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(54) **Method for controlling a treatment process for textile products and apparatus for treating textile products**

(57) The invention relates to a method for controlling a treatment process for textile products, preferably in an apparatus for treating textile products (1), wherein the treatment process comprises the step of ironing textile products in an ironing arrangement (1000) with at least one ironer (1200, 1300, 1400), wherein textile products are conveyed from an introduction side to a discharge side at a treatment speed and wherein a treatment pressure, and preferably a treatment temperature, is applied to the textile products and wherein the method for controlling comprises the step of controlling the treatment speed, treatment temperature, treatment pressure and/or further treatment process parameters and/or the operation of further elements of the apparatus via a control unit (800), characterized by the steps of generating a sensor signal via a sensor connected to the control unit, transmitting the sensor signal to the control unit and changing the treatment pressure via the control unit depending on the sensor signal.

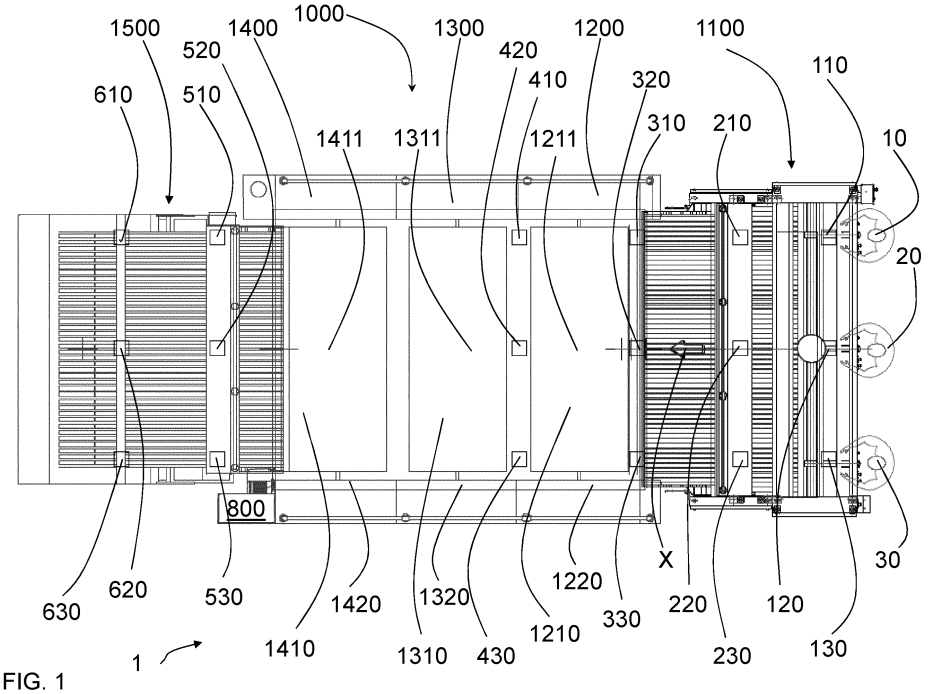

FIG. 1

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Description

[0001] The present invention relates to a method for controlling a treatment process for textile products, preferably in an apparatus for treating textile products.

[0002] A further aspect of the invention relates to an apparatus for treating textile products.

[0003] The primary field of application of the present invention is the treatment of textile products, like laundry, such as sheets and linens, in an associated apparatus like a mangle, which comprises an ironing arrangement, with typically one or more rotary ironers. Rotary ironers are known, for example, from WO 03/048444 A1, WO 03/048445 A1, or WO 2004/106619 A1.

[0004] The present invention has realized that such an apparatus is often arranged in a larger environment of flatwork finishing equipment for the preparation, feeding, ironing, folding and stacking of flatwork.

[0005] Moreover, the present invention has additionally realized that, typically, the treatment of textile products in an ironing arrangement is designed for a high volume, high throughput drying and flattening process, resulting in high energy consumption, for example, in electric power, water and/or heat. A further issue relates to the quality of the treatment process and the process results. The input of such a process may vary, for example, laundry properties like moisture content, size, material, thickness etc. are variable. However, the treated product must meet certain quality criteria independent of the varying input parameters. For example, wrinkles, pleats, a high remaining moisture content, or damages due to a too high temperature, should be avoided in the treated textile product.

[0006] From DE102008013197 it is known to adjust the treatment temperature or treatment speed to avoid that the treated textile products leave the ironing arrangement being too moist and to reduce energy consumption.

[0007] It is a therefore object of the present invention to provide an improved method for controlling a treatment process for textile products, and an improved apparatus for treating textile products, in particular a method for controlling a treatment process for textile products, and an apparatus for treating textile products that reduce energy consumption while maintaining or improving quality of the treatment process and/or of the treated textile products.

[0008] According to a first aspect of the invention, a method for controlling a treatment process for textile products, preferably in an apparatus for treating textile products is provided, wherein the treatment process comprises ironing textile products in an ironing arrangement with at least one ironer, wherein textile products are conveyed along a conveying direction from an introduction side to a discharge side at a treatment speed and wherein a treatment pressure, and preferably a treatment temperature, is applied to the textile products; and wherein the method for controlling comprises the step controlling the treatment pressure, and preferably the treatment speed, the treatment temperature, and/or further treatment process parameters and/or the operation of further elements of an apparatus for treating textile products, via a control unit; characterized by generating a sensor signal via a sensor connected to the control unit and transmitting the sensor signal to the control unit and changing the treatment pressure via the control unit depending on the sensor signal.

[0009] The invention is based on the finding that energy consumption of an ironing arrangement can be controlled and reduced efficiently while maintaining or even improving quality by adapting the treatment pressure. Treatment pressure is understood in particular to mean the pressure that is applied to a textile product during the treatment process.

[0010] Typically, an ironing arrangement comprises at least one rotary ironer with at least one ironing roller with a cylindrical surface and at least one ironing bed or ironing pan in close distance to the ironing roller, forming a thin space, preferably a parallel slot or a gap, between the ironing roller and the ironing bed, into which a textile product is fed such that it is in contact preferably with at least a part of the cylindrical surface of the ironing roller and at least a part of a cylindrical surface of the ironing bed. In particular, the treatment pressure can be the bed or pan pressure, i.e. the contact pressure between an ironing roller and a corresponding bed or pan. Preferably, the ironing roller and/or the ironing bed is vertically movably mounted so that the thin space between the ironing roller and the ironing bed can be adjusted and thereby a contact or treatment pressure can applied to the textile product by the ironing roller pressing the textile product against the ironing bed or vice versa.

