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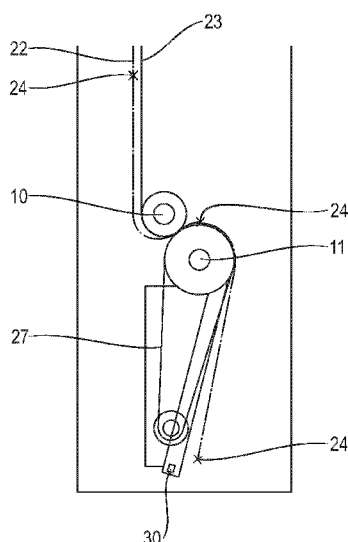


Fig. 9

(57) Abstract: Disclosed is a dispenser (1) for dispensing sheet products, particularly sanitary paper sheet products, such as paper towels, hand towels, paper napkins, facials, toilet paper, or other wiping products in sheet form, and a method for filling the dispenser (1). The dispenser (1) comprises a housing (2) for accommodating paper towels, which are respectively connected to each other via perforations (24). The housing (2) comprises a front surface (8) and side surfaces (3, 4), which respectively extend from the front surface (8) towards a back of the dispenser (1). The housing further comprises a dispensing opening (5) for dispensing the paper towels. The dispenser (1) further comprises an actuator, which is configured to be actuated by a user, and a dispensing mechanism (12) accommodated in the housing (2) for feeding the paper towels through the dispensing opening (5). The dispensing mechanism (12) comprises two rotatable rollers (10, 11) forming a nip, wherein the paper towels pass through the nip, and wherein at least one of the rollers is a driven roller (11). Additionally, the dispenser comprises a controller, which is configured to, upon actuation of the actuator, drive the driven roller (11) by a predetermined amount of rotation for feeding the paper towel towards the dispensing opening (5). The driven roller (11) is configured to, in a non-driven state, be manually rotatable against a predetermined resistance upon an external pulling force on a leading paper towel (6) extending from the dispensing opening (5).

DISPENSER AND METHOD FOR FILLING THE SAMETECHNICAL FIELD

The present disclosure relates to a dispenser for dispensing sheet products, particularly sanitary paper sheet products, such as paper towels, hand towels, paper napkins, facials, toilet paper, or other wiping products in sheet form, and to a method for filling said dispenser.

BACKGROUND

Sheet products, such as paper towels, are oftentimes stacked and accommodated in a housing of a dispenser. The individual sheet products may be folded. Since pre-cut sheet products are provided, for example, in the form of a stack of accordion pleated/folded paper towels, no cutting of the sheet products must be performed in the dispenser. The structure of the dispenser can thereby be facilitated, and the safety can be enhanced. Continuous dispensing of the folded sheet products from the dispenser is enabled by folding consecutive sheet products.

In many conventional dispenser types, a stack of sheet products accommodated in the housing is urged in a direction toward the dispensing opening. In the simplest configuration and if the housing is mounted so that the dispensing opening is directed downward, the stack of sheet products is urged toward the dispensing opening by gravity and/or by additional spring actuation. In such dispensers, individual sheet products, such as paper towels, are withdrawn from the stack from the bottom thereof.

One problem with dispensers of this kind is that the total weight of the stack of sheet products is on the leading (lowermost) sheet product to be dispensed through the dispensing opening. This effect is even higher when dispensers of this kind are overloaded or overfilled with sheet products. This leads to a high pressure against a leading sheet product,

thereby increasing the friction between the leading sheet product and the dispenser. Such increased friction may make it difficult to remove the sheet product, for example paper towels, from the dispenser. In the worst case, the sheet product may tear during withdrawal. Another problem is that a plurality of paper towels is withdrawn at a time leading to unnecessary waste of sheet products.

Attempts have been made to solve the above problems by providing dispensing mechanisms, in which the sheet products, such as paper towels, are not dispensed directly from the stack of sheet products.

WO 2013/007302 A1 discloses a dispenser that contains at least one stack of sheet products, such as paper towels, and which defines a dispensing path from a product reservoir containing and holding the stack(s) to a dispensing opening through which the sheet products are dispensed. This conventional dispenser is configured to dispense paper towels from a stack of interfolded webs comprising first and second elongate webs, which are respectively divided into paper towels defined between longitudinally separated perforations extending across the first and second webs, respectively. The perforations of the first web are offset to the perforations of the second web in a longitudinal dimension of the webs. A leading portion of the first and second webs of the stack is supported in the dispensing path from the product reservoir to the dispensing opening of the dispenser, for example, by a guidance around a rotatable roller arranged at a top region inside the dispenser, wherein the weight of the stack is downwardly oriented to bear against a bottom of the stack and the leading portion of the first and second webs extends from a top of the stack.

Accordingly, the weight of the stack does not bear against the sheets traversing the dispensing path. This is advantageous because sheet tearing at unintended locations is less likely even for very large weight stacks or multiple stacks of sheet products to be stored in the housing of the dispenser. Since

the offset webs tend to additionally support one another, compact stack dispensers with a large capacity can be realized, while the above-mentioned likelihood of unintended sheet tearing can be omitted.

To ensure continuity between a stack of sheet products, which is presently in use, and a spare stack of sheet products, when the sheet products are pulled down by a user and dispensed accordingly, two stacks are joined together by joining means, such that the last fold of sheet products in the existing stack is joined to the first fold of sheet products in the spare stack. Examples for said joining means are adhesives, double-sided adhesive tape, or mechanical fasteners/connectors, such as a hook and loop fastener (see US 2011/0101020 A1).

Most conventional dispensers have in common that the leading paper towel protrudes from the dispensing opening, at worst for a long period of time when the dispenser is not frequently in use. Conventional dispensers further require a manual actuation of the dispensing mechanism, for example, via a button, to achieve the ejection of a sheet product.

Considering the compromised hygiene of such dispensers, touchless dispensers have been suggested in the art. However, such dispensers oftentimes require many sensors and/or actuation means. This results in more expensive and complex dispensers.

Furthermore, their operation is oftentimes not intuitive and user-unfriendly, as for example, the user is unaware where to put his or her hand to get a sheet product, for example a paper towel, from the dispenser.

Consequently, there remains the need for a dispenser that addresses the issues above.

SUMMARY

Therefore, it is an object of the present disclosure to provide a dispenser with a simple structure that can be operated reliably over a long period of time with a minimal need of any manual maintenance.

The above-described problems are solved by means of the dispenser according to independent claim 1 and/or a method for filling the dispenser according to independent claim 10. Distinct embodiments are derivable from the dependent claims.

According to one aspect, a dispenser comprises a housing for accommodating sheet products, particularly sanitary paper sheet products, such as paper towels, hand towels, paper napkins, facials, toilet paper, or other wiping products in sheet form, which are respectively connected to each other via perforations.

The housing comprises several surfaces. Specifically, the housing comprises a front surface and several side surfaces, which respectively extend from the front surface towards a back of the dispenser. The housing further comprises a dispensing opening through which paper towels that are respectively connected to each other via perforations and that are stored inside the housing can be dispensed. Accordingly, the term dispensing opening may also be understood as a mouth or chute of the dispenser.

Commonly, dispensers are mounted on walls, for example of bathrooms or restrooms, at the back of the dispenser to form so-called wall-mounted dispensers. However, the present dispenser is not limited to such a wall-mounted dispenser. It is, for example, also possible that the present dispenser is arranged partially or completely recessed within a wall, such that merely the front surface or parts thereof and the surface comprising the dispensing opening are accessible for the user, that may also to be understood as an operator of the dispenser, when dispensing paper towels therefrom.

The dispenser also comprises a dispensing mechanism, which is accommodated in the housing. The dispensing mechanism is suitable to feed the paper towels through the dispensing opening of the housing.

The dispensing mechanism comprises two rotatable rollers forming a nip, wherein the paper towels pass through the nip, and wherein at least one of the rollers is a driven roller.

The nip is to be understood as an area between the two rotatable rollers through which the paper towels pass. During said passing of the nip, a force is applied via the two rotatable rollers forming the nip, such that slippage of the paper towels through the nip can be eliminated due to the friction force established by the two rotatable rollers in the nip.

The term driven roller is to be construed as a rotatable roller that is connected to a drive source in a power-transmitting manner. Such a drive source may be an electric motor, or the like, but is not limited thereto. Accordingly, said driven roller is at least capable to actively guide and forward the paper towels passing the nip from one side of the nip to another side of the nip that is arranged closer to the dispensing opening than the one side of the nip.

The dispensing mechanism may be of the kind of or based on the dispensing mechanism in which the sheet products, such as paper towels, are dispensed from the top of a stack, such as those disclosed in WO 2013/007302 A2 or WO 2014/065733 A1, the content of which is herewith incorporated in its entirety by reference. In this kind of dispensing mechanism, in order to ensure that a protruding part of a leading paper towel, which protrudes from the dispensing opening, is easily accessible and graspable by the user, a dispensing mechanism for dispensing the paper towels is ideally closely arranged at the bottom surface of the housing, in which the dispensing opening is defined. On the other hand, for refilling the dispensing mechanism, the dispensing mechanism needs to be moved into a

refilling position. To be able to refill the dispensing mechanism, the movement of the dispensing mechanism into the refilling position must therefore not be hindered by the bottom surface of the housing.

In wall-mounted dispenser types, this is often realized by specifically designed dispenser housings, in which the bottom surface/bottom wall of the housing comprising the dispensing opening is attached to a door of the housing and moved away from the dispensing mechanism together with the door upon opening the same.

The dispenser further comprises an actuator, which is configured to be actuated by the user, and a controller. The controller is configured to, upon actuation of the actuator, drive the driven roller by a predetermined amount of rotation for feeding the paper towel towards the dispensing opening.

Hence, the actuation of the actuator by the user may be understood as an instruction to dispense a paper towel accommodated in the housing. To do so, the driven roller of the dispensing mechanism actively guides/forwards the paper towels, which are respectively connected to each other via perforations in a position, where it can be dispensed. Hence, as in conventional dispensers, the leading paper towel gets moved towards the dispensing opening upon the actuation of the actuator. When the controller operates the dispensing mechanism upon the received actuation of the user, the dispensing mechanism feeds a leading paper towel through the dispensing opening, such that it protrudes from the dispensing opening and can accordingly be grasped by the user.

It is to be understood that the controller can be implemented as a pure software controller, a pure hardware component, or mixtures thereof.

Yet, said driven roller is not only configured to be driven by the predetermined amount of rotation for feeding the paper towels towards the dispensing opening in a driven state. The

driven roller is also configured to, in a non-driven state, be manually rotatable against a predetermined resistance upon an external pulling force on a leading paper towel extending from the dispensing opening.

The "non-driven state" refers to a situation, in which the driven roller is not actively driven via the control of the controller upon actuation of the actuator.

It is, hence, the key idea of the present disclosure to provide a dispenser having a dispensing mechanism with a driven roller that is capable to, on the one hand, actively feed a leading paper towel towards the dispensing opening of the dispenser housing by a predetermined amount of rotation upon the receipt of a trigger signal, and, on the other hand, establish a resistance against the user's pulling force on a leading paper towel in a non-actively operated state of the driven roller. Put differently, in a passive state of the driven roller, it is configured to establish a predetermined resistance, i.e., a braking force acting against the external pulling force of the user.

The predetermined resistance may be larger than a longitudinal connection resistance established via the perforations of consecutive paper towels.

By that, it is possible to establish a precise and reliable separation of the leading paper towel from the consecutive paper towels at a leading perforation, once the same has passed the nip. That is, the paper towels get uniformly guided from a storing position to the nip, and once at least one perforation has passed said nip, a predictable rupture between the leading paper towel and the remainder of the paper towels can be achieved.

The two rollers forming the nip are configured to eliminate any slippage of the paper towels through the nip upon the application of the external pulling force on the leading paper towel extending from the dispensing opening. Here, the driven

roller of the two rotatable rollers rotates together with the paper towels upon the application of the external pulling force. In this course, the driven roller is not rotating freely, but applies the above-mentioned predetermined resistance. Further, the two rollers forming the nip enable that slippage of paper towels through the nip can be omitted. It can also be reliably ensured that the paper towels do not get separated at the perforations connecting consecutive paper towels before having passed the nip. Further, having a lower longitudinal connection resistance than the predetermined (braking) resistance established by the driven roller in a non-driven state allows to establish a foreseeable separation of the paper towels at the perforations connecting the same after having passed the nip.

The predetermined resistance may be within a range of 4N to 15N, preferably in a range of $6N \pm 2N$.

This allows to ensure a precise separation of consecutive paper towels while not overburdening the user that manually pulls on the leading paper towel extending from the dispensing opening and accordingly applies the external pulling force.

