



(51) International Patent Classification:
F42C 15/188 (2006.01) *F42C 15/24* (2006.01)

(21) International Application Number:
PCT/SE2011/050229

(22) International Filing Date:
1 March 2011 (01.03.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1050198-9 3 March 2010 (03.03.2010) SE

(71) Applicant (for all designated States except US): **LIFE TIME ENGINEERING AKTIEBOLAG** [SE/SE]; Zakrisdalsslingan 9, S-653 42 Karlstad (SE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **SJÖBLOM, Henrik** [SE/SE]; Fredrikborg Thorsta, S-725 92 Västerås (SE).

(74) Agent: **HYNELL PATENTTJÄNST AB**; P.O. Box 138, S-HAGFORS 683 23 (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: SAFETY ASSEMBLY FOR AMMUNITION

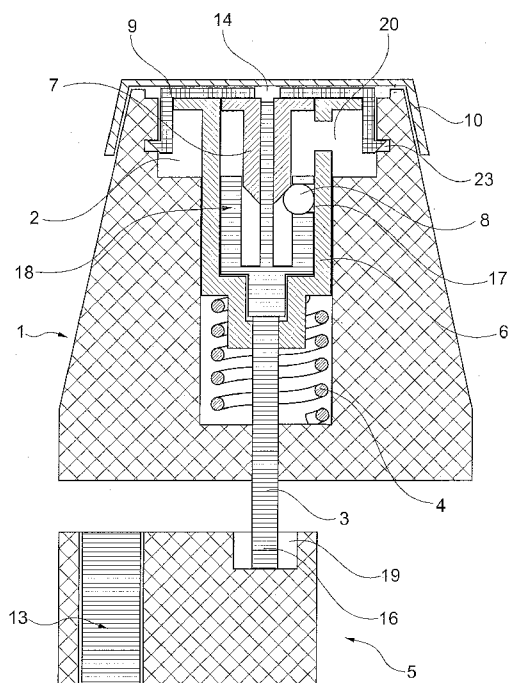


Fig. 2

(57) Abstract: The present invention relates to a safety assembly for ammunition, comprising a housing with a cavity and further comprising firing means having a firing pin mounted in said cavity, said firing means being arranged to cooperate with an interrupter in such a way as to releasably lock said interrupter into an unarmed safety position, in which safety position said firing pin is arranged to protrude into a cavity of said interrupter so that unintentional detonation is prevented, said safety assembly further comprising locking means arranged to releasably lock said firing pin in said safety position, wherein the safety assembly comprises a first and a second movable locking plunger wherein in an unarmed safety position said locking means cooperates with said first locking plunger for locking said firing pin against the movable second locking plunger for retaining the firing pin in said cavity thus keeping the assembly in the safety position.

WO 2011/108980 A1



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**
GW, ML, MR, NE, SN, TD, TG).

— *with international search report (Art. 21(3))*

SAFETY ASSEMBLY FOR AMMUNITION

TECHNICAL FIELD

The present invention relates to a safety assembly for ammunition, comprising a
5 housing with a cavity and further comprising firing means having a firing pin mounted
in said cavity. The invention also relates to a method for establishing and removing a
safety lock on a piece of ammunition, and to ammunition comprising a safety assembly.

BACKGROUND ART

10 Explosive mortar ammunition is used for producing a near surface burst, and generally
consists of a projectile comprising a frontal fuse assembly which is armed during
launch, and ignited in connection to target impact.

A fuse assembly for military projectile is for instance shown in US 4782757 where a
fuse assembly mounted on a mortar round, where the mortar shell is arranged to burst
15 near the ground.

It is very common for simple mechanical mortar fuses to use a spring loaded firing-pin,
which is shown in appended figure 1. Prior to launch the pin is held at a forward
position using a spring. During launch-acceleration the spring is compressed and the
firing-pin moves downwards into a shallow hole in an interrupter, whereas as the
20 acceleration of the projectile decreases, the spring pushes the firing-pin back into its
original position. The interrupter is now free to rotate into armed position by means of
the fuse clock-work known *per se*. On impact the firing-pin is once again forced
downwards, penetrating the pyrotechnics and thereby initiating the explosive charge.
A serious drawback related to the above described system is that there is a certain risk
25 of failure mode, meaning the interrupter might unintentionally rotate into armed
position already before launch. In such a case the firing-pin will inevitably initiate the
fuse thereby detonating the shell at launch which obviously may harm operators as well
as destroying equipment. In GB1017380 there is disclosed a safety device for fuzes for
missiles arranged to be inserted in the firing mechanism between the striker and the
30 detonator, however this design is still connected to safety issues.

DISCLOSURE OF THE INVENTION

It is a primary object of the invention to provide an improved safety assembly for
ammunition, such as mortar ammunition, which is mechanically simple in construction
35 and reliable in operation, leading to elimination of the occurrence of failure mode and
unintended detonation. This and other objects, which are obvious to the expert, have
been able to be realized in a surprising manner by designing the safety assembly in

accordance with the characterizing part of claim 1. Preferred embodiments of the invented safety assembly are defined in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

- 5 The invention will now be described in more detail with reference to the appended drawings, wherein

Fig. 1 shows a schematic view of a fuse body according to the prior art,

Fig. 2 shows a schematic view of a fuse body comprising a safety assembly in a rest
10 position according to a preferred embodiment of the present invention,

Fig. 3a shows a schematic view of the fuse body of Fig. 2 at a first position during a launch,

Fig. 3b shows a schematic view of the fuse body of Fig. 2 at a second position during a launch,

- 15 Fig. 4a shows a schematic view of the fuse body of Fig. 2 at a first position after a launch with an adjacent interrupter in a safety position,

Fig. 4b shows a schematic view of the fuse body of Fig. 2 at a second position after a launch with an adjacent interrupter in an armed position,

Fig. 5a shows an exploded view of a fuse body according to the invention, and

- 20 Fig. 5b shows a perspective cut-away view of a firing pin assembly according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

- Fig. 1 shows a fuse body with a fuse nose cone for mounting on ammunition such as
25 mortar ammunition, according to the prior art, with a housing 1 comprising a central cavity 2 with one end covered by a protective foil 10. At an opposite end of said cavity 2, a lower opening 11 extends towards an interior of said fuse body, where an interrupter 5 is generally located.

- 30 Into said cavity 2, a firing pin 3 is placed along with a spring 4 that serves to push a disc 12 mounted on an upper end of said firing pin 3 towards said protective foil 10. A lower end of said firing pin 3 extends through said lower opening 11 towards the interrupter 5.

