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(54) Arrangement for handling machine rolls and reeling shafts in connection with production of fiber webs

(57) The invention relates to an arrangement for handling machine rolls and reeling shafts in connection with production of fiber webs, comprising a transfer cart (45) for transferring machine rolls (26) and empty reeling shafts (25) and an unwinding station (20) or a corresponding station in connection with production of fiber webs in which an empty reeling shaft (25) is to be replaced by a machine roll (25), which unwinding station (20) or corresponding station comprises stands (24) for locating the machine roll (26) or the reeling shaft (25). The unwinding station (20) comprises means (31) for lowering the reeling shaft (25) from the unwind stand (24) to at least onto level of floor (40) to an override location in which the machine roll (26) moved in process direction is circumvented below by the reeling shaft (25).

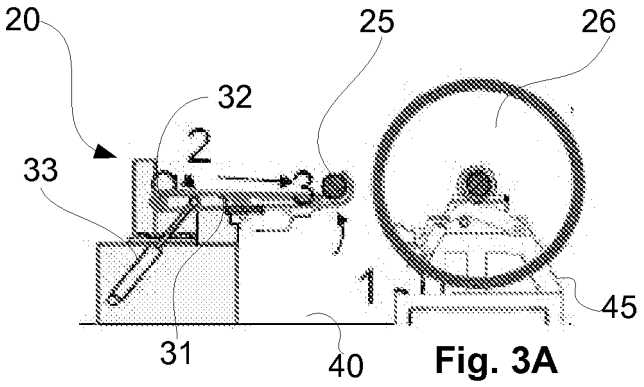

Fig. 3A

EP 2 511 209 A1

Description

[0001] In general present invention relates to producing fiber web in a fiber web machine. More especially the present invention relates to an arrangement according to preamble part of claim 1.

[0002] As known from the prior art in fiber web producing processes typically comprise an assembly formed by a number of apparatuses arranged consecutively in the process line. A typical production and treatment line comprises a head box, a wire section and a press section as well as a subsequent drying section and a reel-up. The production and treatment line can further comprise, for example, a calender. The production and treatment line also typically comprises at least one slitter-winder for forming customer rolls as well as a roll packaging apparatus.

[0003] As known, fiber webs, such as paper or board webs, are manufactured in machines together forming a fiber web 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 paper machine may exceed 2000 m/min and the width of a paper web may be more than 11 meters.

[0004] In fiber web manufacturing lines, manufacturing operates as a continuous process. The finished fiber web being output from the machine is wound with a reel-up around a reeling shaft, i.e., a reel spool, into a machine roll (parent roll), 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 fiber web from its planar manufacturing form into a form in which it can be handled more easily. At the reel-up, which is located in the main machine line, the continuous process of the 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.

[0005] The web of the machine roll generated during 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 mill. As known, this slitting and winding of the web takes place in a separate machine fitted to the purpose, i.e., a slitter-winder.

[0006] In the slitter-winder the machine roll is unwound in the unwinding station and 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 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 roll runs out, at which point the machine roll is replaced and the operation restarts with the winding of a new machine roll.

[0007] In fiber web production lines unwinding stations are also located in connection with for example off-line finishing stations, typically coating or calendering stations.

[0008] In the unwinding stations of known fiber web production lines, the machine roll is typically conveyed to such unwinding stations that is not connected to the paper machine with transfer rails with a crane and lowered to transfer rails. In applications where the unwinding station is connected to the production line with transfer rails inline, the machine roll is transferred along the transfer rails from reel-up to the unwinding station. In the simplest implementation, particularly in the case of small machine rolls, the machine roll may also be conveyed with a crane directly to the unwinding station. The transfer rails for full machine rolls consist of horizontal or inclined rails with stand-by stations. Along transfer rails, the machine roll is transferred from one stand-by station to another until the unwinding station is reached. With horizontal transfer rails, the machine roll 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. The machine roll in some cases is also transferred from the reel-up to the unwinding station by a transfer cart and for example in publication EP 1266091 B1 is disclosed a transfer cart supported on a floor, used for transferring machine rolls at the height of transfer rails for machine rolls.

