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(54) Title: METHOD FOR HANDLING EMPTY WINDING SHAFTS DELIVERED TO A FIBROUS WEB WINDER

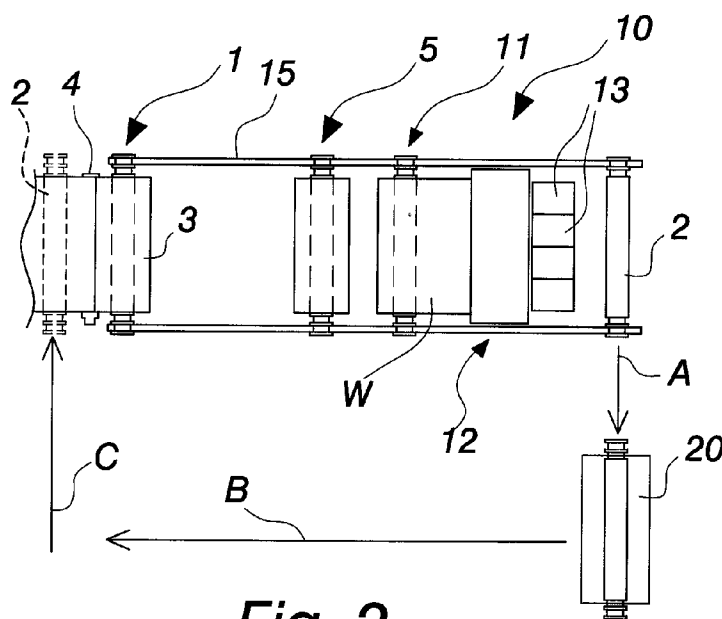


Fig. 2

(57) Abstract: The invention relates to method for handling empty winding shafts delivered to a fibrous web winder, in which method machine rolls produced on a winder are handled in one or more process stages following the winder and the winding shafts thus emptied are transferred back to the winder. In the method, an empty winding shaft (2) is delivered to the winder (1) to a position preceding the winding roll (4) of the winder in the process order by a lateral transfer movement.



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Method for handling empty winding shafts delivered to a fibrous web winder.

The invention relates to a method for handling empty winding shafts delivered to a fibrous web winder, in which method machine rolls produced on a winder are handled in one or more process stages following the winder and the winding shafts thus emptied are transferred back to the winder.

As known from the prior art, paper is manufactured in machines which together constitute a paper-manufacturing line which may be hundreds of metres long. Modern paper machines are able to produce more than 450 000 tonnes of paper per annum. The speed of a paper machine may exceed 2,000 m/min (120 km/h) and the width of the paper web may be more than 11 m.

In paper-manufacturing lines known from the prior art, papermaking is a continuous process. A paper web produced on a paper machine is wound with a winder around a winding shaft, that is, a reel spool, into a machine roll, the diameter of which may exceed 5 m and weight 160 tonnes. The purpose of the winding is to modify the paper web manufactured in planar form into a more easily processable form. On the winder, the continuous process of the paper machine is interrupted for the first time and a shift into periodic operation is made. The aim is to carry out the periodic operation as efficiently as possible in order not to waste the work already done.

The machine-roll web produced in paper manufacture is full-width and may exceed 100 m in length, and thus it must be slit into partial webs of suitable width and length for the paper mill's customers and wound around cores into so-called customer rolls before being delivered from the paper mill. The slitting and winding of the web take place in a manner known from the prior art, in an appropriate separate machine, that is, a slitter-winder.

As known from the prior art, in the slitter-winder, the machine roll is unwound, the wide web is slit on the slitting section into several narrower partial webs which are wound up on the winding section around winding cores, such as spools, into customer rolls. Once the customer rolls are completed, the slitter-winder is stopped and the rolls, that is, the so-called set is removed from the machine, after which the process is continued with the winding of a new set. These stages are repeated periodically until the paper runs out from the machine roll, whereupon the machine roll is changed and the operation starts again by the winding of a new machine roll.

In high-speed paper-manufacturing lines known from the prior art, a paper machine may produce more paper than a single slitter-winder is able to process, whereby several slitter-winders are required on the line, which are normally located in the direction of the machine line and side by side at a certain distance from one another. In the space between them is often located a control room or corresponding arrangement for the machines.

In layout arrangements according to the prior art, the first slitter-winder is typically usually arranged as a so-called inline slitter-winder, which means that it is located in line with the paper machine, that is, in the principal machine line. The second slitter-winder is a so-called offline slitter-winder, that is, it is not located in the centreline of the paper machine, but normally beside the first slitter-winder, in its own so-called aisle, that is, an extension of the machine room built for it. Both slitter-winders produce customer rolls which are transported by roll conveyors, for example, first to the roll packaging machine to be packed and finally to storage before delivery to customers.

In prior art slitter-winders, a machine roll is normally brought to a slitter-winder in the paper machine line, but not coupled with transfer rails to the

paper machine, with a hoist and lowered onto transfer rails which are typically located so that the height of the centre of the machine roll from floor level is about 2.5 m. In embodiments, in which the winder and the slitter-winder of the paper machine are coupled together with transfer rails, the machine roll is transferred along the transfer rails from the winder to the slitter-winder.

