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(54) **An access control device and methods of use same**

(57) An access control device (10) for a manhole cover having a lid (12) and a frame (14) adapted to accommodate the lid (12) is attachable to at least one of the lid (12) and the frame (14) in the area covered by the lid (12) and has an antenna (16) adapted to receive external signals, and a connection to a remote security control unit.

In a method of using an access control device in accordance with any of the preceding claims, a sender, such as a transponder, is used to emit signals received by the antenna.

A method of using a security system having at least one such access control device and at least one remote security control unit.

A lid or a frame of a manhole cover has at least one access control device.

A method of providing a manhole cover having a lid and a frame adapted to accommodate the lid with an access control device has the following steps: preparing an access control device having an antenna adapted to receive external signals, attaching the access control device to at least one of the lid and the frame in an area covered by the lid, positioning the antenna proximate to the lid, and connecting the access control device to a remote security control unit.

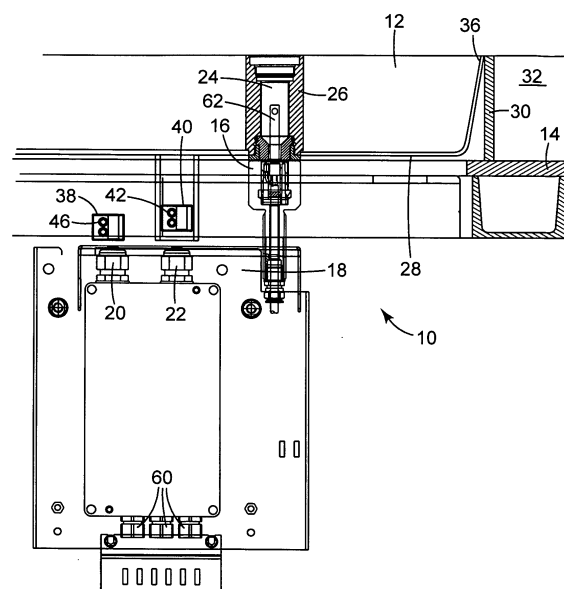


FIG. 1

Description

Technical Field

[0001] The invention relates to an access control device, a security system having an access control device, a lid or a frame of a manhole cover having an access control device and a method of providing a manhole cover having a lid and a frame with an access control device

Background

[0002] Manholes provide access to underground tunnels and passages within which communication cables, electricity supplies, water and gas pipes, waste water and the like may be housed. Because the manholes provide access to vital infrastructure elements, it can be desirable to limit access to authorized personnel. The manholes generally extend in a vertical direction from the tunnel or passage upwards to ground level. A lid may be used to cover the manhole, and the lid often is accommodated in a frame buried in the ground. The arrangement may be adapted to locate the lid such that its upper surface is approximately flush with the surface of the ground. The lid can be located, for example, so that its upper surface is approximately flush with the surface of a street, sidewalk, parking lot, lawn or the like.

[0003] Generally, manholes are provided in the street where they may be accessible to anyone. To gain access to the manhole, the lid needs to be opened or removed. To make access more difficult, the lid is usually heavy so that it cannot be easily lifted. The lid may be formed of, or filled with concrete, solid metal or a combination of both. Unauthorized persons may still remove the lid, however, with appropriate machinery or tools. Thus, there have been various proposals to increase the security in connection with manhole covers.

[0004] German Utility Model DE 29902681 U1 describes a manhole cover having an area in which a lock can be accommodated. The lock may be connected with one or more bars, rods or the like, which can engage with the frame to prevent the lid from being lifted without opening the lock beforehand.

[0005] WO2004/016889 is related to a similar locking mechanism. In this case, the locking mechanism may include a receiver, which detects an externally transmitted signal and causes an unlocking operation if the signal is verified.

[0006] JP 2001279969 describes a manhole cover having an electronic lock which can be activated by connecting the lock with a mobile telephone through which access information can be transmitted.

Summary of the Invention

[0007] The present invention provides access control devices for manhole covers having a lid and frame adapted to accommodate the lid. The access control devices

of the invention generally are attachable to at least one of the lid and the frame in the area covered by the lid thereby making installation of the access control device easier. The access control device has an antenna adapted to receive external signals. Finally, the access control device is connected to a remote security control unit.

[0008] In another aspect, the invention provides a security system having at least one access control device and at least one remote security control unit.

10 [0009] In yet another aspect, the invention provides a lid or a frame of a manhole cover having at least one access control device as describe above.

15 [0010] In a further aspect, the invention provides a method of providing a manhole cover having a lid and a frame with such an access control device.