The dispensing mechanism may further comprise a guiding belt for guiding the paper towels towards the dispensing opening. The guiding belt may be connected to the driven roller in such a manner that the guiding belt is driven upon driving of the driven roller.

The guiding belt allows a reliable feeding of the paper towels towards the dispensing opening. Having such a guiding belt particularly helps to avoid a paper jam that could occur when continuously folded paper towels are to be used and dispensed with the dispenser. As the guiding belt is connected to the driven roller in such a manner that the guiding belt is driven upon driving of the driven roller, a simple construction and design is achieved that does not require an additional actuation, motors, or the like. This connection also allows the supportive guiding of the paper towels in the non-

(actively) driven state, i.e., when the driven roller is rotated manually due to the application of the external pulling force on the leading paper towel.

The dispenser may further comprise an optical sensor unit for detecting the presence of a paper towel in the dispensing opening. The controller may be disabled to operate the dispensing mechanism, i.e., to drive the driven roller, for a predetermined time period upon detection of the presence of a paper towel in the dispensing opening via the optical sensor unit and upon a scenario, in which the driven roller has already been driven by the predetermined amount of rotation. Put differently, if both conditions are true, the dispensing mechanism is disabled for the predetermined time period.

This allows to avoid unnecessary excessive paper dispensing, as the amount of paper towels to be dispensed via the dispenser can be kept as low as possible. This is particularly the case, as the configuration merely continues to dispense further paper towels when a further actuation is detected after the lapse of the predetermined time period and the paper towel blocking the optical sensor unit, i.e., the paper towel detected by the optical sensor unit to be in the dispensing opening, has not yet been grasped and removed. This control scheme allows to motivate the user to grasp the leading paper towel and to remove the same from the dispensing opening, such that the detection area of the optical sensor unit can be cleared. This automatically triggers a return to a normal dispensing operation, as the dispenser has returned to a regular state, which may also be understood as a synchronized state.

Pausing the active driving of the driven roller when the optical sensor unit detects the presence of a paper towel in the dispensing opening for a predetermined amount of time further allows to reduce the number of towels that are to be dispensed and to avoid a potential paper jam caused by paper towels blocking the dispensing opening.

The controller may be configured, upon the lapse of the predetermined time period, the detection of the presence of a paper towel in the dispensing opening via the optical sensor unit, and a further actuation of the actuator by the user, to drive the driven roller for feeding the paper towel out of the dispensing opening by a smaller amount of rotation than the predetermined amount.

Hence, in a scenario, in which, for example, the protrusion of the leading paper towel from the dispensing opening is too small to allow the user to properly grasp and pull onto the leading paper towel, such that the user tries to actuate the actuator several times to get more paper towels dispensed, the controller feeds more paper towel out of the dispensing opening, such that grasping and pulling onto the leading paper towel can be facilitated and the chances of success for dispensing the leading paper towel can be increased. The feeding of more paper towel out of the dispensing opening means that the protruding length of the leading paper towel is increased in this scenario.

Driving the driven roller by a smaller amount of rotation than the (usual) predetermined amount of rotation enables to omit that the same issue occurs from paper towel to paper towel. Accordingly, potential unsynchronized situations, for example, when the perforations have moved too far from the nip towards the dispensing opening, the pulling by the user at the leading paper towel can automatically return the dispensing mechanism to a synchronized state without the need of any additional control schemes or structural features. This is particularly the case, as the optical sensor unit allows to indirectly detect the situation inside the dispenser and the issues are resolved automatically without having to spend too many paper towels.

The smaller amount of rotation, i.e., the distance covered by said rotation, may be shorter than half of the longitudinal dimension of one of the paper towels.

This allows to transfer the system back to the aforementioned synchronized state, in which a leading paper towel inside the housing that is ready to be dispensed upon receipt of a dispenser actuation signal does not block the optical sensor unit and therewith signalized the presence of a paper towel in the dispensing opening.

The optical sensor unit may comprise an infrared sensor.

Such an infrared sensor ensures a reliable paper towel detection at the dispensing opening region, as it is less affected by changing ambient light situations, or the like. In other words, using an infrared sensor reduces the effect of changing ambient light situations on the detection.

The actuator may be a proximity sensor unit configured to detect a motion of the user as the actuation.

The proximity sensor unit is accordingly to be understood as a unit comprising a sensor being able to detect the presence of nearby objects, here, for example, a limb, a hand, the chest, or even a foot of the user, without any physical contact. For example, the proximity sensor unit may be configured to emit an electromagnetic field or a beam of electromagnetic radiation and may accordingly be configured to look for changes in the field or return signal as an actuation signal. Here, the object being sensed is often referred to as the proximity sensor (unit)'s target.

By providing such a proximity sensor unit, a high reliability and long function life due to the absence of any mechanical parts and a lack of physical contact between the sensor (unit) and the sensed object can be achieved.

That is, when the controller operates the dispensing mechanism upon detection of the motion via the proximity sensor unit, the dispensing mechanism feeds a leading paper towel towards/through the dispensing opening, such that it protrudes

from the dispensing opening and can accordingly be grasped by the user.

This leads to a dispenser that can be operated in a touchless manner, which positively affects the hygiene of the dispensing process with the dispenser.

According to another aspect, a method for filling the dispenser according to any of the aspects above comprises the step of inserting a paper towel source into the dispenser.

The paper towel source comprises at least two webs including a first elongate web and a second elongate web. The first elongate web is divided into paper towels defined between longitudinally separated perforations extending across the first web. Similarly, the second elongate web is divided into paper towels defined between longitudinally separated perforations extending across the second web. The perforations of the first elongate web are offset to the perforations of the second web in a longitudinal dimension of the first web.

The perforations of the first elongate web may be offset to the perforations of the second web in the longitudinal dimension of the first web by 50% of a single paper towel length. Put differently, the perforations of the first and second elongate web are shifted along the longitudinal dimension of the webs contacting each other by 50%.

The method further comprises the step of guiding a leading edge of the paper towel source through the nip.

Accordingly, a dispenser being used with a paper towel source comprising first and second elongate webs that are longitudinally offset to each other that is easily (re-) fillable and useable can be established.

The method may further comprise the steps of actuating the actuator, and, after that, manually pulling at the leading edge of the paper towel source, whereby the driven roller is

rotated against a predetermined resistance until the leading perforation of the first elongate web passes the nip and the leading paper towel of the first elongate web is separated from the remainder of the first elongate web.

The actuation of the actuator leads to an activation of the dispensing mechanism, which feeds the leading paper towel towards the dispensing opening of the dispenser. The actual dispensing of the leading paper towel, for example, of the first web, is then manually performed by a pulling force application onto the leading paper towel, which provokes a separation of the leading paper towel of the first elongate web from the remainder of the first elongate web at the leading perforation after the leading perforation has passed the nip on its way to the dispensing opening.

This is particularly the case when the predetermined resistance is larger than the longitudinal connection resistance established via the perforations of consecutive paper towels of the first web (or the second web).

Further aspects of the present disclosure may be found in the following description of a particular embodiment referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective front view of a dispenser of the present disclosure in a closed state, i.e., in an operating state.

Figure 2 is a perspective front view of the dispenser of the present disclosure in an open state, i.e., in (re-) filling and maintenance state.

Figure 3 is a schematic illustration of a paper towel source, i.e., a first elongate web and a second elongate web, which are interfolded to form a stack of paper towels, to be (exemplarily) used with the dispenser.

Figure 4 illustrates the dispenser during the (re-)filling with at least one stack of paper towels.

Figure 5 is a front view of a dispensing mechanism of the dispenser.

Figure 6 is a cross-sectional side view of the dispensing mechanism taken along the longitudinal dimension of the dispensing mechanism illustrated in Figure 5 with the first elongate web and the second elongate web passing through the dispensing mechanism and with an illustration of a first sensing region and a second sensing region.

Figure 7 is a front view on a printed circuit board and a proximity sensor unit.

Figure 8 shows the cross-sectional side view of the dispensing mechanism of Figure 6 with the first elongate web and the second elongate web in a (synchronized) state, in which the leading paper towel of the second elongate web is ready to be grasped by the user and a leading perforation between the leading paper towel and the subsequent paper towel of the second elongate web has passed a nip between a rotatable roller and a driven roller of the dispensing mechanism.

Figure 9 shows the cross-sectional side view of the dispensing mechanism of Figure 8 after the leading paper towel of the second elongate web has been grasped by the user and has been removed from the remainder of the paper towels of the second elongate web.

Figure 10 shows the cross-sectional side view of the dispensing mechanism of Figure 6 with the first elongate web and the second elongate web in an exemplary unsynchronized state, in which the protruding length of the leading paper towel of the first elongate web out of the dispensing opening is too short to be grasped by the user.

Figure 11 shows the cross-sectional side view of the dispensing mechanism of Figure 10 in the unsynchronized state after the leading paper towel of the first elongate web is forwarded, i.e., further fed towards the dispensing opening, by an additional amount that is smaller than a predetermined amount of rotation of the driven roller to enable the user to grasp said leading paper towel.

DETAILED DESCRIPTION OF A PARTICULAR EMBODIMENT

Hereinafter, an embodiment according to the disclosure will be described in detail with reference to the accompanying drawings in order to describe the disclosure using illustrative examples. Further modifications of certain individual features described in this context can be combined with other features of the described embodiments to form further embodiments of the disclosure.

Throughout the drawings/figures, the same reference numerals are used for the same elements.

Figure 1 is a perspective front view of a dispenser 1 of the present disclosure for dispensing (sanitary) sheet products, such as paper (hand) towels, paper napkins, facials, toilet paper, or other wiping products in sheet form.

In the present scenario, the dispenser 1 is illustrated as a wall-mounted dispenser but is not limited thereto. It can also be configured as a standing dispenser or a dispenser that is at least partially recessed in a cabinet. For easier orientation, it will now be focused on a wall-mounted dispenser 1. If desired, a bin may be provided underneath the dispenser 1 for disposal of used sheet products.

The dispenser 1 comprises a housing 2 for accommodating a paper towel source, such as a stack of paper towels. The paper towel source will be described in more detail further below.

The housing 2 comprises a front surface 8, which faces a user when dispensing paper towels from the dispenser 1, and several side surfaces. The side surfaces respectively extend from the front surface 8 towards a back (surface) of the dispenser. The dispenser is configured to be mounted to a wall, for example of a bathroom or restroom, via said back (surface) of the dispenser. These surfaces of the housing 2 are to be understood as walls that confer the housing its shape. As illustrated in Figure 1, the housing 2 may comprise a box-like shape but is not limited thereto.

Speaking of said side surfaces of the housing 2, the housing 2 comprises a first side surface and an opposing, second side surface, which extend vertically, when the dispenser 1 is mounted to the wall. The housing 2 further comprises a top surface 3 and an opposing bottom surface 4. It is apparent, among others, from Figure 1 that the top surface 3 and the bottom surface 4 of the housing 2 extend horizontally, when the dispenser 1 is mounted to the wall. These surfaces of the housing 2 may be shaped as slanted or curved surfaces with a reduced amount or even without any sharp edges.

The housing 2 further comprises a dispensing opening 5 for dispensing paper towels. As illustrated, among others, in Figure 1, said dispensing opening 5 is arranged in the bottom surface 4 of the housing 2, such that the paper towels can be dispensed at a bottom section of the housing 2 via the dispensing opening 5. In the present context, said dispensing opening 5 may, therefore, also be understood as a (dispensing) mouth of the housing 2. Figure 1, in this connection, illustrates a scenario, in which a leading paper towel 6 of the paper towel source, which will be described in more detail below, protrudes from the dispensing opening 5, such that it can be grasped by the user, for example, to dry his hands after washing the same.

In the present configuration, the front surface 8 of the housing 2 is pivotably mounted to one of the first and second side surfaces of the housing 2, such that the inside of the

dispenser can be accessed, for example, when a refilling is to be performed and/or a paper jam is to be resolved. Hence, the front surface 8 may also be understood as a lid 9 that faces the user when dispensing paper towels from the dispenser 1. Yet, the dispenser 1 is not limited to a rotatable connection of the front surface 8 with one of the first and second side surfaces. It may equally be possible to access the inside of the dispenser via a rotatable connection of the front surface 8 with one of the top surface 3 and the bottom surface 4.

Figure 2 illustrates the housing 2 in an open state, i.e., in a state when the inside of the dispenser can be accessed due to a pivoting of the lid 9. To enable said access, the housing is provided with a latch 7 that keeps the dispenser closed during a normal operation, meaning when paper towels are to be dispensed from the dispenser 1, and enables access to the inside of the housing 2 upon actuation of the latch 7. To avoid unauthorized access of the dispenser 1, the latch 7 may be provided with a lock that can, for example, be opened by cleaning stuff responsible for refilling paper towels and the maintenance of the dispenser 1.