The prior art transfer rails for full machine rolls consist of horizontal or inclined rails with stand-by stations. A machine roll is transferred from one stand-by station to another until it reaches an unwinding station. On horizontal transfer rails, the transfer is done by means of a transfer device, and on inclined transfer rails, by means of gravity by allowing the machine roll to roll along the inclined transfer rails, whereby the stand-by stations are provided with mechanisms for stopping the machine roll and releasing it towards the unwinding station.

As known from the prior art, the unwinding station typically consists of two unwind stands (front side and drive side) which carry the machine roll during unwinding. In the unwind stands are pivoted locking arms by means of which the machine roll is locked in place for the duration of the unwinding. The machine roll in the unwinding station is coupled to a brake generator which operates as the actuator of the unwinder.

As known from the prior art, after unwinding, the emptied reel spool, that is, the winding shaft, is usually removed from the unwinding station either manually by lifting with a hoist or automatically by means of a reel spool handling apparatus. The reel spool handling apparatus consists either of vertical lifting devices or turning lifting arms and upper return rails for empty reel spools. An empty or almost empty reel spool is lifted with a lifting device or with lifting arms onto return rails, on which there are normally several return station points. The return station (spool storage) is typically located

above the unwinding or slitting and winding section. On the return rails, the reel spool is transferred from one station to another either by means of the transfer device or by gravity by rolling by means of the stopping and releasing mechanisms. An empty reel spool is removed from the return rails and transferred onto the winder of the paper machine by means of the hoist or partly by means of a machine-roll carriage.

The prior art arrangements require various lifting movements at one or more stages and a hoist is generally used for these. The hoist may typically be an overhead crane or a gantry crane supported on floor level. The hoist is usually controlled manually by an operator. Some of the hoist's functions may be automated, for example, so that the operator acknowledges the starting situation and address and final address and gives the hoist the command to carry out the hoisting, transfer and lifting automatically. It is also possible to implement a substantially fully automatic handling arrangement for winding shafts based on the use of hoists which, however, requires closed safe areas or corresponding safety measures, which will increase the cost of the arrangement. The lifting of the massive winding shafts weighing more than 30 tonnes subjects the shafts and their bearings to different types of damage and exerts considerable forces on the rail structures and foundations which must be taken into account by reinforcing the structures, which in turn incurs additional costs.

The object of the present invention is to provide a method, by means of which the problems and disadvantages described above can be essentially eliminated.

To achieve the object of the invention, the method according to the invention is characterised in that in the method, an empty winding shaft is delivered to the winder to a position preceding the winding roll of the winder in the process order by a lateral transfer movement.

The invention is described in greater detail in the following, with reference to the figures of the accompanying drawing, wherein:

- 5 Figure 1 shows a diagrammatic side view of a slitter-winder arrangement in connection with which the present invention can be applied,
- Figure 2 shows a diagrammatic top view of the arrangement of Figure 1, and
- 10 Figure 3 shows a diagrammatic side view of another slitter-winder arrangement in connection with which the present invention can be applied.
- 15 Figures 1-2 show diagrammatically a slitter-winder arrangement in connection with which the method according to the present invention can be applied. The arrangement shown in the Figures comprises a winder 1, wherein a paper web produced on the paper machine (not shown) is wound on a winding drum 4 into a machine roll 3 around a winding shaft, that is, a
- 20 reel spool 2. Completed machine rolls 3 are transferred along transfer rails 15 to a stand-by station 5, from which the machine rolls 3 are further transferred along transfer rails to the unwinding station 11 of the slitter-winder 10. In the application shown, the unwinding station 11 is on machine level M and the winding section 12 of slitting and customer roll winding
- 25 section 12 is in a space below the machine level. The slitting and winding section of the slitter-winder in the basement may consist of one aggregate, which comprises both a slitting and winding section and a winding section, or the slitting and winding section may consist of two separate aggregates, one of which comprises the slitting and winding section and the other the
- 30 winding section. From the stand-by station 5, the machine rolls are transferred for unwinding at the unwinding station 11 and after the

unwinding, the empty reel spool 2 transferred to the return station 14 which simultaneously acts as a storage for empty reel spools 2 and, if paper broke has remained on the reel spool 13, preferably also as an unloading point for broke layers by locating a pulper (not shown) beneath the return station. At  
5 the unloading point, a machine roll rotating device rotates the bottom layers of the machine roll into the pulper. The same location and apparatus can also be used for unloading any paper broke layers or even for unloading an entire broke machine roll into the pulper. In the above arrangement, the machine roll transfer rails are of a so-called through-rolling type, that is, the  
10 unwinding station is also through-rolling, whereby the handling of the machine rolls/winding shafts is straightforward and simple.

