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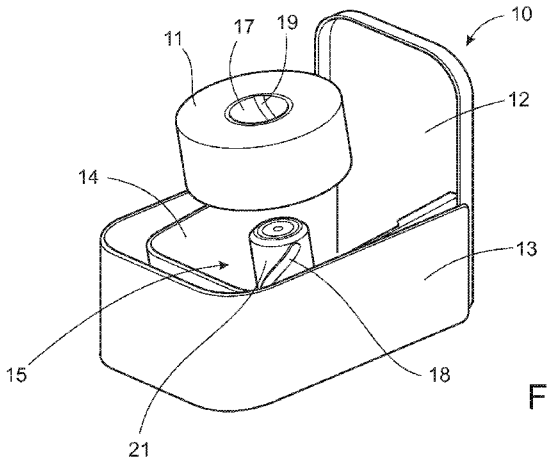

Fig.2

(57) Abstract: The invention concerns dispenser (10) suitable for dispensing absorbent sheet material from a roll (1 1) disposable within said dispenser (10). The dispenser (10) comprising: a dispenser body, a rotational shaft (15) suitable for penetration of said roll (1 1), a drive unit, and an energy storage system (32) for storing energy. The drive unit is rotationally coupled to said rotational shaft (15), which comprising engagement means suitable for rotationally locking said rotational shaft (15) with said roll (1 1). Externally caused rotation of said rotational shaft (15) drives said drive unit, thereby enabling accumulation of energy in said energy storage system (32), and said drive unit is configured to be powered by energy from said energy storage system (32) for temporarily rotating said rotational shaft (15). The engagement means comprises at least one projection (18, 22, 50, 61, 66) and/or at least one recess (37) arranged on a circumferential outer surface (21) of said rotational shaft (15) for radial engagement with said roll (1 1). The invention also concerns a dispenser assembly comprising a dispenser as previously described and a hollow cylindrical core (17) suitable for supporting a roll of absorbent sheet material.

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TITLE

Dispenser

TECHNICAL FIELD

This invention relates to a dispenser suitable for dispensing absorbent sheet material from a roll according to the preamble of claim 1. The dispenser is particularly suitable for being installed on a wall for dispensing absorbent sheet material, or wipes, to a user. The roll may be a continuous or discontinuous hard wound roll towel.

BACKGROUND OF THE INVENTION

One problem frequently occurring during use of a sheet material dispenser is lack of an easily visible leading tail of the sheet material. The user must then search for the leading tail and subsequently pull the sheet material from the roll and out of the dispenser. Dispenser with electrical feeding functions of the leading tail are known, and feeding of sheet material is for example initiated upon detection of a user by a proximity sensor, or a leading tail of the sheet material is automatically fed out of the dispenser after withdrawal of sheet material by a user. However, such dispensers require electrical energy, which normally is supplied by connection to an electrical supply network, or by electrical storage system including batteries. The connection to the electrical supply network is costly and limits the installation location, and batteries must be regularly replaced.

Document US2010/0051737A1, which discloses a rolled material dispenser with energy harvesting, solves these problems. By recuperation of energy from the user that pulls the sheet material, feeding of the leading tail of the sheet material is possible without connection to an external electrical supply network or batteries that must be regularly replaced.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an inventive dispenser for dispensing absorbent sheet material from a roll, wherein the dispenser enables quick and simple replacement of the absorbent sheet material roll while still providing capability of rotational locking of the roll with a rotational shaft of the dispenser. This object is achieved by the features of the characterising portion of claim 1.

The dispenser according to the invention is suitable for dispensing absorbent sheet material from a roll disposable within said dispenser. The dispenser comprising: a dispenser body, a rotational shaft suitable for penetration of said roll, a drive unit, and an energy storage system for storing energy. The drive unit is rotationally coupled to said rotational shaft, which comprising engagement means suitable for rotationally locking said rotational shaft with said roll. Externally caused rotation of said rotational shaft drives said drive unit, thereby enabling accumulation of energy in said energy storage system, and said drive unit is configured to be powered by energy from said energy storage system for temporarily rotating said rotational shaft.

The invention is characterised in that said engagement means comprises at least one projection and/or at least one recess arranged on a circumferential outer surface of said rotational shaft for radial engagement with said roll.

The solution according to the invention provides efficient and simple, potentially automatic, rotational locking between the roll and the rotational shaft upon axial penetration of the rotational shaft in the hole of the roll. No time consuming and complex additional manual locking of the roll is necessary, and the at least one projection and/or at least one recess potentially prevents erroneous mounting of the roll, for example in that the projection/recess intuitively guides the service personnel to the correct mounting. Also, incorrect axial mounting of the roll is mounting is difficult or even impossible when the roll itself is provided with corresponding engagement means. Furthermore, the projection/recess may be designed to

exhibit automatic rotational locking in corresponding engagement means of the roll after mounting of the roll, optionally first upon rotation of the roll. There appears to be no explicit disclosure in the above mentioned prior art concerning the arrangement of the roll on the rotational shaft, except that the roll is mounted on the rotational shaft. Consequently, the inventive solution exhibits many advantageous aspects over the prior art.

Further advantages are achieved by implementing one or several of the features of the dependent claims.

For example, the drive unit may be formed by an electrical machine, said energy storage system may be formed by an electrical storage system, wherein externally caused rotation of said rotational shaft may drive said electrical machine, thereby enabling generation of electrical energy that may be stored in said electrical storage system, and wherein said electrical machine may be configured to be powered by electrical energy from said electrical storage system for temporarily rotating said rotational shaft .

Furthermore, the engagement means may comprise a helically formed projection and/or recess arranged on a circumferential outer surface of said rotational shaft. The helical shape of the projection and/or recess allows cost-effective manufacturing of the core of the replacement rolls because the core is normally manufactured by helically winding a sheet material band about a mandrel. The core may thus in a very economical fashion be provided with at least one corresponding helically shaped projection and/or recess.

Furthermore, the engagement means may comprise at least one retractable radial projection arranged on a circumferential outer surface of said rotational shaft. A retractable radial projection has the advantage of allowing a higher degree of freedom with respect to the angular orientation of the roll upon insertion thereof onto the rotational shaft. In case the angular position of the roll is such that the engagement means of the rotational shaft does not fit

with the engagement means of the core of the roll, then this will not automatically prevent the roll from being pushed on the rotational shaft. After insertion, the roll may simply be rotated to an angular position in which the engagement means of the rotational shaft may rotationally lock with the roll.

Moreover, the at least one retractable radial projection may be spring loaded towards a projecting position. This arrangement further simplifies insertion of the roll onto the rotational shaft, because after insertion of the roll in any angular position, the roll may simply be rotated to an angular position in which the engagement means of the rotational shaft automatically snaps outwardly into corresponding engagement means on the core of the roll, such that the roll becomes rotationally locked with the rotational shaft. Moreover, insertion of the roll is further simplified because the spring loaded radial projection may be configured to automatically retract upon insertion of the roll in any angular position.

Also, the engagement means may comprise at least one retractable radial projection arranged near a free end surface of said rotational shaft, which radial projection is configured to axially secure said roll on said rotational shaft. Axial fastening of the roll on the rotational shaft results in better control of the location of the leading trail of the sheet material, and prevents any undesirable unplanned contact between the roll and the dispenser housing, or other dispenser parts.

Furthermore, the at least one retractable radial projection may be arranged on a leaf spring blade. A leaf spring blade results in an elegant, compact and reliable spring loading of the retractable radial projection.

Still further, the retractable radial projection may be configured to temporarily lock said rotational shaft upon radial depression from its projecting position. An incorrect core will consequently depress the radial projection of the leaf

spring to rotationally lock the rotational shaft in a stationary, non-rotating position. This configuration has the advantage of preventing the inventive automatic feeding function of the dispenser if an incorrect core of a roll is inserted on the rotational shaft. The rotational locking of the rotational shaft also results in rotational sliding friction between the roll and the core, such that the pulling force required for rotating the roll on the rotational shaft during removal of sheet material from the roll is increased. This increased pulling force motivates the use of a correct roll.