The open state of the dispenser 1 illustrated in Figure 2 shows that the housing 2 comprises a product reservoir 13 for storing the paper towel source and further accommodates a dispensing mechanism 12. As such, the product reservoir 13 may be understood as a magazine part for accommodating the paper towel source, such as at least one stack of sheet products, i.e., at least one stack of paper towels. The product reservoir 13 and the dispensing mechanism 12 are arranged flush along the longitudinal dimension of the housing 2 of the dispenser 1. Particularly, the product reservoir 13 is arranged above the dispensing mechanism 12 for feeding the paper towels through the dispensing opening 5.

Figures 2, 4 and 5 further illustrate that the dispensing mechanism 12 is rotatably connected to the product reservoir 13 via hinges 20 that are arranged on arms 25 of the dispensing mechanism 12. Accordingly, the arms 25 of the

dispensing mechanism 12 can be considered as lever arms and the hinges 20 accordingly enable that the dispensing mechanism 12 can be rotated away from the longitudinal direction of the housing 2 to allow access to the product reservoir 13 and a corresponding refilling of the product reservoir 13 with sheet products.

The (re-)filling process of the dispenser 1 is already known in the art, for example, from WO 2020/182284 A1, which is herewith incorporated by reference, and will, thus be explained briefly with a reference to Figures 3 and 4 only.

In the present configuration, the paper towel source being the source of paper towels to be dispensed from the dispenser 1 comprises at least two elongate webs 22, 23. It can, in this connection, be taken from Figure 3 that the paper towel source comprises a first elongate web 22 and a second elongate web 23. The first elongate web 22 is divided into paper towels defined between longitudinally separated perforations 24 extending across the first web 22. The second elongate web 23 is divided into paper towels defined between longitudinally separated perforations 24 extending across the second web 23. As illustrated in Figure 3, the first and second elongate webs 22, 23 each comprise paper towels, which are identical in size, wherein the paper towels of the first web 22 are respectively connected to each other via the perforations 24 and the paper towels of the second web 23 are respectively connected to each other via the perforations 24, too.

Each paper towel of the first and second webs 22, 23 may comprise an exemplary length from perforation 24 to perforation 24 of 255mm. Figure 3 illustrates the paper towels of the first elongate web 22 in a state, in which paper towels forming the first web 22 are separated from each other at the perforations 24, as a pulling force has been applied on the same that is larger than the connection force of the perforation 24 between consecutive paper towels. Vice versa, the paper towels of the second elongate web 23 are illustrated in an interconnected state.

This paper towel source allows to omit a cutting device, blades, or the like inside the dispenser, as a separation of the respective paper towels forming the first web 22 or the second web 23 is achieved by the perforations when a pulling force applied to a leading paper towel of the first web 22 or the second web 23 is larger than the perforation strength.

Against this background, the perforations 24 may equally be understood as lines of weakness extending across the first and second webs 22, 23, respectively. The term across the [first or second] web may be construed as extending along the width dimension of the first or second web from one longitudinal edge to the other longitudinal edge of the first or second web. Optionally, the perforations 24 extend perpendicular to the longitudinal dimension of the respective first and second webs. Yet, the disclosure is not limited to perforations extending perpendicular to the longitudinal dimension of the first and second webs, respectively.

It is apparent from Figure 3 that the back surface of the first elongate 22 is in contact with the front surface of the second elongate web 23. Accordingly, slippage of the first and second webs 22, 23 relative to each other can be omitted. The friction achieved by the contact of the first and second web surfaces is larger enough to omit such a slippage of the first web 22 relative to the second web 23 and vice versa.

Figure 3 shows that the perforations 24 of the first web 22 are offset to the perforations 24 of the second web 23 in a longitudinal dimension of the first web 22. Specifically, the perforations 24 of the first elongate web 22 are offset to the perforations 24 of the second elongate web 23 by half of the length of a single paper towel. In other words, the first and second webs 22, 23 comprise an identical structure and paper towel size, but are arranged in such a manner that the perforations 24 of the respective webs are shifted relative to each other by 50% of the paper towel length. Consequently, the respective paper towels of the first and second webs 22, 23

overlap each other by 50%. For example, a perforation 24 of the second web 23 contacts a paper towel of the first web 22 at a length of 127,5mm, i.e., at half of the total paper towel length of 255mm.

The first elongate web 22 and the second elongate web 23 are interfolded to form a stack 21 of the two perforated, interfolded webs. This structure of two elongate webs forming a stack of paper towels is already known from WO 2013/007302 A1, which is incorporated in its entirety herein by reference.

With reference to Figure 4, it will now be briefly explained how a (re-)filling of the dispenser is to be performed with paper towel stacks 21 as explained above.

Figure 4, in line with Figure 2, shows the dispenser 1 with a housing 2 that is open, as the lid 9 forming the dispenser's front surface 8 has been pivoted towards an open position. Other than in Figure 2, Figure 4 shows the dispenser in an empty state, i.e., in a state with no (stacks 21 of) interfolded webs of paper towels being stored/accommodated inside the housing 2.

Each of the stacks 21 of interfolded elongate webs 21, 22 comprises a leading portion of the webs 21, 22, and a bottom portion of the webs. In other words, the leading portion of the webs 21,22 is to be understood as the first paper towel separable from the stack 21, while the bottom portion of the webs 21, 22 is to be construed as the last paper towel of the stack 21. Figure 4 illustrates that each of the leading portion and the bottom portion of the webs forming the stack 21 is provided with a fastening means to establish a connection between several stacks 21. In the exemplary form of Figure 4, a hook and loop fastener 31, especially Velcro®, is respectively attached to the leading portion and the bottom portion of the webs forming a stack 21. Said hook and loop fastener 31 enables a connection of a last paper towel of a first stack 21 to a first, i.e., a leading, paper towel of a second stack 21. Accordingly, several stacks 21 of interfolded

paper towels can be interconnected to each other, and the leading paper towel does not have to be guided through the dispenser after a single stack has been dispensed.

As the guidance of the first and second webs from the product reservoir 13 through the dispenser and out of the dispensing opening 5 via the dispensing mechanism 12 is also already elaborated in detail in WO 2020/182284 A1 and WO 2013/007302 A1 it will not be elaborated in more detail.

To initially fill or refill the dispenser 1 with sheet products, one or multiple stacks 21 of paper towels are to be inserted into the dispenser 1. The illustrated dispenser 1 can, for example, accommodate three stacks 21 of interfolded webs. Yet, the dispenser configuration is not limited thereto. It may equally be possible to establish a dispenser 1 that can accommodate two, four, or even more stacks 21 of interfolded webs. To do so, it is apparent from Figure 4 that the dispensing mechanism 12 is tilted away from the product reservoir 13 via the arms 25 and hinges 20 arranged on the dispensing mechanism 12. Accordingly, the product reservoir 13 can be accessed and the stacks 21 can be stored therein.

To dispense a leading portion of the first and second webs 22, 23, a dispensing path is established from the product reservoir 13 to the dispensing opening 5 of the housing 2. Here the stacks 21 are arranged in such a manner that their weight is oriented downwardly to bear against a bottom of the stack and the leading portion of the first and second webs 22, 23 extend from the top of the stack 21. In the exemplary configuration, the leading portion of the first and second webs 22, 23 extending from the top of the stack 21 are guided from the stack 21 towards and around a top roller 14, which is arranged at an uppermost portion of the housing 2. Optionally, the top roller 14 is a freely rotatable roller. Subsequently, the leading portion of the first and second webs 21, 22 is guided downwards again towards the dispensing opening 5 in the bottom surface 4 of the housing 2 to be dispensed from the dispenser 1.

While being guided towards the dispensing opening 5 in the bottom surface 4 of the housing 2, the leading edge of the first and second webs 21, 22 pass through the dispensing mechanism 12, which will now be described in more detail with reference to Figure 5.

The dispensing mechanism 12 comprises two rotatable rollers, namely a rotatable roller 10 and a driven roller 11. The rotatable roller 10 and the driven roller 11 form a nip, wherein the first elongate web 22 and the second elongate web 23 pass through the nip.

The rotatable roller 10 is configured to act on the first elongate web 22 and the second web 23, dependent on the orientation of the dispenser, via gravity, i.e., via the weight of the rotatable roller, and/or via an additional spring preload. Irrespective of the question whether the rotatable roller 10 acts on the first and second webs 22, 23 via gravity and/or the additional spring pre-load, it is to be understood that said rotatable roller 10 is configured to push the first and second webs 22, 23 onto the driven roller 11. Accordingly, the rotatable roller 10 may also be understood as a push roller, which assures a contact force between the rotatable roller 10, the first and second elongate webs 22, 23, i.e., the paper to be fed through the nip, and the driven roller 11. Hence, a friction force between the driven roller 11 and the paper is assured as well, such that slippage of the webs 22, 23 through the nip, and a corresponding paper jam, can, thereby be reliably omitted. The first and second webs 22, 23 can be guided through the nip without any slippage. Thus, the first web 22 and the second web 23 can be kept synchronized to each other and the offset between the first elongate web 22 and the second elongate web 23 can be maintained at sustainably 50% of the longitudinal dimension of the paper towel length. This is the case, as the rotatable roller 10 ensures that, for example, the second web 23 doesn't slip against the first web 22, and vice versa.

The surface of the driven roller 11 may additionally be coated with an elastomeric or rubber coating to increase friction between the first or second web 22, 23 and the driven roller 11. The present application is, nonetheless, limited to such coatings. It may equally be possible to apply other types of friction-increasing surfaces, such as sandpaper, a molded plastic surface with a rough finish, or a knurled metal surface.

The actual guidance is achieved by a driving, i.e., an operation of the driven roller 11. In the present configuration the driven roller 11 is actuated, i.e., driven via a (non-illustrated) electro motor that is coupled to the driven roller 11 via a gearbox. Yet, the configuration is not limited thereto. It may equally be possible to connect the electro motor directly to the driven roller without an intermediate gear box. In any case, it is apparent that the driven roller 11 is also to be understood as a drive roller of the dispensing mechanism 12. Said electro motor is connected to a battery that is accommodated in the housing 2. Yet, the configuration is not limited to such a battery-driven dispenser. It may equally be possible to provide a dispenser 1 that is connected to a local power supply, such that no battery is required.

As is apparent from Figure 6, the rotatable roller 10 and the driven roller 11 are arranged such that the first and second elongate webs 22, 23 are guided in such a manner that they follow the shape of an "S" around the rotatable roller 10, through the nip, and along the surface of the driven roller 11. This S-shape allows that the paper towels can be dispensed more easily. Further, the S-shape gives more friction between the rotatable roller 10, the driven roller 11 and the first and second webs 22, 23. This reduces the amount of bias force (from gravity or springs) needed between the rotatable roller 10 and the driven roller 11 to keep the first and second webs 22, 23 from slipping.

The driven roller 11 is configured to, in a non-driven state, be manually rotatable against a predetermined resistance upon an external pulling force on a leading paper towel 6 extending from the dispensing opening 5. The non-driven state is a state, in which the electro motor is not activated to drive the driven roller 11.

It is apparent from the aforesaid that the predetermined resistance may be understood as a drag or an extra electronic brake force against which the leading paper towel has to be dispensed. In other words, in between driven feeds of paper, there is always an extra electronic brake applied to the driven roller 11. This is to be understood as an extra brake force in addition to the torque required to rotate the gear and mechanical parts included in the dispensing mechanism 12. Said drag is established by the electric motor, which is operated to act as a generator in the non-driven state. That is, the electric motor for driving the driven roller 11 establishes - other than in the driven state - an electromagnetic resistance by shortening the motor leads of the electric motor.

In a preferred configuration leading to a dispenser with a reduced power consumption and, accordingly, a longer battery life, it is possible to provide two different means for establishing the predetermined brake force, i.e., the extra electronic brake force. This is realized by the provision of a first and a second brake circuit, which both use the motor that is linked to the driven roller 11 to generate the brake force and apply the same directly via the electric motor and the driven roller 11 to the paper.

In this connection, the first brake circuit is applied for a certain period of time, for example, three seconds.

After the lapse of said certain period of time, the second brake circuit, which is more energy-efficient and may also be understood as a parking brake circuit, takes over the application of the braking force.

Both means, i.e., both circuits establish a brake force in such a manner that no difference in pull force is noticeable for the user when moving from the first to the second brake circuit.

In the first brake circuit, a motor driver integrated circuit (IC) short-circuits the motor leads and turns the motor into a generator, thus applying the braking force.

