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(54) **A MACHINE FOR CUTTING A MOVING ELONGATED WEB OF PAPER OR NONWOVEN MATERIAL**

(57) The invention relates to a machine for cutting a moving elongated web of paper or nonwoven fabric, the machine comprising a plurality of movable first cutting members (101), each arranged for cutting the web along the direction of movement (WM) of the web, each first cutting member (101) being movable along a first guiding arrangement (111) extending transversely to the web movement direction and in parallel to a lateral extension (LE) of the web, characterized in that each of at least a plurality of the first cutting members (101) comprises a motor (105) arranged to drive the respective first cutting member (101) along the first guiding arrangement (111).

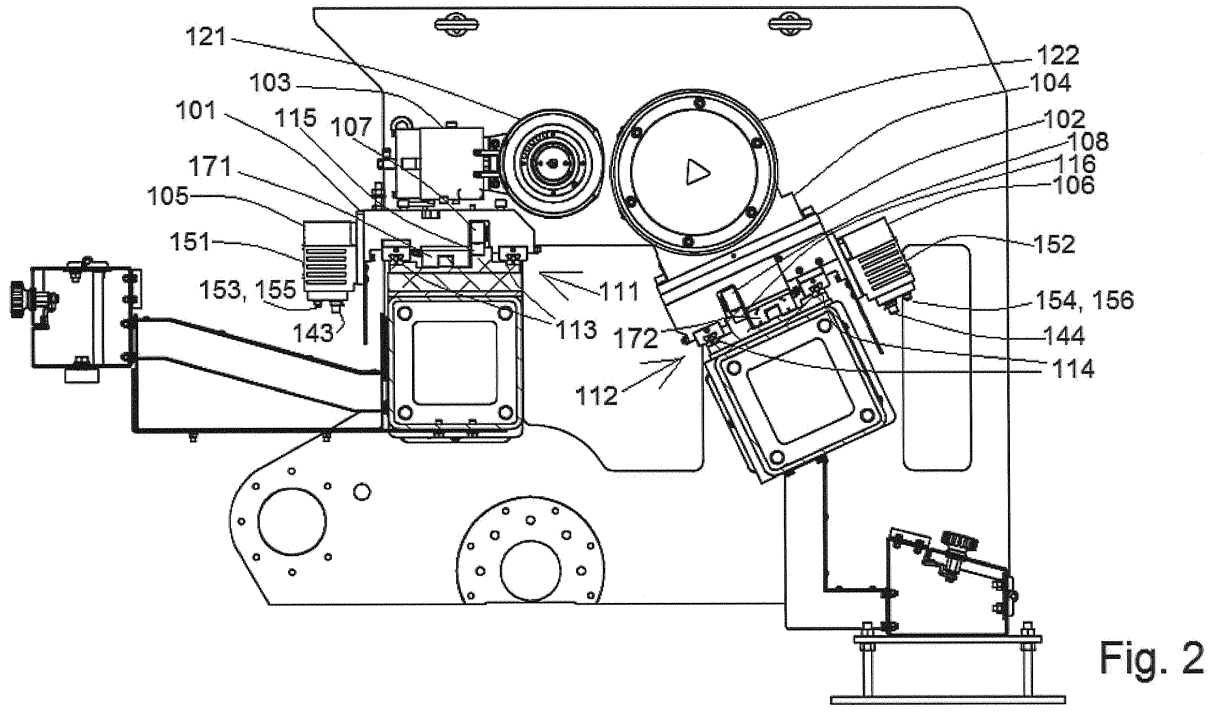

Fig. 2

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Description

TECHNICAL FIELD

[0001] The invention relates to a machine for cutting a moving elongated web of paper or nonwoven fabric, the machine comprising a plurality of movable first cutting members each arranged for cutting the web along the direction of movement of the web, each first cutting member being movable along a first guiding arrangement extending transversely to the web movement direction and in parallel to a lateral extension of the web.