[0011] An ironing arrangement, in particular a rotary ironer, can comprise more than one ironing roller and more than one corresponding ironing bed, to subject textile products to a sequence of ironing processes.

[0012] Typically, an ironing roller is rotatably mounted around an axis of rotation through the center of the ironing roller. Furthermore, the ironing roller is preferably driven by at least one electrically powered motor, more preferably driven by two electrically powered motors on each side of the rotational axis. Usually, through the rotation of the ironing roller, the textile products are conveyed at a treatment speed through the ironing arrangement.

[0013] The ironing roller and/or the ironing bed are preferably heated to apply a treatment temperature to the textile product. The heat is preferably generated by a heat source, which is for example, heated oil, so that the textile product is dried by the applied temperature. The heat source could also be heated water, preferably steam, which, for example, can be released or injected through small vents in the ironing roller or the ironing bed to the textile product.

[0014] The textile products usually are pieces of cloth, in particular of substantially rectangular shape, such as bed linen or tablecloth, which are wet, damp or moist and unsmooth after washing or tumbling. The textile products

can be made of cotton, for example, or other textile materials. By conveying the textile products through the ironing arrangement, the moisture or humidity of the textile products is removed or reduced and the textile products are flattened or ironed.

[0015] The process in an ironing arrangement operates from an introduction side, where the textile product is supplied to or fed into the ironing arrangement, to a discharge side, where the textile product is released from the ironing arrangement. At the introduction side, typically one or more human operators feed textile products to the ironing arrangement. Preferably, a feeding station is arranged at the introduction side to facilitate the supply of textile products into the ironing arrangement. On the discharge side, preferably a folding and/or stacking arrangement is arranged to further process the textile products after the ironing process.

[0016] The treatment process is controlled via a control unit which controls the treatment pressure. Preferably, the control unit is adapted to further control the treatment speed, the treatment temperature, and/or further treatment process parameters and/or the operation of further elements of an apparatus for treating textile products. The control unit preferably comprises a programmable logic controller (further referred to as PLC) to control the treatment process.

[0017] According to the invention, a sensor signal is generated. Preferably, a sensor is provided, which is adapted and arranged to measure a physical quantity and/or detect a condition and convert such measurement or detection into a sensor signal. The sensor signal is preferably an electric signal, analog or digital, for example, a current or voltage proportional to the measured physical quantity or corresponding to the detected condition.

[0018] Further below, preferred embodiments of different sensors will be described.

[0019] Preferably, the sensor is connected to the control unit. The connection may be wireless or wired, e.g. via a cable. The sensor signal is transmitted to the control unit, and the control unit is able to adjust the treatment pressure depending on the sensor signal, in particular depending on the measured physical quantity and/or corresponding to the detected condition.

[0020] By adapting the treatment pressure, in particular the bed or pan pressure, the energy consumption can be adjusted very efficiently. In particular, compared to an adjustment of treatment speed and/or treatment temperature, the adjustment of treatment pressure has a number of advantages. For example, a change in treatment speed influences the throughput of the apparatus and/or the workload or required working speed of the human operators. Further, decreasing the treatment speed may result in an undesired backlog. An adjustment of the treatment temperature may only be realized with a certain delay due to the time required for cooling down or heating up certain process elements to a desired temperature. For example, the process described in DE 10 2008 013 197 A1 comprises a temperature measurement sensor fitted before the end of the ironing process, approximately in the middle of an ironer, and the information from this sensor is used to adjust the treatment speed or temperature for the final stage of ironing to accomplish full drying of a textile product each time or to reject the product. However, adjusting the treatment speed cannot be realized without effecting the machine production and product quality significantly and these production and quality losses could negate any energy gains. Further, adjusting the treatment temperature cannot be realized for the intended purpose: the temperature of a thermal fluid used in an ironer, in particular steam or thermal oil, cannot be adjusted within the short time frame required to ensure that the products coming into the final treatment stage would be dry by the time they leave the ironer.

[0021] The invention is based on the finding that it is possible to adjust the treatment pressure to achieve certain advantages. By adjusting the treatment pressure, for example, a fast and reliable influence on the treatment quality and energy consumption can be achieved while keeping throughput and workload constant.

[0022] A preferred embodiment of the method further comprises changing the treatment speed, the treatment temperature and/or further treatment process parameters and/or the operation of further elements of the apparatus for treating textile products via the control unit depending on the sensor signal.

[0023] In addition to changing the treatment pressure, it may be desirable to change further treatment process parameters, e.g. treatment speed, treatment temperature or the like. Further, also the operation of other elements of the apparatus may be changed in the operation.

[0024] For example, the control unit may able to change the treatment speed by reducing the rotational speed of the ironing roller. The control unit may be further able to change the treatment temperature.

[0025] In general, the change of any of the changed parameters may be incremental or continuous.

[0026] In particular, the control unit is preferably able to change the treatment speed and/or the treatment temperature and/or the treatment pressure and/or further treatment process parameters and/or the operation of further elements of the apparatus, in case the value or the condition detected by the sensor deviates from a predefined value and/or condition, preferably by a predefined amount or deviation.

[0027] By predefining values and/or conditions it is possible to set limits or borders of certain parameters of the treatment process and to adjust the process accordingly, i.e. to ensure that the process does not run outside these predefined limits or borders. Predefined values or conditions preferably are threshold values, boundary values or ranges and are further preferably stored in a memory unit within the control unit, preferably in the PLC.

[0028] The method may also be improved by generating two or more sensor signals via two or more sensors, each of which is connected to the control unit, transmitting

the two or more sensor signals to the control unit and changing the treatment speed, the treatment temperature, the treatment pressure and/or further treatment process parameters and/or the operation of further elements of for treating textile products via the control unit depending on at least one of the two or more sensor signals or on a combination of the two or more sensor signals.

[0029] With two or more sensors it is possible to generate two or more sensor signals that are transmitted to the control unit. A plurality of sensors can be used to measure two or more different physical quantities in the same location of the treatment process or to measure the same physical quantities in two or more locations of the treatment process or to measure different physical quantities in different locations of the treatment process. Two or more sensors could also be used for redundancy or to make the measuring fail-proof. They could also be used to generate a mean value or an average value. Additionally, two or more sensors could be used for error correction of the measuring.

[0030] In this description, embodiments, preferred improvements, functions or advantages described with respect to one sensor apply accordingly to two or more sensors.

