



- (51) **International Patent Classification:**
B65H 19/12 (2006.01) *B65H 19/30* (2006.01)
- (21) **International Application Number:**
PCT/FI2010/050139
- (22) **International Filing Date:**
25 February 2010 (25.02.2010)
- (25) **Filing Language:** Finnish
- (26) **Publication Language:** English
- (30) **Priority Data:**
20095181 25 February 2009 (25.02.2009) FI
U20090143 8 April 2009 (08.04.2009) FI
- (71) **Applicant (for all designated States except US):** **METSO PAPER, INC.**; Fabianinkatu 9 A, FI-00130 Helsinki (FI).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** **ENWALD, Petri** [FI/FI]; Karkiantie 1 E, FI-04310 Tuusula (FI). **KOJO, Teppo** [FI/FI]; Alhontie 10, FI-04600 Mäntsälä (FI).
- (74) **Agent:** **ESPATENT OY**; Kaivokatu 10 A, FI-00100 Helsinki (FI).
- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** HANDLING OF WINDING SHAFTS AND ROLLS

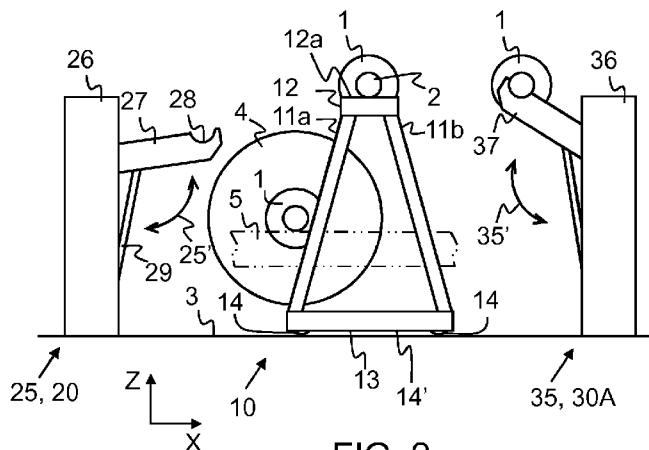


FIG. 2

(57) **Abstract:** A movable storage (10, 10', 10'') supported on a floor (3) and movable between at least two target stations for receiving, moving and handing over rolls, winding shafts (1) and/or machine reels (4) intended for the handling of a fiber web (W) comprises reception members (12) for receiving a load (1, 4) being handled and for holding it up at both its support ends (2). The movable storage (10, 10', 10'') comprises at least one vertical support member (11 a, 11b) supported on the floor (3) for supporting the reception members (12) at a fixed height or in a manner enabling adjustable height and for holding the load (1, 4) up so that, during operation, the movable storage and the at least one roll, winding shaft and/or machine reel being handled is moved supported on the floor (3) by means of at least one vertical support member above a fiber web manufacturing device (100) and/or a finishing device (20, 30A, 30B, 30, 31 A, 31 B, 31). A method for handling rolls, winding shafts (1) and/or machine reels (4) intended for the handling of a fiber web (W) by means of a movable storage, a manufacturing line of a fiber web, and a computer program for controlling a movable storage.



HANDLING OF WINDING SHAFTS AND ROLLS

FIELD OF THE INVENTION

- 5 The invention relates to fiber web machines, such as paper, board, and chemical pulp machines.

Particularly, but not exclusively, the invention relates to a movable storage and to a method for receiving, storing and handing over rolls or similar items, such as
10 winding shafts and/or machine reels, intended for the handling of a web-like material. The present invention also relates to the manufacturing lines of fiber webs. The present invention also relates to a computer program for implementing the method and controlling the storage.

15 BACKGROUND OF THE INVENTION

As known, paper is manufactured in machines together forming a paper manufacturing line, which may be hundreds of meters long. Modern paper machines may produce more than 450,000 tons of paper per year. The speed of a
20 paper machine may exceed 200 m/min and the width of a paper web may be more than 11 meters.

In paper manufacturing lines, paper manufacturing operates as a continuous process. The finished paper web being output from the paper machine is wound
25 with a winder around a winding shaft, i.e., a reel spool, into a machine reel, the diameter of which may be more than 5 meters and which may weigh more than 160 tons. The purpose of the winding is to transfer the paper web from its planar manufacturing form into a form in which it can be handled more easily. At the winder, which is located in the main machine line, the continuous process of the
30 paper machine is interrupted for the first time, after which the process continues in stages. Every attempt is made to interlink these stages as smoothly as possible so that the work already performed would not be wasted.

The web of the machine reel generated during paper manufacture is full-width and even more than 100 km long, so it must be cut into partial webs of a suitable width and length for customers and wound around cores into “customer rolls” before dispatch from the paper mill. As known, this slitting and winding of the web takes
5 place in a separate machine fitted to the purpose, i.e., a slitter-winder.

In the slitter-winder the machine reel is unwound, the broad web is slit with the slitting section into a number of narrower partial webs, which are wound with the winding section around winding spools such as cores into customer rolls. When
10 the customer rolls are ready, the slitter-winder is stopped and the rolls, or “set”, is removed from the machine. After this, the process continues with the winding of a new set. These stages are repeated periodically until the paper on the machine reel runs out, at which point the machine reel is replaced and the operation restarts with the winding of a new machine reel.

15

In known fast-running paper manufacturing lines, the paper machine may produce more paper than a single slitter-winder is able to process, in which case more than one slitter-winder is needed in the paper manufacturing line. In some applications, the slitter-winders are located sequentially in the direction of the machine line at a
20 certain distance from each other.

In known layout arrangements for paper manufacturing lines, the first slitter-winder is typically arranged as an “inline” slitter-winder, which means that the slitter-winder is aligned with the paper machine and the winder, i.e., located in the main
25 machine line. The second slitter-winder is an “offline” slitter-winder, which may be positioned aligned with the paper machine after the first slitter-winder. Both slitter-winders output customer rolls, which are normally first conveyed with roll conveyors to, e.g., a roll packaging machine for packaging and finally to storage before being sent to customers.

30

In the slitter-winders of known paper machine lines, the machine reel is typically conveyed to such a slitter-winder that is not connected to the paper machine with transfer rails with a hoist and lowered to transfer rails, which are typically

positioned so that the height of the machine reel's centre from the floor surface is about 2.5 meters. A minimum distance of 500 mm is typically applied as a safety distance between the machine reel and the surface below the machine reel, such as the floor surface. In applications where the winder of the paper machine and the slitler-winder are connected to each other with transfer rails inline, the machine reel is transferred along the transfer rails from the winder to the slitler-winder.

In the simplest implementation, particularly in the case of small machine reels, the machine reel may also be conveyed with a hoist directly to an unwind stand.

The transfer rails for full machine reels consist of horizontal or inclined rails with stand-by stations. Along transfer rails, the machine reel is transferred from one stand-by station to another until the unwinding station is reached. With horizontal transfer rails, the machine reel is transferred from one stand-by station to another by means of a transfer device, and with inclined transfer rails, by means of rolling based on gravity and stop and release mechanisms.

An unwinding station typically consists of an unwind stand which holds the machine reel up during unwinding. The unwind stand comprises a first unwind stand on the driving side and another unwind stand on the tending side. The ends of the machine reel are on these unwind stands during unwinding. Locking arms are fastened to the unwind stand with joints; the arms are used for locking the machine reel in place during unwinding. A machine reel located in an unwinding station is connected to a brake generator, which functions as a drive of the unwinder.

Generally, a winding shaft emptied as a result of unwinding is removed from the unwinding station either through manual lifting with a hoist or automatically with a winding shaft handling apparatus. A winding shaft handling apparatus consists of either vertical lifting devices or rotatable lifting arms and return rails for empty winding shafts, located above. An empty or nearly empty winding shaft is lifted with a lifting device or with lifting arms to return rails, which normally have a number of return positions. Typically a return station (a winding shaft storage) is

located above the unwinding or the slitting and winding section. Along the return rails, the winding shaft is transferred from one station to another either by means of a transfer device or by means of rolling based on gravity using stop and release mechanisms. The empty winding shaft is removed from the return rails and moved
5 to the winder of the paper machine with a hoist. In an inline slitter-winder, the return rails may also be connected directly to a winder's winding shaft storage rails, whereby the winding shaft may be transferred directly from the slitter-winder to the winder.

10 To ensure a smooth continuity of the process, storage spaces are needed in the slitter-winder area for full machine reels, partly filled machine reels and empty winding shafts. As known, such storage spaces at the finishing end of the fiber web manufacturing line are located in the main machine line between the main devices of the manufacturing process in the winding and slitting-winding area, i.e.,
15 between the slitter-winders, unwinders of the slitter-winders, and the windup belonging to the paper machine or a coating machine.

The winding shaft handling solutions implemented in the prior art are inflexible. For example, it is difficult to make paths of winding shaft and machine reel transfer
20 carriages, transfer rails, and transfer and conveyance routes of gantry cranes adjust to changing needs. The handling solutions for winding shafts require expensive concrete and steel beam structures implemented according to the full machine reel in order to hold up lifting devices, such as hoists. The hoist capacity may be reserved, in which case the hoist may not be able to respond to transfer
25 needs at a short notice.