The second (parking) brake circuit is a transistor circuit, which accordingly also allows to turn the motor into a generator and thus apply the braking force, but in a more energy-efficient manner.

The predetermined resistance is larger than a longitudinal connection resistance established via the perforations 24 of consecutive paper towels. The longitudinal connection resistance may equally be understood as the perforation strength of the first elongate web 22 or the second elongate web 23.

Accordingly, a reliable separation of two consecutive paper towels can be achieved and one paper towel at a time can be reliably dispensed.

The force to tear the perforation, that is, said longitudinal connection resistance established via the perforations 24 of consecutive paper towels, is typically in a range of 6N to 8N, but is not limited thereto. If the longitudinal connection resistance is set to be in a range of 6N to 8N, the predetermined resistance established by the motor of the driven roller 11 is accordingly set higher.

Irrespective of the actual resistances chosen, it will now be described how the longitudinal connection resistance, meaning the strength of the perforation lines of the first web 22 and the second web 23, is to be evaluated. To do so, the pull force measurement method described in WO 2015/167 371 is to be applied.

Here, the web material of the first and second webs 22, 23 (see Figure 3) is respectively to be evaluated, as their material properties can slightly vary due to manufacturing.

For the evaluation, a Mecmesin BFG 50 N force gauge is to be used with a small clamp of 3 X 1 cm.

The method is to be performed in an environment with 50% RH (relative humidity), at 23 °C. The web material of the first and second web 22,23 is to be conditioned separately in this environment for 24 hours before the method is performed. For further information, reference is made to the ISO-187 standard.

In general, always attach the clamp (about 1 cm from the edge of the paper towel) and then pull the paper towel at an even speed similar to the speed used when dispensing (~1 m/s). The force gauge should be set to register the maximum force during the pull. Do ten tests in the same way with each of the first and second web and note the values. Note any tabbing or tearing or failures that may occur. Always zero the instrument before measuring.

Accordingly, measure the perforation strength of the single webs as follows:

a. Place the web material of the first web or the second web on a smooth flat surface. To lock the web material in place, put a weight (or clamp) on the web beyond a first perforation line, i.e., beyond the leading perforation 24. Attach the clamp and zero the force gauge, then pull unidirectionally, slowly (~1 m/s), and constantly. Register the maximum force which is reached when a perforation line breaks.

b. Move the web material forward and put the weight beyond the next paper towel. Then attach the clamp and pull in the same manner as before and register the maximum force when the next perforation line breaks.

c. Repeat the above steps until you have at least ten recorded perforation strengths for the first web 22 or the second web 23.

d. Repeat steps a to c for the other one of the first web 22 and the second web 23.

e. Calculate the average perforation strength of all measurements.

For example, the predetermined resistance is within a range of 4N to 15N. Optionally, the predetermined resistance is in a range of 4N to 12N. Optionally, the predetermined resistance is in a range of $6N \pm 2N$.

In addition to the above-mentioned method to determine the longitudinal connection resistance, it will now be explained how the predetermined resistance, i.e., the electronic brake force applied via the driven roller, is to be determined. This method is also based on the disclosure in WO 2015/167 371 A1.

For the evaluation of the predetermined resistance, a Mecmesin Multitest 2.5-dv test stand with a Mecmesin AGF500N force gauge is to be used with a small clamp of 3 X 1 cm and the data is to be collected with a computer running Vector Pro software.

The method is to be performed in an environment with 50% RH (relative humidity), at 23 °C.

An unperforated web material is to be used together with the dispenser 1, which are to be conditioned in this environment for 24 hours before the method is performed. For further information, reference is made to the ISO-187 standard.

In general, always attach the clamp about 1 cm from the (leading) edge of the unperforated web material and then pull

the material downward at a steady (i.e., constant) speed (i.e., velocity) of 1200mm/min.

The test machine shall produce a continuous graph of the pull force during the pull (pull force vs position). Determine a graphical average pull force from the data.

Accordingly, measure the predetermined resistance as follows:

- a. Ensure that fresh batteries are installed in the dispenser 1. Arrange the unperforated web material in the dispenser 1 along the web path so as to extend through the dispensing opening 5.
- b. Actuate the sensor to dispense web material.
- c. Measure downstream of the dispensing opening 5 by attaching the force gauge clamp to the web material; pull straight down at a steady speed of 1200mm/ min for 150mm after taking up slack. Determine a graphical average pull force from the data.

The front view on the dispensing mechanism 12 of Figure 5 shows that dispensing mechanism 12 is provided with an information unit.

Said information unit comprises, for example, a detection indicator 16, which is configured to inform the user that a detection signal has been received. For example, it indicates that a hand gesture has been detected. In an exemplary configuration, the detection indicator 16 may stay activated until the dispensing is completed. This provides acknowledgement and feedback to the user.

To omit that the dispenser 1 cannot be operated at a desired point in time, the information unit further comprises a low battery indicator 17. Said low battery indicator 17 is configured to alert the user in advance of running out of battery power, which is required to drive the driven roller

11. Accordingly, a pre-cautionary recharging of the battery or a sufficiently early replacement thereof can be performed.

Should, for whatever reason, issues occur during the operation of the dispenser 1, the information unit comprises a paper jam indicator 19, which is configured to alert the user about a malfunction in the dispensing process. Accordingly, superfluous paper dispensing can be omitted and potential issues inside the dispenser 1 can be resolved early.

To omit that the dispenser 1 runs out of paper towels provoking that a leading paper towel 6 of a new stack has to be manually pulled through the inside of the dispenser 1 along the dispensing path, the information unit further comprises a low paper indicator 18. Said low paper indicator 18 may be configured to detect a certain paper towel threshold value, for example, a remaining stack height, and provide an early alert/warning, such that running out of paper towels in the dispenser 1 can reliably be omitted. This helps to omit that the first and second webs 22, 23 must be manually guided along the dispensing path inside the dispenser 1 from the uppermost stack in the product reservoir 13, around the top roller 14 and into the nip formed between the rotatable roller 10 and the driven roller 11.

As mentioned earlier, the rotatable roller 10 pushes onto the driven roller 11 such that no slippage of the first and second webs 22, 23 occurs in the nip formed between the rotatable roller 10 and the driven roller 11.

As is apparent from Figure 6, the dispensing mechanism 12 comprises at least one guiding belt 26 for guiding the paper towels of the first and second webs 22, 23 that have passed the nip towards the dispensing opening 5. To do so, the guiding belt 26 is connected to the driven roller 11 in such a manner that the guiding belt 26 is driven upon rotation of the driven roller. Hence, the guiding belt 27 propels/urges the paper towels to move down towards and out of the dispensing opening 5. The guiding belt 26 may, for example, be realized

in the form of an O-Ring that extends around the driven roller 11 and a guide roller 26 but is not limited thereto (see, for example, Figure 6). Yet, the guide belt 27 is not limited towards a O-Ring. This could also be a flat rubber belt, or a flat, flexible belt with a roughened surface. Irrespective of the actual configuration of the guiding belt 27, the feeding of the paper towels towards the dispensing opening 5 is supported by the guiding belt 27 extending between the driven roller 11 and the guide roller 26.

To dispense the manually inserted leading paper towel 6 of the first and second webs 22, 23 in the nip out of the dispensing opening 5 of the housing 2, the dispensing mechanism 12 further comprises a feed button 15. Said feed button is configured to start/activate a rotation of the driven roller 11 as long as the button is pushed. Thereby, the leading paper towel 6 can be forwarded towards and out of the dispensing opening 5 of the housing 2, where it can be grasped by the user. After said leading paper towel 6 has been guided out of the dispenser 1 through the dispensing opening 5 by the actuation of the feed button 15, the initial loading or reloading of the dispenser 1 is finished and the lid 9 can be closed. As illustrated in Figure 5, the feed button 15 is a capacitive touch sensor for activating the driving of the driven roller in a (re-)filling process of the dispenser 1. Yet, the present disclosure is not limited to capacitive touch sensor and other configurations of the feed button 15, such as a momentary contact switch, may be feasible as well.

In the present configuration, the detection indicator 16, the low battery indicator 17, the low paper indicator 18, and the paper jam indicator 19 are configured as visual information devices, namely as warning lights. However, the present application is not limited thereto. It may equally be possible that at least one of the detection indicator 16, the low battery indicator 17, the low paper indicator 18, and the paper jam indicator 19 are configured as acoustic information devices and comprise, for example, a speaker, or the like.

To dispense a paper towel from the dispenser 1, the dispenser according to the present configuration further comprises an actuator, which is configured to be actuated by the user.

Here, a proximity sensor unit 32 configured to detect a motion of the user, such as a waving gesture of the user's hand, is provided as the actuator. Therefore, the dispenser is to be understood as a contactless dispenser 1. Meaning, a dispenser that can be actuated and can dispense paper towels without the need to be touched, for example, at a trigger button, or the like.

Said configuration is, nonetheless, not limit to a proximity sensor unit 32. It may equally be possible to provide a time-of-flight sensor, an infrared sensor, or the like to detect the motion of the user as an actuation of the dispenser.

The dispenser 1 further comprises a controller, which is configured to operate the dispensing mechanism 12 upon detection of said motion via the proximity sensor unit 32. Specifically, the controller is configured to drive the electro motor of the driven roller 11 upon detection of the user's motion via the proximity sensor unit 32. The driven roller 11 is thereby driven by a predetermined amount of rotation for feeding the paper towel towards the dispensing opening.

Considering the 50% longitudinal offset between the perforations 24 of the first elongate web 22 and the second elongate web 23, said predetermined amount of rotation is chosen accordingly that the leading paper towel of the first web 22 (or the second web 23) is moved out of the dispensing opening 5 and the consecutive perforation 24, meaning the first perforation 24 between two consecutive paper towels of the first web 22 (or the second web 23), has already passed the nip. As such, when pulling force is applied onto the leading paper towel 6, the rupture at the first perforations occurs just after the nip. As such, the predetermined amount

of rotation may equal half of the paper towel length in a normal operation scenario.

Figure 6 illustrates that the proximity sensor unit 32 acting as the actuator of the dispenser 1 is arranged inside the dispensing mechanism 12. Yet, the present disclosure is not limited thereto. It may equally be possible to arrange the proximity sensor unit 32, for example, in the lid 9.

Figure 7 is a frontal view on the proximity sensor unit 32 and a printed circuit board 29 of the controller. The proximity sensor unit 32 comprises a single capacitive sensor that is configured to generate a measurement field. The measurement field allows to detect a motion of the user that is used to active the dispensing mechanism 12 upon detection of said motion.

The capacitive sensor comprises a plate-shaped sensing electrode 28 comprising a substantially rectangular shape having an electrode front surface 33 and, as illustrated in the Figure 6, an electrode side surface 34, which is arranged perpendicular to the electrode front surface 33. The illustrated electrode side surface 34 reflects the side surface of the sensing electrode 28 at the bottom of the sensing electrode 28 in Figure 7.

As is apparent from Figure 7, the plate-shaped sensing electrode 28 is arranged on and connected to a printed circuit board 29 of the controller. Said printed circuit board 29 is substantially plate-shaped and comprises a main surface 35 and a circumferential edge 36. The circumferential edge 36 is the edge of the main surface at the bottom surface of the printed circuit board 29. The sensing electrode 28 is connected to the main surface 35 of the printed circuit board 29. Hence, power can be supplied from the printed circuit board 29 to the sensing electrode 28.

The electrode side surface 34 is arranged at the circumferential edge 36 of the printed circuit board 29. In

other words, the circumferential edge 36 of the printed circuit board 29 and the electrode side surface 34 are aligned. Thus, the circumferential edge 36 of the printed circuit board 29 and the electrode side surface 34 form a substantially even plane, wherein the electrode and the printed circuit extend parallel to each other. As is apparent from Figure 7, the electrode side surface 34 extends along the width dimension of the printed circuit board 29. Such that a measurement field of the plate-shaped sensing electrode 29 along the width dimension of the dispenser can be achieved. This may be adapted depending on the width dimension of the electrode 28 at the bottom edge of the printed circuit board.

The geometry and orientation of plate-shaped sensing electrode 28 at the circumferential edge 36 allows to detect the motion in a first sensing region A and a second sensing region B via the accordingly generated measurement field.

Figure 6 indicates that the printed circuit board 29 and the plate-shaped sensing electrode 28 connected to the main surface 35 thereof, are arranged in such a manner inside the housing 2 that the main surface 35 of the printed circuit board 29 faces the front surface 8 of the housing 2, and that the circumferential edge 36 faces a side surface of the housing 2, here the bottom surface 4 of the housing 2. It results therefrom that the first sensing region A is located in front of the front surface 8 and the second sensing region B is located in front of one of the side surfaces, here underneath the bottom surface 4. Meaning, since the plate-shaped sensing electrode 28 is positioned at the bottom edge of the printed circuit board 29 and also close to the bottom surface 4 of the dispenser 1, it can sense towards the bottom as well as to the front of the dispenser 1.

