

(19)



(11)

EP 2 717 242 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

09.04.2014 Bulletin 2014/15

(51) Int Cl.:

G09F 3/03 (2006.01)

(21) Application number: **12187076.0**

(22) Date of filing: **03.10.2012**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

(71) Applicant: **Oneseal A/S**

2980 Kokkedal (DK)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Nielsen, Henrik Sten et al**

Budde Schou A/S

Hausergade 3

1128 Copenhagen K (DK)

(54) **Engagement lock for a container**

(57) An engagement lock for a container that comprises a string which comprises a metal core such as a metal wire. The metal core is coated by a flexible insulating material, the string defines a first end portion and a second end portion located opposite the first end portion. The engagement lock for a container further comprises a housing which comprises a first opening for receiving the first end portion of the string and a second opening for receiving the second end portion of the string and the housing further includes a cavity for accessing the first end portion of the string within the housing. The engagement lock for a container further comprises an arresting part

to be received into the cavity of the housing, and finally, the engagement lock for a container further comprises a communication unit accommodated within the housing or on the arresting part. The arresting part includes a first element of electrically conductive material for penetrating the flexible insulating material of the first end portion of the string, arresting the first end portion of the string relative to the housing and establishing an electrical connection between the communication unit and the metal core of the first end portion of the string.

EP 2 717 242 A1

Description

[0001] The present invention relates to an engagement lock for a container, a housing for an engagement lock for a container, an arresting part for being received in a cavity, a communication unit and a method of operating an engagement lock for a container.

Background

[0002] The present invention relates to an engagement lock for a container having a pair of locking rings or locking eyelets. Engagement locks are typically used in the shipping industry for preventing unauthorised opening of the container. One type of engagement lock is described in US 2003/0075933. This type of engagement lock has a housing and a pull absorbing string. The string is intended to form a loop through the locking rings and the opposing end portions of the string should subsequently be permanently arrested in the housing. Once locked, the locking rings are joined together and the container cannot be opened unless the engagement lock has been broken. Such engagement locks are also known as seals.

[0003] According to the authorised opening of the engagement lock known in the art, the engagement lock is opened by cutting the string by means of a wire cutter, or a strong pair of scissors or shears. The engagement lock is thereafter unusable. Since each engagement lock has a unique identification number, any attempt to open the engagement lock and thereafter replace the engagement lock with a new one will be detected.

[0004] A thief or a person having fraudulent thoughts, e.g. of transporting non legal goods in a container will not use the authorised opening referred to above, since this person does not want the opening and the subsequent closing of the container and the opening and the subsequent closing of the engagement lock to be revealed later on during inspection of the engagement lock. A thief or a fraudulent person attempting to transport non legal goods, e.g. drugs, etc in the container will attempt to break the engagement lock and store his "goods" in the container prior to - if at all possible - locking the container again. This person does not want the theft of goods or the addition or replacement of goods to be revealed, e.g. by visible crack or other hammering or drilling traces, later on by customs officers or other persons inspecting the engagement lock. Any cracks or marks on the engagement lock which may indicate that an unauthorised opening has taken place may thus alert customs officers or other persons which may then perform a more in-depth analysis of the content of the container.

[0005] It may however be difficult for customs officers or other persons inspecting the engagement lock to determine whether the lock has been tampered with in case the engagement lock after tampering is left after without any major traces on the engagement lock. Any minor marks on the engagement lock may possibly be overlooked by customs officers or other persons inspecting

the engagement lock. There is thus a need for technologies for providing additional indications that a tampering has taken place.

[0006] US 7 878 561 B2 shows a seal device having an attachment device which may be joined to a connection device and thereby provide an electrical contact.

[0007] WO2007/059161 A1 relates to an electronic tamper evident seal including an integrated circuit for impedance through a shackle.

[0008] WO 2009/048516 A2 relates to an electronic security bolt seal which transmits a tamper condition. The bolt being arranged for completing an electronic circuit.

[0009] WO 2011/008871 A1 relates to a security seal including an electrical circuit which is in electrical communication with a first shaft.

[0010] WO 03/042959 A1 relates to a method and apparatus for providing container security with a tag. The device includes a bolt which passes through spaced coils generating a magnetic field.

[0011] WO 2005/094172 A2 relates to a monitorable locking assembly. The assembly includes a sealing wire including a conductor forming an electrical circuit, the integrity of which is monitored.

[0012] WO 2006/095331 A2 relates to a smart container monitoring system. The system includes an electronic seal wire.

[0013] WO 2006/048872 A2 relates to a remotely monitorable electronic locking device including a locking element arranged to engage one end of a conductive loop.

[0014] WO 2004/021299 A1 relates to a smart container monitoring system including an electronic seal and a wireless communicator operable to wirelessly transmit information regarding the status of an electronic seal.

[0015] All of the above documents are hereby incorporated by reference.

[0016] It has recently been discovered that there is a risk that a skilled unauthorised person may be able to open the engagement lock and subsequently close it without the engagement lock breaking and while maintaining the integrity of the electrical circuit. It is therefore an object of the present invention to provide technologies for interrupting the electrical circuit when the engagement lock has been broken.

[0017] It is a feature according to the present invention that the engagement lock is securely arrested and at the same time that a well defined electronic circuit is established.

Summary of the invention

[0018] The above need and object together with numerous other needs and objects, which will be evident from the below detailed description of a preferred embodiment of the module according to the present invention, are according to a first aspect of the present invention obtained by an engagement lock for a container, the engagement lock comprising:

a string comprising a metal core such as a metal wire, the metal core being coated by a flexible insulating material, the string defining a first end portion and a second end portion located opposite the first end portion,

a housing comprising a first opening for receiving the first end portion of the string and a second opening for receiving the second end portion of the string, the housing further including a cavity for accessing the first end portion of the string within the housing, an arresting part for being received into the cavity of the housing, and

a communication unit accommodated within the housing or on the arresting part,

the arresting part including a first element of electrically conductive material for penetrating the flexible insulating material of the first end portion of the string, arresting the first end portion of the string relative to the housing and establishing an electrical connection between the communication unit and the metal core of the first end portion of the string.

[0019] The above engagement lock is intended to be used for locking the doors of containers by securing the locking rings of the container door by means of the string. The word container should however be construed broadly since it is evident that the present engagement lock may be used for other purposes than container doors such as e.g. for securing tank-truck valves, truck trailers, rail wagons, box doors, gates, money bags etc. By using strings of different lengths, a series of locking rings may be locked simultaneously and locking rings located at awkward positions may be achieved.

[0020] The metal core of the string is preferably a flexible steel wire which should be sufficiently flexible for allowing the elements to engage and arrest the string. The wire is coated by a flexible insulating material which prevents any electrical conduction between the string and any conductive body outside the engagement lock. The flexible insulating material should however be sufficiently soft so that the first and second elements may pierce and penetrate the flexible insulation material and establish an electrical connection with the metal core. The elements should define a needle or knife sufficiently rigid for both penetrating the flexible insulating material and arresting the string. The string has two ends, and the length of string adjacent the respective ends is designated the first and second end parts, respectively. The cross-section of the string is preferably square or alternatively another non-circular cross-section such as elliptical in order for the first element to be able to penetrate the string at a well-defined flat position of the string.

[0021] The housing is typically made of metal or rigid plastics. The first and second openings are typically located adjacent each other. The openings should have a circumference corresponding to the circumference of the string such that when the first and second end portions of the string are inserted into its respective opening, it

should not be possible to manipulate the engagement lock by inserting a tool in-between the string and the opening. The first and second openings typically lead to respective channels within the housing. Further, by using a string having a non circular cross-section (typically square) together with an opening having a corresponding cross section (typically square), the string cannot be spun around its own axis as would be the case if the cross section of the string was circular. By spinning the string around its own axis, either as a deliberate attempt of tapering with the engagement lock or as an occasional event during the transport or handling of the engagement lock, the arresting of the string may fail.

[0022] The cavity of the housing allows the first end portion of the string to be accessed once the first end portion of the string has been inserted into the first opening. The cavity typically intersecting the channel corresponding with the first opening. The arresting part may be fitted into the cavity or the arresting part may be provided as a loose accessory for being fitted by the user. When the arresting part is inserted into the cavity, it establishes a first position in which the first end part of the string may be inserted into the first opening of the housing and pushed past the cavity. The arresting part may then establish a second position, typically by pushing the arresting part further into the cavity. In the second position, the first element penetrates the flexible insulation material of the string, thereby arresting the first end part of the string relative to the housing. The term arresting should be interpreted to mean that the string is permanently fixed relative to the housing in the sense that the release of the string, and thereby the opening of the container or the like, will require forceful actions against the engagement lock such as e.g. cutting the string by means of a wire cutter or the like.

[0023] The communication unit is typically located within the housing, but it may alternatively be located on the arresting part. When the arresting part is inserted into the cavity and the second position is established, i.e. when the string is permanently fixed relative to the housing by the first element, the communication unit establishes an electrical connection via the first element to the metal core of the string and back to the communication unit. The communication unit is capable of monitoring whether or not the string is intact by sending an electrical current through the metal core of the string. In case the string has been tampered with, the electrical circuit through the string will be interrupted and the communication unit may establish that tampering has taken place. The communication unit may further be capable of communicating the information that tampering has taken place. The communication may in its simplest form be a visual indicator.

