Jan. 26, 1954 R. B. GIORGI 2,667,123

SAFETY RELEASE DEVICE FOR MECHANISMS

Filed April 10, 1951 3 Sheets-Sheet 1

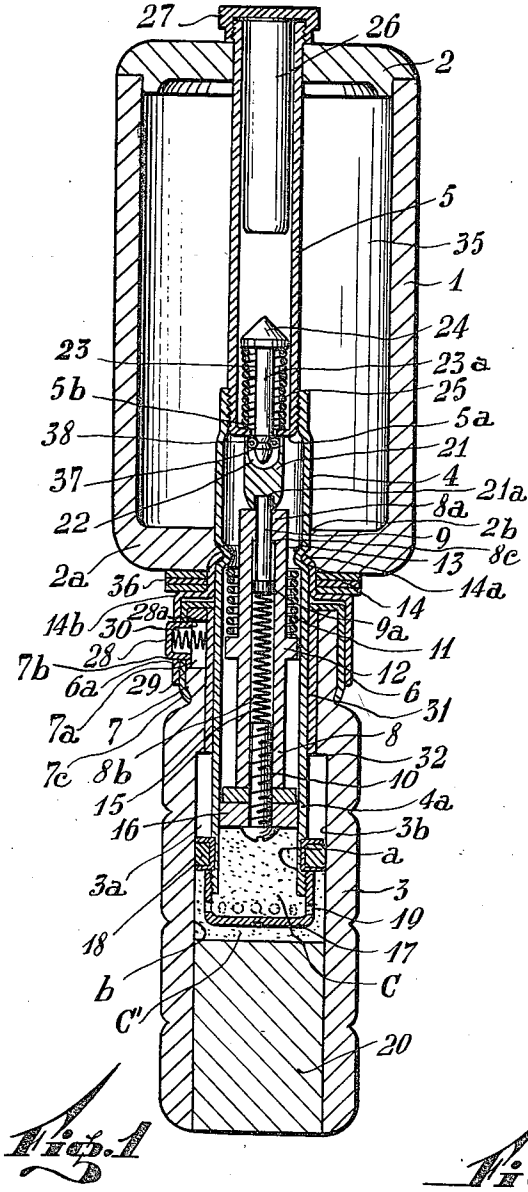


Fig. 1

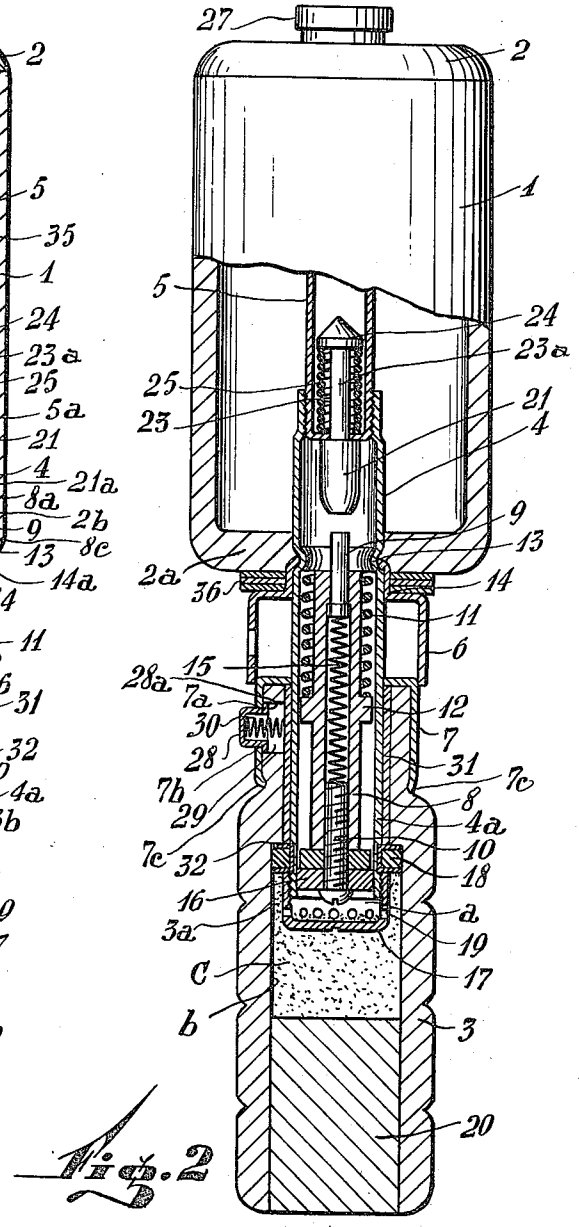


Fig. 2

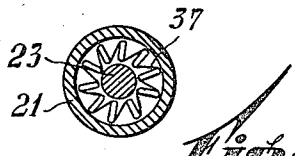


Fig. 3

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SAFETY RELEASE DEVICE FOR MECHANISMS

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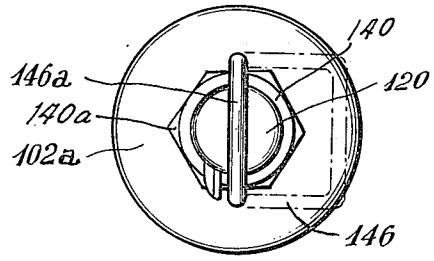


Fig. 5

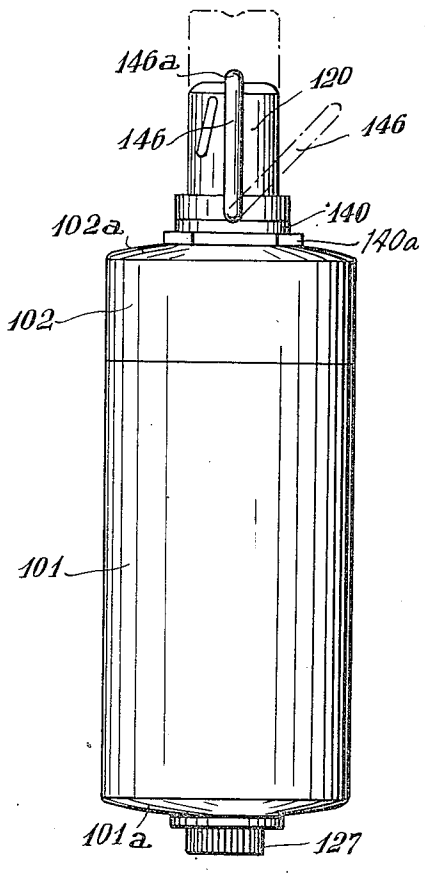
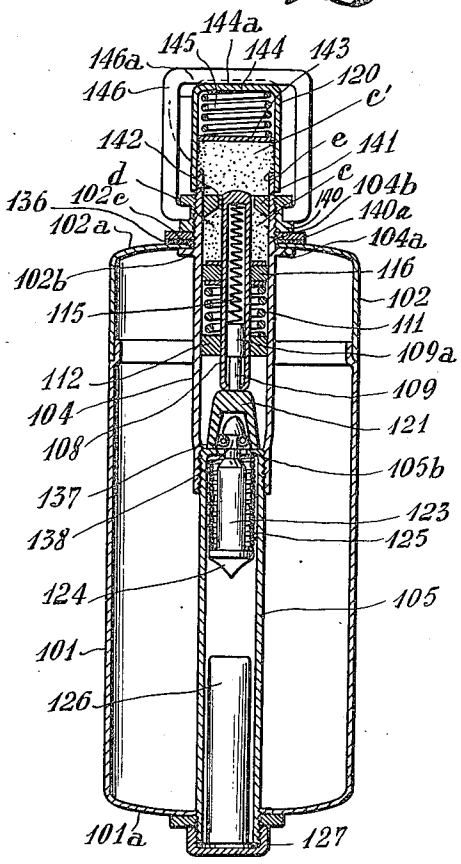