In some cases, the handling solutions for winding shafts are mainly based on the use of a hoist. However, the load to be lifted is not necessarily within reach of the hoist's lifting means. For example, consider a machine reel at an unwinding
30 station, above which empty winding shafts are stored on rails. In some cases, transfer rails intended for winding shaft traffic and located between a winder and a slitter-winder are situated above transfer rails intended for machine reel traffic and located between the winder and the slitter-winder, thus forming an obstacle for

lifting with a hoist or at least make the lifting a complicated procedure as the load to be lifted must be navigated among the transfer rails above. In some cases, a rejecting location for the bottom-ends of machine reels or partially filled machine reels in the pulper is arranged in connection with transfer rails arranged for machine reel traffic, whereby the fixed transfer rails above hamper the handling of winding shafts to be emptied, implemented with a hoist.

The publication EP 1266091 B1 discloses a transfer carriage supported on a floor, used for transferring machine reels at the height of transfer rails for machine reels.

10

SUMMARY

According to a first aspect of the invention, a movable storage is provided, supported on a floor and movable between at least two target stations, for receiving, transferring and handing over rolls, winding shafts and/or machine reels intended for the handling of a fiber web, the movable storage comprising reception members for receiving and holding up the load being handled at both its support ends. The movable storage comprises at least one vertical support member supported on the floor for supporting the reception members at a fixed height or in a manner enabling adjustable height and for holding the load up so that, during operation, the movable storage and the at least one roll, winding shaft and/or machine reel being handled is moved supported on the floor by means of at least one vertical support member above a fiber web manufacturing device and/or a finishing device.

25

According to a second aspect of the invention, a method is provided for handling rolls, winding shafts and/or machine reels intended for the handling of a fiber web by means of a movable storage supported on a floor, the movable storage being movable between at least two target stations and comprising reception members for receiving the load being handled and holding it up at both its support ends. The method comprises: receiving at least one roll, winding shaft and/or machine reel on reception members supported at a fixed height or at an adjustable level by means of at least one vertical support member supported on a floor and comprised

30

by the movable storage; moving the movable storage and the at least one roll, winding shaft and/or machine reel being handled supported on the floor by means of at least one vertical support member above a fiber web manufacturing device and/or a finishing device; and handing over at least one roll, winding shaft and/or
5 machine reel from the movable storage.

According to a third aspect of the invention, a fiber web manufacturing line is provided, comprising a movable storage in accordance with any aspect or embodiment of the invention.

10

Movement of a movable storage and the loads within it taking place above a fiber web manufacturing device and/or a finishing device refers to the fact that the loads and, as necessary, at least part of the structure forming the movable storage are located at least partly above the device in question or a section thereof during the
15 moving. Therefore, the movable storage or the load is not necessarily, at least not the whole time, directly above the device in question in the vertical direction; rather, the movable storage or load may also be on the side of the fiber web manufacturing device and/or the finishing device, for example, on a vertical plane above the fiber web manufacturing device and/or the finishing device, preferably
20 substantially on a vertical plane above the highest point of the device in question. In some embodiments of the invention, the load may naturally be lowered to a level below said vertical plane above when being on the side of the fiber web manufacturing device and/or the finishing device.

25 Preferably, the movable storage comprises vertical support members supported on a floor for supporting the reception members at a fixed height or in a manner enabling adjustable height and for holding the load up so that, during operation, the movable storage and the at least one roll, winding shaft and/or machine reel being handled is moved supported on the floor above a fiber web manufacturing
30 device and/or a finishing device.

Preferably, the movable storage comprises a first end movably supported on a floor, the first end comprising a first vertical support member that comprises a first

reception member for supporting a first end of a load substantially at a fixed height, and the movable storage comprises a second end movably supported on a support means such as a rail fastened to a wall and/or vertical beams, the second end comprising a second vertical support member that comprises a second
5 reception member for supporting a second end of the load substantially at a fixed height for holding the load up so that, during operation, the at least one roll, winding shaft and/or machine reel being handled by the movable storage is moved above a fiber web manufacturing device and/or a finishing device.

10 The second vertical support member may comprise a transfer carriage movable by means of a support means such as a rail.

“Support means” refers to a support member such as a rail, beam or similar, which enables forming a longitudinal support fastened to a wall and/or vertical beams,
15 suitable for holding up the mass of the load to be supported in a movable way via one end of the movable storage. Preferably, the longitudinal support is suitable for moving a transfer carriage above or below the support member, for example.

Preferably, a first end of the movable storage is supported on the floor by means
20 of a rail arranged on the floor, or a driving path supported on the floor may be formed through a longitudinal protrusion arranged on the floor.

The movable storage may be supported on the floor by means of rails arranged on the floor, or a driving path may be arranged upon longitudinal protrusions arranged
25 on the floor.

The movable storage and the load stored in it may be positioned so that a lifting device such as a hoist can move a load without obstacles from a fiber web manufacturing device such as a winder or a slitter-winder. The movable storage
30 and the load stored in it may be positioned so that a lifting device such as a hoist can move another load without obstacles, the other load being a machine reel, for example, located on storage rails preceding a main device of the manufacturing process at any position or on transfer rails leading from a winder to a slitter-winder

at any position.

The movable storage may be movable between at least two target stations. The target station may be a device of the fiber web manufacturing process; a storage stand; a storage rail; a transfer rail; a rejecting location; a location related to roll maintenance, such as a roll grindery; or another movable storage arranged for a roll, winding shaft and/or a machine reel. The target stations may be within the area of one or more machine halls and/or within the area of one or more fiber web manufacturing processes and/or within the area of one or more fiber web manufacturing lines.

The movable storage may be used to move loads below a hoist.

The movable storage may be used to arrange the handling of winding shafts without a hoist, for example, when machine reel traffic is arranged by means of transfer rails, for example.

The movable storage may be used to arrange the handling of winding shafts and machine reels without a hoist, for example, when the machine reels are located on storage stands in a target station within reach of the movable storage. The target stations may form a "grid layout"; in other words, the target stations may be, e.g., storage areas for one load, e.g., storage stands above and around which the movable storage may be moved.

The movable storage may be used to move loads in the vertical direction. The movable storage may be used to move loads in the horizontal direction. The movable storage may be used to move loads in the direction of the main manufacturing line. The movable storage may be used to move loads in the transverse direction of the main manufacturing line. The movable storage may be used to move loads substantially in all directions of the XZ coordinate system in a machine hall. The movable storage may be used to move loads substantially in all directions of the XYZ coordinate system in a machine hall. The X direction refers to the direction of the machine line defined by the fiber web manufacturing devices

or the finishing devices, the Y direction refers to the horizontal direction transverse to the X direction, and the Z direction refers to the vertical direction.

In addition to handling winding shafts, the movable storage may be used to
5 provide for the handling of other loads, such as lifts and transfers in connection with maintenance shutdowns, for example.

Preferably, a manufacturing line comprises a first slitter-winder located after a
windup. Preferably, the manufacturing line additionally comprises a second slitter-
10 winder located after the first slitter-winder. Preferably, the manufacturing line is located in a machine hall.

Preferably, the movable storage with its loads is movable between a windup and a
first slitter-winder. Preferably, the load of the movable storage is movable above a
15 reel yard. Preferably, the movable storage with its loads is movable between a windup and a second slitter-winder. Preferably, the movable storage with its loads is movable in the direction of the machine line.

Preferably, the support of the movable storage on a floor is arranged on the side of
20 a fiber web manufacturing device and/or a finishing device.

Preferably, the movable storage comprises vertical support members, such as
support bases. Preferably, at least one vertical support member is arranged during
operation on both sides of a fiber web manufacturing device and/or a finishing
25 device. The vertical support members may comprise a circumferential structure, such as an "A" structure. The vertical support member may comprise at least one substantially vertical base, such as a vertical beam.

In accordance with some embodiments, a movable storage comprises a first
30 vertical support member for a first support, such as a support base or bases, supported on a floor. Preferably, at least one vertical support member or members are arranged during operation on one side of a fiber web manufacturing device and/or a finishing device.

Preferably, the movable storage comprises drive wheels supported on the floor for moving the movable storage on a support surface. Drive wheels may be arranged in vertical support members. Drive wheels may be arranged for moving the
5 movable storage in a first direction of movement. Drive wheels may be arranged for moving the movable storage in a second direction of movement. The first and the second direction of movement may be perpendicular to each other. The drive wheels may be rotatable. The drive wheels may be arranged on rails. The drive wheels may be steel wheels. The movable storage may comprise a conveyor
10 supported on the floor for moving the movable storage on a support surface. The movable storage may comprise locking in place during the loading of the movable storage. The drive wheels may drive across crossing drive paths of a cart line.

Preferably, the movable storage comprises at least one electrical drive for the
15 drive wheels.

The movable storage may comprise at least one connecting member, such as a connecting beam, for connecting the vertical support members. The movable storage may comprise at least one connecting member, such as a connecting
20 beam, for connecting the vertical support members implementing the support of a first end of the movable storage and the support of a second end of the movable storage. At least one first connecting member may be arranged to connect the vertical support members that are located at a first load support end during operation. Preferably, at least one second connecting member may be arranged to
25 connect the vertical support members that are located at opposite load support ends during operation.