[0024] According to a further embodiment according to the first aspect, the arresting part includes a handle having a predetermined breaking point adapted to break off when exposed to an excessive force once the first end portion of the string has been arrested relative to the

housing. When the user has placed the arresting part in the second position in the cavity, i.e. arrested the first end part of the string relative to the housing, the user should not easily be able to move the arresting part back to the first position and thereby release the string again. In order to prevent this, the arresting part may include a handle which in the second position is visible outside the cavity, but which breaks off when an excessive force is applied. A fraudulent person trying to pull the arresting part away will just break off the handle. Thereafter, the remaining arresting part will be permanently hidden within the cavity, and it will be evident that tampering has taken place. The predetermined breaking point may be a portion of the arresting part which is deliberately weaker and which will withstand the forces applied during piercing when the arresting part is moved from the first position to the second position, but which will break when greater force is applied, i.e. when leveraged tools such as screwdrivers or pliers are used to forcefully move the handle.

[0025] According to a further embodiment according to the first aspect, the second end portion of the string is electrically connected to the communication unit. The second end portion of the string may be permanently connected to the communication unit by means of e.g. soldering or welding. In this way, the string will be connected to the housing already when shipped to the user and there is thus no risk that the string will be lost.

[0026] According to a further embodiment according to the first aspect, the arresting part includes a second element of electrically conductive material for penetrating the plastic coating of the second end portion of the string, arresting the second end portion within the housing and establishing an electrical connection between the communication unit and the metal core of the second end portion of the string. Typically, however, the string is a loose accessory. In this way, the first end portion of the string is arrested as described above. Simultaneously, the second end portion of the string is arrested by a second element which is identical to the first end portion. The second element is electrically connected to the communication unit in order to establish a closed circuit through the string when the arresting part is moved to the second position.

[0027] According to a further embodiment according to the first aspect, the housing comprises a third opening opposite the first opening for establishing a first pass through within the housing between the first opening and the third opening for allowing the first end portion of the string to at least partially extend outside the housing. In this way, the first end portion of the string may be adjusted according to the distance between the locking rings such that a close fit is achieved. Any excessive lengths of the first end portion may be cut off by using a wire cutter.

[0028] According to a further embodiment according to the first aspect, the second opening comprise a nipping area for securing the second end portion of the string. It may be difficult to keep the second end portion of the string in the correct position within the housing. In order

to keep the second end portion at the correct position while inserting the first end portion and moving the arresting part from the second position to the first position, the second end portion may be held in place by a locking device such as a one way roller. In this way it may be avoided that the arresting part is moved to the second position while the second end portion of the string has not passed the cavity of the housing.

[0029] According to a further embodiment according to the first aspect, the housing comprises a fourth opening opposite the second opening for establishing a second pass through within the housing between the second opening and the fourth opening for allowing the second end portion of the string to at least partially extend outside the housing. Alternatively, both the first and second end portions may be allowed to extend through the housing such that by pulling both of the end portions, a close fit may be achieved.

[0030] According to a further embodiment according to the first aspect, the communication unit comprises a wireless communication unit, such as an RFID tag. Preferably, the communication unit may communicate with an external reader by wireless communication. Most preferably, an RFID tag is used. The RFID tag may also be used for providing energy to the communication unit. In this way, the information whether the engagement lock has been tampered with or not may be transmitted by wireless communication.

[0031] According to a further embodiment according to the first aspect, the housing is at least partially made of a transparent plastic material. By using transparent plastic material at least adjacent the cavity, the integrity of the engagement lock may easily be inspected.

[0032] According to a further embodiment according to the first aspect, the arresting part is permanently fitted within the cavity or alternatively the arresting part being removable. In order to prevent loss of the arresting part, the arresting part may be permanently fitted within the cavity. The arresting part is then provided to the user in the first position. Once the first and second end portions of the string have been inserted into the respective opening, the arresting part is moved to the second position. Alternatively, the arresting part is delivered separately. Then, the first position may be defined when the arresting part is located completely outside the cavity, i.e. first and second end portions of the string may be inserted into the respective opening before the arresting part is introduced into the cavity. Subsequently the arresting part is introduced into the cavity and moved to the second position in order to arrest the string relative to the housing.

[0033] According to a further embodiment according to the first aspect, the flexible insulating material comprises a polymeric material such as plastics. Preferably, a soft plastic material is used. In this way, the flexible insulating material may be easily penetrated by the piercing units while still allowing insulation capabilities to be maintained in the non penetrated areas of the string.

[0034] According to a further embodiment according

to the first aspect, the arresting part includes an arresting section for interlocking with the cavity of the housing once the first end portion of the string has been arrested relative to the housing, the arresting section preferably comprising a snap-fit. A snap fit, such as a sloped section of the arresting part, may be used in order to prevent an easy removal of the arresting part once the second position has been established and the elements have arrested the string and established an electrical connection with the metal core of the string.

[0035] According to a further embodiment according to the first aspect, the communication unit establishes a locked state when an electrical circuit is established from the communication unit via the first element of the arresting part and the metal core and back to the communication unit, and, a tampered state when the electrical circuit is or has been interrupted. The communication unit may include a memory which has two states, namely a locked state which is established once the second position has been established and the first element have arrested the string and established electrical connection with the metal core of the string, and, a tampered state which is established in case the electrical circuit from the communication unit via the first element of the arresting part and the metal core and back to the communication unit is broken for whatever reason. The state may be communicate to the user, customs officer or other person by using a reader unit. A further non-enabled state may be established before the arresting part enters the second portion.

[0036] The above need and object together with numerous other needs and objects, which will be evident from the below detailed description of a preferred embodiment of the module according to the present invention, are according to a second aspect of the invention obtained by a housing for an engagement lock for a container, an arresting part for being received into a cavity and a communication unit, the engagement lock further including a string comprising a metal core such as a metal wire, the metal core being coated by a flexible insulating material, the string defining a first end portion and a second end portion located opposite the first end portion, the housing comprising a first opening for receiving the first end portion of the string and a second opening for receiving the second end portion of the string, the communication unit being accommodated within the housing or on the arresting part, the arresting part including a first element of electrically conductive material for penetrating the flexible insulating material of the first end portion of the string, arresting the first end portion of the string relative to the housing and establishing an connection between the communication unit and the metal core of the first end portion of the string. It is evident that the housing according to the second aspect may be used together with the engagement lock according to the first aspect, or, as a retrofit for older engagement locks.

[0037] The above need and object together with numerous other needs and objects, which will be evident

from the below detailed description of a preferred embodiment of the module according to the present invention, are according to a third aspect of the present invention obtained by a method of operating an engagement lock for a container, the engagement lock comprising:

a string comprising a metal core such as a metal wire, the metal core being coated by a flexible insulating material, the string defining a first end portion and a second end portion located opposite the first end portion,
a housing comprising a first opening and a second opening, the housing further including a cavity for accessing the first end portion of the string within the housing,
an arresting part, the arresting part including a first element of electrically conductive material, and
a communication unit accommodated within the housing or on the arresting part,
the method comprising the steps of:

inserting the first end portion of the string into the first opening,
inserting the second end portion of the string into the second opening, and
inserting the arresting part into the cavity of the housing, thereby penetrating the flexible insulating material of the first end portion of the string, arresting the first end portion of the string relative to the housing and establishing an electrical connection from the communication unit via the first element to the metal core of the first end portion of the string.

[0038] It is evident that the method according to the second aspect may be used together with the engagement lock according to the first aspect or the housing according to the second aspect.

Brief description of the drawings

[0039]

Fig 1A-F is a series of views illustrating the locking operation and functional principle of a first embodiment of an engagement lock according to the present invention.

Fig 2A-F is a series of views illustrating the locking operation and functional principle of a second embodiment of an engagement lock according to the present invention.

Fig 3A-F is a series of views illustrating the locking operation and functional principle of a third embodiment of an engagement lock according to the present invention.

Fig 4A-F is a series of views illustrating the locking operation and functional principle of a fourth embodiment of an engagement lock according to the

present invention.

Fig 5A-F is a series of different views of the arresting part and RFID tag.

Fig 6A-C is a series of views illustrating an alternative embodiment of an arresting part.

Fig 7A-C is a series of views illustrating yet an alternative embodiment of an arresting part.

Detailed description of the drawings

[0040] Fig 1A shows a perspective view of an engagement lock 10 according to the present invention. The engagement lock comprises a string 12 and a housing 14. The string 12 defines a first end portion 20 and an opposite second end portion 22. The string 12 comprises a core comprising a metal wire 16 and an insulating coating comprising a flexible plastic coating 18. The string 12 defines a square cross-section which will be discussed below. It is contemplated that other non-circular cross-sections, such as an elliptical cross-section, of the string 12 may have similar advantages as a square cross-section. The string 12 is inserted through a pair of locking rings 24 of a container (not shown), typically a freight container. The locking rings 24 are arranged such that the container cannot be opened when the locking rings 24 are adjacent each other, typically the locking rings 24 are each located on opposite double doors (not shown), or one of the locking rings may be located on an operating handle (not shown) of the container door and the other locking ring may be located on the container door (not shown).

[0041] The housing 14 is made of a rigid polymeric material such as alternatively a metal material such as aluminium, iron, zinc or similar corrosion resistant metals. The housing 14 comprises a first opening 26 and an adjacent second opening 28 adapted for receiving the first end portion 20 and the second end portion 22, respectively, of the string 12. The openings 26, 28 define a square cross-section. In this way the string 12, once the end portions 20, 22 have been inserted into the respective openings 26, 28, cannot be spun around its own axis as would be the case if the cross-section of the string 12 was circular. Further, a square cross-section forms a well-defined flat surface for the arresting of the string which will be discussed in detail below. The first and second openings 26, 28 communicate with respective first and second channels 30, 32 within the housing 14. The first channel 30 further communicate with a third opening 34 opposite the first opening 26, whereas the second channel 32 defines a closed channel, i.e. ends in a wall. The upper housing part 14a located adjacent the first and second openings 26, 28, is in the present embodiment opaque, whereas the lower housing part 14b located adjacent the third opening is transparent. This allows for a visual inspection of the lower housing part 14b.