BACKGROUND

[0002] It is known to use cutting units, which may also be referred to as slitters, in converting machines for paper and nonwoven materials. The cutting units, which may be provided in a relatively large number, e.g. fifty, are arranged in a row transversely to a moving paper web in order to cut or shear the web into a plurality of strips. Each cutting unit may each include a pair of cutting members, each with a circular rotating knife, each held by a carrier. In operation, the knives in each pair overlap each other similarly to the blades of a scissor. One of the knives may be driven by a motor or the like and the other knife may be idle and driven by contact with the motor-driven knife. The distances between adjacent knife pairs along the row of cutting units determine the width of the strips that are being cut. The width of the knife carriers determines the smallest width that can be cut.

[0003] From time to time, the cutting units must be moved such that the distances between at least some of the units are changed. The reason could be that the width of the strips being cut must be changed, for example when there is a change in production from one product to another. Thereby, since the width of each strip is usually the same across the web, each of the cutting units may be moved a respective distance which is different from the respective distance over which each of the other cutting units are moved. Another reason for moving cutting units could be a need to service or replace one or a few of the cutting members, entailing the need to move other cutting members to create access, e.g. for a service person. Changing the position of cutting units or cutting members one by one is a time-consuming process, e.g. taking 15-20 minutes, during which the production is halted, which is costly.

[0004] US5125301A describes a system for positioning of cutting units, including carriages holding shearing tools in an array transverse to a longitudinally-moving web of paper. The system includes an endless steel drive band, and the carriages each have clutches for selectively engaging or disengaging the band so that the carriages can be moved relative to each other or simultaneously by the band. However, in practice the clutches cannot be engaged and released while the band is moving. Since all carriages use the same band for moving, this means that when a plurality of carriages are moved different distances, e.g. when changing from one web strip width to another, all carriages have to be stopped to allow a single of the carriages to be engaged to, or released from the band. Since a cutting machine often presents a large number of cutting units, the known solution may require a single carriage to stop and start a lot of times before reaching its final position. This adds a lot of time to the cutting unit moving operation, and reduces the time in which the machine is in production, which is costly for the operator.

[0005] In addition, the known solution with band driven cutting units provides for complicated interventions at machine service procedures, e.g. involving the removal or exchange of cutting units.

SUMMARY

[0006] An object of the invention is to facilitate the operation of machines for cutting moving webs of paper and non-woven materials into strips. Another object of the invention is to facilitate changing the positions of cutting members in machines for cutting moving webs of paper and non-woven materials into strips.

[0007] The objects are reached with a machine for cutting a moving elongated web of paper or nonwoven fabric, the machine comprising a plurality of movable first cutting members each arranged for cutting the web along the direction of movement of the web, each first cutting member being movable along a first guiding arrangement extending transversely to the web movement direction and in parallel to a lateral extension of the web, characterized in that each of at least a plurality of the first cutting members comprises a motor arranged to drive the respective first cutting member along the first guiding arrangement.

[0008] Since each of at least a plurality of the first cutting members comprises a motor arranged to drive the respective first cutting member along the first guiding arrangement, the movement and positioning of each motorized first cutting member may be done by individual control of the respective motor. Thereby, the time consuming requirement in the known band and clutch based cutting unit movement solution described above, of stopping all cutting units while others are engaged or disengaged, can be avoided. For example, a move of one or more of the first cutting members, herein also referred to as primary first cutting members, may be initiated, and while said move is undertaken, a move of one or more additional first cutting members, herein also referred to as secondary first cutting members, may be initiated, without stopping the movement of the primary first cutting members. Similarly, while a move of one or more primary first cutting members is undertaken, a move of one or more secondary first cutting members may be terminated, without stopping the movement of the primary first cutting members. This will provide substantial time saving for a cutting unit movement operation, which may involve moving fifty or more cutting units along different

respective distances.