The movable storage comprises reception members for receiving and holding up the loads to be stored at both support ends of the load, such as shaft necks of a
30 winding shaft. The reception members may comprise a storage space for one or more rolls, winding shafts and/or machine reels. The reception member is preferably fastened in connection with a vertical support member. The reception member may comprise a storage rail. The reception member may comprise a load

stopping point for the shaft end. The reception member may comprise a locking device for locking the load in place. The movable storage may comprise a steel beam structure. The reception member may comprise a rail fastened with joints in a rotating manner or a rail sliding in the axial direction, such as a section of a rolling rail, for moving the load. A rail, e.g., a section of a rolling rail, may be turned up or to the side with an actuator. The reception member may comprise a transfer device for moving the load and/or the moving of the load in connection with the reception member may be based on gravity and take place by rolling. The transfer device for moving the device may be arranged to operate in connection with a rail equipped with joints or operating by sliding.

In accordance with some embodiments, an apparatus suitable for handling fiber web winding shafts and/or machine reels located between a windup and an unwinder is provided, and machine reels awaiting unwinding are arranged between the windup and the unwinder, the apparatus comprising a movable storage supported on a floor, being movable between the windup and the unwinder, the movable storage comprising reception members arranged at a fixed height for receiving, holding up and handing over at least one winding shaft and/or machine reel at a fixed height above machine reels. In a simple application, the movable storage can be moved in the X direction, while in another application, the movable storage can be moved in the XY direction.

In accordance with some embodiments, an apparatus suitable for handling fiber web winding shafts and/or machine reels located between a windup and an unwinder is provided, and machine reels awaiting unwinding are arranged between the windup and the unwinder, the apparatus comprising a movable storage supported with a first support on a floor and supported with a second support on a wall of the building on a rail and/or support posts on a rail, the movable storage being movable between the windup and the unwinder and comprising reception members arranged at a fixed height for receiving, holding up and handing over at least one winding shaft and/or machine reel at a fixed height above machine reels.

The reception member may be rigidly fastened to a certain level in the movable storage. The reception member is preferably movable in the vertical direction. The reception member is preferably fastened to a vertical support member. The reception member is preferably supported movably in the vertical direction on
5 vertical support members.

The movable storage may comprise a vertical movement mechanism for the reception member supported with ropes, bars or guides. A reception means may comprise a lifting hook. The vertical movement mechanism of the reception
10 member may be supported at its upper end on a connecting member of the movable storage. The vertical movement mechanism preferably comprises an electrical drive.

The movable storage may comprise a structure that enables driving over a fiber web manufacturing line, preferably with a load. The movable storage may
15 comprise a structure that enables driving over a fiber web manufacturing device, preferably with a load. A movable storage may comprise a structure whose height of passage in the passage area below is at least 2 m, preferably at least 3 m. The movable storage may comprise a load storage height where the height of passage
20 below the lowest point of the load is at least 2 m, preferably at least 3 m.

The movable storage may be electrically driven. The movable storage may comprise at least one battery for electrical drives. Power supply for the movable storage may be arranged with a cable, preferably through an unwinding and
25 rewinding cable reel. In some conditions, the movable storage may also be gas-driven, e.g., in very well ventilated conditions. In accordance with some embodiments, the power supply of the movable storage is implemented wirelessly, e.g., inductively, whereby it may not be necessary to resort to power stored in a battery. The path of the movable storage may be automated, for example, by
30 means of identifiers located on a floor. Preferably, the movable storage comprises a safety device, such as a buffer, and/or an optical signaling device, such as a flasher, and/or a stopping sensor and/or an acoustic signaling device, such as a buzzer. In accordance with some embodiments, the power supply of the movable

storage is implemented with bus-bars arranged in connection with the support member at one end.

5 According to a fourth aspect of the invention, a computer program stored on a memory device is provided for controlling a movable storage supported on a floor for handling rolls, winding shafts and/or machine reels intended for the handling of a fiber web, the movable storage being movable between at least two target stations and comprising reception members for receiving and holding up the load being handled at both its support ends. The computer program comprises: a
10 program code executed by a computer so that the code, when executed, makes a movable storage receive at least one roll, winding shaft and/or machine reel on reception members supported at a fixed height or at an adjustable level by means of at least one vertical support member supported on a floor and comprised by the movable storage; move the movable storage and the at least one roll, winding
15 shaft and/or machine reel being handled supported on the floor by means of at least one vertical support member above a fiber web manufacturing device and/or a finishing device; and hand over at least one roll, winding shaft and/or machine reel from the movable storage.

20 The computer program may be executed in a movable unit moving together with the movable storage. In this case, it is not necessary to arrange a mobile communication connection between the movable storage and the unit executing the program.

25 The computer program may be executed in a unit that is separate from the movable storage. A wireless communication connection may be provided between said unit separate from the movable storage and the movable storage itself. The wireless communication connection may use a wireless local area network (WLAN) connection.

30

It is possible to decrease the fixed storage spaces in the manufacturing line, particularly between the windup and the slitter-winder. At least some of the fixed storage spaces decreased between the windup and the slitter-winder may be

located in the at least one movable storage for machine reels and/or winding shafts comprised by the manufacturing line. Decreasing storage spaces is advantageous particularly in the case of target stations where a lifting and transfer device such as a hoist has limited access to a load below a storage location. A
5 movable storage enables implementing a winding shaft storage location above a windup station and at least partly in connection with a winder. A movable storage enables implementing a storage facility above an unwinder above winding shafts at least partly in connection with a slitter-winder. A movable storage enables implementing the winding shaft traffic between the winder and the slitter-winder in
10 part or in its entirety.

The arrangements presented provide layout solutions for the manufacturing line of a paper machine that enable an entirely new approach to the storage and handling of either winding shafts or machine reels or both in connection with winding and/or
15 slitting.

Loads such as winding shafts can be transported flexibly and comprehensively over large areas and using alternative routes, for example. It is possible to automate and standardize the load lifting and transfer functions, whereby the
20 operations can be arranged efficiently and safely.

Another safety-enhancing feature is the possibility to decrease lifting and transfer operations implemented using lifting ropes. It is possible to avoid the number of lifts and transfers implemented using long lifting ropes, whereby it is also possible
25 to avoid collisions of loads due to lifting device control errors.

By applying the presented arrangement implemented using a movable storage for storing and handling rolls, winding shafts and/or machine reels, it is possible to obtain a significant financial advantage in the form of lower construction costs, as
30 a fiber web manufacturing line can be located in a smaller, particularly lower, building with a lighter structure. A smaller building volume may be sufficient for a manufacturing line.

When implementing rearrangements of winding shaft traffic and modernizations of manufacturing lines in rebuild situations, it is possible to arrange a support location of one end of the movable storage on a rail above floor level even in buildings with limited space. An example of such circumstances is the driving side of a fiber web
5 manufacturing apparatus which does not necessarily have room for a support position of a movable storage at floor level.

The support of one end of the movable storage on a rail is preferably arranged on the driving side of a fiber web manufacturing apparatus.

10

Machine reels and winding shafts refer to winding shafts at different stages of the fiber web manufacturing process with varying amounts of paper around them, i.e., full machine reels, partially filled machine reels, reject reels and winding shafts. Rolls refer to rolls and cylinders used for processing the fiber web in the devices of
15 the fiber web manufacturing process.

In this description and the claims, the term "reel spool" is used to refer to winding shafts or similar, around which the machine reel is wound and from which the machine reel is unwound before slitting. Even if this description primarily refers to
20 paper, the invention can also be applied in connection with the manufacture of other fiber webs.

Various embodiments of the present invention will only be or have only been described in connection with one or some of the aspects of the invention. A person
25 skilled in the art will appreciate that any embodiment of an aspect of the invention may be applied in the same aspect and other aspects alone or in combination with other embodiments.

BRIEF DESCRIPTION OF THE FIGURES

30

The invention will be described in the following by way of example with reference to the appended drawings.

Figure 1 schematically shows a paper manufacturing line which comprises a movable storage between a winder and slitter-winder, the storage being movable in the direction of the manufacturing line.

Figure 2 schematically shows a side view of the movable storage of Figure 1.

5 Figure 3 schematically shows a side view of a modification of the movable storage of Figure 2.

Figure 4 schematically shows a side view of another embodiment of the movable storage.

10 Figure 5 schematically shows another paper manufacturing line, which comprises two movable storages that can be moved in the direction of the manufacturing line and in a transverse direction to the manufacturing line.

Figure 6 schematically shows a paper manufacturing line which comprises a movable storage between a winder and slitter-winder, the storage being movable in the direction of the manufacturing line.

15 Figure 7 schematically shows a side view of the movable storage of Figure 6 viewed in the direction shown by arrow A.

Figure 8 schematically shows a side view of a modification of a first end of the movable storage.

20 DETAILED DESCRIPTION

In the following description, like references refer to similar parts. It should be noted that the figures are not to scale and that they mainly serve the purpose of illustrating embodiments of the invention.

25

The fiber web manufacturing lines shown in Figures 1 and 5 comprise a fiber web machine such as a paper machine 100 and a windup 20 in line with the machine, as well as at least one slitter-winder. A paper web W being output from the paper machine 100 is wound at the windup 20 by means of a winding cylinder into a machine reel 4 around a winding shaft 1.

30

The manufacturing line shown in Figure 1 comprises a windup 20, an unwinder 30A and a slitter-winder 31A as the main devices of the process. The

manufacturing line shown in Figure 5 comprises a windup 20, a first unwinder 30A and a first slitter-winder 31A, a second unwinder 30B and a second slitter-winder 31B as the main devices of the process. In the manufacturing lines shown in Figures 1 and 2, the slitter-winders output customer rolls 19, which can be conveyed with, e.g., slat-type conveyors outside the actual machine hall.