[0009] An unwinding station of typically comprises an unwind stand which holds the machine roll 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 roll 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 roll in place during unwinding. A machine roll located in an unwinding station is connected to a brake generator, which functions as a drive of the unwinder.

[0010] Generally, a reeling shaft emptied as a result of unwinding is removed from the unwinding station either through manual lifting with a crane or automatically with a reeling shaft handling apparatus. A reeling shaft handling apparatus comprises either vertical lifting devices or rotatable lifting arms and return rails for empty reeling shafts, located above the transfer rails for machine rolls, often also above the unwinding station or above the slitter-winder. An empty or nearly empty reeling shaft is lifted with a lifting device or with lifting arms to return rails, which normally have a number of return positions. Typically reeling shaft storage is located above the unwinding station. Along the return rails, the reeling 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. In some cases the empty winding shaft is removed from the return rails by lowering devices and moved to the reel-up of the machine with a crane or by a transfer cart. The return rails may

also be connected directly to the reel-up's reeling shaft storage rails, whereby the reeling shaft may be transferred directly from the unwinding station to the reel-up.

[0011] In publication EP 2184244 A2 is disclosed a device, in which transport path has been formed by a pivoting rail element between an unwinding position and a delivery position for machine rolls and reeling shafts as a continuation to respective rails.

[0012] In publication DE 102004049719 is disclosed an arrangement, in which a pivoting arm is used to lift and transfer the reeling shaft from the unwinding position to waiting position.

[0013] To ensure a smooth continuity of the process, storage spaces are needed in for full machine rolls, partly filled machine rolls and empty reeling 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. Also typically a rejecting location for the bottom-ends of machine rolls or partially filled machine rolls in the pulper is needed in connection with the arrangements for handling machine rolls and reeling shafts.

[0014] The reeling shaft handling solutions implemented in the prior art are complex, inflexible and expensive. For example, it is difficult to make paths of reeling shaft and machine reel transfer carriages, transfer rails, and transfer and conveyance routes of cranes adjust to changing needs. The handling solutions for reeling shafts require expensive concrete and steel beam structures implemented according to the full machine reel in order to hold up lifting devices, such as cranes. The crane capacity may be reserved, in which case the crane may not be able to respond to transfer needs at a short notice. In some cases the machine hall height is not enough for arranging return rails for reeling shafts above the machine reel transferring rails or for the use of a crane.

[0015] An object of the present invention is to create a new arrangement for handling machine rolls and reeling shafts to achieve simple, flexible and cost effective handling of machine rolls and reeling shafts in connection with production of fiber webs and especially in connection with an unwinding station of a production line for fiber webs.

[0016] One object of the present invention is to solve at least part of the disadvantages and problems relating to arrangements according to prior art.

[0017] To achieve the objects mentioned above and later the arrangement according to the invention is mainly characterized by the features of the characterizing part of claim 1.

[0018] According to the invention the arrangement for handling machine rolls and reeling shafts in connection with production of fiber webs, comprising a transfer cart for transferring machine rolls and empty reeling shafts and an unwinding station or a corresponding station in connection with production of fiber webs in which an empty reeling shaft is to be replaced by a machine roll, which unwinding station or corresponding station comprises stands for locating the machine roll or the reeling shaft, which unwinding station comprises means for lowering the reeling shaft from the unwind stand to at least onto level of floor to an override location in which the machine roll moved in process direction is circumvented below by the reeling shaft.