- 35 The fuse nose cone 1 is mounted onto the fuse body of the ammunition before the ammunition is to be used. During launch, the firing pin 3 will be pushed downwardly towards the interrupter 5 by the force caused by the acceleration to a maximum, whereat the disc 12 is abuts the edges of the cavity 2. When pressed down into this position, the

spring 4, here in the form of a mechanical coil, will be compressed, thereby loading a force into said spring 4 so that the spring 4 strives to keep the firing pin 3 in its original position. After the launch, upon ceased acceleration, the spring 4 is extended again, pressing the disc 12 of the firing pin 3 up towards the protective foil 10. During the time
5 after launch that the ammunition with the fuse body travels towards its target location, a safety device in the form of the interrupter is arranged to rotate transversally, said rotation being controlled by a clockwork mechanism, so that a passage 13 containing pyrotechnics formed in the interrupter 5 is positioned directly under the firing pin 3. This process arms the ammunition.

10

Upon impact at the target location, the ammunition will land on the fuse nose cone 1 so that the protective foil 10 breaks, thus enabling the disc 12 of the firing pin 3 to be instantly forced downwards into the passage 13, thereby initiating an ignition process that will lead to an explosion of the ammunition.

15

As can be seen from the description above, the movement performed by the firing pin 3 upon launch, when its lower end is pressed against the interrupter 5, is the same movement as the one which upon landing causes ignition of the ammunition. The only difference between the process upon launch and the process upon landing is that the
20 interrupter 5 is in different positions, first a safety position with the passage 13 turned away from the firing pin 3 and later an armed position with the passage 13 placed directly underneath the firing pin 3. If the interrupter 5 has been accidentally placed in the armed position before a launch, it can easily be understood from the description above that this would cause an ignition and subsequent explosion of the ammunition.

25

With the prior art design of Fig. 1, no easy solution is presented to warn personnel handling the ammunition if it has been accidentally armed, so no difference can be perceived between a handling that is safe and one that may be very dangerous.

30 Fig. 2 shows a corresponding fuse nose cone 1 in a rest position, that could also be called a safety position, according to a preferred embodiment of the present invention. A housing 1 now comprises a cavity 2 wherein a firing assembly 18 comprising a firing pin 3 can be placed and extend through an opening 11 of a bottom of said housing 1. The cavity 2 is covered by a washer 9 with a central hole 14 placed directly above an
35 upper end 15 of the firing pin 3, and upon the washer 9, a protective foil 10 is mounted to cover said washer 9 and cavity 2 completely. The washer 9 is held in position by

engaging with a machined groove 23 inside the cavity 2 in such a way that it is prevented from moving upwards out from the cavity 2.

5 Around the firing assembly 18, a first locking plunger 6 is mounted and held by a spring 4 in the form of a mechanical coil that in this safe position strives to push said first locking plunger 6 up towards the washer 9 and protective foil 10. A second locking plunger 7 is mounted around the upper end 15 of the firing pin 3 and is held by a locking means 8 in the form of a ball placed in an opening 17 in a wall of the firing assembly 18 in such a way that said second locking plunger 7 is pressed upwards and
10 the firing assembly 18 with the firing pin 3 is pressed downwards. The lower end 16 of the firing pin 3 is pressed down into an interrupter cavity 19 of the interrupter 5 and securely held between the interrupter 5 and the first and second locking plungers 6, 7.

15 This is the safe position where the ammunition is locked into a position where no accidental ignition can occur. Since the lower end 16 of the firing pin 3 is pressed into the interrupter cavity 19, no unintentional rotation of the interrupter 5 to align the passage 13 with the firing pin 3 is possible, and therefore an accidental firing of the ammunition can be prevented.

20 Fig. 3a shows the fuse nose cone 1 during launch of the ammunition. Due to acceleration at the launch, the first locking plunger 6 is pushed downwards against the spring 4, compressing said spring 4. The other components placed inside the cavity 2, i.e. the firing assembly 18 with the firing pin 3, the second locking plunger 7 and the locking means 8 are held in their original position, pressed between the interrupter
25 cavity 19 and the washer 9, unable to move in relation to each other thanks to the locking means 8, i.e. the ball 8, that holds the second locking plunger 7 fixed in relation to the firing assembly 18.

30 In Fig. 3b, the state of the components inside the housing 1 is shown after that the first locking plunger 6 has reached its position at a bottom of the cavity 2 with the spring 4 compressed as much as possible. In this position, the opening 17 housing the locking means 8 is aligned with a second opening 20 in the first locking plunger 6 so that the locking means 8 can slide into this second opening 20 and thereby free the second locking plunger 7 so that it is able to move in relation to the firing assembly 18. Due to
35 the acceleration that the housing 1 and the fuse nose cone 1 is subjected to from the launch, and thanks to a tapering shape of a lower end of the second locking plunger 7,

the ball 8 is pushed partly into this second opening 20 so that its locking function is ceased.

5 The second locking plunger 7 now slides as far down as it can go, around the upper end 15 of the firing pin 3 to reach the bottom of a holder of the firing assembly 18. In its new position inside the second opening 20 and inside the opening 17, the locking means now serve to lock the first locking plunger 6 and the firing assembly 18 together.

10 Fig. 4a shows a state after launch where the initial acceleration from said launch has decreased and a downwardly directed force that was present in Fig. 2a-2b has ceased to act. The compressed spring 4 can now return to its original position, pushing the first locking plunger 6 up towards the washer 9. Since the first locking plunger 6 is now locked together with the firing assembly 18 by the locking means 8 placed inside the opening 17 and the second opening 20, the firing assembly 18 will also be pushed up to reach the position shown by Fig. 4a. The interrupter cavity 19 is now empty and the interrupter 5 free to move without being prevented by the firing pin 3.

20 The upwards movement of the firing assembly 18 also means that the upper end 15 of the firing pin 3 is pushed upwards through the central hole 14 of the washer and through the material of the protective foil 10. Said protective foil 10 is preferably made from a thin metal foil that will easily break when confronted with the upper end 15 of the firing pin 3, showing clearly that the movement required for allowing the interrupter 5 to rotate in order to arm the ammunition has been performed. The skilled person understands that the invention is not limited to metal foil, but that other materials also may be used. Thanks to the invention personnel handling the ammunition can be certain that the ammunition has not been armed as long as the protective foil 10 is unbroken, and thanks to this failsafe mechanism a higher level of security can be achieved. Since this mechanism is independent from the mechanism for arming the ammunition by rotating the interrupter 5, the requirement of having at least two independent safety locks for securing the ammunition is fulfilled.