[0042] The intersection between the upper housing part 14a and the lower housing part 14b defines a cavity 36 which allows access to the first and second channels

30, 32. The cavity comprises an arresting part 38 which will be explained in more detail below. The arresting part 38 defines a handle 40. Adjacent the cavity 36, a wireless communication unit in the form of an RFID tag 42 is located.

[0043] Fig 1B shows a perspective view of the engagement lock 10 according to the present invention before the engagement lock 10 has been arrested. The first end portion 20 of the string 12 has now been inserted into the first channel 30 via the first opening 26 and the second end portion 22 of the string 12 has been inserted into the second channel 32 via the second opening 28. The circumference of the first opening 26 and the second opening 28 should match the circumference of the string 12 in order to avoid any significant gap between the string 12 and the respective first and second openings 26, 28. The first end portion 20 of the string 12 will extend through the third opening 34 such that the length of the part of the string 12 extending between the first and second openings 26, 28 may be adjusted by simply pulling or pushing the first end portion 20 of the string 12.

[0044] Fig 1C shows a perspective view of the engagement lock 10 according to the present invention after the engagement lock 10 has been arrested. The arresting part 38 has now been pushed in an inward direction as shown by the arrow by using the handle 40, from a first position in which the handle 40 of the arresting part 38 extends slightly outside the housing 12, to a second position in which the handle 40 of the arresting part 38 is located adjacent the housing 12. In this way, as will be explained further below, the arresting part 38 will arrest the string 12 such that the string 12 cannot be moved in relation to the housing. In this way, the container (now shown) is sealed. In order to open the engagement lock 10, the string 12 must be cut by using a wire cutter or similar device (not shown). The arresting part 38 is permanently arrested in the second position, i.e. it cannot return to the first position without significantly damaging the engagement lock 10. The arresting part 38 further connects to the RFID tag 42 as will be described in more detail below.

[0045] Fig 1D shows a perspective view of the engagement lock 10 according to the present invention when the RFID tag 42 is being read. By using an RFID reader 44, the information stored in the RFID tag 42 may be read by a customs officer or other person inspecting the engagement lock 10. The information stored in the RFID tag 42 may include basic data, such as an identification number or the like, which uniquely identifies the engagement lock. In this way the customs officer may determine whether the engagement lock 10 is authentic or has been replaced by a fraudulent person. Further, the RFID tag 42 may include information about whether the engagement lock 10 has been tampered with, e.g. whether or not the string 12 has been cut and replaced. Yet further, additional user specific information may be stored, such as the type of cargo transported, the weight of the cargo and similar information. All this information may be col-

lected automatically, thus saving a lot of time otherwise spent on inspecting the engagement lock 10 and the container. It is evident that the information on the RFID tag 42 may be scrambled and/or read-only, such that any attempt to manipulate or misuse the information is prevented.

[0046] Fig 1E shows a cross-sectional view of the engagement lock 10 according to the present invention. The first and second channels 30, 32 each include an optional locking device 46 in the form of a roller. The locking device 46 cooperates with the string 12 and the respective first and second channels 30, 32 for preventing that the respective first and second end portions 20, 22 of the string 12 may be pulled out of the respective first and second channels 30, 32 before the arresting part 38 has arrested the respective first and second end portions 20, 22 of the string 12. In this way the user may focus his attention on the first end portion 20 of the string 12 and by pulling the first end portion 20 through the third opening ensure that a snug fit of the string 12 is achieved with respect to the locking rings of the container (not shown).

[0047] In the present situation, the arresting part 38 has been pushed into the cavity 36 to the second position in which the handle 40 of the arresting part 38 is located adjacent the housing 14. The arresting part 38 of the present embodiment includes an arresting section in the form of a wedge 48 which permanently arrests the arresting part 38 in the second position by acting against an inner wall of the housing 14. In this way, the arresting part 38 cannot again be pulled out of the cavity 36. To further complicate any attempt of removing the arresting part 38 once it has been arrested in the second position, a predetermined breaking point 50 is located between the handle 40 and the wedge 48 of the arresting part 38. In this way, the handle 40 will simply break off in case a fraudulent person attempts to use any forceful actions in order to remove the arresting part 38. The lack of a handle 40 on the engagement lock 10 will of course alert the customs officers.

[0048] Fig 1F shows a detailed view of the arresting part 38 and the RFID tag 42 according to the present invention and as shown in fig 1. The RFID tag 42, which is here shown without antennas, includes a control unit 52 which is in electrical communication with a first sliding contact 54 and a separate second sliding contact 56. The first sliding contact 54 is contacting a first element 58 of the arresting part 38 and the second sliding contact 56 is contacting a second element 60 of the arresting part 38. There is no direct contact between the first element 58 and the second element 60. In the first position of the arresting part 38, the first element 58 and the second element 60 are both spaced apart from the string 12, whereas in the present second position of the arresting part 38, the first element 58 is penetrating the plastic coating 18 of the string 12 and thereby establishes an electrical contact with the metal wire 16 at the first end portion 20 of the string 12 and arrests the string 12 relative to the housing 14. At the same time, the second element

60 is penetrating the plastic coating 18 of the string 12 and thereby establishes an electrical contact with the metal wire 16 at the second end portion 22 of the string 12 and arrests the string 12 relative to the housing 14.

[0049] An electrical circuit may thereby be established from the control unit 52 of the RFID tag 42, via the first sliding contact 54 of the RFID tag 42, the first element 58 of the arresting part 38, the first and second end portions 20, 22 of the string 12, the second element 60 and the second sliding contact 56 to the control unit 52. In case a fraudulent person attempts to remove the string 12 from the housing 14 by e.g. forceful mechanical action, the first and second elements 58, 60 will either cause significant damage to the string 12 and prevent a new string 12 from being inserted, or, alternatively, the first and second elements 58, 60 will bend in the direction of the force and make it impossible to arrest the string and electrically connect the first and second elements 54, 56 with a new string 12. Additionally, the removal, even briefly, of the string 12 from the housing 14 will interrupt the electrical circuit. The interruption will be detected by the control unit 52 and even in case a skilled fraudulent person did replace the string 12 in such a skilful manner that a visual inspection would not reveal that the engagement lock had been opened, the control unit 52 of the RFID tag 42 would have detected the removal of the string 12 and consequently when the RFID tag 42 is read by the RFID reader 44, the customs officer will be notified of the fraud and a more thorough inspection of the engagement lock, container and cargo may be initiated.

[0050] Figs 2A-D show a perspective view of an alternative embodiment of an engagement lock 10' which is identical to the previous engagement lock 10 as shown in connection with fig 1 except that the housing 14 is provided with a fourth opening 62 opposite the second opening 28. The fourth opening 62 allows the second end portion 22 of the string 12 to partially extend outside the housing 14. In this way both the first end portion 20 and the second end portion 22 of the string may be pulled in order to achieve a snug fit of the string 12 in relation to the locking rings 24.

[0051] Fig 2E shows a cross section view of the engagement lock 10'. The interior of the engagement lock 10' is identical to the previous engagement lock 10 except that the first and second channels 30, 32 now lack any locking device for the reason that the second end portion 22 of the string 12 should now extend outside the housing 14 and be adjustable together with the first end portion 20 of the string 12.

[0052] Fig 2F shows a detailed view of the arresting part 38 and the RFID tag 42 according to the present invention which as such are identical to the arresting part and the RFID tag as shown in fig 1F.

[0053] Fig 3A-D show a perspective view of yet an alternative embodiment of an engagement lock 10'' which is identical to the previous engagement lock 10' as shown in connection with fig 2 except that the housing 14 lacks a fourth opening 62 opposite the second opening 28. The

fourth opening 62 allows the second end portion 22 of the string 12 to partially extend outside the housing 14, however, the first end portion 20 of the string 12 is permanently fixed inside the housing 14 as will be described in more detail below. In this way there is no risk of misplacing the string 12.

[0054] Fig 3E shows a cross section view of the engagement lock 10". The interior of the engagement lock 10" is identical to the previous engagement lock 10' except that the second channel 32 now is closed off and the first end portion 20 of the string 12 is welded or soldered onto the first sliding contact 54' which now constitutes a first contact connected to the control unit 52. The arresting part 38' now is shorter and includes only a second element 60 and no first element. The arresting part 38', which now optionally may be completely removed from the cavity 36 thus only extend into the cavity 36 as far as to reach the second channel 32.

[0055] Fig 3F shows a detailed view of the arresting part 38 and the RFID tag 42 according to the present invention which as such are identical to the arresting part and the RFID tag except that the first element has been omitted and the first end portion 20 of the string 12 is directly welded or soldered onto the first contact 54'.

[0056] Fig 4A-D show a perspective view of a yet more an alternative embodiment of an engagement lock 10" which as such is similar to the engagement lock 10 of fig 1, however, the arresting part 38 and the cavity 36 have been shifted by 90°

[0057] Fig 5A shows a side view of the RFID tag 42. The RFID tag 42 comprises a RFID antenna 64. The RFID antenna 64 is connected to the control unit 52. The RFID antenna 64 is used for the wireless communication with the RFID reader (not shown here) and may optionally be used for receiving power to the control unit 52. The control unit may also alternatively or in addition be powered by a battery (not shown).

