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(54) **Container surveillance system**

(57) A container surveillance system for surveying the interior of a container (10), comprising at least one surveillance sensor (22) arranged inside the container (10); and a processing unit (20) for receiving a surveillance signal from the at least one surveillance sensor (22). The processing unit (20) comprises evaluation

means for evaluating the surveillance signal and determining whether a violation of the container (10) has taken place and communication means for transmitting an alarm signal to at least one monitoring station (24) as soon as the evaluation means has determined that a violation has taken place.

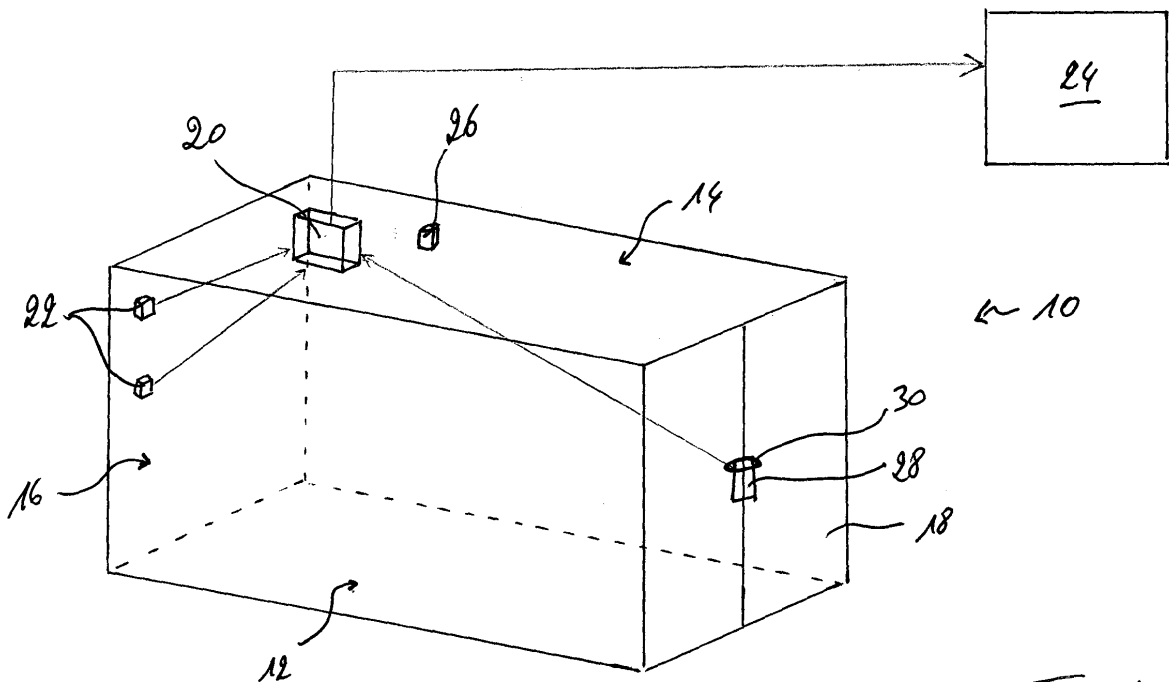


Fig 1

**Description****Introduction**

5 **[0001]** The present invention relates to a container surveillance system, in particular for commercial containers, more particularly for detecting any intrusion into such a container.

**[0002]** Commercial containers, in storage or in transit, are prone to being broken into, generally for the purpose of stealing its contents, but sometimes also for the purpose of tampering with it. Such intrusions into commercial containers should obviously be avoided or at least detected.

10 **[0003]** In order to detect if an intrusion has taken place, the container doors are generally provided with sealing devices. Such sealing devices are configured and arranged so as to break when the container doors are opened. Any intrusion of the container through opening of the container doors can hence be detected at the latest when the container reaches its destination. Such systems however generally only provide information on the integrity of the container when the sealing device is checked, by which time it is generally too late to avoid the contents of the container from disappearing or being tampered with.