Depending on the paper manufacturing process, e.g., the paper type manufactured, flexibility may be needed in terms of storage space on a case-by-case basis for full machine reels, partially filled machine reels, reject reels, winding shafts. Flexibility in terms of storage space may be formed by means of a movable storage 10, 10' supported on a floor.

Storage and transfer capacity for machine reels 4 and winding shafts 1 may be arranged by applying preferred embodiments of the movable storage 10, 10' and by modifying (e.g., Figure 3) said preferred embodiments to a suitable extent so that by preferably simultaneously using a dense layout of the main devices and by locating the necessary machine reel and/or winding shaft storages away from between the main devices, it is possible to provide a short manufacturing line that enables using a short machine hall. By applying embodiments of the movable storage 10, 10' it is in some cases possible to do without a full-scale hoist, even without any hoist, whereby the machine hall and the building may be constructed to be lower than usual.

Figure 1 schematically shows a first application of the invention where a storage of winding shafts 1 and winding shaft traffic are arranged using a movable storage 10. The machine reel 4 traffic between a winder 20 and an unwinder 30A is arranged using rails 5 comprised by the winder. In the application shown in Figure 1, the movable storages shown in Figures 2, 3 and 4 may be used as the movable storage. The movement area of the movable storage 10 in the movement direction 14' aligned with the machine line is shown with a pair of lines 14".

In connection with transfer rails 5, the windup 20 preferably comprises a stand-by station for a machine reel 4 preferably accommodating one machine reel 4 or, for

example, when the flexibility or operational reliability of the process so requires, more than one machine reel 4 as necessary.

Preferably, there is a first unwinding station 30A of the first slitter-winder 31A in
5 connection with the windup 20 through the transfer rails 5.

It is recommended that a number of machine reels 4 and/or winding shafts 1,
within the tolerance of the manufacturing process, are located in storage away
from the immediate vicinity of the main devices of the manufacturing line,
10 especially from between the main devices, in order to provide a layout solution that
takes as little room as possible in the longitudinal direction of the building.

In accordance with some embodiments of a manufacturing line, a movable storage
10, 10' is located in the main machine line, preferably to be moved above devices
15 within the machine line or above machine reels 4 within the machine line.

A movable storage to be moved above the main machine line may be positioned
to run in the area between a first slitter-winder 30A and a second unwinding
station 30B, for example, advantageously above a "roll yard".
20

A movable storage in the main machine line may be mainly located in the area
between a winding station 20 and a first unwinding station 30A as shown in Figure
2.

25 With regard to the positions and operating applications of the movable storage,
also refer to the description in connection with Figures 1, 2, and 5. It should be
emphasized that the descriptions in connection with Figures 1 to 5 only concern
example structures for implementing a movable storage and that the movable
storage may also be implemented otherwise with regard to structures, numbers of
30 storage spaces, types of storage spaces, positions within the storage space
structures, etc.

Figure 2 shows a simple implementation of a movable storage 10, implementing

winding shaft traffic between a winder 20 and a slitter-winder 31A. The movable storage 10 may be used to arrange the handling of winding shafts 1 without a hoist, for example, when the machine reel 4 traffic is arranged by means of transfer rails 5. The movable storage in Figure 2 arranges the handling of winding shafts 1 over machine reels 4 stored between a windup 20 and an unwinder 30A. The movable storage 10 may comprise a structure that enables driving above a fiber web manufacturing line with a winding shaft 1. The movable storage may also comprise a structure that enables driving over a fiber web manufacturing device or an entire manufacturing line with a load. Thereby, the movable storage may be employed for lifts and transfers of loads, such as rolls, in connection with the maintenance of manufacturing and finishing devices preferably at least at the dry end of the machine line. Maintenance operations are enabled particularly when using a movable storage that is able to move a load in the XZ directions or in the XYZ directions.

15

A movable storage 10 makes it possible to arrange a short cycle of winding shafts 1 at the "dry end" by bringing the winding shafts 1 from the unwinder 30A directly over the windup to wait for use at the winder 20 as illustrated in Figure 2.

20 The winding shafts 1 may be brought with the movable storage 10, 10' within reach of the windup 20 to such a level where the winding shafts 1 may be moved over the machine reel 4 being wound to the windup 20.

25 In Figure 2, the winding shafts 1 may be brought from the lifting device 35 of the unwinder 30A within reach of the lifting device 25 of the windup 20 to such a level where the winding shafts 1 can be moved to the windup 20 over a full machine reel being wound, located on the transfer rails 5.

30 The lifting device 25 on the windup 20 comprises a vertical frame 26, such as a steel beam, to which a lifting arm 27 is rotatably mounted with bearings. The lifting arm 27 is moved by means of an actuator, such as a hydraulic cylinder. The lifting arm comprises a reception space 28 for an end 2 of the winding shaft 1. The lifting arms 27 grip both ends of a winding shaft 1, which is moved, e.g., for winding, as

shown by arrow 25'.

A lifting device 35 at the unwinder 30A comprises a lifting device of similar operation as the one at the windup 20. A lifting arm 37 is rotatably mounted with bearings to the vertical frame 36. The lifting arm 37 is moved by means of an actuator, such as a hydraulic cylinder. The lifting arms 37 grip both ends of an emptied winding shaft 1 or a partially filled machine reel 1, which is moved to the movable storage 10 as shown by arrow 35' to be transported over the waiting machine reel 4, e.g., to wait to be loaded away with the lifting device 25 of the windup 20.

The movable storage 10 is supported on a floor 3 by means of rails arranged on the floor, or a driving path may be arranged upon longitudinal protrusions arranged on the floor.

The support on the floor 3 of the movable storage 10 is arranged on the sides of the winder 20 and the slitter-winder 31A.

The movable storage 10 comprises vertical support members 11a, 11b, such as support bases. Preferably, two vertical support members are arranged at both sides of the movable storage 10. In Figure 2, the vertical support member comprises an A-shaped circumferential structure comprising a first connecting structure 13 connecting the vertical support members 11a, 11b in the lower section. A second connecting member is arranged to connect vertical support members at opposite load support ends (not shown in the figures).

The movable storage 10 comprises drive wheels 14 supported on the floor for moving the movable storage in the direction of the machine line 14' on a support surface, such as the floor 3. The drive wheels 14 are fastened to the vertical support members, preferably the first connecting member 13, such as a horizontal beam. The drive wheels may be rotatable. The drive wheels are preferably equipped with rolling blocking, such as a brake. The drive wheels may be arranged on rails.

Preferably, the movable storage comprises at least one electrical drive for the drive wheels 14.

5 The movable storage 10 comprises reception members 12 for holding up the winding shafts 1 at both their ends 2. The reception member 12 preferably comprises an substantially horizontal beam 12 on the upper surface 12a of which the load is stored. In Figure 2, the reception member comprises a storage space for one load. The reception member 12 is fastened to the upper end of the support
10 bases 11a, 11b. The reception member 12 may comprise a stopping point for the shaft end 2. The reception member 12 may comprise a locking device for locking the load in place. The movable storage 10 preferably comprises a steel beam structure.

15 In Figure 2, the level of the reception member is not adjustable, i.e., the reception member is rigidly fastened to a fixed level in the movable storage 10.

A movable storage 10' shown in Figure 3 may be moved in two directions of movement. First drive wheels 14 are arranged in the movable storage 10' for
20 moving the storage in the direction of the machine line 14', and second drive wheels 15 are arranged for moving the storage in a transverse direction to the machine line 15'. The drive wheels of one direction of movement may be used when the drive wheels of the second direction of movement are lifted off a support surface 3, and vice versa. In Figure 3, the first and the second direction of
25 movement are perpendicular to each other. Preferably, the movable storage comprises at least one first electrical drive for the first drive wheels 14 and at least one second electrical drive for the second drive wheels 15. The movable storage 10' shown in Figure 3 comprises three storage spaces for winding shafts 1 or similar.

30

A movable storage 10" shown in Figure 4 may be moved in two directions of movement supported on a floor 3. The movable storage 10' shown in Figure 4 may be moved in two directions of movement 14', 15', e.g., over a machine reel 4, by

means of drive wheels 14, 15 of two different directions of movement.

By means of the movable storage 10' shown in Figure 4, a load may be moved in a vertical direction 12'. A reception member is preferably fastened to vertical support members 11a, 11b and supported on them in a movable manner in the vertical direction 12'. The vertical movement mechanism preferably comprises ropes or bars or guides that are preferably supported on second connecting members 16b (Figure 5) connecting the ends of the movable storage 10'. In the case of Figure 4, the movement mechanism is supported on first connecting members 16a connecting the vertical support members 11a, 11b at one end of the movable storage. In accordance with an alternative embodiment, the reception means comprises a lifting hook. The vertical movement mechanism preferably comprises at least one electrical drive.

The movable storage 10' shown in Figure 4 may be used to arrange the handling of winding shafts 1 and machine reels 4 without a hoist, for example, when the machine reels are located on storage stands in a target station within reach of the movable storage. The target stations may also be outside the main machine line. The target stations may form, e.g., a "grid layout"; in other words, the target stations may be, e.g., storage areas for one load, e.g., storage stands 5' above and around which the movable storage 10' may be moved. By dimensioning the level of the load in the movable storage in a suitable manner it is also possible to drive over machine reels 4 in storage, for example.