[0031] The method may be further improved in that the sensor signal is generated by an input activity sensor adapted and arranged to detect input activity at the introduction side.

[0032] Textile products are feed into the apparatus from the introduction side, preferably via a feeding station. Input activity is to be understood as an activity resulting in textile products entering the apparatus from the introduction side.

[0033] Said activity sensor preferably is adapted and arranged to detect whether at least one human operator is present at the introduction side, to detect whether at least one automated input device at the introduction side is active, and/or to detect whether a feeding station arranged at the introduction side is active.

[0034] Input activity can result, for example, from the activity of one or more human operators or one or more automated input devices, which are present or arranged, respectively, at the introduction side and typically take textile products from a supply and feed them into the ironing arrangement. An automated input device may be a robot or a machine, built to feed supplied washed textile products into the ironing arrangement, preferably via a feeding station. Therefore, detecting whether one or more human operators are present at the introduction side and/or detecting whether one or more automated input device arranged at the introduction side is active can be used to detect input activity. Further, if a feeding station is arranged at the introduction side and textile products are fed into the ironing arrangement via the feeding station, activity of the feeding station can be used to detect input activity. The feeding station preferably comprises a stretching or spreading arrangement, where a washed textile product is prepared for the ironing process and is fed to the ironing arrangement. Activity of the feeding station may, for example, be detected by whether the feeding station is running and/or by a product sensor detecting the presence of textile products in the feeding station.

[0035] Preferably, the activity sensor is a proximity sensor, an optical sensor, for example, with face recognition, in particular a camera, a photo sensor, or an infrared sensor, a radiofrequency identification (RFID) sensor, an near field communication (NFC) sensor, or a weight sensor located in the standing spot of the human operator.

[0036] By using more than one activity sensor, it is possible to individually detect the presence of two or more human operators at the introduction side or to detect the activity of more than one automated input device arranged at the introduction side.

[0037] The method may be further improved in that the sensor signal is generated by a product sensor adapted and arranged to detect whether a textile product is present within the ironing arrangement, in particular, within a slot between an ironing roller and an ironing bed. With the product sensor it is possible to detect whether one or more textile products are present within the ironing arrangement. Preferably, the product sensor is located near the introduction side, near the discharge side or between the introduction and the discharge side of the ironing arrangement. In case the ironing arrangement comprises more than one rotary ironer, the product sensor preferably can be located on or near a bridge between the two beds of the two rotary ironers. Additionally or alternatively, a product sensor may be arranged in a feeding station to detect whether a textile product is present within the feeding station.

[0038] The product sensor could, for example, be an infrared sensor, a laser sensor, a visual sensor, or a camera, for example, with pattern recognition.

[0039] Furthermore, the product sensor preferably is arranged and adapted to detect the type and/or quality of the textile product. For example, a textile product made from cotton can be exposed to a higher treatment temperature than a polyester or polyester-blend textile product.

[0040] By using more than one product sensor, it is possible to trace the way of the product through the arrangement. It is also possible to detect more than one textile product. Preferably, two, three or several product sensors can be positioned in a line rectangular to the conveying direction.

[0041] The method may also be improved in that the sensor signal is generated by a thickness sensor adapted and arranged to measure the thickness of a textile product.

[0042] The thickness sensor could, for example, be a distance sensor, an optical sensor, a fiber-optic sensor, a laser sensor, or an ultrasound sensor. Preferably, the thickness sensor incorporates the features of a product

sensor. If a thickness greater zero is measured, a product is detected and if a thickness equal to zero (or below a predefined minimal value) is measured, no product is detected.

[0043] Furthermore, the method may be improved in that the sensor signal is generated by a humidity sensor, adapted and arranged to measure the humidity of a textile product, in particular, at the discharge side of the ironing arrangement. The humidity sensor could, for example, be an infra-red sensor, a capacitive sensor, an impedance sensor, a tensiometer or a hygrometric sensor.

[0044] By measuring the humidity it is possible to measure the residual water or moisture content in the textile product during and/or after the treatment process, to avoid that the treated textile product has a too high remaining moisture content when leaving the ironing arrangement.

[0045] The method may also be improved in that the sensor signal is generated by a temperature sensor adapted and arranged to measure the temperature of a textile product and/or to measure the temperature of the ironing arrangement or one or more elements thereof. The temperature sensor could, for example, be an infrared sensor, a thermistor, a quartz sensor, a thermo element, a pyro-electric sensor, pyrometer or a fiber-optical sensor.

[0046] With a temperature sensor it is possible to measure the applied temperature, the temperature of elements of the ironing arrangement and/or the temperature of the textile products during or after the treatment, for example. On the one hand, the treatment temperature is important since a maximum tolerable treatment temperature depends on the kind of textile product. On the other hand, the temperature of the treated textile product at the discharge side may be an indicator for the residual moisture content.

[0047] The method may be further improved in that the sensor signal is generated by a pressure sensor adapted and arranged to measure the pressure applied to a textile product within the ironing arrangement, in particular, within a slot between an ironing roller and an ironing bed.

[0048] The pressure sensor could be a capacitive sensor, a piezo-resistive or piezo-electric sensor, an optical fiber sensor, an electromagnetic sensor or any other kind of pressure sensor. In particular, the pressure sensor is adapted and arranged to measure the treatment pressure, in particular the bed pressure.

[0049] The various sensors could be arranged at different positions to gather measurements and/or detections in different locations of the treatment process, for example, at the introduction side, before entering the ironing arrangement (e.g. in a feeding station), within the ironing arrangement, in particular, within the slot between the ironing roller and the ironing bed, at the discharge side, or after leaving the ironing arrangement (e.g. in a subsequent device, like a folder or a stacker).

[0050] The sensors could also be arranged in an array at different positions, to generate a variety of signals in desired locations. For example, a humidity sensor could be used in combination with a heat sensor to measure humidity and temperature at the same or close locations, preferably at the discharge side, e.g. in a folder or stacker.

[0051] In general, a sensor can be adapted to measure a quantity or detect a condition contact-based or contactless.

[0052] The method may be further improved by reducing the treatment pressure and/or treatment temperature and/or treatment speed by or to a predefined value and/or shutting down further elements of the apparatus for treating textile products via the control unit in case the activity sensor detects that a lower number of human operators than a predefined number of operators has been present at the introduction side, in particular at a feeding station, for a first predetermined period of time, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, has been inactive for a first predetermined period of time, and/or the product sensor detects that no textile product has been present within the apparatus, in particular not within the ironing arrangement, for a first predetermined period of time.