[0009] In addition, the invention provides for simplified interventions at machine service procedures, e.g. involving the removal or exchange of individual cutting members, due to the absence of any common device, such as a belt, for driving the cutting members.

[0010] The motors of the first cutting members may be provided in any suitable form, such as electric motors, e. g. brushless motors such as step motors.

[0011] Preferably, each of all of the movable first cutting members comprises a motor. It is conceivable however, that less than all of the movable first cutting members comprises a motor. For example, every other first cutting member may comprise a motor and intermediate cutting members may be provided without a motor arranged to drive the respective first cutting member along the first guiding arrangement. Thereby, motorized cutting members may be arranged to push adjacent non-motorized cutting members along the first guiding arrangement.

[0012] The first cutting members may form an array of cutting members along the first guiding arrangement. In some embodiments there may be a cutting member which is permanently fixed in relation to the guiding arrangement, e.g. at an end of the array of first cutting members.

[0013] Preferably, the machine comprises a plurality of movable second cutting members, the first cutting members each comprising a first knife, the second cutting members each comprising a second knife, the first and second cutting members being adapted to form pairs in which the first and second knives are adjacent to each other and cooperate for the cutting of the web, each second cutting member being movable along a second guiding arrangement extending in parallel with the first guiding arrangement, wherein each of at least a plurality of the second cutting members comprises a motor arranged to drive the respective second cutting member along the second guiding arrangement. The second cutting members may form an array of cutting members along the second guiding arrangement. The pairs of first and second cutting members are herein also referred to as cutting units.

[0014] The first knives may be provided in the form of rotatable knives. Each first knife may be rotatably mounted to a carrier of the respective first cutting member, whereby the first knife is rotatable around an axis extending transversely to the web movement direction and in parallel to the lateral extension of the web. Similarly, the second knives may be provided in the form of rotatable knives. Each second knife may be rotatably mounted to a carrier of the respective second cutting member, whereby the second knife is rotatable around an axis extending transversely to the web movement direction and in parallel to the lateral extension of the web. It is understood that the first and second cutting members are preferably located on opposite sides of an intended path of the moving web. The first and second knives in each pair of first and second cutting members may cooperate for the cutting of the web moving between the first and second cutting members, similarly to the legs of a pair of scissors. One of the first and second knives in each pair may be driven by a motor or the like, and the other knife may be idle and driven by contact with the motor-driven knife.

[0015] Similarly to the first cutting members, each of all of the movable second cutting members may comprise a motor. It is conceivable however, that less than all of the movable second cutting members comprises a motor. For example, every other second cutting member may comprise a motor, and intermediate second cutting members may be provided without a motor arranged to drive the respective second cutting member along the second guiding arrangement. Thereby, motorized cutting members may be arranged to push adjacent non-motorized cutting members along the second guiding arrangement.

[0016] It should be noted that it is possible to implement the invention such that when the cutting members are placed with a minimum distance between them, a relatively short distance is provided between the knives of the adjacent cutting units, e.g. 50 mm.

[0017] The first guiding arrangement may comprise one or more rails extending transversely to the web movement direction and in parallel to the lateral extension of the web. Similarly, the second guiding arrangement may comprise one or more rails extending transversely to the web movement direction and in parallel to the lateral extension of the web. Such a rail may engage with the first or second cutting members and serve to guide them along the first or second guiding arrangement.

[0018] The motors of the motorized first cutting members may each be arranged to drive one or more wheels, and each wheel may be arranged to engage with a wheel engagement arrangement of the first guiding arrangement. Similarly, the motors of the motorized second cutting members may each be arranged to drive one or more wheels, and each wheel may be arranged to engage with a wheel engagement arrangement of the second guiding arrangement. The engagement may be a friction engagement. The wheel engagement arrangement may comprise at least one flat surface extending transversely to the web movement direction and in parallel to the lateral extension of the web. In some embodiments, the engagement may be a teeth engagement. Thereby, the at least one wheel may be at least one gear wheel, and the wheel engagement arrangement may comprise at least one row of teeth extending transversely to the web movement direction and in parallel to the lateral extension of the web. Thus, each motorized first or second cutting member may move along the rail(s) of the first or second guiding arrangement when the wheel(s) is(/are) rotated by the motor.