A movable storage 10' shown in Figure 5 enables moving loads in a horizontal direction, both in the direction of the main manufacturing line 14' and in the transverse direction 15'. In Figure 5, there are two movable storages 10'. In Figure 5, the movable storage 10' is preferably of the type shown in Figure 4, but the movable storages may also be of different types.

30

The upper movable storage 10' in Figure 5 moves a machine reel in a transverse direction to the manufacturing line 15' along rails 15" from storage stands 5' to a second unwinding station 30B. A lower movable storage 10' in Figure 5 handles

the storage and traffic of winding shafts 1 in the machine direction 14' along a drive route 14", such as rails, between a first unwinding station 39A and a winder 20. As necessary, both movable storages are capable of handling all of the winding shafts and machine reels at the dry end of the manufacturing line.

5

The movable storage 10' in Figure 5 enables implementing not only the handling of winding shafts but also that of other loads, such as lifts and transfers in connection with, e.g., maintenance shutdowns, e.g., when the movement area 14" extends towards the initial end of the manufacturing line in the direction of the manufacturing line.

10

In Figure 5, the positions for the machine reels 4 between a windup 20 and a first slitter-winder 31A are implemented with storage stands 5' instead of the transfer rails 5 shown in Figure 1, some of the stands being situated to the side of the main machine line. The reduced storage number of machine reels 4 between the main devices, such as the windup 20 and the first slitter-winder 31A, contributes to the reduction of the total length of the machine line. As necessary, a ready machine reel 4 may be moved further from a machine reel stand-by station, e.g., by means of the movable storage 10' shown in Figure 5, e.g., to a storage space located to the side from the main machine line, e.g., on storage stands 5'. The machine reel 4 may be moved with the movable storage from the storage space to a stand-by station of the machine reel or to an unwinding station of a slitter-winder of the manufacturing line.

15

20

25

The movement area of the movable storage 10' is shown with double lines 14" in the movement direction aligned with the machine line and with double lines 15" in the transverse direction of the machine line. The drive route within the movement area may be implemented with rails, for example, or it may be a drive route of drive wheels on the floor.

30

As necessary, a passage may be arranged between a first slitter-winder 31A and a second slitter-winder 31B for users and/or goods traffic. In Figure 5, the traffic of

the movable storage 10' to an unwinding station 30B of a second slitter-winder is arranged along such a passage.

5 The second slitter-winder 31B comprises the second unwinding station 30B and unwind stands 5' located therein for receiving a machine reel 4.

10 A fiber web manufacturing line shown in Figure 6 comprises a fiber web machine, such as a paper machine 100, and a windup 20 in line with it and at least one slitter-winder 31. A paper web W being output from the paper machine 100 is wound at the windup 20 by means of a winding cylinder into a machine reel 4 around a winding shaft 1.

15 The manufacturing line shown in Figure 6 comprises the windup 20, an unwinder 30 and the slitter-winder 31 as the main devices of the process. In the manufacturing line, the slitter-winder outputs customer rolls 19, which can be conveyed with, e.g., slat-type conveyors outside the actual machine hall in the building.

20 Depending on the paper manufacturing process, e.g., the paper type manufactured, flexibility may be needed in terms of storage space on a case-by-case basis for full machine reels, partially filled machine reels, reject reels, winding shafts. It is possible to enhance flexibility in terms of storage space by means of a movable storage 10". The movable storage 10" comprises a first end 10A and a second end 10B where support spaces are arranged for the loads handled. The movable storage 10" is supported on a floor 3, preferably on rails 3A shown by a dash-dot line, at its first end 10A and on a rail 50, shown by a dashed line and located above floor level, at its second end 10B.

30 Storage and transfer capacity for machine reels 4 and winding shafts 1 may be arranged by applying the embodiments of the movable storage 10" and by modifying said preferred embodiments to a suitable extent so that by preferably simultaneously using a dense layout of the main devices and by locating the necessary machine reel and/or winding shaft storages away from between the

main devices, it is possible to provide a short manufacturing line that enables using a short machine hall. By applying the embodiments of the movable storage 10" it is in some cases possible to do without a full-scale hoist, even without any hoist, whereby the machine hall and the building may be constructed to be lower
5 than usual.

Figure 6 schematically shows a first application of the invention where a storage of winding shafts and winding shaft traffic are arranged by means of a movable storage 10". The machine reel 4 traffic between a winder 20 and an unwinder 30 is
10 preferably arranged using rails 5 comprised by the winder.

In connection with transfer rails 5, the windup 20 preferably comprises a stand-by station for machine reels 4 preferably accommodating one machine reel 4 or, for example, when the flexibility or operational reliability of the process so requires,
15 more than one machine reel 4.

In connection with the windup 20, there is an unwinding station 30 of a slitter-winder 31, preferably through transfer rails 5.

20 It is recommended that a number of machine reels 4 and/or winding shafts 1, within the tolerance of the manufacturing process, are located in storage to be away from the immediate vicinity of the main devices of the manufacturing line, especially from between the main devices, in order to provide a layout solution that takes as little room as possible in the longitudinal direction of the building.

25

In accordance with some embodiments of the manufacturing line, a movable storage 10" is located in the main machine line, preferably to be moved above devices within the machine line or preferably above machine reels 4 within the machine line.

30

A movable storage to be moved above the main machine line may be positioned to run in the area between a first slitter-winder 30 and a second unwinding station arranged after it, advantageously above a "roll yard".

A movable storage within the main machine line may be mainly located in the area between a winding station 20 and an unwinding station 30 as shown in Figure 7.

5 Figure 7 shows an application of a movable storage 10" implementing the handling of winding shafts and winding shaft traffic above machine reels 4 being stored between a winder 20 and an unwinder 30. The movable storage 10" may be used to arrange the handling of winding shafts 1 without a hoist, for example, when machine reel 4 traffic is arranged by means of transfer rails 5. The movable
10 storage 10" may comprise a structure that enables driving above the fiber web manufacturing line with the winding shaft 1. The movable storage may also comprise a structure that enables driving over a fiber web manufacturing device or an entire manufacturing line with a load. Thereby, a movable storage may be employed for lifts and transfers of loads, such as rolls, in connection with the
15 maintenance of manufacturing and finishing devices preferably at least at the dry end of the machine line.

A movable storage 10" makes it possible to arrange a short cycle of winding shafts 1 at the "dry end" by bringing the winding shafts 1 from the unwinder 30 directly
20 over the windup to wait for use at the winder 20 as illustrated in Figure 7.

The winding shafts 1 may be brought with the movable storage 10" within reach of the windup 20 to such a level where the winding shafts 1 may be moved over the machine reel 4 being wound to the winder 20.
25

In Figure 7, the winding shafts 1 may be brought from a lifting device 35 of an unwinder 30 within reach of a lifting device 25 of a windup 20 to such a level where the winding shafts 1 can be moved over a full machine reel 4 being wound, located on transfer rails 5.
30

The lifting device 25 at the windup 20 comprises a vertical frame 26, such as a steel beam, to which a lifting arm 27 is rotatably mounted with bearings. The lifting arm 27 is moved by means of an actuator, such as a hydraulic cylinder. The lifting

arm comprises a reception space 28 for an end 2 of the winding shaft 1. The lifting arms 27 grip both ends of the winding shaft 1, which is moved for winding, for example, as shown by arrow 25'.

- 5 The lifting device 35 at the unwinder 30 comprises a lifting device of similar operation as the one at the windup 20. A lifting arm 37 is rotatably mounted with bearings to the vertical frame 36. The lifting arm 37 is moved with an actuator, such as a hydraulic cylinder. The lifting arms 37 grip both ends of the emptied winding shaft 1 or partially filled machine reel 1, and the winding shaft 1 is moved
10 as shown by arrow 35' to a movable storage 10" to be transported over the waiting machine reel 4, to wait to be loaded away, e.g., with the lifting device 25 of the windup 20.

The movable storage 10" is supported on a floor 3 at its first end 10A, e.g., through
15 rails 3A arranged on the floor, or a driving path may be arranged upon longitudinal protrusions arranged on the floor.

The support on the floor 3 of the movable storage 10" is arranged on the sides of
20 the winder 20 and the slitter-winder 31.

The movable storage 10" comprises a first vertical support member 11a, 11b, such
as support bases, at its first end 10A. In Figure 2, the first vertical support member
11a, 11b comprises an A-shaped circumferential structure comprising a first
connecting member 13 connecting the support bases 11a, 11b in the lower
25 section.

The movable storage 10" is supported at its second end 10B on a rail 50 above
floor level, which rail may be arranged on a beam that is supported on a wall of the
building and/or on vertical structures 51 separate from the wall, such as beams.
30 The vertical beams 51 may also be part of the wall.

The support of the second end 10B of the movable storage 10" on the rail 50 is
arranged on the side of the winder 20 and the slitter-winder 31, or the support on

the rail 50 may also be partially arranged above the process devices in question, preferably so that a hoist reaches the machine reels 4 below and is able to lift them.

- 5 The movable storage 10" comprises in its second end 10B a second vertical support member 41, such as a transfer carriage (shown in Figure 2 by a dashed line), on which one end 2 of the load being handled is placed, and which transfer carriage 41 can be moved in the direction of arrow 14' on the rail 50.
- 10 A second connecting member (not shown in the figures) may be arranged to connect the first end 10A and the second end 10B of the movable storage 10". The second connecting member enables keeping the first end 10A at a suitable distance from the second end 10B, whose position in the transverse direction to the direction of movement 14' is defined by the rail 50. Thus it is possible to keep
- 15 the first end 10A upright through the second connecting member. Power or data transfer may be arranged through the second connecting member to the first end 10A via the second end 10B. The second connecting member may be beam-like.