[0058] Fig 5B shows a side view of the arresting part 38. The first element 58 and the second element 60 are typically made of metal in order to be both rigid and electrically conductive. The wedge 48 has a sloped shape for being able to be inserted into the cavity of the housing, while preventing it to be removed, once it has achieved a snap fit interlock with the inner wall of the housing.

[0059] Fig 5C shows a top view of the arresting part 38. The first element 58 and the second element 60 are adapted for sliding against and contacting the respective first sliding contact 54 and second sliding contact 56.

[0060] Fig 5D shows a top view of the RFID tag 42 when produced. The first and second sliding contacts 54, 56 both exhibit holes for the string to pass through. Two opposite located RFID antennas 64, both electrically connected to the control unit 52, are provided.

[0061] Fig 5E shows a perspective view of the RFID tag 42 when the RFID antennas are being bend in the direction of the arrows in order to allow the RFID tag 42 to fit into the housing.

[0062] Fig 5E shows a perspective view of the final

RFID tag 42 ready to be fitted into the housing.

[0063] Fig 6A shows a alternative embodiment of an arresting part 38' when a first end portion of the 20 string 12 is pushed past the arresting part 38'. The alternative embodiment of the arresting part 38' may be fixedly installed into the cavity of the housing (not shown) and must not be pushed into the cavity, it is sufficient to push the string 12 into the opening of the housing (not shown). The present embodiment of the arresting part 38' comprises a first element 58' which is flexible. As shown in the figure, the string 12 may be pushed in a upward direction, i.e. inwardly from one of the first or second openings of the housing (not shown), and the first element 58' will flex in the same inwardly direction as the string 12 is moving. The string 12 will thereby not be penetrated.

[0064] Fig 6B shows the alternative embodiment of the arresting part 38' when the string 12 is pulled in an outward direction, i.e. towards the first or second opening of the housing (not shown). The first element 58' will thereby flex back and penetrate the plastic coating 18 of the string 12, arrest the string 12 and establish a conductive path with the metal wire 16 of the string 12. The string 12 may thus not be removed from the housing (not shown). It is evident that the above arresting principle may be used in any of the embodiments shown in the previous figures 1-5.

[0065] Fig 6C shows the alternative embodiment of the arresting part 38' when the first element 58' has penetrated the plastic coating 18 and established a conductive relationship with the metal wire 16 of the string 12.

[0066] Fig 7A-C shows a alternative embodiment of an arresting part 38" which is similar to the arresting part 38' shown in connection with fig 6A-C, except that the first element pierces the string 12 at four points of the string 12 instead of only one point of the string. This will allow a better arrestment of the string 12 and also a better conductive relationship with the metal wire 16 of the string 12.

[0067] Although the engagement lock has been described above with reference to specific embodiments, it is evident to a skilled person that numerous modifications can be made, such as simple combinations of the presented embodiment. As an example, it is evident that the above described engagement lock for containers may be used for similar locking purposes such as locking of tank-truck valves, truck trailers, rail wagons, box doors, gates, money bags etc.

List of parts with reference to the figures:

[0068]

- 10. Engagement lock
- 12. String
- 14. Housing
- 14a. Opaque housing part
- 14b. Transparent housing part
- 16. Metal wire

- 18. Plastic coating
- 20. First end portion
- 22. Second end portion
- 24. Locking rings
- 26. First opening
- 28. Second opening
- 30. First channel
- 32. Second channel
- 34. Third opening
- 36. Cavity
- 38. Arresting part
- 40. Handle
- 42. RFID tag
- 44. RFID reader
- 46. Locking device
- 48. Wedge
- 50. Break point
- 52. Control unit
- 54. First sliding contact
- 56. Second sliding contact
- 58. First element
- 60. Second element
- 62. Fourth opening
- 64. RFID antenna

Claims

1. An engagement lock for a container, said engagement lock comprising:
 - a string comprising a metal core such as a metal wire, said metal core being coated by a flexible insulating material, said string defining a first end portion and a second end portion located opposite said first end portion,
 - a housing comprising a first opening for receiving said first end portion of said string and a second opening for receiving said second end portion of said string, said housing further including a cavity for accessing said first end portion of said string within said housing,
 - an arresting part for being received into said cavity of said housing, and
 - a communication unit accommodated within said housing or on said arresting part, said arresting part including a first element of electrically conductive material for penetrating said flexible insulating material of said first end portion of said string, arresting said first end portion of said string relative to said housing and establishing an electrical connection between said communication unit and said metal core of said first end portion of said string.
2. The engagement lock according to claim 1, wherein said arresting part including a handle having a predetermined breaking point adapted to break off when

exposed to an excessive force once said first end portion of said string has been arrested relative to said housing.

- 5 3. The engagement lock according to any of the claims 1 or 2, wherein said second end portion of said string being electrically connected to said communication unit.
- 10 4. The engagement lock according to any of the claims 1 or 2, wherein said arresting part including a second element of electrically conductive material for penetrating said plastic coating of said second end portion of said string, arresting said second end portion within said housing and establishing an electrical connection between said communication unit and said metal core of said second end portion of said string.
- 15 5. The engagement lock according to any of the preceding claims, wherein said housing comprising a third opening opposite said first opening for establishing a first pass through within said housing between said first opening and said third opening for allowing said first end portion of said string to at least partially extend outside said housing.
- 20 6. The engagement lock according to any of the claim 1-2, wherein said housing comprising a fourth opening opposite said second opening for establishing a second pass through within said housing between said second opening and said fourth opening for allowing said second end portion of said string to at least partially extend outside said housing.
- 25 7. The engagement lock according to any of the preceding claims, wherein said second opening comprise a nipping area for securing said second end portion of said string.
- 30 8. The engagement lock according to any of the preceding claims, wherein said communication unit comprise a wireless communication unit, such as an RFID tag.
- 35 9. The engagement lock according to any of the preceding claims, wherein said housing is at least partially made of a transparent plastic material.
- 40 10. The engagement lock according to any of the preceding claims, wherein said arresting part being permanently fitted within said cavity or alternatively said arresting part being removable.
- 45 11. The engagement lock according to any of the preceding claims, wherein said flexible insulating material comprise a polymeric material such as plastics.
- 50 12. The engagement lock according to any of the pre-

ceding claims, wherein said arresting part including an arresting section for interlocking with said cavity of said housing once said first end portion of said string has been arrested relative to said housing, said arresting section preferably comprising a snap-fit. 5

13. The engagement lock according to any of the preceding claims, wherein said communication unit establish a locked state when an electrical circuit is established from said communication unit via said first element of said arresting part and said metal core and back to said communication unit, and, a tampered state when said electrical circuit is or has been interrupted. 10 15

14. A housing for an engagement lock for a container, an arresting part for being received into a cavity and a communication unit, said engagement lock further including a string comprising a metal core such as a metal wire, said metal core being coated by a flexible insulating material, said string defining a first end portion and a second end portion located opposite said first end portion, said housing comprising a first opening for receiving said first end portion of said string and a second opening for receiving said second end portion of said string, said communication unit being accommodated within said housing or on said arresting part, said arresting part including a first element of electrically conductive material for penetrating said flexible insulating material of said first end portion of said string, arresting said first end portion of said string relative to said housing and establishing an electrical connection between said communication unit and said metal core of said first end portion of said string. 20 25 30 35

15. A method of operating an engagement lock for a container, said engagement lock comprising: 40

a string comprising a metal core such as a metal wire, said metal core being coated by a flexible insulating material, said string defining a first end portion and a second end portion located opposite said first end portion, 45
a housing comprising a first opening and a second opening, said housing further including a cavity for accessing said first end portion of said string within said housing,
an arresting part, said arresting part including a first element of electrically conductive material, and 50
a communication unit accommodated within said housing or on said arresting part,
said method comprising the steps of: 55
inserting said first end portion of said string into said first opening,
inserting said second end portion of said string

into said second opening, and
inserting said arresting part into said cavity of said housing, thereby penetrating said flexible insulating material of said first end portion of said string, arresting said first end portion of said string relative to said housing and establishing an electrical connection from said communication unit via said first element to said metal core of said first end portion of said string.