35 Fig. 4b shows the position of the components in the housing 1 after the interrupter 5 has also been rotated, for instance by fuse clockwork, to align the channel 13 with the firing pin 3 to reach the armed position. The spring 4 holds the first locking plunger 6 and the firing assembly 18 in place, until the moment when the ammunition reaches a solid object that can form a target. The confrontation with such an object will cause the firing assembly to be slammed down into the channel 13, thereby igniting the ammunition and

creating a desired explosion. The mechanism for generating the explosion from the ignition by the firing pin 3 can be designed according to any suitable method that is known in the art.

- 5 Thanks to the design of the fuse nose cone 1 with the housing 1 and the components placed into the cavity 2 being similar to other known firing devices in the art, the design according to the invention can be mounted on different kinds of ammunition, replacing other fuse nose cones and performing the same function of firing the ignition by a firing pin 3 being pushed into a channel 13 of the interrupter 5, but at the same time adding
10 the safety function described above in a reliable and convenient manner. The risk of an accidental detonation at launch can thereby be eliminated.

- Thus, in the rest position or safety position, the firing pin 3 cooperates with the interrupter 5 in such a way as to lock said interrupter 5 in a safety position, and the
15 acceleration at the launch creates a movement of the firing pin 3, as has been described in the above, where the firing pin 3 is moved from the rest position to a second position shown in Fig. 4a and Fig. 4b, where it can strike against the interrupter.

- Fig. 5a shows an exploded view of the fuse body with the safety assembly according to the preferred embodiment of the invention. The spring 4 is arranged to be mounted
20 around a lower section of the first locking plunger 6, said first locking plunger 6 having an interior cavity into which the firing pin 3 of the firing assembly 18 can be inserted. The dimensions of the firing assembly 18 are adapted to allow a holder 21 of the firing assembly 18 to be inserted into the first locking plunger 6 and to allow the second
25 locking plunger 7 to be inserted into the holder 21 and move in relation to the firing assembly 18 in the absence of the locking means 8. The ball 8 that serves as the locking means 8 is arranged to be placed into an opening 17 in the form of a through hole through a wall of the holder 21 and a second opening 20 of the first locking plunger 6, also in the form of a through hole. As can be seen in the exploded view of Fig. 5a, the
30 second locking plunger 7 has a tapering bottom and a longitudinal through hole, so that it can be placed onto the upper end 15 of the firing assembly 18 and be moved into the holder 21. When the ball 8 is placed into the opening 17, it is in contact with the tapered bottom of the second locking plunger 7 and thereby prevents it from sliding down into the holder 21, but when the ball 8 is allowed to slide partially into the second opening
35 20, the tapered shape of the bottom will facilitate this movement and eliminate the risk of the ball 8 being stuck in its safety position and being unable to move towards the second opening 20. In a position in the opening 17 and the second opening 20, the ball 8

instead serves to lock the first locking plunger 6 and the firing assembly 18 together, since the presence of the ball 8 in the openings 17, 20 prevents the first locking plunger 6 and the firing assembly 18 from moving in relation to each other.

5 The washer 9 is arranged to be placed into the housing 1 after the spring, the first and second locking plunger 6, 7, the locking means 8 and the firing assembly 18 have been inserted into the cavity 2 of the housing 1. The washer is equipped with legs 22 for interacting with interior walls of the cavity 2 and locking the washer 9 into place after insertion. The central hole 14 is positioned such that the upper end 15 of the firing
10 assembly 18 is directly below it and can be extended through said central hole 14 upon moving from the safety position to a second position. The protective foil 10 can be mounted onto the top of the housing 1 with the washer 9 after all the other components have been inserted and seal the housing 1, thereby preventing the entering of particles or fluids into the housing 1.

15

Fig. 5b shows the firing assembly 18 with one side cut away, displaying the holder 21 and the upper end 15 around which the second locking plunger 7 can slide. It can be seen that the firing pin 3 is wider closest to the holder 21, in order to provide a strong and durable structure and to fit into the first locking plunger 6, that is to be mounted
20 around the firing pin 3 and the holder 21.

Thus, the method of establishing a safety lock and removing said lock according to the present invention can be condensed by the method steps described below:

- 25 a) providing a safety assembly mounted in a fuze nose cone, said safety assembly comprising a housing 1 with an interior cavity 2 and a firing pin 3,
b) said firing pin 3 being held in a safety position where it interacts with an interruptor 5 of a piece of ammunition in such a way that said interruptor 5 is held fixed in relation to said firing pin 3.
30 c) releasing said firing pin 3 from said safety position by a locking means 8 holding said firing pin 3 fixed in relation to a second locking plunger 7 moving to allow said firing pin 3 to move freely in relation to said second locking plunger 7.
d) said locking means 8 after releasing said firing pin 3 in step c) moving to a
35 position where it fixedly locks said firing pin 3 in relation to a first locking plunger 6.

- e) said firing pin 3 and said first locking plunger 6 being moved together to an armed position.

The invention is not to be seen as limited by the preferred embodiment described above,
5 but can be varied within the scope of the appended claims, as will be readily understood
by the person skilled in the art. For instance, the precise shape and arrangement of the
various components forming the safety assembly can be varied as long as their function
and interaction is maintained.

CLAIMS

1. A safety assembly for ammunition, comprising a housing (1) with a cavity (2)
and further comprising firing means having a firing pin (3) mounted in said
5 cavity (2), said firing means being arranged to cooperate with an interrupter (5)
in such a way as to releasably lock said interrupter (5) into an unarmed safety
position, in which safety position said firing pin (3) is arranged to protrude into a
cavity (19) of said interrupter (5) so that unintentional detonation is prevented,
said safety assembly further comprising locking means (8) arranged to
10 releasably lock said firing pin (3) in said safety position, characterised in that
the safety assembly comprises a first (6) and a second (7) movable locking
plunger wherein in an unarmed safety position said locking means (8)
cooperates with said first locking plunger (6) for locking said firing pin (3)
against the movable second locking plunger (7) for retaining the firing pin (3) in
15 said cavity (19) thus keeping the assembly in the safety position.
2. A safety assembly according to claim 1, wherein said locking means (8) in an
armed position is arranged to release the second locking plunger (7) so that it is
movable in relation to the firing pin (3), and lock said firing pin (3) against said
20 first locking plunger (6), said assembly further comprising a resilient member
(4) arranged to permanently urge said first locking plunger (6) in a direction
away from the interrupter (5) so that said firing pin (3) when locked against the
first locking plunger (6) in an armed position will be withdrawn from said cavity
(19) thus releasing said interrupter (5).
- 25 3. A safety assembly according to claim 1 or 2, wherein said locking means (8) is
positioned inside an opening (17) in a firing assembly (18) comprising said
firing pin (3), said opening being in the form of a through hole and substantially
matching a second opening (20) in a movable first locking plunger (6) arranged
30 to at least partially surround said firing pin (3), and wherein, in an armed
position, said first locking plunger (6) and said locking pin (3) are positioned so
that the through hole (17) in said firing pin (3) is aligned with the second
opening (20) in the movable first locking plunger (6) allowing the locking means
(8) to move into the second opening (20) thereby releasing the firing pin (3)
35 from the second locking plunger (7) and unlocking the firing pin (3) from said
safety position, simultaneously releasably connecting the firing pin (3) together
with the second locking plunger (7).