[0053] This embodiment preferably reduces the energy consumption of the apparatus by reducing certain process parameters and/or shutting down certain elements, in particular energy-consuming ones, non-essential machinery and/or elements that can be turned on again quickly. This reduced operating mode is applied if there has been no or low input activity for a first predetermined period of time. This delay of reducing the operating mode by the first predetermined period of time has the advantage that short breaks or disruptions of input activity do not interrupt the treatment process. In particular, the reduced operating mode serves to render the process more efficient, especially energy efficient, if the activity sensor indicates that the number of required human operators are not present to continuously feeding textile products into the ironing arrangement at the required quota or if the automated feed device is inactive, due to failure or supply reasons, for example.

[0054] The method may also be improved by shutting down the apparatus for treating textile products or at least the ironing arrangement via the control unit in case the activity sensor detects that a lower number of human operators than a predefined number of operators has been present at the introduction side, in particular at a feeding station, for a second predetermined period of time, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, has been inactive for a second predetermined period of time and/or the product sensor detects that no textile product has been present within the apparatus, in particular not within the ironing arrangement, for a second predetermined period of time.

[0055] Compared to the previously described reduced operating mode, in this embodiment preferably the whole or substantially the whole apparatus, in particular the

ironing arrangement, is shut down to reduce energy consumption even more. In particular, if not human operators have been present for the second predetermined period of time or another indicator of input activity detects no input activity for the second predetermined period of time, such a shutdown of the apparatus can save energy.

[0056] Preferably, the second predetermined period of time is longer than the first predetermined period of time. Thereby it is possible to differentiate a reduced operating mode during a short break or a supply shortfall, for example, from a longer break during which the whole apparatus can be shut down, to avoid any unnecessary energy consumption.

[0057] Furthermore, the method may be improved by increasing the treatment pressure and/or treatment temperature and/or the treatment speed by or to a predefined value and/or turning on further elements of the apparatus for treating textile products via the control unit in case the activity sensor detects that the predefined number of operators present again at the introduction side, in particular at a feeding station, and/or the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement.

[0058] Such an increase preferably follows a reduction during a reduced operating mode. For example, if a break in input activity has been longer than the first predetermined period of time but shorter than the second predetermined period of time, the apparatus is still running in the reduced operating mode and can be run again in the full mode when the input activity is resumed after the break.

[0059] The method may as well be improved by turning on the apparatus for treating textile products or at least the ironing arrangement via the control unit in case the activity sensor detects that the predefined number of operators present again at the introduction side, in particular at a feeding station, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, is active again and/or the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement.

[0060] When a break in input activity has been longer than the second predetermined period of time, preferably the apparatus is shut down, as described above. However, at least one sensor preferably is still able to measure a quantity or to detect a condition when the apparatus is shut down. Then, when input activity is resumed (and detected by at least on activity sensor), the apparatus can be turned on again.

[0061] The method may be further improved by generating an alarm signal in case the activity sensor detects that a lower number of human operators than a predefined number of operators is present at the introduction side, in particular at a feeding station, or has been present for a predetermined period of time, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, is inactive or has been inactive for a predetermined period of time, and/or the product sensor detects that no textile product is present or has been present within the apparatus, in particular not within the ironing arrangement, for a predetermined period of time; turning off the alarm signal when the activity sensor detects that the predefined number of operators is present again at the introduction side, in particular at a feeding station, and/or the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement; and/or when a reduced operating mode is chosen by an operator, and wherein the control unit is adapted to reduce the treatment speed and/or treatment pressure and/or treatment temperature by or to a predefined value in the reduced operating mode.

[0062] This embodiment is particularly designed to optimize the operation of the apparatus depending on the input activity, in particular the number of human operators. For example, most feeding stations require three operators to run efficiently but unexpected breaks etc. may still reduce the number of operators. If it is detected that one operator is missing or a feeding station for a predetermined period of time, an alarm is activated indicating that a change in the operating mode is necessary. The alarm can only be silenced when a reduced operating mode is selected, preferably on the machine control panel or when the input activity is back to the desired level. The reduced operating mode is specifically designed for running with only a lower number operators, for example, speed is lowered, quality functions improved, and treatment pressure adjusted. On return of all operators, preferably again an alarm signal is generated to indicate a return to the standard operating mode is necessary. Preferably, this alarm again can only be silenced by the selection of the correct operating mode.

[0063] The alarm signal is preferably at least one of a visual alarm signal, an acoustical alarm signal, a message alarm signal or a network alarm signal. The visual alarm signal could be a flashing light or an all-round light, or a visual or textual display, showing a message. The acoustical alarm signal could be an alarm sound, a siren, a bell or a chime ringing, or a speaker playing a sound or a verbal message. The message alarm signal could be a short message sent to a predefined mobile device as a cell phone or a pager, through WiFi or GSM or another mobile carrier. It could also be a message as an e-mail sent to a predefined e-mail address or a computer message, displayed on a desktop or portable computer. It could as well be a radio signal broadcast to a walkie

talkie or a radio phone. The network alarm signal could be a LAN or WiFi signal sent to a desktop or portable computer, or a call delivered to a landline or mobile phone. It could as well be a data package delivered to a server or any other kind of network signal. Through this improvement, it is also possible to notify a supervisor who is off-site or in a different location on the site.

[0064] The method may also be improved by collecting information about the productivity of the apparatus, about the time the apparatus or parts thereof, in particular the ironing arrangement, operates with one or more reduced treatment process parameters and/or shut down further elements and/or in the reduced operating mode, and/or about the quality of the treatment process, in particular in the form of at least one quality signal generated by at least one operator input device arranged preferably at the discharge side, preferably at a downstream end of a folding device, preferably displaying the collected information and preferably generating an alarm signal if the collected information or parts thereof differ from predefined values or conditions.

[0065] Thereby, it is possible to monitor and improve the treatment process on a long-term basis. Energy consumption can be put in relation to the treatment process and the process can be adjusted to be more efficient.

[0066] In particular, this embodiment provides an easy means of allowing production staff to record the overall equipment efficiency of the apparatus, e.g. on an hourly basis, by providing information about productivity, downtime, and quality. By providing an additional quality input device, preferably with two input options for "rag" and "rewash", for example, additional quality information can be gathered easily. Results of this information collection are preferably displayed and/or further evaluated. In particular, predetermined alarm limits to deviations to acceptable standards may be set to alert supervisors and/or management allow them to react accordingly.

