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(54) A SHEET DISPENSING SYSTEM AND A METHOD FOR SUPPLYING AND DISPENSING INDIVIDUAL SHEETS

(57) The present invention relates to a method of dispensing individual sheets and a sheet dispensing system. The sheet dispensing system (10) comprises a frame assembly (14), a reel loading station (20), a sheet dispenser station (40) and a delivery station (70) connected to the sheet dispenser station (40). The reel loading station (40) includes a supply reel (22) of a cellulose fiber based web and a support for supporting the supply reel. The sheet dispenser station includes a feeding mechanism (50) serving to receive the cellulose fiber based web from the reel loading station (20) and a cutting mechanism (60) having a reciprocating cutter assembly for cutting the cellulose fiber based web into individual sheets (28). The delivery station (70) includes a delivery table (71) connected to the sheet dispenser station (40). The reel loading station (20) or the sheet dispenser station (40) or delivery station (70) further comprises a smoothing mechanism (100) to compensate for the curvature of the cellulose fiber based web and provide non-curved individual sheets (28).

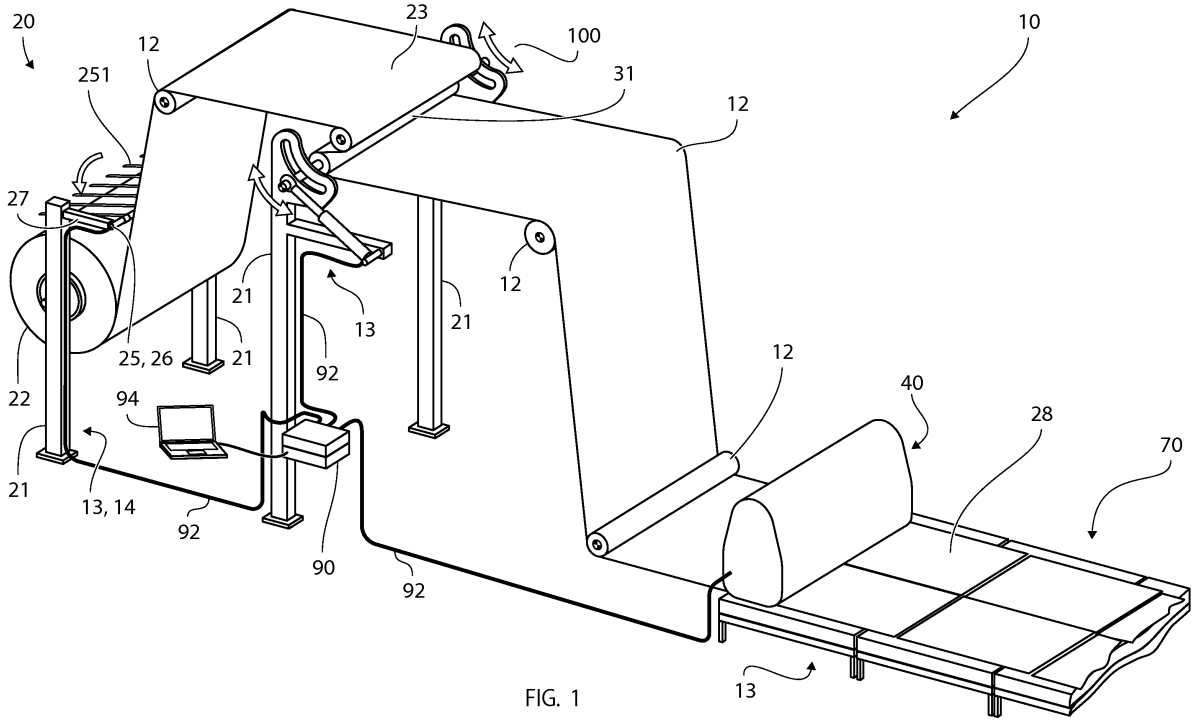

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a sheet dispensing system for providing individual sheet of a cellulose fiber based material from a supply reel or web roll into the desired sheet dimension, said sheets being substantially straight after having been unrolled from the supply reel on which the cellulose fiber based web is supplied.

BACKGROUND OF THE INVENTION

[0002] It has been known to use individual sheets of cardboard for laying between items stacked on a pallet in order for the stacked items on the pallet to be prevented from sliding or moving during transport of the item. The individual sheets used for laying between items are mostly dispensed from a supply reel of paper or cardboard, from where they are cut into the desired dimension.

[0003] Examples of sheet dispensers can be found in EP2789559 A1, US 4941374 and WO 2004031058 A1. All of these publications describe dispensing of individual intermediate sheet layers, where the paper is rolled up on a supply reel from where it is fed to the sheet feeder of the sheet dispenser. After entering the sheet dispenser, the paper is cut into sheets of suitable length and the sheets are to be placed on pallets.

[0004] One of the disadvantages of these sheet dispensers are that they do not have means for smoothing the unrolled paper, which would be necessary, as the sheets would inherently have a curvature after the paper is unrolled from the reel. This is due to the circumstance that the paper or cardboard is delivered on a large supply reel, from which the web is unrolled and fed into the sheet dispensing machine.

[0005] Another drawback is that the known sheet dispensers do not have means for adjusting or compensating the degree of smoothing during the process of unrolling the paper from the paper reel (supply reel). This is necessary as the inherent curvature of the paper changes with the every changing diameter of the paper reel during the unrolling of the paper from the paper reel. As the paper starts to be unrolled from the paper reel, the curvature of the outer most layers of the paper on a large paper reel would be smaller compared to the curvature of the inner most layers of the paper near the final state of unrolling the paper from the reel. The curvature of the outer most layer on the paper reel does not need to be smoothened (straightened) to the same degree as the inner layer of the supply reel. Thereby, the need for the smoothing of the cellulose-based material/web (paper or cardboard) varies during the process of dispensing the sheet layers.

[0006] The general object of the present invention is to provide a solution according to which smoothing is done dependent of the diameter of the supply reel or cardboard reel.

[0007] It is an object of the present invention to provide a sheet dispensing system for dispensing individual sheets, said sheet dispensing system comprising a frame assembly, a reel loading station, a sheet dispenser station, and a delivery station,

- said reel loading station, said sheet dispenser station, and said delivery station being supported individually or collectively by said frame assembly,
- said reel loading station including a supply reel of a cellulose fiber based web and a support for supporting said supply reel and allowing the dispensing of said cellulose fiber based web from said supply reel,
- said sheet dispenser station including a feeding mechanism and a cutting mechanism,
- said feeding mechanism serving to receive said cellulose fiber based web from said reel loading station and having a tension roller and a feeding roller,
- said cutting mechanism having a reciprocating cutter assembly for cutting said cellulose fiber based web into individual sheets when moved transversally relative to said cellulose fiber based web from a first position to a second position at opposite sides of said cellulose fiber based web,
- said delivery station including a delivery table connected to said sheet dispenser station for receiving said individual dispensed sheets,

[0008] The present invention is primarily directed towards a sheet dispensing system for dispensing individual sheets and provides a system having said reel loading station or said sheet dispenser station or delivery station, further comprising a smoothing mechanism having a first guide roller and second guide roller, said first and second guide rollers being adjustable in relation to one another for altering the smoothing angle dependent of the diameter of said supply reel in order to compensate for the curvature of said cellulose fiber based web and provide non-curved individual sheets.

[0009] Through the use of a smoothing mechanism, it is possible to remove the curvature from the cellulose fiber based material for obtaining non-curved sheets. The smoothing mechanism may be implemented at any suitable position in the sheet dispensing system.

[0010] The advantageous aspect of the present invention is that the diameter of the reel is compensated during the process of unrolling the web from the supply reel, and the sheet dispenser station would therefore be fed with a cellulose fiber based web, which can be cut into sheets having the required dimensions.

[0011] A further advantage is that the smoothing of the cellulose fiber based material is performed during the process of dispensing the cellulose fiber based web.

[0012] A further advantage is that the individual sheets can be delivered to the delivery table, from where the handling of the individual sheets can easily be done by other equipments as the individual sheets would be

straight and non-curved after being dispensed from the sheet dispenser station.

[0013] A further advantage is that the frame assembly for individually or collectively supporting said reel loading station, said sheet dispenser station and said delivery station provides the possibility that the different unit would not have to be located in close vicinity of each other, which would be advantageous as the sheet dispensing system could be fitted into different production facilities, where the area of the ground floor could be utilized for other purpose.

[0014] The smoothing angle is the angle, which is established by adjustment of the position of the guide rollers. The smoothing angle is opposite the convex arc or the tangent line for the guide rollers. The smaller the smoothing angle is, the larger the contact surface would be and hereby, the contact surface of the cellulose fiber based web with the guide roller of the smoothing mechanism would be larger.

[0015] The tension of the cellulose fiber based web or material is established as the feeding mechanism starts drawing the cellulose fiber based web from the supply reel. The sheet dispensing system does not have means for controlling the tension in the web like a dancer roller connected to an individual controller.

[0016] The smoothening of the cellulose fiber based web could also be provided based on a measurement of the curvature of the cellulose fiber based web after it has been cut into individual sheets. The measurement could be performed by a sensor mounted on the delivery table.

[0017] According to the first aspect of the invention, said cutting mechanism is prevented from cutting when moved in the opposite direction from said second position to said first position.

[0018] According to the first aspect of the invention, said cutting mechanism is cutting when moved in the opposite direction from said second position to said first position.

[0019] According to a first aspect of the invention, said first and second guide rollers are adjustable in relation to one another for altering the smoothing angle by a mechanical suspension of the first guide roller and/ or second guide. Through the use of a mechanical suspension of the first guide roller and/ or second guide, it is possible to obtain a reliable mechanical construction, which can be mounted in different locations in the dispensing system.

[0020] According to a first aspect of the invention, said first and second guide rollers are adjustable in relation to one another for altering the smoothing angle by a mechanical coupling between the first guide roller and second guide roller. Through the use of a mechanical coupling between the first guide roller and the second guide roller it is possible to obtain a reliable mechanical construction, where the first guide can be fixed and the second guide roller can be adjusted relative to the first guide roller. The mechanical coupling facilitates the mounting at different location in the dispensing system.

[0021] According to a first aspect of the invention, said first and second guide rollers are adjustable in relation to one another for altering the smoothing angle by the provision of an electronic controller controlling said first and second rollers in relation to one another in response to an electrical signal generated by a sensor mounted on the loading station or the delivery station. Through the use of an electronic controller and a sensor, it is possible to obtain adjustment of the smoothing mechanism where the electrical signal can be correlation and information of the cellulose fiber based web which can be entered and used by the controller used operation of the sheet dispensing system.

[0022] According to a first aspect of the invention, said controller has an input channel and an out signal, said controller being capable of receiving a signal from a reel sensor connected to said reel loading station for generating said electrical signal being representative of the diameter of said supply reel. By using a controller, it is possible to obtain an operation of the sheet dispensing system, where adjustment of the smoothing mechanism is based on the signal from the reel sensor. Moreover, it is possible to operate the smoothing mechanism in dependency of the diameter of the supply reel.

[0023] According to a first aspect of the invention, said cellulose fiber based web is movable continuously, and said cutting mechanism is movable reciprocating in parallel with and in synchronism with said cellulose fiber based web during the cutting of said cellulose fiber based web into said individual sheets. By continuously feeding said cellulose fiber based web, it is possible to obtain an "on the fly" cutting of the cellulose fiber based web and allowing sheets to be produced without intermediate stop.

[0024] According to a first aspect of the invention, said cellulose fiber based web is movable intermittently and said cutting mechanism is movable transversally relative to said cellulose fiber based web during the cutting of said cellulose fiber based web into said individual sheets. By intermittently feeding said cellulose fiber based web it is possible to obtain a more simple construction of the cutting mechanism, where the cutter assembly can be guided on a sledge mounted in the sheet dispensing station.