[0019] Embodiments of the invention are useful for paper, such as tissue paper, or nonwoven materials, e.g. where the end product is diapers and where the need to

change the width of the web occurs within relatively short time intervals.

[0020] Each first cutting member may be fixable to the first guiding arrangement. The motor of the respective first cutting member may be arranged to keep the first cutting member in position when it is not being moved. In addition or alternatively, each second cutting member may be fixable to the second guiding arrangement. The motor of the respective second cutting member may be arranged to keep the second cutting member in position when it is not being moved.

[0021] Alternatively or in addition, each of the first cutting members may comprise a locking mechanism arranged to lock the respective first cutting member to the first guiding arrangement. Preferably, each of the second cutting members also comprises a locking mechanism arranged to lock the respective second cutting member to the second guiding arrangement. Each locking mechanism may be provided in any suitable manner, for example as a pneumatic piston arranged to engage a surface or a cavity of the guiding arrangement, and thereby lock the cutting member in the desired position, e.g. by friction or by mechanical engagement. By the locking mechanism it may be assured that the respective cutting member is secured to its position during operation of the machine.

[0022] Preferably, the machine comprises a central control unit, and each first cutting member comprising a motor comprises a control device arranged to control the respective motor, the control device being arranged to receive data signals from the central control unit, which signals are indicative of desired first cutting member movements and/or positions. Similarly, each second cutting member comprising a motor may comprise a control device arranged to control the respective motor, the control device being arranged to receive data signals from the central control unit, which signals are indicative of desired second cutting member movements and/or positions.

[0023] It is understood that the central control unit may be an electronic control unit. The central control unit may serve as a master in a control system for the machine. Each control device of the first cutting members may be provided as a distributed control device. Each control device may serve as a slave in a control system for the machine.

[0024] Preferably, the respective control device is arranged to send to the control unit signals indicative of the position of the respective first or second cutting member. Thereby, the respective cutting member may comprise a position sensor or a position calculator, and the signals from the control device to the control unit may be based on signals from the position sensor or calculator.

[0025] Preferably, the machine comprises a first data bus connecting the control unit to the control devices of the first cutting members. Similarly, the machine may comprise a second data bus connecting the control unit to the control devices of the second cutting members.

[0026] Preferably, the first data bus comprises a plurality of flexible data communication wires, each of at least a plurality of the wires extending from one of the first cutting members to another of the first cutting members, whereby the wire is arranged to provide data communication between the control devices of the first cutting members between which the wire extends. Similarly, the second data bus may comprise a plurality of flexible data communication wires, each of at least a plurality of the wires extending from one of the second cutting members to another of the second cutting members, whereby the wire is arranged to provide data communication between the control devices of the second cutting members between which the wire extends. The first or second cutting members, between which the wires extend, are preferably adjacent in the array of first or second cutting members.

[0027] Such interconnecting wires provide flexibility allowing relative movements between cutting members while securing data traffic between them. The wires may be connected to the control devices via suitable interfaces.

[0028] In some embodiments, each motorized cutting member has a plurality of interfaces: A first interface may be adapted to receive an end of one of said interconnecting wires. A second interface may be adapted to receive an end of another of said interconnecting wires. The wires connected to the first and second interfaces of one of the cutting members may, at opposite ends of the wires, be connected to interfaces of cutting members on opposite sides of the one of the cutting members.

[0029] The first interface may be adapted for receiving signals from the control unit, via other control devices forming, together with the interconnecting wires, parts of the first or second data bus. The first interface may also be adapted for sending signals from respective control device to the control unit.

