Title: RACK FOR HOLDING A PLURALITY OF MEDICAL DEVICES

Abstract: Rack for holding a plurality of medical devices. A rack (1) for holding a plurality of medical devices (2), the rack (1) comprises: a plurality of connection means (11) for connecting the plurality of medial devices (2) to the rack (1); a power supply unit (102) for providing electric power to the plurality of medical devices (2); and a communication means (107) for providing a communication link for the medical devices. Herein, the rack (1) comprises a base part (10) and a holding part (11) which is detachable from the base part (10), wherein the base part (10) includes the power supply unit (102) and the communication means (107) of the rack (1) and the holding part (11) includes the plurality of connection means (111) for connecting the plurality of medial devices (2) to the rack (1). Thus, a rack is provided for holding a plurality of medical devices such as infusion pumps in a secure and reliable fashion, the rack allowing for a communication of the medical devices among each other and with external periphery devices and an external network and in addition allowing for moving the medical devices attached to the rack in an easy and convenient way.
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ), GW, ML, MR, NE, SN, TD, TG.

Published:

— *with international search report (Art. 21(3))*

**Declarations under Rule 4.17:**

— *of inventorship (Rule 4.17(iv))*
Rack for holding a plurality of medical devices

Description

The invention relates to a rack for holding a plurality of medical devices according to the preamble of claim 1.

A rack of this kind comprises a plurality of connection means for connecting the plurality of medical devices to the rack, a power supply unit for providing electric power to the plurality of medical devices and a communication means for providing a communication link for the medical devices.

The rack for example may be used for holding a number of infusion pumps for administering for example a fluid such as medication or nutrients to a patient. The rack combines several infusion pumps to form a complex infusion system which in particular may be used in an intensive care unit in a hospital environment.

The rack in this context serves different functions:

- the rack shall organize the medical devices to optimize the required space to arrange the medical devices;

- the rack shall supply electric power to the medical devices and for this purpose comprises a power supply unit;
the rack shall serve to fix the medical devices for a reliable and secure arrangement and for this comprises connection means to hold the medical devices; and

the rack shall serve as a communication spine to provide a communication between the infusion pumps among each other and between the infusion pumps and external periphery devices such as a barcode reader, an external communication network such as a local area network (LAN) and, possibly, via the communication network to a hospital management system.

A rack of this kind - for example in an intensive care unit in a hospital environment - in general is arranged at the bedside of a patient and provides an infusion system with multiple infusion pumps and multiple infusion lines providing fluids such as medication or nutrients to the patient. Since the providing of the fluids over the infusion lines, in particular in an intensive care environment of a hospital, may be vital to the patient and therefore may not be disconnected from the patient or the infusion pumps, occasionally the infusion pumps must be moved together with the patient when the patient moves for example to obtain another hospital service at a different location in the hospital, such as an X-ray examination or the like.

In order to move a patient together with attached infusion lines commonly two options exist. As a first option, the patient may be moved together with the complete rack including the infusion pumps attached to the rack. As a second option, the patient may be moved with the infusion pumps detached from the rack.

The first option may pose the problem that the rack together with the devices attached thereto is rather heavy and difficult to handle, due to for example the communication electronics and the power supply unit(s) included in the rack. In addition, the rack must be disconnected from local periphery devices such as a printer, a computer, a monitor or the like, a power feed cable must be detached and communication lines such as a network connection must be unplugged. It thus takes time and effort to transfer the rack with the attached infusion pumps into a condition in which it can be moved, and it also takes time and effort to again connect all external devices and lines after returning the rack, including the risk of not correctly establishing all required connections.

The second option may pose the problem that the infusion pumps must be held securely when moving the patient. Often, the infusion pumps are simply placed on a patient's bed,
which bears the risk that an infusion pump falls down when moving the patient's bed, in particular if multiple infusion pumps are placed on the bed. Furthermore, by detaching the infusion pumps from the rack the arrangement of the infusion lines is altered, bearing the risk that infusion lines are mixed up, confused and disarranged, including the danger of a possible interruption of an infusion line.

EP 0 671 178 A1 discloses a medical monitoring system including a wall mounting plate to which a centre support member is rigidly attached using a pair of mounting flanges which engage a pair of integral tracks on a forward surface of the mounting plate. The centre support supports a plurality of module housings, each of which contains module slots for insertion of interchangeable modular components.

EP 1 702 649 A1 discloses a medical device for monitoring or therapy purposes including a base station and at least one module attachable to the base station, the module still being fully functional when separated from the basis station.

It is an object of the invention to provide a rack for holding a plurality of medical devices such as infusion pumps in a secure and reliable fashion, the rack allowing for a communication of the medical devices among each other and with external periphery devices and an external network and in addition allowing for moving the medical devices attached to the rack in an easy and convenient way.

This object is achieved with a rack comprising the features of claim 1.