Brief Description of the Drawings

20 [0011] The invention will be described hereafter in part by reference to non-limiting examples thereof and with reference to the drawings in which:

FIG. 1 shows a partial sectional view of an access control device attached to a frame of a manhole cover covered by a lid;

FIG. 2 shows a sectional view of a sleeve incorporated into the lid shown in Fig. 1; and

FIG. 3 shows a top view of the frame shown in Fig. 1 in which the lid is removed.

Detailed Description of a Preferred Embodiment

35 [0012] The access control devices as described herein are generally intended for manhole covers having a lid and a frame. The frame may generally be buried in the ground and may have any suitable shape for reliably staying in a particular position in the ground. The frame may, in a top view, for example, be circular, square, rectangular or of any other useful shape. As seen in a sectional view, the frame may have flanges and/or wall portions extending away from the manhole to secure the frame in the ground. Moreover, one or more substantially vertical walls may be provided to form a type of receptacle for the lid. The frame may have a continuous or non-continuous rim or projection extending to the interior of the manhole configured to be a bearing surface for a lid when placed in the frame to cover the manhole. The rim may be provided at an upper part of the frame. The lid can be placed on the rim with an upper part of the lid resting on the rim, the upper surface of the lid being substantially flush with the surrounding ground, and the lower part of the lid extending into the frame. The lid generally has a shape adapted to the shape of the frame to substantially cover the manhole completely. Moreover, suitable sealings may be present between the lid and the frame to hinder liquid or debris from entering the manhole.

[0013] The access control devices described herein are generally attachable to at least one of the lid and the

frame in the area covered by the lid. In other words, the access control device may be attached to the lid and/or the frame within the footprint of the lid. Thus, the access control device as described herein can be added to manhole covers, even to existing manhole covers, without the need to significantly alter the frame. In particular, the area covered by the lid is generally easy to access, so that the access control device can readily be installed in this area. There is substantially no work required on the frame outside the area covered by the lid, or even in the ground in which the frame is buried. Thus, the ease of installation of the access control device as described herein, enables retrofitting of existing manholes with a remote access control system.

[0014] The access control device may have a base, a carrier, a housing or the like, through which it may be attached to the frame or the lid. The attachment may, for example, be made by screws, one or more intermediate holders, by welding or in any other suitable manner.

[0015] The access control devices described herein have an antenna which is adapted to receive external coded/control signals carrying information relevant for authorization and/or access control. These signals may originate from senders, such as transponders. These can be operated by persons who are authorized to access the manholes, for example to do maintenance or installation work.

[0016] The access control devices also have a connection to a remote security control unit. Thus, any information which is received and/or created in the access control device can be sent to a remote security control unit. For example, any external signals received by the antenna can be forwarded to the remote security control unit. The remote security control unit can also be provided with information at what date and time the antenna received a certain signal.

[0017] In at least some embodiments the access control device may have at least one of a sensor, mechanical lock, electronic lock or combination thereof. Additional information, such as the position of a lock as well as the output of one or more sensors, can also be forwarded to the remote security control unit through the described connection. Thus, it is possible to monitor a manhole cover and/or collect a variety of information at a remote security control unit that can be a central control unit for plural access control devices. The remote control unit may be located, for example, in a central office, regional office or service dispatch center.

[0018] The access control device may be attachable to the frame alone with the antenna in close proximity to the lid. In this embodiment the step of providing a manhole cover with an access control device, which may be an addition of an access control device to an existing cover, can be performed easily as it can be done independent of the lid. The access control device may be attached to the frame and the position of the antenna, i.e., in close proximity to the lid, allows communication of the antenna if necessary with the outside through the

lid. When the antenna is in close proximity to the lid, for example, a transponder can send appropriate signals through the lid or a portion of the lid to the antenna.

[0019] It may be advantageous to support the antenna resiliently on the access control device. This may prevent damage to the antenna and/or those portions to which the antenna is mounted on the access control device when the device or the lid is handled. Moreover, when the support of the antenna is strong enough and inflexible, it may be possible to position the lid such that it rests on the antenna and not on the frame. This may cause misalignment of the lid resulting in its being tilted or resting in a way such that it is not flush with the surface of the ground. Thus, with a resilient support, both the antenna and the lid can be properly positioned in the frame. For example, with a resilient support of the antenna, the antenna may be provided in a position where it extends at least partially into an area and/or up to a level, at which the lid will be accommodated when it is placed in the frame. When the lid reaches this position, it can displace the antenna, to some extent due to the resilient support, without breaking the antenna and/or the antenna support. At the same time, the antenna can reliably be placed in close proximity to the lid, so that signals from outside can be transmitted to the antenna through the lid or portions of the lid. For example, the antenna may be attached to a support mounted to the access control device with a resilient element, such as a spring, a piece of rubber or the like. The antenna may be accommodated in a housing that protects and/or guides the housing. In an embodiment, as described in more detail below, in which the antenna is resiliently supported on the access control device or in a lid, the housing may be supported by a spring or the like located between the housing and the access control device or the lid.

