



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.06.2009 Bulletin 2009/23

(51) Int Cl.:
F41H 13/00 (2006.01)

(21) Application number: **07425758.5**

(22) Date of filing: **29.11.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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Remarks:

Amended claims in accordance with Rule 137(2) EPC.

(54) **Machine shooting bullets of ice**

(57) A machine (120) shooting bullets of ice, comprising:

- at least one storage device (121) containing a specific quantity of water (so called *first stage*), that represents a tank of raw material for the bullets of ice;
- at least one cooling device (122) (so called *second stage*), that represents a means of transformation of a definite quantity of water into bullets of ice (127);
- at least one ice bullet gun (123) (so called *third stage*),

comprising a specific device able to load said bullets of ice and shoot them on external targets;

- at least one transportation chain (124) for said bullets of ice, comprising a series of containing elements (125), that is free to run inside a specific set of connection pipelines (126) mounted between all of the above said devices (121, 122, 123);
- so that said bullets of ice (127) can be generated, loaded and instantaneously launched towards an external target.

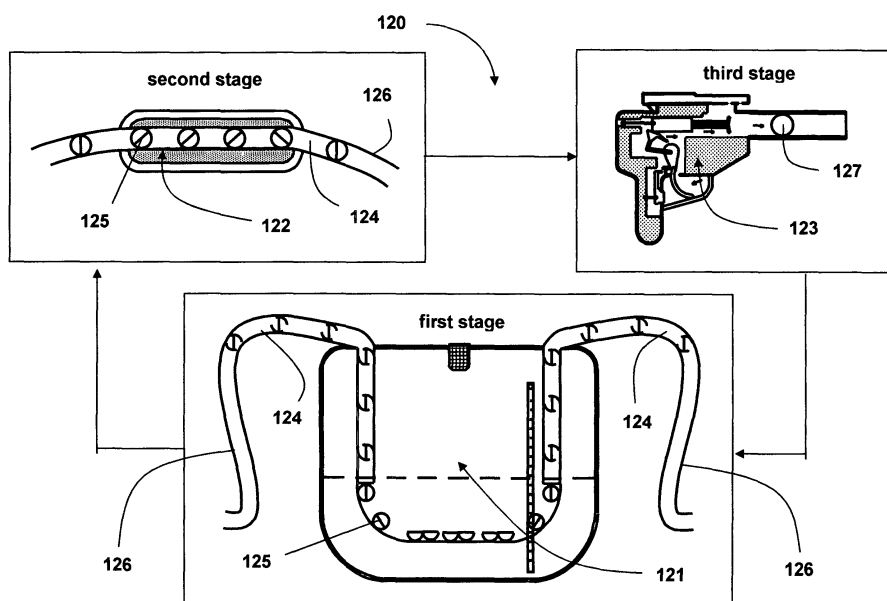


Fig. 12

Description

TECHNICAL FIELD

[0001] The present invention concerns a machine able to shoot bullets made of ice and that can be realized, in example, as a gun able to launch blocks of ice with high speed towards a specific target.

The use, for this kind of machine, is especially as a non-lethal weapon, that can be employed in case of preserving the public order, but it is clear that the same basic solutions can describe a real lethal weapon, available to the police forces or to the military forces.

Other uses of this machine are: possibility of fast extinguishing fires, diffusion of artificial snow on winter sport plants, fast cleaning service of buildings or monuments affected by pollution's dust, and fast disinfection of areas affected by viral or bacteriological agents.

Naturally, according to each of the above uses, different calibres of ice bullets are chosen, going from a high granularity level, in case of non-lethal weapon, cleaning service, artificial snow or extinguishing of fires, to a very high level of robustness in case of weapons of the police forces or war machine available to the military forces.

BACKGROUND ART

[0002] As known, machines for creation of artificial ice, or fast transformation of water in ice, are already available from the prior art. In particular, some recent inventions are related to means for cleaning floors and surfaces using the so called dry ice. They have the characteristic of a more effective removal of fat in respect of the common cleaning methods based on detergents.

Another class of machines is given by artificial snow means, widely used in touristic plants in case of lack of snow on mountains during the winter.

All the above machines have the serious drawback of not permitting to change the calibre for the particles of ice and not permitting to direct a high rapid jet of them towards a specific target. For this reason, they are not suitable for a use as a weapon, either as a lethal one or a non-lethal one.

DISCLOSURE OF INVENTION

[0003] Therefore, the main objective of the present invention is to provide a machine able to shoot particles of ice, with high speed, towards a specific target.

[0004] Another objective of the present invention is to describe a machine with bullets of ice having a variable calibre, being possible to choose the granularity level and the robustness level for the same bullets.

[0005] A further objective is to propose a perfectly autonomous machine, in a sense of not requiring outer sources as raw material or energy, and able to make the necessary ice bullets in real time and continuously starting from an available quantity of water.

Therefore, it is specific subject of the present invention a machine shooting bullets of ice, comprising:

- at least one storage device containing a specific quantity of water (so called *first stage*), that represents a tank of raw material for the bullets of ice;
- at least one cooling device (so called *second stage*), that represents a means of transformation of a definite quantity of water into bullets of ice;
- at least one ice bullet gun (so called *third stage*), comprising a specific device able to load said bullets of ice and shoot them on external targets;
- at least one transportation chain for said bullets of ice, comprising a series of containing elements, that is free to run inside a specific set of connection pipelines mounted between all of the above said devices;

so that said transportation chain, running inside said pipelines, permits for a definite number of times, that:

- inside said storage device (so called *first stage*), each of said containing elements is filled by a definite quantity of water;
- according to a physical cooling process existing inside the above said cooling device (so called *second stage*), said definite quantity of water, inside each containing element, is transformed into a respective bullet of ice;
- each bullet of ice is sequentially loaded in the ice bullet gun (so called *third stage*) and it is available for an instantaneous launch towards an external target.