Accordingly, the rack comprises a base part and a holding part which is detachable from the base part, wherein the base part includes the power supply unit and the communication means of the rack and the holding part includes the plurality of connection means for connecting the plurality of medical devices to the rack.

The instant invention is based on the idea to divide the rack into two separate functional parts. The first part, denoted as base part, serves to combine the main electronic components of the rack, in particular a power supply unit for electrically supplying the medical devices attached to the rack with power and an electronic communication means for enabling the medical devices attached to the rack to communicate with each other and with external devices. The second part, denoted as holding part, serves for mechanically holding the medical devices and, for this, encompasses the connection means used to attach the medical devices to the rack. The holding part is arranged on the base part and functions together with the base part in a normal condition of use, but
may be detached from the base part in order to move the medical devices with a patient in case the patient is moved. Thus, for moving the patient the holding part can be detached from the base part, such that the medical devices, combined and held in an organized fashion via the holding part, can be moved together with the patient.

The medical devices attached to the holding part, hence, remain fixedly combined by the holding part in a secure and reliable manner when moving the patient. For moving the holding part may be attached to a bed post or another accessory, and thus the medical devices attached to the holding part can be moved together with the patient in an organized, easy to carry fashion.

Since the particularly heavy components of the rack, for example the power supply unit and the communication electronics, are part of the base part, the weight of the holding part together with the medical devices attached thereto is substantially reduced compared to the weight of a complete rack. Because in addition the space required by the holding part and the medical devices attached thereto is substantially smaller than the space of the complete rack, the handling of the holding part and the devices attached thereto is easy and convenient.

Further, since all interface connections providing the connection to, for example, an external power supply line and external devices such as a printer, a monitor or a communication network may be part of the base part, external connection lines such as a power feed line, a monitor cable or a network connection do not have to be detached prior to moving the holding part together with the attached medical devices. For moving, only the holding part is detached form the base part, but all the lines connected to the base part can remain in place.

The medical devices to be attached to the holding part preferably are infusion pumps, in particular syringe pumps or volumetric pumps. Syringe pumps, also denoted as small-volume pumps, use a syringe (which is actuated in a computer-controlled manner) for pumping a fluid. Volumetric pumps, also denoted as large-volume pumps, usually are formed as peristaltic pumps in which pressure is asserted on a rubber tube to move a fluid in the rubber tube.

The rack advantageously is to be attached to a stand, such as a post or the like. A fixing means herein may be provided on the base part, and an additional fixing means may be provided on the holding part such that both the base part and the holding part are attached to the stand. The fixing means may be for example a screwing clamp (a clamp
which is fixed by a screw), a spring-tensioned clamp (a clamp having a spring exerting a pressure for providing a clamping fixture), a hook, a positive-locking engagement device or any other suitable means for providing a secure and reliable, yet releasable connection between the parts of the rack and the stand.

The holding part is connected, in a normal condition of use of the rack, to the base part, wherein the holding part may be detached from the base part to move the holding part together with medical devices attached thereto independent from the base part. The base part and the holding part may comprise connection means for electrically and mechanically connecting the holding part to the base part in a detachable fashion. For this, the holding part - in a connected state of the rack in which the holding part is connected to the base part - is arranged on a top side of a housing of the base part, wherein the connection means of the base part are arranged on said top side.

The connection means may in one embodiment be formed by at least one first connection element of the base part and at least one second connection element of the holding part, the connection elements being constituted to establish a mechanical connection for mechanically fixing the base part to the holding part and an electrical connection for electrically connecting the base part to the holding part. This is based on the idea to use a single connection element to both establish a mechanical connection and an electrical connection between the base part and the holding part to be attached to the base part of the rack. The base part, for this purpose, comprises a first connection element which can be engaged with a second connection element of the holding part, wherein one of the first connection element and the second connection element may be a male connector and the other of the first connection element and the second connection element may be a female connector, the male connector being engagable into the female connector.

Via a single pair of connection elements of the base part and the holding part, hence, the holding part can be both electrically and mechanically fixed to the base part. The first connection element of the base part serves to hold and fix the holding part to the base part such that the attachment of the holding part to the base part mechanically is provided via the first connection element. In addition, the first connection element also establishes the electrical connection between the holding part and the base part, wherein the electrical connection may include both a power connection for supplying the holding part with electric power and a communication link for establishing a communication connection between the holding part and the base part.
The first connection element of the base part herein may be shaped either as a connection cone protruding from a housing of the base part to engage with a connection opening of the second connection element of the holding part or as a connection opening to engage with a connection cone of the second connection element of the holding part. In the first case the first connection element of the base part represents a male connector in the shape of a connection cone to engage with a female connector on the side of the holding part. In the second case the first connection element of the base part is a female connector into which a male connector on the side of the holding part can be inserted. In general, there is no functional difference whether the male connector is arranged on the base part and the female connector on the holding part or vice versa.