Still further, said temporary rotation of said rotational shaft may be realised by operating said drive unit a certain time period, or operating said drive unit such that said rotational shaft rotates a certain angle, wherein said certain time period or certain angle is predetermined or calculated based on registered or estimated radial roll size. The time period or angle may be set to provide a desired length of leading tail graspable by a user. The time period or angle may further advantageously be calculated based on current registered radial roll size, such that substantially the same length of leading tail sheet material is dispensed during said feeding of the leading tail, independent in the current fill level of the roll.

Also, the dispenser body may comprise a dispenser console, and a hood pivotally connected to said dispenser console, wherein said rotational shaft being rotatably mounted to said hood or said console. When the rotational shaft is arranged on the console, the hood may be less rigid and less complex because it does not have to support the drive unit and energy storage system. However, when the rotational shaft is arranged on the hood, the rotational shaft will project upwardly when tilting the hood 90° forwards, thereby simplifying insertion of a new roll onto the rotational shaft due to gravity and improved handling.

In addition, the at least one retractable radial projection may be mechanically actuated upon pivoting motion of said hood. Mechanical actuation of the radial projection may result in increased projection force of said projections, since it is no longer dependent on any spring loading. Moreover, removal and insertion of the roll onto the rotational shaft is also simplified because the radial projection is in a retracted position, and no spring loading must be overpowered.

The dispenser may further comprise an additional rotational shaft suitable for holding an additional roll. The additional rotational shaft being rotationally connectable to said drive unit or to an additional drive unit, said additional rotational shaft comprising engagement means suitable for rotationally locking said additional rotational shaft with said additional roll, wherein externally caused rotation of said additional rotational shaft drives said drive unit or said additional drive unit, thereby enabling accumulation of energy in said energy storage system or an additional energy storage system, and wherein said drive unit or said additional drive unit is configured to be powered by energy from said energy storage system or said additional energy storage system for temporarily rotating said additional rotational shaft. This arrangement has the advantage of simultaneously holding two rolls of absorbent sheet material. The capacity of the dispenser is thereby increased and the service interval may be extended correspondingly.

Moreover, the additional drive unit may be formed by an additional electrical machine, said additional energy storage system may be formed by an additional electrical storage system, wherein externally caused rotation of said additional rotational shaft may drive said electrical machine or said additional electrical machine, thereby enabling generation of electrical energy that may be stored in said electrical storage system or said additional electrical storage system, and wherein said electrical machine or said additional electrical machine may be configured to be powered by electrical energy from said electrical storage system or said additional electrical

storage system for temporarily rotating said additional rotational shaft. Electricity as power carrier allows a compact and cost-effective solution for energy harvesting and subsequent feeding of the leading tail of the absorbent sheet material.

Moreover, the dispenser may comprise means suitable for registering radial roll size of both said roll and said additional roll, wherein said dispenser being configured to dispense absorbent sheet paper from the roll having the smallest radial roll size. The arrangement has the advantage of completely depleting one roll before initiating feeding from the other roll, thereby eliminating any waste of sheet material due to replacement of non-depleted rolls.

Still further, the dispenser may comprise a rear wall that is configured to at least partly contact an external wall onto which said dispenser is configured to be installed, and a longitudinal axis of said drive rotational shaft is in a closed dispenser arranged substantially perpendicular to a plane defined by the parts of said rear wall that are configured to contact said wall. A rotational shaft that is oriented substantially perpendicular to the wall onto which the dispenser is configured to be mounted simplifies refilling of the dispenser, because accessibility is frequently easiest from the front of the dispenser. Lateral obstacles, such as walls or other dispensers frequently hinder easy access to the dispenser from the side thereof.

Still further, the externally caused rotation of said rotational shaft may be configured to be realised by withdrawal of absorbent sheet material from said roll when arranged on said rotational shaft by a user, and said temporary rotation of said rotational shaft is suitable for advancing a certain length of said absorbent sheet material when said roll is arranged on said rotational shaft, for the purpose of realising an advancement of a leading tail of said absorbent sheet material.

The invention further involves a dispenser assembly comprising a dispenser as defined above, and a hollow cylindrical core suitable for supporting a roll of absorbent sheet material, wherein said dispenser assembly may comprise: a dispenser body, a rotational shaft on which said core is arranged, a drive unit, and an energy storage system for storing energy, wherein said drive unit is rotatably mounted to said rotational shaft, wherein each of said rotational shaft and said core comprising engagement means that are in cooperating mating position, such that said rotational shaft being rotationally locked with said core, wherein externally caused rotation of said core drives said drive unit, thereby enabling accumulation of energy that is stored in said energy storage system, and wherein said drive unit is configured to be powered by energy from said energy storage system for temporarily rotating said core.

BRIEF DESCRIPTION OF DRAWINGS

In the detailed description of the invention given below reference is made to the following figure, in which:

Figure 1 shows a perspective view of the dispenser according to a first embodiment of the invention in a semi-open state,

Figure 2 shows the dispenser of fig. 1 in an open state,

Figure 3 shows the electrical feeding mechanism according to the invention installed in a dispenser,

Figure 4 shows a rotational shaft having recess according to the invention,

Figure 5a shows the rotational shaft having spring loaded radial projection according to the invention,

Figure 5b shows a perspective view of fig. 5a,

Figure 5c shows a perspective view of fig. 5a,

Figure 6a shows the rotational shaft having spring loaded radial projection according to the invention,

Figure 6b shows a perspective view of fig. 6a,

Figure 6c shows a top view of a rotational shaft according to the invention having a radial projection,

Figure 7 shows a dispenser according to the invention having dual rotational shafts.

DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

Various aspects of the invention will hereinafter be described in conjunction with the appended drawings to illustrate and not to limit the invention, wherein like designations denote like elements, and variations of the inventive aspects are not restricted to the specifically shown embodiment, but are applicable on other variations of the invention.

Figure 1 shows a first embodiment of the dispenser 10 according to the invention. The dispenser 10 is suitable for dispensing absorbent sheet material from a roll 11 arranged within said dispenser 10. The dispenser comprises a dispenser body, which comprises a dispenser console 12, an outer hood 13 pivotally connected to said dispenser console 12, and an inner hood 14 also pivotally connected to said dispenser console 12. The dispenser 10 is here shown with the outer hood 13 pivoted to an open position and the inner hood 14 in the closed position, i.e. in a semi-open state. In a completely closed state, both hoods 13, 14 are in a closed state. A window 16 in the inner hood 14 allows visual fill level control of the roll 11 without requiring opening of the inner hood 14. Moreover, with a window (non-showed) also in the outer hood 13, visual fill level control of the roll 11 is possible without opening of any hood 13, 14.

Fig. 2 shows the dispenser of fig. 1 but with both the inner and outer hoods 13, 14 in the open position, i.e. pivoted towards a front of the dispenser 10.

The roll 11 with a central hollow core 17 is also shown in a non-mounted position, such that a rotational shaft 15 of the dispenser is visible. The rotational shaft 15 is rotatably mounted to inner hood 14 and configured to penetrate at least part of the hollow core 17 of the roll 11. The rotational shaft 15 comprises engagement means that are suitable for rotationally locking the rotational shaft 15 with the core 17 of the roll 11. Although not illustrated in fig. 1 or 2, the dispenser 10 further comprises a drive unit in form of an electrical machine that is rotationally coupled to said rotational shaft, and an energy storage system for storing energy, in particular electrical energy, connected to the drive unit.

The console 12, which comprises a rear wall of the dispenser 10, is configured to at least partly contact an external wall onto which said dispenser 10 is configured to be installed. A longitudinal axis of the rotational shaft 15 is in a closed state of the dispenser 10 arranged substantially perpendicular to a plane defined by the parts of the rear wall of the console 12 that are configured to contact said wall. This arrangement serves to have a substantially horizontally arranged rotational shaft 15 when mounted on a substantially vertical wall, as well as allowing easy replacement of the sheet material roll 11, because good access is provided to the roll 11 when pivoting the outer and inner hoods 13, 14 of the dispenser 10 to the open position. The same effect is realised when the rotational shaft 15 is rotatably connected to the console 12 instead of the inner hood 14.

