(54) ANALYZER AND METHOD FOR LOADING A RACK INTO A RACK SLOT OF AN ANALYZER

An analyzer (100) is disclosed. The analyzer (100) comprises a rack slot (102) configured to receive at least one rack (104), wherein the rack slot (102) comprises a front end (106), at which the rack (104) is manually loadable into the rack slot (102), and a rear end (108), which is opposite to the front end (106) and at which the rack (104) is fully receivable in the rack slot (102), and a spring device (112) arranged at the rear end (108), wherein the spring device (112) is configured to provide a biasing force towards the front end (106), wherein the biasing force is adapted to move the rack (104) towards the front end (106) if not fully received in the rack slot (102), wherein the spring device (112) is configured to fix the rack (104) in a final position if the rack (104) is fully received in the rack slot (102).

Further, a method for loading a rack (104) into a rack slot (102) of an analyzer (100) and a system (136) comprising an analyzer (100) and a computer controller (138) are disclosed.
The present invention relates to an analyzer and a method for loading a rack into a rack slot of an analyzer.

Related art

Modern analyzers are based on automated sample processing systems that permit high throughput specimen processing. Such systems not only permit greatly increased sample processing throughput but also decrease the number of samples that cannot be analyzed, decrease the manual labor and allow for productive use of an operator's "walk away time" during sample processing. Such analyzers usually comprise a rack slot into which a rack may be inserted, wherein the rack comprises a plurality of sample vessels such as sample tubes.

EP 0 738 541 B1 describes an analyzer comprising a plurality of rack slots into which racks holding a plurality of sample vessels may be inserted.

When racks are loaded into an analyzer, a barcode reader is often used for identifying the rack ID, position ID and sample ID. A lock or sensor is required to trigger the bar code reader or to keep the rack in its final position.

Using such automated analyzers provides advantages concerning the handling. Nevertheless, there are still some drawbacks. Such analyzers are cost intensive and they miss robustness against frequent manual loading processes. Thus, user convenience is not sufficient.

According to the present invention, an analyzer comprises a rack slot configured to receive at least one rack, wherein the rack slot comprises a front end, at which the rack is manually loadable into the rack slot, and a rear end, which is opposite to the front end and at which the rack is fully receivable in the rack slot, and a spring device arranged at the rear end, wherein the spring device is configured to provide a biasing force towards the front end, wherein the biasing force is adapted to move the rack towards the front end if not fully received in the rack slot, wherein the spring device is configured to fix the rack in a final position if the rack is fully receivable in the rack slot.

As the spring device fixes the rack in the final position, a robust positioning of the rack is provided. Further, unless the rack is in the final position, the spring device is configured to push the rack rearwards, i.e. towards the front end. Thus, the spring device gives a kind of mechanically feedback whether the rack is completely or correctly inserted in the rack slot or not. Thereby, a premature and incorrect starting of an analyzing process of samples provided in the rack is prevented.

The rack slot may be configured such that the rack is moveable between the front end and the rear end in a longitudinal direction. Thus, in order to move the rack into the final position, the rack merely has to be linearly moved against the biasing force of the spring device. Thereby, the risk of incorrectly inserting the rack is minimized.

The rack slot may comprise an elastic snap fit device configured to engage the rack if the rack is in the final position. Thus, the fixation of the rack in the final position is facilitated.

The spring device may be configured to fix the rack in the final position by means of pushing the rack against the snap fit device. By pushing the rack against the snap fit device, the spring device ensures an exact positioning of the rack at the final position. Particularly, the rack may not deviate from its position during an analyzing process such that any interruptions of the analyzing process due to a positional shift are avoided.

The snap fit device may be configured to engage a depression on a lower side of the rack. Thus, by means of a simple positive fit, the positioning of the rack at the final position is ensured.

The rack slot may comprise a sliding surface on which the rack is slidable moveable between the front end and the rear end, wherein the snap fit device may be located at the sliding surface. Thus, the snap fit device may engage the rack along a path being as short as technically possible.

The snap fit device may be moveable between a protruded position, in which the snap fit device protrudes from the sliding surface for engaging the lower side of the rack if the rack is in the final position, and a retracted position, in which the snap fit device does not protrude from the sliding surface, if the rack is loaded into the rack slot and not in the final position. Thus, engaging the lower side by the snap fit device is provided by protruding from the sliding surface and disengaging is provided by not protruding from the sliding surface.

Particularly, unless the rack is in the final position, the lower side of the rack presses the snap fit device downwards in the retracted position such that the snap fit device does not obstruct the inserting or loading of the rack into the rack slot.