4. A safety assembly according to any of claims 1 - 3, wherein said locking means is a ball (8), preferably a steel ball, and wherein each of the through hole (17) in said firing pin (3) and the second opening (20) in said movable first locking plunger (6) comprises a size which substantially corresponds to the diameter of said ball (8).
5. A safety assembly according to any of the previous claims, wherein said assembly comprises a resilient member, preferably in the form of a spring device (4), which is arranged to push upwards against the lower portion of said movable first locking plunger (6).
6. Mortar ammunition, characterized in that said ammunition comprises a safety assembly according to any of the claims 1-5.
7. A method for establishing and removing a safety lock on a piece of ammunition, comprising the steps of
- a) providing a safety assembly mounted in a fuze nose cone, said safety assembly comprising a housing (1) with an internal cavity (2) and a firing pin (3),
 - b) said firing pin (3) being held in a safety position where it interacts with an interruptor (5) of a piece of ammunition in such a way that said interruptor (5) is held fixed in relation to said firing pin (3), and characterized in the step
 - c) releasing said firing pin (3) from said safety position by a locking means (8) holding said firing pin (3) fixed in relation to a second locking plunger (7) moving to allow said firing pin (3) to move freely in relation to said second locking plunger (7).
8. A method according to claim 7, further comprising the step of
- d) said locking means (8) after releasing said firing pin (3) in step c) moving to a position where it fixedly locks said firing pin (3) in relation to a first locking plunger (6).
9. A method according to claim 8, further comprising the step of
- e) said firing pin (3) and said first locking plunger (6) being moved together to an armed position.

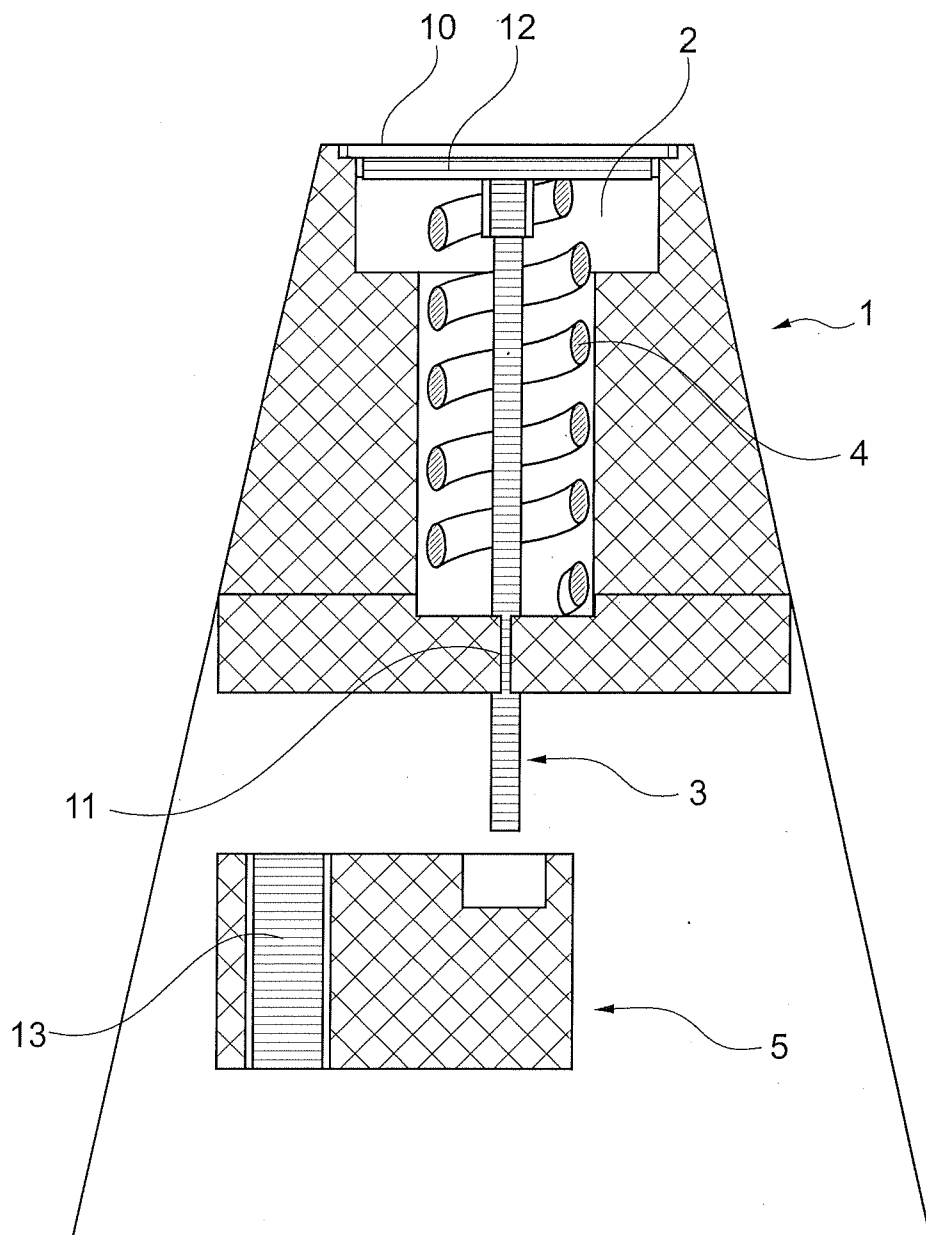
10. A method according to claim 9, wherein said moving of step e) is effected by a spring (4) acting on at least one of said first locking plunger (6) and said firing pin (3).

5

11. A method according to claim 9 or 10, wherein said firing pin (3) during step e) marks a protective foil (10) that is mounted on said safety assembly.