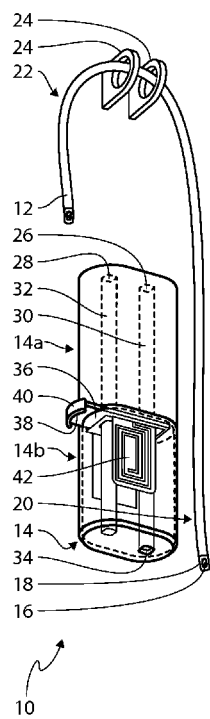


FIG. 1A

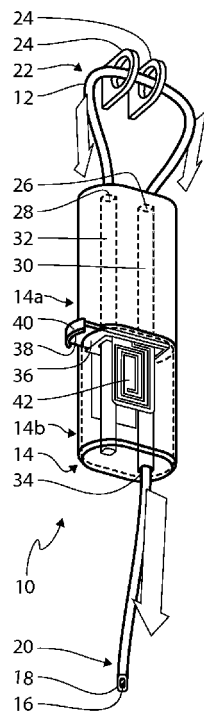


FIG. 1B

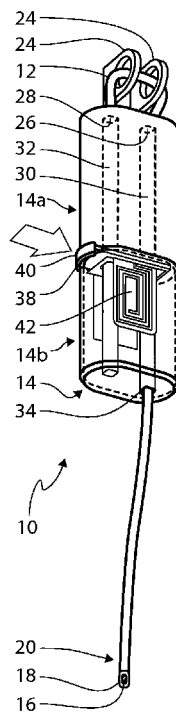


FIG. 1C

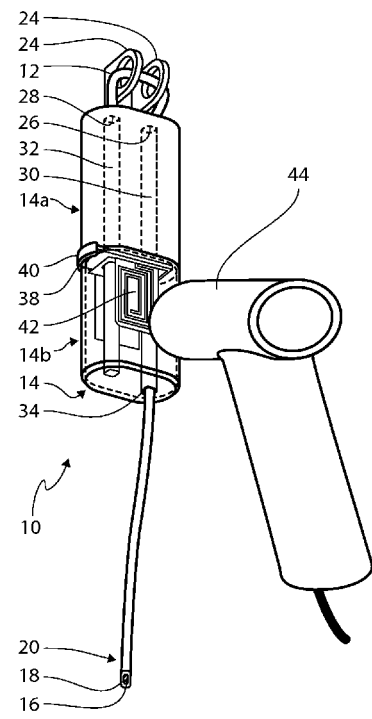
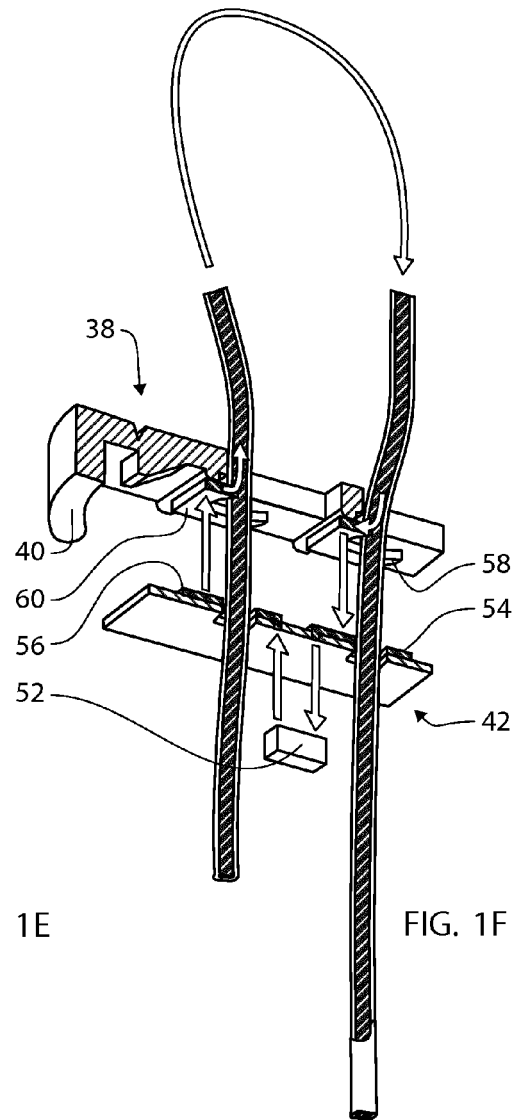
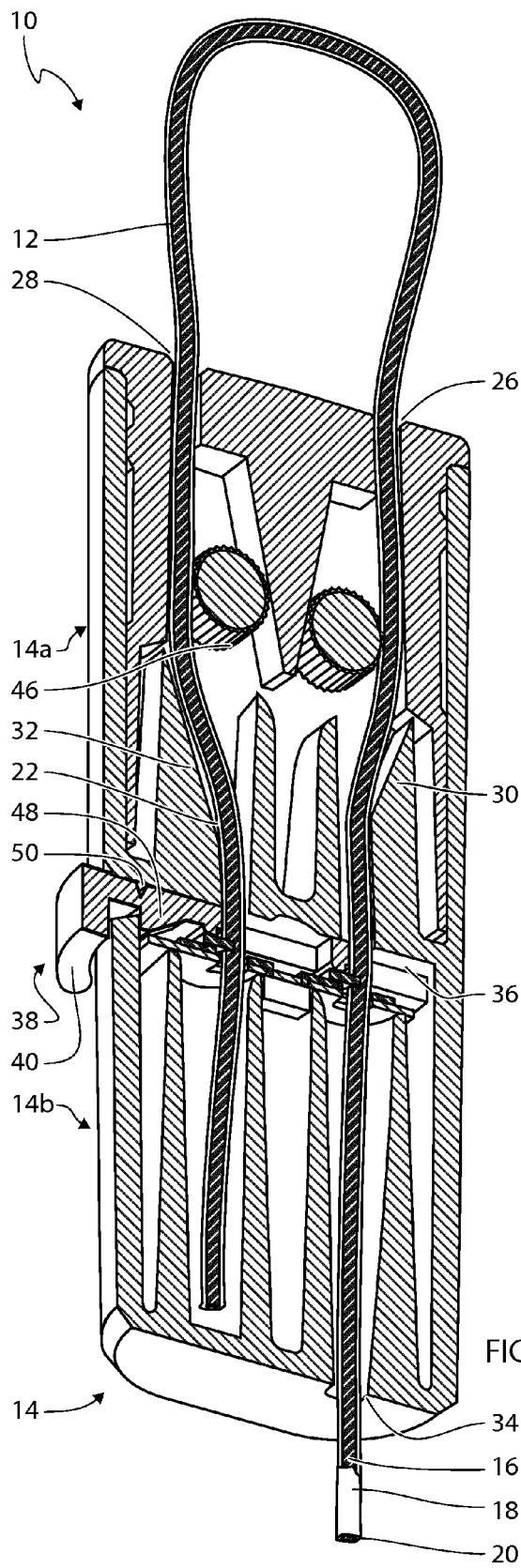