Accordingly, a more intuitive dispenser 1 is established, which can be actuated to dispense a leading paper towel 6, for example, via a waving gesture in front and, as known from conventional contactless soap dispensers, underneath the dispensing opening 5.

To improve the measurement quality in front of the front surface 8 and in front of the bottom surface 4, meaning underneath the bottom surface 4, even further, the back surface of the printed circuit board 29 may be provided with a hatched guard.

To emphasize the position of at least the first sensing region A in front of the front surface 8 of the housing 2, it is apparent from Figure 1 that the front surface 8 of the housing 2 may be provided with a sensor logo, which may also be understood as a sensor emblem, that helps to indicate where the first sensing region A is present and where the dispensing mechanism 12 can be triggered accordingly.

The plate-shaped sensing electrode 28 of the capacitive sensor are configured in such a manner that the first sensing region and/or the second sensing region extend up to 100mm, optionally 75mm, away from the sensing electrode, when measured normal to the sensing electrode. Dependent on the arrangement of the plate-shaped sensing electrode 28 on the printed circuit board 29 as well as their arranged inside the dispenser 1, the first sensing region A and the second sensing region B can also comprise different extensions of their sensing region. For example, the second sensing region B underneath the bottom surface 4 of the housing 2 may be more compact than the first sensing region A in front of the front surface 8 of the housing 2 in order to omit an accidental actuation of the dispensing mechanism 12 when the user throws away used paper towels into the bin that may be provided underneath the dispenser 1.

Further, it is apparent from the detailed description of the optical sensor unit 30 in the remainder of the present description that, once the proximity sensor unit 32 is actuated to trigger the dispensing of a towel and the towel is delivered by the dispenser 1, the towel gets detected in the dispensing opening 5 by the optical sensor unit 30, such that the controller may block the proximity sensor unit 32 for a

predetermined amount of time, here, for example three seconds. The purpose of this is to prevent the user from actuating a second towel dispense while he or she grasps the first towel. Accordingly, a reliable portion control can be achieved.

To improve the reliable portion control even further, it may be possible to center the arrangement of the plate-shaped sensing electrode 28 between the, in Figure 7 vertically extending, circumferential side edges of the printed circuit board 29 while positioning the largest dimension of the plate-shaped sensing electrode 28 (here its width dimension) to match with the circumferential bottom edge 34 of the printed circuit board 29.

Yet, in the present configuration not only the maximum extension of the sensing regions A, B, when measured normal to the sensing electrode, is specified. The first and second sensing regions A, B of the plate-shaped sensing electrode 28 may also be limited to a minimum extension, when measured normal to the electrode front surface. An example for such a lower limit of the first sensing region A may be 25mm measured normal to the electrode front surface 33 and 25mm measured normal to the electrode side surface 34 for the second sensing region B. Unhygienic contacts of the dispenser 1 by various users can be omitted.

With reference to Figures 8 and 9, a regular paper towel dispensing operation of the dispenser 1 will now be described. A resynchronization after, for example, a connection between two stacks, for example via the hook and loop fastener 31, has been passed through the nip or the dispenser has been run out of paper towel and new paper towels are fed through the dispenser 1 will be described with reference to Figures 10 and 11 as well.

To be provided with a paper towel from the dispenser 1, the user must perform a motion inside one of the first sensing region A and the second sensing region B. Said motion gets detected via the capacitive sensor of the proximity sensor

unit 32 and said actuation information gets forwarded to the controller.

During said (non-illustrated) state, the leading paper towel 6 that is to be dispensed from the dispenser 1 hangs inside the housing 2 without protruding from the dispensing opening.

Upon receipt of the actuation information of the proximity sensor unit 32, the controller forwards a drive signal to the electro motor of the driven roller 11, which accordingly drives the driven roller 11 by the predetermined amount of rotation for feeding the paper towel towards the dispensing opening 5. As a result, the first and second webs 22, 23 passing through the nip are forwarded through the nip without any slippage and the leading paper towel 6 of the, in the illustration of Figure 8, second elongate web 23 is guided by the guide belt 26 out of the dispenser 1 via the dispensing opening 5. By said protrusion, the leading paper towel 6 can be grasped by the user. This is illustrated in Figure 8 showing the cross-sectional side view of the dispensing mechanism 12 of Figure 6 with the first elongate web 22 and the second elongate web 23 in a (synchronized) state, in which the leading paper towel 6 of the second elongate web 23 is ready to be grasped by the user and a leading perforation 24 between the leading paper towel 6 and the subsequent paper towel of the second elongate web 23 has passed the nip between the rotatable roller 10 and the driven roller 11 of the dispensing mechanism 12.

In the situation illustrated in Figure 8, the rotatable roller 10 and the driven roller 11 do not rotate as long as the predetermined resistance (drag force) exceeds the longitudinal connection force (perforation strength) of the second web 23. Once the pulling force at the (leading edge of the) lead paper towel 6 of the second elongate web 23 exceeds the longitudinal connection force of the (leading) perforation 24 between consecutive paper towels (and as the perforation 24 of said second elongate web 23 has passed the nip established by the rotatable roller 10 and the driven roller 11), the leading

paper towel 6 of the second elongate web 23 is separated from the remainder of the paper towels of the second elongate web 23 accordingly.

To achieve this, the predetermined resistance established by the driven roller 11 is larger than the longitudinal connection resistance established via the perforations 24 of consecutive paper towels to ensure a reliable rupture after the second web 23 (and first web 22) has passed the nip.

Hence, the leading paper towel 6 of the second elongate web 23 is dispensed from the dispenser. Figure 9 shows this state after the leading paper towel 6 of the second elongate web 23 has been grasped by the user and has been removed from the remainder of the paper towels of the second elongate web 23.

It is apparent from said Figure 9 that after the leading paper towel 6 of the second elongate web 23 has been grasped by the user and has been removed from the remainder of the paper towels of the second elongate web 23, the (leading edge of the) lead paper towel 6 of the first elongate web 22 has already passed the nip and is hanging inside to dispenser to be dispensed next due to the 50% longitudinal offset of the perforations of the first and second webs 22, 23 without protruding from the dispensing opening 5.

The repetition of the dispensing of one single paper towel and now the leading paper towel 6 of the first elongate web 22 can be initiated by the detection of another motion of the user via the proximity sensor unit 32. Due to the 50% longitudinal relative offset of the first and second webs 22, 23, it is possible to dispense the respective leading paper towel 6 of the first elongate web 22 and the leading paper towel 6 of the second elongate web 23 in an alternating manner until the stack of interfolded first and second elongate webs 22, 23 is dispensed completely.

It is apparent from the above that the combination of the dispensing mechanism 12 together with the longitudinal offset

first and second elongate webs 22, 23 leads to two different cases when dispensing the paper towel.

In the first case, the leading perforation 24 has already passed the nip. Since the force to tear the perforation between two consecutive paper towels is less than the brake force established by the driven roller 11, i.e., the predetermined resistance, no additional rotation of the rollers 10, 11 of the dispensing mechanism is required to dispense the leading paper towel 6.

In the second case, the leading perforation 24 has not yet passed the nip. Hence, by pulling at (the leading edge of) the leading paper towel 6, the driven roller 11 of the dispensing mechanism 12 is rotated together with the paper in order to forward the leading perforation 24 through the nip.

Nonetheless, issues can occur when the regular dispensing of paper towels as described above results in a scenario, in which the leading paper towel does not protrude long enough from the dispensing opening that it can be grasped and manually pulled by the user. This may, for example, occur, when the hook and loop fastener 31, or any other fastening means for joining two stacks 21 together, passes the nip and the hook and loop fastener 31 affects the longitudinal extension of the leading paper towel. Figure 10 shows the cross-sectional side view of the dispensing mechanism 12 of Figure 6 with the first elongate web 22 and the second elongate web 23 in an exemplary unsynchronized state, in which the protruding length of the leading paper towel of the first elongate web 22 out of the dispensing opening is too short to be grasped by the user.

To automatically resolve such a scenario, the dispenser 1, here the dispensing mechanism 12, comprises an optical sensor unit 30. Nonetheless, the arrangement of the optical sensor unit 30 is not limited thereto, it may, for example, be also possible to arrange the optical sensor unit 30 directly in the housing 2 close to the dispensing opening 5.

The optical sensor unit 30 comprises an infrared sensor. Yet, the present application is not limited thereto. It may equally be possible to provide lidar, radar, ultrasound, or the like for detecting a presence of a paper towel in the dispensing opening 5.

Said infrared sensor is arranged in such a manner that it detects a presence of a (leading edge of the) paper towel in the dispensing opening 5. As is apparent, for example, from Figures 6, 8, 9, 10, and 11, said infrared sensor is arranged in a region adjacent the dispensing opening 5.

It is apparent therefrom that the predetermined amount of rotation of the driven roller 11 during a normal operation (see the outlines with reference to Figures 8 and 9 above) is set in such a manner that the leading perforation 24 of the first web 22 or the second 23 to be dispensed next has passed the nip but the optical sensor unit 30 is not blocked when the driven roller 11 is driven once to carry the leading paper towel 6 out of the dispensing opening 5 and the leading paper towel 6 has been grasped by the user. Consequently, the optical sensor unit 30 is capable to indirectly detect the paper position and trigger a synchronization of the paper towel position inside the dispenser, if required.

In this connection, the controller is configured to be disabled to operate the driven roller 11 of dispensing mechanism 12 for a predetermined time period upon the detection of the presence of the leading paper towel in the dispensing opening 5 via the optical sensor unit 30 and when the driven roller 11 has already been driven for the predetermined amount of rotation. This state when both of said conditions are true is illustrated in Figure 10.

This is because the signal of the infrared sensor 30 affirming the presence of the paper towel at the dispensing opening indicates that the leading paper towel 6 should be able to be grasped and manually pulled by user, such that the perforation

having passed the nip ruptures and frees/dispenses the leading paper towel 6. To avoid superfluous papers to be dispensed, the controller, therefore, disengages the operation of the driven roller 11 for the predetermined time period. During said time period, the detection of further motion of the user via the proximity sensor unit 32 does not lead to an additional actuation of the driven roller 11. The predetermined time period can, for example, be two or three seconds. In other words, when the optical sensor unit 30 detects the presence of a paper towel in the dispensing opening 5, the hand sensor detection via the proximity sensor unit 32 gets disabled for a predetermined amount of time.

Upon said lapse of the predetermined amount of time and once the active driving of the driven roller 11 is further initiated via a user's gesture, the motor of the driven roller drives the towel forward until the leading edge of the towel is detected by the optical paper sensor. An encoder on the motor of the driven roller 11 counts the driven revolutions and when the correct number of revolutions, i.e., the predetermined amount of rotation occurs, the motor stops driving the driven roller 11.

During the normal dispense, the dispensing opening 5 is distanced at least so far from the nip that when the leading paper towel 6 protruding from the dispensing opening 5 is grasped and manually pulled out by the user, the leading perforation 24 of the first web 22 (or second web 23) has already passed the nip. Accordingly, the grasping and manual pulling provokes a separation of the leading paper towel 6 from the remainder of the paper towels of the first elongate web 22 (or the second elongate web 23) in a region between the nip and the dispensing opening 5, as the predetermined resistance is larger than the longitudinal connection resistance established via the perforations 24 of consecutive paper towels.

If the grasping of the leading paper towel 6 has been unsuccessful, for example because the protruding portion of

the leading paper towel 6 is too short, the predetermined time period has lapsed, the presence of the paper towel in the dispensing opening is still detected via the optical sensor unit 30, and a further actuation of the actuator by the user is detected via the proximity sensor unit 32, the controller is configured to drive the driven roller for feeding the paper towel (further) out of the dispensing opening by a smaller amount of rotation than the predetermined amount of rotation. Here, the smaller amount of rotation, i.e., the distance covered by said amount of rotation, is smaller/shorter than the longitudinal dimension of one of the paper towels. This scenario is illustrated in Figure 11.

Ideally, the smaller amount of rotation is just less than half of the paper towel, for example, in a range of 40% to 15%, preferably in a range of 25% to 15%, more preferably 19% of a length of the paper towel.

As the configuration of the nip as described above prevents any slippage during a normal operation of the dispenser 1, both the predetermined amount of rotation and the smaller amount of rotation are to be understood as, i.e. equal, a (tail) length of the paper to be feed towards the dispensing opening 5 of the dispenser 1.