When a user wants a piece of absorbent sheet material, the user can grab a leading tail of the sheet material, which is wound on the core 17 to form the roll 11. The leading tail preferably is arranged at least partly outside the dispenser 10, for example hanging down a certain length through a dispensing opening at the lower part of the dispenser 10. Upon pulling the leading tail, the roll 11 starts to rotate due to the pulling force actuated by the user, and sheet material is removed from the roll 11. Due to the engagement means of the rotational shaft 15 and corresponding engagement means on

the core 17, the rotational shaft 15 may be rotationally locked with the roll 11. The externally caused rotation of the roll 11 consequently causes the rotational shaft 15 to rotate as well. The rotational shaft 15 is rotationally connected to the electrical machine, which is configured to transform the pulling energy originating from the user into electrical energy that is supplied to an electrical storage system. The pulling and withdrawal of sheet material from the roll 11 thus drives the electrical machine, thereby enabling generation of electrical energy that is stored in the electrical storage system. The electrical storage system is preferably formed by at least one capacitor. The electrical storage system may comprise a plurality of capacitors and/or batteries.

When the user has withdrawn a desired amount of sheet material, he may tear the sheet material on a tearing segment arranged on the dispenser 10, or the like, to separate the withdrawn sheet material from the roll 11. As a result, the roll 11 begins to stop rotating due to lack of external pulling force and the rotational resistance caused mainly by the electrical machine operating as an electrical generator. After a certain delay, the electrical machine may be controlled, for example by means of an electrical control unit, to operate as an electrical motor and rotationally drive the rotational shaft 15 a certain time period. The driving of the rotational shaft 15 causes the rotational shaft 15 to rotate, and consequently to feed a certain length of sheet material from the roll 11. The certain length of sheet material being fed is selected to provide a graspable leading tail of the sheet material, such that the user can easily find, grasp and pull the leading tail next occasion sheet material is requested. Without the feeding of a certain length of sheet material after finished withdrawal by the user, the leading tail of the sheet material is likely difficult the find and difficult to grasp, because the leading tail of the sheet material likely will be positioned close to the tearing segment of the dispenser 10. The tearing segment may for example be formed by a tooth-shaped tearing rim on a lower end of a hood 13, 14.

The control unit of the dispenser 10 may further register the rotational direction of the roll 11 during withdrawal of sheet material therefrom. Thereby, the control unit may control the electrical machine to rotate the rotational shaft 15 in the same direction during the automatic feeding of the sheet material. This arrangement assures that the sheet material actually is dispensed upon powering the electrical machine, and not simply wound-up on the roll 11 instead.

According to an alternative control method for realising an advancement of a leading tail of said absorbent sheet material from the dispenser 10, the dispenser may be provided with a proximity sensor arrangement for detecting the proximity of user. The detected proximity of the user is interpreted by the control unit as a desire to withdraw sheet material from the dispenser 10, and in response thereto, the control unit is configured to control the electrical machine to feed a certain length of the sheet material from the roll 11 for simplifying detection and grasping of the leading tail of the sheet material. Upon detecting and grasping the leading tail, the user pulls the sheet material to withdraw a desired amount of sheet material, and during said removal of sheet material, the electrical machine is caused to rotate and produce electrical energy that is stored in the electrical storage system for next occasion of advancement of the leading tail. The proximity sensor arrangement may be formed using one or more proximity sensors that are based on one or more proximity sensing technologies, such as capacitive sensing, infrared light emitting/detecting sensing, etc.

Fig. 3 schematically illustrates the layout of a dispenser feeding arrangement 20. The dispenser 10, which exhibits another layout that the dispenser of fig. 1 and 2 is here seen from a front view and with a front cover removed to expose the inside of the dispenser 10. The dispenser 10 is provided with a rotational shaft 15 that is arranged to penetrate a centre of a sheet material roll 11, for rotatably supporting the roll 11 within the dispenser 10. The rotational shaft 15 exhibits an outer cylindrical surface 21 with an axial

straight projection 22 extending in an axial direction of the rotational shaft 15. An axial abutment collar 23 at the rear end of the rotational shaft 15 for axially supporting the roll 11 is here provided with gearing teeth 24 that engage gearing teeth 25 of a smaller gear wheel 26 of an intermediate dual gear wheel 27 having two interlocked gear wheels, namely a smaller gear wheel 26 and a larger gear wheel 28. The electrical machine 29 comprises a rotational shaft provided with a gear wheel 30 whose gear teeth engage with gear teeth 31 of the larger gear wheel 28 of said intermediate dual gear wheel 27. This gearing arrangement provides a transmission having a rotational speed reduction ratio that will allow the speed of the electrical machine 29 to be significantly higher than the rotational speed of the rotational shaft 15 that is arranged to support the roll 11. This transmission reduction ratio may be necessary for enabling the relatively low power electrical machine 29 to drive the rotational shaft 15 and roll 11 for advancing the leading tail of the sheet material. The electrical storage system 32, an electronic control unit 33, and a proximity sensor arrangement 35 is also schematically shown arranged within the dispenser of fig. 3. The dispenser comprises a dispenser console 12 that has an outer side wall 35 and a lower dispensing opening 34.

According to an alternative non-showed design of the dispenser feeding arrangement 20, the electrical storage system, the electrical machine and the transmission may be arranged inside the roll supporting rotational shaft 15 instead. Such an arrangement has many advantages, such as physical protection of the parts of the feeding arrangement 20, a more compact design, and higher operating reliability due to reduced risk of interference with other parts.

When the control unit 33 arrives at an instruction to feed sheet material, several different feeding strategies are available. For example, temporary rotation of the rotational shaft 15 may be realised by simply operating the electrical machine 29 a certain predetermined time period. This feeding

control strategy is easy to implement but the resulting feeding length may vary due to roll fill level, energy level of the electrical storage system 32, rotational friction of the rotational shaft 15 and roll assembly, etc. Alternatively, the control unit 33 may operate the electrical machine 29 such that the rotational shaft 15 rotates a certain predetermined angle. This control strategy results in a more constant feeding length but require some input relating to the angular position of at least one part of the transmission, thereby increasing the cost of the dispenser 10. A further improved feeding result may be accomplished by providing the dispenser 20 with roll size sensing means (non-showed), because then the electrical machine 29 may be controlled based also on current fill level of the roll 11. The roll size sensing means may be realised by a mechanical and/or electrical sensor that is responsive to the radial size of the roll 11. According to a still a further example, the current roll fill level may be estimated by monitoring the accumulated number of sheet material feeding events for a unique roll 11, and estimating total amount of withdrawn sheet material based on predetermined data relating to average sheet material withdrawal length for each withdrawal occasion.

In fig. 2, the engagement means of the rotational shaft 15 is formed by a helically extending projection 18 extending in a helical winding direction on the outer cylindrical surface 21 of the rotational shaft 15. The helical projection 18 may extend over the entire length of the rotational shaft 15 in the axial direction of the rotational shaft 15, but other extension lengths may be possible while still providing a reliable rotational locking between the rotational shaft 15 and core 17 of the roll 11. The core 11 itself is provided with corresponding engagement means 19, which here consequently is formed as a helically extending groove 19. During mounting of the roll 11, the service personnel handling the replacement of rolls 11 rotate the roll 11 and/or rotational shaft 15 until the projection 18 and groove 19 coincides at the first mutual engagement location. Then, the roll 11 is simply pushed onto the rotational shaft 15 whilst the roll 11 is rotated in the direction of the helical

winding, until the roll 11 for example abuts an abutment collar 34 of the rotational shaft 15. Possibly, when inserting the roll 11 substantially vertically, gravity may give raise to sufficient down force to the roll 11 such that insertion of the roll 11 onto the rotational shaft 15 does not require any additional force.

As illustrated in fig. 4, the rotational shaft 15 may alternative be provided with a recess 37, such as a groove, on the circumferential outer surface 21 of said rotational shaft 15 instead. Here, the groove 37 extends axially in a straight line, but it could alternatively have been extending in a helically winding fashion. Optionally, the cylindrical outer surface 21 of the rotational shaft 15 can be provided with both one or more radial projections 18 and one or more radial recesses 37. According to still a further design alternative, the outer surface 21 of the rotational shaft 15 may exhibit a non-cylindrical cross-sectional shape, which is configured to cooperate with a core 17 of a roll 11 that exhibits a correspondingly non-cylindrical cross-sectional shape of the inner surface of the roll. For example, the outer surface of the rotational shaft 15 may have a rectangular or elliptic cross-sectional shape.