[0067] According to a further aspect of the invention, an apparatus for treating textile products is provided, comprising an ironing arrangement with at least one ironer, which is adapted and arranged to convey textile products along a conveying direction from an introduction side to a discharge side at a treatment speed and which is adapted and arranged to apply a treatment pressure, and preferably a treatment temperature, to the textile products; a control unit, which is adapted and arranged to control the treatment pressure, and preferably the treatment speed, the treatment temperature, and/or further treatment process parameters and/or the operation of further elements of the apparatus; characterized by a sensor connected to the control unit, wherein the sensor is adapted and arranged to generate a sensor signal and to transmit the sensor signal to the control unit and further characterized in that the control unit is adapted and arranged to change the treatment pressure depending on the sensor signal.

[0068] In the following, preferred embodiments of the apparatus are described, which are in particular suitable for use with the previously described method and its improvements. As to the advantages, preferred embodiments and details of the apparatus and its preferred embodiments, reference is made to the corresponding aspects and embodiments of the above described method and its preferred embodiments.

[0069] The apparatus may be improved in that the control unit is adapted and arranged to change treatment speed, the treatment temperature and/or further treatment process parameters and/or the operation of further elements of the apparatus for treating textile products via the control unit depending on the sensor signal.

[0070] The apparatus may also be improved in that it comprises two or more sensors, of which each is connected to the control unit and adapted and arranged to generate a sensor signal and to transmit the sensor signal to the control unit; and wherein the control unit is adapted and arranged to change the treatment speed, the treatment temperature, the treatment pressure and/or further treatment process parameters and/or the operation of further elements of the apparatus depending on at least one of the two or more sensor signals or on a combination of the two or more sensor signals.

[0071] The apparatus may be further improved in that the sensor is adapted to generate a signal and/or the control unit is adapted to change the treatment speed, the treatment temperature, the treatment pressure and/or further treatment process parameters and/or the operation of further elements of the apparatus in case the value and/or condition detected via the sensor deviates from a predefined value and/or condition, preferably by a predefined amount or deviation.

[0072] The apparatus may as well be improved in that the sensor is an activity sensor adapted and arranged to detect input activity at the introduction side.

[0073] The apparatus may be further improved in that the activity sensor is adapted and arranged to detect whether at least one human operator is present at the introduction side.

[0074] Furthermore the apparatus may be improved in that the activity sensor is adapted and arranged to detect whether at least one automated input device arranged at the introduction side is active.

[0075] Additionally, the apparatus may be improved in that the activity sensor is adapted and arranged to detect whether a feeding station arranged at the introduction side is active.

[0076] The apparatus may be further improved in that the sensor is a product sensor adapted and arranged to measure whether a textile product is present within the ironing arrangement, in particular within a slot between an ironing roller and an ironing bed.

[0077] The apparatus may be also improved in that the sensor is a thickness sensor adapted and arranged to measure the thickness of a textile product.

[0078] The apparatus may as well be improved in that the sensor is a humidity sensor, for example, an infrared sensor, adapted and arranged to measure the hu-

midity of a textile product, in particular the humidity of a textile product on the discharge side of the ironing arrangement.

[0079] Furthermore the apparatus may be improved in that the sensor is a temperature sensor adapted and arranged to measure the temperature of a textile product and/or to measure the temperature of the ironing arrangement or one or more elements thereof.

[0080] Further, it can be preferred that a humidity and/or temperature sensor is arranged to measure the humidity and/or temperature of a textile product at the end or after the treatment process, for example on a discharge side. In this way, the temperature and/or humidity results of the treatment process can be recorded. If this is done regularly or continuously, a trend for temperature and/or humidity results can be established. In particular, if this trend develops into a negative or undesired direction, warnings or counter measures can be initiated.

[0081] In particular, it is preferred that based on a sensor signal of a humidity and/or temperature sensor a desired value for the treatment pressure is generated and the treatment pressure is changed according to the desired value. In this embodiment, rather than changing process parameters trying to fully dry one textile product during the remaining treatment after it has been detected or measured during a part of the process, a process trend is identified and a process parameter, in particular the treatment pressure, is adjusted to establish a process leading to reliable results, in particular with respect to humidity and/or temperature results. In particular, the sensor signal may be used to predict the changes needed in treatment pressure to ensure that the next textile products in the batch have a higher quality regarding humidity and/or temperature after treatment. This way, it may be that the first few textile products of a treatment batch are damp, but the method will adjust and correct the process parameters, in particular the treatment pressure, to provide for better quality treatment process outcome, in particular desired humidity and/or temperature results, for the rest of the treatment batch while on the same time maintaining production targets, like throughput, for example.

[0082] Additionally, the apparatus may be improved in that the sensor is a pressure sensor adapted and arranged to measure the pressure applied to a textile product within the ironing arrangement, in particular within a slot between an ironing roller and an ironing bed.

[0083] The apparatus may be further improved in that the control unit is adapted to reduce the treatment pressure and/or treatment temperature by or to a predefined value and/or to shut down further elements of the apparatus for treating textile products in case the activity sensor detects that a lower number of human operators than a predefined number of operators has been present at the introduction side, in particular at a feeding station, for a first predetermined period of time, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, has been inactive for a first predetermined period of time, and/or the product sensor detects that no textile product has been present within the apparatus, in particular not within the ironing arrangement, for a first predetermined period of time.

[0084] The apparatus may also be improved in that the control unit is adapted to shut down the apparatus for treating textile products or at least the ironing arrangement in case the activity sensor detects that a lower number of human operators than a predefined number of operators has been present at the introduction side, in particular at a feeding station, for a second predetermined period of time, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, has been inactive for a second predetermined period of time and/or the product sensor detects that no textile product has been present within the apparatus, in particular not within the ironing arrangement, for a second predetermined period of time.

[0085] The apparatus may be also improved in that the control unit is adapted to increase the treatment pressure and/or treatment temperature by or to a predefined value and/or to turn on further elements of the apparatus for treating textile products in case the activity sensor detects that the predefined number of operators present again at the introduction side, in particular at a feeding station, and/or the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement.

[0086] The apparatus may be further improved in that the control unit is adapted to turn on the apparatus for treating textile products or at least the ironing arrangement in case the activity sensor detects that the predefined number of operators present again at the introduction side, in particular at a feeding station, and/or the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement.