The first connection element of the base part and the second connection element of the holding part may establish both a mechanical connection and an electrical connection. To ensure that the holding part is securely held on the base part, the first connection element and the second connection element may in addition comprise mechanical locking means for mechanically locking the at least one first connection element of the base part to the second connection element of the holding part. For this, the first connection element of the base part, as a mechanical locking means, may for example comprise a groove to engage with at least one engagement element of the second connection element of the holding part. Vice versa, it is also possible that the first connection element of the base part comprises at least one engagement element to engage with a groove of the second connection element of the holding part.

The one engagement element may for example be a ball arranged on the associated connection element, which may be brought into engagement with the groove on the other connection element, such that the mechanical connection between the first connection element and the second connection element is locked once the ball engages the groove.

The at least one engagement element in the shape of a ball for example may be arranged on the associated connection element in a pretensioned manner, such that the connection elements of the base part and the holding part may be attached to each other and the at least one engagement element snaps into engagement with the groove once the connection elements are plugged fully into each other. The at least one engagement element may then be locked in its engaging position such that the connection of the connection elements cannot be released without releasing the locking.

In a further embodiment the holding part may comprise a handle for carrying the holding part after having detached the holding part from the base part. The handle may be
pivotable with respect to a body of the holding part such that the handle may be moved into a position in which the holding part can easily be carried when moving a patient. Further, the pivotable handle may also serve to trigger a locking or unlocking of the connection of the holding part to the base part or to a stand in that - dependent on a pivot position of the handle - a mechanical connection between the holding part on the one hand and the base part or the stand on the other hand is locked or unlocked.

For example, the handle may be constituted to be in a rest position when the holding part is connected and fixed to the base part. When the holding part shall be detached from the base part, the handle is manually moved into a move position which at the same time causes the mechanical connection of the holding part to the base part to be unlocked such that the holding part can be detached and separated from the base part.

As stated above, the functional separation of the rack into two parts, namely the holding part and the base part, causes the base part to contain all major electronic devices of the rack (in particular the communication means and the power supply unit). To maintain operation of the medical devices, in particular the infusion pumps, when detaching the holding part from the base part and carrying the holding part along with the patient, each medical device may carry its own battery such that at least for a limited period of time the medical devices can uphold operation. In addition, it may be advantageous to also include a battery into the holding part such that an additional electric energy source is provided to secure and prolong operation of the medical devices.

Further, the holding part may comprise a wireless communication interface for wirelessly communicating with the base part and/or an external communication network. The wireless communication interface may provide communication, at least to a basic level including essential information and control commands, between the holding part with its attached communication devices and the base part and/or the external network even when the holding is detached from the base part and carried along with a patient separately from the base part. The wireless communication interface for example may be implemented as a wireless local area network (WLAN) connection or a so called bluetooth connection or the like.

The base part may comprise at least one power interface for connection with an external power supply and at least one communication interface for connection with an external communication network and/or external periphery devices. The base part preferably includes all wire-based connection terminals and ports such as a USB connection, a network connection such as an Ethernet / local area network (LAN) connection, a printer
connection, a connection for a barcode reader, a monitor connection, a power line connection or the like. Thus, when detaching the holding part from the base part to move the medical devices attached to the holding part, all lines can remain in place, and the holding part can be moved without having to unplug the lines from the base part.

The idea of the invention shall subsequently be described in more detail according to the embodiments shown in the figures. Herein,

Fig. 1 shows a schematic overview of a rack for holding medical devices, in particular infusion pumps, being placed at a bedside of a patient;

Fig. 2 shows a perspective overview of a rack comprising a base part and a holding part detachably connected to the base part;

Fig. 3A shows a schematic view of the holding part and the base part connected to each other in a normal state of use of the rack;

Fig. 3B shows a schematic view of the holding part and the base part in a detached state;

Fig. 4 shows a schematic view illustrating circuitry of the base part and the holding part;

Fig. 5 shows a schematic view of the holding part and the base part in a normal state of use of the rack, the holding part including a fastening means for attaching a fluid container to the holding part;

Fig. 6 shows a perspective view of the holding part comprising a number of first connection elements to be engaged with a second connection element of a medical device;

Fig. 7 shows a perspective view of a first connection element in the shape of a male connector and a second connection element in the shape of a female connector in a detached fashion;

Fig. 8 shows a partially cut view of a first connection element on the side of the rack attached to a second connection element on the side of the medical device.
Fig. 1 shows in a schematic drawing a scenario as it typically can be found in a hospital environment, for example an intensive care unit of a hospital. Next to the bed B of a patient a number of medical devices 2 constituted as infusion pumps, such as syringe pumps or volumetric pumps, are located and connected to a patient via infusion lines 42.