The snap fit device may be arranged adjacent the front end. As the distance between the front end and the rear end corresponds to at least a length of the rack, the rack may be pushed by the spring device against the snap fit device with almost the complete length thereof.

The analyzer may further comprise a bar code reader for reading a rack identification, a position identification, an identification of a sample, reagent or consumable provided in the rack and/or a compartment identification of the rack. Thus, the analyzer is configured to obtain different information directly or indirectly associated with the rack by means of the bar code reader as bar codes are commonly used with racks, samples stored therein and the like.

The analyzer may further comprise a sensor configured to detect whether the rack is in the final position. Such a construction allows to initiate any analyzing process.
process only in case the rack is completely and correctly inserted into the rack slot.

[0017] The sensor may be configured to trigger a reading process of the bar code reader. Thus, the bar code reader is only activated if the sensor indicates that the rack is completely and correctly inserted into the rack slot. Thereby, any potential reading errors are prevented. Further, energy may be saved if the bar code reader is not permanently activated.

[0018] The sensor may be arranged adjacent the rear end. Thus, the sensor is close to the final position which facilitates the detection process.

[0019] The sensor may be configured to detect whether the rack is in the final position by means of detecting a compressed state of the spring device. Thus, the spring device indicates the final position of the rack if the spring device is compressed. Such a compressed state of a spring is easily to detect for a sensor.

[0020] The sensor may be a light barrier. Thus, it is possible to detect whether the rack is in the final position or not by means of a well established technical device, which facilitates the installation of the sensor.

[0021] The spring device may comprise a plunger and a plunger rod moveable together with the spring device. The light barrier may be configured to detect the compressed state of the spring device by means of detecting the plunger rod. Thus, depending on whether the plunger rod is detected or not, the sensor is capable to indicate whether the rack is in the final position or not.

[0022] The light barrier may comprise a light emitter and a light receiver. The light emitter may be configured to emit light on a light path towards the light receiver. The light barrier may be configured to detect the plunger rod if the light receiver is not capable of receiving light from the light emitter. Thus, if the light receiver does not receive light, the sensor indicates that the rack is in the final position. Accordingly, by means of a simple construction, the correct and complete insertion the rack into the rack slot may be detected.

[0023] The plunger rod may be moveable such that the light path is interruptible. Thus, an interruption of the light path indicates the final position of the rack and if the plunger rod exposes the light path, this indicates that the rack is not fully received in the rack slot.

[0024] The light barrier may be configured to trigger the reading process of the bar code reader if the light barrier detects that the rack is in the final position. Thus, the bar code reader is only activated if the sensor indicates that the rack is completely and correctly inserted into the rack slot. Thereby, any potential reading errors are prevented. Further, energy may be saved if the bar code reader is not permanently activated. Accordingly, a user friendly loading of a rack into the rack slot of the analyzer is provided.

[0025] According to the present invention, a method for loading a rack into a rack slot of an analyzer comprises

- manually loading a rack at the front end of the rack slot,
- manually moving the rack to the rear end of the rack slot against the biasing force of the spring device,
- fixing the rack in the final position by means of the spring device when the rack is fully received in the rack slot.

[0026] Thus, a robust and user friendly loading concept is provided.

[0027] The rack may be engaged by an elastic snap fit device when the rack is in the final position. Thus, the fixation of the rack in the final position is facilitated.

[0028] The spring device may fix the rack in the final position by means of pushing the rack against the snap fit device. By pushing the rack against the snap fit device, the spring device ensures an exact positioning of the rack at the final position. Particularly, the rack may not deviate from its position during an analyzing process such that any interruptions of the analyzing process due to a positional shift are avoided.

[0029] The snap fit device may engage a depression on a lower side of the rack. Thus, by means of a simple positive fit, the positioning of the rack at the final position is ensured.

[0030] The snap fit may protrude from a sliding surface of the rack slot for engaging the lower side of the rack when the rack is in the final position within the rack slot, wherein the snap fit device may not protrude from the sliding surface when the rack is loaded into the rack slot and not in the final position. Thus, engaging the lower side by the snap fit device is provided by protruding from the sliding surface and disengaging is provided by not protruding from the sliding surface. Particularly, unless the rack is in the final position, the lower side of the rack presses the snap fit device downwards in the retracted position such that the snap fit device does not obstruct the inserting or loading of the rack into the rack slot.

[0031] The method of the present invention may also comprise reading a rack identification, a position identification, an identification of a sample, reagent or consumable provided in the rack and/or a compartment identification of the rack by means of a bar code reader. Thus, the analyzer is configured to obtain different information directly or indirectly associated with the rack by means of the bar code reader as bare codes are commonly used with racks, samples stored therein and the like.