In the method according to the invention, the transfer of empty winding shafts from the return station is preferably carried out by a lateral  
15 movement, for example, by means of a transfer car 20 moving on the floor surface, by means of which car the winding shaft can be further delivered to the winder and transferred to a point preceding the winding roll 4 of the winder 1 by a lateral transfer movement. In this application, the winding roll refers to a winding drum or other roll of the winder, against which the  
20 machine roll is formed. The path of the transfer track is preferably arranged in such a way that the elevation of the winding shafts will not change substantially during the transfer stage/stages. A substantial change refers to the maximum difference in level of the machine rolls with respect to the winding roll of the winder over the entire handling area, which difference is  
25 at least the size of the radius of the winding shaft or, where gravity-based machine roll transfer rails are concerned, determined by the angle of inclination. Figure 2 illustrates diagrammatically, by means of arrows A-C, the transfer route of the winding shafts from the storage 14 to the position preceding the winding roll 4.

Figure 3 shows diagrammatically an alternative slitter-winder arrangement, in which the parts corresponding to Figure 1 are marked with corresponding reference numerals. The arrangement in Figure 3 differs from the arrangement in Figure 1 in that the slitter-winder and customer roll winding section 12 is also positioned essentially on machine level M. In this arrangement, the empty reel reel cats spool 2 formed in the unwinding station 11 is preferably transferred onto the transfer car 20 located in the area between the unwinding station 11 and the slitting and winding section 12 and then away from the unwinding station by means of the said transfer car in a lateral transfer movement.

By transferring the winding shafts in accordance with the invention in a controlled manner, substantially horizontally at the different stages of transfer, damage to the shafts and their bearings is eliminated and forces exerted on the rail structures and foundations are reduced. The dynamic coefficients used in dimensioning may be decreased and savings can be made in material costs. This is emphasised especially with the continuous increase of winding shaft masses, these masses currently being as high as 30 tonnes. The solution according to the invention does not require a substantial transfer of the winding shaft in the direction of gravity or against it. Transfers of the winding shaft in the horizontal direction are carried out, for example, by means of reel carts, air-cushion carts, conveyors, forklift trucks, straddle carriers, or similar devices differing substantially from a hoist. The car may run on the floor surface, for example, on wheels, on an air cushion or on rails arranged on the floor surface or, for example, supported on rails/guides provided on the side or above the carts supported on the floor surface. The return chain of the winding shaft to a position preceding the winder may function from the following process stage/stages either fully automatically, in a most preferred embodiment, wherein the winding shaft is moved aside after the unwinding station/stations of the following process stage/stages by means of a transfer device, such as a reel

cart, or partly automatically, wherein there may be a part function performed by a hoist in connection with the unwinder, after which the winding shaft is transferred by means of the transfer device, such as a reel cart, all the way to the position preceding the winding roll of the winder.

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The solution according to the invention does not extend the machine layout because, if necessary, the quality measurement devices, etc. are located on a different level with respect to the transfer route of the winding shaft. The method according to the invention is applicable in connection with any

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winder winding a paper, board or tissue web.

The solution according to the invention makes possible fully automatic handling of winding shafts and an easier and more economical implementation of the safety arrangements required than in a hoist-based arrangement. The safety arrangements can be realised, for example, according to the principles of currently used reel cart solutions (motion detectors, etc.), without the closed safety area arrangements etc. required by automated hoists.

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## Claims

1. A method for handling empty winding shafts (2) delivered to a fibrous web winder (1), in which method machine rolls (3) produced on a winder are  
5 handled in one or more process stages following the winder (1) and the winding shafts (2) thus emptied are transferred back to the winder, **characterised** in that in the method, an empty winding shaft (2) is delivered to the winder (1) to a position preceding the winding roll (4) of the winder in the process order by a lateral transfer movement.
- 10
2. A method as claimed in claim 1, **characterised** in that the transfer of the winding shaft (2) from the position following the winder (1) to the position preceding the winder is carried out by means of a transfer device (20) moving on the floor surface or on structures supported on the floor surface.
- 15
3. A method as claimed in claim 2, **characterised** in that the transfer device is a winding shaft (2) transfer cart which is arranged to move on wheels, rails or an air-cushion.
- 20
4. A method as claimed in claim 2 or 3, **characterised** in that the transfer device is used after the winding station (11) of the process stage following the winder (1) for moving an empty winding shaft (2) aside from the process line and further to the winder (1) to a position preceding the winding roll (4) of the winder in the process order.
- 25
5. A method as claimed in any of the above claims, **characterised** in that the route of the transfer track of the winding shafts (2) is arranged in such a way that the elevation of the winding shafts will not change substantially during the transfer stage/stages.



## INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER 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: B65H Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched FI, SE, NO, DK Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	WO 2005054100 A2 (PERINI FABIO SPA et al.) 16 June 2005 (16.06.2005), page 11, line 4 – page 14, line 28; figure 1; page 5, lines 5-9; page 15, lines 31-34; figures 2-4	1-5
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p>		
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2009/050055

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

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CLASSIFICATION OF SUBJECT MATTER

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