15 **[0004]** International patent application WO 2004/001550 describes a cargo container locking system, which attempts to avoid intrusion into the container by placing the locking mechanism of the container door inside the container. It follows that the container door can only be opened from inside the container with a predetermined unlock signal. The necessary unlock signal for opening the door is transmitted after the monitoring station has verified that the container is in the correct location. In order to verify the location of the container, the latter is provided with a GPS receiver for forwarding GPS data to a monitoring station. The transmittal of the GPS data from the container to the monitoring station and of the unlock signal from the monitoring station to the container is carried out by a communication module, which is advantageously configured to operate in real-time, e.g. via the GSM network. This cargo container locking system does however not prevent from nor detect any intrusion into the container through the container walls, floor or roof. Although  
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25 this system allows real-time tracking of the container and prevents opening of the container doors from outside, it does not allow the checking of the integrity of the container in real-time.

**[0005]** However, in particular in connection with the recent terrorist threats, it is of importance to ensure that any unauthorised access to a container is detected as soon as possible, i.e. well before arrival of the container at its destination.

30 **Object of the invention**

**[0006]** The object of the present invention is to provide an improved container surveillance system, which allows to quickly identify a violation of the integrity of the container. This object is solved by the system as described in claim 1.

35 **General description of the invention**

**[0007]** The present invention proposes a container surveillance system for surveying the interior of a container, wherein the system comprises at least one surveillance sensor arranged inside the container; and a processing unit for receiving a surveillance signal from the at least one surveillance sensor. The processing unit comprises evaluation means for  
40 evaluating the surveillance signal and determining whether a violation of the container has taken place and communication means for transmitting an alarm signal to at least one monitoring station as soon as the evaluation means has determined that a violation has taken place.

**[0008]** Such a system allows a continuous monitoring of the container. The processing unit is capable of determining that an intrusion has taken place as soon as the intrusion is made. This allows an alarm to be raised immediately. If the container is e.g. opened in order to place an explosive device inside the container, such intrusion can be detected and notified in real-time. It follows that action can be taken before the container reaches its destination. With previous systems, wherein the intrusion is detected upon arrival of the container at its destination, it might be too late to take action and avoid detonation of the explosive device.

**[0009]** Preferably, the at least one surveillance sensor is chosen from the group comprising light detectors, motion detectors, sound detectors, still or motion cameras, infrared cameras. The choice of surveillance sensor, or any combination thereof, will depend on the nature of the cargo and/or external conditions. With such surveillance sensors, it is possible to monitor the interior of the container itself. Any intrusion that takes place e.g. through a container wall, roof or floor, without violating the container door and its associated sealing device, can hence also be detected in real-time.

**[0010]** The communication means is advantageously configured to continuously or periodically transmit a signal indicative of the status of the container to the monitoring station. Alternatively, the communication means can be configured to transmit a signal to the monitoring station only when an intrusion is determined by the processing unit.

55 **[0011]** The communication means preferably comprises a modem using the GSM (e.g. GPRS) or UMTS standard for transmitting the signal indicative of a violation of the integrity of the container to the monitoring station. Such a transmitter

can hence use existing networks for communicating with the monitoring stations, thus assuring low cost and high availability of communications. The status information of the container can hence easily be transmitted all over the world.

5 **[0012]** The system can further comprise an event logger for storing a log of events. In case a communication cannot be established between the processing unit and the monitoring station, the information to be transmitted can be temporarily stored in the event logger. The stored information can then be transmitted to the monitoring station once the communication is restored.

10 **[0013]** Advantageously, the system further comprises a GPS receiver for determining the position of the container. The GPS data can then also be transmitted to the monitoring stations. The container surveillance system hence also comprises a tracking system wherein the container can be continuously located with precision. This also has the advantage that if action has to be taken in response of an alarm being raised, the container can be quickly located.

**[0014]** Generally, such a container comprises at least one container door and the system preferably further comprises at least one sealing device associated with a locking device of the container door.

