

A method of localizing storage devices, a monitoring system for localizing storage devices for goods, and use of the monitoring equipment

- 5 The invention relates to a method of localizing storage devices, e.g. containers, where each container is equipped with a data processing unit programmed to try to position the unit concerned at determined intervals by establishing a connection to a positioning satellite, and
10 where each container is moreover equipped such that a message on observed positions may be emitted via a communications satellite.

- The invention moreover relates to a monitoring system for
15 localizing storage devices for goods, e.g. containers, where each container is also equipped with a near field radio system which enables communication between the data processing units in the individual containers and between the containers and near field radio systems on yards,
20 ships, trains or other transporting or storing units.

Finally, the invention relates to uses of the method and the monitoring system.

- 25 US Patent No. 5 565 858 discloses a localization system for use in connection with the monitoring of containers comprising a group of containers which are e.g. stored. Each container has communications equipment which consists of a satellite communications device and a near
30 field communications device. The satellite and near field communications devices are capable of communicating with each other so that an arbitrary container can communicate its position directly via other containers to a GPS positioning system, or indirectly via a connection to an in-
35 terrogator.

Another monitoring system is known from the applicant's own International Patent Application WO 96/16387.

5 This known monitoring system, which is used e.g. in connection with the monitoring of containers, in principle consists of a communications system in which exchange of information with the surrounding world takes place via communications satellites, e.g. of the GPS type. Each container has a radio connection to a data processor system. Each container additionally has a data connection to a tag, which cooperates with the radio connection of the container in such a manner that if the data connection of the container is removed from the container, a connection to a satellite will be established via the data processor system.

15 The system operates fully satisfactorily as long as there is a good connection between the satellite and the data processor system. However, the data processor system requires that there is a line of sight between the data processor system and the satellite. This cannot always be satisfied, e.g. if containers and the data processor system connected to it are stored on the bottom of a ship or on a train which drives through a tunnel. Furthermore, it is a drawback that if a radio connection fails, it may be difficult to find the reason for the failure.

25 Accordingly, an object of the invention is to provide a system which, in an even faster manner, is capable of monitoring storage devices for goods, e.g. containers, and of providing an indication of what is wrong if a container cannot be positioned.

35 The object of the invention is achieved by a monitoring system of the type defined in the introductory portion of claim 1 which is characterized in that the data process-

ing unit in each container will individually try to determine its position and communicate information on this via a communications satellite, and which, when no connection to the positioning satellite can be established, is adapted to transfer data to a communications satellite containing the information that a connection to the positioning satellite cannot be established.

When contact to the communications satellite cannot be established, the data processing unit, as stated in claim 2, activates the near field radio system and tries to connect to another near field radio which is capable of creating or has contact to the positioning and communications satellite via a data processing unit or in another manner. It is ensured hereby that all containers positioned within the overall operating range of the near field radio system can position and communicate their positions to the surrounding world.

The individual containers can hereby transfer data between each other and to the surroundings via the radio connections, thereby achieving a greater certainty that the desired positioning of the individual container can be established, and information on this can be applied and enable tracking of any containers with faulty equipment for the satellite-based positioning and communication.

It is moreover expedient, as stated in claim 3, that precisely as many radio connections are established between near field communications equipment on a plurality of storage devices as are sufficient to set up radio connection to the positioning satellite and the communications satellite, respectively.

As mentioned, the invention also relates to a monitoring system.

5 This monitoring system is characterized in that each storage unit, container, is provided with equipment which, in combination, enables positioning and tracking of the individual unit, also when it is not possible to create contact to the satellites concerned for positioning and communication because of functional restraints or
10 because parts of the equipment are out of order.

As stated in claim 5, each container is equipped with a data processing unit which is programmed to initiate a procedure for producing ID as well as for determining
15 the position and time of it and for presenting this information via communication with satellite or near field radio system.

In order to be able to identify the individual containers
20 additionally, it is expedient, as stated in claim 6, that the container which establishes a connection to one or more other containers is adapted to produce its own identification data.

25 In order to additionally ensure careful monitoring of the containers, it is an advantage, as stated in claim 7, that each container tries to set up a connection to the positioning satellite at suitable intervals.

30 For use of the monitoring equipment according to the invention in connection with locations where no container can establish a connection to a satellite, it is an advantage, as stated in claim 8, that the near field communications equipment of the containers is in communication
35 with further near field communications equipment which is not positioned on the containers.

As mentioned, the invention also relates to uses of the monitoring system according to the invention.

5 These uses are defined in claims 10 - 12.

The invention will now be explained more fully with reference to an example shown in the drawing, in which

10 fig. 1 shows examples of the storage of containers under various conditions,

fig. 2 shows a basic sketch of the mode of operation of the monitoring system according to the invention, and

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fig. 3 shows a further embodiment of the mode of operation of the system according to the invention.

In fig. 1, 5 designates a GPS positioning satellite for providing position data, while 6 designates a SatCom communications satellite for providing communications data. As will be seen in the figure, the satellites 5, 6 can establish data transfer to a truck 1, a containership 2 with several containers 4, or a train 3 with carriages 12. Each container has an antenna capable of reading information from a tag which is positioned on an underlying container, e.g. as shown on the ship 2, at the reference numeral 10. This system is described in detail in the previously mentioned WO application. In brief, the mode of operation of the system is such that if one of the containers is unlawfully removed, then a radio connection between the bridge of the ship and the container will ensure that a connection is set up to e.g. a police authority. Fig. 1 moreover shows a train with a plurality of carriages 12, each of which communicates with a locomotive, which in turn communicates with the satellites 5,

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6. Finally, fig. 1 shows a plurality of containers which are stored at a site where they are in radio connection with a stationary data connection unit 9 which communicates with the satellites 5, 6.