FIG. 1D



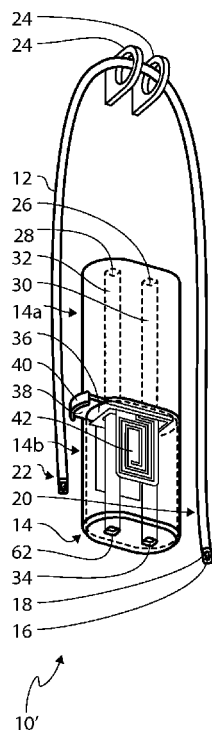


FIG. 2A

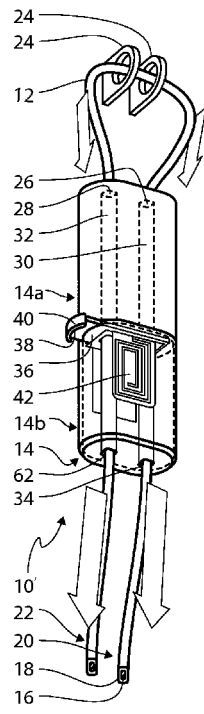


FIG. 2B

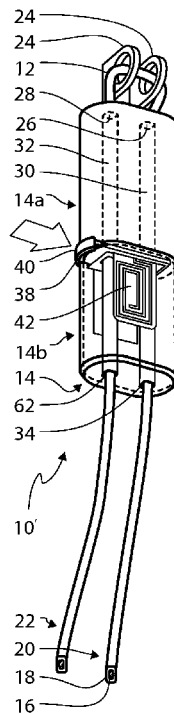


FIG. 2C

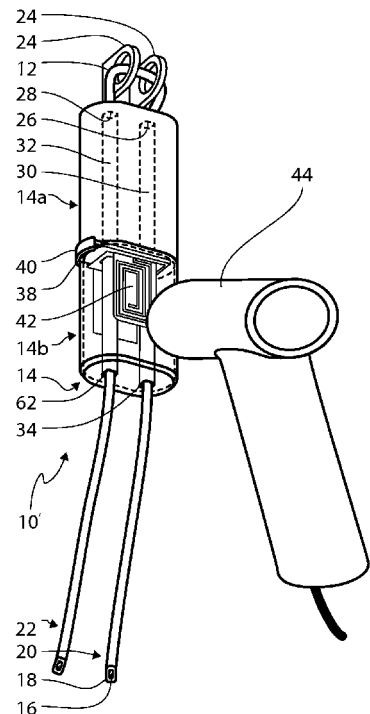


FIG. 2D

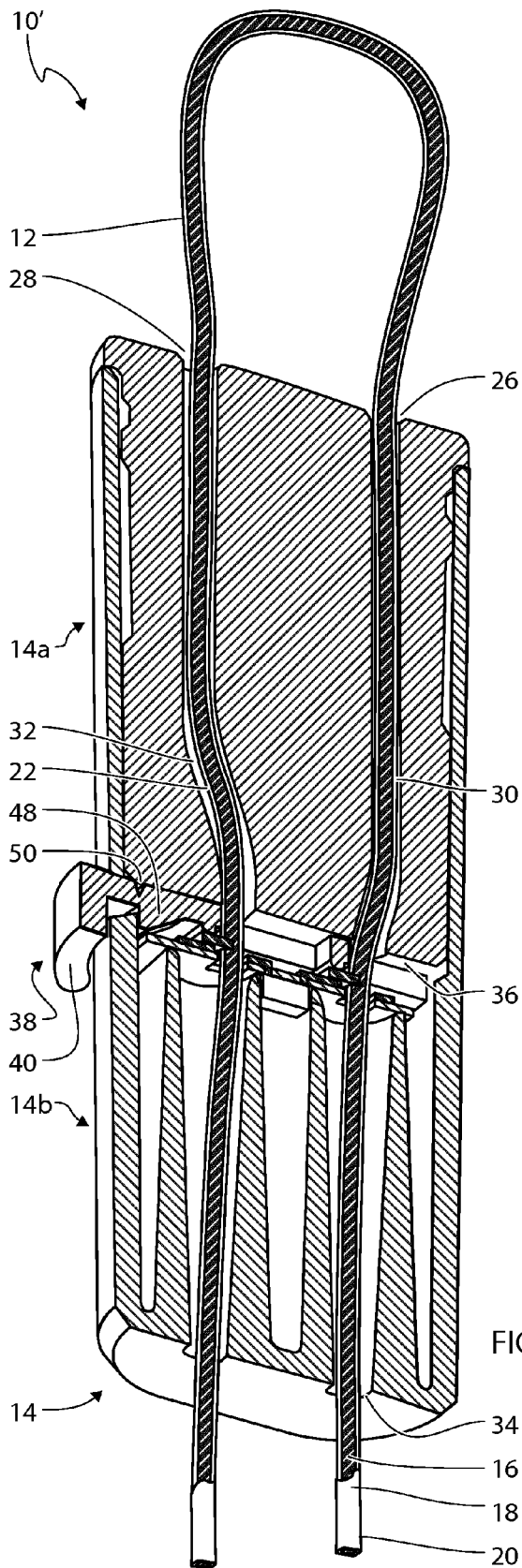


FIG. 2E

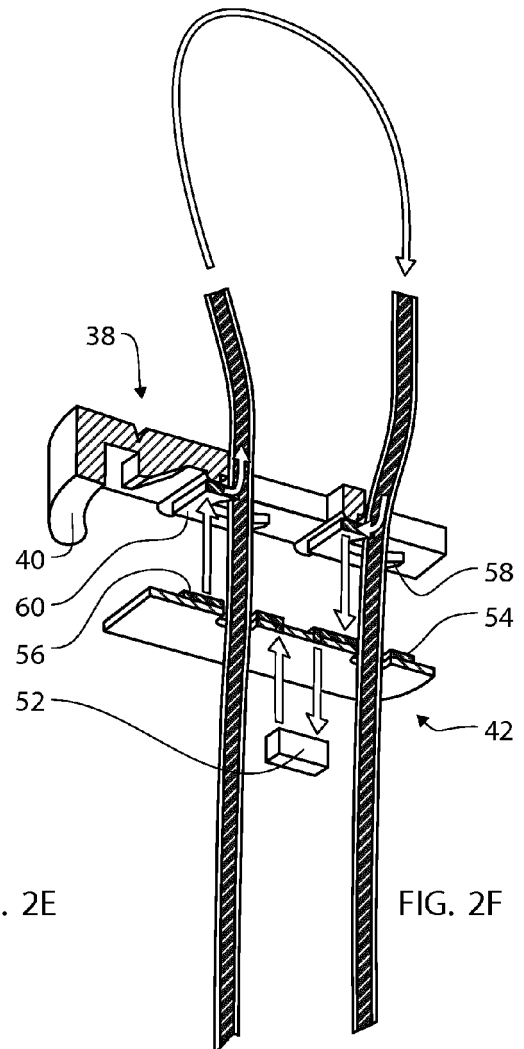


FIG. 2F

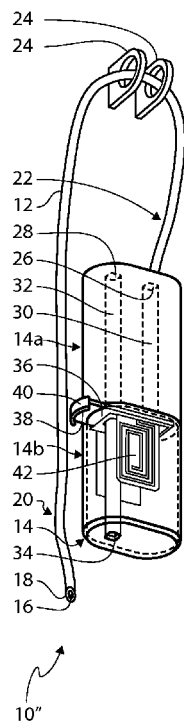


FIG. 3A

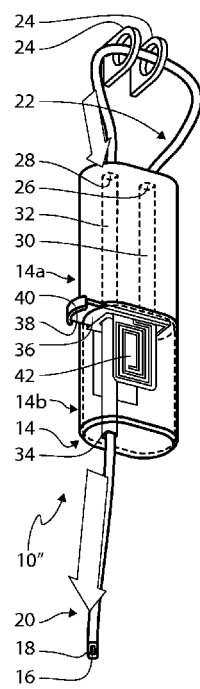


FIG. 3B

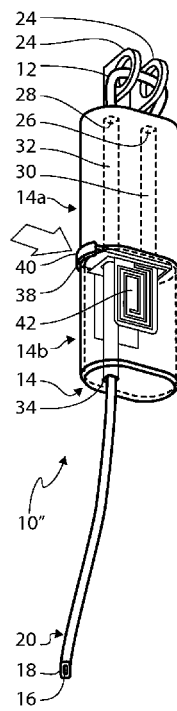


FIG. 3C

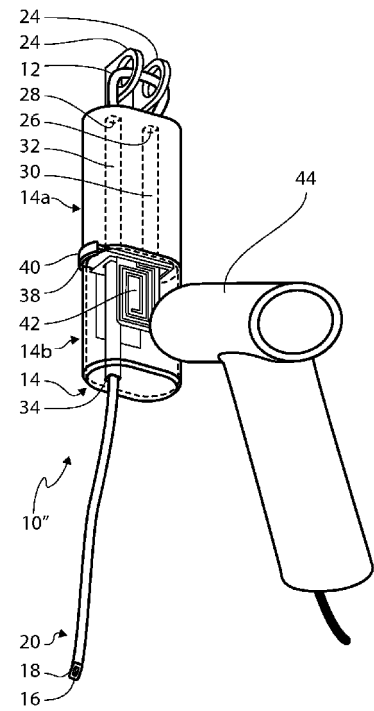


FIG. 3D

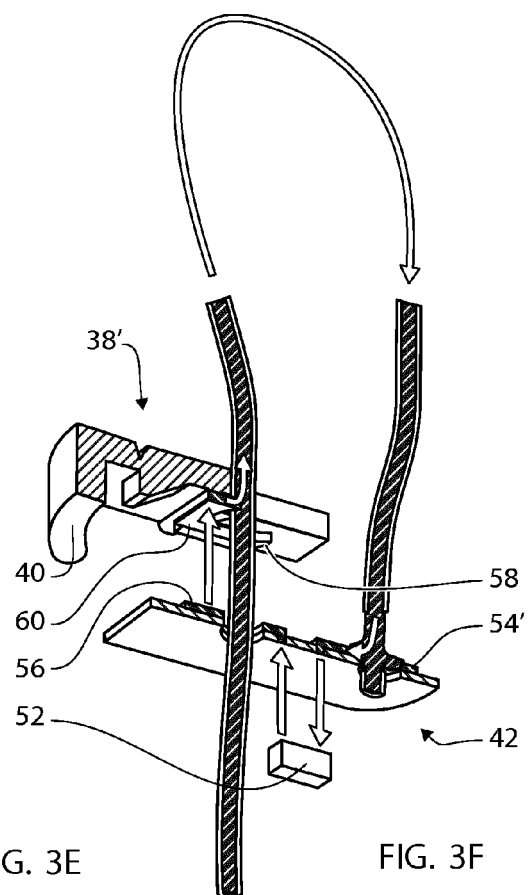
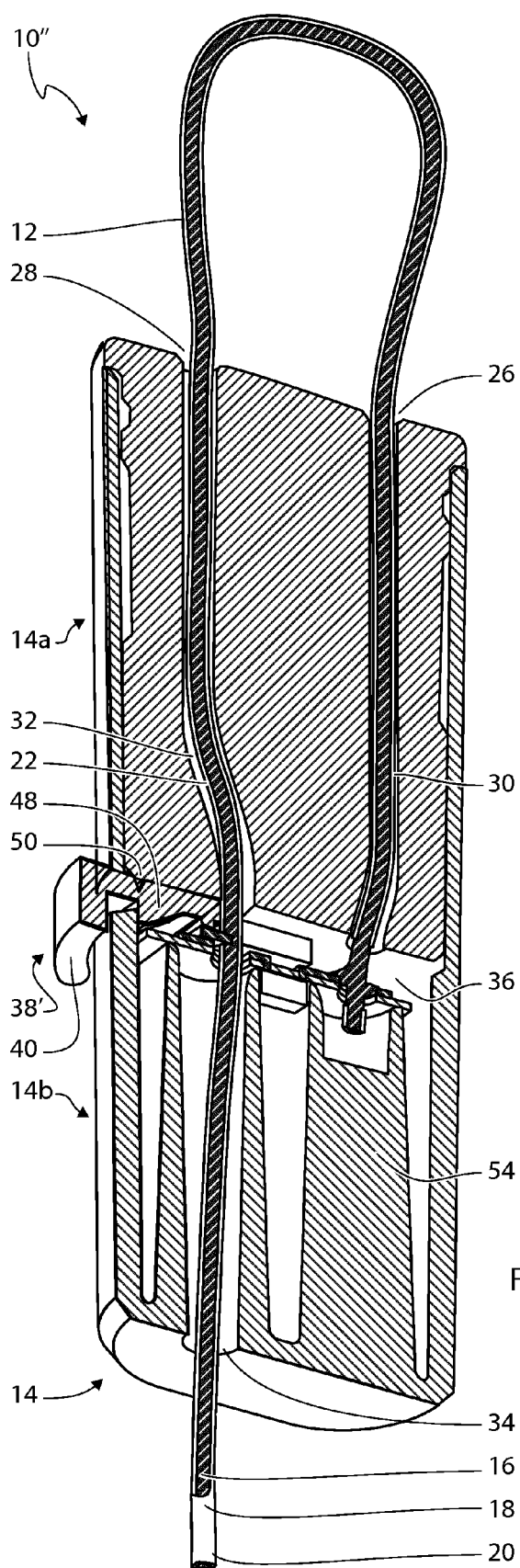