[0087] The apparatus may be further improved in that the control unit and/or the sensor is adapted to generate an alarm signal in case the activity sensor detects that a lower number of human operators than a predefined number of operators is present at the introduction side, in particular at a feeding station, or has been present for a predetermined period of time, and/or the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, is inactive or has been inactive for a predetermined period of time, and/or the product sensor detects that no textile product is present or has been present within the apparatus, in particular not within the ironing arrangement, for a predeter-

mined period of time; and wherein the control unit and/or the sensor is adapted to turn off the alarm signal when the activity sensor detects that the predefined number of operators is present again at the introduction side, in particular at a feeding station, and/or the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement; and/or when a reduced operating mode is chosen by an operator, and wherein the control unit is adapted to reduce the treatment speed and/or treatment pressure and/or treatment temperature by or to a predefined value in the reduced operating mode.

[0088] Furthermore, the apparatus may be improved in that the control unit is adapted to collect information about the productivity of the apparatus, about the time the apparatus or parts thereof, in particular the ironing arrangement, operates with one or more reduced treatment process parameters and/or shut down further elements and/or in the reduced operating mode, and/or about the quality of the treatment process, in particular in the form of at least one quality signal generated by at least one operator input device arranged preferably at the discharge side, preferably at a downstream end of a folding device and wherein the control unit preferably is adapted to display the collected information, and wherein the control unit preferably generate an alarm signal if the collected information or parts thereof differ from predefined values or conditions.

[0089] Preferred embodiments of the invention shall now be described with reference to the attached drawings, in which

Figure. 1: shows a top view of a preferred embodiment of an apparatus for treating textile products; and

Figure 2: shows a side view of a preferred embodiment of the apparatus shown in Fig. 1.

[0090] Figure 1 shows a top view of an apparatus for treating textile products 1 comprising and ironing arrangement 1000 for ironing textile products. The apparatus 1 is shown in Figure 2 in a side view. At an introduction side of the and ironing arrangement 1000 a feeding station 1100 is arranged, and at the discharge side a folder or stacker 1500 is arranged. The ironing arrangement 1000 comprises three rotary ironers 1200, 1300, 1400. Within the ironing arrangement 1000 textile products are conveyed along a conveying direction X from the introduction side to the discharge side at a treatment speed and wherein a treatment temperature and/or a treatment pressure is applied to the textile products.

[0091] The three rotary ironers 1200, 1300, 1400 each consist of one ironing roller 1210, 1310, 1410 and one ironing bed 1220, 1320, 1420. The ironing roller 1210, 1310, 1410 comprises a cylindrical surface 1211, 1311, 1411 and is mounted in close distance to the respective ironing bed 1220, 1320, 1420, forming a thin space there between.

[0092] A set of three individual activity sensors 110, 120, 130 is located at the feeding station 1100 to detect the presence of three individual human operators 10, 20, 30. Further, three product sensors 210, 220, 230 are provided to detect the presence of a textile product within the feeding station 1100. Alternatively or additionally, product sensors can be located in the ironing arrangement 1000. Further, a set of three individual thickness sensors 310, 320, 330 to measure the thickness of a textile product as well as three individual pressure sensors 410, 420, 430 to measure the treatment pressure applied to the textile products are provided. Further, a set of three temperature sensors 510, 520, 530, to measure the temperature of the textile products as well as a set of three individual humidity sensors 610, 620, 630, to measure the residual humidity of the textile products are provided. Preferably, infra-red technology is used in a temperature sensor to measure the temperature of the finished textile product.

[0093] Preferably, the sensors 110, 120, 130, the product sensors 210, 220, 230, the temperature sensors 510, 520, 530 and the humidity sensors 610, 620, 630 are contactless sensors, while the thickness sensors 310, 320, 330 and the sensors 410, 420, 430 are contact-based sensors. However, other embodiments are possible. All sensors are connected to a control unit 800, preferably wireless.

[0094] A preferred method d for controlling a treatment process for textile products in an apparatus 1 for treating textile products works as follows. Textile products are ironed in the ironing arrangement 1000, wherein the textile products are conveyed along conveying direction X from the introduction side to the discharge side at a treatment speed and wherein a treatment pressure, and preferably a treatment temperature, is applied to the textile products. The treatment pressure, and preferably the treatment speed, the treatment temperature, and/or further treatment process parameters and/or the operation of further elements of an apparatus for treating textile products, are controlled via the control unit 800.

[0095] Further, one of the various sensors generates a sensor signal and transmits it to the control unit. Preferably, at least temperature sensors 510, 520, 530 and/or humidity sensors 610, 620, 630 transmit sensor signals corresponding to the temperature and/or humidity of the finished textile products to the control unit 800.

[0096] Based on the sensor signals, the control unit 800 changes the treatment pressure. For example, if the sensor signal indicates that the remaining moisture content in the finished textile products is too high, the treatment pressure may be increased. Adjusting the treatment pressure depending on the sensor signal has been found to be very efficient, fast and reliable as well as energy

saving.

[0097] Further improvements of the method comprise running the apparatus 1 in a reduced operating mode, if one or more of the activity sensors 110, 120, 130 indicate lower or no input activity and/or if the product sensors 210, 220, 230 and/or thickness sensors 310, 320, 330 indicate that no textile products are present in the feeding station 1100 or the ironing arrangement 1000. In particular, if this state continues, not only a reduced operating mode with reduced treatment parameters may be installed, but the apparatus 1, at least the ironing arrangement 1000, may be shut down to save energy. On the other hand, when sensors indicate increased input activity or presence of textile products, the treatment parameters may be increased again and/or the apparatus 1, at least the ironing arrangement 1000, turned on again.

Claims

1. Method for controlling a treatment process for textile products, preferably in an apparatus for treating textile products, wherein the treatment process comprises

   - ironing textile products in an ironing arrangement with at least one ironer, wherein textile products are conveyed along a conveying direction from an introduction side to a discharge side at a treatment speed and wherein a treatment pressure, and preferably a treatment temperature, is applied to the textile products;
   and wherein the method for controlling comprises
   - controlling the treatment pressure, and preferably the treatment speed, the treatment temperature, and/or further treatment process parameters and/or the operation of further elements of an apparatus for treating textile products, via a control unit;
   characterized by
   - generating a sensor signal via a sensor connected to the control unit and transmitting the sensor signal to the control unit;
   - changing the treatment pressure via the control unit depending on the sensor signal.