Accordingly, the leading paper towel protruding length from the dispensing opening 5 is increased, and the successful grasping and manual pulling of the leading paper towel can be ensured along a pulling direction C. As the predetermined amount of rotation is smaller than the longitudinal dimension of one of the paper towels in this case, an automatic resynchronization of the first and second elongate webs 22, 23 and their respective perforations 24 can be achieved. This is particularly the case, as this smaller amount of rotation leads to a leading perforation 24 being upstream of the nip. Once the leading paper towel gets pulled, the driven roller 11 is rotated via the pulling as well. Then, the (re-) synchronization happens when the leading perforation 24 just exits downstream of, i.e. passes, the nip and the perforation

ruptures as soon as it passes/exits the nip. That leaves the dispenser synchronized for the next dispense.

Put differently, as the amount of rotation is smaller than the longitudinal dimension of one of the paper towels, the position of the respective perforations 24 of the first and second webs 22, 23 inside the housing 2 can be shifted.

This re-synchronized scenario, i.e., a situation, in which the infrared sensor no longer detects the presence of the leading paper towel 6 in the dispensing opening 5 and the leading perforation 24 of the paper towel of first or second web 22, 23 that is to be dispensed next, has passed the nip formed between the rotatable roller 10 and the driven roller 11, is illustrated in Figure 9. When this state has been achieved (again), a normal dispensing operation of the dispenser 1 can be performed (again).

That is, the leading paper towel 6 of either the first elongate web 22 or second elongate web 23 is carried towards and out of the dispensing opening 5, such that it can be grasped and manually pulled by the user along direction C against a predetermined resistance. Since the first and second webs 22, 23 are offset to each other by 50% of the respective length of the paper towels forming each of the first and second webs 22, 23, it is enough to drive the driven roller 11 during the normal operation by only half of the length of a single paper towel to establish a reliable operation. Given the fact that the paper towels of the first and second webs 22, 23 comprise an exemplary length of 255mm, the driven roller is driven in such a manner that it carries the first and second webs 22, 23 by 127,5mm upon a single actuation.

This configuration allows that no subsequent conveying is necessary, when the leading paper towel of the first elongate web 22 or the second elongate web 23 has been dispensed, as the subsequently to be dispensed paper towel is already in a starting position. This is the case as, due the user grasping and pulling the leading paper towel 6, already half of the

next paper towel of the other elongate web not forming the leading paper towel in the initial dispensing step is ready for being dispensed, as its leading edge hangs inside the housing in a region between the nip and the dispensing opening 5.

LIST OF REFERENCE SIGNS

- 1 dispenser
- 2 housing
- 3 top surface
- 4 bottom surface
- 5 dispensing opening
- 6 leading paper towel
- 7 latch
- 8 front surface
- 9 lid
- 10 rotatable roller
- 11 driven roller
- 12 dispensing mechanism
- 13 product reservoir
- 14 top roller
- 15 feed button
- 16 detection indicator
- 17 low battery indicator
- 18 low paper indicator
- 19 paper jam indicator
- 20 hinge
- 21 stack of paper towels
- 22 first elongate web
- 23 second elongate web
- 24 perforation
- 25 arm
- 26 guide roller
- 27 guiding belt
- 28 plate-shaped sensing electrode
- 29 printed circuit board
- 30 optical sensor unit (infrared sensor)
- 31 hook and loop fastener

- 32 proximity sensor unit
- 33 electrode front surface
- 34 electrode side surface
- 35 main surface (of the printed circuit board)
- 36 circumferential edge (of the printed circuit board)
- C Pulling direction

CLAIMS

1. Dispenser (1), comprising:

a housing (2) for accommodating paper towels, which are respectively connected to each other via perforations (24), the housing (2) comprising:

a front surface (8) and side surfaces (3, 4), which respectively extend from the front surface (8) towards a back of the dispenser (1), and

a dispensing opening (5) for dispensing the paper towels;

a dispensing mechanism (12) accommodated in the housing (2) for feeding the paper towels through the dispensing opening (5), wherein the dispensing mechanism (12) comprises two rotatable rollers (10, 11) forming a nip, wherein the paper towels pass through the nip, and wherein at least one of the rollers is a driven roller (11);

an actuator (32), which is configured to be actuated by a user; and

a controller configured to, upon actuation of the actuator (32), drive the driven roller (11) by a predetermined amount of rotation for feeding the paper towel towards the dispensing opening (5),

wherein the driven roller (11) is configured to, in a non-driven state, be manually rotatable against a predetermined resistance upon an external pulling force on a leading paper towel (6) extending from the dispensing opening (5).

2. Dispenser (1) according to claim 1, wherein the predetermined resistance is larger than a longitudinal connection resistance established via the perforations (24) of consecutive paper towels.

3. Dispenser (1) according to any of the preceding claims, wherein the predetermined resistance is within a range of 4N to 15N.

4. Dispenser (1) according to any of the preceding claims, wherein the dispensing mechanism (12) comprises a guiding belt (27) for guiding the paper towels towards the dispensing opening (5), wherein the guiding belt (27) is connected to the driven roller (11) in such a manner that the guiding belt (27) is driven upon driving of the driven roller (11).

5. Dispenser (1) according to any of the preceding claims, wherein

the dispenser (1) further comprises an optical sensor unit (30) for detecting a presence of a paper towel in the dispensing opening (5), and

the controller is disabled to drive the driven roller (11) for a predetermined time period upon the detection of the presence of a paper towel in the dispensing opening (5) and the driven roller (11) has been driven by the predetermined amount of rotation.

6. Dispenser (1) according to claim 5, wherein the controller is configured to, upon a lapse of the predetermined time period, the detection of the presence of a paper towel in the dispensing opening (5), and a further actuation of the actuator by the user, drive the driven roller (11) for feeding the paper towel out of the dispensing opening (5) by a smaller amount of rotation than the predetermined amount of rotation.

7. Dispenser (1) according to claim 5 or 6, wherein the smaller amount of rotation is smaller than the longitudinal dimension of one of the paper towels.

8. Dispenser (1) according to any of claims 5 to 7, wherein the optical sensor unit (30) comprises an infrared sensor (30).

9. Dispenser (1) according to any of the preceding claims, wherein the actuator is a proximity sensor unit (32) configured to detect a motion of a user as the actuation.

10. Method for filing a dispenser (1) according to any of the preceding claims, the method comprising the steps of:

- inserting a paper towel source into the dispenser (1), wherein the paper towel source comprises at least two webs (22, 23), including:

- a first elongate web (22) divided into paper towels defined between longitudinally separated perforations (24) extending across the first web (22), and

- a second elongate web (23) divided into paper towels defined between longitudinally separated perforations (24) extending across the second web (23);

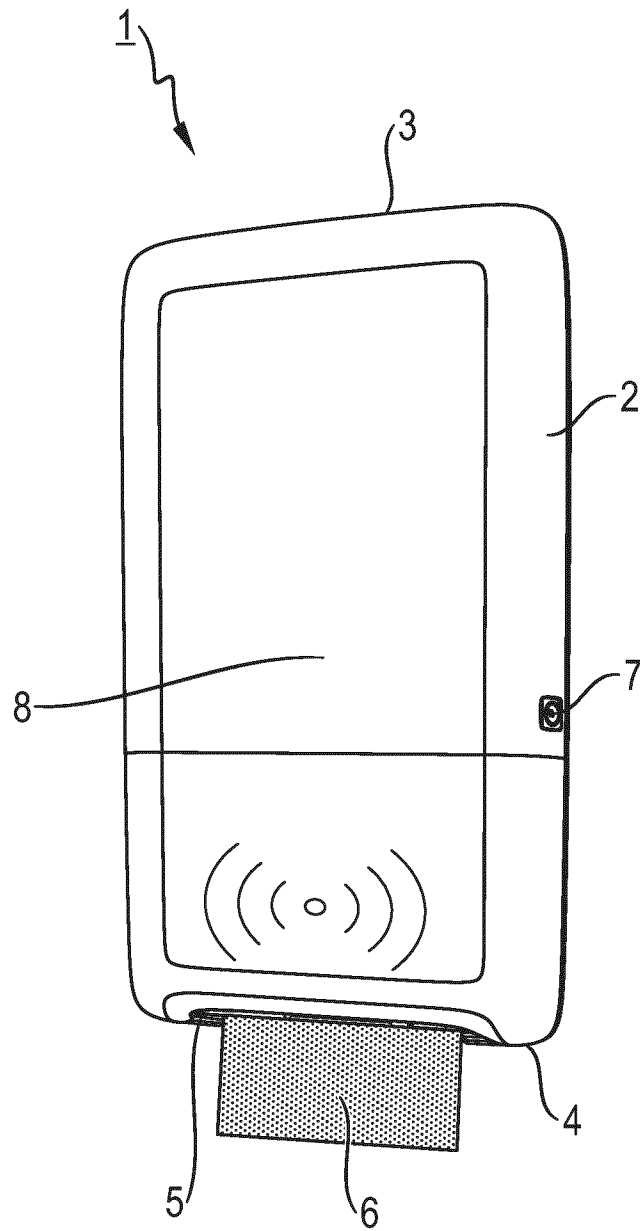
- wherein the perforations (24) of the first web (22) are offset to the perforations (24) of the second web (23) in a longitudinal dimension of the first web (22);

- guiding a leading edge of the paper towel source through the nip.

11. Method according to claim 10, further comprising the steps of:

- Actuating the actuator (32); and

- Manually pulling at the leading edge of the paper towel source, whereby the driven roller (11) is rotated against a predetermined resistance until a leading perforation of the first elongate web (22) passes the nip and the leading paper towel (6) of the first elongate web (22) is separated from the remainder of the first elongate web (22).