According to still a further rotational shaft engagement means layout as illustrated in fig. 5a, the rotational shaft engagement means may comprise at least one retractable radial projection 50 arranged on a circumferential outer surface 21 of said rotational shaft 15. A retractable radial projection 50, which is displaceable between a projecting position as seen in fig. 5a and 5b, and retracted position as seen in fig. 5c, increases the possible design possibilities of the corresponding engagements means of the core 17 that is configured to be penetrated by the rotational shaft 15. The core 17 must no longer be provided with engaging means that extends axially over a certain length of the core 17 because the engagement means of the core 17 does no longer necessarily engage with the engaging means of the rotational shaft 15 also during mounting of the core 17 onto the rotational shaft 15, i.e. during the relative axial displacement of the core 17 and rotational shaft 15. Instead,

the radial projection 50 may be set in the retracted position, in which the radial projection 50 does not extend beyond the outer cylindrical surface 21 of the rotational shaft 15. When the core 17 reaches the end position, possibly abutting an abutting collar 23 of the rotational shaft 15, the radial projection 50 may be set in the projecting position, in which the radial projection 50 is configured to rotationally interlock the rotational shaft 15 with the core 17, as illustrated in fig. 5b, where the core 17 with a helical internal groove 19 is indicated using dotted lines.

Possibly, the shape and configuration of the radial projection 50 and core 17 are such that the radial projection 50 and core 17 only mutually engage to provide said rotational interlocking at certain relative angular positions. For example, the core 17 may be provided with at least one discrete aperture or cavity in the inner cylindrical surface of the core 17, and at least one radial projection 50 of the rotational shaft 15 is configured to engage with said at least one discrete aperture or cavity when said radial projection 50 and said aperture or cavity radially coincide. Hence, if the radial projection 50 and the aperture or cavity do not radially coincide after axial mounting of the core 17 on the rotational shaft 15, a relative rotation between the rotational shaft 15 and core 17 automatically results in that the radial projection 50 radially coincides with the aperture or cavity. In practice, this means that the service personnel that replaces the rolls 11 do not need to be concerned with correct and finalised mounting of the roll 11, i.e. such that the rotational shaft 15 rotationally interlocks with the core 17 of the roll 11. Instead, merely axially pushing the core 17 onto the rotational shaft 15 may be sufficient, and subsequent rotational interlocking may occur automatically upon rotation of the roll 11, at the angular position when the radial projection 50 radially coincides with the aperture or cavity. Similar will of course also occur when the core 17 comprises one or more axially, straight or helically extending grooves.

As illustrated in fig. 5a, the retractable radial projection 50 is preferably spring loaded towards a projecting position. This may be realised by arranging the retractable radial projection 50 on a leaf spring blade 51 that is secured to the rotational shaft 15. The leaf spring blade 51, which preferably is aligned with an axial direction 53 of the rotational shaft 15, may be fastened to an inner cylindrical surface 54 of the rotational shaft 15 at a first end region 55 of said leaf spring blade 51. The leaf spring blade 51 may be fastened to the rotational shaft 14 using any common fastening means, such as mechanical fastening, adhesive fastening, or the like. Alternatively, the leaf spring blade 51 may be formed integrally with the rotational shaft 15. Suitable material of the leaf spring blade 51 is plastic or metal material. The radial projection 50 may be arranged in a window 56 in the rotational shaft 15. Fig. 5c illustrates how the leaf spring blade 51, including the radial projection 50, are temporarily depressed to the retracted position due to momentarily lack of any recess in the interior cylindrical surface of the core 17. Other spring loading arrangements of the radial projection 50 are possible, such as a helical spring arranged in a radial cavity in the outer cylindrical surface of the rotational shaft 15, or the like.

The rotational shaft 15 according to the invention may further be provided with an arrangement for rotationally locking the rotational shaft 15 with the dispenser body upon use of a core 17 that does not exhibit engaging means that correspond to the engagement means of the rotational shaft 15. One possible realisation of such rotationally locking is schematically depicted in fig. 5a, 5b and 5c. The leaf spring blade 51 is here configured to temporarily rotationally lock the rotational shaft 15 with the dispenser body upon radial depression of the leaf spring blade 51 a certain length. The rotational locking is realised when the leaf spring 51 is depressed to an extent where a second, free end 57 of the leaf spring 51 engages a stationary member of the dispenser body. The stationary member is here formed by an internal stationary rotational shaft 58 that rotationally supports the rotational shaft 15 at end regions of the rotational shaft 15. The stationary rotational shaft 58 is

provided with engagement means in form of one or more radial projections 59 that may engage with the free end 57 of the leaf spring 51, such that rotation of the rotational shaft 15 is prevented. The free end 57 of the leaf spring 51 may be provided with corresponding engagement means, such as a cavity 60, to simplify rotational locking of the rotational shaft 15 to the internal stationary rotational shaft 58. The leaf spring blade 51 is aligned with the longitudinal axis 53 of the rotational shaft 15, and may be arranged with the free end 57 close to a free end 62 of the rotational shaft 15, or close to the abutment collar 23 of the rotational shaft 15. As a result of the rotation locking of the rotational shaft 15 upon use of a non-compliant core 17, sheet paper withdrawal is only possible if the core 17 is slidingly rotating on the locked rotational shaft 15, and the energy recuperation function, as well as the sheet material feeding function is blocked from use.

The core 17 of the roll 11 may advantageously also be axially secured to the rotational shaft 15 to avoid axial displacement of the core 17, which may give raise to undesired contact between the roll 11 and internal parts of the dispenser 10. One solution for preventing this is to provide the rotational shaft 15 with engagement means that comprises at least one retractable radial projection 61 arranged near a free end surface 62 of the rotational shaft 15, which radial projection 61 is configured to axially secure the core 17 and roll on the rotational shaft 15, as illustrated in fig. 6a, 6b and 6c. The radial projection 61 must be retractable to enable mounting and removal of the roll 11 on the rotational shaft 15.

The radial projection 61 is preferably spring loaded radially outwardly to automatically return to a projecting position when the complete roll 11 has passed the radial projection 61 in an axial direction, i.e. when the radial projection 61 no longer overlaps with the core 17 in a radial direction. The radial projection 61 may be provided with a chamfered surface (non-showed) in the axial direction away from the dispenser wall that supports the rotational shaft 15 for automatic displacement of the radial projection 61 to a retracted

position upon initial engagement with the core 17. Removal of the core 17 for roll replacement may require manual depression of the radial projection 61 to the retracted position, thereby enabling removal of the core 17.

Spring loading of the radial projection 61 may be realised by arranging the retractable radial projection 61 on a free end of a leaf spring blade 63, which preferably is aligned with an axial direction 53 of the rotational shaft 15. The leaf spring blade 63 may be a separate part that is attached to the rotational shaft 15 at an attachment location 64, which for example may be located on the internal surface of the rotational shaft 15, as shown in fig. 6c. The radial projection may project through a window 65 in the rotational shaft 15. Alternatively, the leaf spring blade 63 may be integrally formed with the rotational shaft 15, whereby the retractability of the leaf spring blade may be realised by cutting two longitudinal through-going slits in the rotational shaft 15, thereby forming an integrally formed leaf spring blade 63, as shown in fig. 6a and 6b.

Optionally, the leaf spring blade 63 carrying the radial projection 61 for axially securing the core 17 may additionally be provided with a further radial projection 66, which is adapted to engage with a recess or cavity of the core 17, similar to the radial projection described in conjunction with fig. 5a – 5c.

The further radial projection 66, which is configured to engage a recess or cavity in the internal cylindrical surface of the core 17 preferably exhibits a shape that corresponds to the shape of dimensions of said recess or cavity. For example, as shown in fig. 6a – 6c, if the rotational shaft 15 is configured to rotationally engage with a core 17 having a helically extending internal groove 19, then the further radial projection 66 suitable exhibits an elongated shape that is provided with an angular orientation that corresponds to the helical angle of the helically extending groove. The longitudinal direction of the elongated radial projection 66 may consequently define an angle α to an axial direction 53 of the rotational shaft 15 in the range of about 40° - 85° when the rotational shaft 15 is arranged to receive a core 17 having a

helically extending groove or recess 19. This arrangement of the further radial projection 66 may of course also apply to other radial engagement projections of the rotational shaft 15. Other shapes of one or more radial engagement projections may include conical, cylindrical, polygonal, or the like, with or without chamfering for simplifying potential automatic locking upon penetration of the core 17 by means of spring loaded radial projections 50, 61, 66.