BRIEF DESCRIPTION OF DRAWINGS

[0006] The present invention will now be described for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 is a sectioned lateral view of a ice bullet gun, comprising a spherical bullet ready to be launched outside using a proper mechanism of instantaneous launch;

figure 2 is a sectioned lateral view of the same ice bullet gun of figure 1, comprising said spherical bullet at the step of being launched outside under the action of the above mechanism of instantaneous launch;

figure 3 is a front view of a machine shooting bullets of ice, turned in action by a person, and comprising external devices in order to generate, load and instantaneously launch the bullets like the above seen;

figure 4 is a plant view of a storage device (*first stage*), that represents a tank of raw material for said bullets of ice;

figure 5 is a sectioned lateral view of the same device of figure 4, that is a storage device (*first stage*), that represents a tank of raw material for said bullets of

ice;

figure 6 is a plant view of a cooling device (*second stage*), that represents a means of transformation of a definite quantity of water into a respective bullet of ice;

figure 7 is a sectioned lateral view of the same cooling device of figure 6 (*second stage*), that represents a means of transformation of a definite quantity of water into a respective bullet of ice;

figure 8 is a plant view of the same ice bullet gun (*third stage*) of figure 1, where is visible the outer loading mechanism of said bullets of ice;

figure 9 is a sectioned lateral view of the same ice bullet gun of figure 1;

figure 10 is a sectioned lateral view of the same ice bullet gun of figure 2;

figure 11 is a plant view of a particular of a transportation chain for said bullets of ice;

figure 12 is a schematic global view of a machine shooting bullets of ice comprising the proper above said devices for generation, loading and instantaneous launch of said bullets of ice.

BEST MODES FOR CARRYING OUT THE INVENTION

[0007] It is herein underlined that, in the following, only some of the many conceivable embodiments of the present invention will be described, and they are just particular examples that do not introduce any limitations, having the possibility to describe many other embodiments based on the disclosed technical solution of the present invention. In figure 1 it is illustrated a gun 10 that is the main part of the machine which is subject of the present invention (*third stage*). In particular, it receives some bullets 12 going inside, that are externally generated and then carried on using the containing elements 82 (figure 8) locked on a mobile transportation chain 110 (figure 11). Each single containing element 82 is composed of two hemispheres holding a bullet of ice 12 inside. When the mobile chain 110 makes an element 82 to arrive close to the gun 84, a proper mechanism provides the two hemispheres to open and to release the contained bullet of ice 12. Then, the bullet 12, located in the ballistic barrel 13, is ready to be instantaneously launched outside using a proper launch mechanism 14. This mechanism 14 is switched on by gears connected to a trigger 15, pushed by an external user that is responsible to "fire" a shot. Said situation is better represented in figure 2 where it is illustrated, using arrows, the motion of mechanisms 23, 24, 25 and 26, and the consequent instantaneous launch of bullet 22 going outside.

[0008] The system has been designed so that there is a cyclic rate, and when a shot has been fired it is immediately possible to fire again, according to a rapid load of a new bullet, in a "machine gun" style.

[0009] Indeed, in order to make it possible, new bullets should be generated in real time and continuously. That is realized by the following described process and device-

es.

[0010] In particular, elements 82 go to "catch" a specific quantity of water from the inner side of a tank 50 like the one of figure 5 (*first stage*).

[0011] Pipelines 51 and 52 allow the above said mobile transportation chain to run inside the tank. Each containing element 53, according to a open/close mechanism of the two belonging hemispheres 57 and 59, holds a definite quantity of water inside. The same quantity of water is carried outside the tank following the run of the mobile transportation chain.

In figure 4 it is better illustrated how input 43 and output 42 pipelines allow the transportation of water outside tank 41.

In the design of the present machine, a particular attention has been addressed to the closing mechanism of said spherical containing elements. In fact, it is clear how this closing operation must be not only extremely fast and efficient, but also perfectly "watertight". Some thin O-rings, made of rubber or polymeric material, joint on the respective edges of said hemispheres, are able to reach this objective.

Another critical aspect of this machine is given by the connection element of pipelines 51 and 52 inside tank 50. In fact, once that a containing element 58 holds a specific quantity of water inside, and it is going outside the tank, it is important that water is not pushed towards the output pipeline 52. In other words, the connection element between tank 50 and output pipeline 52 should allow the passage of a solid element, the spherical container 58, but not the passage of a liquid element like the water of the tank. This result is obtained providing a proper open/close mechanism with O-rings, valves and a possible integrated drainage system by pressure.

A similar problem is located at the input pipeline 51. In fact, a connection element should guarantee the passage of a spherical container 53 going inside and avoid the simultaneous flowing back of water from tank 50 to the pipeline 51. Another open/close mechanism with O-rings, valves and a possible integrated drainage system by pressure can solve the problem and obtain the desired result.