[0020] The connection to the remote security control unit may include a telecommunications line having at least one wire. It may be advantageous to have a wire pair, which may be a twisted wire pair, used as the telecommunications line to connect the access control device with the remote security control unit. This may especially be advantageous when the manhole provides access to telecommunications equipment which is connected, for example through one or more telecommunications lines, with a switch, exchange or "PBX" (central office exchange operated by the telecommunications company). In such a situation one or more telecommunications lines - which are already present due to the presence of telecommunications equipment - may be used for connecting the access control device described herein with the remote security control unit. In this context, a particular telecommunications line may be used for transmitting telecommunications signals as well as (and simultaneously with) the signal sent from the access control device to the remote security control unit. This may be accomplished by sending the signal from the access control device in a particular frequency band.

[0021] Generally, the access control device can be op-

erated by any suitable device emitting signals which can be received by the antenna. The access control device may be adapted to communicate with a transponder or a similar device emitting signals that is already in use, for example, with a different access control device. However, it may be advantageous to further include at least one transponder with the access control device that is adapted to communicate with the antenna, so that a separate access control is established.

[0022] As described herein, the access control device provides the advantage that it is attached in the area covered by the lid, so that the frame and/or its surroundings do not have to be changed to mount the access control device. It may be advantageous to provide the access control device with a protective cover to prevent the device from being damaged when a person enters the manhole. Moreover, liquids or debris, which may enter the manhole, may be prevented from affecting the access control device by such a protective cover.

[0023] The access control device may provide access control simply by communicating with a remote security control unit and allowing a manhole to be monitored. It may be advantageous, however, to additionally provide the access control device with a protective lock which may be an electronic lock controllable by signals received through the antenna. For example, the electronic lock may be connected with one or more mechanical locks that can only be opened when the electronic lock has been released. Thus, the access control device does not only control access to the manhole but also prevents the lid from being opened unless a signal implying authorization has been received by the antenna which initiates, in this embodiment, the unlocking. As an alternative, the protective lock may be a mechanical lock that locks the lid to the frame.

[0024] It may, further, be advantageous to provide the access control device with at least one sensor for detecting a position of the lid relative to the frame and/or a position of the electronic and/or mechanical lock. The mechanical lock may have one or more bars, rods or the like, which may be lineally displaceable or pivotable to move them to a position where they engage the frame or a portion of the manhole in a manner to prevent the lid from being lifted.

For example, a central lock may be provided which extends in at least two opposite directions to provide engagement at at least two opposite sides. This can also be achieved by providing one or more locks at one or more edges of the lid. In this embodiment, the access control device cannot only monitor signals that have been received by the antenna but also monitor whether the lid has been opened and/or whether there has been an attempt to do so. This also applies to the position of the electronic and/or mechanical lock. For example, it can, in this embodiment, monitor whether a desired locking position is acquired by the one or more protective locks after a person has entered a manhole, performed maintenance work, or similar operations, and left the manhole

again. As soon as the lid is placed in the frame, it is generally desirable to lock it and/or verify this position by a sensor.

[0025] As described herein, the access control device can be added to existing manhole covers and can improve the security in connection with manhole covers. However, it may be advantageous to provide, in line with a second aspect of the invention, a lid or a frame of a manhole cover having at least one access control device as described herein. In this embodiment, the components of a manhole cover, a lid and/or a frame, may be provided in a manner to offer improved security.

[0026] In connection with the lid, it may be advantageous to provide the lid with at least one opening in the vicinity of the antenna. The opening may, for example, be used to allow a transponder or similar device emitting signals that can be received by the antenna to be brought into close proximity with the antenna. The opening may generally penetrate the lid and, when no access to the manhole is needed (i.e., when no transponder or similar device needs to communicate with the antenna) may be covered by a plug or the like. It may also be advantageous to form the opening as a blind hole, in other words having a bottom. The bottom, i.e., the thickness of the lid remaining underneath the opening, may be thin enough to allow a transponder or a similar device to communicate with the antenna through this remaining thickness of the lid. In this embodiment, i.e. when the opening has a bottom, it is easier to ensure that liquids and debris can be prevented from entering the manhole through the opening.