2. Method according to the previous claim,
   characterized by:

   - generating two or more sensor signals via two or more sensors, each of which is connected to the control unit;
   - transmitting the two or more sensor signals to the control unit;
   - changing the treatment speed, the treatment temperature, the treatment pressure and/or further treatment process parameters and/or the operation of further elements of for treating textile products via the control unit depending on at least one of the two or more sensor signals or on a combination of the two or more sensor signals.

3. Method according to at least one of the previous claims, wherein the sensor signal is generated by an input activity sensor adapted and arranged to detect input activity at the introduction side.

4. Method according claim 3, wherein the activity sensor is adapted and arranged to detect whether at least one human operator is present at the introduction side.

5. Method according to claim 3, wherein the activity sensor is adapted and arranged to detect whether at least one automated input device arranged at the introduction side is active.

6. Method according to at least one of the claims 3-5, wherein the activity sensor is adapted and arranged to detect whether a feeding station arranged at the introduction side is active.

7. Method according to at least one of the previous claims, wherein the sensor signal is generated by a product sensor adapted and arranged to detect whether a textile product is present within the ironing arrangement, in particular within a slot between an ironing roller and an ironing bed.

8. Method according to at least one of the previous claims, wherein the sensor signal is generated by a humidity sensor, for example, an infra-red sensor, adapted and arranged to measure the humidity of a textile product, in particular the humidity of a textile product on the discharge side of the ironing arrangement.

9. Method according to at least one of the previous claims, wherein the sensor signal is generated by a temperature sensor adapted and arranged to measure the temperature of a textile product and/or to measure the temperature of the ironing arrangement or one or more elements thereof.

10. Method according to at least one of the previous claims,
    characterized by:

    reducing the treatment pressure and/or treatment temperature and/or treatment speed by or to a predefined value and/or shutting down further elements of the apparatus for treating textile products via the control unit in case

- the activity sensor detects that a lower number of human operators than a predefined number of operators has been present at the introduction side, in particular at a feeding station, for a first predetermined period of time, and/or
- the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, has been inactive for a first predetermined period of time, and/or
- the product sensor detects that no textile product has been present within the apparatus, in particular not within the ironing arrangement, for a first predetermined period of time.

11. Method according to at least one of the previous claims,
characterized by:

shutting down the apparatus for treating textile products or at least the ironing arrangement via the control unit in case

- the activity sensor detects that a lower number of human operators than a predefined number of operators has been present at the introduction side, in particular at a feeding station, for a second predetermined period of time, and/or
- the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, has been inactive for a second predetermined period of time and/or
- the product sensor detects that no textile product has been present within the apparatus, in particular not within the ironing arrangement, for a second predetermined period of time.

12. Method according to at least one of the previous claims,
characterized by:

increasing the treatment pressure and/or treatment temperature and/or the treatment speed by or to a predefined value and/or turning on further elements of the apparatus for treating textile products via the control unit in case

- the activity sensor detects that the predefined number of operators present again at the introduction side, in particular at a feeding station, and/or
- the activity sensor detects that the automated input device is active again at the introduction side, in particular at a feeding station, and/or
- the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement.

13. Method according to at least one of the previous claims,
characterized by:

turning on the apparatus for treating textile products or at least the ironing arrangement via the control unit in case

- the activity sensor detects that the predefined number of operators is present again at the introduction side, in particular at a feeding station, and/or
- the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or
- the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement.

14. Method according to at least one of the previous claims,
characterized by

- generating an alarm signal in case

  - o the activity sensor detects that a lower number of human operators than a predefined number of operators is present at the introduction side, in particular at a feeding station, or has been present for a predetermined period of time, and/or
  - o the activity sensor detects that an automated input device at the introduction side, in particular at a feeding station, is inactive or has been inactive for a predetermined period of time, and/or
  - o the product sensor detects that no textile product is present or has been present within the apparatus, in particular not within the ironing arrangement, for a predetermined period of time;

- turning off the alarm signal when

  - o the activity sensor detects that the predefined number of operators is present again at the introduction side, in particular at a

feeding station, and/or
o the activity sensor detects that an automated input device is active again at the introduction side, in particular at a feeding station, and/or
o the product sensor detects that a textile product enters the apparatus, in particular the ironing arrangement, or is present within the apparatus, in particular within the ironing arrangement; and/or
o when a reduced operating mode is chosen by an operator, and wherein the control unit is adapted to reduce the treatment speed and/or treatment pressure and/or treatment temperature by or to a predefined value in the reduced operating mode.

15. Method according to at least one of the previous claims,
characterized by:

- collecting information about the productivity of the apparatus, about the time the apparatus or parts thereof, in particular the ironing arrangement, operates with one or more reduced treatment process parameters and/or shut down further elements and/or in the reduced operating mode, and/or about the quality of the treatment process, in particular in the form of at least one quality signal generated by at least one operator input device arranged preferably at the discharge side, preferably at a downstream end of a folding device;
- preferably displaying the collected information,
- preferably generating an alarm signal if the collected information or parts thereof differ from predefined values or conditions.

16. Apparatus for treating textile products, comprising

- an ironing arrangement with at least one ironer, which is adapted and arranged to convey textile products along a conveying direction from an introduction side to a discharge side at a treatment speed and which is adapted and arranged to apply a treatment pressure, and preferably a treatment temperature, to the textile products;
- a control unit, which is adapted and arranged to control the treatment pressure, and preferably the treatment speed, the treatment temperature, and/or further treatment process parameters and/or the operation of further elements of the apparatus;
characterized by a sensor connected to the control unit, wherein the sensor is adapted and arranged to generate a sensor signal and to transmit the sensor signal to the control unit;
further **characterized in that** the control unit is adapted and arranged to change the treatment speed pressure depending on the sensor signal.