Once that each containing element 58 runs outside tank 50, carrying away a definite quantity of water, proper pipelines drive it to another device, a cooling device 70 - figure 7 (*second stage*), that provides, for the objects going through it, a very fast cooling process going to extremely low temperatures. Consequently, the water inside is subject of a very quick change of state, from the liquid state to the solid one, transforming itself in a small block of ice quite instantaneously. The geometrical shape of the small block of ice is defined by the above said containing element that, exactly for this reason, is indicated with the name of "mould". In fact, the mould defines size and granularity of said bullets of ice, giving then, indirectly, the level of wounding power (from *non-lethal* to *lethal* bullets).

From a technical point of view, the nearly instantaneous

passage from room temperature to an extremely lower temperature states non trivial problems.

The most appropriate solution is to introduce some heat exchange devices 73, with highly thermal conductive walls, where a fluid, having a temperature close to absolute zero, like liquid hydrogen or helium, is forced to circulate.

This solution, together with a size of few millimetres for said ice bullets, can guarantee the passage of water, from a liquid to solid state, in a split second.

In figure 6 it is illustrated more in particular how pipelines 65 and 66 permit: first the spherical containers 61 (with water inside) to enter in said cooling device 60, and then the spherical containers 62 (with ice inside) to exit from the same cooling device 60.

In such a way, the process of real time generation of bullets of ice is complete. These bullets are immediately available in sequence to the gun 84 so that the user can shoot immediately towards an external target. In figures 9 and 10 the proper mechanisms, for use the gun with ice bullets, are illustrated again.

The global machine, in this embodiment, appears like that illustrated in figure 3. A water tank 32 guarantees the raw material that, going through pipelines 35, is driven to a cooling device 31 where ice bullets are generated. Additional pipelines 36 make the same ice bullets immediately available to a gun 33, where they can be shot to an external target. A pipeline 34 drives the moulds to "catch" new material before to repeat the cycle again and again for an indefinite number of times.

In figure 11 it is illustrated the transportation chain 110 that drives the containing elements 115 through the entire machine. As already mentioned, each container is composed of two hemispheres (i.e. 111 and 112) that can be hermetically sealed, in order to contain a definite quantity of water inside, and then to open again in order to release the material that is stored inside.

Naturally, in order to make the chain 110 to run in the pipelines for an indefinite quantity of time, it should be dragged by a proper external device.

A first possible solution is that pressure vacuum, consequent to a bullet firing, can give the necessary energy to keep the chain 110 in motion. Another more realistic solution is to integrate, in the machine, an automatic dragging device that provides the motion of chain in a programmed cyclic sequence.

Another significant characteristic of chain 110 is the presence of articulation means 113, with one or more degrees of freedom, so that is possible to follow the curves and bends of said pipelines in the 3D space.

In synthesis, in figure 12 it is represented a global schematic view of each part belonging to this machine, including all the above described devices with reference to generation, load and instantaneous launch of bullets of ice.

[0012] According to the above basic principles, it is possible to introduce additional embodiments of this invention. As already mentioned, in case of weapon available to police or military forces, the ice bullet gun can be

as represented in figure 3, with a main structure on ground so that user is free in respect of weights and bulks. However, another solution is to locate the entire machine on a mobile trolley so that is possible to have a very big and heavy tank of water. In some cases, it is possible to have a significant extension of uses if this invention is mounted on a big vehicle, a truck, a train, a ship or an helicopter.

In such a way, it appears particularly suitable, i.e., to fast extinguishing fires, diffusion of artificial snow on winter sport plants, fast cleaning service of buildings or monuments affected by pollution's dust, and fast disinfection of areas affected by viral or bacteriological agents.

[0013] Furthermore, another embodiment of the present invention is given when the user can carry this machine directly on his body, with water tank and cooling device on shoulders, and gun ready to shoot ice towards fast moving targets. Such a machine would be particularly suitable to police forces, fire brigades, military forces and rapid reaction forces.

Therefore, all of the above examples show that the present invention achieves the proposed objectives. In particular, it permits to realize a machine able to shoot particles of ice, with high speed, towards a specific target.

Then, it permits to realize a machine with bullets of ice having a variable calibre, being possible to choose the granularity level and the robustness level for the same bullets.

Furthermore, the present invention introduces a perfectly autonomous machine, in a sense of not requiring outer sources as raw material or energy, and able to make the necessary ice bullets in real time and continuously starting from an available quantity of water.

[0014] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is clear that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope, as defined in the enclosed claims.

Claims

1. A machine (120) shooting bullets of ice, comprising:

- at least one storage device (121) containing a specific quantity of water (so called *first stage*), that represents a tank of raw material for the bullets of ice;
- at least one cooling device (122) (so called *second stage*), that represents a means of transformation of a definite quantity of water into bullets of ice (127);
- at least one ice bullet gun (123) (so called *third stage*), comprising a specific device able to load said bullets of ice and shoot them on external targets;
- at least one transportation chain (124) for said

bullets of ice, comprising a series of containing elements (125), that is free to run inside a specific set of connection pipelines (126) mounted between all of the above said devices (121, 122, 123);

so that said transportation chain (124), running inside said pipelines (126), permits for a definite number of times, that:

- inside said storage device (121) (so called *first stage*), each of said containing elements (125) is filled by a definite quantity of water;
- according to a physical cooling process existing inside the above said cooling device (122) (so called *second stage*), said definite quantity of water, inside each containing element (125), is transformed into a respective bullet of ice;
- each bullet of ice (127) is sequentially loaded in the ice bullets gun (123) (so called *third stage*) and it is available for an instantaneous launch towards an external target.