[0019] According to an advantageous embodiment the present invention the arrangement for handling machine rolls and empty reeling shafts is based on using a transfer cart for transferring the machine rolls to an unwinding station and for transferring the empty reeling shafts from the unwinding station. The reeling shaft is advantageously lowered from the rails of the unwinding station to a override i.e. circumvent location near the floor level, on the floor level or below the floor level such that the machine roll is circumvented below by the reeling shaft. In the override position level of topmost points of the reeling shaft is under an imaginary level that is defined by lowest points of the machine roll when it is moved forward in the process. typically from transfer cart to the rails of the unwinding station. The arrangement has means for lowering the reeling shaft and the means advantageously comprise lowering arm which incline from the receiving position for receiving the shaft to the override i.e. circumvent position. The means for lowering the reeling shaft may also comprise of a lift or respective device and means for transferring the shaft from the unwinding position to the lowering position.

[0020] According to an advantageous feature of the arrangement the rails of the unwinding station have gate rails that connect to the transfer cart such that the machine roll is transferrable from the cart to the unwinding station along the gate rails while the empty reeling shaft removed by the lowering arms is located in override i.e. circumvent position. According to another advantageous feature of the arrangement the transfer cart the rails of the unwinding station has gate rails that connect to the unwinding station such that the machine roll is transferrable from the cart to the unwinding station along the gate rails while the empty reeling shaft removed by the lowering arms is located in override i.e. circumvent position. Advantageously the gate rails are inclined such that no transfer device is needed for the machine roll movement and the movement is based on gravity. The gate rails may also be provided with transfer device in cases where it is appropriate.

[0021] The operations in the arrangement are advantageously automatized.

[0022] According to an advantageous feature the circumvent position is close to a pulper opening so that the possible fiber web material still on the reeling shaft can be emptied while the shaft is in the circumvent position.

[0023] According to an advantageous embodiment of the invention in connection with the arrangement

a) means for lowering a reeling shaft are moved to the receiving position of the reeling shaft,

b) the reeling shaft is disengaged from the unwinding position,

c) the reeling shaft moves along the rail part of the lowering means or along the lowering arm to the lowering position,

d) the means for lowering are lowered to the circumvent position,

e) the gate rails are lifted to transfer position,

f) the transfer cart is moved to the transfer position of the machine reel,

g) the gate rails are closed,

h) a machine roll is transferred from the cart to the gate rails,

i) the machine roll is moved to the unwinding position,

j) machine roll is locked to the unwinding position,

k) the reeling shaft is moved from the circumvent position to the cart,

l) the gate rail is opened,

m) the transfer cart transfers the reeling shaft to next location of need, for example to a reel-up and

n) the lowering means are moved to waiting position.

[0024] According to another advantageous embodiment the reeling shaft is moved to the circumvent position as in the embodiment before and the machine roll moved to the unwinding position as in the embodiment before and then

a) the gate rails are opened,

b) the transfer cart is moved away to a nearby location,

c) the lowering arm lift the reeling shaft up to the top level of the transfer cart, the transfer cart is moved to the receiving position and reeling shaft is transferred to the cart (and locked) and as in the previous example the transfer cart transfers the reeling shaft to next location of use, f. ex. to reeling shaft storage of a reel-up where the reeling shaft is transferred for example by lifting arms or by a crane.

[0025] By the arrangement according to the invention efficient machine roll and reeling shaft transfer is achieved since all steps of transfer of machine roll and reeling shaft are accomplished by one device and the operations are easily automatized.

[0026] In cases where there is not much space for the circumvent position the floor is constructed to have an embedding into which the reeling shaft is positioned for the bypass stage at least partially.

[0027] According to an embodiment the reeling shaft is transferred by using separate lowering arms, that extend in the machine direction away from the unwinding station so that the transfer position of the reeling shaft goes around the gate rails. By the lowering arms the reeling shaft is lowered to a circumvent point which is in vertical direction below the virtual plane on which the lowest point of a machine reel moves when it is transferred in the process direction from a transfer cart via the gate rails to the unwinding station. The circumvent position of the reeling shaft is substantially on the floor level or in an embedding of the floor. Instead of an embedding also vertical level of transfer of the machine reel could be lifted for example by loading the machine reel to the cart in the loading station up-hill by using transfer arms. In new builds or in large modernization also the overall height of the machine roll traffic center point could be set such that there will be space for the circumvent position of the reeling shaft.