**Fig. 1**

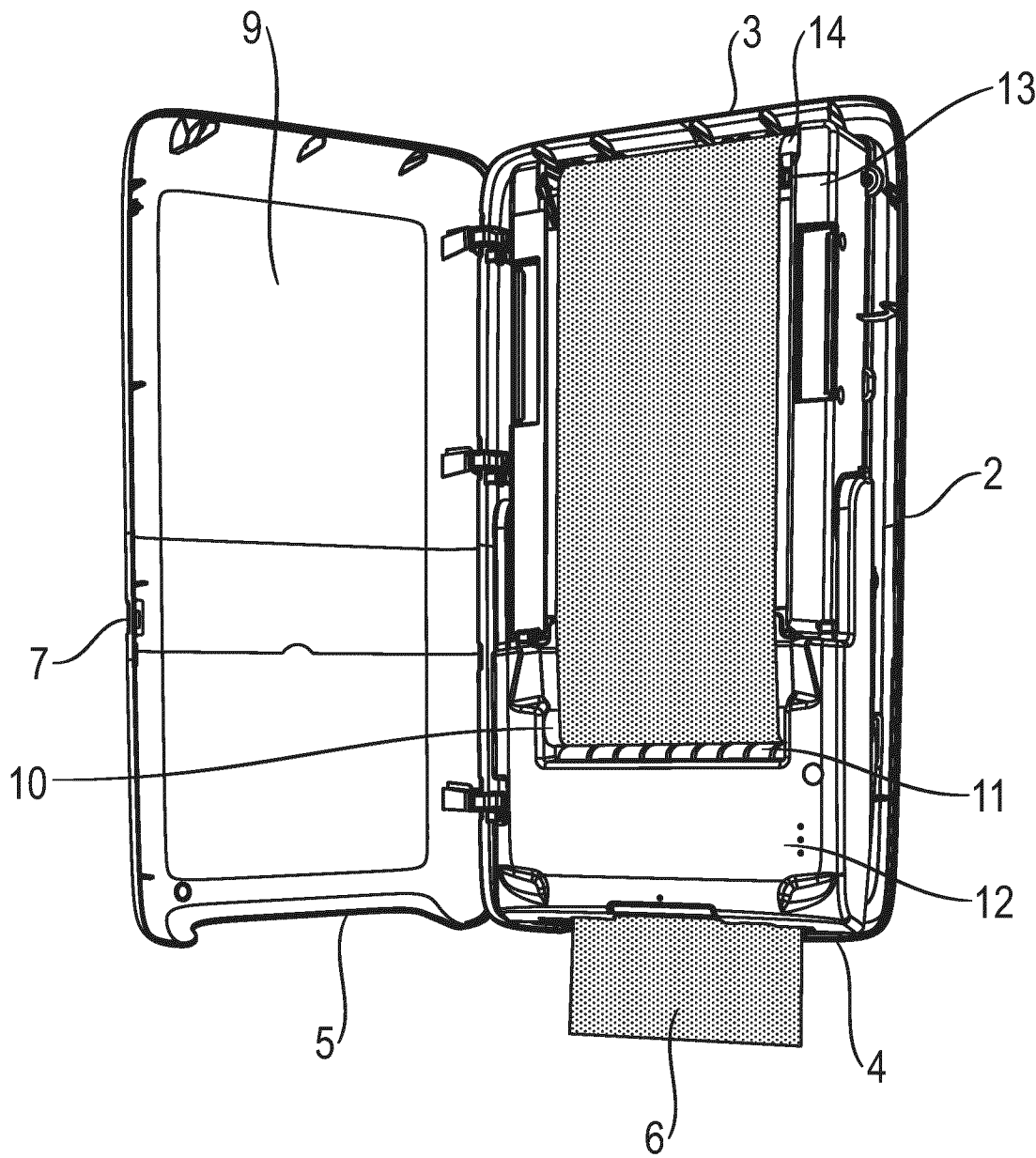


Fig. 2

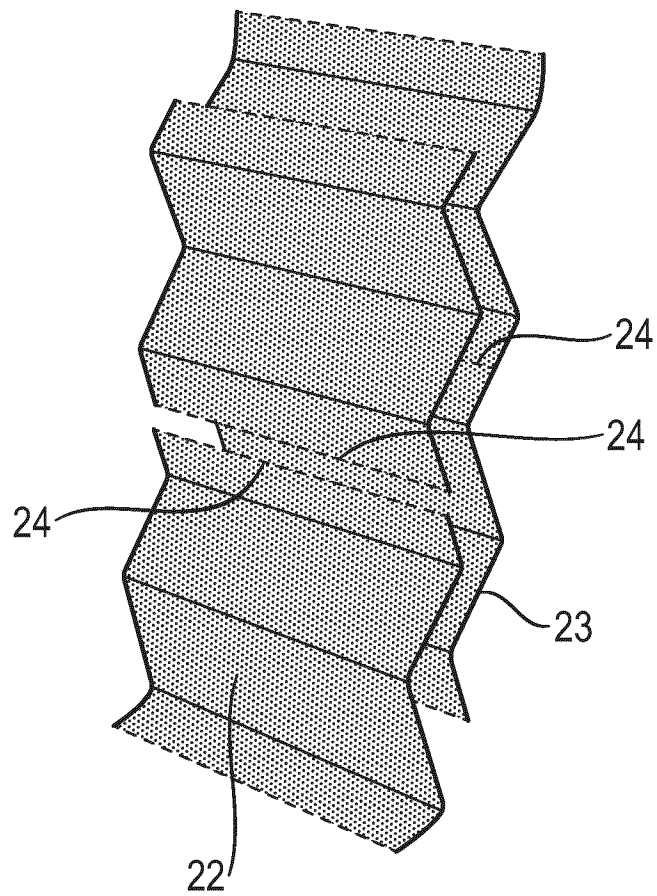


Fig. 3

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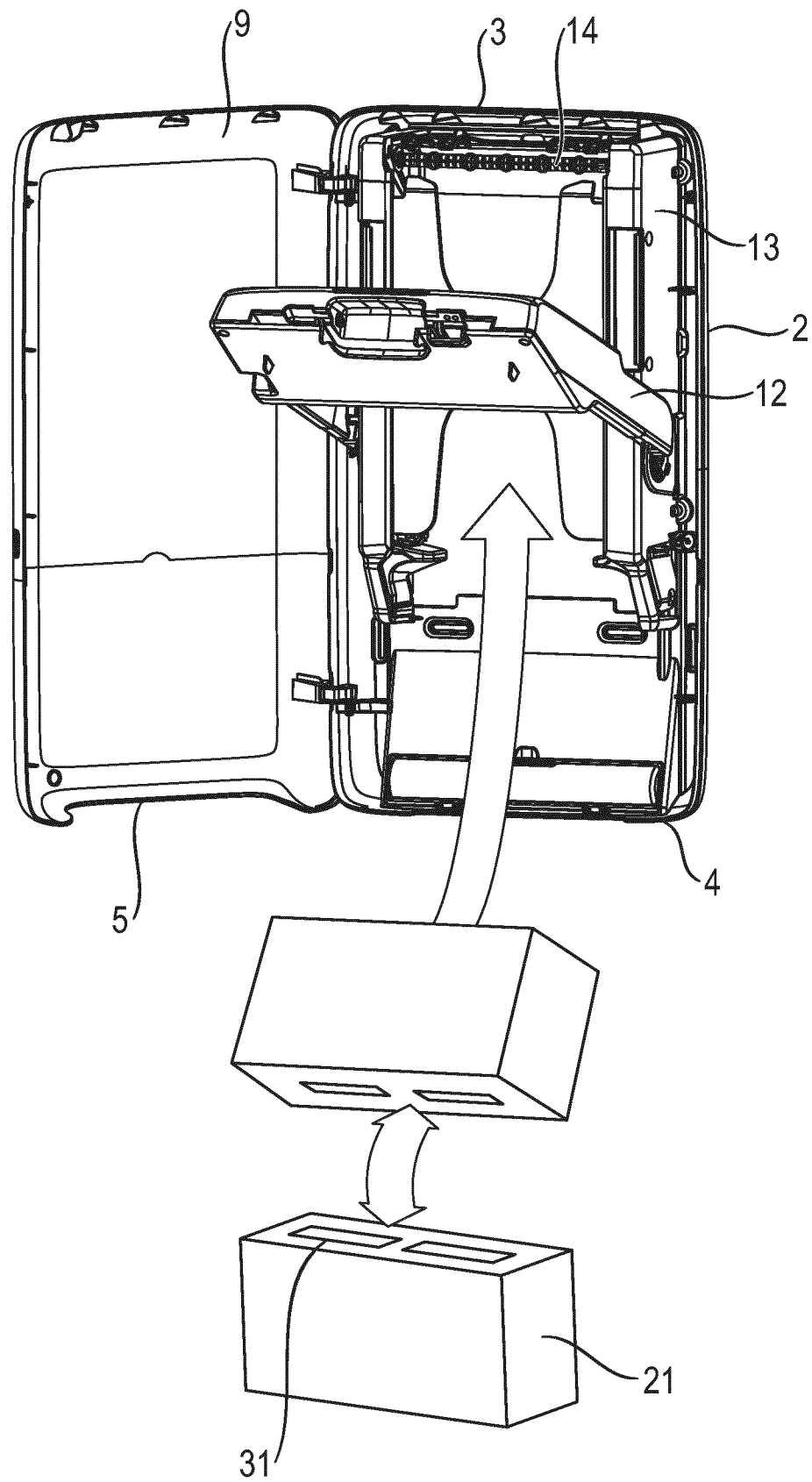