10

1/8



PRIOR ART

Fig. 1

2/8

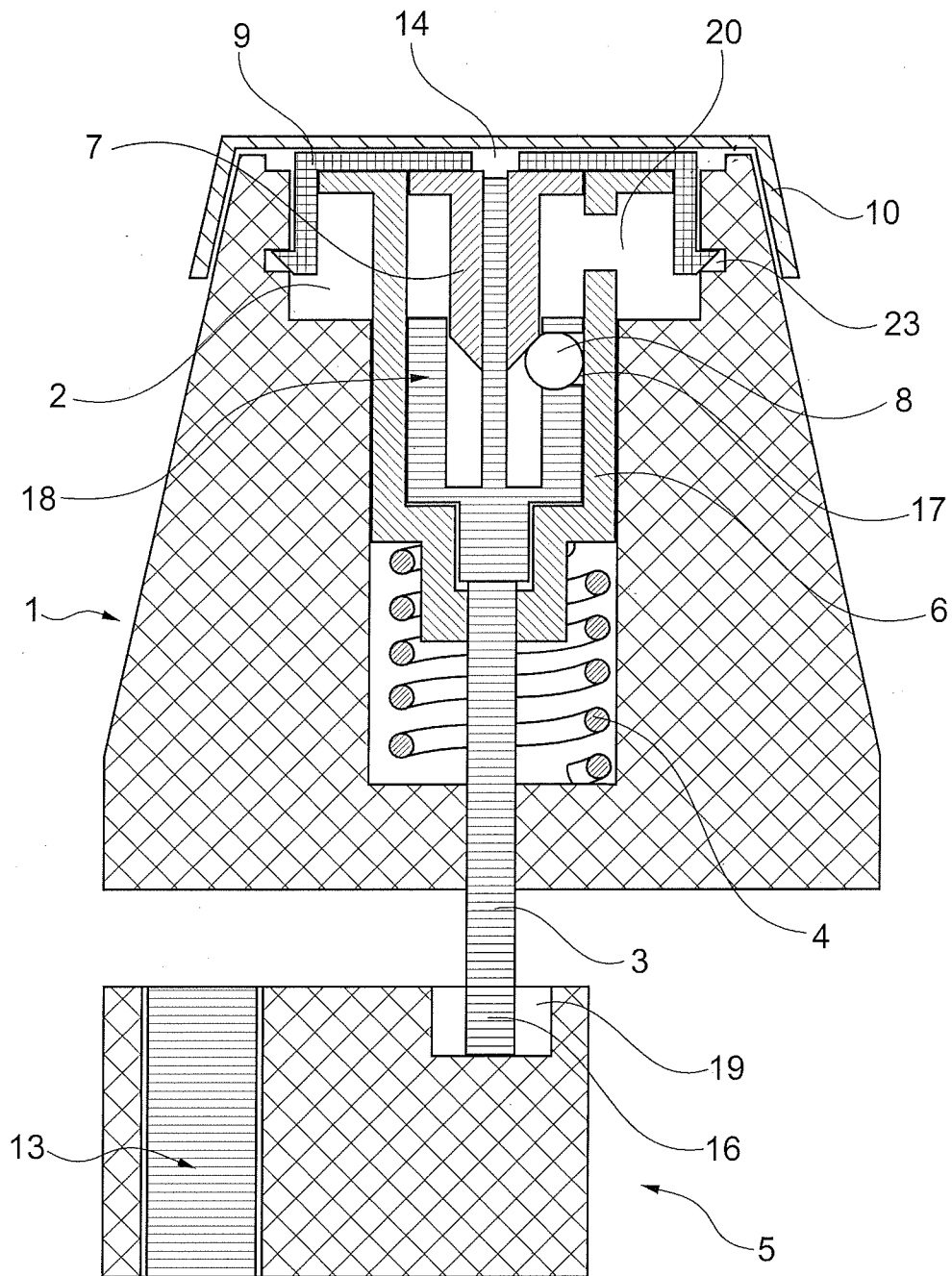


Fig. 2

3/8

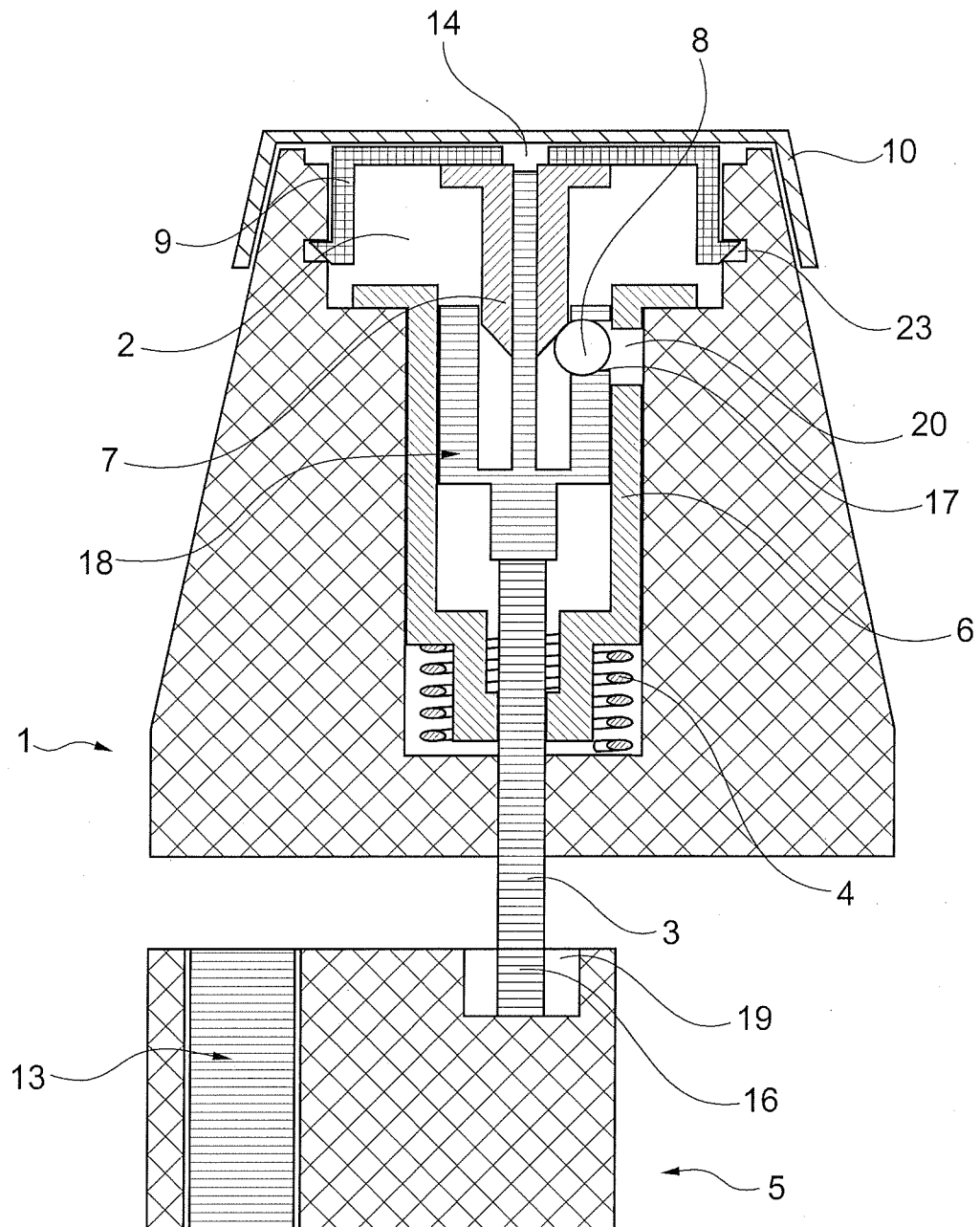


Fig. 3a

4/8

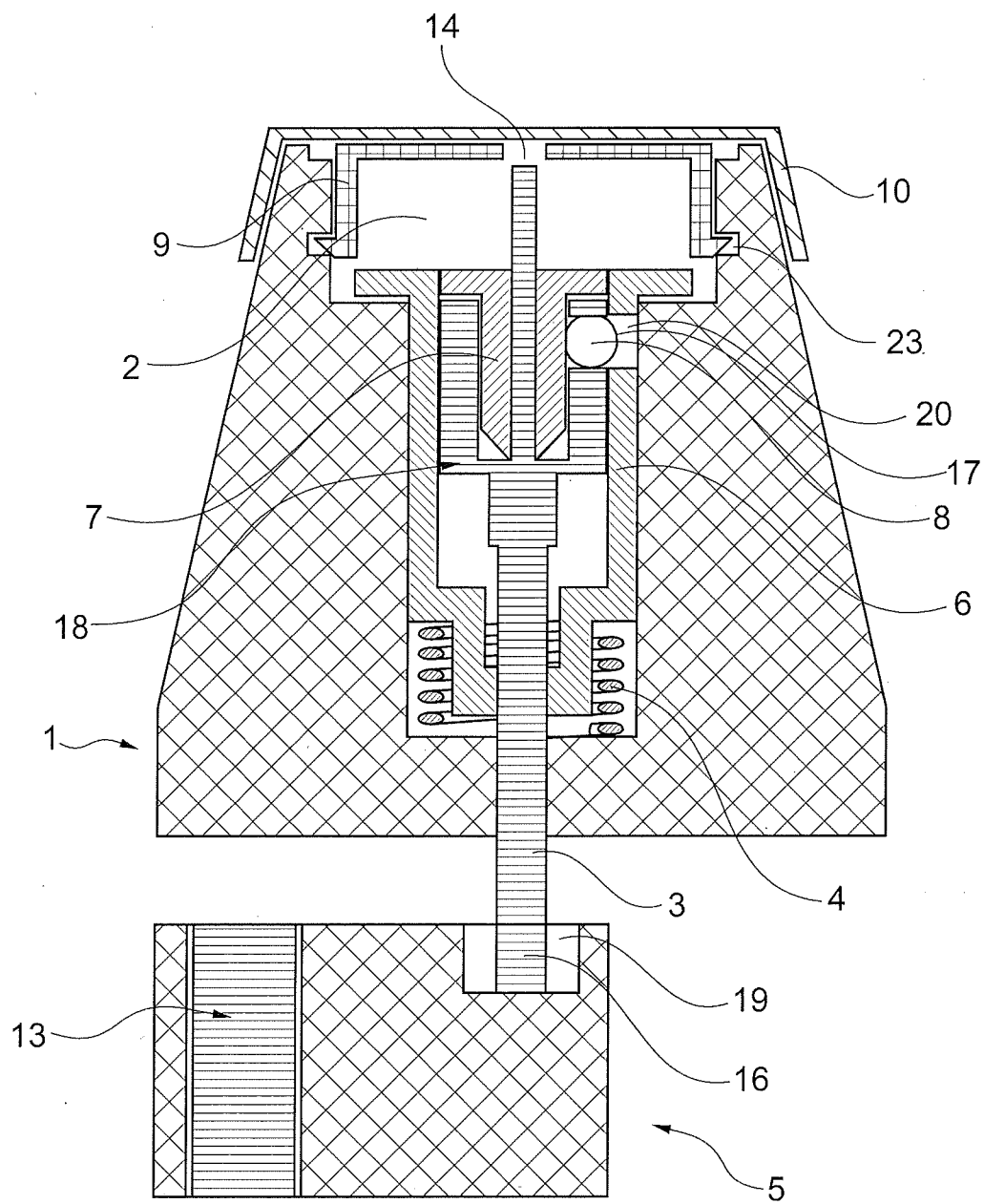


Fig. 3b

5/8

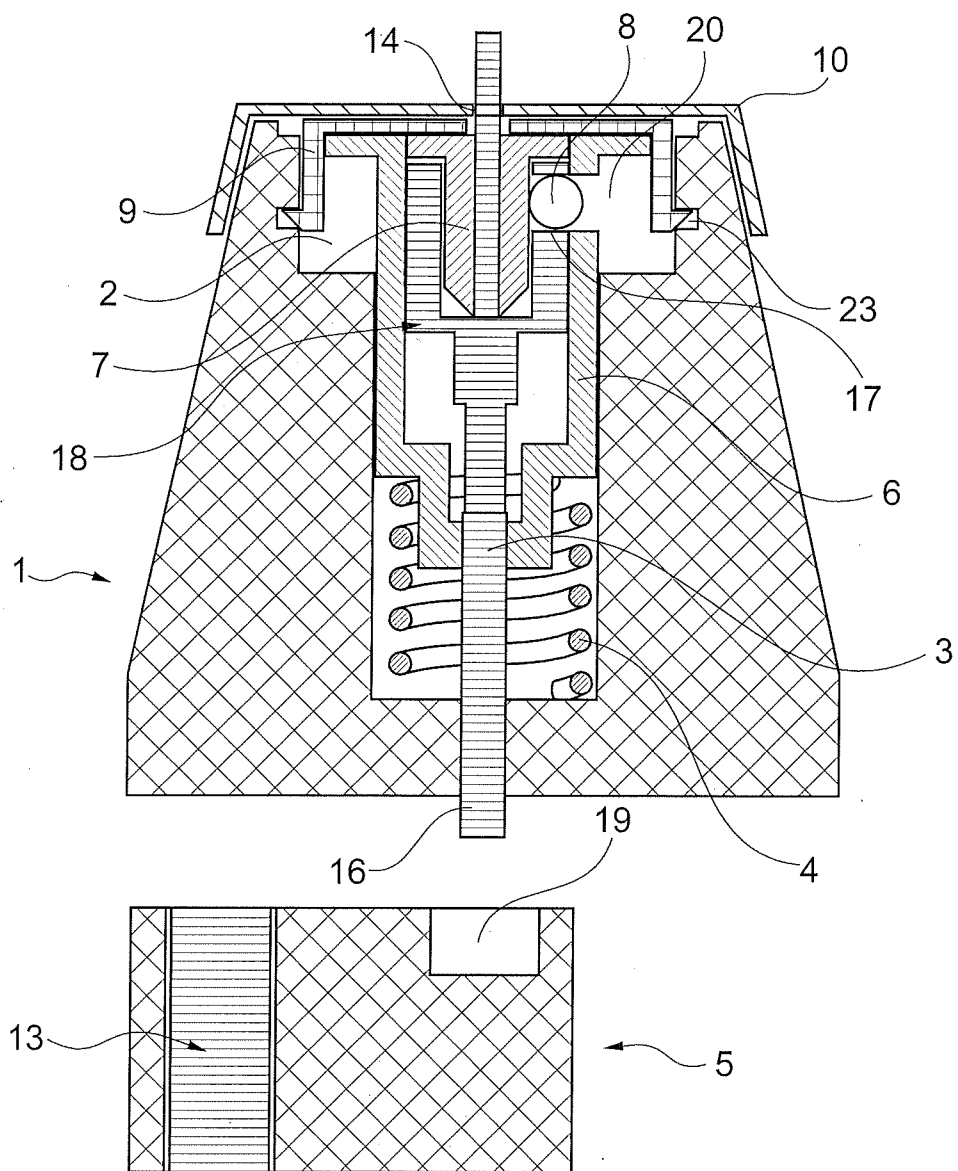


Fig. 4a

6/8

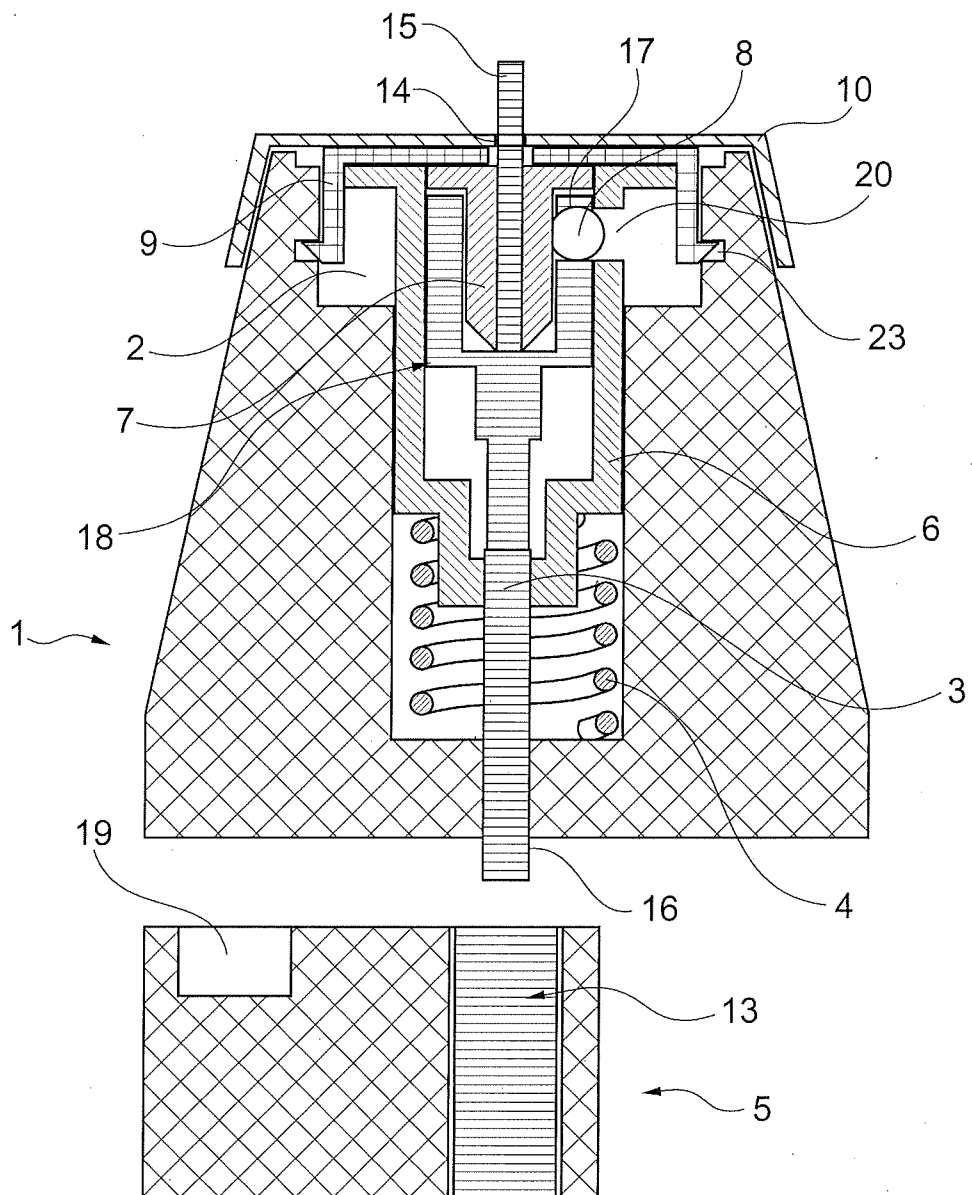


Fig. 4b

7/8

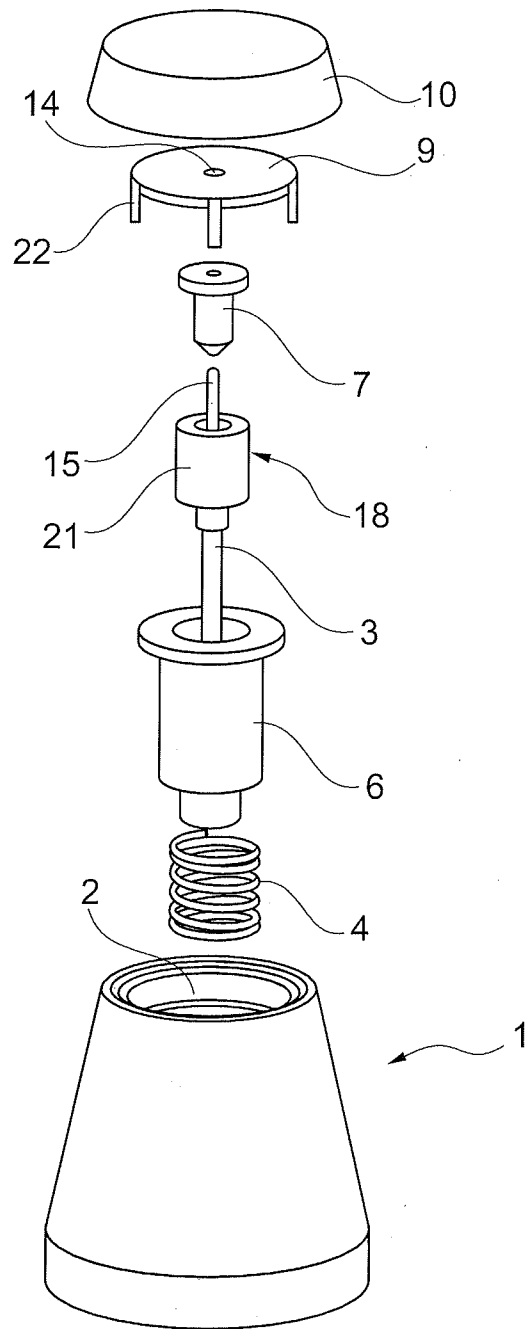


Fig. 5a

8/8

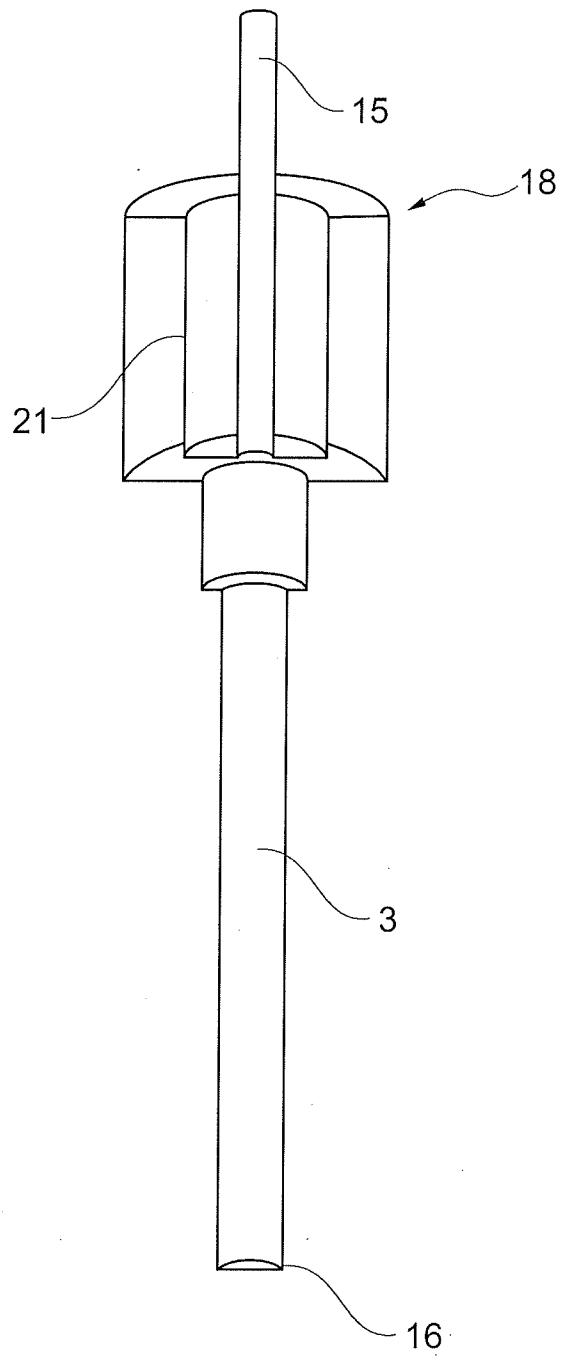


Fig. 5b

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2011/050229

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F42C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1017380 A (S.A. "LES FORGES DE ZEEBRUGGE"), 19 January 1966 (19.01.1966), page 2, line 97 - page 3, line 16, figures 3-6 --	1-11