Such medical devices 2 serve to administer a fluid such as medication or nutrients for example contained in containers 4 via infusion lines 42 to the patient, such infusion lines 42 (especially in the environment of an intensive care unit of a hospital) possibly being vital to the patient such that they under all conditions must remain connected to the patient to ensure the required administration of medication, nutrients or the like.

Typically, such medical devices 2 constituted as infusion pumps are organized in a rack 1 to form a vertical stack of medical devices 2 which is fixed for example to a stand 3. The stand 3 may comprise wheels such that the stand 3 at least to some extent is movable with respect to the patient's bed B or together with the patient's bed B. The stand 3 may have the shape of a post to which the rack 1 for carrying the medical devices 2 is attached and comprises, at its top end, fastening means 31 in the shape of hooks to fasten a number of containers 4 containing medication or nutrients or other fluids to be administered to the patient.

The rack 1 serves to arrange the medical devices 2 in an organized fashion at the bedside of the patient. The rack 1 herein provides a power supply for the medical devices 2, ensures a secure and reliable fixation of the medical devices 2, and provides a communication of the medical devices 2 among each other and with an external communication network and with external periphery devices such as a nurse call, a printer, a computer, a monitor or the like.

Conventionally, the medical devices 2 can be fixed to the rack 1 and for this are mechanically and electrically connected to the rack 1 such that via the rack 1 each medical device 2 can be supplied with power and may communicate with other medical devices 2 and with external devices and/or an external communication network. The rack 1 hence serves as a communication spine providing a communication facility and an electric power supply and embedding the medical devices 2 into a hospital environment including a hospital communication network and a hospital management system.

By combining a number of medical devices 2 in the shape of infusion pumps the rack 1 provides a complex infusion system which in general is large and heavy. While this poses no problem when a patient remains stationary in for example an intensive care unit, this may be problematic when a patient must be moved for example to a different facility in a
hospital such as an X-ray examination facility. Since at least some of the infusion lines 42 may be vital to the patient and therefore must not be disconnected from the patient, the medical devices 2, namely the infusion pumps, must be moved together with the patient.

For this, two options exist. As a first option, the rack 1 in total may be moved together with the patient, for example by moving the stand 3 to which the rack 1 is attached. This however may not be easy since the rack 1 is heavy and due to its dimensions difficult to handle. Further, because a number of periphery devices in general are attached to the rack 1 and the rack 1 may be connected to an external communication network, for moving the rack 1 a number of lines such as a power line, a network connection or connecting cables to external periphery devices must be disconnected prior to moving the rack 1. A second option is to move the medical devices 2 without the rack 1. For this, the medical devices 2 are detached from the rack 1, and are placed for example on the bed B of the patient to be moved together with the bed B. Because the rack 1 stays behind and is not moved, the overall weight that must be moved is reduced. However, since the medical devices 2 are not connected to the rack 1 anymore, there is an inherent risk for the medical devices 2 to fall down or for infusion lines 42 to get disarranged and mixed up. Since at least some of the infusion lines 42 may be vital to the patient, a disruption of an infusion line 42 due to a medical device 2 falling down or due to a breakage of an infusion line 42 may have dramatic consequences for the patient.

To overcome these problems and to provide a third option for moving medical devices 2 (in particular infusion pumps) together with a patient, according to the instant invention a rack 1 is provided which comprises, as shown in Fig. 2 to 4, a base part 10 and a holding part 11 which is detachable from the base part 10.

Herein, the holding part 11 comprises a number of connection means in the shape of cone-shaped connection elements 111 arranged on a body (vertical column) 110 of the holding part 11. The holding part 11 may for example comprise four connection elements 111 for connecting four medical devices 2 in the shape of infusion pumps to the body (column) 110, yet other numbers of connection elements 111 such as six or eight being equally conceivable.

The base part 10, to which the holding part 11 is connected, comprises in a housing 100 a power supply unit 102 (see Fig. 4) and a communication means 107 and thus serves to provide a communication and power interface to external devices, an external communication network and an external power supply.
Hence, the rack 1 is functionally divided into two parts, namely the base part 10 and the holding part 11. The holding part 11 with its connection elements 111 herein serves for mechanically fixing and holding the medical devices 2 and does not comprise a large and heavy power supply unit (including a transformer) or extensive communication circuitry and interfaces for connecting external devices. In a particular embodiment, the holding part 11 may even comprise no power supply and communication electronics at all, but comprises only connecting lines for connecting external devices 2 to the circuitry of the base part 10.

The base part 10, in contrast, comprises all major electronic components that are necessary for providing communication and electric power to the medical devices 2 attached to the rack 1. In particular, the base part 10 comprises the power supply unit 102, in general including a transformer, and the communication means 107 (see Fig. 4). Further, the base part 10 comprises a number of communication ports 106 for connecting different periphery devices such as a nurse call, a barcode reader, a computer, a monitor, a printer or an external network or the like to the base part 10 and hence the rack 1. For this, different lines may be connected to the communication ports 106 which may for example be constituted as USB connections or Ethernet / LAN connections. The base part 10 further comprises a power connection 101 to which an external power line can be connected.