[0030] The second interface may be adapted for receiving and forwarding signals to other control devices. Preferably, the signals received via the first interface are addressed to the receiving control device, or they are addressed and forwarded to another control device in the first or second data bus. Preferably, the signals received via the second interface are addressed to the control unit, and they originate from another control device along the first or second data bus, and are forwarded to the control unit. Preferably, signals received from the control unit are indicative of positioning orders for the receiving cutting member or for another cutting member along the first or second data bus. Preferably, signals sent to the control unit are indicative of a position of the sending cutting member or of another cutting member along the first or second data bus.

[0031] It is understood that in embodiments of the invention, the positioning signal to several different cutting members may advantageously travel through the same wire connections. A large amount of flexibility for the cutting member control may be provided. All of the cutting

members, or a sub-group of the cutting members, may move simultaneously, or the cutting members may move individually. The cutting member moving strategy can be such that a cutting member movement operation may be effected in a short time span. In a practical application, the time to reposition cutting members to change the width of web strips to be cut may be as low as one minute.

[0032] The data traffic in the first and second data buses may be controlled according to any suitable network technology such as a suitable Ethernet version, e.g. Process Field Net (PROFINET), as exemplified below.

[0033] The motorized cutting members may be provided with a third interface adapted for receiving electric power.

[0034] The objects are also reached with a cutting member arranged to be mounted to, and movable along, a guiding arrangement of a machine for cutting a moving elongated web of paper or nonwoven fabric, characterized in that the cutting member comprises a motor arranged to drive the cutting member along the guiding arrangement.

DESCRIPTION OF THE DRAWINGS

[0035] Below embodiments of the invention will be described with reference to the drawings, in which

- fig. 1 is a perspective view of a machine according to an embodiment of the invention,
- fig. 2 is a cross-sectional view oriented as indicated with the arrows II-II in fig. 1, and
- fig. 3 is a top view of a part of the machine in fig. 1 with parts of a control system for the machine.

DETAILED DESCRIPTION OF EMBODIMENTS

[0036] Fig. 1 shows a machine 1 for cutting a moving elongated web of paper or nonwoven fabric, according to an embodiment of the invention. The machine comprises a plurality of movable first cutting members 101, and a plurality of movable second cutting members 102. As described closer below, the first cutting members 101 each comprises a first knife, and the second cutting members 102 each comprises a second knife, the first and second cutting members being adapted to form pairs in which the first and second knives are adjacent to each other and cooperate for the cutting of the web.

[0037] The web movement direction is indicated with the arrow WM. Each first cutting member is movable along, and fixable to, a first guiding arrangement 111 extending transversely to the web movement direction WM and in parallel to a lateral extension of the web, indicated with a double arrow LE. Similarly, each second cutting member 102 is movable along, and fixable to, a second guiding arrangement 112 extending in parallel with the first guiding arrangement 111. The first cutting members 101 form a first array of cutting members along the first guiding arrangement 111, and the second cutting members 102 form a second array of cutting members along the second guiding arrangement 112.

[0038] Reference is made also to fig. 2 showing a pair of first and second cutting members 101, 102. As mentioned, the first cutting members 101 each comprises a first knife 121, and the second cutting members each comprises a second knife 122, whereby the first and second knives are adjacent to each other and cooperate for the cutting of the web.

[0039] The first knife 121 of the first cutting member 101 is provided in the form of a circular, rotatable knife. The first knife 121 is at its center rotatably mounted to a carrier 103 of the respective first cutting member 101. Thereby, the first knife 121 is rotatable around an axis extending transversely to the web movement direction WM (fig. 1) and in parallel to the lateral extension LE of the web. Similarly, the second knife 122 of the first cutting member 101 is provided in the form of a circular, rotatable knife. The second knife 122 is at its center rotatably mounted to a carrier 104 of the respective second cutting member 102. Thereby, the second knife 122 is rotatable around an axis extending transversely to the web movement direction WM (fig. 1) and in parallel to the lateral extension LE of the web.