[0027] In connection with the opening, it may be advantageous to form the opening in a sleeve integrated into the lid. The sleeve may be made of metal or any other suitable material and may be machined or the like to have a number of separated portions adapted to perform specific functions. For example, a lower part of the sleeve can be formed as a guide for a transponder or a similar device. In an upper part of the sleeve an area may be provided in which a mechanical lock may be placed. Thus, the guide where the transponder can communicate with the antenna is accessible only when the mechanical lock is unlocked and a plug is removed. Finally, in an uppermost part, the sleeve may be adapted to receive a dust cover.

[0028] It may be advantageous to provide the sleeve at a location where it projects from the underside of the lid. Since the sleeve is intended for receiving a transponder or the like, the described position of the sleeve may ensure that the transponder is brought into a position where it can reliably communicate with the antenna.

[0029] As indicated above, it may be advantageous when the opening is provided with a dust cover to avoid dust and similar substances from entering the sleeve and possibly endangering its functionality. The dust cover may, for example, be flush with the upper surface of the lid to provide a pleasant outer appearance and avoid open edges or the like which will collect debris and/or render the dust cover susceptible to being removed.

[0030] This is also achieved by a protective lock that may be provided in the opening. Such a protective lock may be a mechanical or an electronic lock and may prevent unauthorized persons from attempting to bring a transponder in a position to communicate with the antenna to unlock a further lock locking the lid to the frame or otherwise obtain access to the manhole.

[0031] It may, furthermore, be advantageous to provide at least one of the antenna and the lid with a signalling device for displaying at least one signal in response to signals received through the antenna. In this embodiment, the person handling a transponder or the like communicating with the antenna receives feedback through the signalling device that signals have been received by the antenna. The signal that is fed back to the person handling the transponder may be a tonal, visual and/or an optical signal. The optical signal may be different depending on whether an authorized or an unauthorized signal has been received by the antenna.

[0032] As regards an optical signal, at least one of the signalling device, the lid and the antenna may include a light emitting diode or a light guide guiding a light signal to the top surface of the lid so that it is visible to a person handling a transponder.

[0033] Turning now to FIG. 1, which is a partial sectional view of an access control device 10 attached to the opening of a manhole that accommodates a frame 14 and a lid 12. In the embodiment shown, the frame 14 has, in its lower part, an essentially box-like cross-section and, in an upper part, a substantially vertical wall 30. The frame 14 is generally buried in the ground 32 with the upper end of the wall 30 being substantially flush with the ground 32. It is to be noted that the frame is generally continuous around the opening forming the manhole so that the rim 36 is formed at least partially around the frame 14. The frame 14 may, for example, be circular, square or rectangular or may have any other suitable form. In any case, it generally provides a rim for providing support to a lid 12 which has an outwardly extending portion adapted to be supported by the rim 36.

[0034] In the embodiment shown, the lid 12 is provided with an opening 24 that is, in this embodiment, formed in a sleeve 26 integrated into the lid 12. The sleeve 26 having the opening 24 is provided in the lid 12 at a position which substantially corresponds to a position of an antenna 16 provided on the access control device attached to the frame 14. The antenna 16 is provided on the access control device 10 in a position to project from the access control device 10. The antenna may extend from the access control device 10 to be in close proximity with the lid 12. A transponder 62 or a similar device emitting signals that can be received by the antenna may be inserted into the opening 24, and the transponder can communicate with the antenna.

[0035] In the embodiment shown, the access control device further comprises two sensors 20, 22 which detect a position of magnets 38, 40. Magnet holders 42, 44 are provided to attach the magnets 38, 40 to the lid or a me-

chanical lock. In the case shown, one of the magnets, magnet 38, is attached to a mechanical lock and the other magnet, magnet 40, is attached to the lid. The magnets generally have a constant magnetic field and changes of this field are detected by the corresponding sensor 20, 22. Thus, when the position of the lid is changed, for example when it is lifted, this is detected by sensor 22. In a similar manner, when the mechanical lock is moved, the position of the magnet 38 changes and the resultant change of the magnetic field is detected by sensor 20. The corresponding information, i.e., the output of the sensor 20, 22, can be communicated to a remote security control unit. Those connectors 60 which are related to the connection of the access control device 10 with the antenna 16 and a remote security control unit (not shown) are apparent from the lower part of FIG. 1. When one or more sensors, as shown at 20 and 22 in FIG. 1, is present, it may be exposed through the protective cover 18 to allow the sensors to detect the position of, for example, the magnets 38, 40. The access control device 10 may have a housing, a base, a carrier or the like, on which the antenna 16 and/or the sensor 20, 22 and/or the connectors 60 may be mounted. Moreover, the base, carrier or housing may accommodate any connections between the above-mentioned elements as well as further components that the access control device 10 may include.