The movable storage 10" comprises first drive wheels 14 supported on a floor at

20 the first end 10A for moving the movable storage 10" in the direction of the machine line 14' on a first support surface, such as the floor 3. The first drive wheels 14 are fastened to the vertical support members, preferably the first connecting member 13, such as a horizontal beam. The first drive wheels 14 are preferably equipped with rolling blocking, such as a brake. The first drive wheels

25 14 may be arranged on a rail 3A supported on the floor.

The transfer carriage 41 preferably comprises second drive wheels 44 for driving on a support surface of the transfer rail 50. The second drive wheels 44 are preferably equipped with rolling blocking, such as a brake.

30

Preferably, the movable storage 10" comprises at least one electrical drive for the first drive wheels 14 and/or the second drive wheels 44.

The movable storage 10" is preferably moved with position-based control, whereby the first drive wheels 14 of the first end 10A are driven with a first electrical drive with position-based control and the second drive wheels 44 of the second end 10B are driven with a second electrical drive with position-based control so that both
5 ends of the movable storage 10" move the same amount in the direction of movement 14'. The position-based control and the synchronization of the movement of each end 10A, 10B may be implemented through the drive wheels, or the position-based control and the synchronization may be implemented based on the measurement of the position of each end, e.g., using laser.

10

It is possible that a second connecting member described above is not arranged to connect the first end 10A and the second end 10B of the movable storage 10". In accordance with some embodiments, the first end 10A is arranged to stay upright without a connecting member functioning through the second end 10B. The
15 vertical support member of the first end 10A may be arranged to stay upright independently, e.g., by means of a mechanism connecting to the profile of one or more rails 3A, being supported on the floor and preventing the disconnection of the first drive wheels 14 from the rail.

20

The first end 10A comprises a first reception member 12 for holding up the winding shaft 1 at its first end 2. The first reception member 12 preferably comprises an substantially horizontal beam 12 on the upper surface 12' of which an end of the load is stored. In Figure 7, the first reception member 12 comprises a storage
25 space for one load. The first reception member 12 is fastened to the upper end of the support bases 11a, 11b. The first reception member 12 may comprise a stopping point for the shaft end 2. The first reception member 12 may comprise a locking device for locking the load in place.

30

The second end 10B comprises an upper surface of 42 of the transfer carriage
30 functioning as a second reception member in the transfer carriage 41 for holding up the winding shaft 1 at its one end 2. The second reception member 42 may preferably comprise an substantially horizontal upper surface 42 on which the end of the load is stored. In Figure 2, the second reception member 42 comprises a

storage space for one load. The second reception member 42 may comprise a stopping point for the shaft end 2. The second reception member 42 may comprise a locking device for locking the load in place.

- 5 The movable storage 10" preferably comprises a steel beam structure.

In Figure 7, the level of the reception members is not adjustable, i.e., they are rigidly fastened to a fixed level in the movable storage 10".

- 10 The modification of a movable storage shown in Figure 8 comprises three storage spaces for winding shafts 1 or similar at its first end 10A. Correspondingly, a transfer carriage 41 at a second end 10B of the movable storage preferably comprises three storage spaces (not shown in the figures) in such an application.

- 15 The structure of the movable storage is preferably based on a steel profile that well supports the mass to be stored in the vertical direction. The movable storage may be designed to receive heavy full machine reels 4, lighter partially filled machine reels 4 and winding shafts 1, or the structure of the movable storage may comprise a combination of the loads mentioned above.

20

The movable storage 10, 10' may be controlled with an apparatus that may comprise a computer program. The computer program may be stored on an optical or a magnetic memory means, such as a floppy disk, a CD-ROM, a DVD, or a memory stick. The computer program comprises a program code executable
25 by a computer which, when executed, makes a movable storage receive at least one roll, winding shaft and/or machine reel in a movable storage supported on a floor, move the movable storage, and hand over at least one roll, winding shaft and/or machine reel from the movable storage.

- 30 It should be emphasized that what is described above is only example structures for implementing a movable storage and that a movable storage may also be implemented otherwise with regard to structures, numbers of storage spaces, types of storage spaces, positions within the storage space structures, etc.

The preceding invention and its various applications are suited to be used in connection with various types of paper manufacturing lines, slitter-winder concepts and other process device concepts. The invention may be implemented in
5 connection with both new paper manufacturing lines and complements to and modernizations of existing paper manufacturing lines.

The description given above provides non-limiting examples of some embodiments of the invention. It is apparent to persons skilled in the art that the
10 invention is not confined to the details presented above, but that the invention may also be implemented in other equivalent ways.

Some features of the embodiments presented may be utilized without employing other features. The above description must be regarded as an explanatory
15 account describing the principles of the invention and not as limiting the invention. Thus the scope of the invention is only limited by the appended claims.

CLAIMS

1. A movable storage (10, 10', 10") supported on a floor (3) and movable between at least two target stations for receiving, moving and handing over rolls, winding shafts (1) and/machine reels (4) intended for the handling of a fiber web (W), and the movable storage comprising reception members (12) for receiving a load (1, 4) being handled and holding it up at both its support ends (2), **characterized** in that the movable storage (10,10', 10") comprises at least one vertical support member (11a, 11b) supported on the floor (3) for supporting the reception members (12) at a fixed height or in a manner enabling adjustable height and for holding up the load (1, 4) so that, during operation, the movable storage and the at least one roll, winding shaft (1) and/or machine reel (4) being handled is moved supported on the floor (3) by means of at least one vertical support member above a fiber web manufacturing device (100) and/or a finishing device (20, 30A, 30B, 30, 31A, 31B, 31) .

2. A movable storage as claimed in claim 1, **characterized** in that the movable storage (10, 10') comprises vertical support members (11a, 11b) supported on the floor (3) for supporting the reception members (12) at a fixed height or in a manner enabling adjustable height and for holding the load (1, 4) up so that, during operation, the movable storage and the at least one roll, winding shaft (1) and/or machine reel (4) being handled is moved supported on the floor (3) above a fiber web manufacturing device (100) and/or a finishing device (20, 30A, 30B, 31A, 31).

3. A movable storage as claimed in claim 1, **characterized** in that the movable storage (10") comprises:

a first end (10A) that is movably supported on the floor (3), and the first end (10A) comprising a first vertical support member (11a, 11b) which comprises a first reception member (12) for supporting a first end (2) of a load (1, 4) substantially at a fixed height; and

a second end (10B) that is movably supported on a supporting means (50), such as a rail fastened to a wall and/or vertical beams (51), and the second

end (10B) comprising a second vertical support member (41) which comprises a second reception member (42) for supporting a second end (2) of the load (1, 4) at an substantially fixed height;

5 for holding the load (1,4) up so that, during operation, the movable storage (10") moves the at least one roll, winding shaft and/or machine reel being handled above a fiber web manufacturing device (100) and/or a finishing device (20, 30, 31).

10 4. A movable storage as claimed in claim 3, **characterized** in that the second vertical support member comprises a transfer carriage (41) movable on a support means (50), such as a rail.

15 5. A movable storage as claimed in any one of claims 1 to 4, **characterized** in that the first end (10A) of the movable storage is supported on the floor (3) through rails arranged on the floor or through longitudinal protrusions arranged on the floor.

20 6. A movable storage as claimed in any one of claims 1 to 5, **characterized** in that the movable storage (10, 10') is supported on the floor (3) through rails arranged on the floor or through longitudinal protrusions arranged on the floor.

25 7. A movable storage as claimed in any one of claims 1 to 6, **characterized** in that a target station comprises a device of the fiber web (W) manufacturing process; a storage stand (5'); a storage rail; a transfer rail (5); a rejecting location; a location for roll maintenance, such as a roll grindery; or a movable storage (10, 10', 10") arranged for the roll and/or the winding shaft (1) and/or the machine reel (4).

30 8. A movable storage as claimed in any one of claims 1 to 7, **characterized** in that the target stations are located in the area of one or more machine halls and/or fiber web manufacturing processes and/or fiber web manufacturing lines.

9. A movable storage as claimed in any one of claims 1 to 8, **characterized**

in that the movable storage (10, 10', 10'') comprises drive wheels (14, 15, 44) arranged in connection with vertical support members (11a, 11b, 13, 41) for moving the movable storage in a first direction (14') and/or in a second direction (15').

5

10. A movable storage as claimed in any one of claims 1 to 9, **characterized** in that the movable storage (10, 10') comprises a movement mechanism (12, 12') for the load in the vertical direction.

10

11. A movable storage as claimed in any one of claims 1 to 10, **characterized** in that the support on the floor (3) of the vertical support member (11a, 11b, 13, 14, 15) is arranged on the side of a fiber web manufacturing device and/or a finishing device.

15

12. A movable storage as claimed in any one of claims 1 to 11, **characterized** in that the movable storage (10, 10') is arranged to move loads substantially in the directions of the XZ coordinate system in a machine hall, preferably substantially in the directions of the XYZ coordinate system in the machine hall.

20

13. A movable storage as claimed in any one of claims 1 to 12, **characterized** in that the movable storage (10, 10') is movable between a windup (20) and an unwinder (30A) so that the winding shafts (1) being handled with the movable storage can be moved over machines reels (4) arranged between the windup and the unwinder.