[0028] In another embodiment the reeling shaft is lifted after the machine roll has been transferred to the unwinding station past the reeling shaft by lifting arms over the rail level and then move the transfer cart to receiving position and then load the reeling shaft to the transfer cart.

[0029] The arrangement according to the invention is possible to be located in connection with any storage rails where there is need to deliver the machine roll from a transfer cart to rails and take up a reeling shaft. The operations are not necessarily performed as a sequence but they may also be separate operations not depending on other operations. According to an advantageous feature the lowering arms are located to extent to unwinding position of the unwinding station or to a location to which the reeling shaft is moved by arms with an extension.

[0030] In this description and claims by empty reeling shafts are also meant such reeling shafts that may have layers of fiber web around, for example reject rolls and partially unwound machine rolls

[0031] In the following the invention is discussed in more detail by reference to figures of accompanying drawings.

Figure 1 shows schematically one example of the arrangement according to one advantageous embodiment of the invention.

Figure 2 shows schematically another example of the arrangement according to another embodiment of the invention.

Figures 3A - 3H show schematically examples of process steps when using one advantageous em-

bodiment of the arrangement according to the invention.

[0032] In the following description same reference signs designate for similar components unless otherwise mentioned and it should be understood that the examples are susceptible of modification in order to adapt to different usages and conditions within the frames of the invention. In some figures some reference signs indicating parts or components respective to the same parts or components in other figures have been omitted for the clarity of the figures.

[0033] In figure 1 is schematically shown an example of an unwinding 20 station which comprises frame structures 21 on the floor 40 providing for the unwind stands 24 onto which a machine roll to be unwound is placed for unwinding. In the situation of the figure the unwinding has ended and an empty reeling shaft 25 is located on the unwind stands 24. The unwinding station 20 further comprises lowering arms 31 for moving the empty reeling shaft 25 from the unwinding station 20 in order to replace it by a machine roll for continuing unwinding. The empty reeling shaft 25 is located in a fastening mechanism 23 of the unwinding station 20. In this example the fastening mechanism 23 comprises a swing lever that is pivotably attached to the unwind stand 24. The swing lever 23 is pivoted and the reeling shaft 25 is moved onto the lowering arms 31 that are advantageously inclined such that the reeling shaft rolls down to the holding ends 31 A of the lowering arms 31. The lowering arms 31 are provided with an actuator 33 for pivoting the lowering arms 31 so that the holding ends 31 A at the level of the floor 40 shown by dashed line for moving the reeling shaft 25 to the circumvent position. The gate rails of the unwinding station 20 are marked with reference signs 22.

[0034] In figure 2 is schematically shown another example of an unwinding 20 station which comprises frame structures 22 on the floor 40 providing for the unwind stands 24 onto which a machine roll to be unwound is placed for unwinding. In the situation of the figure the unwinding has ended and an empty reeling shaft 25 is located on the unwind stands 24. The unwinding station 20 further comprises lowering arms 31 for moving the empty reeling shaft 25 from the unwinding station 20 in order to replace it by a machine roll for continuing unwinding. The empty reeling shaft 25 is located in a fastening mechanism 23 of the unwinding station 20. In this example the lowering arms 31 are located on the outer side of the frame structure 21 of unwind stands 24 and provided with a support frame 34 and extend to the unwinding location and are thus longer than in the example of figure 1. The lowering arms 31 are advantageously inclined such that the reeling shaft rolls down to the holding ends 31 A of the lowering arms 31. The lowering arms 31 are provided with an actuator 33 for pivoting the lowering arms 31 so that the holding ends 31 A at the level of the floor 40 shown by dashed line for moving the reeling shaft 25 to the circumvent position. The gate rails of the unwinding station 20 are marked with reference signs 22.

[0035] In the schmatical presentation of figures 3A - 3H are shown process steps when using one advantageous embodiment of the arrangement according to the invention. In the figures the numerals of greater size than the reference signs indicate the order of steps.