[0025] In accordance with the method according to the second aspect of the invention, the invention discloses a method of dispensing individual sheets by means of a sheet dispensing system comprising a frame assembly, a reel loading station, a sheet dispenser station, and a delivery station, said method comprising the following steps:

- providing said frame assembly for individually or collectively supporting said reel loading station, said sheet dispenser station and said delivery station,
- providing said reel loading station including a supply reel of a cellulose fiber based web and a support for supporting said supply reel,

- providing said sheet dispenser station including a feeding mechanism and a cutting mechanism,
- providing said feeding mechanism having a tension roller and a feeding roller,
- providing said cutting mechanism having a reciprocating cutter assembly,
- providing said delivery station connected to said sheet dispenser station,
- providing a smoothing mechanism having a first guide roller and a second guide roller at said reel loading station or said sheet dispenser station or said delivery station,
- dispensing said cellulose fiber based web to said feeding mechanism serving to receive said cellulose fiber based web from said reel loading station
- cutting said cellulose fiber based web by moving said reciprocating cutter transversally relative to said cellulose fiber based web from a first position to a second position at opposite sides of said cellulose fiber based web and preventing cutting when moving said reciprocating cutter in the opposite direction from said second position to said first position,
- adjusting said first or second guide rollers being adjustable in relation to one another, said guide rollers being adjustable for altering the smoothing angle dependent of the diameter of the supply reel in order to compensate for the curvature of said cellulose fiber based web and provide non-curved individual sheets.
- dispensing said individual sheets on said delivery table of said delivery station

[0026] The gantry is depicted to be moved along the guide rods spanning in between the supporting columns in a first end of the supporting structure for the gantry and the fixation of the gantry to the delivery table in the opposite end of the first end of the supporting structure for the gantry, however still within the scope of this invention, it is possible that the operation of gantry is not constrained to only move along the lengthwise direction of the delivery table, as the handling arm could be fitted with means enabling the handling arm to be moved in the transverse direction of the length of the transfer station and/or delivery station.

[0027] The term "smoothing mechanism" should in this context be understood as a mechanism, which is able to straighten the paper or cardboard from having a curvature relative to the longitudinal direction of the length of the paper.

[0028] The term "cellulose fiber based material" or "cellulose fiber based web" should in this context be understood as cellulose fiber material produced by pressing together moist fibres of cellulose pulp derived from wood, rags or grasses, and drying them into flexible sheets, e. g. commonly referred to as paper or carboard. The pulp could also contain non-wood material.

[0029] It is contemplated that the smoothing mechanism of the present invention may be utilized in other combinations with various foils such as polymer foils or sheets having ab inherent "memory" to a smaller or larger degree, aluminum foils and/or combinations thereof.

[0030] The term "delivery table" should in this context be understood as a table or platform, where the table or platform serves to receive the cellulose fiber based material after it has been cut into sheets. In a preferred embodiment, the delivery section includes a delivery table.

DETAILED DESCRIPTION

[0031] The invention will now be explained in detail with reference to the schematic drawings in which:

Fig. 1 is an overall schematic view of a presently preferred embodiment of the sheet dispensing system for dispensing and supplying individual sheets of paper or cardboard according to a first aspect of the present invention.

Fig. 2A is a view of a first and presently preferred embodiment of the sheet dispenser station with the cutting mechanism according to a first aspect of the present invention.

Fig. 2B is a close up view of figure 2A of the cutting mechanism of a first presently preferred embodiment of the sheet dispenser station according to a first aspect of the present invention.

Fig. 3A is a view of a first presently preferred embodiment of the reel loading station and the sheet dispenser station with the smoothing mechanism and the feeding mechanism for dispensing individual sheets of paper or cardboard according to a first aspect of the present invention.

Fig. 3B is a close up view of figure 3A of the smoothing mechanism and the feeding mechanism of a first presently preferred embodiment of the sheet dispenser station according to a first aspect of the present invention.

Fig. 4A-4B shows the smoothing mechanism according to a second aspect of the present invention.

Fig. 5 is a view of the reel loading station with a third preferred embodiment of the smoothing mechanism connected to the reel loading station according to a third aspect of the present invention.

Fig. 6A shows the loading of a supply reel in the reel loading station with the smoothing mechanism according to a third aspect of the present invention.

Fig. 6B-6D shows the unrolling of material from the supply reel in the reel loading station with a third preferred embodiment of the smoothing mechanism

connected to the reel loading station according to a third aspect of the present invention.

Fig. 7A-7C shows the unrolling of material from the supply reel in the reel loading station with a fourth preferred embodiment of the smoothing mechanism according to a fourth aspect of the present invention.

Fig. 8A-8D shows the unrolling of material from the supply reel in the reel loading station according to a fifth aspect of the present invention.

Fig. 9A-9D shows the unrolling of material from the supply reel in the reel loading station according to a sixth aspect of the present invention.

[0032] In figure 1, a first and presently preferred embodiment of a system for providing intermediate layers of paper or cardboard (cellulose fiber based material) is shown designated the reference numeral 10 in its entirety. The system 10 comprises a reel loading station 20, a sheet dispenser station 40, a controller 90 and a delivery station 70. The cellulose fiber based material in the form of paper or cardboard is unrolled from the supply reel 22 and introduced to the sheet dispenser station 40. The sheet dispenser station 40 (hereafter referred to as the sheet dispenser) comprises a feeding mechanism 50 (not shown in figure 1) enabling the supply of paper or cardboard to be drawn through the sheet dispenser station 40, where the paper or cardboard is cut into the sheet 28, which will be dispensed onto the delivery table 71. The individual sheets 28 shown in figure 1 are cut both in the transverse direction and in the longitudinal direction. The paper or cardboard would be referred to as cellulose-based material.

[0033] From figure 1 it can be seen that the cellulose fiber based material would travel over a number of roller 12, which would allow the cellulose fiber based material to be transferred between the different unit of the sheet dispensing system. Through the use of a number of roller 12, the different unit would not have to be located in close vicinity of each other, which would be advantageous as the sheet dispensing system could be fitted into different production facilities, where the area of the ground floor could be utilized for other purpose.

[0034] The reel loading station 20 comprises a supporting frame 14 for the supply reel 22 of paper or cardboard. The supporting frame 14 is shown in an embodiment where the supporting frame 14 would consist of four supporting columns 21, where the supply reel 22 has an axel penetrating the centre of the supply reel and where the weight of the supply reel is supporting the two supporting columns. The supply is supported in a manner that allows the supply reel to rotate freely around the centre axle. The reel loading station is intended to be operated in a stepwise manner, allowing continuous feeding of the cellulose fiber based web to the sheet dispenser station, where the continuous feeding is stopped when the cutting of the cellulose fiber based web is performed.

[0035] The cutting could also be performed without stopping the dispensing of the cellulose fiber based web from the sheet dispensing station, this would however require that the cutting mechanism is provided on a movable unit. This provides an "on the fly" operation mode.

[0036] The reciprocating cutter is shown as a mechanical cutter, more precisely a mechanical roller knife. Instead of using a reciprocating cutter, e.g. a mechanical knife, it would also be possible to provide a laser cutter and enabling a continuous cutting of the cellulose fiber material, which in this case would be supplied continuously during the cutting process.

[0037] As can be seen in figure 1, the reel loading station 20 further comprises a supporting roller 25, which is suspended from the supporting frame 14, the supporting roller 25 is preferably pivotally suspended from the supporting frame 14 by means of two support arms 27, whereby the supporting rollers 25 are able to arrest on the circumference of the supply reel 22. The supporting roller 25 comprises a reel sensor 26, which is able to send data of the position of the supporting roller 25 to a controller 90 interconnected with a computer 92. As depicted in figure 1 the supporting rollers could further be provided with fingers 251. The reel sensor can be any type of sensor, which can be used for the purpose of generating an electrical signal, which can be used to indicate or determine a position, e.g. a potentiometer.

[0038] The sheet dispensing system 10 comprises a controller 90, which is interconnected with the reel loading station via cables 92 and where the controller 90 comprises an input channel and an out channel. The controller 90 receives signals from the reel sensor 26 connected to said reel loading station 20 and from the collected data from the reel sensor 26, the collected data is used to determine the diameter of the supply reel 22.

[0039] The collected data from the reel sensor 26 is used to adjust the position of the guide roller (not shown) of the smoothing mechanism 100, whereby the smoothing mechanism is adjusted in order to ensure the sufficient amount of smoothing for the paper based material.

[0040] As shown in fig. 1, the smoothing mechanism 100 is a dependent unit of the sheet dispensing system, which can be connected to either the sheet dispenser station, the delivery table or the reel loading station, which is reflected in the figure.

[0041] Figure 2A-2B shows the sheet dispenser station 40 including the cutting mechanism 60 and the feeding mechanism 50 (not shown) in a presently preferred embodiment of a system for providing layer of paper or cardboard according to a first aspect of the present invention. The feeding mechanism 50 and the cutting mechanism 60 will be explained in more details in relation to figure 3B.

[0042] The sheet dispenser station includes feeding means for drawing in the cellulose fiber based material from the supply reel 22. The feeding mechanism 50 comprises two rollers, which interact in mutual operation, al-

lowing a free end of the cellulose fiber based material to be placed between the mutually interacting rollers, whereby the cellulose fiber based material can be drawn into the sheet dispenser station 40.

[0043] The sheet dispenser station 40 is connected to the delivery station 70, which comprises a delivery table 71 onto which the cut sheets are delivered and a transfer station 80 located at the end of the delivery table 71, so that the sheets 28 can be transferred from the delivery table 71 on the pallet 83. The delivery table 71 arrests on an underframe 710 with supporting columns, more precisely four supporting columns 711, which can be adjusted to level out the delivery table 71 on the ground floor of the production facilities.

[0044] In figure 2A, a stacking machine for handling individual sheets 28 is shown, said stacking machine comprising a frame assembly 13, a delivery station 70, a transfer station 80 and an elevation station 82. The frame assembly 13 includes support columns 711, 811 for supporting said delivery station 70, said transfer station 80 and said elevation station 82. The delivery station 70 has a delivery table 71 defining a first horizontal plane. The handling arm 85 is used for transferring the sheet 28 from the delivery table 71 onto the platform 83 (shown as a pallet), where the sheets can be stacked and the delivery table 71 serving to receive and present the sheets 28 individually. The handling arm 85 is movable from a first position above the delivery table 71 to a second position above the elevation station and the handling arm 85 includes holding members 86 for contacting the sheets 28 individually and transferring the sheets 28 individually from the delivery table 71 to the elevation station 82 and releasing the sheets individually at the elevation station 82 and the elevation station having a platform 83 for collecting the individual sheets,

[0045] The platform 83 is moved vertically from a first level to a second level and the first level is substantially in the same horizontal plane as the first horizontal plane of the delivery table 71, and the second plane being is located in parallel with and below the first horizontal plane for allowing the sheets 28 to be stacked on top of the one another.

[0046] The handling arm 85 is suspended by the frame assembly 13 and the handling arm 85 is resting on supporting columns 811 at one end and being connected to the delivery station in the opposite end allowing the transfer station 80 to span the width of the delivery station 70 and the elevation station 82. The handling arm 85 is provided with holding members 86 being constituted by vacuum lifters located at the perimeter of the handling arm and the vacuum lifters being used for transferring the sheets. The pneumatic system is depicted for the sake of simplicity

[0047] The transfer station 80 includes a gantry 84 spanning substantially half the dimension of the delivery station 70 perpendicular to the width and being movable along the width of the delivery station 70 and the elevation station 80. The elevation station 82 has a linkage mechanism 821, preferably a scissor mechanism, enabling the platform to be moved between the first and second levels and the linkage mechanism being connected to an actuator (not shown).

[0048] The gantry 84 spans the width of the transfer station 80 and substantially half of the length of the delivery table. The gantry can also be connected to the controller 90, which would allow for operation of the gantry in connection or communication with the sheet dispenser station, delivery table and gantry.

[0049] The controller can be operated for the purpose of synchronizing the operation of the different stations of the dispensing system including the stacking machine.

[0050] The controller can be programmed to deliver the sheets continuously on the delivery table 71 in order to transfer the sheets individually from the delivery table 71 to the elevation station 80 before the next sheet being delivered to the delivery table71.

[0051] The controller can be programmed to deliver the sheets intermittently on the delivery table detecting the presence of the sheets and transferring the sheet from the delivery table to the elevation station and stopping the delivering of the sheet during the step of transferring the sheet to the elevation station.

[0052] In figure 2A, the delivery table 71 includes one or several conveying means 72, which will ensure that the individual sheets 28 of the cellulose fiber based material are advanced from the cutting mechanism 60 in the longitudinal direction of the delivery table. The conveying means 72 could be in the form of conveyer belts, which will move the individual sheets on the delivery table 71 after the cellulose fiber based material has been cut by the cutting mechanism 60. The conveyer belts will stretch out the individual sheets on the delivery table 71 after the cellulose fiber based material (web). The delivery station 71 includes a sensor 74, and the senor 74 is used for detecting the presence and location of the sheets. A number of sensors can be arranged on the delivery table in between the conveyer belts. The sensor(s) could also be in combination with the controller for adjusting the guide rollers of the smoothing mechanism.