[0036] FIG. 2 shows a sectional view of the sleeve 26 in greater detail. As will be apparent from the lower part of FIG. 2 a transponder guide 46 having a bottom 48 is provided with a seal, for example an O-ring 50 between the outside of the transponder guide 46 and the sleeve 26. The transponder guide is held in place by a nut 52 which is, in the embodiment shown, screwed onto the sleeve 26. In its upper part, the sleeve 26 may be adapted to receive a protective lock (section 54) as well as a dust cover (section 56). The height of the sleeve may vary depending on the thickness of the lid. As there is more than one type of lid, and the thickness of the lid may vary, parts of the sleeve, such as the transponder guide and the nut, can advantageously be standardized. However, the remainder of the sleeve can be varied with regard to its height to adapt the sleeve to lids with different thicknesses.

[0037] As an alternative, a sleeve may be provided in the lid to be moveable in a vertical direction. In this case, a transponder may be accommodated in the sleeve and may be moved vertically downwards to bring the transponder close to the antenna to allow communication therewith. Such a moveable sleeve may also be supported resiliently, for example, by a spring to bias the sleeve in an upwards direction. In this manner, the sleeve is, initially, in a position to easily insert a transponder and may, against the force of the spring, be brought in a position to be close to the antenna. As a further alternative, the sleeve may be fixed and the antenna may be movably mounted in the lid.

[0038] FIG. 3 shows a top view of the frame 14 with the lid removed to allow the access control device to be

viewed. The access control device 10 may be mounted to the frame by one or more holders 58. The top view of FIG. 3 shows a protective cover 18 covering the access control device 10 and preventing persons entering the manhole from stepping on the access control device 10. In the embodiment shown, the protective cover 18 has an opening through which the antenna 16 extends in a direction towards the viewer of FIG. 3. Further openings may be present for the sensors 20, 22 (see FIG. 1). As is also apparent from FIG. 3, the frame shown has a square shape. However, a rectangular or any other suitable shape is also possible. The access control device 10 is mounted on the edge of the frame 14 in order to interfere as little as possible with the area through which the manhole can be entered. However the access control device 10 is mounted to the frame 14 in the area of the lid (i.e., within the footprint of the lid) so that the frame and/or the ground surrounding the frame 14 do not have to be changed.

[0039] In the embodiment described above and shown in the drawings, the complete access control device, including the antenna, is attached to the frame. It is noted, however, that the access control device can completely or partially be attached to the lid. For example, the antenna can be accommodated in the lid and can be in wired or wireless connection with the remainder of the access control unit. The antenna may also be accommodated in a recess of the lid so that the lid can be removed with the antenna staying in place. In this case, the antenna may be positioned close to the upper surface of the lid so that a transponder or similar device can be caused to communicate with the antenna by locating the transponder close to the upper surface of the lid. This will make the sleeve unnecessary. When the antenna is accommodated in a recess provided in the lid, a suitable sealing may be provided to prevent liquids or debris from entering the manhole through the recess.

[0040] The antenna may also be attached to the lid and wireless communications can be provided between the antenna and the remainder of the access control device. As an alternative, a cable which is long enough and/or flexible may be provided between the antenna and the remainder of the access control device to allow the lid including the antenna to be lifted and removed from the frame. In some applications, the mechanical lock, for example those including a bar or rod, may be used to hold the antenna within the lid.

[0041] The present invention has now been described with reference to several individual embodiments. The foregoing detailed description has been given for clarity of understanding only. No unnecessary limitations are to be understood or taken from it. All references to right, left, front, rear, up and down as well as references to directions are exemplary only and do not limit the claimed invention. It will be apparent to those persons skilled in the art that many changes can be made in the embodiments described without departing from the scope of the invention. Thus, the scope of the present invention

should not be limited to the details and structures described herein, but rather by the structures described by the language of the claims, and the equivalents of those structures.