[0036] In the process steps of figure 3A (in step1) machine roll 26 is in a waiting position in a transfer cart 45 near the unwinding station 20 and (in step 2) in the unwinding station 20 the reeling shaft is released from the unwinding position and (in step 3) moved to the holding ends of the lowering arms 31.

[0037] In the process steps of figure 3B machine roll 26 is still in a waiting position in a transfer cart 45 and (in step 4) the lowering arms 31 are pivoted around a pivot point 32 such that the reeling shaft is lowered to the level of the floor.

[0038] In the process steps of figure 3C (in steps 5) the lowering arms 31 bend around a bending point 34 such that the holding ends of the lowering arms 31 with the reeling shaft are moved close to the unwind stands and the reeling shaft is in the circumvent position and also the gate rails 22 of the unwinding station 20 are lifted. For this purpose the lowering arms 31 also can be of telescopic structure. The transfer cart 45 with the machine roll 26 is moved the delivery position of the machine reel 26 (in step 6).

[0039] In the process step of figure 3D (in step 7) the reeling shaft 25 is in the circumvent position and also the gate rails 22 of the unwinding station 20are lowered.

[0040] In the process step of figure 3E (in step 8) the reeling shaft 25 is in the circumvent position and also the gate rails 22 of the unwinding station 20 are closed and connected to the transfer cart 45.

[0041] In the process step of figure 3F (in steps 9 - 10) the reeling shaft 25 is in the circumvent position and the gate rails 22 of the unwinding station 20 are connected to the transfer cart 45 and the machine roll 26 is transferred from the cart 45 over the gate rails to the unwinding position of the unwinding station 20 and the machine roll is locked to the unwinding position.

[0042] In the process step of figure 3G (in step 11) the gate rails 22 are disconnected and lifted up and the reeling shaft 25 is lifted from the circumvent position to the transfer cart 45. In this example the transfer cart 45 has a lower location for transferring reeling shafts that is below the top level on which the machine rolls 26 are attached when transported by the transfer cart 45.

[0043] In the process step of figure 3H (in step 12) the reeling shaft 25 transported by the transfer cart 45 to next location and the lowering arm 31 is moved to a waiting position.

[0044] In some cases the reeling shafts 25 can also be transported by the transfer cart such that they are located in top position i.e. the typical machine roll position. In these cases in steps of process differ in steps 3G - 3H such that first gate rails 22 are opened and the transfer cart 45 is moved away to a nearby location, the low-

ering arms lift the reeling shaft 25 up to the top level of the transfer cart 45 and the transfer cart 45 is moved to the receiving position and the reeling shaft 25 is transferred to the cart (and the transfer cart transfers the reeling shaft 25 to next location).

[0045] Above some preferred embodiments and examples of the invention have been described but many modifications are possible to those presented.

Claims

1. Arrangement for handling machine rolls and reeling shafts in connection with production of fiber webs, comprising a transfer cart (45) for transferring machine rolls (26) and empty reeling shafts (25) and an unwinding station (20) or a corresponding station in connection with production of fiber webs in which an empty reeling shaft (25) is to be replaced by a machine roll (26), which unwinding station (20) or corresponding station comprises stands (24) for locating the machine roll (26) or the reeling shaft (25), **characterized in, that** the unwinding station (20) comprises means (31) for lowering the reeling shaft (25) from the unwind stand (24) to at least onto level of floor (40) to an override location in which the machine roll (26) moved in process direction is circumvented below by the reeling shaft (25).

2. Arrangement according to claim 1, **characterized in, that** in the override position level of topmost points of the reeling shaft (25) is under an imaginary level that is defined by lowest points of the machine roll (26) when it is moved forward in the process.

3. Arrangement according to claim 1, **characterized in, that** the means (31) for lowering the reeling shaft (25) comprise lowering arms (31) which incline from a receiving position to the override position.

4. Arrangement according to claim 1, **characterized in, that** the means (31) for lowering the reeling shaft (25) comprise lowering arms (31) which comprise transfer means for transferring the reeling shaft (25) from unwind stand (24) along the lowering arm (31) to a holding end (31 A) of the lowering arm (31).