15 **[0015]** Advantageously, the sealing device comprises a first sealing element having a housing with an internal chamber therein; and a second sealing element having a shaft. When the first and second sealing elements are connected, the shaft of the second sealing element extends into the internal chamber of the first sealing element through an opening in its housing. The first sealing element preferably comprises a pressure sensor connected to the internal chamber for sensing a pressure in the internal chamber; and a transmitter for receiving a signal indicative of the pressure in the internal chamber and for transmitting the signal to the processing unit.

20 **[0016]** The pressure sensor in the housing allows monitoring of the pressure in the internal chamber. The configuration of the sealing device is such that, when the second sealing element is connected to the first sealing element, the pressure in the internal chamber is increased due to the introduction of the shaft in the internal chamber. If the second sealing element is correctly connected to the first sealing element, the pressure is increased so as to reach a predetermined pressure range. As long as the second sealing element is not correctly connected to the first sealing device, the shaft does not sufficiently penetrate into the internal chamber of the housing. In turn, this means that the pressure in the  
25 internal chamber has not sufficiently increased to reach the predetermined pressure range. Only once the pressure in the internal chamber has reached the predetermined pressure range, it can be concluded that the sealing device is correctly installed. By sensing the pressure in the internal chamber, it is hence possible to determine if the first and second sealing elements are correctly connected, i.e. if the sealing device is correctly installed.

30 **[0017]** Furthermore, after installation of the sealing device, the integrity of the sealing device can be checked. When the sealing device is broken, the pressure in the internal chamber changes and leaves the predetermined pressure range. Indeed, as the first and second sealing elements are separated, the shaft is withdrawn from the internal chamber and the pressure drops. When the pressure in the internal chamber drops below a predetermined pressure threshold, it can be concluded that the sealing device is broken or disassembled. By sensing the pressure in the internal chamber, it is hence possible to determine if the first and second sealing elements are still correctly connected, i.e. if the integrity  
35 of the sealing device is maintained.

**[0018]** The transmitter in the first sealing element receives a signal indicative of the pressure in the internal chamber and transmits it to the processing unit. The processing unit can hence be used to verify if the sealing device has been correctly installed and to verify the integrity of the sealing device. If the integrity of the sealing device is violated, an alarm can be raised.

40 **[0019]** Advantageously, the first sealing element further comprises a preferably resilient membrane dividing the internal chamber into a first chamber and a second chamber, the first chamber facing the second sealing element, and the shaft of the second sealing element has a length such that, when the first and second sealing elements are connected, the shaft at least partially pushes the membrane into the second chamber so as to reduce the volume of the second chamber and hence increase the pressure therein. By providing such a membrane, it can be more easily ensured that the chamber  
45 to which the pressure sensor is connected is gastight. The internal chamber is divided into two separate chambers, wherein one, the first chamber, comprises an opening in the housing for receiving the shaft of the second sealing element, and the other, the second chamber, comprises the pressure sensor. By separating the chamber comprising the pressure sensor from the opening in the housing, it is no longer necessary to provide a gastight connection between the first and second sealing elements. This considerably simplifies the connection between the first and second sealing elements.

50 **[0020]** The resilient membrane can return to its initial position when the shaft is withdrawn from the internal chamber, thereby causing a pressure drop in the second chamber. The resilience of the membrane can further provide an ejection force for the shaft, pushing the shaft out of the internal chamber more quickly, thereby obtaining a faster pressure drop in the second chamber. The violation of the integrity of the sealing device can hence be detected more quickly.

55 **[0021]** The first sealing element can further comprise fixing means for fixing a peripheral region of the membrane to an inner wall of the housing, wherein a central portion of the membrane can be pushed into the second chamber by the shaft.

**[0022]** The second sealing element can comprise a base with a sleeve perpendicularly mounted thereon, the shaft being received in the sleeve and, the base cooperating with the housing of the first sealing element for sandwiching

fastening members between the first and second sealing elements.

[0023] The housing can be substantially cylindrical and have a substantially circular cross-section.

[0024] The sealing device can further comprise connecting means between the first and second sealing elements for connecting the first and second sealing elements and for maintaining the first and second sealing elements in their connected relationship.