[0040] It is understood that the first and second cutting members are located on opposite sides of an intended path of the moving web. The first and second knives 121, 122 present at their peripheries respective knife edges for the cutting operation. The second cutting member 102 is provided with an electric motor (not shown) for driving the second knife 122. The first knife 121 is idle and is driven by contact with the second knife 122. Thereby, the first and second knife rotate in opposite directions. The first knife 121 has, compared to the second knife 122, a lower bending stiffness so that it can yield or bend to some extent when the first and second knives 121, 122 are pressed against each other.

[0041] Thereby, the second knife 122 determines the position of the cut in the web provided by the first and second knives 121, 122. This means that minor errors in the positioning of the first knife 121 have no substantial effect on the positioning of the cut.

[0042] It should be noted that the knives 121, 122 of the cutting members 101, 102 may be of some other type suitable for the web cutting operation, such as scoring knives.

[0043] The first guiding arrangement 111 comprises two rails 113, which the first cutting member 101 engages. Further, the rails 113 serve to guide the first cutting member 101 along the first guiding arrangement 111. The second guiding arrangement 112 similarly comprises two rails 114, which the second cutting member 102 engages and which serve to guide the second cutting member 102 along the second guiding arrangement 112.

[0044] Each first cutting member 101 comprises an electric motor 105 arranged to drive the respective first cutting member 101 along the first guiding arrangement 111, and each second cutting member 102 comprises

an electric motor 106 arranged to drive the respective second cutting member 102 along the second guiding arrangement 112.

[0045] The motor 105 of the first cutting member 101 is arranged to drive a wheel 107. The wheel 107 is arranged to engage with a wheel engagement arrangement of the first guiding arrangement, in the form of an elongated ridge 115 with a flat upper surface for a friction engagement of the wheel 107. Similarly, the motor 106 of the second cutting member 102 is arranged to drive a wheel 108. The wheel 108 is arranged to engage with a wheel engagement arrangement of the second guiding arrangement, in the form of an elongated ridge 116 with a flat upper surface for a friction engagement of the wheel 108. Thus, the first and second cutting members 101, 102 may move along the rails 113, 114 when the wheels 107, 108 are rotated by the motors 105, 106.

[0046] Each of the first and second cutting members 101, 102 presents an interface (not shown) for pressurized air provided via flexible conduits, for pneumatic functions as described below.

[0047] The first cutting member 101 comprises a locking mechanism 171 arranged to lock the first cutting member to the first guiding arrangement 111, and the second cutting member 102 comprises a locking mechanism 172 arranged to lock the second cutting member to the second guiding arrangement 112. Each locking mechanism 171, 172 comprises a pneumatically activatable piston which is arranged to engage a locking rail of the respective guiding arrangement. By the locking mechanisms it may be assured that the cutting members are secured to their positions during operation of the machine.

[0048] It is understood that the width of the cutting members 101, 102 will determine the minimum width of the strips to be cut from the web. For example, where it is desired to allow the production of strips with a width of 50 mm, the cutting members should be slightly narrower, e.g. 49 mm.

[0049] Reference is made also to fig. 3. The machine comprises an electric power source 140 for the motors 105, 106 for the movement of the cutting members 101, 102, and also for the motors for the rotation of the knives of the first cutting members 101. The power source 140 comprises a connection to an electricity network, and suitable current and voltage transformation equipment. The cutting members 101, 102 are connected to the power source via power cables 141, 142 and power interfaces 143, 144 (fig. 2) at the cutting members 101, 102, herein also referred to as third interfaces.

[0050] The machine further comprises a control system comprising a central electronic control unit 150 (fig. 3). Each first cutting member 101 comprises a control device 151 (fig. 2) arranged to control the respective motor 105. Similarly, each second cutting member 102 comprises a control device 152 (fig. 2) arranged to control the respective motor 106.