5. Arrangement according to claim 1, **characterized in, that** in the arrangement the unwinding station (20) has gate rails (22) that connect to the transfer cart (45) such that the machine roll (26) is transferrable from the cart (45) to the unwinding station (20) along the gate rails (22) while the empty reeling shaft (25) removed by the lowering means (31) is located in override position.

6. Arrangement according to claim 4, **characterized in, that** the gate rails (22) are inclined such that the machine roll movement along the gate rails (22) is based on gravity.

7. Arrangement according to claim 1, **characterized in, that** the override position is constructed as an embedding in the floor (40) into which the reeling shaft (25) is positioned for the bypass stage at least partially.

8. Arrangement according to claim 1, **characterized in, that** the means (31) for lowering the reeling shaft (25) are fitted to move the reeling shaft from the override position to the transfer cart (45).

9. Arrangement according to claim 3, **characterized in, that** the lowering arms (31) are connected to the unwind station (20) by a pivot joint (32) for pivoting the arm (31) downwards.

10. Arrangement according to claim 9, **characterized in, that** the lowering arms (31) comprise further a turning point (34) for bending the lowering arm (31) to the override position.

11. Arrangement according to claim 9, **characterized in, that** the lowering arms (31) are of telescopic structure for positioning the lowering arm (31) to the override position.

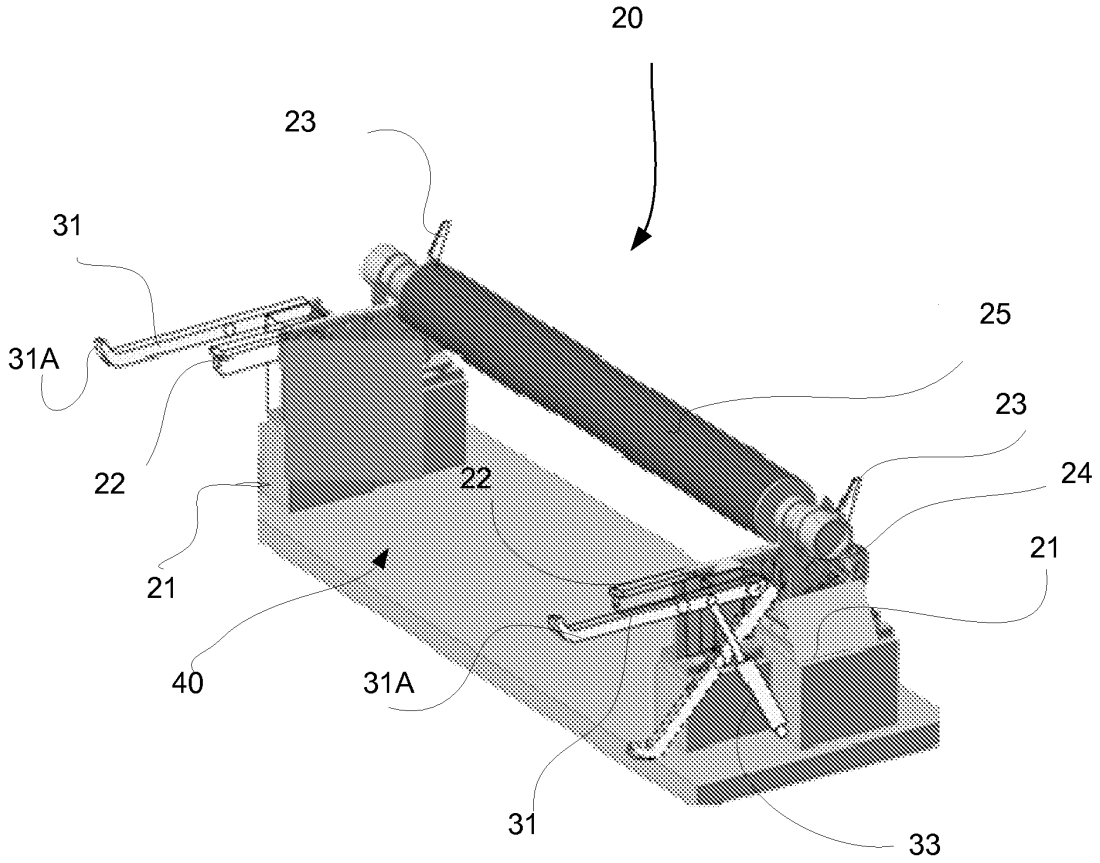
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Fig. 1