Fig. 4

Fig. 6



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SAFETY RELEASE DEVICE FOR MECHANISMS

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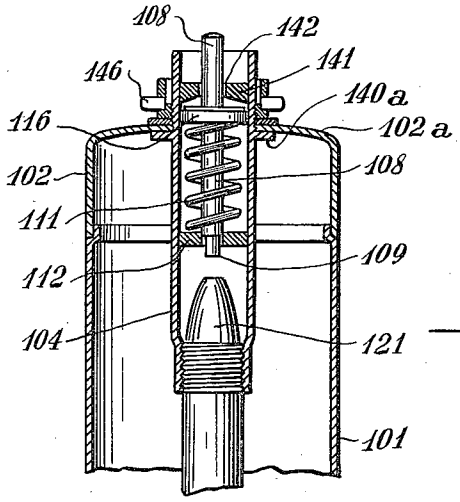


Fig. 7

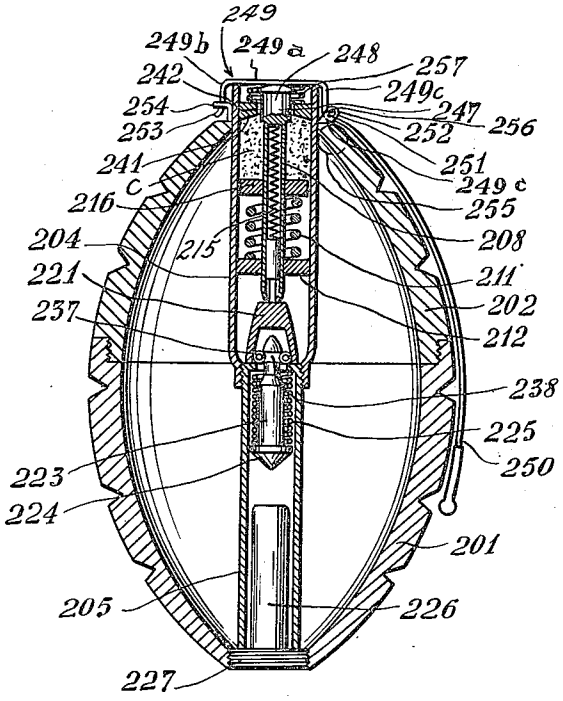


Fig. 8

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UNITED STATES PATENT OFFICE

2,667,123

SAFETY RELEASE DEVICE FOR MECHANISMS

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Application April 10, 1951, Serial No. 220,242

11 Claims. (Cl. 102—65.4)

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The present invention which is a continuation-in-part of application Serial No. 20,948 filed April 14, 1948, relates to release and safety devices for mechanisms.

The principal object of the present invention is to provide a safety release device for mechanisms including time delay means, whereby under normal circumstances the mechanism may be held securely in inoperative position, and when desired, said device may be actuated to bring the mechanism into a set position after a predetermined time interval, whereby said mechanism may thereafter be instantaneously caused to become operative.

Another object of the present invention is to provide a device of the type described which shall comprise a mechanical retaining means for an operative member and loosely coupled thereto, the assembly when not otherwise blocked being responsive to shocks to instantaneously release said member, and having associated therewith mechanical time delay means arranged to counteract the shock responsiveness of said detaining means, and means for normally locking said time delay means in counteracting position.

The novel safety release device of the present invention may be applied to a variety of mechanisms where a trigger action release of an operative member is desired to take place in certain eventualities in response to shock-like disturbances, as for instance in burglar alarms, but since the novel release device is particularly suitable for fire-arms, and especially for fire-arms of the hand grenade type, said device will hereinafter be more particularly described as applied to hand grenades, but it is not intended thereby to limit the usefulness or applicability of the safety release device, since, as will be clear to those skilled in the art, it may readily be applied to other mechanisms.

These and other objects and advantages of the present invention will become more clearly apparent in the course of the following detailed description of certain preferred embodiments thereof illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a longitudinal section of a handled type of hand grenade incorporating the safety release device of the present invention, showing the release device in the locked position.

Fig. 2 is a longitudinal section of the grenade of Fig. 1 showing the release device in fully released position.

Fig. 3 is a detail view partly in section, of the shock responsive coupling means.

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Fig. 4 is a side elevation of a handleless hand grenade provided with the safety release device of the present invention.

Fig. 5 is a top plan view of the grenade of Fig. 4.

Fig. 6 is a vertical section along the line VI—VI of Fig. 5.

Fig. 7 is a fragmentary sectional view on an enlarged scale, of a portion of the grenade of Fig. 4, showing the release device in fully retracted position, and

Fig. 8 is a longitudinal section showing the safety release device applied to yet another type of hand grenade.

Considering first Figs. 1, 2 and 3, it will be observed that the grenade therein shown is of the type comprising a head casing 1 having at one end an end closure 2 and at the other end a handle 3, whereby to grasp the weapon so as to facilitate throwing same. Inside the head casing are partition means dividing the head casing into a charge chamber 35 and a firing chamber, said partition means consisting of a tubular housing 5 extending inwardly of the head 1 and suitably secured to the end closure 2, which tubular housing 5 also projects slightly beyond the end closure on the outside thereof to receive a primer or detonator 26 conveniently held in position as by a screw cap 27. Said tubular housing 5 extends to the neighborhood of the closed bottom 2a of the head 1, where said housing meets and is connected, as by screwing, to a tubular casing or cylinder 4, which extends through hole 2b in said bottom 2a, into the handle 3, which is made hollow for this purpose. At a point of said tubular casing 4 lying within the thickness of the bottom 2a of head 1, a circumferential constriction 13 is provided concave on the outside of the casing 4, to receive the inturned end 14a of a cylindrical projection 14 of relatively small diameter extending axially from a thimble 6 of relatively large diameter, between which thimble and the projection 14 there is an annular shoulder 14b, between which and the outer face of the bottom 2a a packing 36 may be provided. It is to be understood that the tubular casing 4 is fixedly secured, as by press fitting, welding, or screwing, to the bottom 2a, so that, owing to the presence of the constriction 13a, said casing will hold the thimble 6 in position. The thimble 6 has a lateral hole 6a for a purpose to be presently described.