Thus, substantially all heavy electronic components are included in the base part 10. However, for example a battery 117 (see Fig. 4) and a wireless communication interface 118 may also be included into the holding part 11. The battery 117 herein serves as an auxiliary power supply for the medical devices 2 attached to the holding part 11, in particular in case the holding part 11 is disconnected from the base part 10. The wireless communication interface 118 may provide a wireless communication between the holding part 11 and the base part 10 or an external communication network such as a wireless local area network (WLAN). In essence, however, at least a major portion of the electronics is enclosed in the base part 10 such that the rack 1 only is fully functional when the holding part 11 is connected to the base part 10.

As indicated in Fig. 3A and 3B, the holding part 11 can be detached from the base part 10 to carry the holding part 11 together with medical devices 2 attached to the holding part 11 independent from the base part 10. Both the holding part 11 and the base part 10 herein comprise a fixing means, possibly constituted as a screw clamp, a spring-tensioned clamp or a hook, for fixing the holding part 11 and the base part 10 to the stand 3. To connect the holding part 11 to the base part 10 connection means 114, 115 on a
bottom side 110B of the holding part 11 and connection means 104, 105 on a top side
100T of the housing 100 of the base part 10 are provided which serve to mechanically
and electrically connect the holding part 11 to the base part 10. One connection means
104, 114 herein may be constituted to provide both a mechanical and electrical
connection, wherein the electrical connection includes a communication link as well as a
power supply connection. The other connection means 105, 115 may serve for providing
a mechanical connection only. (It is also conceivable that both connection means 104,
114, 105, 115 provide both an electrical connection and a mechanical connection.)

When detaching the holding part 11 from the base part 10, the fixing means 113 of the
holding part 11 is released from the stand 3 and the connections via the connection
means 104, 114, 105, 115 are disconnected. The holding part 11 comprises a handle 112
which, in the pivoting position shown in Fig. 3B, can be used to carry the holding part 11
together with the medical devices 2 attached thereto. The handle 112 is pivotably
connected to the body (column) 110 of the holding part 11 and may also cause a locking
or unlocking of the connection of the holding part 11 via the fixing means 113 to the stand
3 and/or via the connection means 104, 114, 105, 115 to the base part 10.

Namely, in a rest position as shown in Fig. 3A the handle 112 may cause the fixing
means 113 and the connection means 104, 114, 105, 115 to be locked such that the
holding part 11 cannot be detached from the base part 10 and the stand 3. When pivoting
the handle 112 into a move position as indicated in Fig. 3B, the fixing means 113 and the
connection means 104, 114, 105, 115 may be unlocked, such that the holding part 11 can
be detached from the base part 10 and the stand 3 and can be moved without the base
part 10 and the stand 3.

When moving the holding part 11 without the base part 10 and the stand 3, the medical
devices 2 attached to the holding part 11 may be power supplied by internal batteries of
the medical devices 2. In addition, electric power may be provided to the medical devices
2 via the battery 117 of the holding part 11 such that a continuous power supply of the
medical devices 2 is ensured over a sufficient period of time when the holding part 11 is
detached from the base part 10.

When the holding part 11 is detached from the base part 10, the holding part 11 may
communicate via the base part 10 via the wireless communication interface 118
establishing a connection to a wireless communication interface 108 of the base part 10
or an external communication network such as a wireless local area network (WLAN). Via
the wireless communication interface 118, thus, a basic communication for the holding
part 11 with its attached medical devices 2 may be provided to communicate control commands to the medical devices 2 or to exchange alerts or measurement values between an external network and/or the base part 10 and the medical devices 2 attached to the holding part 11.

By moving the holding part 11 together with the attached medical devices 2 without the base part 10 and the stand 3 the weight of the arrangement to be moved is substantially reduced compared to moving the full rack 1, and because the dimensions of the holding part 11 are small compared to the full rack 1 and the stand 3, the handling of the holding part 11 with the attached medical devices 2 is simplified compared to the handling of the full rack 1. Further, no lines must be disconnected when moving the holding part 11 since all lines can remain connected to the base part 10. In addition, the medical devices 2 remain in an organized fashion on the holding part 11 and via the holding part 11 may for example be attached to a bed B (for example by using the fixing means 113) to be moved in an easy way together with the bed B.

When moving the medical devices 2, in particular when they are constituted as volumetric infusion pumps, containers 4 containing a fluid such as medication or nutrients or the like to be administered to a patient must be moved together with the medical devices 2.

Hence, in an embodiment shown in Fig. 5 the holding part 11 comprises a fastening means 116, possibly including one or multiple hooks, for fastening one or multiple containers 4 such as bottles or bags to the holding part 11 such that the containers 4 may easily be moved together with the holding part. The fastening means 116 may have the shape of a post protruding vertically from the body 110 of the holding part 11 and carrying one or multiple hooks.