FIG. 3E

FIG. 3F

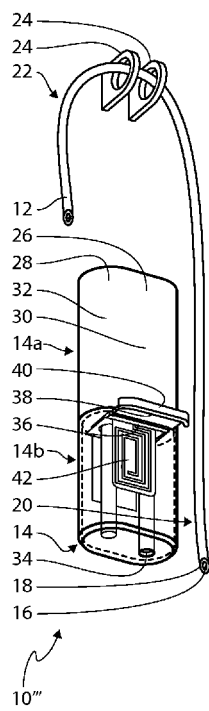


FIG. 4A

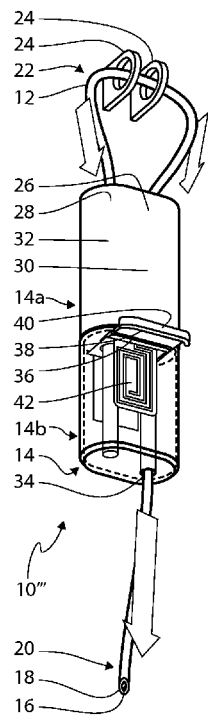


FIG. 4B

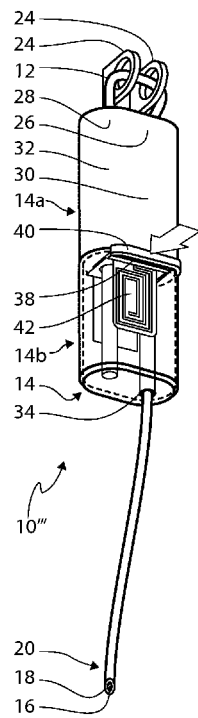


FIG. 4C

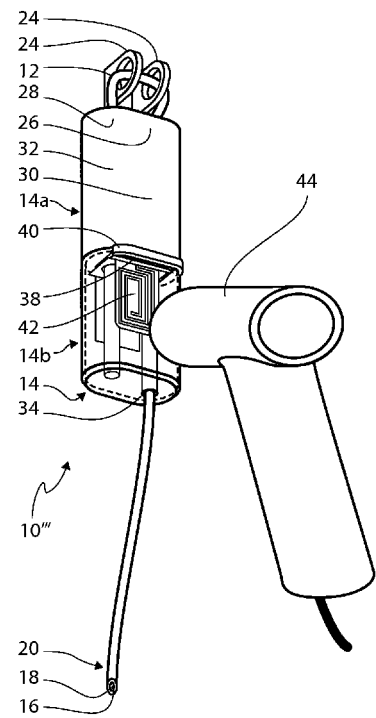


FIG. 4D

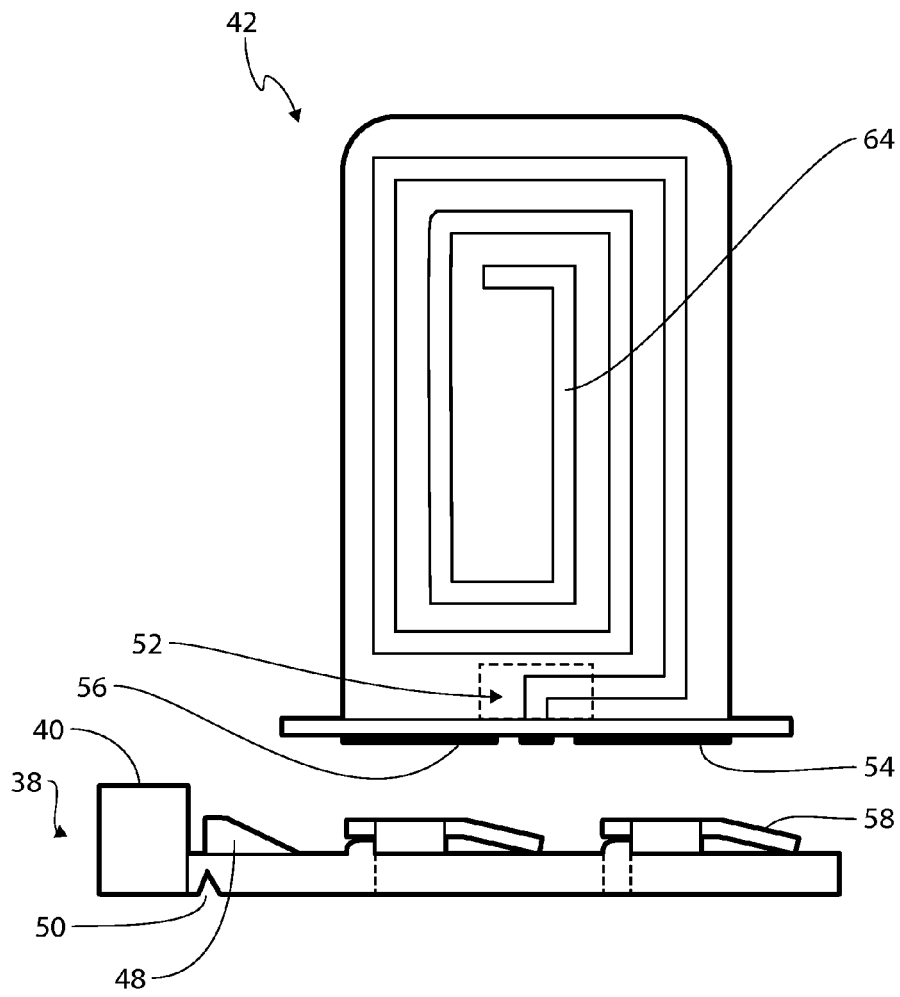


FIG. 5A

FIG. 5B

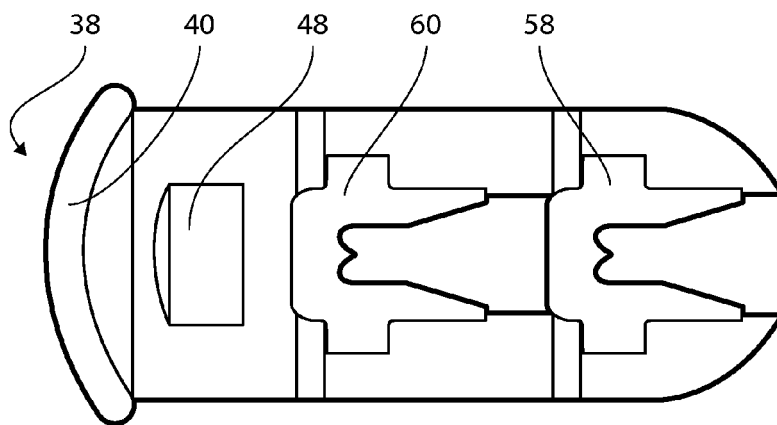


FIG. 5C

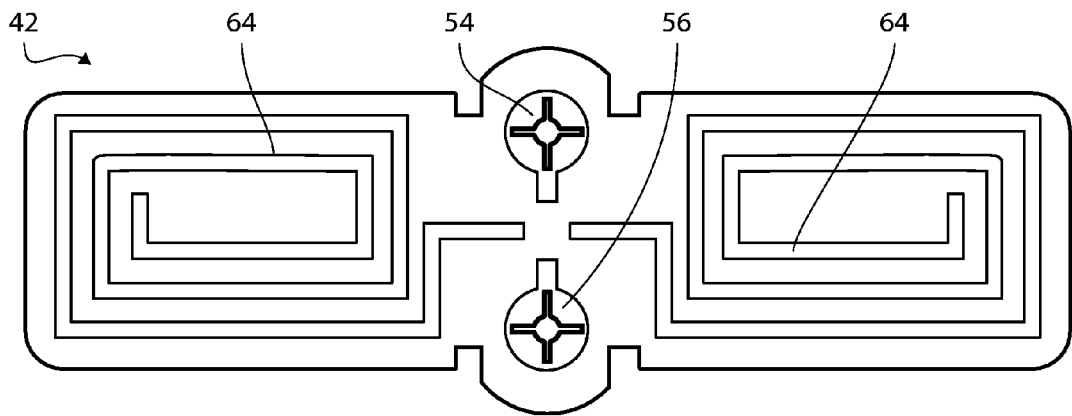


FIG. 5D

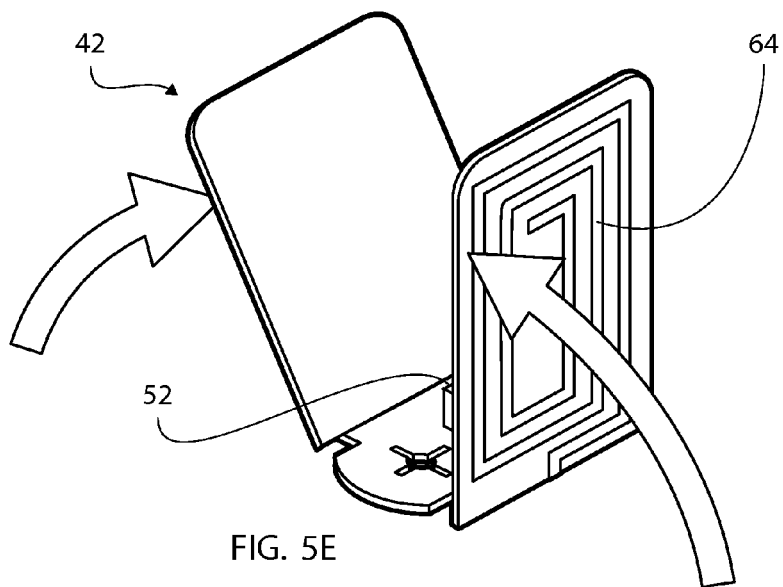


FIG. 5E

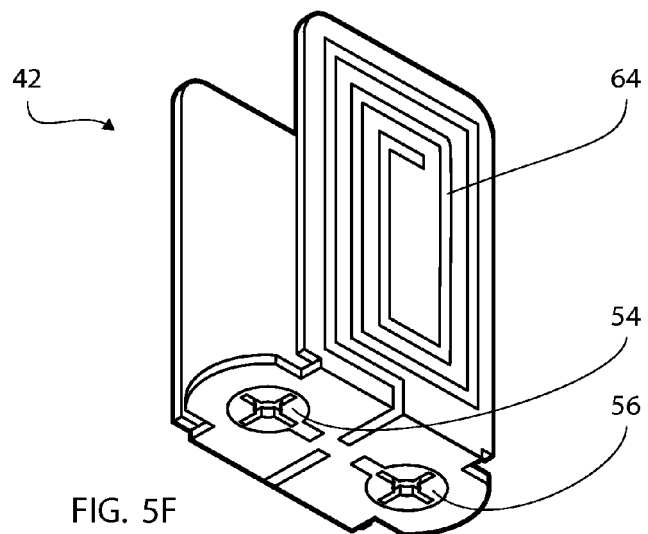


FIG. 5F

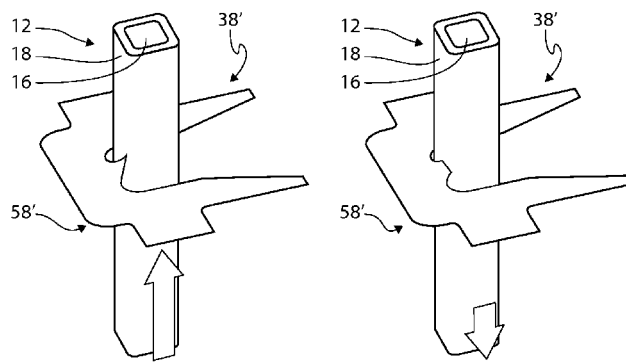


FIG. 6A

FIG. 6B

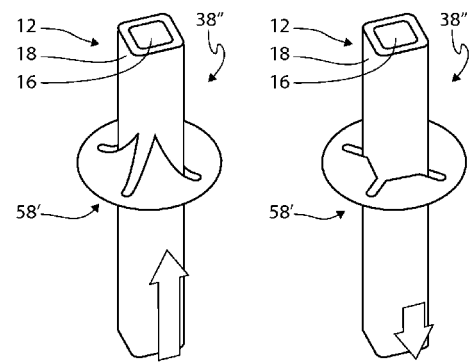


FIG. 7A

FIG. 7B

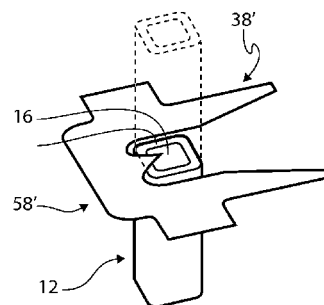


FIG. 6C

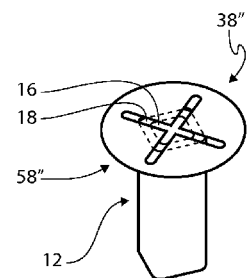


FIG. 7C



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 7076

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,D	WO 2007/059161 A1 (BROOKS CO E J [US]) 24 May 2007 (2007-05-24) * the whole document *	1-15	INV. G09F3/03
A,D	US 2003/075933 A1 (VELSCHOU JENS [DK] ET AL) 24 April 2003 (2003-04-24) * the whole document *	1-15	
A,D	US 7 878 561 B2 (RIETZLER MANFRED [DE]) 1 February 2011 (2011-02-01) * the whole document *	1-15	
A,D	WO 2011/008871 A1 (SAVI NETWORKS LLC [US]; LOCKHEED CORP [US]; ENVOTECH NETWORK SDN BHD 6) 20 January 2011 (2011-01-20) * the whole document *	1-15	
A,D	WO 2009/048516 A2 (BROOKS CO E J [US]; DEBRODY ROBERT [US]; RUTH DONALD [US]; LUNDBERG GE) 16 April 2009 (2009-04-16) * the whole document *	1-15	
A,D	WO 03/042959 A1 (SAVI TECHN INC [US]) 22 May 2003 (2003-05-22) * the whole document *	1-15	TECHNICAL FIELDS SEARCHED (IPC)
A,D	WO 2005/094172 A2 (HI G TEK LTD [IL]; AUERBACH MICHA [IL]; SHEKEL JOSEPH [IL]; ZELZION AL) 13 October 2005 (2005-10-13) * the whole document *	1-15	G09F G09B
A,D	WO 2006/095331 A2 (HI G TEK LTD [IL]; AUERBACH MICHA [IL]; COHEN RONY [IL]; GOLAN ELI [IL]) 14 September 2006 (2006-09-14) * the whole document *	1-15	
		-/--	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 February 2013	Examiner Demoor, Kristoffel
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	

 2
EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 7076

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,D	WO 2006/048872 A2 (HI G TEK LTD [IL]; AUERBACH MICHA [IL]; EIZEN NOACH [IL]; SHEKEL JOSEP) 11 May 2006 (2006-05-11) * the whole document *	1-15	
A,D	WO 2004/021299 A1 (HI G TEK LTD [IL]; AUERBACH MICHA [IL]; COHEN RONY [IL]; GOLAN ELI [IL]) 11 March 2004 (2004-03-11) * the whole document *	1-15	
A	WO 01/39162 A1 (BROOKS CO E J [US]) 31 May 2001 (2001-05-31) * abstract; figures 5,16,17 *	1-15	
A	US 5 743 574 A (KOHN RAYMOND F [US]) 28 April 1998 (1998-04-28) * abstract; figures 1-2a *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 February 2013	Examiner Demoor, Kristoffel
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	

2
EPO FORM 1503 03.82 (P04C01)