The tubular casing 4 extends slidably through an elongated bushing 31 provided in the end of handle 3 adjacent the head 1, and projects

therebeyond into a chamber 3a of diameter greater than of said bushing, the chamber 3a being closed at its end remote from the head 1, as by a plug 20 inserted into the axial bore of the handle 3.

Near but not at the extremity of the casing 4 lying within the chamber 3a, a plunger ring 18 is provided which is in sliding engagement with the inner cylindrical surface 3b defining the chamber 3a, and is consequently adapted to be engaged and stopped by the annular shoulder 32 formed between the bushing 31 and the surface 3b which is of greater diameter as already indicated, when relative movement occurs between the plunger ring and the handle as will hereinafter be explained. The extremity of the tubular casing 4 which lies within the chamber 3a is closed by a cover member 17 suitably secured thereto as by screwing, and provided with lateral perforations 19, whereby restricted communication is established between the interior of the cylinder or casing 4 here shown as the interior room a, and the circumambient medium, which in this embodiment is represented by a lower portion b of the chamber 3a.

Returning now to the tubular housing 5, it will be observed that it is provided with a wall on floor 5a defining in the firing chamber a primer chamber in which detonator 26 is located and serving as a seat for one end of a compression spring 25 the other end of which abuts against a head 24 of an actuating member, here shown as a firing pin 23, including a stem 23a the end of which remote from head 24 has a peripheral groove 38, said head being located on the same side of the floor or wall 5a as said primer or detonator 26, and said stem passing freely through said wall or floor 5a.

In the normal or safety position of the parts, said firing pin is adapted to be retained in retracted position, in which the grooved end thereof extends beyond the floor 5a through a perforation 5b, by releasable means comprising a generally circular resilient member 37, as seen also in Fig. 3, which is adapted for radial compression and expansion. In the expanded condition of resilient member 37, it defines an aperture which will readily allow the grooved end of pin 23 to pass therethrough, so that normally said resilient member is held in radially compressed condition by a retaining cap 21 having an end recess 22 adapted to receive the grooved end of pin 23 and said resilient member 37. The mouth of the recess 22 is so formed that when said retaining cap is in position, the frictional engagement and the spring pressure of the resilient member 37, with respect both to said retaining cap 21 and the grooved end of pin 23, is just sufficient to retain said retaining cap 21 in position over said resilient member, unless subjected to a disassembling or releasing force of a desired and predetermined intensity, say of the order of 100 grams. Hence, even with the retaining cap freely suspended as just described, from the grooved end of the firing pin 23, the grenade will not be exploded until the requisite releasing force or shock is applied, because the firing pin 23 will be held in retracted position as regards the detonator 26 which will therefore not detonate any charge provided within interior or charge chamber 35 of the head 1. It should be noted that the releasing force may be applied to the retaining cap 21 in any direction.

For normal handling, storage and the like, of the grenade, said retaining cap 21 is adapted to be held positively and securely in retaining position by a retractable time delay means, which in turn is adapted to be held locked in inoperative position.

The time delay means comprises a plunger means 16 slidably located in tubular casing 4, between the constriction 13 and the cover 17 thereof, the tubular casing 4 acting as a cylinder for said plunger. Said plunger 16 has secured to it, as by a screw 10, a hollow elongated sustaining member 10 having, at a point intermediate its ends, an external annular flange 12, between which and the convex side of the constriction 13 a compression spring 11 is provided whereby said sustaining member and the plunger secured thereto are urged towards the perforate end, in this embodiment the end cover 17, of the tubular casing or cylinder 4.

The end of the sustaining member remote from the plunger 16 is closed and has an axial hole 8a of smaller diameter than the axial bore 8b of said hollow sustaining member 8, through which hole 8a projects coaxially with the sustaining member the shank of a delaying member such as the pin 9, telescopically associated with the sustaining member, and having a head 9a located within the bore 8b, so that the delaying pin cannot be withdrawn from the sustaining member from the closed end of the latter. The delaying pin is urged to fully projecting position towards said cap member 21 by a compression spring 15 located in the bore 8b of the sustaining member 8, one end of said spring abutting against the head 9a and the other end thereof abutting against the plunger 16, or, as shown against a stop associated therewith, for example the inner end of screw 10. The plunger 16 is normally held in retracted position as regards the end cover 17 by a filling C of a flowable material, such as a fluid, semi-liquid granular or pulverulent substance, preferably a substance of substantially constant viscosity under all conditions likely to be met in practice. Preferably such substance is a silicone, which has been found to give highly satisfactory results. How this substance operates will be hereinafter explained.

The handle which, by reason of the bushing 31, is slidably mounted on the tubular casing 4, is adapted to be normally locked in safety position by suitable locking means, which while they form an essential component of the safety release device of the present invention, will vary in design in accordance with the requirements of the particular type of mechanism to which said safety release mechanism is to be applied. Examples of some of the variations will be given hereinbelow, but in connection with the embodiment illustrated in Figs. 1 to 3, the locking means conveniently takes the form of a push button 28 which is hollow and open at one end, and around which there is an external flange 28a, adapted to be held normally in abutting engagement with a lip 7a defining a hole 7b in the side wall of a ferrule 7 fitted over the end of the handle nearer to the head 1 and permanently secured to said end, as by being spun over at the open end of the ferrule as indicated at 7c. The hole 7b of ferrule 7 registers with a recess or perforation 29 extending laterally into the ferruled end of the handle 3 and providing a chamber in which a spring 30 is housed to hold said button 28 in said abutting relationship.

In the locked, safety position of the parts, the push button 28 is adapted to project through the lateral hole 6a of thimble 6, thereby holding the

handle 3 in close-up, contracted relationship to the head 1. In this position of the handle 3, the free closed end of the sustaining member 8 is firmly held in engagement with the retaining member 21, against the action of spring 11 by reason of the fact that the room *a* defined between the plunger 16 and the end cover 17 is filled with said flowable material C which is prevented by check means from escaping through the perforate end of the cylinder or casing 4, that is to say, in this embodiment, through the holes 19. As shown in the drawings, in this embodiment the check means consists in that the portion *b* of the chamber 3*a* lying between the plunger ring 18 and the plug 20 and surrounding the end cover 17 is likewise filled with the same kind of material, as indicated at C'.