25

14. A method for handling rolls, winding shafts (1) and/or machine reels (4) intended for the handling of a fiber web (W) by means of a movable storage (10, 10'), the movable storage being movable between at least two target stations and comprising reception members (12) for receiving a load (1, 4) being handled and
30 holding it up at both its support ends (2), **characterized** in that the method comprises receiving at least one roll, winding shaft (1) and/or machine reel on reception members (12) supported at a fixed height or at an adjustable level by means of at least one vertical support member (11a, 11b) comprised by the

movable storage (10, 10') and supported on a floor (3); moving the movable storage and the at least one roll, winding shaft (1) and/or machine reel (4) being handled supported on the floor (3) by means of at least one vertical support member above a fiber web manufacturing device (100) and/or a finishing device (20, 30A, 30B, 30, 31A, 31B, 31); and handing over at least one roll, winding shaft and/or machine reel from the movable storage.

15 15. A method as claimed in claim 14, **characterized** in that the method comprises handling loads by means of a movable storage (10, 10', 10'') below a hoist, preferably without a hoist.

16. A method as claimed in claim 14 or 15, **characterized** in that the method comprises moving the movable storage (10, 10', 10'') in a fiber web manufacturing line, preferably between a windup (20) and a slitter-winder (31A, 31B).

15

17. A method as claimed in any one of claims 14 to 16, **characterized** in that the method comprises moving the movable storage (10, 10', 10'') on the side of the main fiber web manufacturing line.

20 18. A method as claimed in any one of claims 14 to 17, **characterized** in that the method comprises moving the movable storage (10, 10', 10'') over a fiber web manufacturing line.

25 19. A fiber web manufacturing line comprising a movable storage (10, 10', 10'') as claimed in any one of claims 1 to 13.

20. A computer program stored in a memory means for controlling a movable storage (10, 10', 10''), supported on a floor (3), for handling rolls, winding shafts (1) and/or machine reels (4) intended for the handling of a fiber web (W), the movable storage being movable between at least two target stations and the movable storage comprising reception members (12) for receiving a load (1, 4) being handled and for holding it up at both its support ends (2), **characterized** in that the computer program comprises:

30

a program code executable by a computer so that the code, when executed, makes the movable storage (10, 10') receive at least one roll, winding shaft and/or machine reel on reception members (12) supported at a fixed height or at an adjustable level by means of at least one vertical support member (11a, 11b) supported on a floor (3) and comprised by the movable storage; move the movable storage and the at least one roll, winding shaft (1) and/or machine reel (4) being handled supported on the floor (3) by means of at least one vertical support member above a fiber web manufacturing device (100) and/or a finishing device (20, 30A, 30B, 31A, 31B); and hand over at least one roll, winding shaft and/or machine reel from the movable storage.

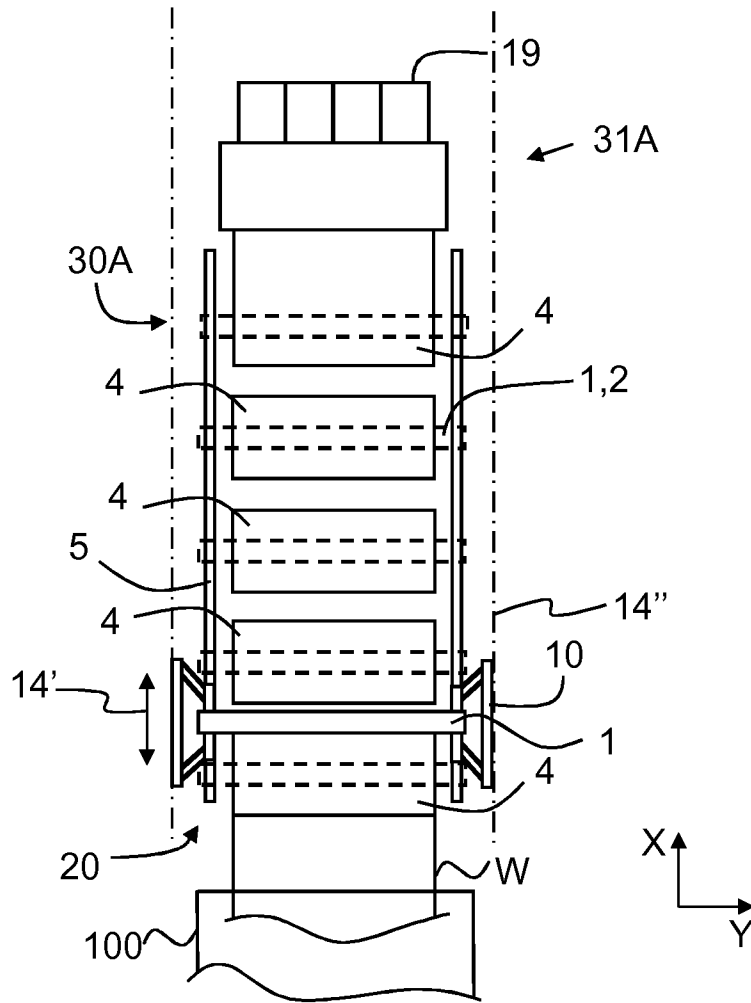
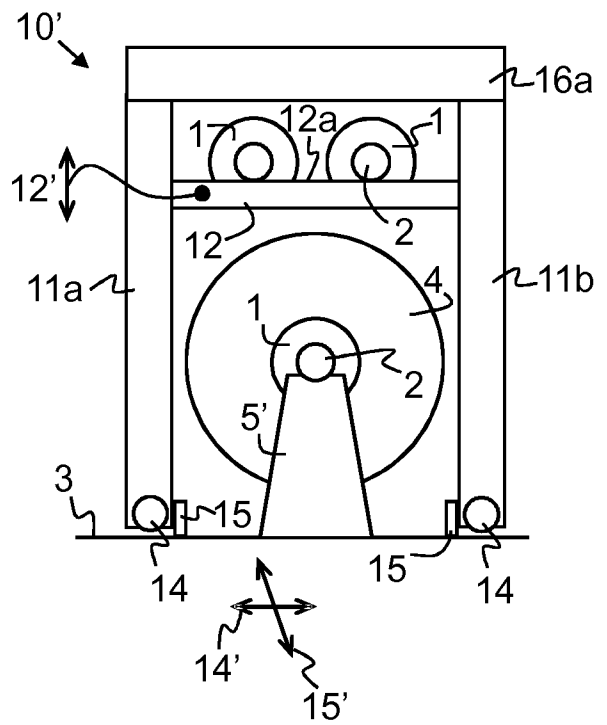
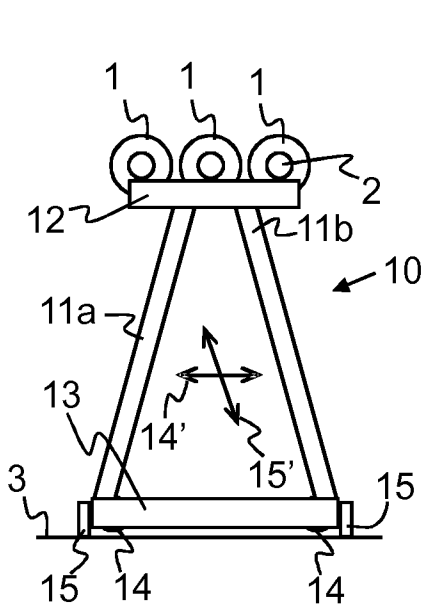
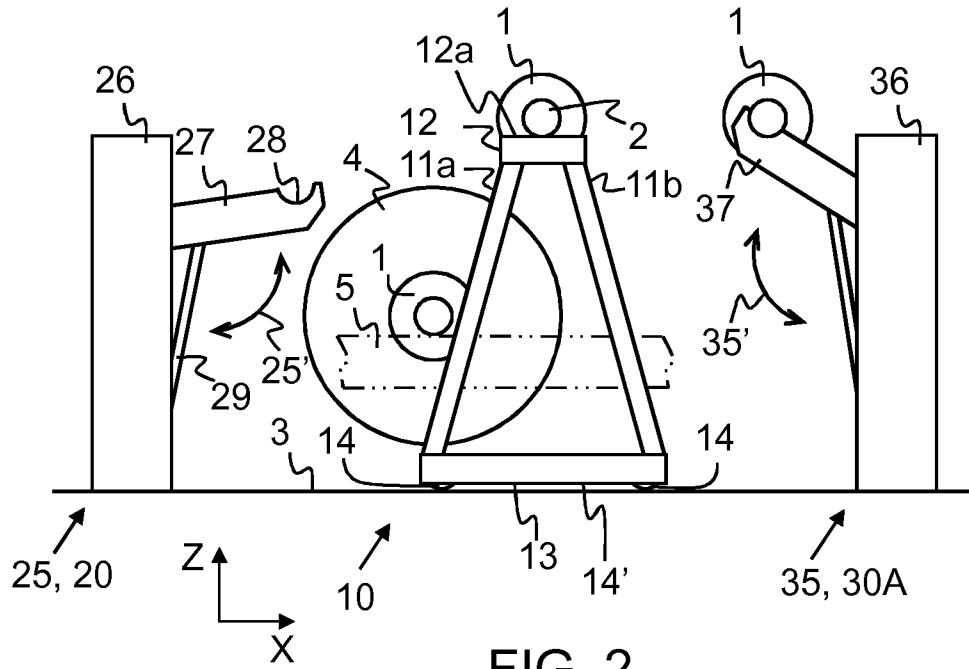