[0053] In figure 2B can be seen that the cutting mechanism 60 of the sheet dispenser station 40 includes a reciprocating cutter, preferably a mechanical cutting knife 61, which serves to cut the cellulose fiber based web from the supply reel 22 into pieces of sheets having a convenient size when they are fed to the delivery table 71. The cutting knife 61 is oriented transversely of the longitudinal direction of the delivery table 71 for cutting off the part of the cellulose fiber based web 23 having its end drawn forth a suitable length. The cutting knife 61 is in the shown embodiment a mechanical roller knife mounted on a guided sledge 63, on which the knife 61 can freely rotate around it center. The sledge 63 is able to move in the transverse direction of the longitudinal direction of the delivery table 71 and the sledge 63 is guided by two guide rods 62, where the bushings 64 are in interposition between the two outer guide rods 62 and

the sledge 63. The cutting knife 61 can be moved pulling the cable 65 or by other similar means to drag the roller knife back and forth.

[0054] Figure 3A shows a preferred embodiment of the reel loading station 20 and the sheet dispenser station 40 with the smoothing mechanism 100 for dispensing individual sheets of paper based material. The reel loading station 20 is where the cellulose fiber based web 23 is fed to the sheet dispenser station 40. The reel loading station 20 includes an underframe 211 for supporting the supply reel 22, which is rotatably suspended on the underframe 211 having four castor wheels 213. The underframe 211 is equipped with bushings 212, which support the through going axel of the supply reel 22. The through going axle of the supply reel 22 is furthermore locked relative to the underframe by a stop ring (not shown).

[0055] Figure 3B shows a close up view of the smoothing mechanism 100 and the feeding mechanism 50 of the first presently preferred embodiment of the sheet dispenser station according to a first aspect of the present invention, where the feeding mechanism 50 comprises interspaced rollers (51,52), which are synchronously driven by using a belt. The free end of the cellulose fiber based web 23 is fed to the cutting station 60, where the cutting knife 61 cuts the cellulose fiber based web into individual sheets 28 (intermediate layer).

[0056] The sheet dispenser station 40 comprises a housing 41 having two housing covers 42, a top wall 43, a bottom wall 44, two side walls 45 and side wall covers 46. The two housing covers 42 are both located in the longitudinal direction of the dispensing direction of the cellulose fiber based web 23 and the housing covers 42 are hinged to the top wall 43 of the dispenser housing 41, which will provide accesses to the interior of the sheet dispenser station for the operator.

[0057] In figure 3B, the feeding mechanism 50 comprises two interspaced rollers (51,52), where the first roller is a tension roller 51, which can be moved by operating the handle 53 whereby movement of the tension roller 51 is obtained. The tension mechanism of the feeding mechanism 50 is achieved by a movable tension roller 51 and a feeding roller 52, which are arranged and connected to the side walls 45 of the sheet dispenser station housing 41. The tension roller 51 is connected in each end to a linkage mechanism 54, where the linkage mechanism 54 itself is connected to the side walls 45 of the sheet dispenser station housing 41. Each linkage mechanism 54 penetrates an opening in the housing covers 42 allowing the operator to grab the tensioning handle 53 on each of the linkage mechanisms 54. By operation of the tensioning handle 53, the tension roller 51 can be moved or be disconnected from engagement with the feeding roller 52, depending on whether or not the free end of the cellulose fiber based web is to be inserted into the feeding mechanism 50.

[0058] The tension roller 51 and the feeding roller 52 constitute the main elements of the feeding mechanism. The feeding roller 52 is connected by means of a belt to a motor 47 in each end and the elements are covered by side wall covers 46. The motor 47 is located in the upper part of the sheet dispenser station housing 41 and will, when activated, rotate the feeding roller 52, which in cooperation with the tension roller 51 will guide and dispense the cellulose fiber based web through the sheet dispenser station 40.

[0059] An emergency stop 25 is provided on the sheet dispenser station housing 41. The sheet dispenser station 40 may also include means to apply a coating to the cellulose-based material.

[0060] The smoothing mechanism 100 in fig 3A and fig. 3B is shown according to a first aspect of the present invention, where the smoothing mechanism 100 is connected to the side wall 45 of the sheet dispenser station housing 41. The smoothing mechanism 100 comprises a guide plate 33 and two guide rollers, which would be referred to as a first guide roller 31 and a second guide roller 32. The first guide roller 31 and second guide roller 32 are both mounted on a guide plate 33, which is pivotally connected to a mounting plate 34 connected with the side wall 45 of the sheet dispenser station housing 41.

[0061] The mounting plate 34 is provided with an arc portion having a number of slots 35 extending the width of the mounting plate 34, where the slots 35 are arranged near the circumference of the arc shape of the mounting plate 34. A lever 36 with biasing means is arranged perpendicular on the guide plate 33, where the lever 36 is provided with a pin being substantially longer than the width of the guide plate 33. This will allow the lever 36 to provide an interlocking of the guide plate 33 relative to the mounting plate 34.

[0062] The guide plate 33 is pivotally connected to the mounting plate 34, so that the pivot axis of the mounting plate 34 is coincident with the longitudinal axel of the second guide roller 32. In this way, the distance between the longitudinal axis of the feeding roller 52 and the longitudinal axis of the second guide roller 32 is maintained during the advancing process of the cellulose fiber based web (intermediate sheet layer).

[0063] In fig 3A and fig 3B, the smoothing mechanism 100 is shown in a position, where the smoothing mechanism is raised to the highest possible position in relation to the sheet dispenser station. In the highest position, the lever 36 is inserted in the slot at the highest position on the circumference of the arc portion of the mounting plate 34, this point would be located at the longest distance from the ground floor.

[0064] The amount of smoothing of the cellulose fiber based web is determined by the number of slots provided in the sheet dispenser station 40, more precisely by the number of slots provided in the mounting plate 34 of the sheet dispenser station, which is decisive for the position of the first guide roller 31 and thereby the angular position of the first guide roller 31 in relation to the second guide roller 32 of the smoothing mechanism 100.

[0065] When the smoothing mechanism 100 is fixed in the highest possible position, then the contact area be-

tween the paper web and the guide rollers 31, 32 is at its maximum level, whereas when the smoothing mechanism is lowered by a pivoting movement around the axis of the second guide roller, then the contact surface between the cellulose fiber based web and the guide rollers 31, 32 is at its minimum level.

[0066] The number of slots provided in the mounting plate 34 of the sheet dispenser station allows for a stepwise adjustment for the smoothing mechanism. Another embodiment of the smoothing mechanism 100 is shown in figure 1, where the adjustment can be performed in a continuous manner, through the use of one actuator connected to the frame of the sheet dispensing system, and where the adjustment is achieved in cooperation with a curved recess in a guidance plate connected to the frame of the sheet dispensing system.

[0067] The smoothing angle is the angle, which is established by the position of the guide rollers, e.g. in fig 3A. The smoothing angle is opposite the convex arc or the tangent line for the guide roller. The smaller the smoothing angle is, the larger the contact surface would be, hereby the contact surface of the cellulose fiber based web with the guide roller of the smoothing mechanism would be larger.

[0068] Fig. 4A-4B shows the smoothing mechanism 200 according to a second aspect of the present invention, where the smoothing mechanism 200 can be positioned below the cutting section of the sheet dispenser station (not shown). The smoothing mechanism 200 comprises four guide rollers 210a, 210b, 212 having each guide rollers connected in the end to main frame 214. The main frame 214 comprises two frame plates 218a, 218b, which are interconnected in one end allowing the two frame plates 218a, 218b to be pivotable around a common pivot axis. The cellulose fiber based web 23 is fed through the smoothing mechanism 200 and dependent on the amount upon the thickness and density of the cellulose fiber based web, the frame plates 218a, 218b will be clamped together, whereby the secondary guide roller 212 on the second frame plates 218b will be interposed between the two primary guide roller 210a on the first frame plate 218a.

[0069] Fig. 4C-4D shows the smoothing mechanism 200 in the position, where the primary guide roller 210a on the first frame plate 218a and the secondary guide roller 212b on the second frame plates 218b are fully engaged in order to achieved the maximum compensation for an unwanted curvature of the cellulose fiber based web 23. The amount of smoothing can be adjusted by movement of the secondary guide roller 212 on the second frame plates 218b relative to the two primary guide rollers 210a on the first frame plate 218a.

[0070] In Fig. 5, the smoothing mechanism 300 reel loading station 302 is shown according to a third aspect of the present invention, where the smoothing mechanism 300 is connected to the reel loading station 302. The connection of the smoothing mechanism 30b is obtained through the use of linkage rods 311, where a pair of linkage rods 311 are used for suspending the first guide roller 312 and the second guide roller 314 in each end. Each linkage mechanism comprising two linkage rods 311 are interconnected by a linkage lever 316 and the linkage rods 311 are in one end connected to the underframe 310. The first linked rod 311 a is connected to the first guide roller 312 in the end opposite the end connected to the underframe 310. The second linked rod 311 b is connected to the second guide roller 314 in the end opposite the end connected to the underframe 310. The first guide rollers 312 will arrest on the circumference of the supply reel 22.

[0071] Fig. 5-6D shows the smoothing mechanism 300 according to a third aspect of the present invention. A supply reel 22 is loaded in the reel loading station 302 and the supply reel 22 is supported by bushing 318 located on the underframe 310 for supporting the supply reel 22, which is rotatable suspended on the underframe 310 having four castor wheels 315. The underframe 310 is equipped with bushings 318, which support the throughgoing axel of the supply reel 22 and the axel of the throughgoing axel of the supply reel 22 is furthermore locked relative to the underframe by a locking element 317.

[0072] Fig. 6B-6D shows the sequence of unrolling the cellulose fiber based web 23 from the supply reel 22 in the reel loading station 302. The smoothing mechanism 300 works in dependency of the diameter of the supply reel 22. The first guide roller 312 and the second guide roller 314 will during unrolling of the cellulose fiber based web 23 from the supply reel 22 be adjusted in relation to one another, which would alter the smoothing angle dependent of the diameter of said supply reel in order to compensate for the curvature of said individual sheets and provide non-curved individual sheets.

[0073] When comparing fig. 6B, which shows the fully loaded supply reel 22 and figure 6D, which shows a supply reel after the majority of the cellulose fiber based web 23 has been rolled off the supply reel 22, it is furthermore possible to see that the second guide roller 314 has moved from a first position (initial) behind the first guide roller 312 in the vertical plane to a second position being in front of the first guide roller 312 in fig 6D.

[0074] Fig. 7A-7C shows a principle drawing of a fourth preferred embodiment of the smoothing mechanism 400 according to a fourth aspect of the present invention. The reel loading station is connected to the reel loading station, however not shown in fig. 7A-7C for the sake of simplicity. The smoothing mechanism 400 comprises a supporting frame, supporting rollers 410, a pair of first guide rollers 412 and one second guide roller 414, the pair of first guide rollers 412 being connected to the supporting frame, where the first guide rollers 412 are positioned with a distance in between one another. The supporting frame comprises a recess 416 extending between the first guide rollers 412 in a direction being perpendicular to the distance between the two first guide rollers 412. A second guide roller 112 is provided and positioned

in the recess 316 of the supporting frame, and the second guide roller 414 is moved between a first position to a second position.

[0075] Fig 7A shows the second guide roller 414 in the first position, where the second guide roller 414 applies a minimum of force to the cellulose fiber based web 23. Fig 7C shows the second guide roller 414 in the first position, where the second guide roller 414 applies a maximum force to the cellulose fiber based web 23.

[0076] By increasing the engagement of the second guide roller 414 in relation to the two first guide rollers it is possible to alter the smoothing angle in dependency of the diameter of said supply reel 22. The smoothing mechanism 400 is connected to a frame by using a linkage mechanism similarly to mechanism shown in fig. 6A-6D. By using two linkage rods, it is possible to suspend the smoothing mechanism enabling a motion pattern as shown in the fig. 7A-7C. The linkage mechanism could be implemented by having a first linkage rod connected to the first guide roller 412 and a second linkage rod connected to the second guide roller 414. The first and second linkage rod would be connected to the frame assembly.