It will be recalled that the handle 3 is slidable on the tubular housing 4, to be retracted from the head 1 to an extent determined by the position on the tubular housing, of the plunger ring 18. Hence, in the contracted position of the handle there will be a free space between the shoulder 32 of chamber 3*a* and said plunger ring to permit retracting movement of the handle when unlocked, whereby the portion *b* of chamber 3*a* will gain in volume at the expense of the annular space between said plunger ring and shoulder 32, to thereby permit the material C contained in the room *a* to escape through the holes 19 into portion *b*, under the thrust communicated to plunger 16 by the spring 11, which, in the unlocked position of the parts, will be free to expand.

While the parts are still in locked position, the pin 9 will have its free end in engagement with the retaining member 21, which, to this end, is conveniently recessed as indicated at 21*a*, and the arrangement of the parts is such that, in said locked position thereof, the pin 9 is pushed back somewhat into the bore 8*b*, so that the spring 15 is compressed.

Thus it will be understood that in the locked position of the parts as illustrated in Fig. 1, the firing pin 23 is positively held in retracted position with respect to detonator 26, and cannot be released even by shock, until the retaining member 21 is at least free to drop off the grooved end of said firing pin.

To free said retaining member and thereby put the grenade in a condition to be instantaneously detonated on being subjected to shock or impact, the handle is first unlocked by depressing the push-button 28 and giving the handle a slight turn in either direction, to bring an imperforate part of the thimble 6 opposite said button 28 to lock same in depressed position. It is then possible to cause the handle 3 to be retracted from the head 1, either under the action of centrifugal force, as when throwing the grenade, or by pulling on the handle, or even by leaving the handle to be slowly pushed to retracted position by the thrust of the expanding spring 11, the action of which is essentially the same in any case, so that one description thereof is deemed sufficient.

When the handle 3 has been unlocked as just described, spring 11 can make its stored energy felt by exerting a live thrust upon the annular flange 12 to urge the sustaining member 8 and the plunger 16 away from the head 1. The retraction of the sustaining member 8 and the plunger 16, is however opposed by the material C filling the room *a*, which as already indicated, cannot, in the locked position of the handle, escape through the holes 19 owing to the fact

that, in those circumstances, the volume of portion *b* of chamber 3*a* is positively restricted and is also full of the same kind of material C'. When, however, the handle is unlocked, the handle may slide along the tubular housing 4, to thereby increase the volume of portion *b* thus allowing material C from room *a* to escape through holes 19 into said portion *b*, at a rate depending on the viscosity of the material and on the size of the holes, and, owing to the emptying of said room *a*, the plunger 16 may move towards the end cover to take up, as it were, the place previously occupied by the filling C of flowable material inside the room *a*. The retracting movement of the sustaining member 8 is assisted by the expansion of spring 15, which, so long as the head 9*a* of delaying pin 9 is out of engagement with the internal shoulder 8*c* formed between the bore 8*b* and the smaller bore 8*a*, will maintain the free end of said delaying pin in engagement with the retaining member 21. The arrangement of the parts is such that said engagement of the head 9*a* and shoulder 8*c* does not take place until the spring 11 is fully expanded as indicated in Fig. 2, and the amount of time which elapses between unlocking of the handle 3 and full expansion of spring 11, will depend principally upon the rate of outflow of the flowable material C through the holes 19. Thus, by suitable choice of such material, any desired time delay may be provided for between unlocking of the handle and the arrival of the parts at a position in which the grenade is set for detonation instantaneously by impact or shock. This set position is shown in Fig. 2 from which it will be seen that the retaining member 21 is still in position to hold the resilient member 37 in the groove of the firing pin 23, and thereby hold the firing pin in retracted position with respect to the detonator 26. However, the connection between the retaining member 21 and the firing pin 23 is, as has already been explained, so precarious as to be instantaneously broken if the head 1 or the grenade as a whole is subjected to a shock, as upon impact of the grenade against an object at any angle, or upon the application thereto of a blow or kick. By properly choosing and designing the shape of the recess 22 with respect to the strength and design of the resilient member 37, the sensitivity of the retaining member may be adjusted to a predetermined lower limit, such for example as 100 grams, or may even be adjusted for certain purposes in such a manner that the retaining member will drop off the firing pin 23 as soon as the delaying pin 9 has been sufficiently retracted.

The purpose of the delaying pin 9 is to provide sufficient time for the plunger 16 and the sustaining member 8 to reach almost fully retracted position, before the retaining member 21 is liberated to respond to shock, and it also provides an additional element in the combination whereby the timing of the safety release mechanism may be preadjusted to a desired value.

As will be understood from the foregoing description of one embodiment of the novel safety release mechanism of the present invention, when applied to arms such as hand grenades, it has the great advantage that, with the elimination of a time match, which, unless something is not in order with the detonator or the charge of the grenade, will at the end of a predetermined time interval, inevitably cause the grenade to explode, irrespective of circumstances, and will not cause explosion until the expiry of such time

interval, the present mechanism provides not only instantaneous explosion of the grenade upon impact or shock, but also the greatest measure of safety to the user and a considerable flexibility in design. Thus, so long as the handle is in the locked position, as in the case of other types of grenade provided with safety pin or safety catch, the grenade cannot explode. If the handle is unlocked, the grenade will not explode until the sustaining member and delay mechanism have operated to free the retaining member, and even then the grenade may be handled gently without provoking explosion. Thus, it may be laid upon the ground, where it will be perfectly innocuous for an indefinite time until given a shock. Hence, if for some reason a user, after unlocking the mechanism, does not throw the grenade, or throws it short, neither he nor his companions, if any, need rush to cover. All that is required is that he and they withdraw to a reasonable, safe distance depending on the rating of the grenade, and then explode same, either by firing a bullet at the grenade, or even by throwing a stone or other missile at it. Moreover this property of the novel safety release mechanism of the present invention, makes it possible to utilize a hand grenade or the like fitted therewith, as a land-mine, booby-trap or the like personal attack, since all that is needed is to unlock the mechanism and, if necessary, move such parts as may require it, into the set position, for the grenade to be ready to be, as it were, touched off, at the slightest shock above the rated minimum, as by being kicked by advancing enemy troops. Aside from this, the advantages of an impact grenade over a time match type will be obvious to those skilled in the art of warfare, and furthermore, the elimination of the time match makes the safety release device applicable to other than bellicose purposes, as already indicated.