[0025] Preferably, the sleeve has a threaded portion and the opening in the housing has a corresponding thread for receiving the threaded portion. This enables an easy connection of the second sealing element to the first sealing element, wherein the second sealing element is screwed to the first sealing element and tightened until the sealing device is correctly installed.

[0026] The transmitter can be configured to continuously or periodically transmit the signal indicative of the pressure in the internal chamber to the processing unit. By continuously or periodically, preferably at short intervals, transmitting information from the sealing device to the processing unit, the status of the sealing device can be monitored in real-time.

[0027] The transmitter preferably transmits automatically and is to that effect battery powered. It is however not excluded to provide a transmitter which only transmits the signal upon request e.g. from the processing unit.

[0028] The transmitter may comprise a modem using the GSM (e.g. GPRS) or UMTS standard for transmitting the signal indicative of the pressure in the internal chamber to the processing unit. Alternatively, the transmitter can be a RF transmitter for transmitting the signal indicative of the pressure in the internal chamber to the processing unit.

[0029] The sealing device and/or container can further comprise a transponder for storing contents information, travel information and/or inspection information of the container.

***Detailed description with respect to the figures***

[0030] The present invention will be more apparent from the following description of a not limiting embodiment with reference to the attached drawings, wherein

Fig.1 shows a schematic perspective view of a commercial container equipped with a container surveillance system according to the present invention; and

Fig.2 shows a cut through a sealing device preferably used in connection with the system of Fig.1.

[0031] Figure 1 shows a commercial container 10 having a container floor 12, a container roof 14 and four container walls 16, one of which comprises container doors 18.

[0032] Inside the commercial container 10, e.g. attached to one of the container walls 16, a processing unit 20 is arranged. Furthermore, one or more surveillance sensors 22 are arranged inside the commercial container 10. These surveillance sensors 22 can be light detectors, motion detectors, sound detectors, still or motion cameras, infrared cameras. The choice of surveillance sensor, or any combination thereof, will depend on the nature of the cargo and/or external conditions. The surveillance sensors 22 are connected to and transmit surveillance signals to the processing unit 20. The processing unit 20 comprises evaluation means (not shown) for evaluating the received surveillance signals and for determining, based on the received surveillance signals, whether a violation of the container has taken place. The processing unit 20 further comprises communication means for transmitting an alarm signal to at least one monitoring station 24 as soon as the evaluation means has determined that a violation has taken place.

[0033] It should be noted that the communication means preferably communicates with the monitoring station in real-time. For this purpose, the communication means preferably comprises a modem (not shown) using the GSM or UMTS standard. Any alarm signal or other signal is immediately transmitted to the monitoring station 24 so that action can be taken as soon as possible.

[0034] A GPS receiver 26 can further be arranged inside the container 10 for providing the processing unit 20 with GPS data, which can then be transmitted via the communication means to the monitoring station 24. Due to the GPS receiver 26 and the GPS data, the monitoring station 24 can determine the precise location of the container. The container surveillance system hence comprises an integrated real-time tracking system.

[0035] The container doors 18 are generally provided with a locking device 28 for locking the container 10. The locking device 28 further comprises a sealing device 30 for verifying that the container doors 18 have not been opened. The sealing device 30 is generally configured so as to break when an attempt is made to open the container doors 18. The sealing device 30 used in connection with the present container surveillance system preferably comprises means for verifying its own integrity and means for communicating with the processing unit 20. When the sealing device 30 detects that its integrity has been broken, it sends a corresponding signal to the processing unit 20, the evaluation means of which can as a consequence determine that a violation of the container has taken place.

[0036] The sealing device 30 can be more closely described by referring to Fig.2, which shows a preferred embodiment of a sealing device 30 comprising a first sealing element 32 and a second sealing element 34, which can be connected to the first sealing element 32. The first and second sealing elements 32, 34 are arranged and configured such that,

when they are connected, two fastening members 36, 36' can be sandwiched therebetween. Fastening members 36, 36' can be any elements that need to be connected together in a secure way, such as e.g. a container body and a container door or respective fixing plates thereof. In the present invention any means for fixing two elements together, such as fixing plates, will be referred to as "fastening members".