[0077] Fig. 8A-8D shows the unrolling of cellulose fiber based web 23 from the reel in the reel loading station according to a fifth aspect of the present invention. The smoothing mechanism 500 works in dependency of the diameter of the supply reel 22. The cellulose fiber based web 23 will be unrolled and drawn by feeding mechanism onto the delivery table 506 and the feeding mechanism comprises a first roller 502 and a second roller 504. The cutting mechanism is not shown in Fig. 8A-8D. The smoothing comprises a guide roller 508, which will be moved along the circumference of the supply reel 22 during unrolling of the cellulose fiber based web 23 from the supply reel 22 and the motion of the guide roller 508 will alter the smoothing angle 510 in dependency of the diameter of said supply reel. The guide roller 508 is moved from a first position (initial) shown in fig. 8A to a second position shown in fig. 8D. The first position being behind the rotation center of the supply reel 22 (the left side of the rotation center) and a second position being in front of rotation center of the supply reel 22 (the right side of the rotation center). The smoothing angle 510 is adjusted by moving the guide roller 508 along the circumference of the supply reel 22 and by changing the smoothing angle 510 it is possible to compensate for the curvature of the cellulose fiber based web 23 and provide non-curved individual sheets.

[0078] Fig. 9A-9D shows the unrolling of the cellulose fiber based web 23 from the reel in the reel loading station according to a sixth aspect of the present invention. The smoothing mechanism 600 works in dependency of the diameter of the supply reel 22. The smoothing mechanism 600 comprises a first guide roller 610 and a second guide roller 612 being adjustable in relation to one another. The cellulose fiber based web 23 will be unrolled and drawn by a feeding mechanism onto the delivery table 601 and the feeding mechanism comprises a first feeding roller 604 and second feeding roller 605. The cutting mechanism is not shown in Fig. 9A-9D. The first guide roller 610 and the second guide roller 612 is connected to a frame facilitating that the first guide roller 610 and the second guide roller 612 can rotate around a common axis 606 from a first position (initial) shown in fig. 9A to a second position shown in fig. 9D. In a first position, the smoothing angle is substantially 180 degrees and the gravity centre of the first guide roller 610 and second guide roller 612 defines a plane being substantial parallel with the horizontal plane of the delivery table 601. The smoothing angle 608 is adjusted by rotating the guide rollers 610, 612 around the common axis 606 and by changing the smoothing angle 608 it is possible to compensate for the curvature of the cellulose fiber based web 23 and provide non-curved individual sheets.

[0079] The solution shown in fig. 9A-9D provides and allows for a continuous and stepless operation of the sheet dispenser system. Besides being able to compensate for the curvature of the cellulose fiber based web 23 fed from the supply station, it is furthermore possible to have a number of sensors arranged in the delivery table 601, where the sensors are able to detect the curvature of the cellulose fiber based web 23 for allowing an "on the fly" operation mode that provides for compensation of the curvature at a specific location.

[0080] In this way, it is possible to provide a second compensation for the individual sheets, if the smoothing of the cellulose fiber based web 23 was not sufficiently to straightening the sheets after being dispensed from the sheet dispenser station.

[0081] The compensation can be performed independently of the smoothing mechanism or in cooperation with the sheet dispenser station and/or the supply station. The smoothing mechanism shown in fig 9A-9D could also be combined with the sheet dispenser station, where the smoothing mechanism show in fig.1-3b is removed and the only smoothing is performed by the smoothing mechanism shown in fig 9A-9D.

[0082] Fig. 9A shows a positioning of the guide rollers for obtaining a large smoothing angle (substantially 180 degree) and the compensation of the cellulose fiber based web 23 is almost insignificant. Fig. 9D shows a position of the guide rollers, where the smoothing angle is relatively small (substantially 30 degree) and the compensation for the curvature of the cellulose fiber based web 23 almost reaches its maximum.

REFERENCE NUMBERS

[0083]

sheet dispensing system 10
guide roller 12
frame assembly 13
supporting frame 14
reel loading station 20

supporting frame column 21
underframe 211
castor wheels 213
supply reel 22
paper based material 23
supporting roller 25
finger of the supporting roller 251
reel sensor 26
support arm 27
sheet 28
first guide roller 31
second guide roller 32
guide plate 33
mounting plate 34
slots 35
lever 36
sheet dispenser station 40
sheet dispenser housing 41
housing covers 42
top wall 43,
buttom wall 44
side wall 45
side wall covers 46
motor 47
feeding mechanism 50
tension roller 51
feeding roller 52
tensioning handle 53
linkage mechanism 54
cutting mechanism 60
cutter assembly 61
guide rods 62
sledge 63
guide bushing 64
pulling cable 65
delivery station 70
delivery table 71
supporting column 711
conveying means 72
sensor 74
transfer station 80
elevation station 82
platform, pallet 83
gantry 84
handling arm 85
holding member 86
supporting column 811
scissor mechanism 821
controller 90
cable 92
computer 94
smoothing mechanism 100, 200, 300, 400, 500, 600
primary guide roller 210a, 210b,
secondary guide roller 212
main frame 214
pivot axis 216
first frame plate 218a
second frame plates 218b
reel loading station 302
underframe 310
linkage rods 311
first linkage rod 311 a
second linkage rod 311 b
first guide roller 312
second guide roller 314
castor wheel 315
linkage lever 316
locking element 317
bushing 318
supporting rollers 410
first guide rollers 412
second guide roller 414
recess 416
first roller 502
second roller 504
delivery table 506
guide roller 508
smoothing angle 510
delivery table 601
roller 602 603
first feeding roller 604
second feeding roller 605
common axis 606
smoothing angle 608
first guide roller 610
second guide roller 612

Claims

1. A sheet dispensing system for dispensing individual sheets, said sheet dispensing system comprising a frame assembly, a reel loading station, a sheet dispenser station, and a delivery station,

- said reel loading station, said sheet dispenser station, and said delivery station being supported individually or collectively by said frame assembly,
- said reel loading station including a supply reel of a cellulose fiber based web and a support for supporting said supply reel and allowing the dispensing of said cellulose fiber based web from said supply reel,
- said sheet dispenser station including a feeding mechanism and a cutting mechanism,
- said feeding mechanism serving to receive said cellulose fiber based web from said reel loading station and having a tension roller and a feeding roller,
- said cutting mechanism having a reciprocating cutter assembly for cutting said cellulose fiber based web into individual sheets when moved transversally relative to said cellulose fiber based web from a first position to a second position at opposite sides of said cellulose fiber

based web,

- said delivery station including a delivery table connected to said sheet dispenser station for receiving said individual dispensed sheets, and
- said reel loading station or said sheet dispenser station or delivery station further comprising a smoothing mechanism having a first guide roller and second guide roller, said first and second guide rollers being adjustable in relation to one another for altering the smoothing angle dependent of the diameter of said supply reel in order to compensate for the curvature of said cellulose fiber based web and provide non-curved individual sheets.

2. The sheet dispensing system according to claim 1, said cutting mechanism being prevented from cutting when moved in the opposite direction from said second position to said first position,

3. The sheet dispensing system according to claim 1, said cutting mechanism cutting when moved in the opposite direction from said second position to said first position.

4. The sheet dispensing system according to claim 2 or 3, said first and second guide rollers being adjustable in relation to one another for altering the smoothing angle by a mechanical suspension of the first guide roller and/ or second guide.

5. The sheet dispensing system according to claim 2 or 3, said first and second guide rollers being adjustable in relation to one another for altering the smoothing angle by a mechanical coupling between the first guide roller and the second guide roller.

6. The sheet dispensing system according to claim 2 or 3, said first and second guide rollers being adjustable in relation to one another for altering the smoothing angle by the provision of an electronic controller controlling said first and second rollers in relation to one another in response to an electrical signal generated by a sensor mounted on the loading station or the delivery station.

7. The sheet dispensing system according to claim 6, said controller having an input channel and an out signal, said controller being capable of receiving a signal from a reel sensor connected to said reel loading station for generating said electrical signal being representative of the diameter of said supply reel.

8. The sheet dispensing system according to any of the preceding claims, said cellulose fiber based web being movable continuously, and said cutting mechanism being movable reciprocating in parallel with and in synchronism with said cellulose fiber based web during the cutting of said cellulose fiber based web into said individual sheets.

9. The sheet dispensing system according to any of the preceding claims, said cellulose fiber based web being movable intermittently and said cutting mechanism being movable transversally relative to said cellulose fiber based web during the cutting of said cellulose fiber based web into said individual sheets.

10. The sheet dispensing system according to any of the preceding claims, said cutter assembly of the cutting mechanism being constituted by a blade, a mechanical roller knife or a laser cutter.

1. The sheet dispensing system according to any of the preceding claims, said smoothing mechanism comprising a first second guide roller being mounted on a guide plate, which is pivotally connected to a mounting plate connected with the side wall of the sheet dispenser station housing.

12. The sheet dispensing system according to claim 1 said mounting plate having an arc portion with slots extending the width of said mounting plate, said slots being arranged near the circumference of the arc shape of said mounting plate, a lever with biasing means is arranged perpendicular on said guide plate, said lever is provided with a pin being substantially longer than the width of said guide plate, and this will allow said lever to provide an interlocking of said guide plate relative to the mounting plate.

13. A method of dispensing individual sheet by means of a sheet dispensing system comprising a frame assembly, a reel loading station, a sheet dispenser station, and a delivery station, said method comprising the following steps:

- providing said frame assembly for individually or collectively supporting said reel loading station, said sheet dispenser station and said delivery station,
- providing said reel loading station including a supply reel of a cellulose fiber based web and a support for supporting said supply reel,
- providing said sheet dispenser station including a feeding mechanism and a cutting mechanism,
- providing said feeding mechanism having a tension roller and a feeding roller,
- providing said cutting mechanism having a reciprocating cutter assembly,
- providing said delivery station connected to said sheet dispenser station,
- providing a smoothing mechanism having a first guide roller and a second guide roller at said reel loading station or said sheet dispenser sta-

tion or said delivery station,

- dispensing said cellulose fiber based web to said feeding mechanism serving to receive said cellulose fiber based web from said reel loading station
- cutting said cellulose fiber based web by moving said reciprocating cutter transversally relative to said cellulose fiber based web from a first position to a second position at opposite sides of said cellulose fiber based web and preventing cutting when moving said reciprocating cutter in the opposite direction from said second position to said first position,
- adjusting said first or second guide rollers being adjustable in relation to one another, said guide rollers being adjustable for altering the smoothing angle dependent of the diameter of the supply reel in order to compensate for the curvature of said cellulose fiber based web and provide non-curved individual sheets.
- dispensing said individual sheets on said delivery table of said delivery station

14. A method according to claim 13 further including any of the features of the system according to any of the claims 2-12.