2. A machine (120) shooting bullets of ice, according to claim 1, **characterized in that:**

- each of said containing elements (125) is composed of two mobile hemispheres, that open and close when they are inside said storage device (121), in order to catch a definite quantity of water, and then open and close again, when they are inside said gun (123), in order to release a respective bullet of ice (127).

3. A machine (120) shooting bullets of ice, according to claim 2, **characterized in that:**

- said mobile hemispheres of said containing elements (125) are perfectly "watertight", comprising thin O-rings, made of rubber or polymeric material, joint on their respective edges.

4. A machine (120) shooting bullets of ice, according to one or more of the above claims, **characterized in that:**

- said storage device (121) comprises connection elements, located in the respective input/output pipelines, including a proper open/close mechanism with O-rings, valves and a possible integrated drainage system by pressure,

so that it is guaranteed the passage of said containing elements (125) and it is avoided the simultaneous flowing of water from the tank.

5. A machine (120) shooting bullets of ice, according to one or more of the above claims, **characterized**

in that:

- said cooling device (122) has highly thermal conductive walls, where a fluid, having a temperature close to absolute zero, like i.e. liquid hydrogen or helium, is forced to circulate, so that said definite quantity of water, hold inside of said containing elements (125), changes from a liquid to solid state, in a split second.

6. A machine (120) shooting bullets of ice, according to one or more of the above claims, **characterized in that:**

- said transportation chain (124) runs inside said pipelines (126) under the action of an automatic dragging device, that provides a motion with a programmed cyclic sequence.

7. A machine (120) shooting bullets of ice, according to one or more of the above claims, **characterized in that:**

- said transportation chain (124) has articulation means 113, with one or more degrees of freedom, so that is possible to follow the curves and bends of said pipelines (126) in the 3D space.

Amended claims in accordance with Rule 137(2) EPC.

1. A machine (120) shooting bullets of ice, comprising:

- at least one storage device (121) containing a specific quantity of water, that represents a tank of raw material for the bullets of ice;
- at least one cooling device (122), that represents a means of transformation of a definite quantity of water into bullets of ice (127);
- at least one ice bullet gun (123), comprising a specific device able to load said bullets of ice and shoot them on external targets;
- at least one transportation chain (124) for said bullets of ice, comprising a series of containing elements (125), that is free to run inside a specific set of connection pipelines (126) mounted between all of the above said devices (121, 122, 123);

so that said transportation chain (124), running inside said pipelines (126), permits for an indefinite number of times, that:

- inside said storage device (121), each one said containing elements (125) is filled by a definite quantity of water;

- according to a physical cooling process existing inside the above said cooling device (122), said definite quantity of water, inside each containing element (125), is transformed into a respective bullet of ice;
- each bullet of ice (127) is sequentially loaded in the ice bullets gun (123) and it is available for an instantaneous launch towards an external target,

wherein :

- each one of said containing elements (125) is composed of two mobile hemispheres, that open and close when they are inside said storage device (121), in order to catch a definite quantity of water, and then open and close again, when they are inside said gun (123), in order to release a respective bullet of ice (127).

2. A machine (120) shooting bullets of ice, according to claim 1, characterized in that:

- said mobile hemispheres of said containing elements (125) are perfectly "watertight", comprising thin O-ring, made of rubber or polymeric material, joint on their respective edges.

3. A machine (120) shooting bullets of ice, according to Claim 1, characterized in that:

- said storage device (121) comprises connection elements, located in the respective input/output pipelines, including a proper open/close mechanism with O-rings, valves and a possible integrated drainage system by pressure, so that it guarantees the passage of said containing elements (125) and it avoids the simultaneous flowing of water from the tank. avoids the simultaneous flowing of water from the tank.

4. A machine (120) shooting bullets of ice, according to Claim 1, characterized in that:

- said cooling device (122) has highly thermal conductive walls, where a fluid, having a temperature close to absolute zero, like i.e. liquid hydrogen or helium, is forced to circulate,

so that said definite quantity of water, field inside said containing elements (125), changes from a liquid to solid state, in a split second.

5. A machine (120) shooting bullets of ice, according to Claim 1, characterized in that:

said transportation chain (124) runs inside said pipelines (126) under the action of an automatic

dragging device, that provides a motion with a programmed cyclic sequence.

6. A machine (120) shooting bullets of ice, according to Claim 1, characterized in that:

- said transportation chain (124) has articulation means (113), with one or more degrees of freedom, so that is possible to follow the curves and bends of said pipelines (126) in the three spatial dimensions