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

EP 12 18 7076

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-02-2013

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2007059161 A1	A1	24-05-2007	CA 2622585 A1	24-05-2007
			CN 101375322 A	25-02-2009
			EP 1949346 A1	30-07-2008
			US 2007120381 A1	31-05-2007
			WO 2007059161 A1	24-05-2007

US 2003075933 A1	A1	24-04-2003	AU 2664301 A	31-07-2001
			BR 0107916 A	05-11-2002
			CN 1404597 A	19-03-2003
			DK 1275099 T3	10-11-2008
			DK 200000081 A	20-07-2001
			EP 1275099 A1	15-01-2003
			US 2003075933 A1	24-04-2003
			WO 0154100 A1	26-07-2001

US 7878561 B2	B2	01-02-2011	AT 498173 T	15-02-2011
			CN 101142606 A	12-03-2008
			DE 102004063487 A1	13-07-2006
			EP 1831862 A1	12-09-2007
			ES 2360295 T3	02-06-2011
			JP 4792041 B2	12-10-2011
			JP 2008525675 A	17-07-2008
			US 2007139196 A1	21-06-2007
			WO 2006066555 A1	29-06-2006

WO 2011008871 A1	A1	20-01-2011	EP 2454729 A1	23-05-2012
			KR 20120126059 A	20-11-2012
			US 2011133932 A1	09-06-2011
			WO 2011008871 A1	20-01-2011

WO 2009048516 A2	A2	16-04-2009	EP 2195802 A2	16-06-2010
			US 2009091144 A1	09-04-2009
			WO 2009048516 A2	16-04-2009

WO 03042959 A1	A1	22-05-2003	CN 1613101 A	04-05-2005
			EP 1442445 A1	04-08-2004
			HK 1072493 A1	26-02-2010
			IL 161796 A	20-09-2007
			JP 2005509958 A	14-04-2005
			TW 591552 B	11-06-2004
			US 6747558 B1	08-06-2004
			WO 03042959 A1	22-05-2003

WO 2005094172 A2	A2	13-10-2005	EP 1735879 A2	27-12-2006
			US 2008036596 A1	14-02-2008
			WO 2005094172 A2	13-10-2005

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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

EP 12 18 7076

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-02-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2006095331 A2	14-09-2006	CN 101218612 A EP 1862018 A2 JP 2008533582 A KR 20070120134 A US 2005212671 A1 US 2008278318 A1 WO 2006095331 A2	09-07-2008 05-12-2007 21-08-2008 21-12-2007 29-09-2005 13-11-2008 14-09-2006
WO 2006048872 A2	11-05-2006	CN 101095175 A EP 1815563 A2 JP 2008519187 A KR 20070100246 A US 2008291019 A1 WO 2006048872 A2	26-12-2007 08-08-2007 05-06-2008 10-10-2007 27-11-2008 11-05-2006
WO 2004021299 A1	11-03-2004	AU 2003250514 A1 CN 1692382 A EP 1540613 A1 JP 2005537569 A KR 20050067386 A US 2004041705 A1 US 2006103524 A1 WO 2004021299 A1	19-03-2004 02-11-2005 15-06-2005 08-12-2005 01-07-2005 04-03-2004 18-05-2006 11-03-2004
WO 0139162 A1	31-05-2001	AU 2920601 A CN 1425174 A US 6494508 B1 WO 0139162 A1	04-06-2001 18-06-2003 17-12-2002 31-05-2001
US 5743574 A	28-04-1998	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20030075933 A [0002]
- US 7878561 B2 [0006]
- WO 2007059161 A1 [0007]
- WO 2009048516 A2 [0008]
- WO 2011008871 A1 [0009]
- WO 03042959 A1 [0010]
- WO 2005094172 A2 [0011]
- WO 2006095331 A2 [0012]
- WO 2006048872 A2 [0013]
- WO 2004021299 A1 [0014]