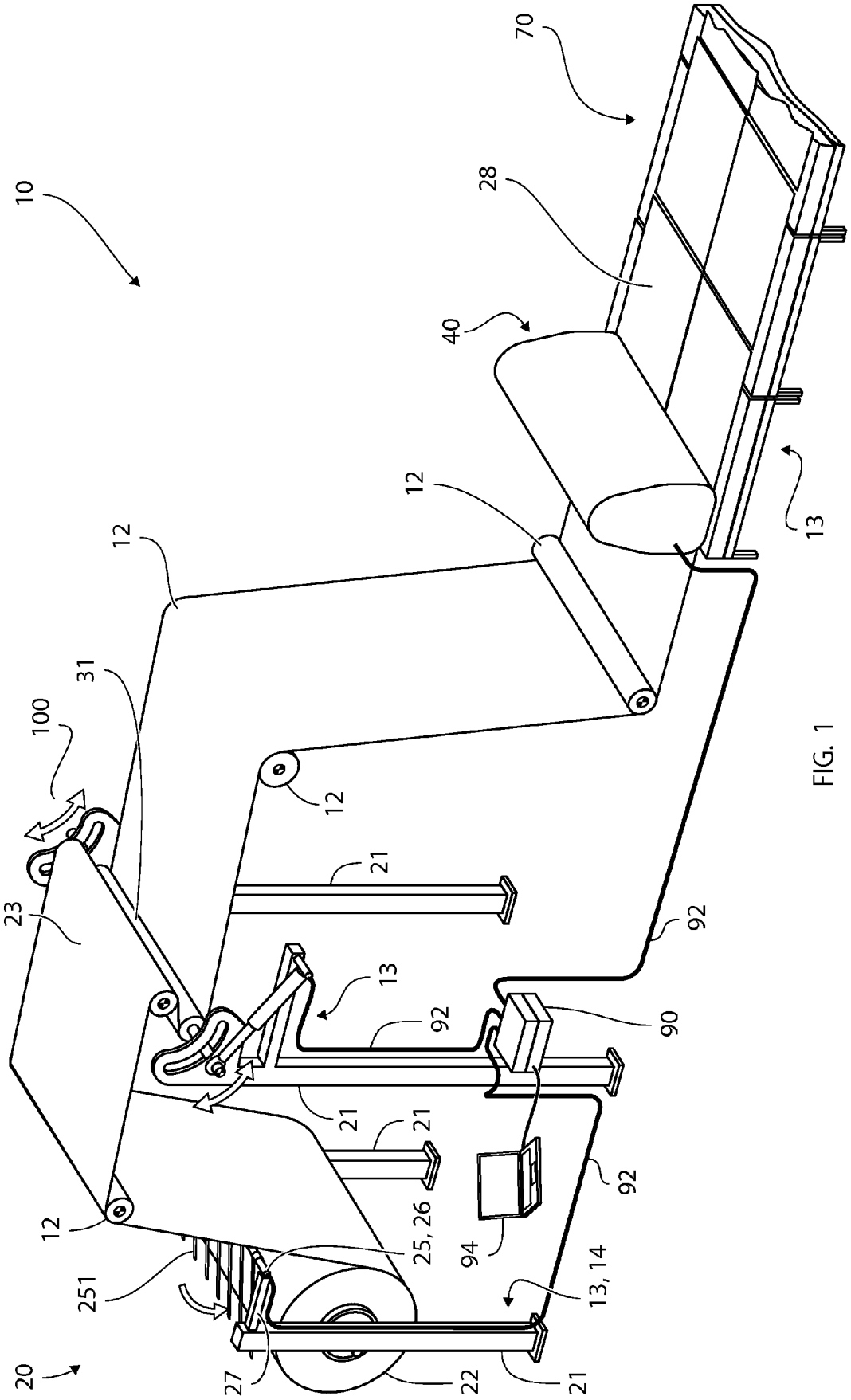

FIG. 1

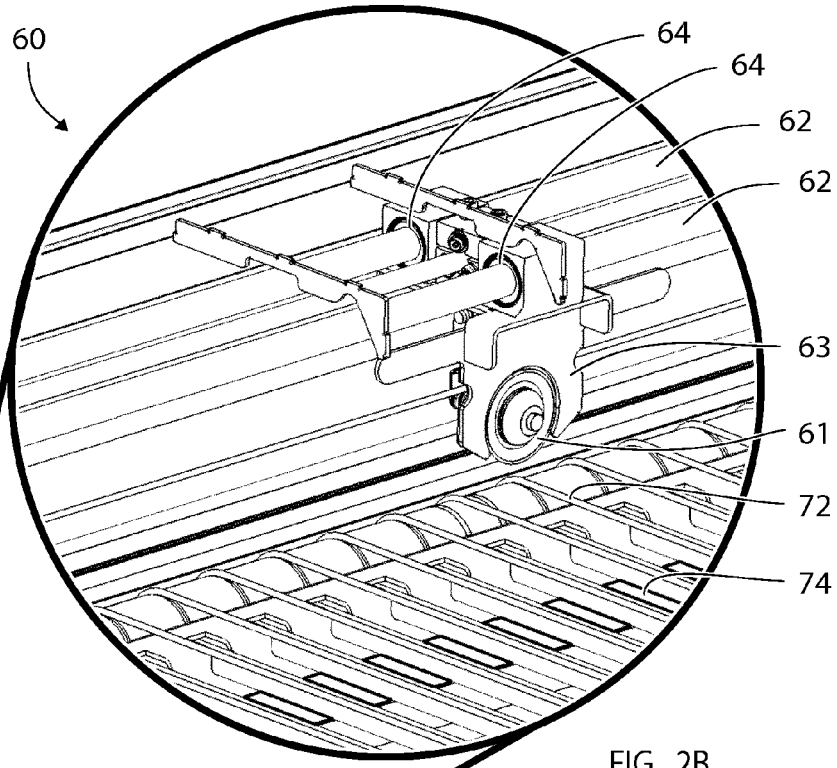
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FIG. 2B

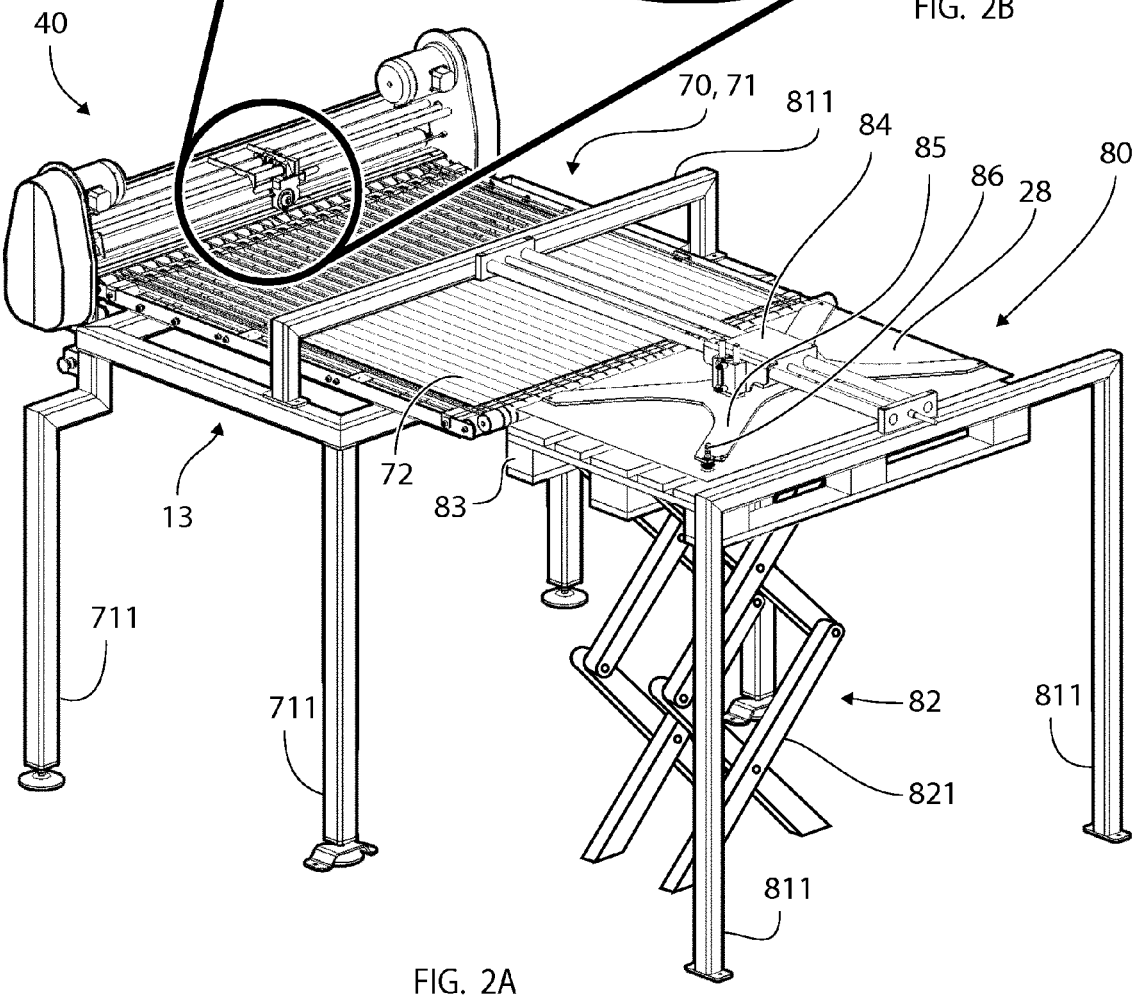
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FIG. 2A

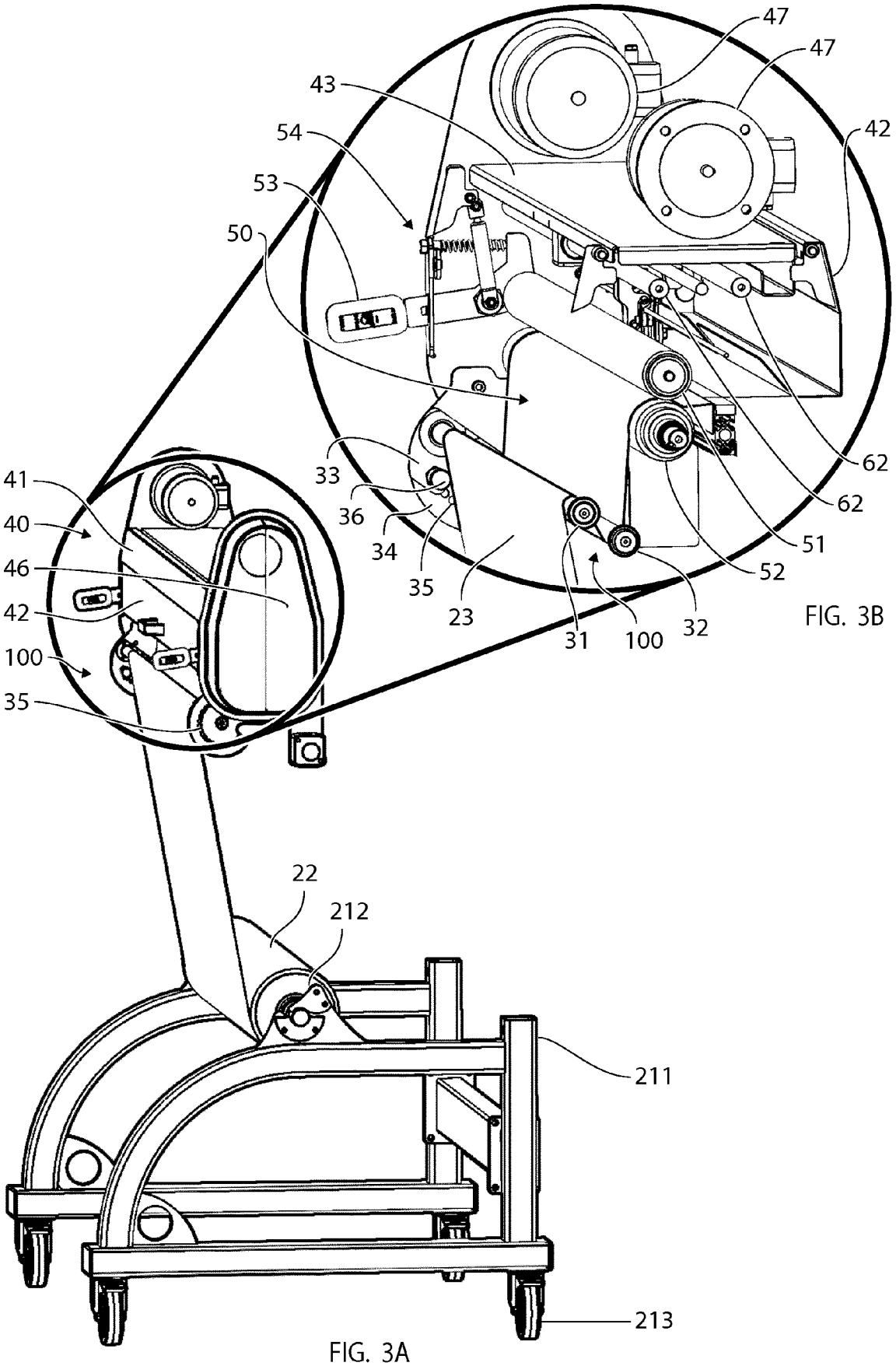
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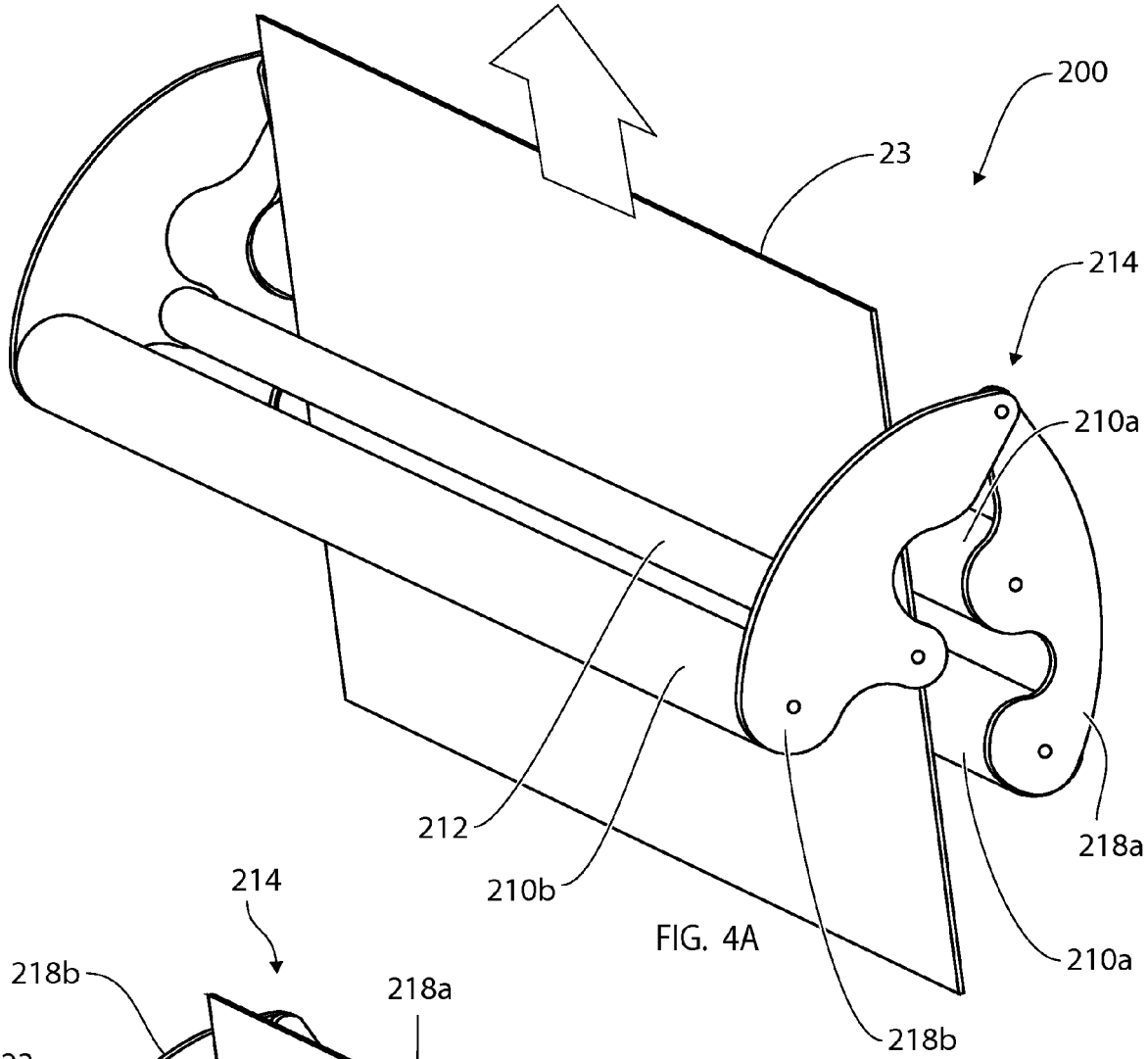
FIG. 3B