5 [0037] The first sealing element 32 comprises a generally cylindrical housing 38 having a first end wall 40, a second end wall 42 and an enveloping wall 44 extending therebetween. The first and second end walls 40, 42 and the enveloping wall 44 define an internal chamber 46 inside the housing 38. The housing 38 further comprises a flexible membrane 48 therein for dividing the internal chamber 46 into a first chamber 50 and a second chamber 52, wherein the first chamber 50 is delimited by the flexible membrane 48, the first end wall 40 and the enveloping wall 44, whereas the second chamber 52 is delimited by the flexible membrane 48, the second end wall 42 and the enveloping wall 44.

10 [0038] The second sealing element 34 comprises a shaft 54 received in a sleeve 56 perpendicularly mounted on a base 58. The first end wall 40 of the first sealing element 32 comprises an opening 60 therein, having a diameter corresponding substantially to an outer diameter of the sleeve 56, such that the shaft 54 and sleeve 56 can penetrate the internal chamber 46 of the housing 38. The sealing device 30 further comprises connecting means 62 between the first and second sealing elements 32, 34 in order to, once connected, maintain the first and second sealing elements 32, 34 in their connected relationship.

15 [0039] The shaft 54 has a length such that, when the second sealing element 34 is correctly connected to the first sealing element 32, a free end 64 of the shaft 54 is in contact with the membrane 48 and pushes the latter into the second chamber 52. The second chamber 52 is gastight such that, as the membrane is pushed into the second chamber 52, the pressure in the second chamber 52 is increased.

20 [0040] A pressure sensor 66 is arranged in the housing 38 and is connected to the second chamber 52 for sensing the pressure therein. The pressure sensor 66 is preferably an active pressure sensor continuously or periodically sensing the pressure in the second chamber 52. The pressure sensor 66 is connected to a transmitter 68 for transmitting a pressure signal to a monitoring station (not shown).

25 [0041] Due to the pressure sensor 66, the pressure in the second chamber 52 can be determined. It can be concluded that the sealing device 30 has been correctly installed if the pressure in the second chamber 52 exceeds a first predefined pressure threshold. Indeed, when the second sealing element 34 is correctly connected to the first sealing element 32, the shaft 54 extends into the second chamber 52 by a certain amount, thereby compressing the gas, generally air, in the second chamber 52 by a certain amount. A signal indicative of the pressure in the second chamber 52 is received by the transmitter 68 and transmitted to the monitoring station. If the monitoring station can, based on the received signal, determine that the pressure in the second chamber 52 is above the first predefined pressure threshold, it can be concluded that the first and second sealing elements 32, 34 are correctly connected and that the sealing device 30 is correctly installed.

30 [0042] Furthermore, the pressure sensor 66 can be used to verify the integrity of the sealing device 30. Indeed, if the sealing device 30 is broken, e.g. along lines A-A or B-B in Fig.2, the first and second sealing elements 32, 34 are no longer correctly connected. The shaft 54 of the second sealing element 34 is retracted from the internal chamber 46 of the first sealing element 32, thereby reducing the pressure in the second chamber 52. If the pressure in the second chamber 52 drops below a second pressure threshold, it can be concluded that the sealing device 30 has been broken and an alarm can then be raised.

35 [0043] The transmitter 68 preferably comprises a RF transmitter for transmitting the signal indicative of the pressure in the second chamber 52 to the processing unit 20 of the commercial container 10. Alternatively, it is not excluded to provide the transmitter 68 with a modem using the GSM, e.g. GPRS, or UMTS standard for transmitting the signal indicative of the pressure in the second chamber 52 directly to the monitoring station 24.