Again, as pointed out hereinabove, the safety release mechanism is adaptable as to its precise design and construction so as to allow it to be combined with different types of objects to be governed thereby. As instances of such modifications, the application thereof to two other types of hand grenade have been illustrated in the drawings.

In Figs. 4, 5 and 6, there is shown a handleless type of hand grenade comprising a hollow body member 101 having a closed end 101*a* from which extends inwardly of the body member 101 a tubular housing 105 which, as in the case of Fig. 1, receives a detonator 126 held in position by a screw cap 127. The other end of the body member 101 is closed by a closure member 102 in the bottom 102*a* of which is secured the safety release mechanism of the present invention. As best seen in Fig. 6, said mechanism again comprises a retaining member 121 holding resilient member 137 in position in groove 138 of firing pin 123 between the head 124 of which and the floor 105*b* of the tubular housing 105 is located the firing spring 125.

Said tubular housing 105 is secured, as by screwing, to the tubular casing 104 which in general is similar to the casing 4 of Figs. 1 to 3. As seen in Fig. 6, however, the casing 104 has, intermediate its ends, an external flange 104*a* on the side of which, remote from the housing 105, said casing 104 is externally screw-threaded, as at 104*b* to receive a clamping ring 140 having a hexagonal shoulder 140*a* between which and the flange 104*a* the internal margin 102*c* defining a central hole 102*b* in the bottom 102*a* of the end closure 102, may be gripped to secure the casing 104 to said end closure and hence to the body of the hand grenade. If desired, packing 136 may be inserted between the clamping ring 140 and the inner margin 102*c* as shown. At a point inside the casing 104 lying within the enclosure of the hand grenade proper, that is the assembly of the body portion 101 and the end closure 102, is a transverse bridge member or disc 112, which is centrally perforated to permit the sustaining member 108 to pass slidingly therethrough, so that said bridge member 112 functions much as the flange 12 in the embodiment of Fig. 1, to guide the sustaining member when moving and to support it centrally of the casing 104. Likewise inside the casing 104 and on the side of the bridge member 112 remote from the retaining member 121, and spaced an appreciable distance from the bridge member 112, is a centrally perforated plug 141, the bore 142 of which is somewhat larger in diameter than the sustaining member 108. Mounted on that portion of the sustaining member 108 which lies within the space defined between the bridge member 112 and the plug 141, is a plunger member 116, between which and said bridge member 112 is a compression spring 111 tending to urge toward the plug 141 the plunger 116 and hence the portion of the sustaining member 108 on the side of the plunger member 116 remote from bridge member 112, which portion acts as a check rod. Between the plunger 116 and the plug 141 is a charge of flowable material C, the space thus filled corresponding functionally to the room *a* of Fig. 1, but being distinguished in Fig. 6 as variable space *d*.

The casing 104 extends beyond the screw ring 140 to receive as a sliding fit an end cover 120 which is appreciably longer axially than the projection of casing 104, and has fitted within it for free sliding a closure member 143 which, in the assembled condition of the parts, defines with the plug 141 a space which is functionally the equivalent of the restricted space or portion *b* shown in Fig. 1 and contains a filling C′ of flowable material. Between the closure member 143 and the closed end 144 of the end cover 120 is located a compression spring 145 of strength greater than that of spring 111. The end cover 120 is adapted to be held in place by a U-shape or stirrup-like clip 146 having a pair of legs pivoted to the screw ring 140 and including a cross bar 146*a* adapted to engage a diametral depression 144*a* of the closed end 144 of cover 120, as clearly seen in Fig. 6.

As in the example of Figs. 1 to 3, the sustaining member 108 is hollow to receive delaying pin 109 with its head 109*a*, and the compression spring 115. It will thus be clear that with the end cover 120 in position, the spaces *d* and *e* are full of flowable material C, C′, held in check, as it were, by the more powerful spring 145 against the thrust of spring 111, so that plunger 116 is immobilized, so long as clip 146 is in cover holding position. When the clip 146 is swung to the cover free position as indicated in Fig. 4 in broken lines, the spring 145 becomes effective to cause the end cover 120 to leave the projecting portion of the sustaining member 108, thereby allowing the material C′ previously contained in space *e* to disperse, and also permitting material C from space *d* to discharge through the clearance between the check rod portion and the margin defining the bore 142, at a rate depending on the viscosity or flow characteristics of the material

and the strength of spring 111. The plunger 116 moves under the thrust of spring 111 to take up the space left available by the discharge of the material C from space *d*, as before, and carries with it the sustaining member 108, with the same functional results as regards the retaining member and delaying pin, as in the case of Figs. 1 to 3.

In Fig. 8 is shown a further application of the safety release device of the present invention, to an egg-shape grenade having a shell 201, 202 of standard pattern into which is fitted in a central axial position a casing and housing assembly 204, 205 comprising the detonator 226, screw cap 227, firing pin 223, with head 224 and firing spring 225, and the retaining assembly including the retaining member 221 and resilient member 237 fitting into the groove 238 of the firing pin. The casing 204 also accommodates the sustaining assembly comprising a sustaining member 208 which is similar to the sustaining member 108 of Fig. 6 and includes a plunger member 216 fixed externally thereon, between which and a transverse bridge or disc member 212 secured peripherally to the casing 204 is located a compression spring 211, and between which and a plug member 241 is contained a quantity of flowable material C. The plug 241 has a bore 242 which is slightly larger in diameter than the check rod portion of the sustaining member 208, which member, however, has at the end remote from the retaining member 221, an enlargement 247 which has an accurate sliding fit in said bore 242, and beyond which the sustaining member has a head 248, which is held in close engagement with the outer side of the plug 241, by a U-shape portion 249 forming part of a check lever 250 and comprising a yoke member 249*a*, a free leg 249*b* terminating in a catch lip 253, and a second leg from which an extension or tail 249*c* extends to form a shoulder of sufficient width to fit between a pair of ears 252 upstanding from the outside of the shell of the grenade, and located at a point diametrically opposite a catch member such as a bridge-like member 254 projecting also from the shell of the grenade. The extension 249*c* lies closely adjacent the outside of the shell of the grenade and the yoke member 249*a* is designed to engage said enlargement 247 when the catch lip 253 is engaged with said bridge member 254 and said shoulder 249*c* is between the ears 252. To retain the check lever 250 in the position just described, a releasable locking pin 256 is provided of a size to pass through alined perforations in said ears 252 and having a ring 255 for facilitating manual withdrawal of the pin 256 from ears 252, as in the case of standard safety pins of similarly shaped grenades. Between the outer surface of the plug 241 and the floor 249*a* of the U-shape portion 249 is a spring 257 whereby, after the safety pin 256 has been withdrawn, the U-shape portion 249 is assisted to disengage itself from the free end of the tubular casing 204, to free the lever 250, so that under the combined thrust of springs 211, 215 and 257, the check lever 250 as a whole swings about the bridge 254 until it reaches an angular position in which the lip 253 can disengage itself from the bridge 254, to allow said assembly to drop off the shell of the grenade. Obviously, if desired, as when laying land mines or setting booby-traps, the check lever assembly may, after withdrawal of the safety pin 256, be removed by hand, since this can be done with perfect safety, because the plunger 216 and the moving parts associated therewith are still in their retaining means sustaining position, thus holding the firing pin 223 in retracted position.