FIG. 1



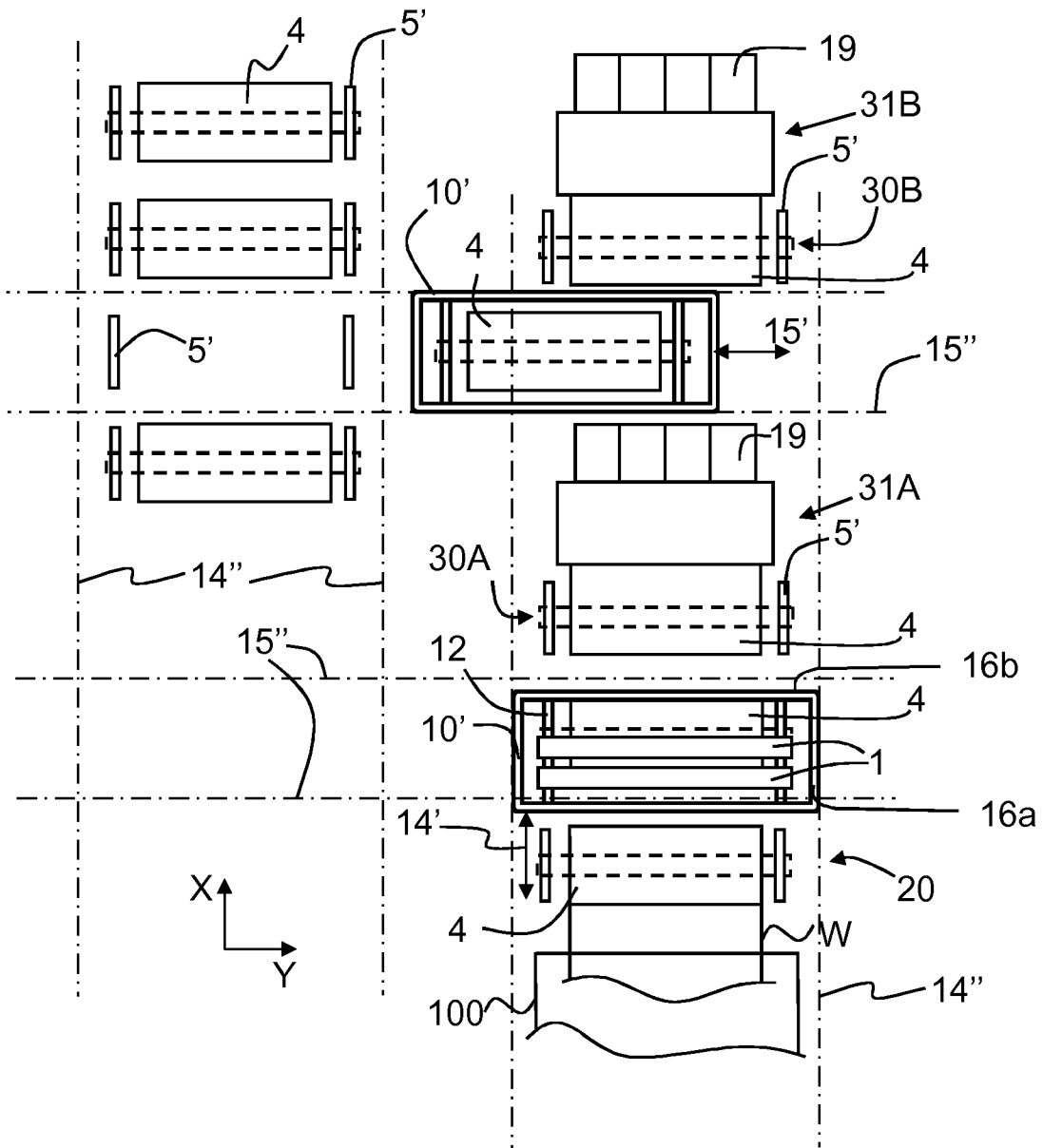


FIG. 5

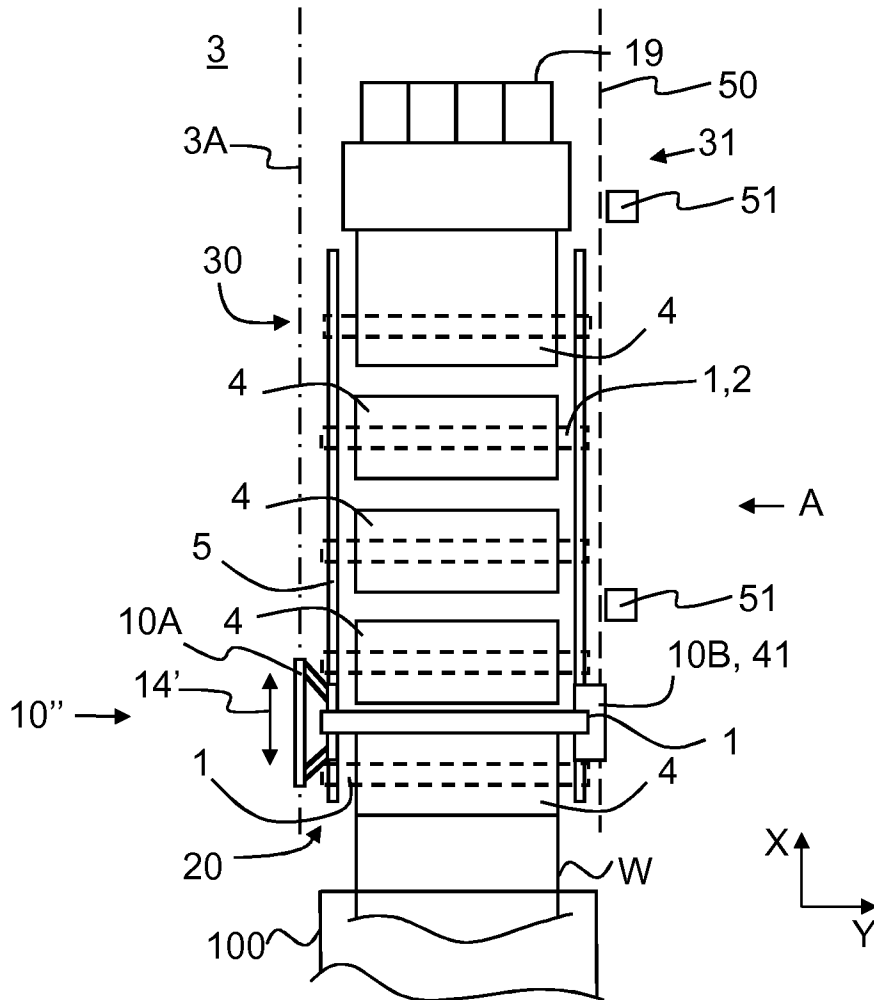


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2010/050139

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65H19/12 B65H19/30
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)

B65H

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 203 07 581 U1 (VOITH PAPER PATENT GMBH [DE]) 25 September 2003 (2003-09-25) the whole document	1
A	US 2004/011914 A1 (GANDINI MARIO [IT]) 22 January 2004 (2004-01-22) the whole document	1
A	EP 1 266 091 A1 (METSU PAPER INC [FI]) 18 December 2002 (2002-12-18) cited in the application claims; figures	1
A	US 2005/056719 A1 (TAFEL BRIAN L [US]) 17 March 2005 (2005-03-17) the whole document	1
	-/--	

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 document 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

18 June 2010

Date of mailing of the international search report

30/06/2010

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Haaken, Willy

INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2010/050139

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 10 2004 050733 A1 (ROLAND MAN DRUCKMASCH [DE]) 20 April 2006 (2006-04-20) the whole document -----	1
A	GB 2 172 877 A (GALILEO SPA OFF) 1 October 1986 (1986-10-01) the whole document -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/FI2010/050139

Patent document cited in search report	Publication date	Publication date	Patent family member(s)	Publication date
DE 20307581	U1	25-09-2003	NONE	
<hr style="border-top: 1px dashed black;"/>				
US 2004011914	A1	22-01-2004	AT 289970	T 15-03-2005
			AU 2677001	A 26-03-2002
			DE 50009686	D1 07-04-2005
			WO 0222478	A2 21-03-2002
			EP 1318963	A2 18-06-2003
			IT BZ20000039	A1 15-03-2002
			JP 2004509036	T 25-03-2004
<hr style="border-top: 1px dashed black;"/>				
EP 1266091	A1	18-12-2002	AT 326578	T 15-06-2006
			AU 4423901	A 12-09-2001
			CA 2401529	A1 07-09-2001
			DE 60119705	T2 14-09-2006
			WO 0165007	A1 07-09-2001
			NO 20024167	A 22-10-2002
			US 2003145969	A1 07-08-2003
<hr style="border-top: 1px dashed black;"/>				
US 2005056719	A1	17-03-2005	NONE	
<hr style="border-top: 1px dashed black;"/>				
DE 102004050733	A1	20-04-2006	GB 2419342	A 26-04-2006
			US 2006157612	A1 20-07-2006
<hr style="border-top: 1px dashed black;"/>				
GB 2172877	A	01-10-1986	DE 3610550	A1 06-11-1986
			IT 1201265	B 27-01-1989
<hr style="border-top: 1px dashed black;"/>				