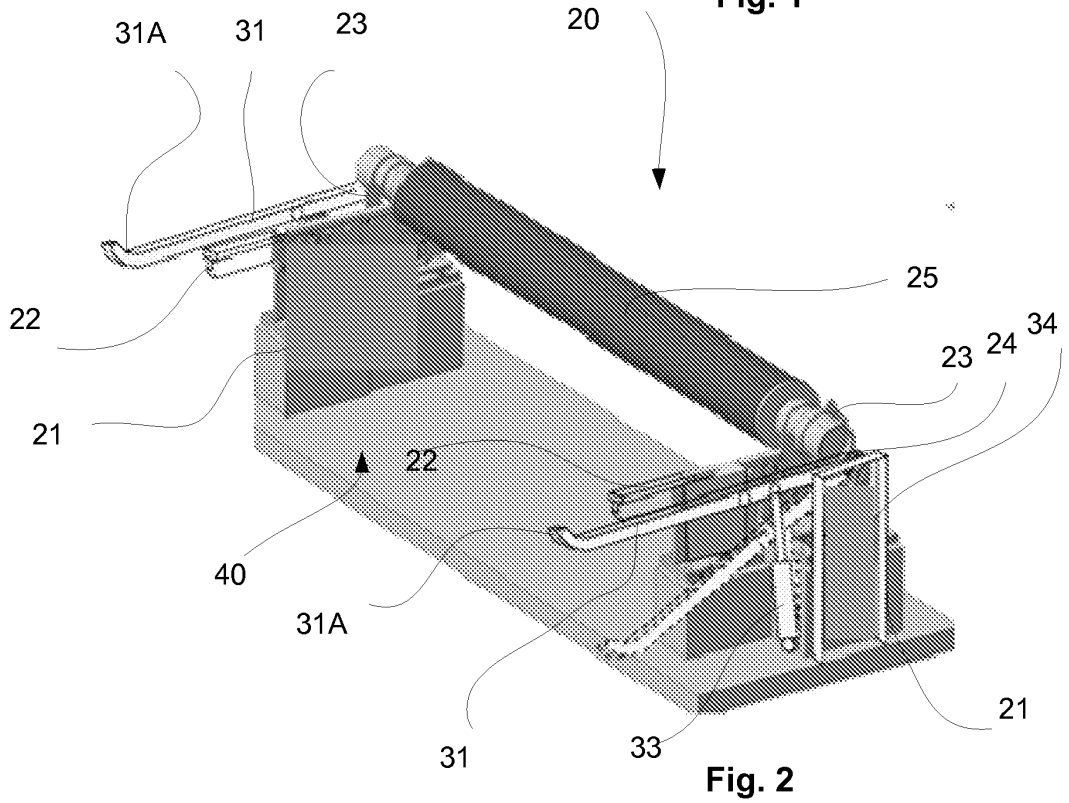
31A
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Fig. 2