As an alternative to a spring loaded radial projection 50, 61, 66 on the rotational shaft 15, at least one retractable radial projection may be mechanically actuated upon pivoting motion of one of said hoods 14, 15 between closed and open positions. Such a solution may be realised by means of a mechanical linkage (not showed) that is connected to the radial projection 50, 61, 66, and which is actuated upon pivoting the hood 13, 14, such that the radial projection 50, 61, 66 is moved to a retracted position upon pivoting the hood 13, 14 to an open position, and moved to a projecting position upon pivoting the hood 13, 14 to a closed position.

The dispenser 10 was previously described having only one rotational shaft 15, but the invention is equally applicable to dispenser having two rotational shafts, or more. Fig. 7 shows a dispenser layout having an additional rotational shaft 70 suitable for holding an additional roll. The additional rotational shaft 70 is rotatably mounted to said dispenser body, similar to the neighbouring arranged rotational shaft 15. The additional rotational shaft 70 is rotatably connectable either to the previously described electrical machine or to an additional drive unit, preferably formed by an additional electrical machine. The dispenser layout may thus be provided with one common electrical machine that is rotatably connected to all rotatable rotational shafts 15, 70, or each rotatable rotational shaft 15, 70 is rotatably connected to an individual electrical machine. The additional rotational shaft 70 comprising engagement means suitable for rotationally locking the additional rotational shaft 70 with an additional roll.

The function of the electrically operated dual rotational shaft dispenser will now be described. Externally caused rotation of the additional rotational shaft 70 due to user induced pulling force in the leading tail of the sheet material drives the electrical machine or the additional electrical machine, depending on dispenser layout, thereby enabling generation of electrical energy. The generated electrical energy is stored in the previously described electrical storage system or an additional energy storage system specifically provided for the additional rotational shaft 70, in particular an electrical storage system. Upon determining that advancement of a leading tail is required, either the electrical machine or the additional electrical machine is configured to be powered and driven by electrical energy from the electrical storage system or the additional electrical storage system for temporarily rotating the additional rotational shaft 70. The exact layout of electrical machines and electrical storage systems may vary and depends mainly on the specific arrangement of the dispenser in general, and the feeding mechanism. For example, if a feeding mechanism including an electrical machine and an electrical storage system is used that is integrated into the rotating rotational shaft itself, then the additional rotational shaft 70 is advantageously provided with a separate feeding mechanism including an additional electrical machine and an additional electrical storage system. However, of the feeding mechanism is installed outside the rotating rotational shaft 15, 70, then it could be advantageous to simply operate both the rotational shaft 15 and additional rotational shaft 70 using the same feeding mechanism, i.e. the same electrical machine and the same electrical storage system. If both the rotational shaft 15 and the additional rotational shaft 70 is operated using the same feeding mechanism, a mechanical clutch device may be required to control the path of rotational torque, such that not both rotational shafts 15, 70 are powered simultaneously.

As illustrated in fig. 7, the rotational shaft 15 and additional rotational shaft 70 may be arranged on a common member 71 that is horizontally slidable a distance d within the dispenser body. The common member 71 is shown in

the farthest left position in fig. 7, and may be sliding displaced to a farthest right position as indicated by the dotted line. Feeding is controlled such that the outermost roll is emptied first, and feeding is continued using the more central roll. When the service personal refills the dispenser 10, the common member 71 is first displaced to the other extreme position, i.e. in fig. 7 to the farthest right position, and a new fully charged roll 11 is mounted on the most central rotational shaft 15, 71. This feeding and refilling procedure allows most efficient use of the dispenser inner volume because the dispenser 10 may have the capacity to only accept a new fully charged roll on the most central rotational shaft due to size constraints.

Particularly when the dispenser 10 is arranged to supply sheet material from one of the two rolls of sheet material, it is advantageous to have information concerning the fill level of each roll. This information can then be used to determine from which roll sheet material shall be dispensed using the electrically operated feeding mechanism. Roll fill level may for example be determined by registering the radial roll size of each roll within the dispenser 10, and radial roll size may be registered by electrical and/or mechanical sensors, such as proximity sensors, etc. Different feeding strategies may be provided, for example feeding of sheet material from the roll having the smallest radial roll size, and upon depletion thereof initiating feeding from the neighbouring roll. Roll fill level information may however also be advantageous for controlling electrical operation of the rotational shafts 15, 70, such that desired length of sheet material is advanced by the electrically operated feeding mechanism. This is consequently also interesting for a single roll dispenser.

As an alternative to fill level information, the dispenser can be equipped with means for confirming that sheet material actually is being fed from the dispenser 10 upon a command from the control unit to perform feeding. When it is detected that no sheet material is being fed despite a given feeding command, it may be concluded that the current roll is empty, and that

feeding of another roll must be initiated. Sensing means for this task may involve sensing the presence of an object, i.e. sheet material, at the dispensing opening of the dispenser, for example using light transmitter in combination with a photoelectric receiver, or a proximity sensor. No detected presence of sheet material at the dispensing opening despite simultaneous feeding may then be interpreted as an empty roll.

The layout of the inventive dispenser of fig. 1 – 7 may be varied to large extent within the scope of the claims. For example, the rotational shaft may be applied to the console pointing out of the dispenser away from the wall on which the dispenser is configured to be fastened, as shown in fig. 3 and 7. Alternatively, the rotational shaft may be applied on an inner pivoting hood, as shown in fig. 1 and 2. The rotational shaft may further according to yet an alternative be applied to an outer hood, thereby eliminating the need for an inner hood, which consequently may be omitted. The rotational shaft may further be oriented with a longitudinal axis substantially perpendicular to the plane of the rear wall of the console, or substantially parallel with said plane.

The drive unit has been described in terms of an electrical machine and the energy storage system has been described in terms of an electrical storage system, such as one or more batteries and/or capacitors. However, the drive unit and energy storage system may alternatively exhibit other configurations. For example, it may be an entirely mechanical system, in which the energy storage system is formed by a spring and the drive unit is formed by the mechanical linkage interconnecting the spring with the rotational shaft and driving the rotational shaft when feeding of the leading tail should occur. Similar to the embodiment using an electrical machine as drive unit, also a mechanical drive unit must be able to obtain rotational energy from a rotational shaft that rotates in a first rotational direction, and subsequently cause the rotational shaft to rotate in the same direction during feeding of the leading tail. The energy storage system may comprise flywheel energy storage suitable for temporarily storing kinetic energy, which originates from

the user pulling the web of the absorbent sheet material. Alternatively, the energy storage system may exhibit a weight that may be translated between at least two different vertical positions corresponding to different potential energy levels, or the energy storage system may be formed by a hydraulic accumulator that may store pressurised hydraulic fluid, and subsequently supply pressurised hydraulic fluid to a hydraulic machine that is rotationally coupled to the rotational shaft for driving thereof.

The phrase "said rotational shaft is rotatably mounted to said dispenser body" used herein means that the rotational shaft is a separate part from the dispenser body, and that the rotational shaft has been mounted on the dispenser such that rotational shaft may be rotated while the dispenser body is stationary. Furthermore, the phrase "rotationally locking said rotational shaft with said roll" used herein means that the roll and the rotational shaft are separate parts, and that they may be interlocked with each other rotationally around a common rotational axis, such that the roll may not be rotated without causing rotation also of the rotational shaft, and vice versa. The term "rotationally coupled" used herein means that rotational motion may be transferred from one object to the other object.

Reference signs mentioned in the claims should not be seen as limiting the extent of the matter protected by the claims, and their sole function is to make claims easier to understand.

As will be realised, the invention is capable of modification in various obvious respects, all without departing from the scope of the appended claims. Accordingly, the drawings and the description thereto are to be regarded as illustrative in nature, and not restrictive.