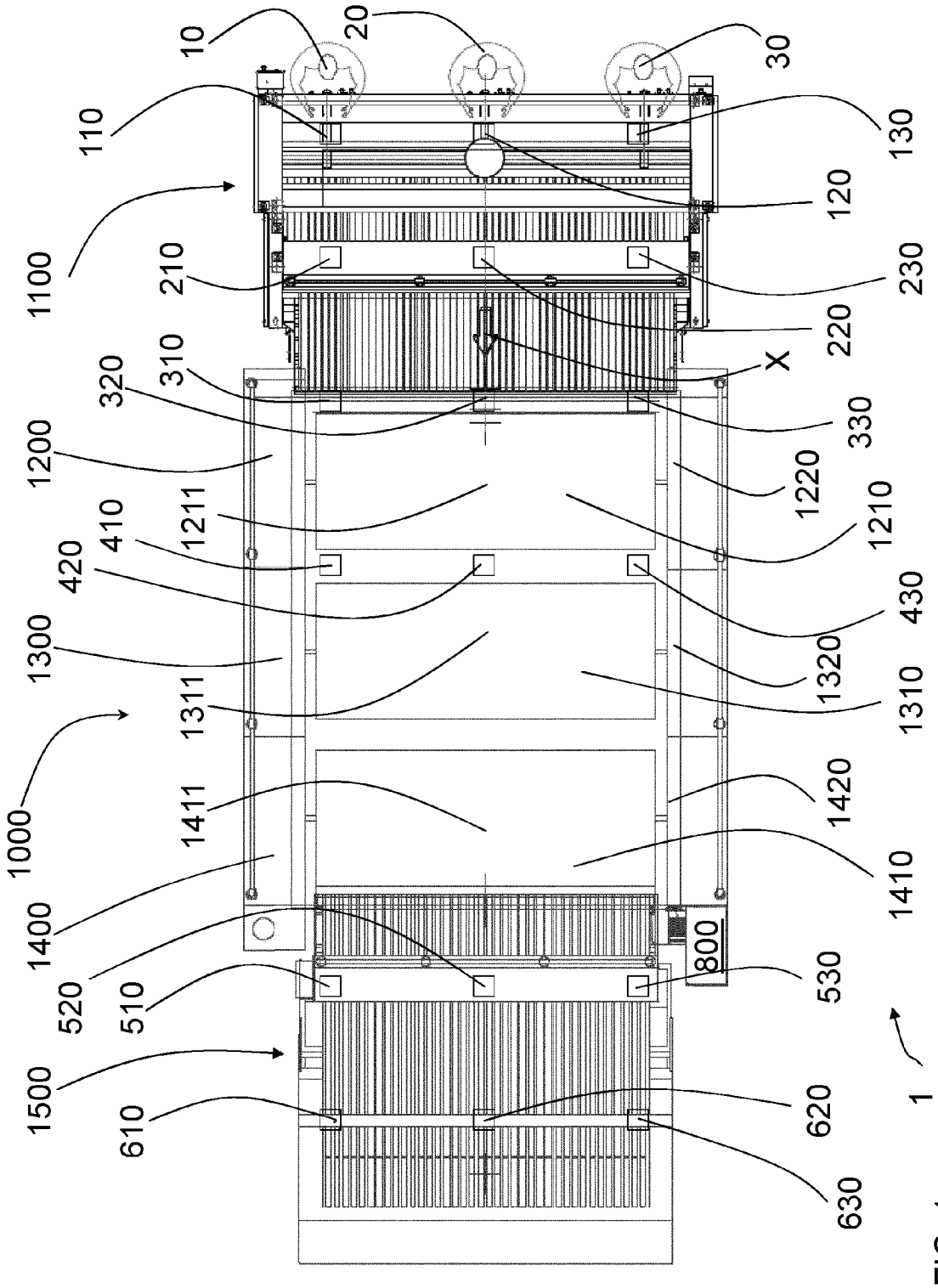
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FIG. 1

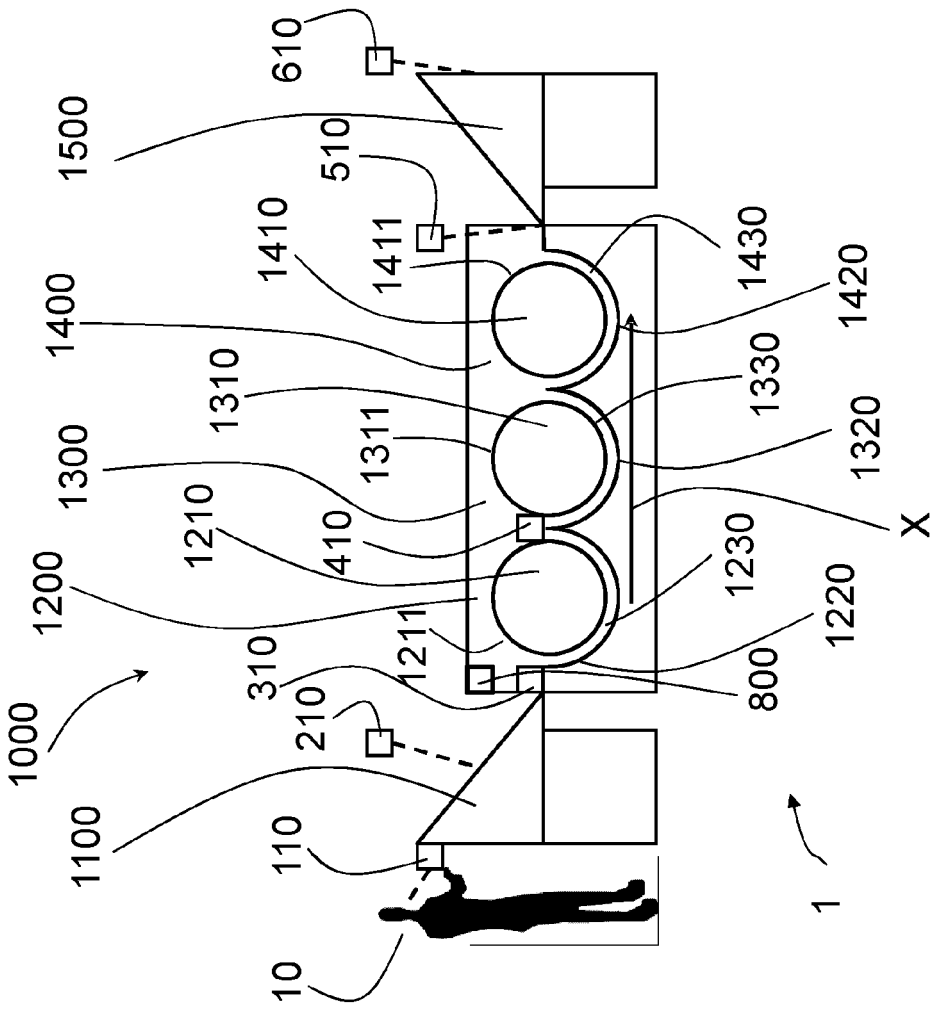
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FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 5614

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