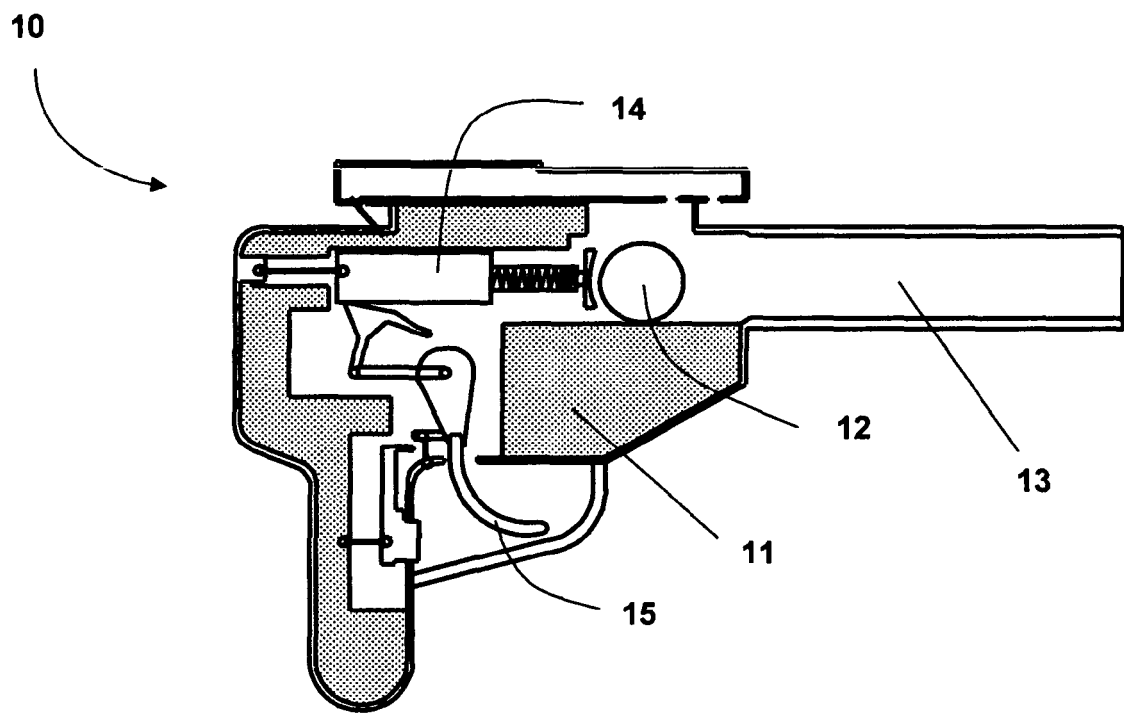


Fig. 1

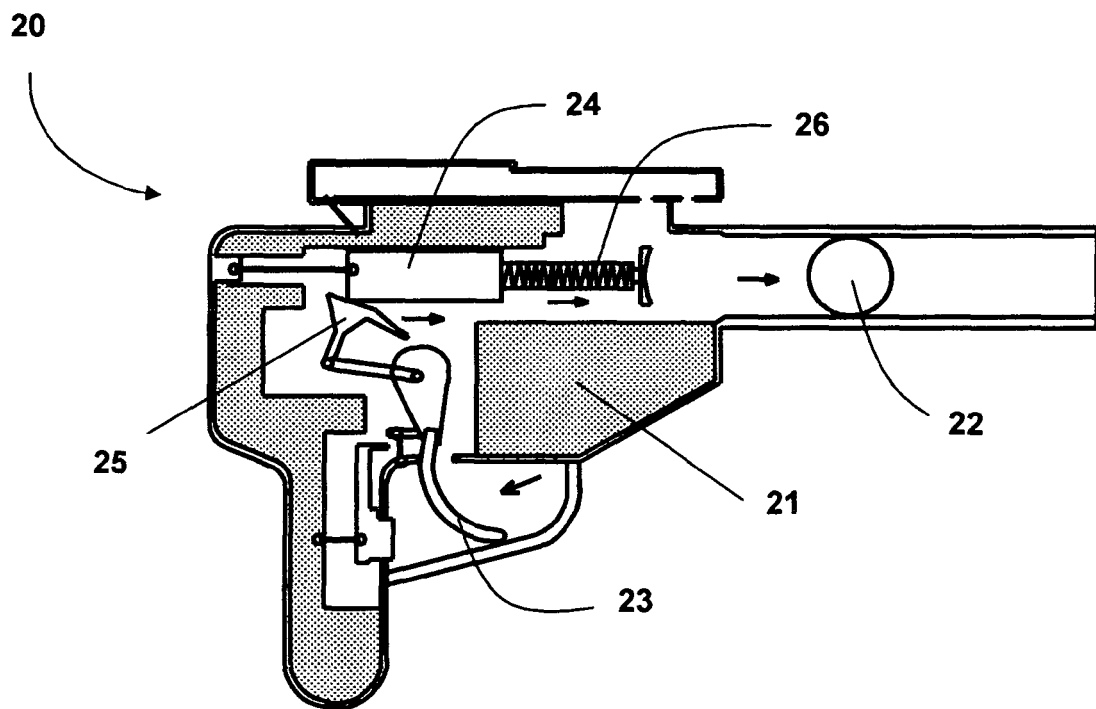


Fig. 2

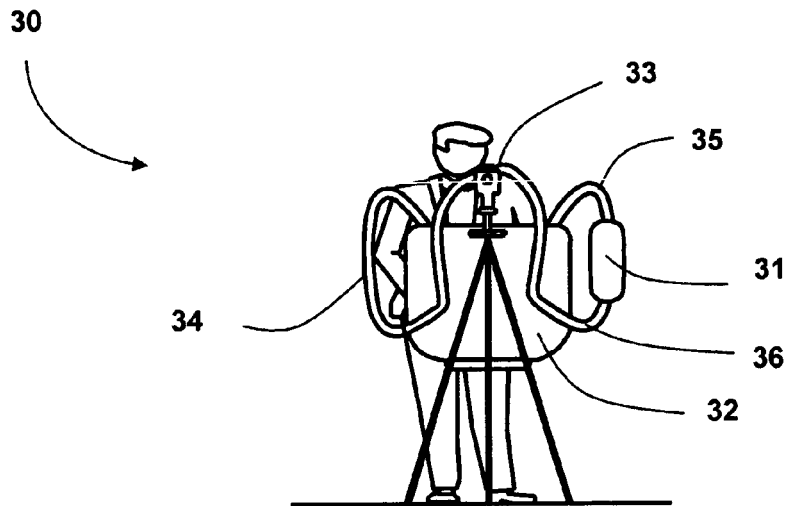


Fig. 3

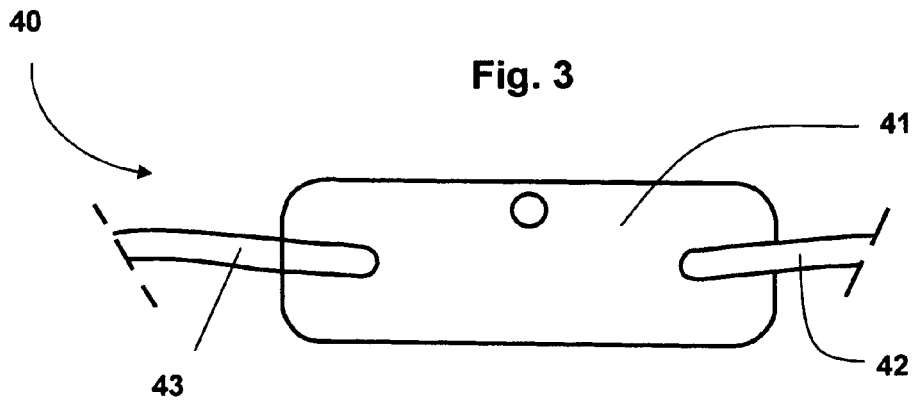


Fig. 4

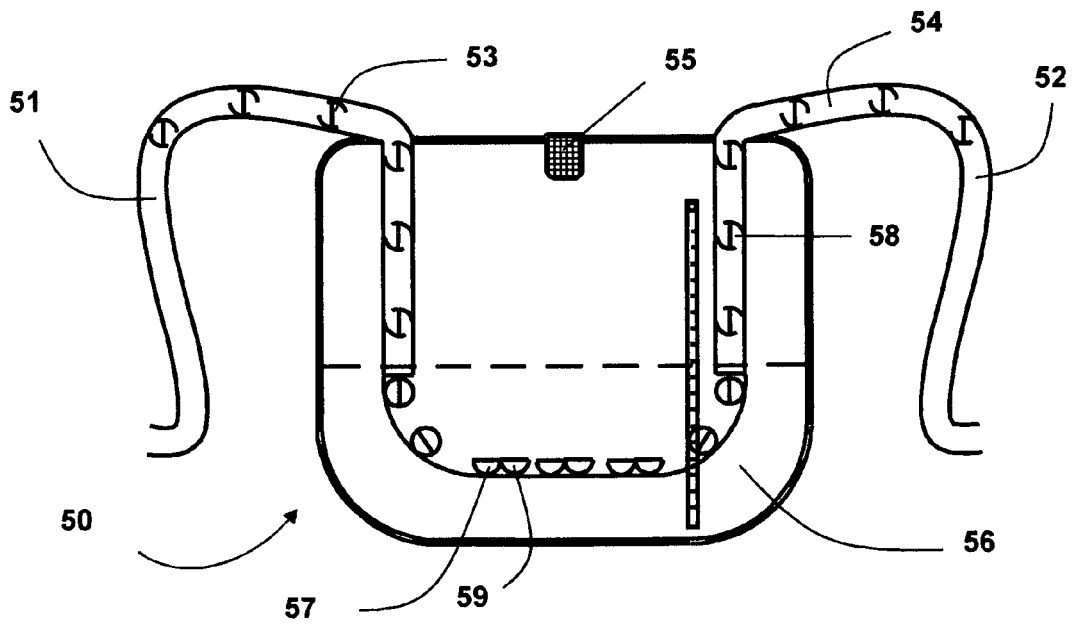


Fig. 5

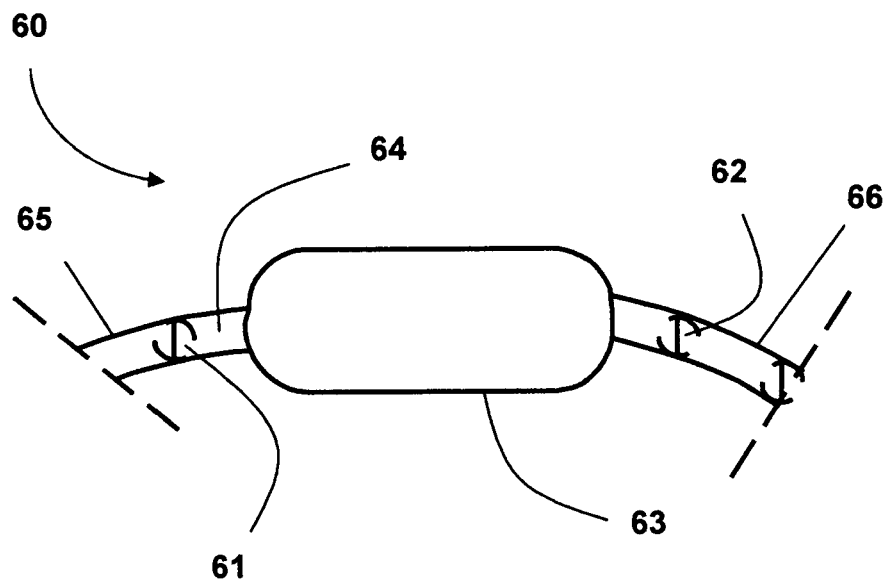


Fig. 6