Claims

1. An access control device (10) for a manhole cover having a lid (12) and a frame (14) adapted to accommodate the lid (12), the access control device (10) being attachable to at least one of the lid (12) and the frame (14) in the area covered by the lid (12) and having:
 - an antenna (16) adapted to receive external signals, and
 - a connection to a remote security control unit.
2. The access control device in accordance with claim 1 wherein the device is attachable to the frame (14) with the antenna (16) in close proximity to the lid (12).
3. The access control device in accordance with claim 1 or 2 wherein the antenna (16) is resiliently supported on the access control device (10).
4. The access control device in accordance with any of the preceding claims wherein the connection to a remote security control unit includes a telecommunications line having at least one wire.
5. The access control device in accordance with any of the preceding claims further having a transponder adapted to communicate with the antenna (16).
6. The access control device in accordance with any of the preceding claims further having a protective cover (18).
7. The access control device in accordance with any of the preceding claims further having at least one sensor (20, 22) for detecting a position of the lid (12) relative to the frame (14) and/or a position of the lock.
8. The access control device in accordance with any of the preceding claims further having at least one lock.
9. A method of using an access control device in accordance with any of the preceding claims, in which a sender, such as a transponder, is used to emit signals received by the antenna.
10. A security system having at least one access control device in accordance with any of claims 1 to 8 and at least one remote security control unit.

11. A lid (12) or a frame (14) of a manhole cover having at least one access control device in accordance with one of claims 1 to 8.
12. The lid in accordance with claim 11 having at least one opening (24) in the vicinity of the antenna (16).
13. The lid in accordance with claim 12 wherein the opening (24) is formed in a sleeve (26) integrated into the lid (12).
14. The lid in accordance with claim 13 wherein the sleeve (26) projects from the underside (28) of the lid (12).
15. The lid in accordance with any of claims 12 to 14 wherein the opening (24) is provided with a dust cover.
16. The lid in accordance with any of claims 12 to 14 wherein the opening (24) is provided with a protective lock.
17. The lid in accordance with any of claims 11 to 16 wherein at least one of the antenna (16) and the lid (12) has a signalling device for displaying at least one signal in response to signals received through the antenna (16).
18. The lid in accordance with claim 17 wherein at least one of the signalling device, the lid and the sleeve has a light guide.
19. A method of providing a manhole cover having a lid and a frame adapted to accommodate the lid with an access control device having the following steps:
- preparing an access control device having an antenna adapted to receive external signals,
attaching the access control device to at least one of the lid and the frame in an area covered by the lid,
positioning the antenna proximate to the lid, and
connecting the access control device to a remote security control unit.
20. The method in accordance with claim 19 wherein the access control device is attached to the frame with the antenna in close proximity to the lid.
21. The method in accordance with claim 19 or 20 wherein the antenna is resiliently supported on the access control device.
22. The method in accordance with any of claims 19 to 21 wherein a telecommunications line having at least one wire is provided to connection the access control device to the remote security control unit.
23. The method in accordance with any of claims 19 to 22 wherein at least one opening is provided in the lid in the vicinity of the antenna.
24. The method in accordance with claim 23 wherein a sleeve comprising the opening is integrated into the lid.