From the foregoing description it will be understood that the novel safety release mechanism of the present invention, not only provides a maximum of safety and a device which when in released position is responsive to shock or impact, in contradistinction to a time match, but also provides a device which can readily be designed to be fitted to a large variety of mechanisms or devices, including a large variety of explosive missiles, such as hand grenades, shells, bombs and the like, and can also be combined, if desired, with a time match actuated detonator, for although in the foregoing description, the firing has been described as alined with a detonator directly, as a preferred embodiment giving impact response, it is obvious that such firing pin may be alined with a primer cap adapted to ignite a match. In non-explosive applications, the firing pin or equivalent member might be alined, for instance with an electrical device of the push-button type connected in a remote control circuit or the like, or such pin or member might be directed to a gas container, containing, for instance, tear gas. Numerous other applications will readily occur to those skilled in the art, practically all of which would involve no more than design or detail modifications such as would lie well within the capacity of skilled persons.

We claim:

1. A safety device for mechanisms which comprises a wall, an actuating member movable relatively to said wall and releasable means for holding said actuating member in non-operative position, said actuating member including operative means located on one side of said wall and a stem passing freely through said wall and having a free end and a peripheral groove adjacent said free end, said releasable means including an annular resilient radially compressible member normally defining a central aperture of diameter greater than that of the portion of said stem between said groove and said free end, a retaining cap having a recess at one end of a size to receive said resilient annular member in radially compressed condition, said cap and said annular member being mounted on said free end of the stem, said annular member grippingly engaging said groove and said one end of said cap engaging the other side of said wall to retain said actuating member in retracted position, the resiliency of said annular member and the friction between said annular member and said cap and said groove being sufficient to hold the cap in assembled condition on said stem against disassembling forces less than a predetermined minimum, retractable time delay means for positively holding said retaining cap in operative position on said stem, said time delay means comprising a cylinder fixedly located on the same side of said wall as said cap member, and having a perforate end remote from said wall, said perforate end communicating the interior of said cylinder with the circumambient medium, plunger means reciprocably mounted in said cylinder, said plunger means having a sustaining member projecting coaxially therefrom towards said cap member, resilient means normally urging said plunger means towards said perforate end, a delaying member telescopically associated with said sustaining member and extending coaxially therewith towards said cap member, resilient means normally urging said delaying member towards said cap member, a charge of flowable material

in said cylinder between said plunger and said perforate end, said charge acting to deter advance of said plunger means to said perforate end at a rate depending on the dimensions of the perforations in said end, check means for preventing the outflow of said flowable material from the interior of the cylinder to the circumambient medium and manually releasable locking means normally maintaining said check means in operative position.

2. A safety device for firing mechanisms for firing explosive charges, said mechanisms comprising a wall, primer means on one side of said wall, a firing pin movable relatively to said wall and to said primer means, and releasable means for holding said firing pin in retracted position from said primer means, said firing pin including a head located on the same side of said wall as said primer means, and a stem passing freely through said wall and having a free end and a peripheral groove adjacent said free end, said releasable means including an annular resilient radially compressible member normally defining a central aperture of diameter greater than that of the portion of said stem between said groove and said free end, a retaining cap having a recess at one end of a size to receive said annular resilient member in radially compressed condition, said cap and said annular member being mounted on said free end of the stem, said annular resilient member grippingly engaging said groove, and said one end of said cap engaging the side of the wall remote from said primer means to retain said firing pin in retracted position. the resiliency of said annular member and the friction between said annular member and said groove and said cap being sufficient to hold said cap in assembled condition on said stem against disassembling forces less than a predetermined minimum, retractable time delay means for positively holding said retaining cap in operative position on said stem, said time delay means comprising a cylinder coaxial with said firing pin and fixedly located on the side of said wall remote from said primer means, and having a perforate end remote from said wall, said perforate end establishing communication between the interior of said cylinder and the circumambient medium, plunger means mounted on said cylinder for movement axially thereof, said plunger means having a sustaining member projecting axially therefrom towards said retaining cap, resilient means normally urging said plunger towards said perforate end of said cylinder, a delaying member telescopically associated with said sustaining member and extending coaxially therewith towards said cap member, resilient means normally urging said delaying member towards said cap member, a charge of flowable material in said cylinder between said plunger means and said perforate end, said charge acting to deter advance of said plunger means towards said perforate end at a rate depending on the size of the perforations in said end and the viscosity of said flowable material, check means for preventing outflow of said flowable material through said perforate end into the circumambient medium and releasable locking means normally maintaining said check means in operative position.

3. A safety device for firing mechanisms for firing explosive charges, said mechanisms comprising a container, partition means in said container, dividing the container internally into a charge chamber and a firing chamber, a perforate wall in said firing chamber defining a primer chamber, a firing pin movable relatively to said wall and releasable means for holding said firing pin in a "ready" position, said firing pin including a head on the same side of said wall as said primer chamber and a stem passing freely through said wall and having a free end and a peripheral groove adjacent said free end, said releasable means including an annular resilient radially compressible member normally defining a central aperture of diameter greater than that of the portion of said stem between said groove and said free end, a retaining cap having a recess at one end of a size to receive said annular resilient member in radially compressed condition, said cap and said annular member being mounted on said free end of the stem, said annular resilient member grippingly engaging said groove and said one end of said cap engaging the side of the wall remote from said primer chamber to retain said firing pin in retracted position, the resiliency of said annular member and the friction between said annular member and said groove and said cap being sufficient to hold said cap in assembled condition on said stem against disassembling forces less than a predetermined minimum, retractable time delay means for positively holding said retaining cap in operative position on said stem, said time delay means comprising a cylinder coaxial with said firing pin and fixedly located on the side of said wall remote from said primer chamber and having an inner end adjacent said wall and a perforate end remote from said wall, a hollow handle surrounding said cylinder and having a cavity therewithin of diameter greater than that of the cylinder and coaxial with said cylinder, said handle having a shouldered inner end defining a bore for sliding engagement with said cylinder, and a closed outer end defining a floor of said cavity in relatively closely spaced relationship with said perforate end of said cylinder, stop means on the outside of said cylinder intermediate the ends thereof for engaging said shouldered end of said handle on displacement of said handle relatively to said cylinder, said perforate end establishing communication between the interior of said cylinder and said cavity, plunger means mounted on said cylinder for movement axially therein, said plunger means having a sustaining member projecting axially therefrom towards said retaining cap, resilient means normally urging said plunger means towards said perforate end of said cylinder, a delaying member telescopically associated with said sustaining member and extending coaxially therewith towards said cap member, resilient means normally urging said delaying member towards said cap member, a charge of flowable material in said cylinder between said plunger means and said perforate end, said charge acting to deter advance of said plunger means towards said perforate end at a rate depending on the size of the perforations and the viscosity of said flowable material, a filling of flowable material in said hollow handle between said stop means and said floor, and releasable locking means for normally holding said handle in retracted position with said shouldered end remote from said stop means whereby said filling prevents outflow of said charge until said locking means is released and said shouldered end is engaged with said stop means.