[0032] The method may further comprise detecting whether the rack is in the final position by means of a sensor. Thus, the method allows to initiate any analyzing process only in case the rack is completely and correctly inserted into the rack slot.

[0033] The sensor may trigger a reading process of the bar code reader. Thus, the bar code reader is only activated if the sensor indicates that the rack is completely and correctly inserted into the rack slot. Thereby, any potential reading errors are prevented. Further, energy may be saved if the bar code reader is not permanently activated.
The sensor may detect whether the rack is in the final position by means of detecting a compressed state of the spring device. Thus, the sensor indicates the final position of the rack if the spring device is compressed. Such a compressed state of a spring is easily to detect for a sensor.

The sensor may be a light barrier and may comprise a light barrier and a light receiver, wherein the light barrier may emit light on a light path towards the light receiver, wherein the sensor may detect the plunger rod if the light receiver does receive light from the light barrier. Thus, if the light receiver does not receive light, the sensor indicates that the rack is in the final position. Accordingly, in a simple manner, the correct and complete insertion the rack into the rack slot may be detected.

The plunger rod may be moved such that the light path is interrupted when the rack is in the final position. Thus, an interruption of the light path indicates the final position of the rack and if the plunger rod exposes the light path, this indicates that the rack is not fully received in the rack slot.

The light barrier may trigger the reading process of the bar code reader if the light barrier detects that the rack is in the final position. Thus, the bar code reader is only activated if the sensor indicates that the rack is completely and correctly inserted into the rack slot. Thereby, any potential reading errors are prevented. Further, energy may be saved if the bar code reader is not permanently activated.

The computer controller may be configured to trigger the bar code reader if the rack is in the final position. Thus, the bar code reader is only activated if the sensor indicates that the rack is completely and correctly inserted into the rack slot. Thereby, any potential reading errors are prevented. Further, energy may be saved if the bar code reader is not permanently activated.

The system may further comprise a signalizing device configured to signalize a correct and/or incorrect loading of the rack. Thus, the system may provide a feedback of the loading process to an user.

The analyzer may comprise a sensor configured to signalize a correct and/or incorrect loading of the rack. Thus, the analyzer may obtain a lot of information by means of the bar code reader and the computer controller. Particularly, the computer controller may handle the information provided by the bar code reader.

The computer controller may be configured to trigger the bar code reader if the rack is in the final position. Thus, the bar code reader is only activated if the sensor indicates that the rack is completely and correctly inserted into the rack slot. Thereby, any potential reading errors are prevented. Further, energy may be saved if the bar code reader is not permanently activated.

The system may further comprise a signalizing device configured to signalize a correct and/or incorrect loading of the rack. Thus, the system may provide a feedback of the loading process to an user.

Thus, an exemplarily embodiment provides that the whole loading and unloading gets supervised with software. It checks whether the rack has been loaded correctly by comparing the scanned results versus the expected results. It buffers the read barcodes and compares the completeness of the content in case the end position has been reached. The signal of the light barrier needs to be stable for a defined interval to start the completeness check mentioned above. This enhances the user friendliness, as the loading gets more robust. The check for completeness is only been done at the end, thus the movement of the rack does not matter, i.e. if the rack gets loaded in front direction, moved backwards during the loading and moved forward again until the end position has been reached. The software may further check whether the correct slot, i.e. the expected or target slot, has been loaded by analyzing the light barrier feedback, as the light barrier is directly linked with the corresponding rack slot identification.

In case the light barrier gets deactivated after the loading process has been successfully completed, which means the rack got lifted and released from its snap fit position, the whole loading process gets invalid, and the user may be asked to load the rack again over the output means. In case the completeness check of the data buffer is not successful, e.g. missing data due to not correctly arranged sample barcodes or not read barcodes because of too fast rack movement of user, the reading process gets rejected, and the user may get informed via a touchscreen or other output means. Once the rack slots are loaded and the user triggers a safety lock of a cover of the analyzer via input means so as to close the analyzer, the reading of the barcode scanner gets terminated.

The concept described has foreseen one barcode scanner per single rack slot. However it is also possible to use the concept with one barcode scanner reading multiple rack slots. Based on the technical properties of the barcode scanner and depending on the arrangement of the components, an additional sensor per rack slot positioned at the very front of each rack slot may be required to adjust the focus of the barcode scanner to the corresponding rack slot reading distance. Hence, the
rack slot identification has to be identified before the rack gets read.

