounted on said screw for engagement with said pawl, said screw provided with an extension having longitudinally arranged channels, a spring firing pin of substantially U-shaped configuration mounted on one end of said extension, the legs of said pin engaging said channels, means for holding said pin in locked position on said shaft, and means whereby said firing pin is unlocked to explode a charge when a predetermined number of movements have been given the screw.

2. In a delayed action fuze, a casing, a screw mounted in said casing and having a longitudinally extending first abutment extending from one end, a firing pin adjacent said one end, spring means urging said pin into charge-detonating movement, a spring arm carried by said pin and simultaneously engaging said abutment and a second abutment on said casing to thereby prevent rotation of said screw as well as charge-detonating movement of said pin, and means responsive to discrete impulses exteriorly of said casing for axially translating said screw away from said spring arm in step-by-step movement, whereby said spring arm is released from both said abutments by the final one of a series of said impulses.

3. A contact fuze comprising a casing, a threaded shaft axially translatable in said casing, a first abutment on and extending from one end of said shaft longitudinally thereof, a second abutment on said casing, a firing pin movable in said casing, resilient means urging

said pin into charge-detonating movement, a spring arm carried by said pin and having means engaging both said abutments to thereby prevent rotation of said shaft and movement of said pin, said arm being yieldingly urged into contact with said shaft, and means responsive to discrete contact pressures exteriorly of said casing to retract said shaft step-by-step from said arm whereby said arm and pin are freed from said abutments for charge-detonating movement by the final one of a predetermined number of said pressures.

4. In a contact fuze, a casing, a threaded shaft mounted in said casing for longitudinal movement, said shaft having a pair of diametrically opposed channels extending longitudinally from one end thereof, a firing pin mounted in said casing adjacent said one end for movement longitudinally of said shaft, spring means urging said pin into charge-detonating movement away from said shaft, said pin including a pair of arms having their ends urged toward each other, the end of each arm being simultaneously engaged in a respective channel and in a recess in said casing, whereby to simultaneously prevent rotation of said shaft and movement of said pin, a ratchet nut threaded on said shaft, and spring-pressed pawl means carried by said casing and responsive to discrete external pressures thereon for rotating said nut step-by-step to thereby retract said shaft from said firing pin, whereby said arms are freed from said channels and recesses by the final one only of a predetermined number of said pressures.

5. In a fuze, a casing having a bore, a shaft mounted in said bore for axial translation and having key means extending longitudinally from one end thereof, a firing pin, means mounting said firing pin for firing movement in one direction coaxially with and away from said one end of said shaft, an arm fixed with said firing pin and having lug means remote from said pin to simultaneously engage said key means and an abutment fixed with said casing, said key means and abutment coacting to prevent firing movement of said pin and rotation of said shaft, said arm being resilient to tend to move its lug means radially inwardly out of contact with said abutment, spring means urging said pin into firing movement, and actuating means carried by said casing and engageable externally thereof to move said shaft axially step-by-step away from said lug means whereby said lug means is released from said key means in response to the final one of a predetermined number of actuations of said actuating means to thereby free said firing pin for firing movement.

6. A fuze comprising a spring-pressed member, a pawl operable by said member, a ratchet operable by said pawl, a longitudinally arranged screw, said ratchet being threadedly engaged with said screw to impart a step-by-step longitudinal movement thereto, a firing pin coupled to said screw and restraining the same against rotation, means responsive to the final one of a predetermined number of movements of said screw for uncoupling said pin from said screw, a casing for enclosing said screw, said screw having longitudinal channels therein and said firing pin being provided with spring legs to simultaneously engage said channels and said casing to thereby prevent rotation of said screw.

7. A fuze comprising a body having intersecting vertical and longitudinal bores, a depressible member, a pawl reciprocably mounted in said vertical bore and operable in response to actuation of said depressible member, a screw mounted for axial movement in said longitudinal bore, a nut threaded on said screw and mounted for rotation only in said body, said nut being rotatable step-by-step in response to discrete operations of said pawl, a firing pin, means fixed to said pin and engageable with said screw and body to simultaneously prevent rotation of said screw and firing movement of said pin, said screw being axially withdrawn from said means to release said firing pin for firing movement, only in response to the final one of a predetermined number of thrusts on said depressible member.

LYLE K. LILJEGREN.

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