CLAIMS

1. Dispenser (10) suitable for dispensing absorbent sheet material from a roll (11) disposable within said dispenser (10), wherein said dispenser (10) comprising: a dispenser body, a rotational shaft (15) suitable for penetration of said roll (11), a drive unit, and an energy storage system (32) for storing energy, wherein said drive unit is rotationally coupled to said rotational shaft (15), wherein said rotational shaft (15) comprising engagement means suitable for rotationally locking said rotational shaft (15) with said roll (11), wherein externally caused rotation of said rotational shaft (15) drives said drive unit, thereby enabling accumulation of energy in said energy storage system (32), and wherein said drive unit is configured to be powered by energy from said energy storage system (32) for temporarily rotating said rotational shaft (15), **characterised in that** said engagement means comprises at least one projection (18, 22, 50, 61, 66) and/or at least one recess (37) arranged on a circumferential outer surface (21) of said rotational shaft (15) for radial engagement with said roll (11).

2. Dispenser (10) according to claim 1, **characterised in that** said drive unit is formed by an electrical machine (29), said energy storage system (32) is formed by an electrical storage system, wherein externally caused rotation of said rotational shaft (15) drives said electrical machine (29), thereby enabling generation of electrical energy that is stored in said electrical storage system, and wherein said electrical machine (29) is configured to be powered by electrical energy from said electrical storage system for temporarily rotating said rotational shaft (15).

3. Dispenser according to any of the previous claims, **characterised in that** said engagement means comprises a helically formed projection (18) and/or recess arranged on a circumferential outer surface (21) of said rotational shaft (15).

4. Dispenser according to any of the previous claims, **characterised in that** said engagement means comprises an axially extending projection (22) and/or recess (37) arranged on a circumferential outer surface (21) of said rotational shaft (15).

5. Dispenser according to any of the previous claims, **characterised in that** said engagement means comprises at least one retractable radial projection (50, 61, 66) arranged on a circumferential outer surface (21) of said rotational shaft (15).

6. Dispenser according to claim 5, **characterised in that** said at least one retractable radial projection (50, 61, 66) is spring loaded towards a projecting position.

7. Dispenser according to any of the previous claims, **characterised in that** said engagement means comprises at least one retractable radial projection (61) arranged near a free end surface (62) of said rotational shaft (15), which radial projection (61) is configured to axially secure said roll (11) on said rotational shaft (15).

8. Dispenser according to any of previous claims 5 to 7, **characterised in that** said retractable radial projection (50, 61, 66) is temporarily locking said rotational shaft (15) upon radial depression from its projecting position.

9. Dispenser according to any of the previous claims, **characterised in that** said temporary rotation of said rotational shaft (15) is realised by operating said drive unit a certain time period, or operating said drive unit such that said rotational shaft (15) rotates a certain angle, wherein said

certain time period or certain angle is predetermined or calculated based on registered or estimated radial roll size.

10. Dispenser according to any of the previous claims, **characterised in that** said dispenser body comprises a dispenser console (12) and hood (13, 14) pivotally connected to said dispenser console (12), wherein said rotational shaft (25) being rotatably mounted to said hood (13, 14) or said console (12).

11. Dispenser according to any of claims 5 and 10, or claims 6 and 10, **characterised in that** said at least one retractable radial projection (50, 61, 66) is mechanically actuated upon pivoting motion of said hood (13, 14).

12. Dispenser according to any of the previous claims, **characterised in that** said dispenser (10) comprises an additional rotational shaft (70) suitable for holding an additional roll, said additional rotational shaft (70) being rotationally connectable either to said drive unit or to an additional drive unit, said additional rotational shaft (70) comprising engagement means suitable for rotationally locking said additional rotational shaft (70) with said additional roll, wherein externally caused rotation of said additional rotational shaft (70) drives said drive unit or said additional drive unit, thereby enabling accumulation of energy in said energy storage system (32) or an additional energy storage system, and wherein said drive unit or said additional drive unit is configured to be powered by energy from said energy storage system (32) or said additional energy storage system for temporarily rotating said additional rotational shaft (70).

13. Dispenser (10) according to claim 12, **characterised in that** said additional drive unit is formed by an additional electrical machine, said additional energy storage system (32) is formed by an additional electrical

storage system, wherein externally caused rotation of said additional rotational shaft (15) drives said electrical machine (29) or said additional electrical machine, thereby enabling generation of electrical energy that is stored in said electrical storage system or said additional electrical storage system, and wherein said electrical machine (29) or said additional electrical machine is configured to be powered by electrical energy from said electrical storage system or said additional electrical storage system for temporarily rotating said additional rotational shaft (15).

14. Dispenser according to claim 12 or claim 13, **characterised in that** said dispenser (10) comprises means suitable for registering radial roll size of both said roll (11) and said additional roll, wherein said dispenser (10) being configured to dispense absorbent sheet paper from the roll (11) having the smallest radial roll size.

15. Dispenser according to any of the previous claims, **characterised in that** said dispenser (10) comprises a rear wall that is configured to at least partly contact an external wall onto which said dispenser (10) is configured to be installed, and a longitudinal axis (53) of said rotational shaft (15) and/or additional rotational shaft (70) is in a closed dispenser arranged substantially perpendicular to a plane defined by the parts of said rear wall that are configured to contact said wall.

16. Dispenser according to any of the previous claims, **characterised in that** said externally caused rotation of said rotational shaft (15) and/or said additional rotational shaft (70) is configured to be realised by withdrawal of absorbent sheet material by a user from said roll (11) and/or said additional roll when arranged on said rotational shaft (15) or said additional rotational shaft (70), and said temporary rotation of said rotational shaft (15) and/or said addition rotational shaft (70) is suitable for

advancing a certain length of said absorbent sheet material from said roll (11) and/or additional roll, for the purpose of realising an advancement of a leading tail of said absorbent sheet material.

17. Dispenser assembly comprising a dispenser according to any of claim 1 – 16, and a hollow cylindrical core (17) suitable for supporting a roll of absorbent sheet material, wherein said dispenser assembly comprising: a dispenser body, a rotational shaft (15, 70) on which said core (17) is arranged, a drive unit, and an energy storage system (32) for storing energy, wherein said drive unit is rotationally coupled to said rotational shaft (15, 70), wherein each of said rotational shaft (15, 70) and said core (17) comprising engagement means that are in cooperating mating position, such that said rotational shaft (15, 70) being rotationally locked with said core (17), wherein externally caused rotation of said core (17) drives said drive unit, thereby enabling accumulation of energy that is stored in said energy storage system (32), and wherein said drive unit is configured to be powered by electrical energy from said electrical storage system (32) for temporarily rotating said core (17).