[0048] Summarizing the findings of the present invention, the following embodiments are disclosed:

Embodiment 1: Analyzer comprising a rack slot configured to receive at least one rack, wherein the rack slot comprises a front end, at which the rack is manually loadable into the rack slot, and a rear end, which is opposite to the front end and at which the rack is fully receivable in the rack slot, and a spring device arranged at the rear end, wherein the spring device is configured to provide a biasing force towards the front end, wherein the biasing force is adapted to move the rack towards the front end if not fully received in the rack slot, wherein the spring device is configured to fix the rack in a final position if the rack is fully received in the rack slot.

Embodiment 2: Analyzer according to embodiment 1, wherein the rack slot is configured such that the rack is moveable between the front end and the rear end in a longitudinal direction.

Embodiment 3: Analyzer according to embodiment 1 or 2, wherein the rack slot comprises an elastic snap fit device configured to engage the rack if the rack is in the final position.

Embodiment 4: Analyzer according to embodiment 3, wherein the spring device is configured to fix the rack in the final position by means of pushing the rack against the snap fit device.

Embodiment 5: Analyzer according to embodiment 3 or 4, wherein the snap fit device is configured to engage a depression on a lower side of the rack.

Embodiment 6: Analyzer according to embodiment 5, wherein the rack slot comprises a sliding surface on which the rack is slidably moveable between the front end and the rear end, wherein the snap fit device is located at the sliding surface.

Embodiment 7: Analyzer according to embodiment 6, wherein the snap fit device is moveable between a protruded position, in which the snap fit device protrudes from the sliding surface for engaging the lower side of the rack if the rack is in the final position, and a retracted position, in which the snap fit device does not protrude from the sliding surface if the rack is loaded into the rack slot and not in the final position.

Embodiment 8: Analyzer according to any one of claims 4 to 7, wherein the snap fit device is arranged adjacent the front end.

Embodiment 9: Analyzer according to any one of embodiments 1 to 8, further comprising a bar code reader for reading a rack identification, a position identification, an identification of a sample, reagent or consumable provided in the rack, and/or a compartment identification of the rack.

Embodiment 10: Analyzer according to embodiment 9, further comprising a sensor configured to detect whether the rack is in the final position.

Embodiment 11: Analyzer according to embodiment 10, wherein the sensor is configured to trigger a reading process of the bar code reader.

Embodiment 12: Analyzer according to embodiment 10 or 11, wherein the sensor is arranged adjacent the rear end.

Embodiment 13: Analyzer according to embodiment 12, wherein the sensor is configured to detect whether the rack is in the final position by means of detecting a compressed state of the spring device.

Embodiment 14: Analyzer according to embodiments 10 to 13, wherein the sensor is a light barrier.

Embodiment 15: Analyzer according to embodiment 14, wherein the spring device comprises a plunger and a plunger rod moveable together with the spring device, wherein the light barrier is configured to detect the compressed state of the spring device by means of detecting the plunger rod.

Embodiment 16: Analyzer according to embodiment 15, wherein the light barrier comprises a light emitter and a light receiver, wherein the light emitter is configured to emit light on a light path towards the light receiver, wherein the light barrier is configured to detect the plunger rod if the light receiver is not capable of receiving light from the light emitter.

Embodiment 17: Analyzer according to embodiment 16, wherein the plunger rod is moveable such that the light path is interruptible.

Embodiment 18: Analyzer according to any one of embodiments 11 to 17, wherein the light barrier is configured to trigger the reading process of the bar code reader if the light barrier detects that the rack is in the final position.

Embodiment 19: Method for loading a rack into a rack slot of an analyzer according to any one of embodiments 1 to 18, comprising

- manually loading a rack at the front end of the rack slot,
- manually moving the rack to the rear end of the
rack slot against the biasing force of the spring device,
- fixing the rack in the final position by means of the spring device when the rack is fully received in the rack slot.

Embodiment 20: Method according to embodiment 19, wherein the rack is engaged by an elastic snap fit device when the rack is in the final position.

Embodiment 21: Method according to embodiment 20, wherein the spring device fixes the rack in the final position by means of pushing the rack against the snap fit device.

Embodiment 22: Method according to embodiment 20 or 21, wherein the snap fit device engages a depression on a lower side of the rack.

Embodiment 23: Method according to embodiment 22, wherein the snap fit device protrudes from a sliding surface of the rack slot for engaging the lower side of the rack when the rack is in the final position within the rack slot, wherein the snap fit device does not protrude from the sliding surface when the rack is loaded into the rack slot and not in the final position.

Embodiment 24: Method according to any one of embodiments 20 to 23, further comprising reading a rack identification, a position identification, an identification of a sample, reagent or consumable provided in the rack, and/or a compartment identification of the rack by means of a bar code reader.