FIG. 3A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210a
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210b
218a
210a
218b

FIG. 4A

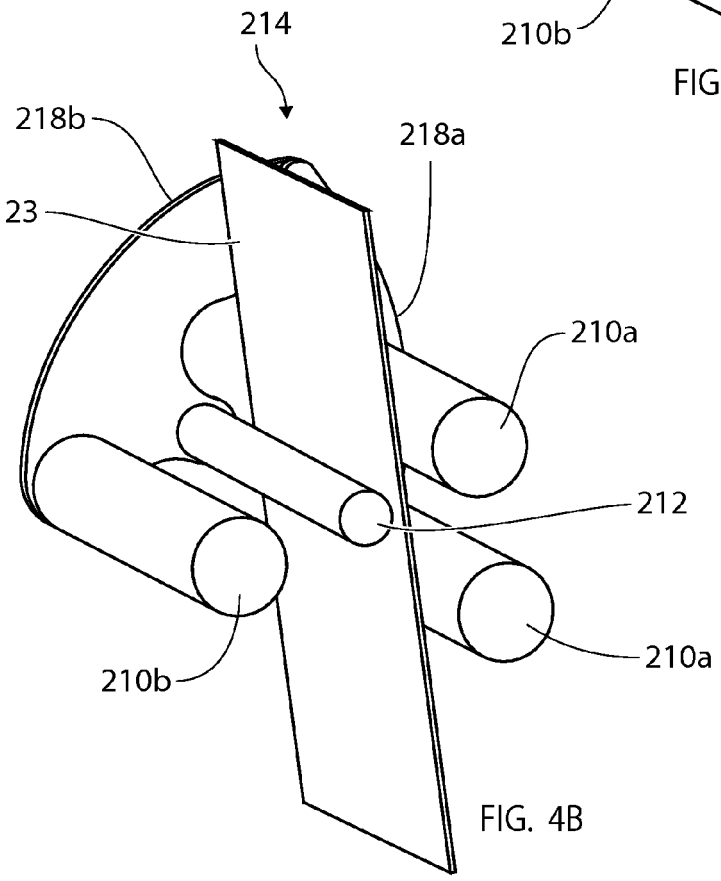
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FIG. 4B

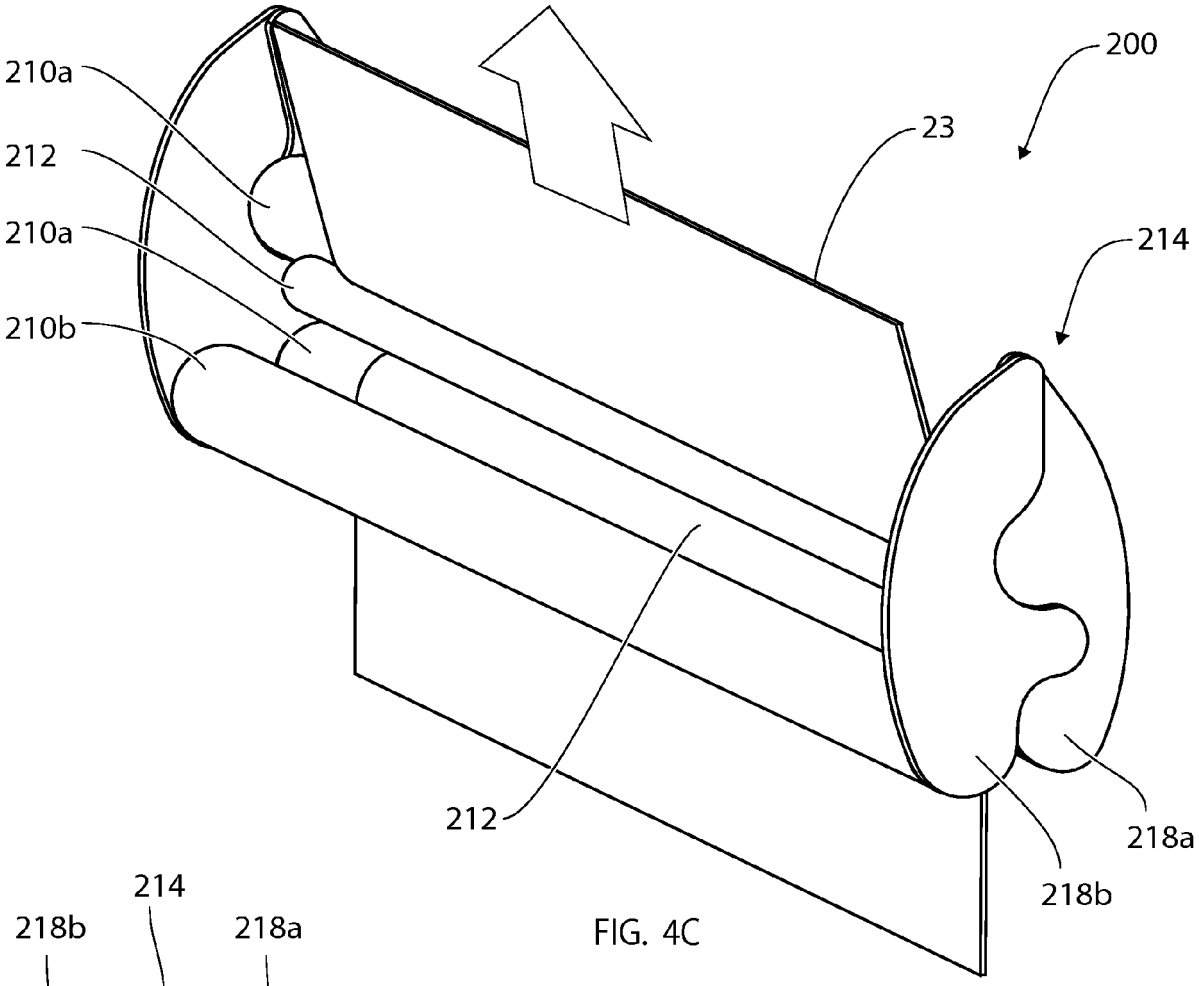
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FIG. 4C

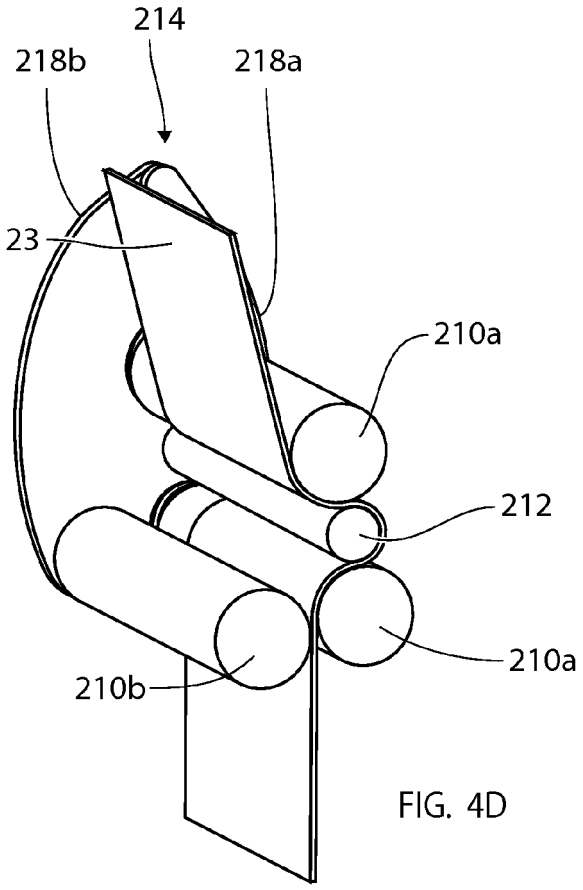
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FIG. 4D