In summary, by functionally dividing the rack 1 into a holding part 11 and a base part 10 within the embodiments of Fig. 1 to 5 the rack 1 is divided into two parts, one of which (namely the holding part 10) carries, if at all, a very limited electronic circuitry and the other (namely the base part 10) carries all or at least a major portion of the electronics. In particular, all external communication interfaces and power line connectors are included in the base part 10, and the power supply and communication interfacing to the holding part 11 is provided via the base part 10.

With reference to Fig. 6 to 8 subsequently the connection elements 111 of the rack 1 providing connection means to connect a medical device 2 to the holding part 11 of the rack 1 shall be explained in detail.
As visible in Fig. 6, on a protruding section 110P of the holding part 11 four (first) connection elements 111 - spaced apart along the protruding section 110P - are arranged each of which is constituted to engage with a (second) connection element 211 arranged within an indentation 210 on a backside of a housing 21 of a medical device 2.

The medical device 2, constituting an infusion pump such as a syringe pump or a volumetric pump, can be attached to the rack 1 by plugging the second connection element 211 in an engagement direction E onto the first connection element 111 on the holding part 11 of the rack. For this, the medical device 2 can be grabbed on a handle 22 and can be attached to the rack 1 in the engagement direction E until the first connection element 111 of the rack 1 fittingly engages the second connection element 211 of the medical device 2.

The first connection element 111 and the second connection element 211 provide connection means which serve for establishing both a mechanical connection and an electrical connection between the rack 1 and the medical device 2. In the exemplary embodiment of Fig. 6 to 8 the first connection element 111 of the holding part 11 of the rack 1 is shaped as a male connector to be engaged with the second connection element 211 on the side of the medical device 2 in the shape of a female connector.

Although the connection elements 111, 211 will subsequently be described with reference to the connecting of a medical device 2 to the holding part 11 of the rack 1, it is to be noted that identical or at least similar connection elements can also be used to form the connection means 104, 114, 105, 115 for attaching the holding part 1 to the base part 10. In particular, the base part 10 may comprise a first connection element and the holding part 11 may comprise a second connection element, the first and the second connection element being constituted to establish a mechanical connection for mechanically fixing the holding part 11 to the base part 10 and an electrical connection for electrically connecting the holding part 11 to the base part 10.

As visible from Fig. 7, the first connection element 111 comprises a connection cone 111.0 which fittingly may be inserted into a connection opening 211.0 of the second connection element 211. On the connection cone 111.0 of the first connection element 111 four electrical contacts 111.1 are arranged, which in a connected state of the first connection element 111 and the second connection element 211 are electrically contacting four electrical contacts 211.1 on a wall 211.5 of the second connection element 211. The electrical contacts 111.1 of the first connection element 111 as well as the electrical contacts 211.1 of the second connection element 211 are spaced evenly (90°) apart about a rotational axis of symmetry A pointing along the engagement direction
E and forming a rotational symmetry axis of the connection cone 111.0 as well as of the engagement opening 211.0.

As can be seen from the partially cut view of Fig. 8, the electrical contacts 211.1 are arranged on the wall 211.5 of the second connection element 211 in a pretensioned manner, wherein the electrical contacts 211.1 can be moved by some distance perpendicularly to the engagement direction E. For pretensioning the electrical contacts 211.1, for example a spring is provided for each electrical contact 211.1 asserting a pretensioning force perpendicularly to the engagement direction E in a direction pointing radially inwards onto the associated electrical contact 211.1.

When connecting the second connection element 211 to the first connection element 111 by inserting the connection cone 111.0 into the connection opening 211.0, the electrical contacts 211.1 of the second connection element 211 slidingly get in touch with the electrical contacts 111.1 of the first connection element 111 and are slightly pushed outwards in the radial direction, such that the electrical contacts 211.1 of the second connection element 211 abut the electrical contacts 111.1 of the first connection element under an elastic pretension.

Because the electrical connection is established by slidingly bringing the electrical contacts 211.1 of the second connection element 211 into contact with the electrical contacts 111.1 of the first connection element 111, at the time of establishing the electrical connection also a cleaning of the contacts 111.1, 211.1 due to the sliding movement of the electrical contacts 111.1, 211.1 with respect to each other is achieved.

At the tip of the connection cone 111.0 of the first connection element 111 a groove 111.2 having a toric shape is arranged which serves to establish a mechanically locked connection to fix the first connection element 111 in a secure manner to the second connection element 211. For this, four engagement elements 211.2 in the shape of balls are arranged on the wall 211.5 of the second connection element 211, the engagement elements 211.2 engaging the groove 111.2 in the connected state of the first connection element 111 and the second connection element 211 as visible in the partially cut view of Fig. 8.