Embodiment 25: Method according to embodiment 24, further comprising detecting whether the rack is in the final position by means of a sensor.

Embodiment 26: Method according to embodiment 25, wherein the sensor triggers a reading process of the bar code reader.

Embodiment 27: Method according to embodiment 26, wherein the sensor detects whether the rack is in the final position by means of detecting a compressed state of the spring device.

Embodiment 28: Method according to embodiment 27, wherein the spring device comprises a plunger and a plunger rod moveable together with the spring device, wherein the light barrier detects the compressed state of the spring device by means of detecting the plunger rod.

Embodiment 29: Method according to embodiment 28, wherein the sensor is a light barrier comprising a light emitter and a light receiver, wherein the light barrier detects the plunger rod if the light receiver does receive light from the light emitter.

Embodiment 30: Method according to embodiment 29, wherein the plunger rod is moved such that the light path is interrupted when the rack is in the final position.

Embodiment 31: Method according to any one of embodiments 25 to 30, wherein the sensor triggers the reading process of the bar code reader if the sensor detects that the rack is in the final position.

Embodiment 32: System comprising an analyzer according to any one of embodiments 1 to 18 and a computer controller configured to supervise a loading process of a rack into the rack slot of the analyzer.

Embodiment 33: System according to embodiment 32, wherein the computer controller is configured to detect whether the rack is in the final position.

Embodiment 34: System according to embodiment 33, further comprising a signalizing device configured to signalize a correct and incorrect loading of the rack.

Embodiment 35: System according to embodiment 34, wherein the analyzer comprises a bar code reader for reading a rack identification, a position identification, an identification of a sample, a reagent or a consumable provided in the rack, and/or a compartment identification of the rack by means of a bar code reader.

Embodiment 36: System according to embodiment 35, wherein the sensor is configured to trigger the bar code reader if the rack is in the final position.

Embodiment 37: System according to any one of embodiments 32 to 36, wherein the analyzer comprises a sensor configured to detect whether the rack is in the final position.

Short description of the figures

[0049] Further features and embodiments of the invention are disclosed in more detail in the subsequent description of embodiments, preferably in conjunction with the dependent claims. Therein, the respective features are realized in an isolated fashion as well as in any arbitrary feasible combination as the skilled person may realize. The embodiments are schematically depicted in the figures. Therein, identical reference numbers refer to identical elements or functionally identical elements.

[0050] In the figures:
Figure 1 shows an enlarged view of an analyzer; Figure 2 shows a side view of a rack slot of the analyzer; Figure 3 shows a further side view of the rack slot; Figure 4 shows an enlarged view of detail A of Figure 3; Figure 5 shows an enlarged view of detail B of Figure 3; and Figure 6 shows a further enlarged view of detail B of Figure 3.

Detailed description of the embodiments

**[0051]** Figure 1 shows an enlarged view of an analyzer 100. The analyzer 100 comprises at least one rack slot 102. The rack slot 102 is configured to receive at least one rack 104. Basically, the rack 104 may be designed as described in EP 0 738 541 B1, the contents of which concerning the formation of the rack is incorporated herein by reference. The rack slot 104 comprises a front end 106, at which the rack 104 is manually loadable into the rack slot 102, and a rear end 108, which is opposite to the front end 106 and at which the rack 104 is fully receivable in the rack slot 102. The rack slot 102 is configured such that the rack 104 is movable between the front end 106 and the rear end 108 in a longitudinal direction. With other words, the rack slot 102 extends in a longitudinal direction from the front end 106 to the rear end 108. Thus, the rack slot 102 comprises a longitudinal shape with a length significantly greater than a width thereof. For this purpose, the rack slot 102 comprises a sliding surface 110 on which the rack 104 is slidably movable between the front end 106 and the rear end 108.

**[0052]** Figure 2 shows a side view of the rack slot 102. Figure 3 shows a further side view of the rack slot 102. Particularly, Figure 2 shows the rack 104 disposed at the front end 106 such that the rack 104 is not fully received in the rack slot 102. Figure 3 shows the rack 104 at the rear end 108 such that the rack 104 is fully received in the rack slot 102. With other words, Figure 3 shows the rack 104 being completely arranged in the rack slot 102 while one of its ends is located at the rear end 108.

**[0053]** The analyzer 100 further comprises a spring device 112. The spring device 112 is arranged at the rear end 108. The spring device 112 is configured to provide a biasing force towards the front end 106. The biasing force is adapted to move the rack 104 towards the front end 106 if the rack 104 is not fully received in the rack slot 102. Thus, the biasing force is adjusted by selecting an appropriate material and spring constant of the spring device 112 so as to overcome the weight force of the rack 104 and the frictional force of the rack 104 along the sliding surface 110. The spring device 112 is further configured to fix the rack 104 in a final position if the rack 104 is fully received in the rack slot 102 as will be described in further detail below.