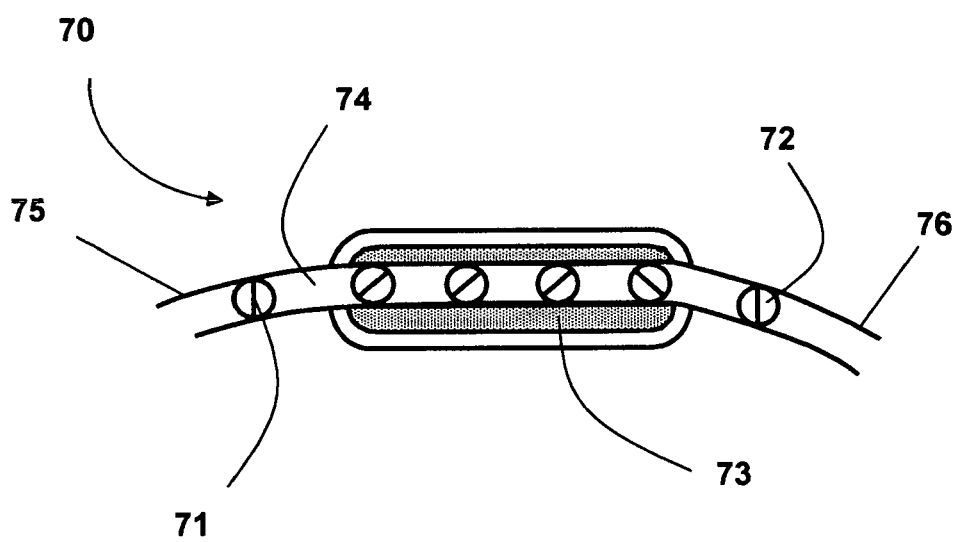


Fig. 7

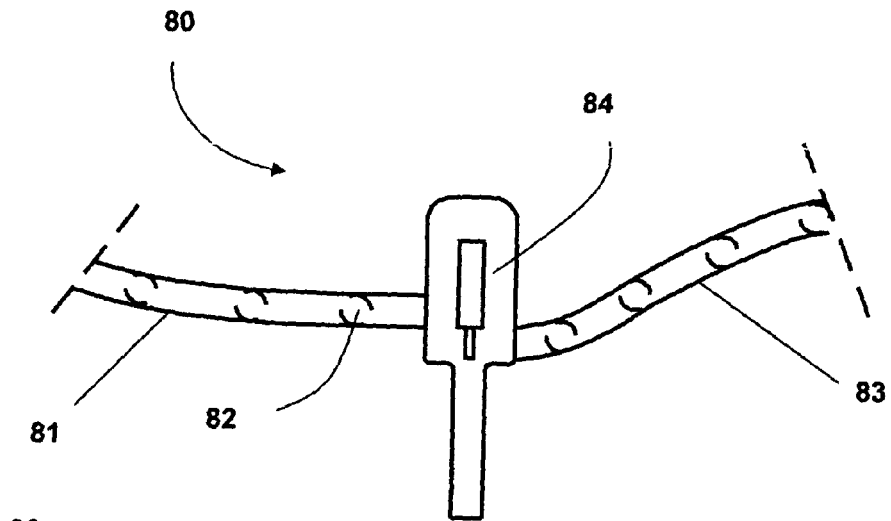


Fig. 8

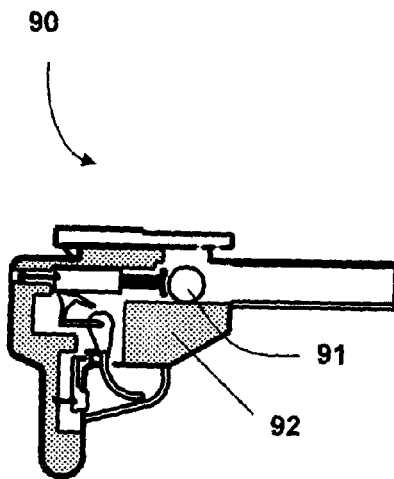


Fig. 9

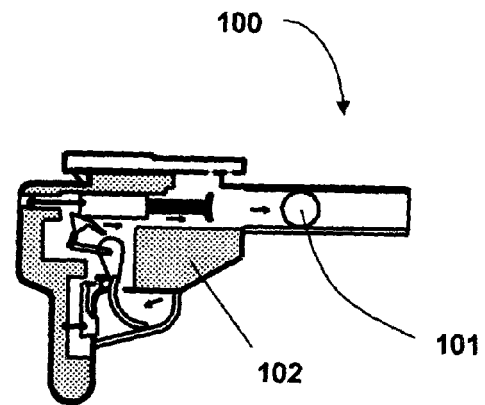


Fig. 10

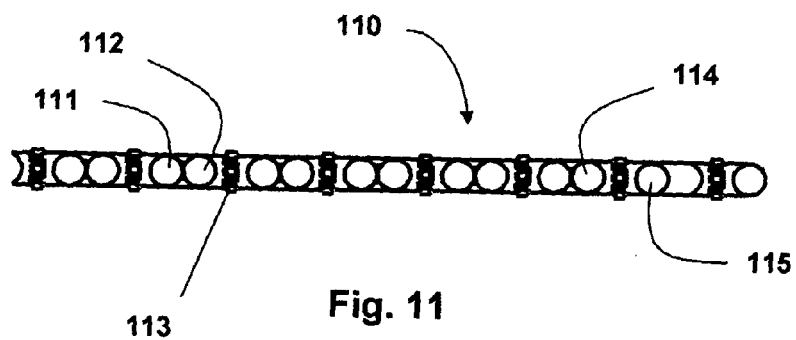


Fig. 11

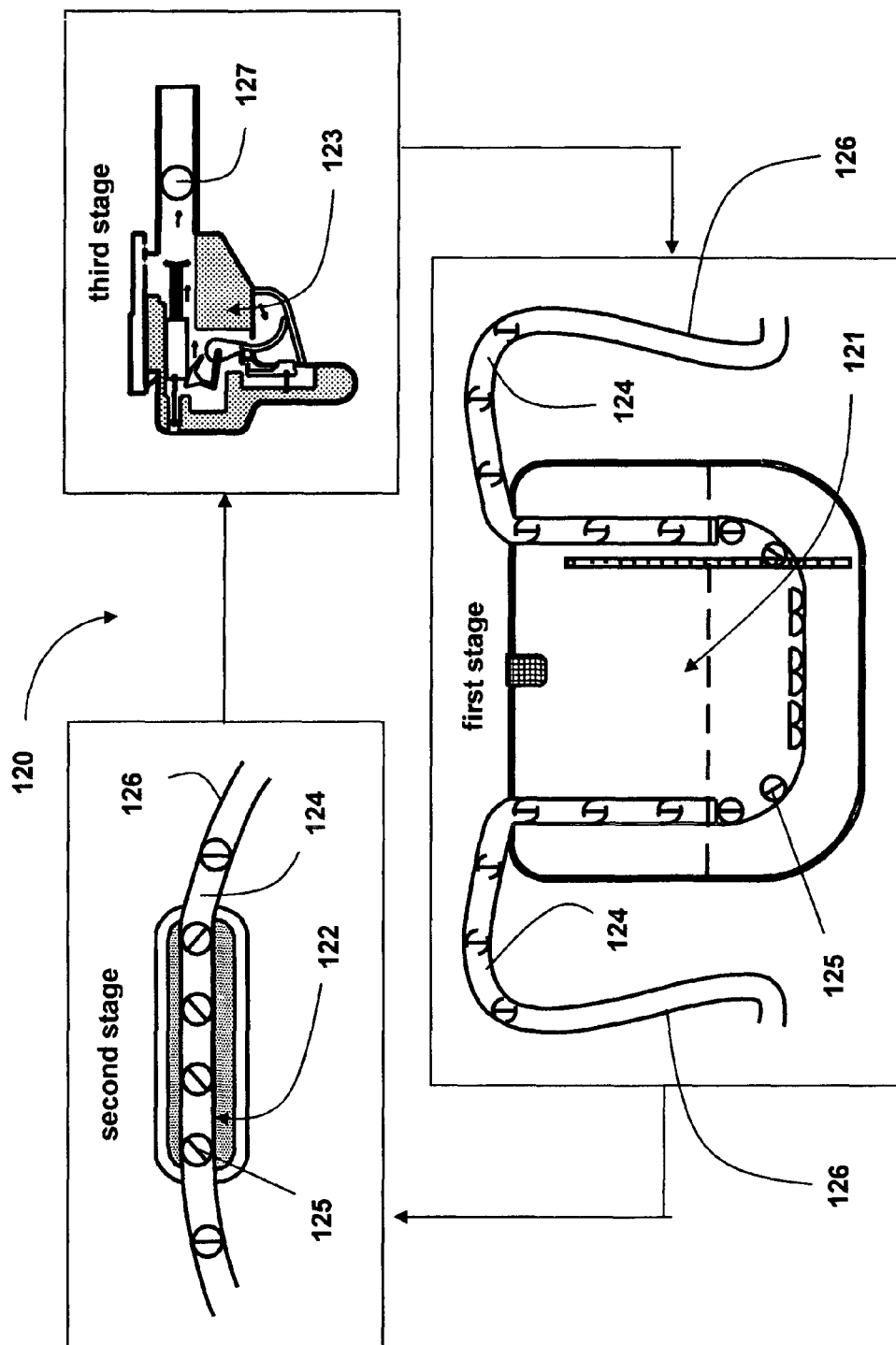


Fig. 12



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5758

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 921 980 A (ARTZER RICHARD F) 25 November 1975 (1975-11-25) * column 2, line 38 - column 4, line 52 * * figures 1-5 *	1	INV. F41H13/00
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A	WO 89/10522 A (COMMISSARIAT ENERGIE ATOMIQUE [FR]) 2 November 1989 (1989-11-02)		
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 July 2008	Examiner Menier, Renan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 42 5758

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02-07-2008

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