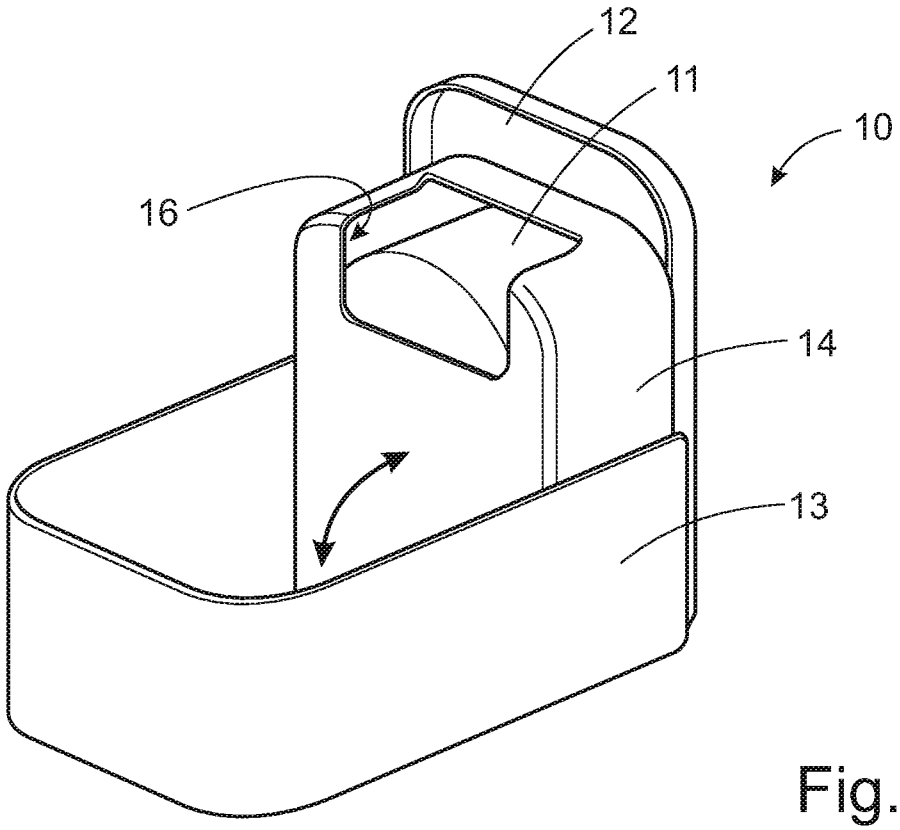

Fig.1

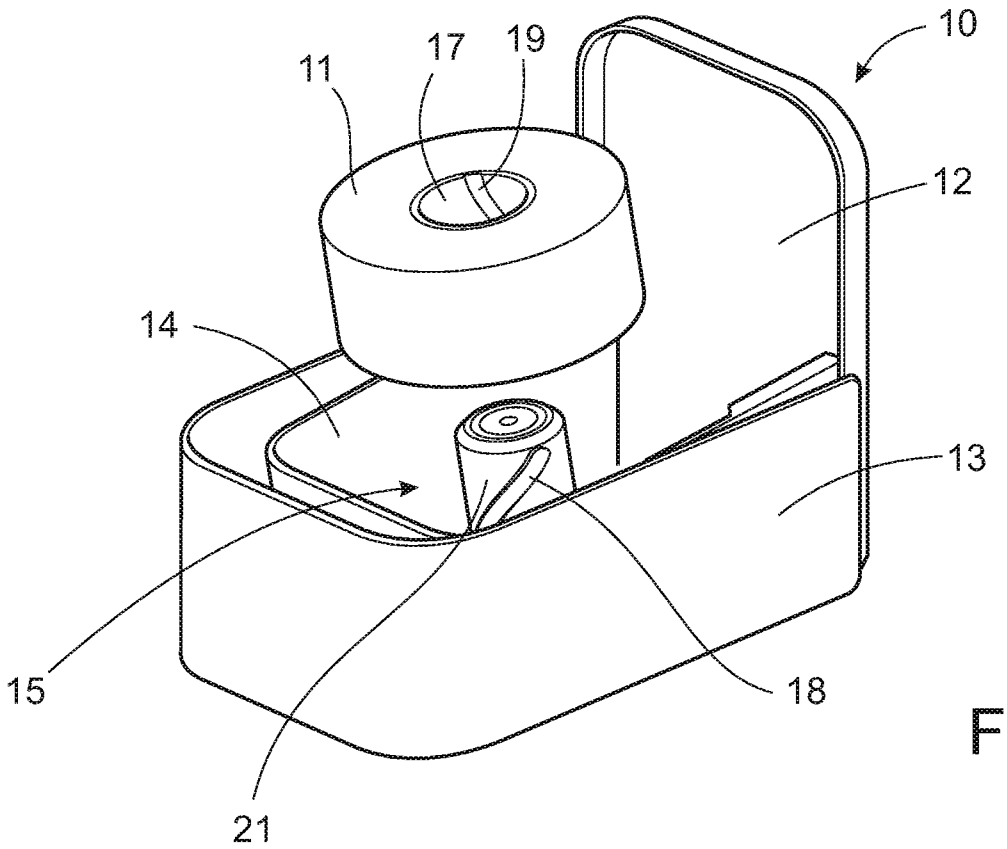

Fig.2

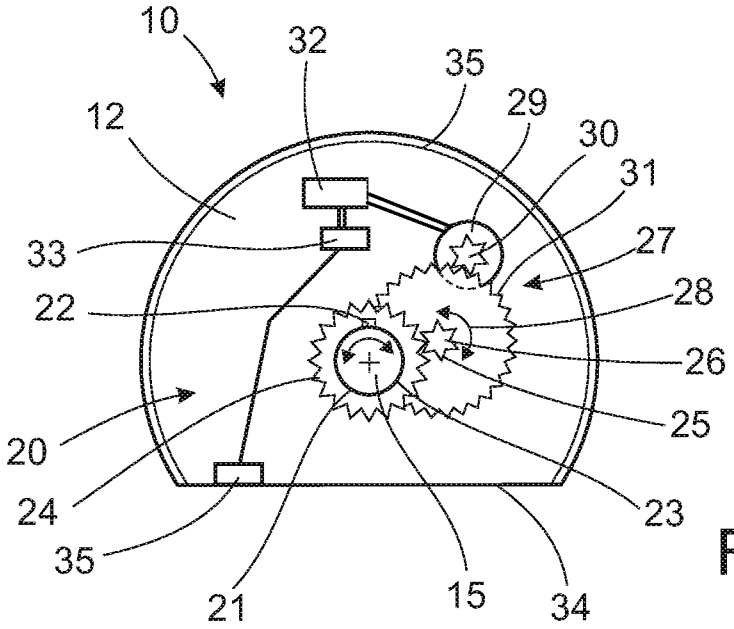

Fig.3

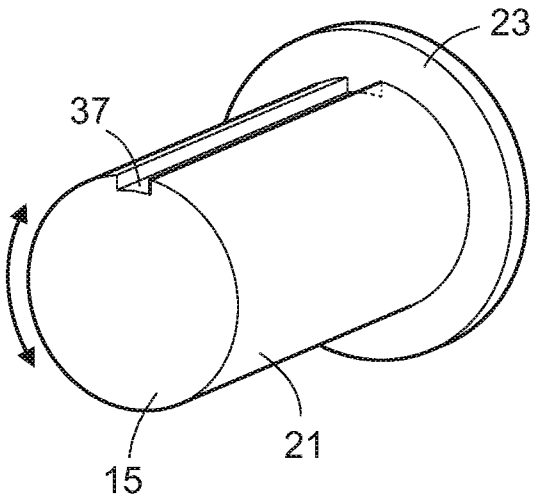

Fig.4

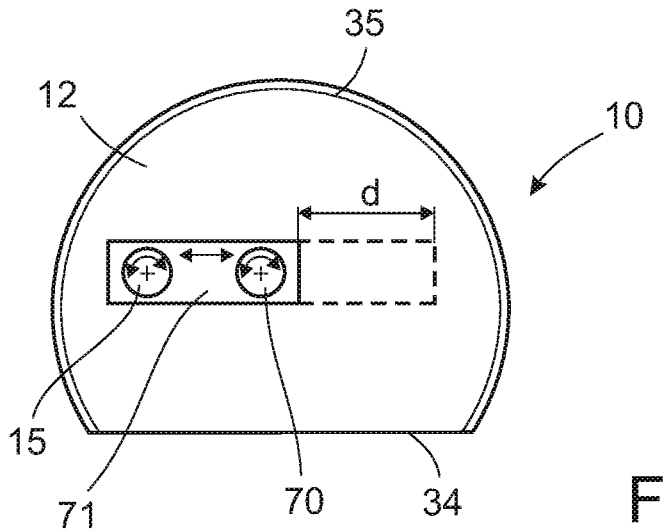

Fig.7

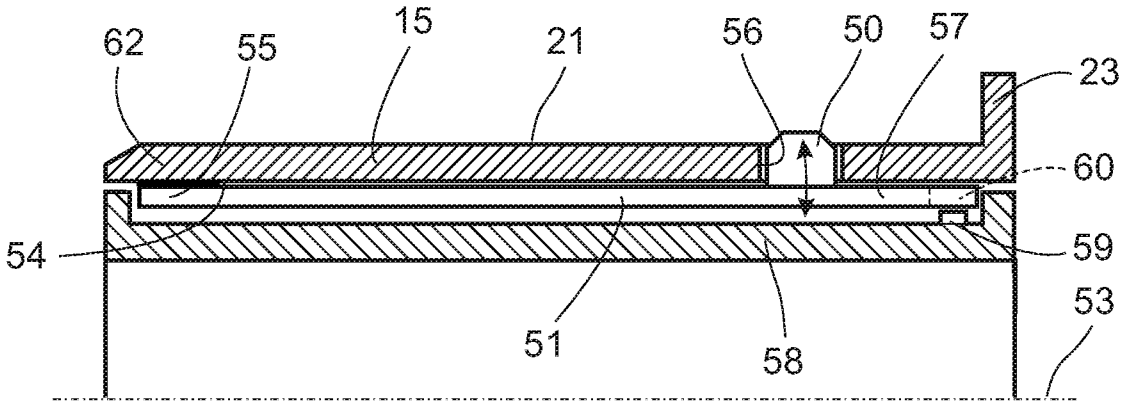

Fig.5a

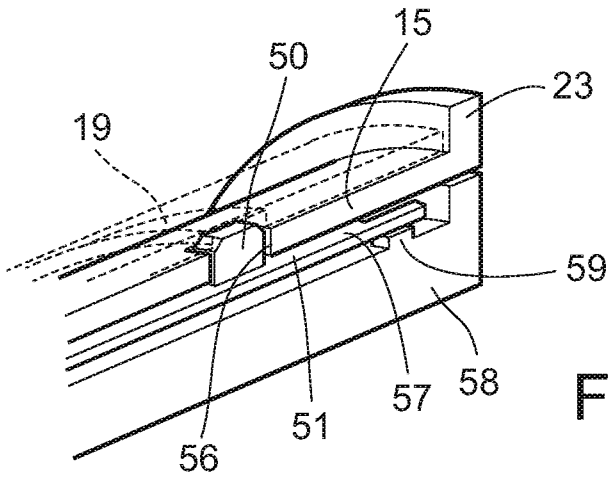

Fig.5b

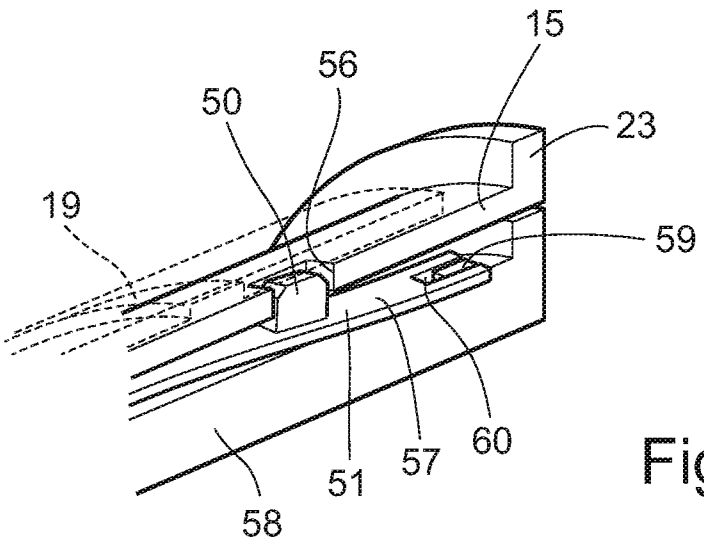

Fig.5c

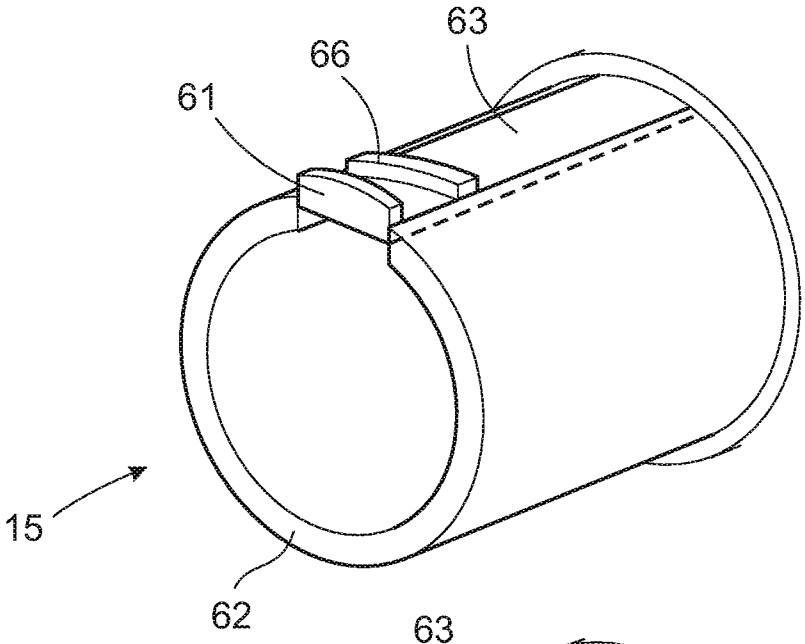

Fig.6a

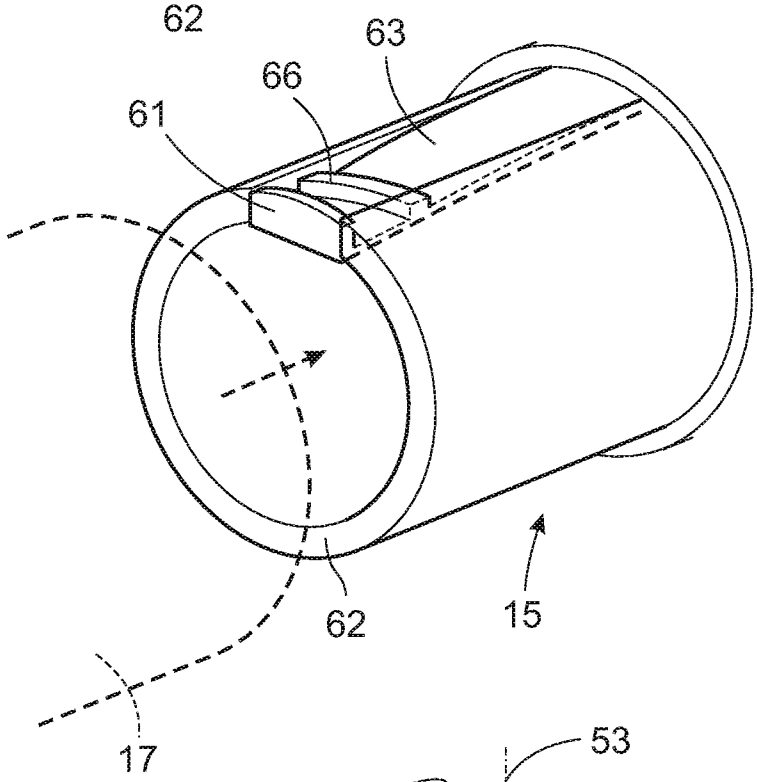

Fig.6b

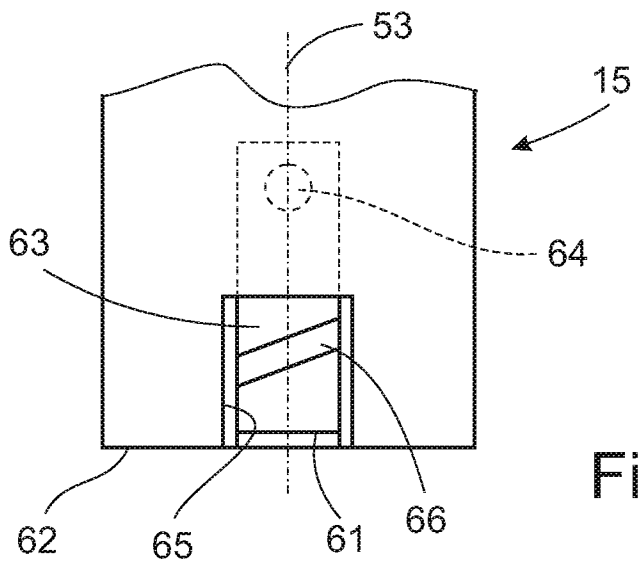

Fig.6c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2012/050759

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: A47K

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 20100051737 A1 (RODRIAN JEFFREY E ET AL), 4 March 2010 (2010-03-04); abstract; figures	1, 2, 4-6, 9, 10, 15, 16
A	--	3, 7, 8, 11-14, 17
Y	US 4071200 A (STONE BARRY N), 31 January 1978 (1978-01-31); whole document	1, 2, 4-6, 9, 10, 15, 16
A	--	3, 7, 8, 17

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25-02-2013	25-02-2013

Name and mailing address of the ISA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Björn Lindkvist Telephone No. + 46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2012/050759

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	--	3, 7, 8, 17
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A	US 20090072073 A1 (CAMPBELL DONALD A ET AL), 19 March 2009 (2009-03-19); abstract; figure 2	1-8, 10, 17
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International application No.
PCT/SE2012/050759

Continuation of: second sheet
International Patent Classification (IPC)
A47K 10/36 (2006.01)

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