**[0054]** Figure 4 shows an enlarged view of detail A of Figure 3. The rack slot 102 comprises an elastic snap fit device 114. The snap fit device 114 is configured to engage the rack 104 if the rack 104 is in the final position. As shown in Figure 4, the snap fit device 114 is configured to engage a depression 116 on a lower side 118 of the rack 104. For this purpose, the snap fit device 114 is moveable between a protruded position, in which the snap fit device 114 protrudes from the sliding surface 110 for engaging the lower side 118 of the rack 104 if the rack 104 is in the final position, and a retracted position in which the snap fit device 114 does not protrude from the sliding surface 110 if the rack 104 is loaded into the rack slot 102 and not in the final position. The spring device 112 is configured to fix the rack 104 in the final position by means of pushing the rack 104 against the snap fit device 114.

**[0055]** Figure 5 shows an enlarged view of detail B of Figure 3. Figure 6 shows a further enlarged view of detail B of Figure 3. Particularly, Figure 5 shows the spring device 112 in an expanded position when the rack 104 is not fully received in the rack slot 102 and Figure 6 shows the spring device 112 when the rack 104 is in the final position within the rack slot 102. As shown in Figures 5 and 6, the spring device 112 comprises a plunger 120 and a plunger rod 122. The plunger 120 and the plunger rod 122 may be integrally formed. The plunger 120 and the plunger rod 122 are moveable together with the spring device 112. For this purpose, the plunger 120 and the plunger rod 122 may be connected or fixed to the spring device 112. Below the plunger 120, the rack slot 102 comprises a stopper element 124 such as a screw configured to prevent an excessive movement of the plunger 120 towards the front end 106.

**[0056]** The analyzer 100 further comprises a sensor 126 configured to detect whether the rack 104 is in the final position. The sensor 126 is arranged adjacent to the rear end 108. Particularly, the sensor 126 is configured to detect whether the rack 104 is in the final position by means of detecting a compressed state of the spring device 112. For example, the sensor 126 is a light barrier 128. The light barrier 128 is configured to detect the compressed state of the spring device 112 by means of detecting the plunger rod 122. For this purpose, the light barrier 128 comprises a light emitter 130 and a light receiver 132. The light emitter 130 is configured to emit light on a light path towards the light receiver 132. With respect to the illustration of Figures 5 and 6, the light path is perpendicular to the drawing plane. The light barrier 128 is configured to detect the plunger rod 122 if the light receiver 132 is not capable of receiving light from the light emitter 130. Thus, the plunger rod 122 is moveable such that the light path is interruptible. Particularly, the plunger rod 122 is configured to be moved through a gap.
between the light emitter 130 and the light emitter 132. With other words, if the light receiver 132 receives light emitted from the light emitter 130, the light barrier 128 does not detect the plunger rod 122 as the light path is not interrupted thereby. To the contrary, if the light receiver 132 does not receive light emitted from the light emitter 130, the light barrier 128 detects the plunger rod 122 and the light path is interrupted thereby. Alternatively, the plunger rod 122 may comprise an orifice such as a slot through which light may pass. The orifice may be positioned at the plunger rod 122 such that the light emitted from the light emitter 130 may pass through the orifice and propagate to the light receiver 132 when the spring device 112 is in the compressed state and may not pass through the orifice when the spring device 112 is in the expanded state.

[0057] The analyzer 100 further comprises a bar code reader 134. The bar code reader 134 serves for reading a rack identification, a position identification, an identification of a sample, reagent or consumable provided in the rack 104, and/or a compartment identification of the rack 104. The light barrier 128 is configured to trigger the reading process of the bar code reader 134 and the light barrier 128 detects that the rack 104 is in the final position. With other words, the bar code reader 134 is exclusively activated if the rack 104 is correctly or fully received in the rack slot 102.

[0058] Hereinafter, a method for loading a rack 104 into the rack slot 102 of the analyzer 100 will be described. At the beginning of the method, an user initiates the loading process on an input means of the analyzer 100 such as the touchscreen. Thereby, a safety lock of a cover for the at least one rack slot 102 opens (not shown in detail). Then, the rack 104 is manually loaded at the front end 106 or the rack slot 102 such as by the user of the analyzer 100. With other words, the rack 104 is disposed on the sliding surface 110 at the front end 106 with an end of the rack 104 facing the rear end 108 of the rack slot 102. Thus, the rack 102 is disposed on the sliding surface 110 only with a portion of its lower side 118. This step is shown in Figure 2.