4. A safety device for firing mechanisms for firing explosive charges, said mechanism comprising a container, partition means in said con-

tainer dividing the container internally into a charge chamber and a firing chamber, a perforate wall in said firing chamber defining a primer chamber, a firing pin movable relatively to said wall and releasable means for holding said firing pin in a "ready" position, said firing pin including a head on the same side of said wall as said primer chamber and a stem passing freely through said wall and having a free end and a peripheral groove adjacent said free end, said releasable means including an annular resilient radially compressible member normally defining a central aperture of diameter greater than that of the portion of said stem between said groove and said free end, a retaining cap having a recess at one end of a size to receive said annular resilient member in radially compressed condition, said cap and said annular member being mounted on said free end of the stem, said annular resilient member grippingly engaging said groove and said one end of said cap engaging the side of the wall remote from said primer chamber to retain said firing pin in retracted position, the resiliency of said annular member and the friction between said annular member and said groove and said cap being sufficient to hold said cap in assembled condition on said stem against disassembling forces less than a predetermined minimum, retractable time delay means for positively holding said retaining cap in operative position on said stem, said time delay means comprising a cylinder coaxial with said firing pin and fixedly located on the side of said wall remote from said primer chamber and having an inner end adjacent said wall and an open outer end lying outside said container, a perforate partition in said cylinder adjacent said outer end, said partition defining a single central perforation, plunger means mounted in said cylinder for movement axially therein between said inner end and said partition, a sustaining member projecting axially from said plunger means towards said retaining cap, a check rod projecting axially from said plunger means on the side thereof remote from the sustaining member, said check rod passing freely through said central perforation, spring means normally urging said plunger means towards said partition, a delaying member telescopically associated with said sustaining means and extending coaxially therewith towards said cap member, resilient means normally urging said delaying member towards said retaining cap, a closure member fitted in said cylinder in spaced relation to said partition and on the side thereof remote from said plunger and arranged to slide freely in said cylinder, an end closure cap fitted over said outer end, a compression spring located in said outer end between said end closure cap and said closure member, releasable locking means for normally locking said end closure cap in closing position, said locking means comprising a U shape member having a cross bar and a pair of legs extending from opposite ends of said cross bar and having free ends pivoted to support on the outside of said container, said cross bar normally overlying said end closure cap, a charge of flowable material in said cylinder between said plunger means and said partition, said charge acting to deter advance of said plunger means towards said partition at a rate depending on the viscosity of said flowable material and the difference in diameter between said perforation and said check rod, and a filling of flowable material between said partition and said closure member, whereby said filling prevents outflow of said charge through said perforation until said U shape member is moved to release said end closure cap.

5. A safety device for firing mechanisms for firing explosive charges, said mechanism comprising a container, partition means in said container, dividing the container internally into a charge chamber and a firing chamber, a perforate wall in said firing chamber defining a primer chamber, a firing pin movable relatively to said wall, and releasable means for holding said firing pin in a "ready" position, said firing pin including a head on the same side of said wall as said primer chamber and a stem passing freely through said wall and having a free end and a peripheral groove adjacent said free end, said releasable means including an annular resilient radially compressible member normally defining a central aperture of diameter greater than that of the portion of said stem between said groove and said free end, a retaining cap having a recess at one end of a size to receive said annular resilient member in radially compressed condition, said cap and said annular member being mounted on said free end of the stem, said annular resilient member grippingly engaging said groove and said one end of said cap engaging the side of the wall remote from said primer chamber to retain said firing pin in retracted position, the resiliency of said annular member and the friction between said annular member and said groove and said cap being sufficient to hold said cap in assembled condition on said stem against disassembling forces less than a predetermined minimum, retractable time delay means for positively holding said retaining cap in operative position on said stem, said time delay means comprising a cylinder coaxial with said firing pin and fixedly located on the side of said wall remote from said primer chamber and having an inner end adjacent said wall and a perforate outer end located outside said container and defining a single central perforation, plunger means mounted in said cylinder for movement axially therein between said inner end and said partition, a sustaining member projecting axially from said plunger means towards said retaining cap, a check rod projecting axially from said plunger means on the side thereof remote from the sustaining member, said check rod passing freely through said central perforation, an enlargement on said check rod outside said outer end, said enlargement being of a size to close said central perforation, catch means located on the outside of said container adjacent said outer end of the cylinder, a pair of spaced ears having alined perforations, said ears being located on the outside of said container at a point diametrically opposite said catch means with respect to said cylinder, a check lever including a substantially U shape portion comprising a yoke member, a free leg terminating in a catch lip for engagement with said catch means, and a second leg, an extension extending from said second leg and forming a shoulder adjacent said second leg of width to fit between said ears freely, said extension being shaped to lie closely adjacent the outside of said container and said yoke member being proportioned to engage said enlargement when said catch lip is engaged in said catch means and said shoulder is located between said ears, a releasable locking pin of a size to pass through said alined perforations to overlie said shoulder and releasably lock said check lever

in checking position, spring means normally located between said perforate end and said yoke member, a charge of flowable material in said cylinder between said plunger means and said perforate end, said charge acting to deter advance of said plunger means towards said perforate end at a rate depending on the viscosity of said flowable material and the difference in diameter between said central perforation and said check rod, upon withdrawal of said locking pin to release said check lever.