40 [0044] The correct installation and integrity of the sealing device 30 can therefore easily and quickly be verified. The transmitter 68 is, according to a preferred embodiment, configured to periodically, at short intervals, transmit the pressure information from the pressure sensor 66 to the processing unit 20 or to the monitoring station 24.

45 [0045] The sealing device 30 can further comprise a programmable read/write transponder 70 for storing contents information, travel information and/or inspection information of the container. Such a transponder 70 can be read by means of a reading device communicating with the transponder 70 via radio frequency. The reading device can also be used to store information in the transponder 70. The transponder 70 can be used to identify the container and its contents on site. If the transponder 70 is linked to the transmitter 68, information from the transponder 70 can also be transmitted to the processing unit 20 or to the monitoring station 24.

50 [0046] An event logger (not shown) can furthermore be provided in the sealing device 30 for storing event information therein. Such an event logger can e.g. comprise a log of the measured pressure in the second chamber 52 over a particular period of time. The event logger can occupy a portion of the memory of the transponder 70. Alternatively, a separate memory can be provided for the event logger. If the transmitter cannot communicate with the processing unit or the monitoring station, the pressure information can be stored in the event logger and transmitted once communication has been restored.

[0047] It will be appreciated that the sealing device 30 of Fig.2 is a preferred embodiment and that any other sealing device capable of transmitting its status to the processing unit may be used in connection with the present invention.

**List of Reference Signs**

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[0048]

10	commercial container	42	second end wall
12	container floor	44	enveloping wall
14	container roof	46	internal chamber
16	container walls	48	flexible membrane
18	container doors	50	first chamber
20	processing unit	52	second chamber
22	surveillance sensors	54	shaft
24	monitoring station	56	sleeve
26	GPS receiver	58	base
28	locking device	60	opening
30	sealing device	62	connecting means
32	first sealing element	64	free end
34	second sealing element	66	pressure sensor
36,36'	fastening members	68	transmitter
38	housing	70	programmable read/write transponder
40	first end wall		

**Claims**

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1. Container surveillance system for surveying the interior of a container, said system comprising:  
 at least one surveillance sensor arranged inside said container  
 a processing unit for receiving a surveillance signal from said at least one surveillance sensor, said processing unit comprising  
 evaluation means for evaluating said surveillance signal and determining whether a violation of said container has taken place  
 communication means for transmitting an alarm signal to at least one monitoring station as soon as said evaluation means has determined that a violation has taken place.
2. System according to claim 1, wherein said at least one surveillance sensor is chosen from the group comprising light detectors, motion detectors, sound detectors, still or motion cameras, infrared cameras.
3. System according to claims 1 or 2, wherein said communication means is configured to continuously or periodically transmit a signal indicative of the status of said container to the at least one monitoring station.
4. System according to any of claims 1 to 3, wherein said communication means comprises a modem using the GSM or UMTS standard.
5. System according to any of claims 1 to 4, further comprising an event logger for storing a log of events.
6. System according to any of claims 1 to 5, further comprising a GPS receiver.
7. System according to any of claims 1 to 6, wherein said container comprises at least one door, said system further comprising at least one sealing device associated with a locking device of said container door.
8. System according to claim 7, wherein said sealing device comprises a first sealing element having a housing with an internal chamber therein, wherein a pressure sensor is connected to said internal chamber for sensing a pressure in said internal chamber; and  
 a second sealing element having a shaft,

wherein, when said first and second sealing elements are connected, said shaft of said second sealing element extends into said internal chamber of said first sealing element through an opening in its housing;  
said sealing device further comprising  
a transmitter for receiving a signal indicative of said pressure in said internal chamber and for transmitting said signal to said processing unit.

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9. System according to claim 8, wherein  
said first sealing element further comprises a membrane dividing said internal chamber into a first chamber and a second chamber, said first chamber facing said second sealing element,  
said shaft of said second sealing element has a length such that, when said first and second sealing elements are connected, said shaft at least partially pushes said membrane into said second chamber so as to reduce the volume of said second chamber.
10. System according to any of claims 7 to 9, wherein said transmitter comprises a modem using the GSM or UMTS standard.
11. System according to any of claims 7 to 9, wherein said transmitter is a RF transmitter.