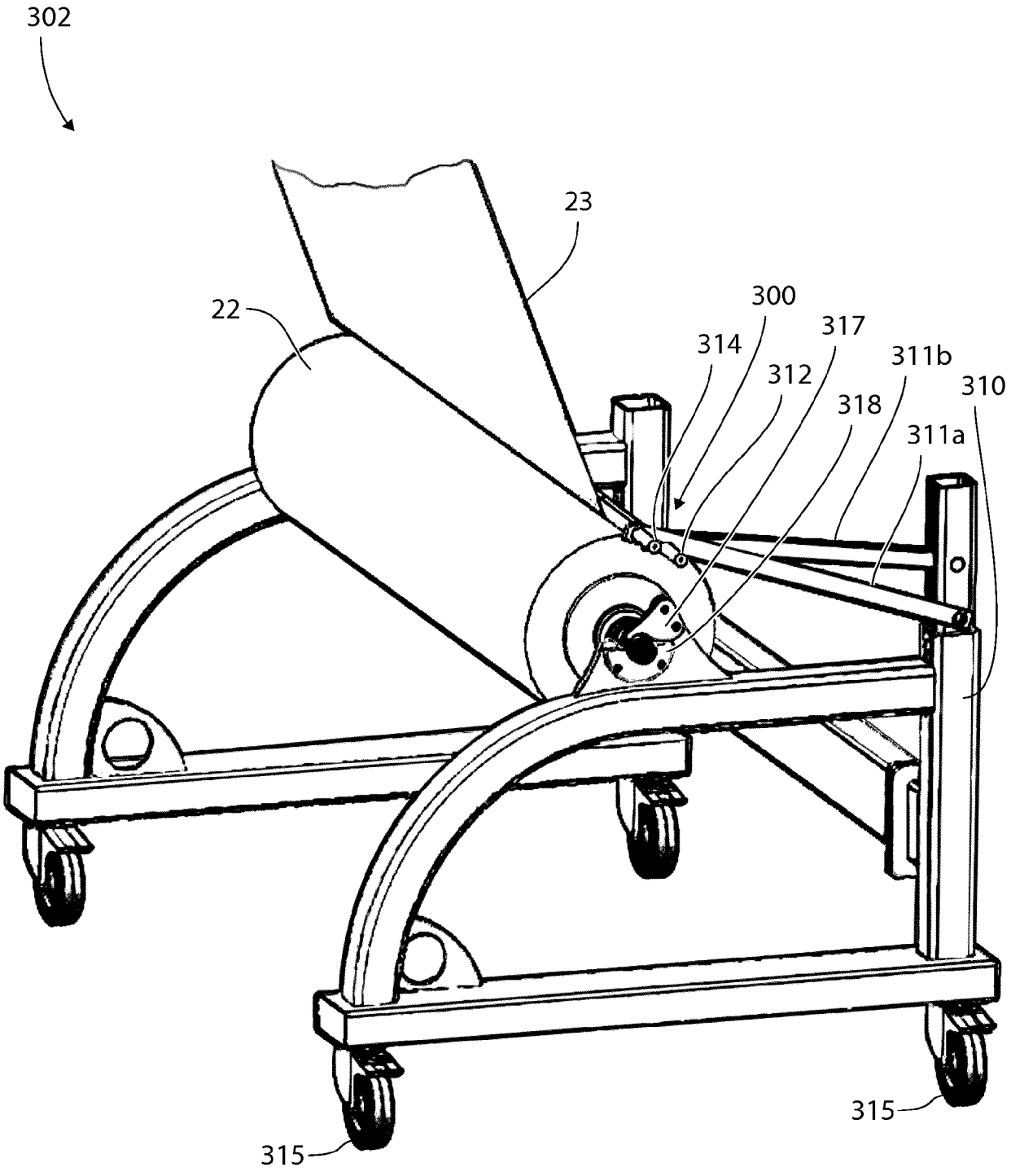
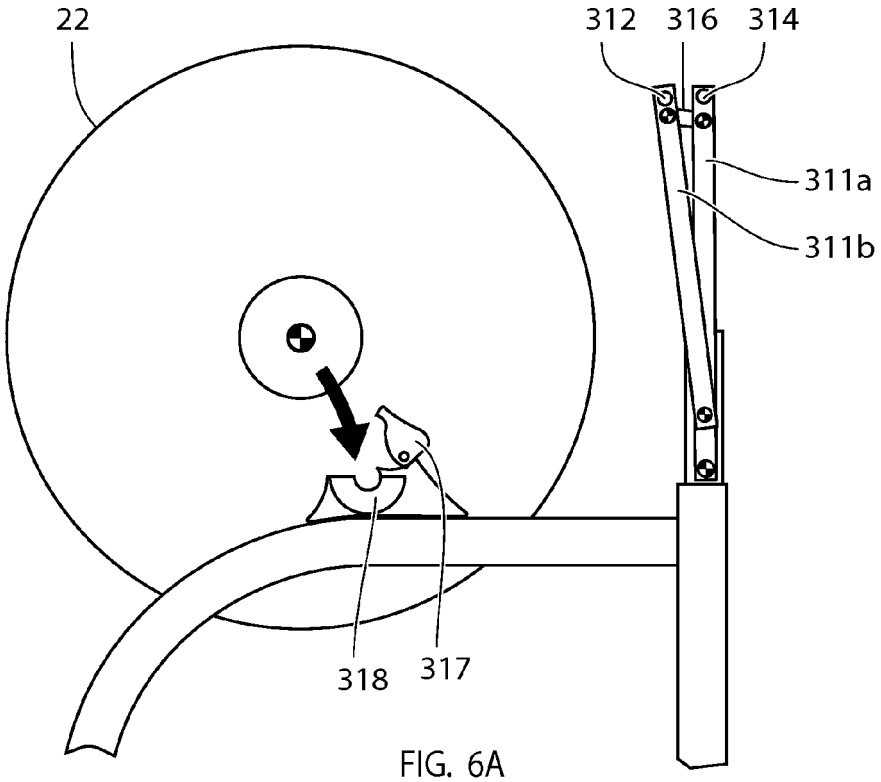


FIG. 5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311a
311b
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FIG. 6A

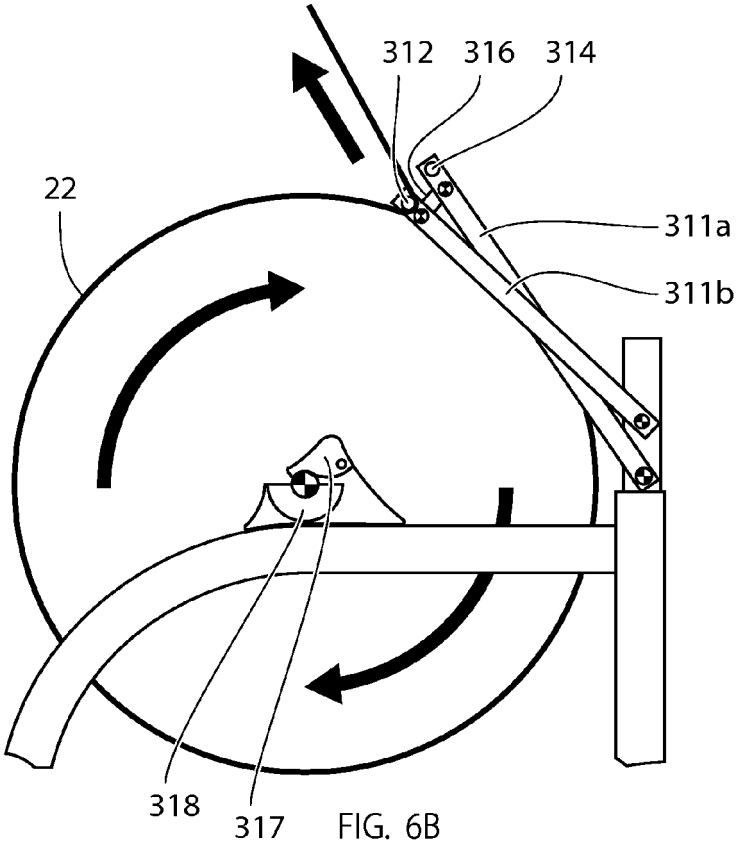
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FIG. 6B