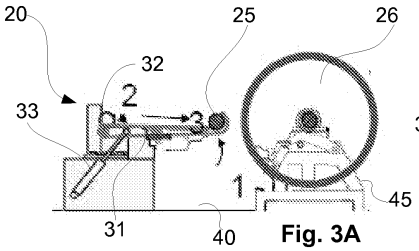

Fig. 3A

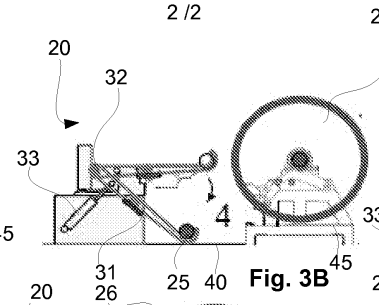

Fig. 3B

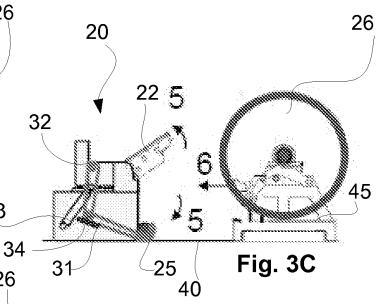

Fig. 3C

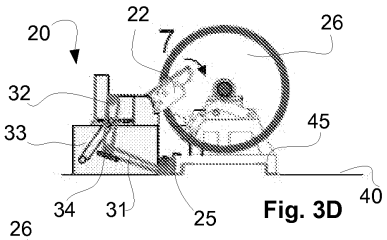

Fig. 3D

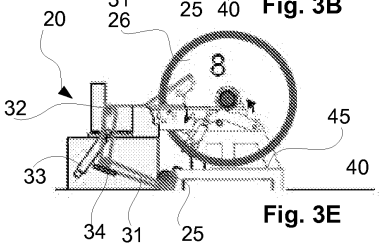

Fig. 3E

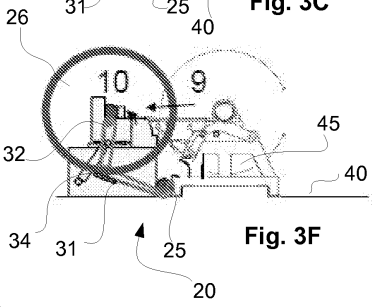

Fig. 3F

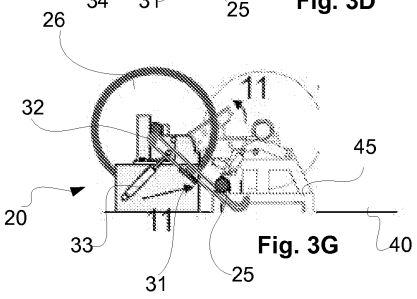

Fig. 3G

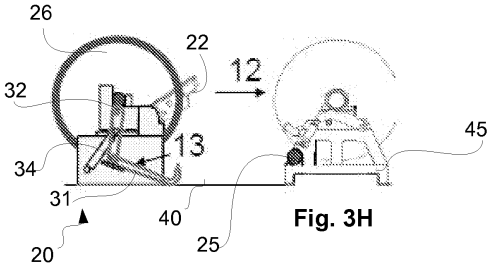

Fig. 3H

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 1869

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2006/157610 A1 (RANN HARALD [DE]) 20 July 2006 (2006-07-20) * paragraph [0006] * * paragraph [0011] * * paragraph [0032] - paragraph [0033]; figures *	1 2-11	INV. B65H19/18 B65H19/12
A	EP 1 046 601 A2 (TOKYO KIKAI SEISAKUSHO LTD [JP]) 25 October 2000 (2000-10-25) * paragraph [0062] - paragraph [0064]; figures 1,3 *	1	
A	DE 591 998 C (ALBERT SCHNELLPRESSEN) 31 January 1934 (1934-01-31) * column 4, line 9 - column 4, line 52; figures 2-4 *	1	
A	DE 42 15 739 A1 (KLEINEWEFERS GMBH [DE]) 18 November 1993 (1993-11-18) * column 9, line 3 - column 10, line 17; figures *	1	
A	US 4 903 910 A (TAMURA HIROMI [JP]) 27 February 1990 (1990-02-27) * column 4, line 45 - column 5, line 18; figure 9 *	1	TECHNICAL FIELDS SEARCHED (IPC) B65H
A	US 2005/017118 A1 (FINETTI PRIMO [IT] ET AL) 27 January 2005 (2005-01-27)	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 September 2011	Haaken, Willy

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