The engagement elements 211.2 in the shape of balls are, similar to the electrical contacts 211.1, arranged in an elastically pretensioned manner on the wall 211.5. For this, an elastic spring may be associated with each engagement element 211.2.
pretensioning the engagement element 211.2 perpendicularly to the engagement direction E in a direction pointing radially inwards.

When the connection cone 111.0 of the first connection element 111 is fittingly brought into engagement with the connection opening 211.0 of the second connection element 211, the engagement elements 211.2 in the shape of the balls are first pressed elastically outwards, until they - under the action of the pretensioning springs - snap into engagement with the groove 111.2 of the first connection element 111.

As visible in Fig. 8, in the connected state a front side 111.4 of the connection cone 111.0 abuts a pin 211.4 arranged on a backside of the connection opening 211.0. Through a pushing action onto the pin 211.4 when inserting the connection cone 111.0 into the connection opening 211.0, a locking device 211.6 (shown only in principle in Fig. 8) is actuated causing the engagement elements 211.2 to be locked in their engagement position engaging the groove 111.2 of the first connection elements 111. Because of the locking of the engagement elements 211.2 in their engagement position the second connection element 211 cannot be detached (without an unlocking actuation of the locking device 211.6) from the first connection element 111 such that the second connection element 211 (and with it the medical device 2) in a secure and reliable manner is held at the first connection element 111 (and hence at the rack 1).

As visible in Fig. 6, on the housing 21 of the medical device 2 an unlocking button 23 may be arranged which can be actuated for releasing the locking device 211.6 and, hence, for taking the medical device 2 of the rack 1.

The medical device 2, in the embodiment shown in Fig. 6 to 8, may be attached to the rack 1 in two different engagement positions, the one engagement position corresponding to the other engagement position when turning the medical device by 180° about the engagement direction E. The medical device 2, as indicated by the arrow in Fig. 6, can be turned about the engagement direction E by 180° and can be connected to the rack 1 via the same connection elements 111, 211 achieving functionally the same mechanical and electrical connection.

As visible from Fig. 7, when turning the second connection element 211 by 180° about the engagement direction E with respect to the first connection element 111, all four electrical contacts 111.2, 211.2 of one connection element 111, 211 will abut electrical contacts 111.2, 211.2 on the other connection element 111, 211. wherein an appropriate electrical switching circuitry may provide for a desired functionality of the electrical
connection (for example to provide a power connection and a communication link) independent on the engagement position of the medical device 2.

As visible from Fig. 7 and Fig. 8, the first connection element 111 and the second connection element 211 each comprise an additional communication port 111.3, 211.3, possibly constituted as an infrared (IRDA) communication port for providing an additional communication link between the connection elements 111, 211.

Into the communication port 111.3 of the first connection element 111 in addition a detection device may be integrated serving to detect whether a medical device 2 is attached to the respective connection element 111. The detection device may for example be a Hall sensor or a micromechan switch detecting the presence of a second connection element 211 on the first connection element 111.

A detection device of this kind may be used to detect whether a medical device 2 is connected to a particular connection element 111 of the rack 1 or not. The detection device 111.3 further may be used to detect whether a mechanical and electrical connection between the second connection element 211 and the first connection element 111 is established in a functionally correct manner. According to a detection signal of the detection device, then, a communication between the medical device 2 attached to the respective connection element 111 of the rack 1 and the rack 1 may be initiated (if a medical device 2 is connected to the respective first connection element 111) or terminated (if a medical device 2 is disconnected from the respective first connection element 111).

With connection means as they are described here on the one hand an easy and secure mechanical fixing and positioning of a medical device 2 on a rack 1 may be achieved and on the other hand electric power may be supplied to a medical device 2 and a communication link may be established. The connection elements 111, 211 herein may provide for a detection of a medical device 2 on a rack 1, and may provide a beneficial cleanability. Because for connecting a medical device 2 to the rack 1 the medical device 2 with its connection element 211 merely needs to be plugged to a connection element 111 of the rack 1 thus establishing in a single step both the electrical connection and the mechanical connection via a single connection element 111 of the rack 1, the handling of the medical device 2 for connecting it to the rack 1 is easy and safe.
List of Reference Numerals

1    Rack
10   Base part
100  Housing
100T Top side
101  Power connection
102  Power supply unit
103  Fixing means (Clamp)
104, 105 Connection means
106  Communication ports
107  Communication means
108  Wireless communication interface
11   Holding part
110  Body (column)
110B Bottom side
110P Protruding section
111  First connection element (male connector)
111.0 Connection cone
111.1 Contact
111.2 Groove
111.3 Communication port
111.4 Front side
112  Handle
113  Fixing means (Clamp)
114, 115 Connection means
116  Fastening means
117  Battery device
118  Wireless communication interface
2    Medical devices
21   Housing
210  Indentation
211  Second connection element (female connector)
211.0 Connection opening
211.1 Contact
211.2 Engagement device (ball)
211.3 Communication port
<table>
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<td>211.6</td>
<td>Locking device</td>
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<td>22</td>
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<tr>
<td>3</td>
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<tr>
<td>31</td>
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<tr>
<td>42</td>
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<tr>
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<td>Bed</td>
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<tr>
<td>E</td>
<td>Engagement direction</td>
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Claims:

1. A rack (1) for holding a plurality of medical devices (2), the rack (1) comprising:
   - a plurality of connection means (111) for connecting the plurality of medical devices (2) to the rack (1),
   - a power supply unit (102) for providing electric power to the plurality of medical devices (2) and
   - a communication means (107) for providing a communication link for the medical devices,

characterized in that

the rack (1) comprises a base part (10) and a holding part (11) which is detachable from the base part (10), wherein the base part (10) includes the power supply unit (102) and the communication means (107) of the rack (1) and the holding part (11) includes the plurality of connection means (111) for connecting the plurality of medical devices (2) to the rack (1).

2. The rack (1) according to claim 1, characterized in that the medical device (2) is an infusion pump, in particular a syringe pump or a volumetric pump.

3. The rack (1) according to claim 1 or 2, characterized in that the rack (1) comprises fixing means (103, 113) for fixing the rack on a stand (4).

4. The rack (1) according to one of claims 1 to 3, characterized in that the base part (10) and the holding part (11) comprise connection means (104, 105, 114, 115) for electrically and mechanically connecting the holding part (11) to the base part (10) in a detachable fashion.

5. The rack according to claim 4, characterized in that the holding part (11) - in a connected state of the rack (1) in which the holding part (11) is connected to the base part (10) - is arranged on a top side (100T) of a housing (100) of the base part (10),
wherein the connection means (104, 105) of the base part (10) are arranged on the top side (100T).

6. The rack according to claim 4 or 5, characterized in that the connection means are formed by at least one first connection element (111) of the base part (10) and at least one second connection element (211) of the holding part (11), the connection elements (111, 211) being constituted to establish a mechanical connection for mechanically fixing the base part (10) to the holding part (11) and an electrical connection for electrically connecting the base part (10) to the holding part (11).

7. The rack (1) according to claim 6, characterized in that the at least one first connection element (111) of the base part (10) is shaped as
   - either a connection cone (111.0) protruding from a housing (100) of the base part (10) to engage with a connection opening (211.0) of the second connection element (211) of the holding part (11)
   - or a connection opening to engage with a connection cone of the second connection element (211) of holding part (11).

8. The rack (1) according to claim 6 or 7, characterized in that the at least one first connection element (111) of the base part (10) comprises a mechanical locking means (111.2) for mechanically locking the at least one first connection element (111) of the base part (10) to the second connection element (211) of the holding part (11).

9. The rack (1) according to claim 8, characterized in that the mechanical locking means (111.2) is formed by
   - a groove (111.2) to engage with at least one engagement element (211.2) of the second connection element (211) of the holding part (11) or
   - at least one engagement element to engage with a groove of the second connection element (211) of the holding part (11).
10. The rack (1) according to one of the preceding claims, characterized in that the holding part (11) comprises a handle (112) for carrying the holding part (11).

11. The rack (1) according to claim 10, characterized in that the handle (112) is pivotably connected to a body (110) of the holding part (11), wherein, dependent on a pivot position of the handle (112), a mechanical connection (105, 115; 113) for mechanically fixing the holding part (11) to the base part (10) and/or to a stand (3) is locked or unlocked.

12. The rack (1) according to one of the preceding claims, characterized in that the holding part (11) comprises a battery device (117).

13. The rack (1) according to one of the preceding claims, characterized in that the holding part (11) comprises a wireless communication interface (118) for wirelessly communicating with the base part (10) and/or an external communication network.

14. The rack (1) according to one of the preceding claims, characterized in that the base part (10) comprises at least one power interface (101) for connection with an external power supply and at least one communication interface (106) for connection with an external communication network and/or external periphery devices.
FIG 9A

Direct Connection

TX High Speed Differential Data
+ Power

RX High Speed Differential Data
- Power

FIG 9B

Reverse Connection

RX High Speed Differential Data
- Power

TX High Speed Differential Data
+ Power
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61G12/00 A61G13/10 A61M5/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61G A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>X</td>
<td>DE 40 30 368 Cl (B. BRAUN MELSUNGEN) 14 November 1991 (1991-11-14) col umn 3 - col umn 5 figures</td>
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Further documents are listed in the continuation of Box C.

Date of the actual completion of the international search 14 September 2012

Date of mailing of the international search report 28/09/2012

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Authorized officer
Edlauer, Martin

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is taken in combination with one or more other such documents, such combination being obvious to a person skilled in the art
"Z" document member of the same patent family
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