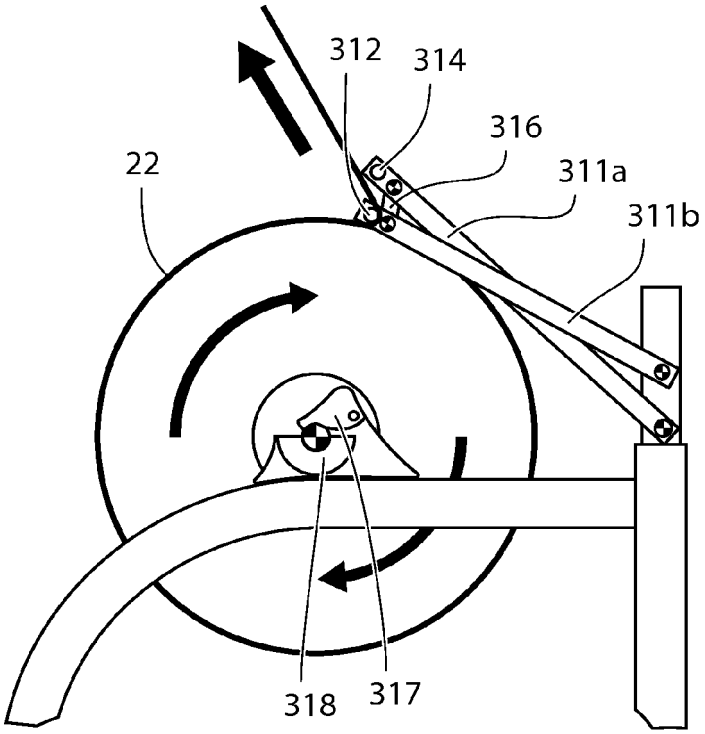

FIG. 6C

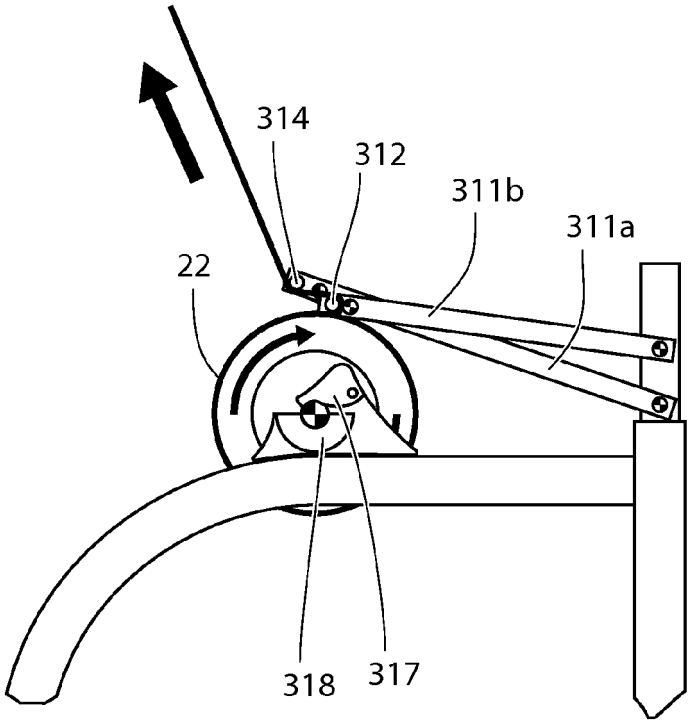

FIG. 6D

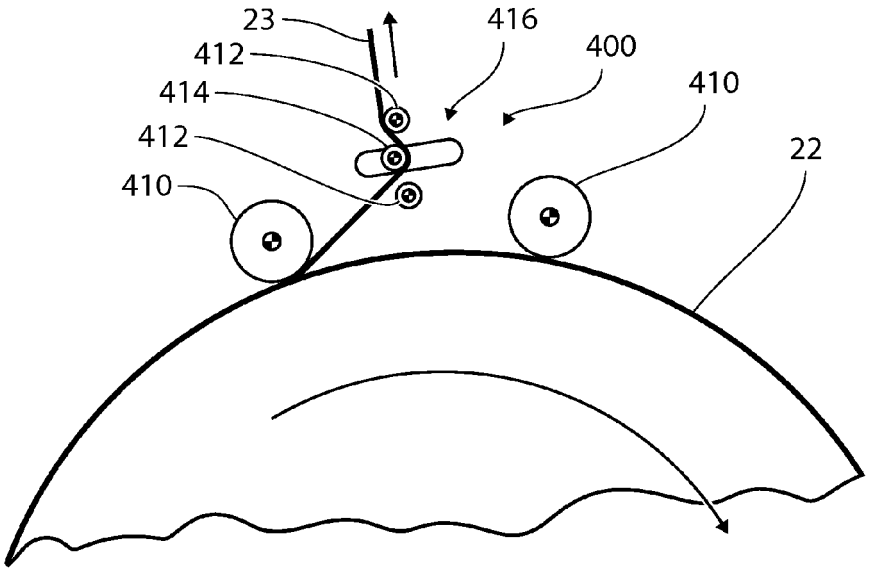

FIG. 7A

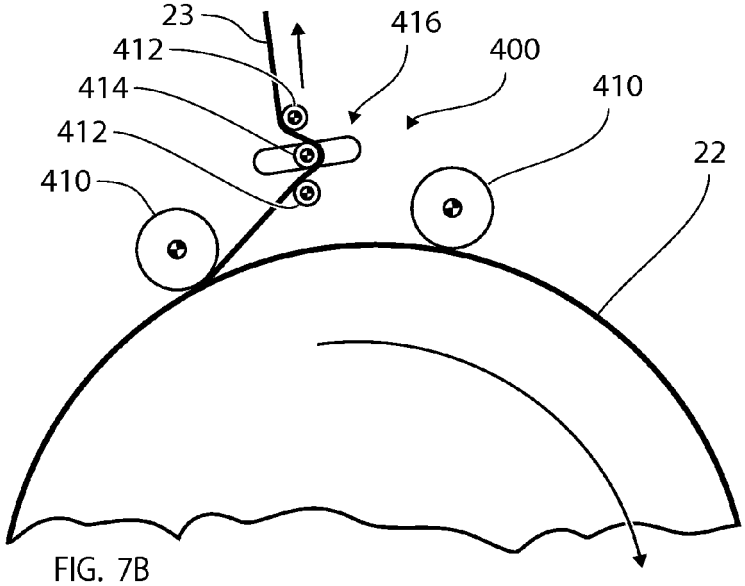

FIG. 7B

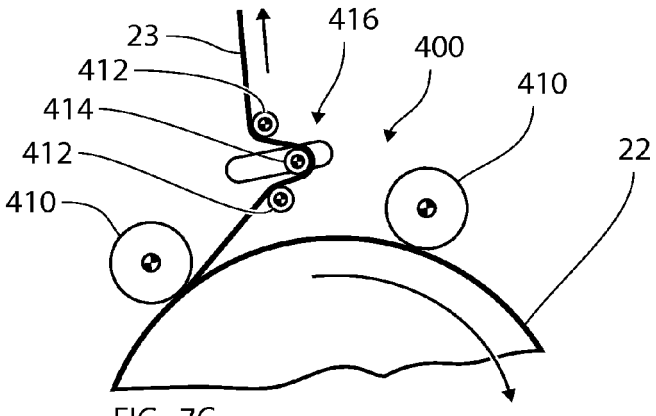

FIG. 7C

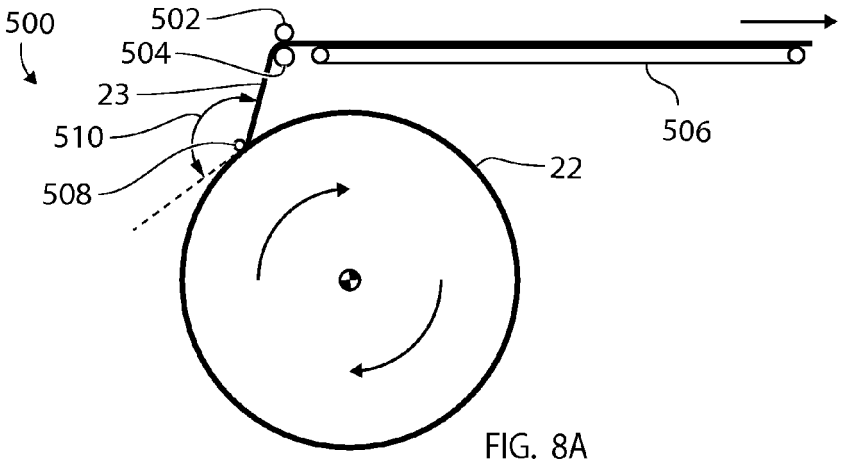

FIG. 8A

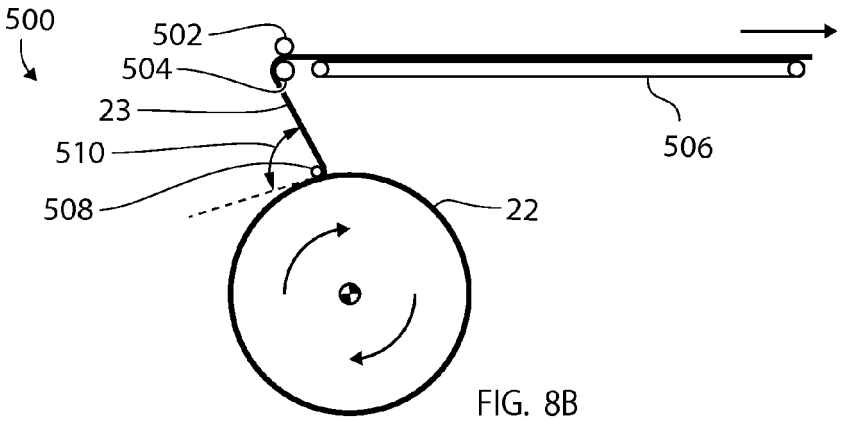

FIG. 8B

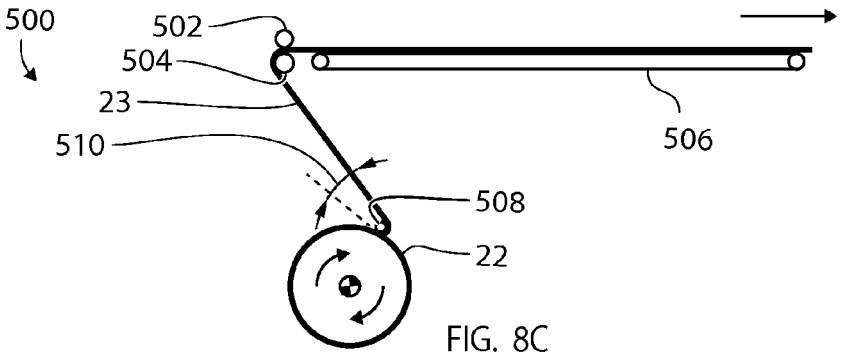

FIG. 8C

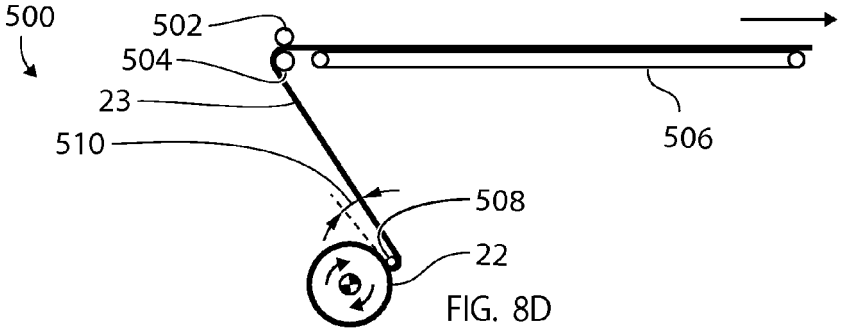

FIG. 8D

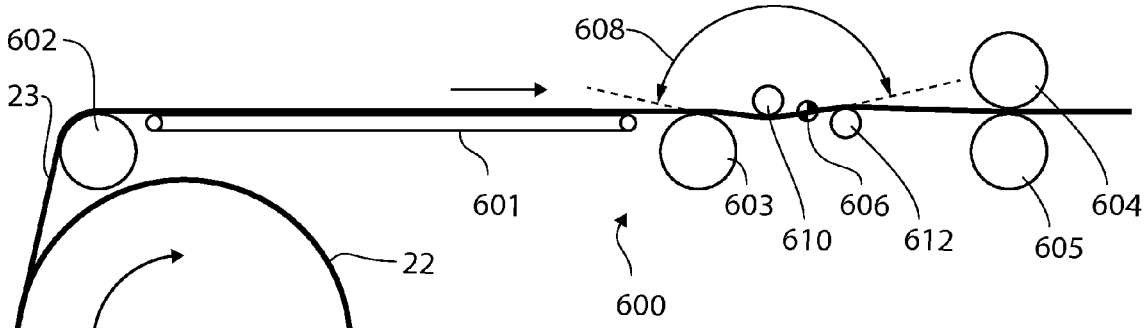

FIG. 9A

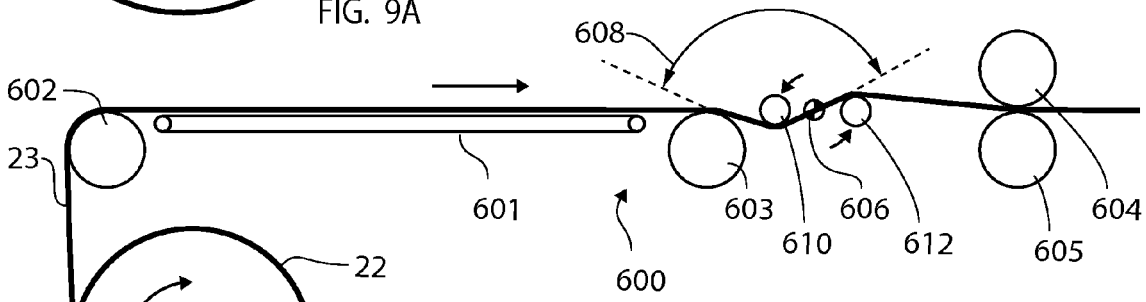

FIG. 9B

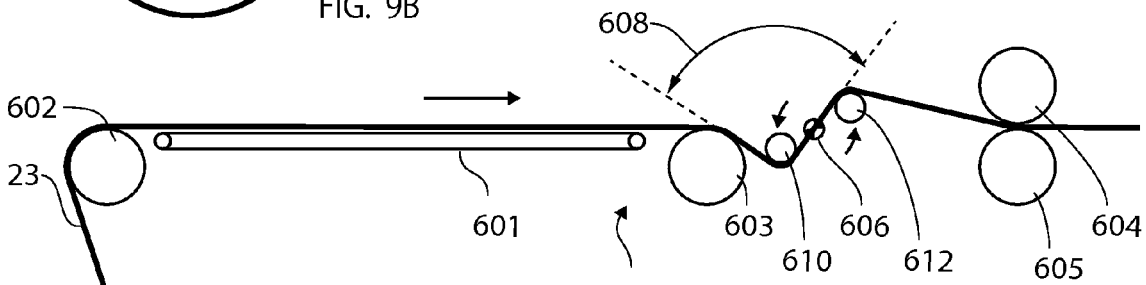

FIG. 9C

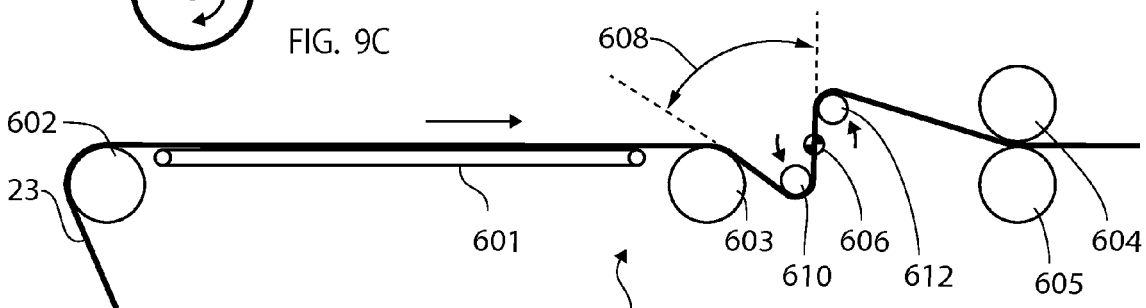

FIG. 9D

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 15 2430

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 Y	JP 2003 048348 A (KONISHIROKU PHOTO IND) 18 February 2003 (2003-02-18) * figures *	1-14 1-3,8-14	INV. B65H23/34 B65H35/04
Y,D	US 4 941 374 A (FOCKE HEINZ [DE]) 17 July 1990 (1990-07-17) * column 3, lines 5-51; figures *	1-14	
Y	JP S56 75337 A (RICOH KK) 22 June 1981 (1981-06-22) * abstract; figures *	4	
Y	DE 20 44 725 A1 (XEROX CORP) 11 March 1971 (1971-03-11) * the whole document *	5	
Y	EP 0 341 971 A2 (KOBAYASHI SEISAKUSHO [JP]) 15 November 1989 (1989-11-15) * column 1, lines 3-51 * * column 3, line 57 - column 4, line 4 * * column 4, lines 47-55 * * column 5, line 1 - column 6, line 9; figures *	6,7	
A	JP S61 64655 A (HITACHI LTD) 3 April 1986 (1986-04-03) * abstract; figures *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)
B65H
B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 July 2017	Lemmen, René

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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