Fig. 4

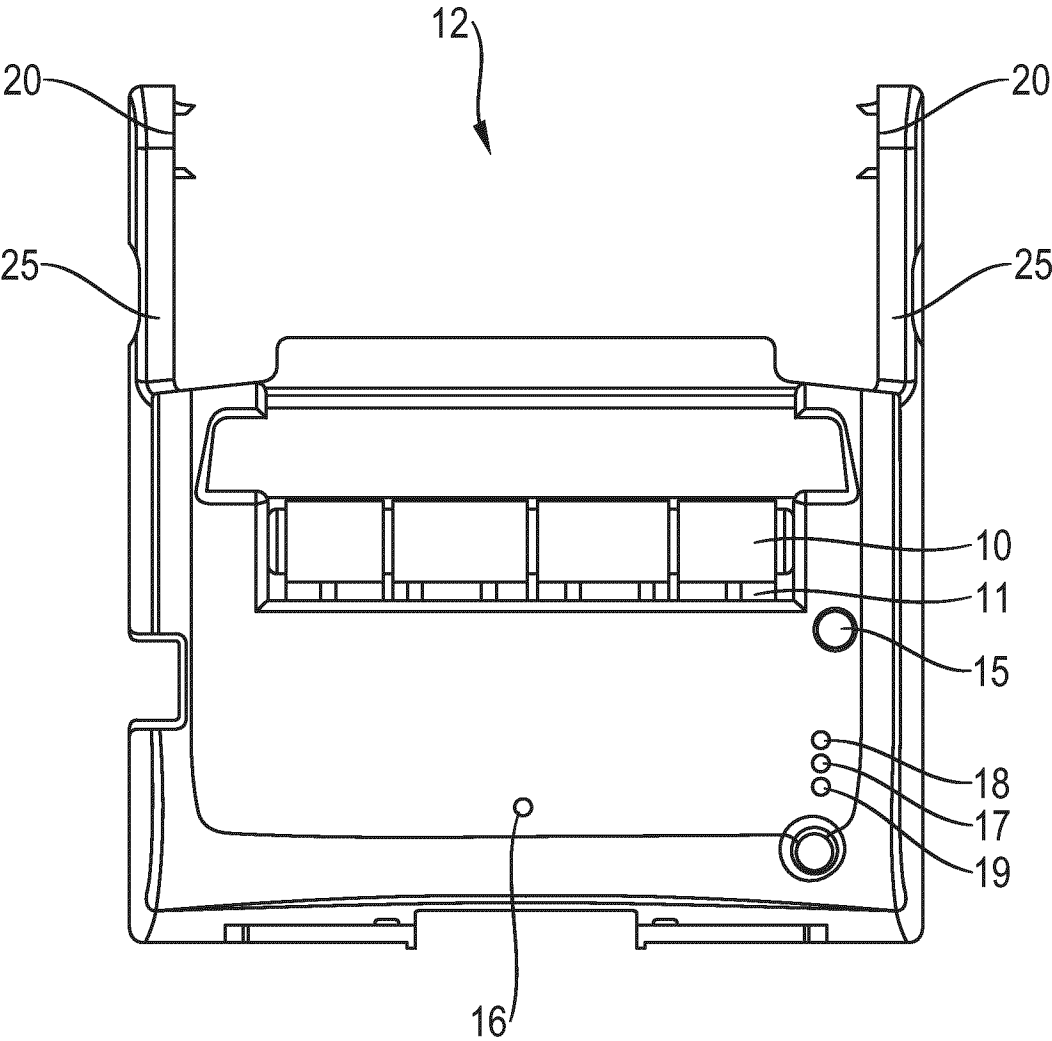


Fig. 5

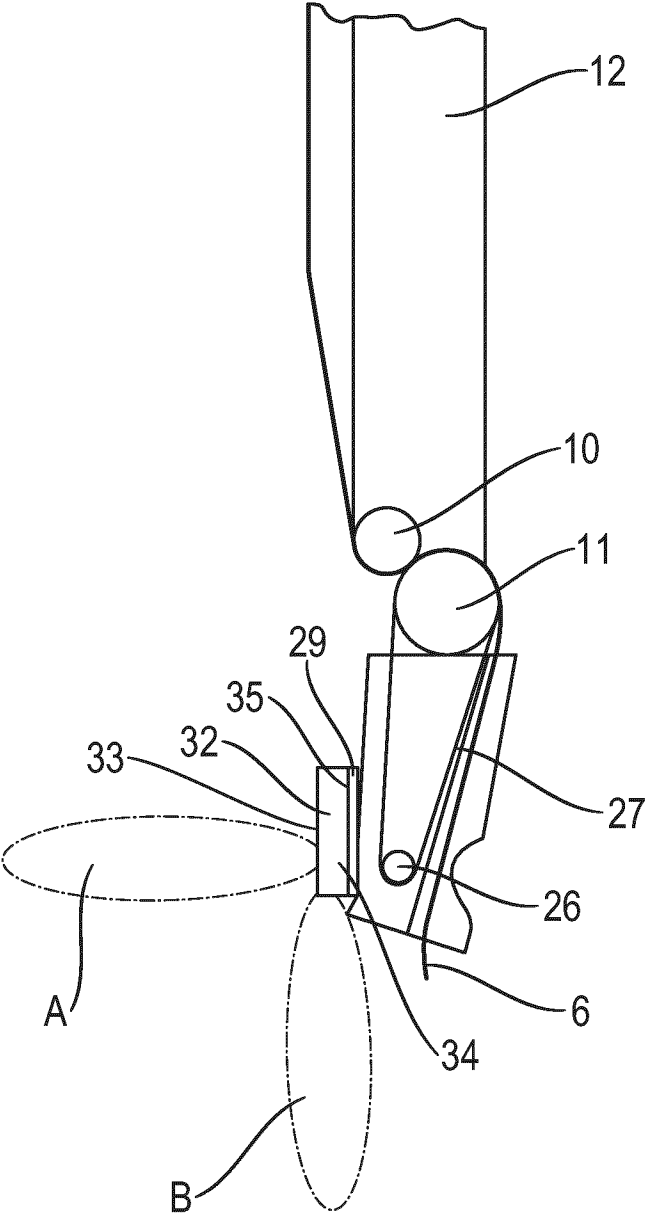


Fig. 6

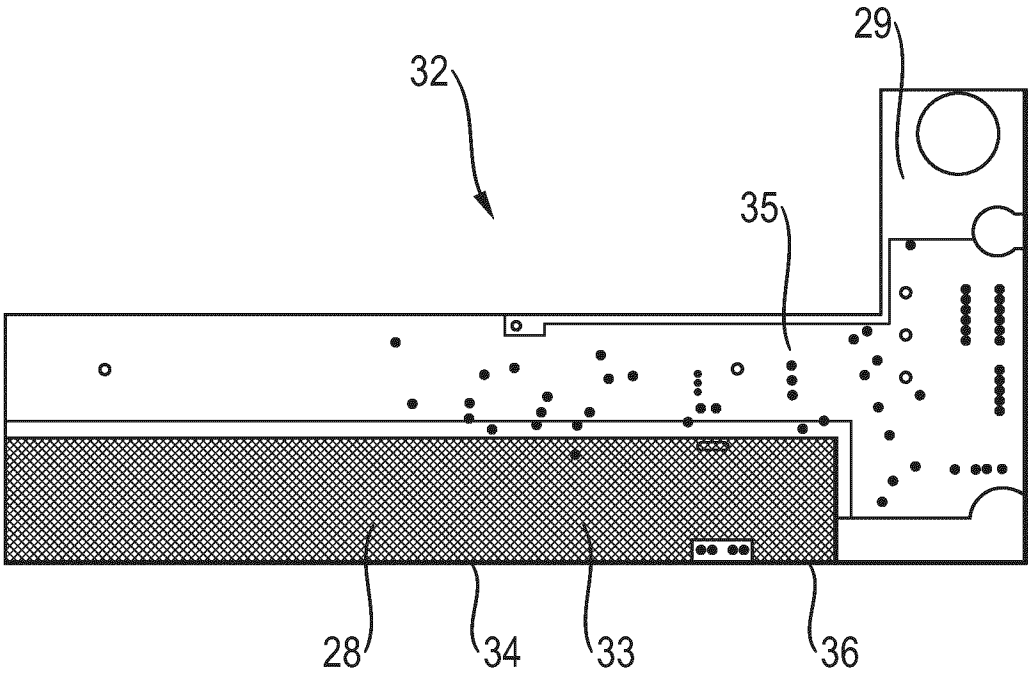


Fig. 7

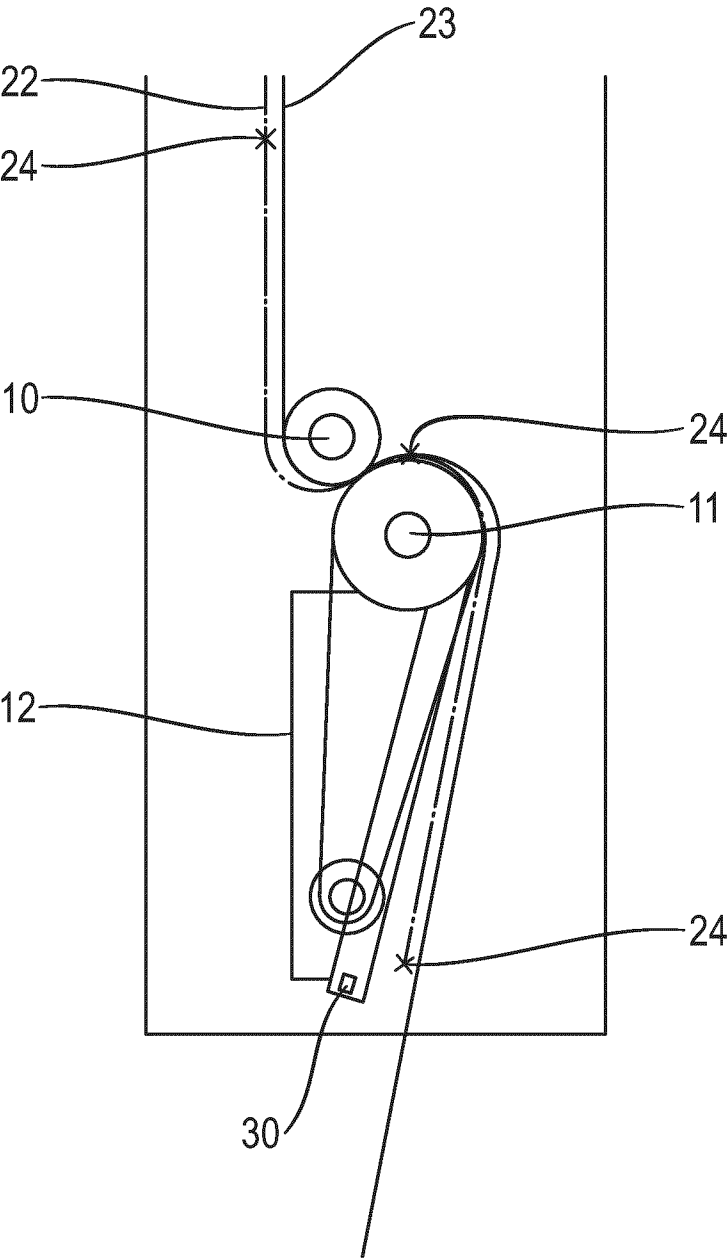


Fig. 8

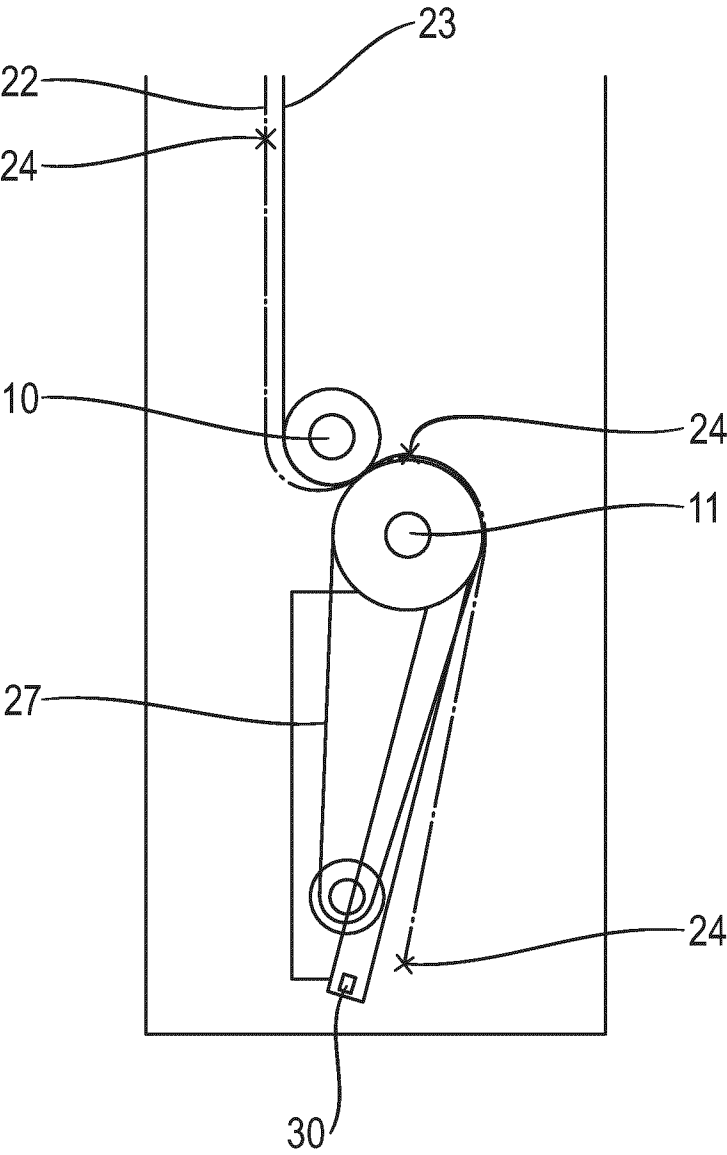


Fig. 9

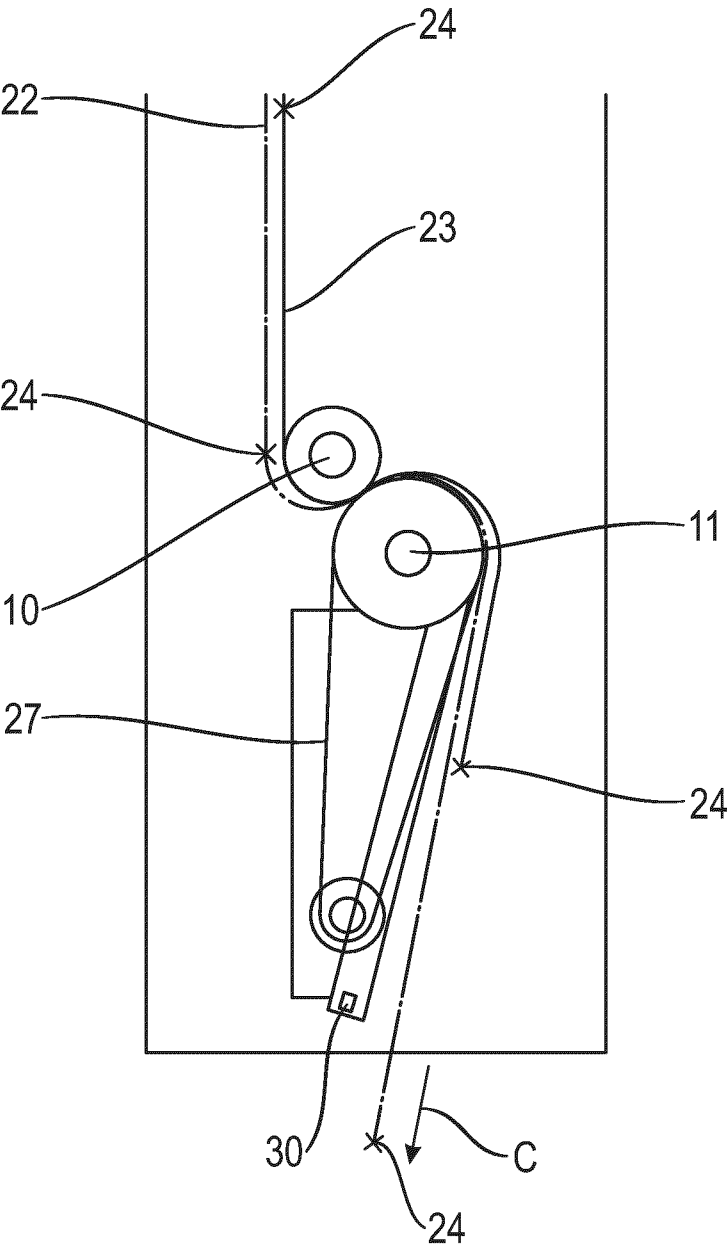


Fig. 11

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2023/066319

A. CLASSIFICATION OF SUBJECT MATTERINV. **A47K10/42** **A47K10/44**

ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47K

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/282680 A1 (LARSSON BJÖRN [SE] ET AL) 8 October 2015 (2015-10-08) paragraphs [0011], [0025], [0050], [0052]; figures 1-4 -----	1-11
X	US 2014/209624 A1 (LARSSON BJÖRN [SE]) 31 July 2014 (2014-07-31)	10
A	paragraphs [0038], [0055], [0065], [0071]; figures 1-3 -----	1, 2
A	US 7 523 885 B2 (KIMBERLY CLARK CO [US]) 28 April 2009 (2009-04-28) column 8, lines 27-44; figures 4, 6 -----	1, 5-9



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

24 November 2023

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2023/066319

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 2015282680	A1	08-10-2015	CN	104736029 A		24-06-2015
			CN	112386151 A		23-02-2021
			EP	2911563 A1		02-09-2015
			RU	2600913 C1		27-10-2016
			US	2015282680 A1		08-10-2015
			WO	2014065733 A1		01-05-2014

US 2014209624	A1	31-07-2014	AR	087031 A1		05-02-2014
			AU	2011373053 A1		16-01-2014
			BR	112014000728 A2		14-02-2017
			CA	2841383 A1		17-01-2013
			CN	103648936 A		19-03-2014
			EP	2731896 A2		21-05-2014
			ES	2547434 T3		06-10-2015
			HU	E028107 T2		28-11-2016
			MX	341398 B		18-08-2016
			PL	2731896 T3		29-01-2016
			RU	2014105168 A		20-08-2015
			US	2014209624 A1		31-07-2014
			US	2021068596 A1		11-03-2021
			WO	2013007302 A2		17-01-2013
			ZA	201400790 B		26-11-2014

US 7523885	B2	28-04-2009	US	2008100185 A1		01-05-2008
			WO	2008053385 A1		08-05-2008