6. A safety device for firing mechanisms for firing explosive charges, said mechanism comprising a container, partition means in said container, dividing the container internaly into a charge chamber and a firing chamber, a perforate wall in said firing chamber defining a primer chamber, a firing pin movable relatively to said wall, and releasable means for holding said firing pin in a "ready" position, said firing pin including a head on the same side of said wall as said primer chamber and a stem passing freely through said wall and having a free end and a peripheral groove adjacent said free end, said releasable means including an annular resilient radially compressible member normally defining a central aperture of diameter greater than that of the portion of said stem between said groove and said free end, a retaining cap having a recess at one end of a size to receive said annular resilient member in radially compressed condition, said cap and said annular member being mounted on said free end of the stem, said annular resilient member grippingly engaging said groove and said one end of said cap engaging the side of the wall remote from said primer chamber to retain said firing pin in retracted position, the resiliency of said annular member and the friction between said annular member and said groove and said cap being sufficient to hold said cap in assembled condition on said stem against disassembling forces less than a predetermined minimum, retractable time delay means for positively holding said retaining cap in operative position on said stem, said time delay means comprising a cylinder coaxial with said firing pin and fixedly located on the side of said wall remote from said primer chamber and having an inner end adacent said wall and a perforate outer end located outside said container and defining a single central perforation, plunger means mounted in said cylinder for movement axially therein between said inner end and said partition, a sustaining member projecting axially from said plunger means toward said retaining cap, a check rod projecting axially from said plunger means on the side thereof remote from the sustaining member, said check rod passing freely through said central perforation, an enlargement on said check rod outside said outer end, said enlargement being of a size to close said central perforation, check means for normally holding said enlargement in closing position, manually releasable locking means for locking said check means in normal operative position, spring means normally located between said perforate end and said check means, a charge of flowable material in said cylinder between said plunger means and said perforate end, said charge acting to deter advance of said plunger means towards said perforate end at a rate depending on the viscosity of said flowable material and the difference in diameter between said central perforation and said check rod upon withdrawal of said locking pin to release said check lever.

7. A safety device for hand grenades having a casing, a firing pin in said casing and a hollow handle movable with respect to the casing, said device comprising a tubular member slidably arranged in the hollow handle and having a closed end, a plunger slidably movable in said tubular member between two end positions and defining a first chamber with said closed end of said tubular member, said first chamber having a small hole arranged in the wall of said closed end of said tubular member, a second chamber arranged in the handle and communicating with said first chamber through said hole, the relative size of said chambers depending on the positions of said tubular member in the handle and said plunger in said tubular member, a substance consisting of small particles and arranged in said chambers and adapted to retard the change of the relative size of said chambers in response to the flow of said substance through said hole, a protective member for the firing pin, a recess in said protective member for engagement with said plunger in one of its end positions, a cavity in said protective member, a trigger connected to the firing pin and having a slot, and an expansion washer adapted to hold said slot of said trigger when said washer is confined in said cavity of said protective member.

8. A safety device for hand grenades having a casing, a firing pin in said casing, and a hollow handle movable with respect to the casing, said device comprising a tubular member slidably arranged in the hollow handle and having a closed end, a plunger slidably movable in said tubular member between two end positions and defining a first chamber with said closed end of said tubular member, said first chamber having a small hole arranged in the wall of said closed end of said tubular member, a second chamber arranged in the handle and communicating with said first chamber through said hole, the relative size of said chambers depending on the positions of said tubular member in the handle and said plunger in said tubular member, a substance consisting of small particles and arranged in said chambers and adapted to retard the change of the relative size of said chambers in response to the flow of said substance through said hole, a spring-loaded bolt arranged for displacement in the end of said plunger turned away from said first chamber, a protective member for the firing pin, and a recess in said protective member for engagement with said bolt in one of the end positions of said plunger.

9. A safety device for hand grenades having a casing, a firing pin in said casing, and a hollow handle movable with respect to the casing, said device comprising a tubular member slidably arranged in the hollow handle and having a closed end, a plunger slidably movable in said tubular member between two end positions and defining a first chamber with said closed end of said tubular member, said first chamber having a small hole arranged in the wall of said closed end of said tubular member, a second chamber arranged in the handle and communicating with said first chamber through said hole, the relative size of said chambers depending on the positions of said tubular member in the handle and said plunger in said tubular member, a substance consisting of small particles and arranged in said chambers and adapted to retard the change of the relative size of said

chambers in response to the flow of said substance through said hole, a spring-loaded bolt arranged for displacement in the end of said plunger turned away from said first chamber, a protective member for the firing pin, a recess in said protective member for engagement with said bolt in one of the end positions of said plunger, a cavity in said protective member, a trigger connected to the firing pin and having a slot, and an expansion washer adapted to hold said slot of said trigger when said washer is confined in said cavity of said protective member.

10. A safety device for hand grenades having a casing, a firing pin in said casing and a hollow handle movable with respect to the casing, said device comprising a tubular member slidably arranged in the hollow handle and having a closed end, a stop on the inner side of the handle, a gasket arranged at the outer surface of said tubular member and adapted to abut against said stop, a plunger slidably movable in said tubular member between two end positions and defining a first chamber with said closed end of said tubular member, said first chamber having a small hole arranged in the wall of said closed end of said tubular member, a second chamber arranged in the handle and communicating with said first chamber through said hole, said second chamber being limited by said gasket and said closed end of said tubular member, the relative size of said chambers depending on the positions of said tubular member in the handle and said plunger in said tubular member, a substance consisting of small particles and arranged in said chambers and adapted to retard the change of the relative size of said chambers in response to the flow of said substance through said hole, a spring-loaded bolt arranged for displacement in the end of said plunger turned away from said first chamber, a protective member for the firing pin, a recess in said protective member for engagement with said bolt in one of the end positions of said plunger, a cavity in said protective member, a trigger connected to the firing pin and having a slot, and an expansion washer adapted to hold said slot of said trigger when said washer is confined in said cavity of said protective member.

11. A safety device for hand grenades having a casing, a firing pin in said casing and a hollow handle movable with respect to the casing, said device comprising a tubular member slidably arranged in the hollow handle and having a closed end, a stop on the inner side of the handle, a gasket arranged at the outer surface of said tubular member and adapted to abut against said stop, a plunger slidably movable in said tubular member between two end positions and defining a first chamber with said closed end of said tubular member, said first chamber having a small hole arranged in the wall of said closed end of said tubular member, a second chamber arranged in the handle and communicating with said first chamber through said hole, said second chamber being limited by said gasket and said closed end of said tubular member, the relative size of said chambers depending on the positions of said tubular member in the handle and said plunger in said tubular member, a substance consisting of small particles and arranged in said chambers and adapted to retard the change of the relative size of said chambers in response to the flow of said substance through said hole, a spring-loaded bolt arranged for displacement in the end of said plunger turned away from said first chamber, a protective member for the firing pin, a recess in said protective member for engagement with said bolt in one of the end positions of said plunger, a cavity in said protective member, a trigger connected to the firing pin and having a slot, an expansion washer adapted to hold said slot of said trigger when said washer is confined in said cavity of said protective member, and a spring-loaded press button arranged in a fixed position on the handle and adapted to engage an opening being in a fixed position with respect to said tubular member.

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