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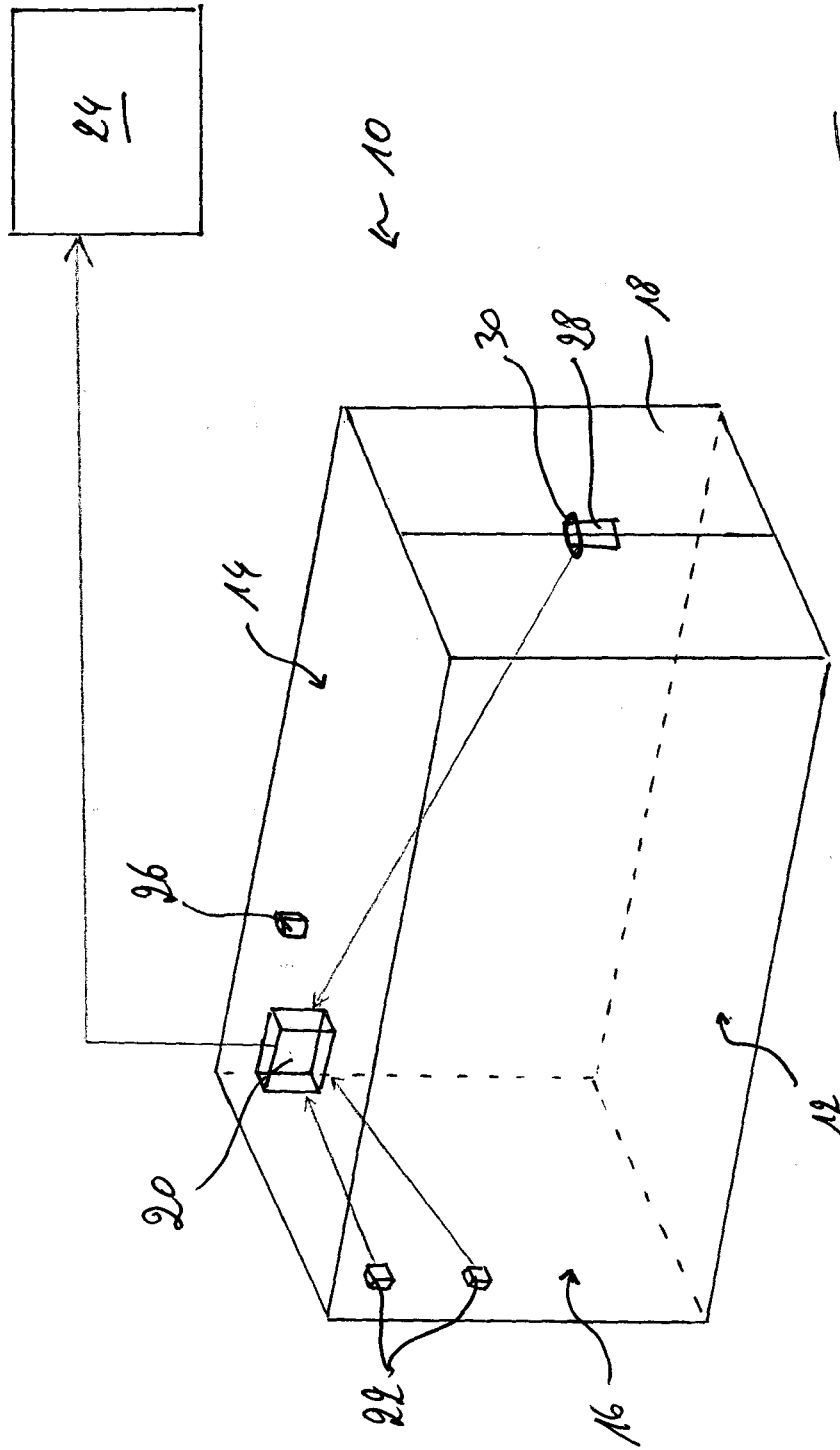