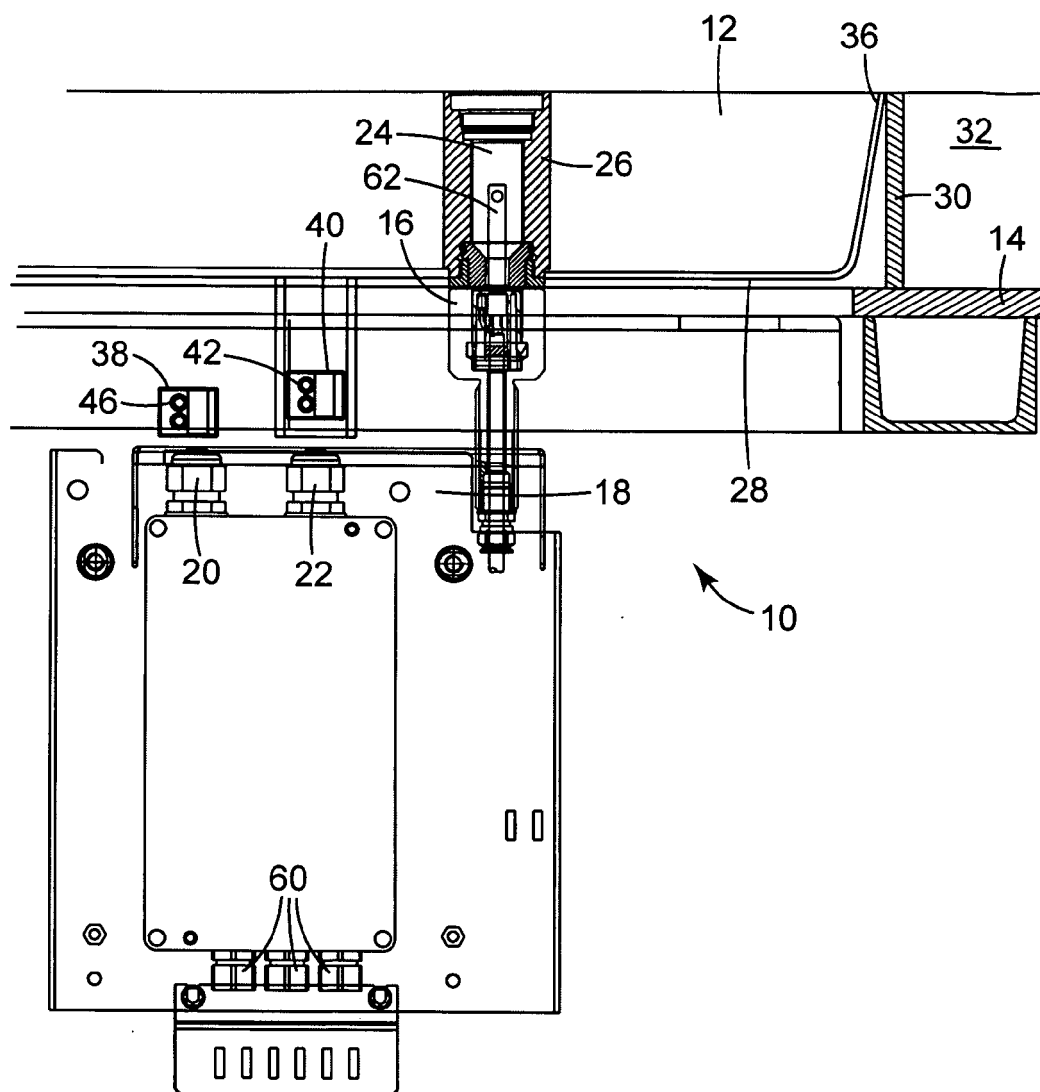


FIG. 1

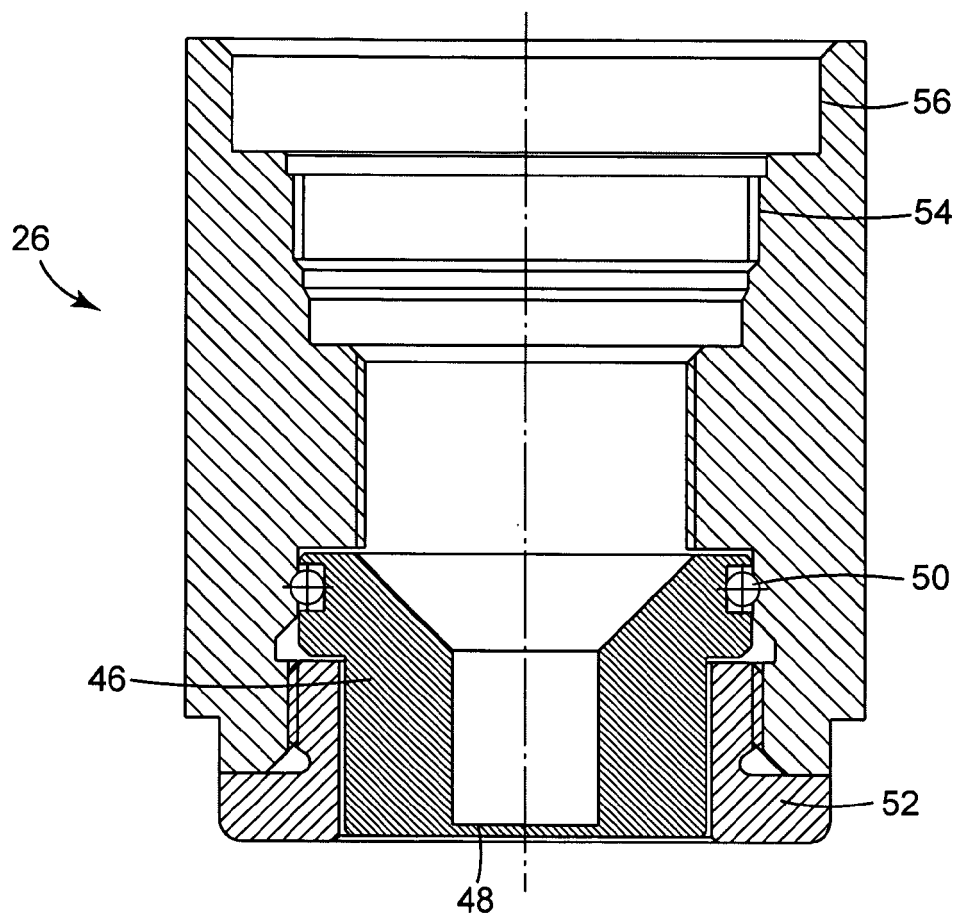


FIG. 2

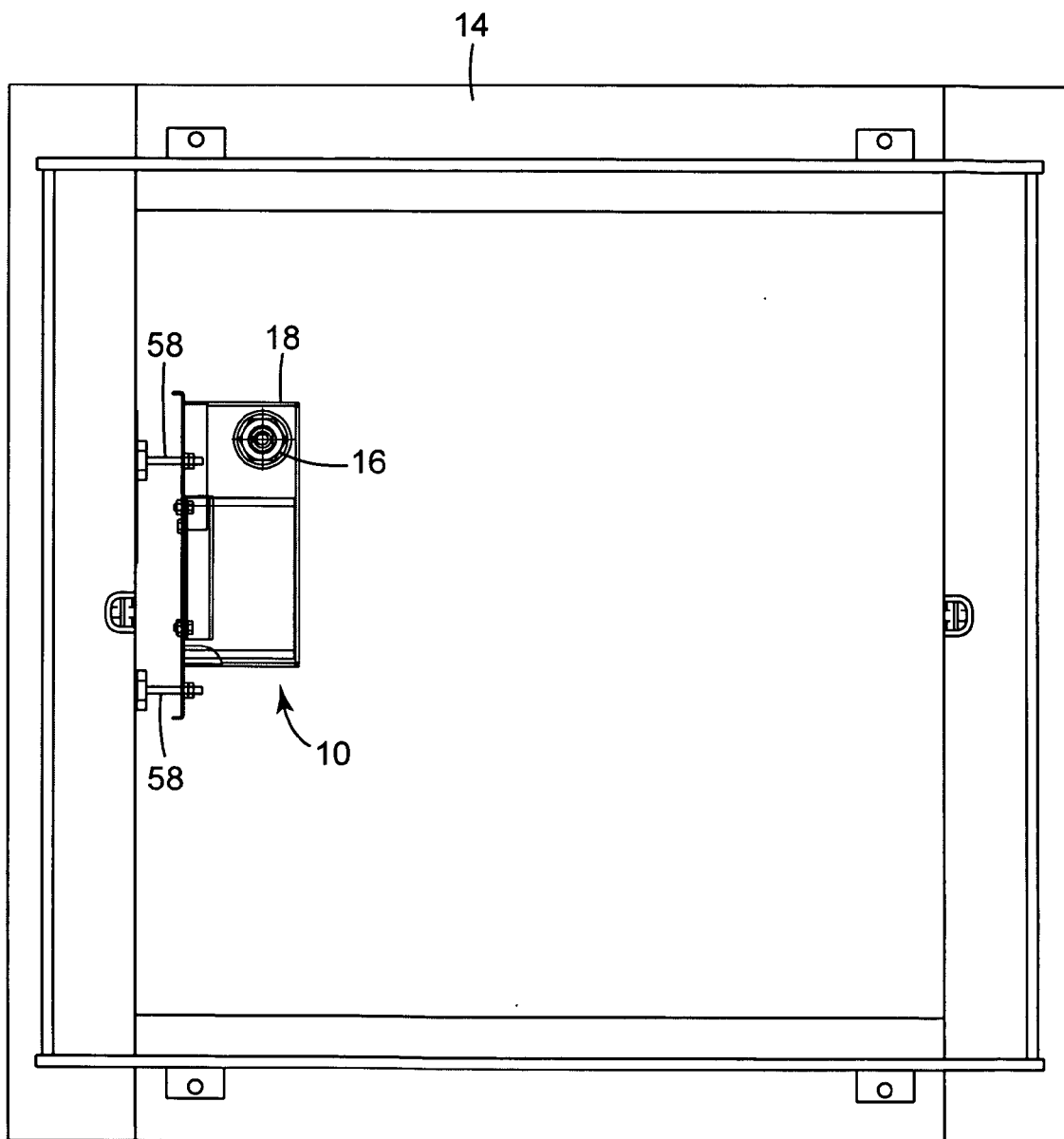


FIG. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 01 2156

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	WO 00/75465 A (PONT A MOUSSON S.A; HAUER, JEAN-CLAUDE; PIETRZAK, JEAN-PAUL) 14 December 2000 (2000-12-14) * page 7, line 28 - page 20, line 9; figures 1-4 *	1-24	INV. E02D29/14
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A	WO 01/94709 A (BROERMANN, RITA; BROERMANN, GERALD) 13 December 2001 (2001-12-13) * page 6, paragraph 1 - page 12, paragraph 4; figures 1-3 *	1-24	
			TECHNICAL FIELDS SEARCHED (IPC)
			E02D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 August 2006	Examiner Geiger, H
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 01 2156

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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28-08-2006

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