A	US 3118378 A (JOSEPH RAYMOND JASSE), 21 January 1964 (21.01.1964), figures 1,4,5, claim 1 --	1-11
A	GB 971113 A (INVENTA A.G. FÜR FORSCHUNG UND PATENTVERWERTUNG), 30 Sept 1964 (30.09.1964), page 2, line 66 - line 107, figure 1 --	1-11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

11 May 2011

Date of mailing of the international search report

12-05-2011

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Erik Dahlblom / JA A

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2011/050229

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 1279895 A (INVENTA A.G. FÜR FORSCHUNG UND PATENTVERWERTUNG), 17 February 1961 (17.02.1961), page 2 - page 3, figure 1 --	1-11
A	GB 944164 A (GEBRUDER JUNGHANS A.G.), 11 December 1963 (11.12.1963), page 4, line 23 - line 67, figures 2,7 --	1-11
A	US 4007689 A (APOTHELOZ), 15 February 1977 (15.02.1977), column 4, line 58 - column 5, line 33, figures 1,3-6, abstract -- -----	1-11

International patent classification (IPC)**F42C 15/188** (2006.01)**F42C 15/24** (2006.01)**Download your patent documents at www.prv.se**

The cited patent documents can be downloaded:

- From "Cited documents" found under our online services at www.prv.se (English version)
- From "Anförda dokument" found under "e-tjänster" at www.prv.se (Swedish version)

Use the application number as username. The password is
WOXFCPRRAR.Paper copies can be ordered at a cost of 50 SEK per copy from
PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2011/050229

GB	1017380	A	19/01/1966	BE	628700	A	0/ /
				BE	643670	A	12/08/1964
				ES	296698	A	01/07/1964
				LU	45459	A	20/04/1964
				NL	6401381	A	24/08/1964

US	3118378	A	21/01/1964	BE	611391	A	30/03/1962
				CH	375253	A	15/02/1964
				DE	1155695	B	10/10/1963
				ES	273616	A	16/07/1962
				FR	1283236	A	02/02/1962
				GB	985826	A	10/03/1965
				NL	272706	A	0/ /

GB	971113	A	30/09/1964	CH	379341	A	30/06/1964
				DE	1133282	B	12/07/1962

FR	1279895	A	17/02/1961	NONE			

GB	944164	A	11/12/1963	NONE			

US	4007689	A	15/02/1977	AT	326976	A	15/01/1977
				AT	339179	B	10/10/1977
				BE	843428	A	18/10/1976
				CA	1052178	A	10/04/1979
				CH	594869	A	31/01/1978
				DE	2621488	A,B,C	02/08/1979
				ES	448512	A	01/07/1977
				FR	2315680	A,B	19/09/1980
				GB	1510924	A	17/05/1978
				IT	1061104	B	20/10/1982
				PH	14520	A	26/08/1981
				SE	412285	B,C	12/06/1980
				SE	7606339	A,L	28/12/1976