Fig 1



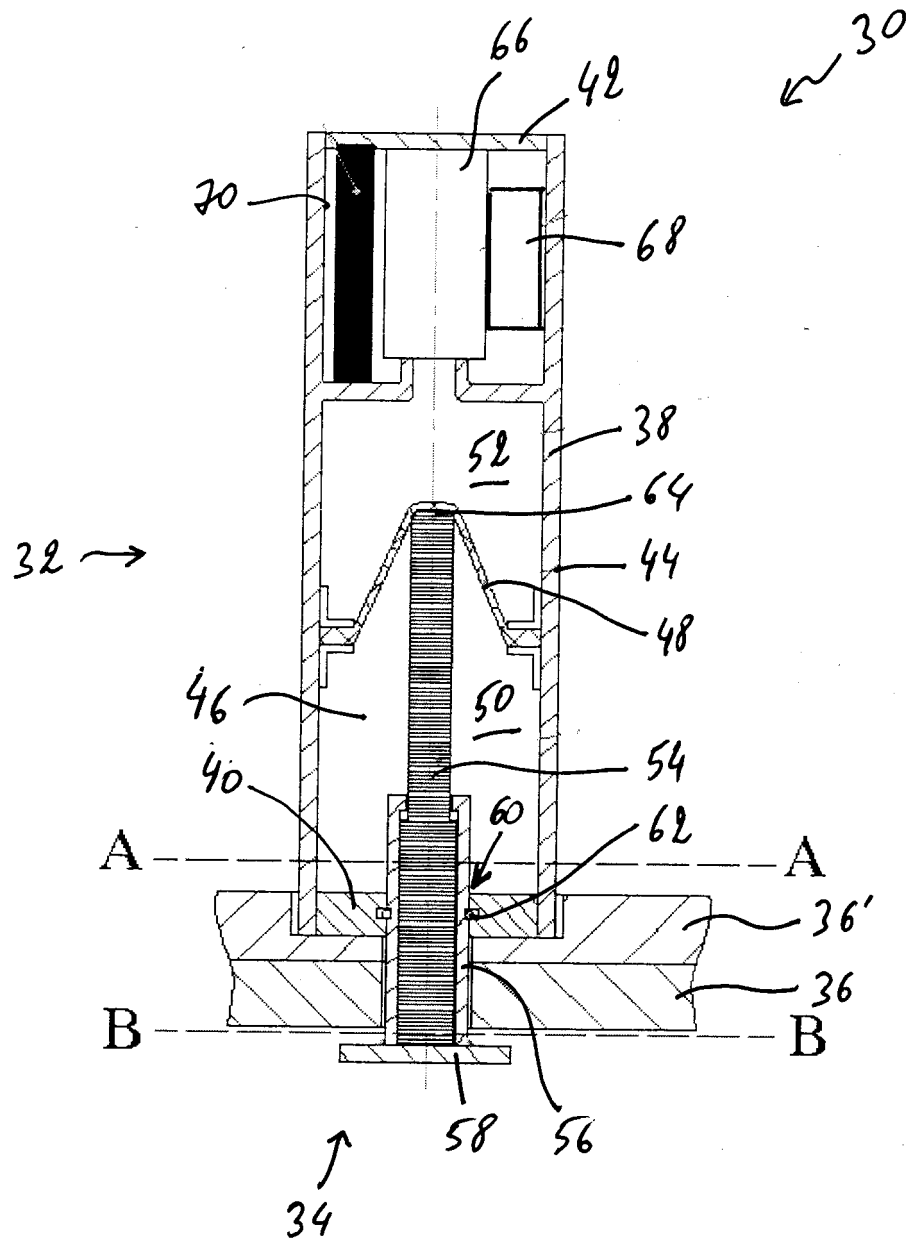


Fig. 2



DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)	
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The present search report has been drawn up for all claims				
Place of search Munich		Date of completion of the search 14 June 2006	Examiner Wille, H-J	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document		

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 11 0351

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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14-06-2006

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