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In fig. 2, 5 and 6 again designate the GPS positioning satellite and the SatCom communications satellite, respectively. The figure also shows a plurality of containers 4 which are placed in a space schematically shown at 14, which might e.g. be on board a ship. It is moreover shown schematically that the satellites 5, 6 are in radio connection with the containers which are designated by 4C and 4I. All the containers are moreover equipped with a positioning satellite system, a communications satellite system, and near field communications equipment, which, however, are not shown in detail in the figure. The near field communications system is capable of establishing a connection between the individual containers. As a result of this, if e.g. the container 4A is to be able to communicate with the satellites 5, 6, then near field communication will be established from the container 4A via 4B to 4C, which communicates with the satellites 5, 6. The position of the container 4A may hereby be determined reasonably accurately. To make the system even more flexible, it is possible to set up relay stations 16 so that e.g. a connection from the container 4D may be established via the radio connections 17 and the relay station 16, further via the radio connection 17A and the container 4I, which, as mentioned, communicates with the satellites 5, 6. The same connection might be set up between the containers 4D and 4I, as shown.

It is noted that each container, if there is a line of sight, has the possibility of communicating directly with the positioning satellite as well as the communications satellite.

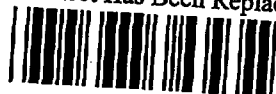
Fig. 3 shows a variant of the embodiment of fig. 2, a near field communications device 18 being established here, which is not positioned on a container, but has a good connection to the satellites 5, 6. Such a set-up may be useful if e.g. the containers are placed so deep down in a ship that is impossible for any satellite communications equipment of any of the containers to establish a connection. Of course, more near field communications devices of the type 18 than shown in the drawing may be set up.

As will be appreciated, the invention provides a system which is capable of monitoring any container in a very safe manner no matter where in the world it is located.

The principles of the invention have been explained particularly in connection with containers, but basically they may be used in connection with all movable objects where security against theft and vandalism is desired.

P a t e n t C l a i m s :

1. A method of localizing storage devices, e.g. contain-
5 ers (4), where each container is a container which is
 equipped with a data processing unit programmed to try to
 position the unit concerned at determined intervals by
 establishing a connection to a positioning satellite, and
 where each container is moreover equipped such that a
10 message on observed positions may be emitted via a commu-
 nications satellite, c h a r a c t e r i z e d in that
 the data processing unit in each container will individu-
 ally try to determine its position and communicate infor-
 mation on this via a communications satellite, and which,
15 when connection to the positioning satellite cannot be
 established, is adapted to transfer data to a communica-
 tions satellite containing the information that a connec-
 tion to the positioning satellite cannot be established.
- 20 2. A method according to claim 2, c h a r a c t e r -
 i z e d in that when contact to the communications sat-
 ellite cannot be established, the data processing unit
 activates the near field radio system and tries to con-
 nect to another near field radio which is capable of cre-
25 ating or has contact to the positioning and communica-
 tions satellite via a data processing unit or in another
 manner.
- 30 3. A method according to claim 2, c h a r a c t e r -
 i z e d in that precisely as many radio connections be-
 tween near field communications devices on a plurality of
 storage devices are established as are necessary to set
 up a radio connection to the positioning satellite and
 the communications satellite, respectively.





4. A monitoring system for localizing storage devices for goods, e.g. containers (4), where each container is also equipped with a near field radio system which enables communication between the data processing units in the individual containers and between the containers and near field radio systems on yards, ships, trains or other transporting or storing units, c h a r a c t e r i z e d in that each storage unit is provided with equipment which, in combination, enables positioning and tracking of the individual unit, also when it is not possible to create contact to the satellites concerned for positioning and communication because of functional restraints or because parts of the equipment are out of order.

5. A monitoring system according to claim 4, c h a r a c t e r i z e d in that each container (4) is additionally equipped with a data processing unit which is programmed to initiate a procedure for producing ID as well as for determining the position and time of it and for presenting this information via communication with satellite or near field radio system.

6. A monitoring system according to claim 5, c h a r a c t e r i z e d in that the container which establishes a connection to one or more other containers is adapted to produce its own identification data.

7. A monitoring system according to any one of the preceding claims, c h a r a c t e r i z e d in that each container tries to set up a connection to the positioning satellite at suitable intervals.

8. A monitoring system according to any one of the preceding claims, c h a r a c t e r i z e d in that the near field communications equipment of the containers is



in communication with further near field communications equipment (18) which is not positioned on the containers.

5 9. A monitoring system according to any one of the preceding claims, characterized in that the positioning satellite is formed by a GPS system (Global Positioning System) (5) and the communications satellite (Satellite Communications System) (6) is formed by a Sat-Com system, while the near field communications equipment
10 is an SR (Short Range) system.

10. Use of the method and the storage device according to any one of claims 1-9 on a containership (21).

15 11. Use of the method and the monitoring system according to any one of claims 1-9 on a goods train (3).

12. Use of the method and the storage device according to any one of claims 1-9 on a storage site for containers.
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