[0059] In this state, the snap fit device 114 does not protrude from the sliding surface 110 but is pressed downwards by the lower side 118 of the rack 104. Thus, the snap fit device 114 does not engage the depression 116. Further, as shown in Figure 5, the spring device 112 is in the expanded state and the plunger rod 122 does not interrupt the light path from the light emitter 130 to the light receiver 132. Thus, the light receiver 132 receives light emitted from the light emitter 130. Accordingly, the bar code reader 134 is not triggered. Then, the rack 104 is manually moved to the rear end 108 of the rack slot 102 against the biasing force of the spring device 112. With other words, the user of the analyzer 100 has to move the rack 104 with a force higher than the biasing force of the spring device 112 in order to allow the rack 104 to be moved to the rear end 108. Thereby, the spring device 112 is compressed.

[0060] If the rack 104 is fully received in the rack slot 102, the rack 104 is fixed in the final position by means of the spring device 112. Particularly, the spring device 112 pushes the rack 104 against the elastic snap fit device 114 which now protrudes from the sliding surface 110 and engages the depression 116. This state is shown in Figure 3. It is to be noted that if the rack 104 is not fully received in the rack slot 102, the spring device 112 pushes the rack 104 towards the front end 106 by means of the biasing force such that the user of the analyzer 100 receives a physical feedback that the rack 104 is not correctly inserted into the rack slot 102.

[0061] If the rack 104 is in the final position, the plunger rod 122 is moved integrally with the spring device 112 and interrupts the light path from the light emitter 130 to the light receiver 132. Thus, the light receiver 132 does not receive light emitted from the light emitter 130 and the light barrier 128 detects the compressed state of the spring device 112. Accordingly, the sensor 126 outputs a signal indicating that the rack 104 is correctly inserted in the rack slot 102. Thereby, the bar code reader 134 is triggered and the reading process thereof is initiated. Thus, the bar code reader 134 reads a rack identification, a position identification, an identification of a sample, reagent or consumable provided in the rack 104, and/or a compartment identification of the rack 104. To unload the rack 104, the user needs to lift the whole rack 104 to release it from the snap fit device 114. The spring device 112 expands and pushes the rack to the front end 106 such that the user may remove the rack from the rack slot 102. Once the snap fit has been overcome, the light barrier 128 may become deactivated.

[0062] Hereinafter, a further optional embodiment will be described. The further embodiment relates to a system 136 comprising the analyzer 100 and a computer controller 138 configured to supervise the loading process of the rack 104 into the rack slot 102 of the analyzer 100. Particularly, the computer controller 138 is configured to detect whether the rack 104 is in the final position. The sensor 126 may be connected to the computer controller 138. Further, the bar code reader 134 may be connected to the computer controller 138. The system 136 may further comprise a signalizing device 140 configured to signalize a correct and/or incorrect loading of the rack 104. The signalizing device 140 may be an acoustic device giving an acoustic feedback to the user. Alternatively, the signalizing device 140 may be a visual device such as the touchscreen giving a visual feedback to the operator of the analyzer 100. The method steps for loading the rack 104 into the rack slot 102 are identical to those describes before.

List of reference numbers

[0063]

100 analyzer
102 rack slot
Claims

1. Analyzer (100) comprising a rack slot (102) configured to receive at least one rack (104), wherein the rack slot (102) comprises a front end (106), at which the rack (104) is manually loadable into the rack slot (102), and a rear end (108), which is opposite to the front end (106) and at which the rack (104) is fully receivable in the rack slot (102), and a spring device (112) arranged at the rear end (108), wherein the spring device (112) is configured to provide a biasing force towards the front end (106), wherein the biasing force is adapted to move the rack (104) towards the front end (106) if not fully received in the rack slot (102), wherein the spring device (112) is configured to fix the rack (104) in a final position if the rack (104) is fully received in the rack slot (102).

2. Analyzer (100) according to claim 1, wherein the rack slot (102) is configured such that the rack (104) is moveable between the front end (106) and the rear end (108) in a longitudinal direction.

3. Analyzer (100) according to claim 1 or 2, wherein the rack slot (102) comprises an elastic snap fit device (114) configured to engage the rack (104) if the rack (104) is in the final position.

4. Analyzer (100) according to claim 3, wherein the spring device (112) is configured to fix the rack (104) in the final position by means of pushing the rack (104) against the snap fit device (114).

5. Analyzer (100) according to any one of claims 3 to 4, wherein the snap fit device (114) is arranged adjacent the front end (106).

6. Analyzer (100) according to any one of claims 1 to 5, further comprising a bar code reader (134) for reading a rack (104) identification, a position identification, an identification of a sample, reagent or consumable provided in the rack (104) and/or a compartment identification of the rack (104).

7. Analyzer (100) according to claim 6, further comprising a sensor (126) configured to detect whether the rack (104) is in the final position.

8. Analyzer (100) according to claim 7, wherein the sensor (126) is configured to trigger a reading process of the bar code reader (134).

9. Analyzer (100) according to claim 6 or 7, wherein the sensor (126) is arranged adjacent the rear end (108).

10. Analyzer (100) according to any one of claims 3 to 9, wherein the sensor (126) is configured to detect whether the rack (104) is in the final position by means of detecting a compressed state of the spring device (112).

11. Analyzer (100) according to claims 7 to 10, wherein the sensor (126) is a light barrier (128).

12. Analyzer (100) according to claim 11, wherein the spring device (112) comprises a plunger (120) and a plunger rod (122) movable together with the spring device (112), wherein the light barrier (128) is configured to detect the compressed state of the spring device (112) by means of detecting the plunger rod (122).

13. Method for loading a rack (104) into a rack slot (102) of an analyzer (100) according to any one of claims 1 to 12, comprising

- manually loading a rack (104) at the front end (106) of the rack slot (102),
- manually moving the rack (104) to the rear end (108) of the rack slot (102) against the biasing force of the spring device (112),
- fixing the rack (104) in the final position by means of the spring device (112) when the rack (104) is fully received in the rack slot (102).

14. System (136) comprising an analyzer (100) according to any one of claims 1 to 12 and a computer controller (138) configured to supervise a loading process of a rack (104) into the rack slot (102) of the analyzer (100).

15. System (136) according to claim 14, further comprising a signalizing device (140) configured to signalize
a correct and/or incorrect loading of the rack (104).
# EUROPEAN SEARCH REPORT

## DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
<th>Relevant to claim</th>
<th>CLASSIFICATION OF THE APPLICATION (IPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-----</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-----</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A,D</td>
<td>EP 0 738 541 B1 (HOFFMANN LA ROCHE [CH]) 16 January 2002 (2002-01-16) * column 6, line 34 - column 7, line 16; figures 1-16 *</td>
<td>1-15</td>
<td>G01N</td>
</tr>
</tbody>
</table>

The present search report has been drawn up for all claims.

---

**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
- **D**: document cited in the application
- **L**: document cited for other reasons
- **T**: theory or principle underlying the invention
- **E**: earlier patent document, but published on, or after the filing date
- **P**: non-written disclosure
- **O**: member of the same patent family, corresponding document

---

The Hague 4 October 2016 Cantalapiedra, Igor
This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on the European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-10-2016

<table>
<thead>
<tr>
<th>Patent document oiled in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>JP 2006275567 A</td>
<td>12-10-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2006216199 A1</td>
<td>28-09-2006</td>
</tr>
<tr>
<td>US 2006216198 A1</td>
<td>28-09-2006</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2008534924 A</td>
<td>28-08-2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2006245865 A1</td>
<td>02-11-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2006104616 A2</td>
<td>05-10-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69632366 D1</td>
<td>09-06-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69632366 T2</td>
<td>04-05-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69633532 D1</td>
<td>04-11-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69633532 T2</td>
<td>23-02-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1326077 A2</td>
<td>09-07-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 3880658 B2</td>
<td>14-02-2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP H0933540 A</td>
<td>07-02-1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 5720377 A</td>
<td>24-02-1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2817101 A1</td>
<td>18-05-2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 103250056 A</td>
<td>14-08-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 2638404 A1</td>
<td>18-09-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2013542450 A</td>
<td>21-11-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2016057316 A</td>
<td>21-04-2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2012118954 A1</td>
<td>17-05-2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2014175168 A</td>
<td>26-06-2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2012064940 A1</td>
<td>18-05-2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2173906 A1</td>
<td>20-10-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 59608575 D1</td>
<td>21-02-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES 2170178 T3</td>
<td>01-08-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP H08285859 A</td>
<td>01-11-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 5700429 A</td>
<td>23-12-1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1292815 A1</td>
<td>19-03-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2004123679 A1</td>
<td>01-07-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2008282814 A1</td>
<td>20-11-2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2014174208 A1</td>
<td>26-06-2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 0179085 A1</td>
<td>25-10-2001</td>
</tr>
</tbody>
</table>

For more details about this annex: see Official Journal of the European Patent Office, No. 1282
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 04-10-2016.

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

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

Patent documents cited in the description

• EP 0738541 B1 [0003] [0051]