[0051] The control system of the machine further comprises a first data bus connecting the control unit 150 to the control devices 151 of the first cutting members 101, and a second data bus connecting the control unit 150 to the control devices 152 of the second cutting members 102. The first data bus comprises a plurality of flexible data communication wires 157, each of the wires 157 extending from one of the first cutting members 101 to an adjacent of the first cutting members 101, whereby the wire 157 is arranged to provide data communication between the control devices 151 of the first cutting members 101 between which the wire 157 extends. Similarly, the second data bus comprises a plurality of flexible data communication wires 158, each of the wires 158 extending from one of the second cutting members 102 to an adjacent of the second cutting members 102, whereby the wire 158 is arranged to provide data communication between the control devices 152 of the second cutting members 12 between which the wire 158 extends.

[0052] As can be seen in fig. 3, a further wire 161 or another suitable electrically conducting element is arranged to connect the control device of a first cutting member 101, at an end of the array of first cutting members 101, to the control unit 150. Similarly, a further wire 162 or another suitable electrically conducting element is arranged to connect the control device of a second cutting member 102, at an end of the array of second cutting members 102, to the control unit 150.

[0053] As indicated in fig. 2, the cutting members 101, 102 each comprises a first interface 153, 154. The first interfaces 153, 154 of the cutting members 101, 102 located closest to the control unit 150 are adapted to receive an end of the respective further wire 161, 162. The first interfaces 153, 154 of the remaining cutting members 101, 102 are each adapted to receive an end of one of said interconnecting wires 157, 158. In addition, the cutting members 101, 102, except for the cutting members which are located at an end of the first array, which is opposite to the end at which the control unit 150 is connected, each comprises a second interface 155, 156 adapted to receive an end of another of said interconnecting wires 157, 158. Thereby, the wires 157, 158 connected to the interfaces 153, 155 of a particular cutting member 101, 102 are at opposite ends of the wires 157 connected to interfaces of adjacent cutting members on opposite sides of the particular cutting member.

[0054] Thus, the first and second data buses each presents a sequence of the control devices 151, 152 of the first and second cutting members 101, 102, respectively, and the interconnecting wires 157, 158. Thereby, the control unit 150 and the respective further wire 161, 162 are at one end of the first and second data buses, respectively. The first interfaces of the cutting members 101, 102 that are in the sequences of the data buses closest to the control unit 150 are adapted for receiving signals directly from, or sending signals directly to the control unit 150. Each of the remaining first interfaces 153, 154 is adapted for receiving signals from, and sending signals to the control unit 150, via one or more other

control devices 151, 152. The second interfaces 155, 156 are adapted for receiving signals from and forwarding signals to other control devices.

[0055] The central control unit 150 serves as a master in the control system of the machine, and each control device 151, 152 serves as a slave in the control system. The signals sent through the first and second data buses are provided in the form of data packets according to a suitable data packet format or data packet protocol. The data traffic in the first and second data buses may be controlled according to any suitable network technology, such as a suitable Ethernet version, e.g. Process Field Net (PROFINET).

[0056] Each control device 151, 152 has its own address in the control system. Each control device 151, 152 is arranged to read at least portions of data packets sent through the respective of the first and second data bus, and identify data packets that are addressed to the respective control device. Thus, data packets received via the first interface 153, 154 may be addressed to the receiving control device 151, 152, or they may be addressed and forwarded to another control device in the first or second data bus. Signals in the data packet format received by the control devices 151, 152 from the control unit 150 are indicative of desired first and second cutting member movements and/or positions. Each control device 151, 152 is arranged to control the respective motor 105, 106 based on the movement and/or position instructions in the data packets addressed to the respective control device. Thereby individual motor control is provided with the first and second data buses.

[0057] Signals in the data packet format, received via the second interface 155, 156 are addressed to the control unit 150; they originate from a control device 151, 152 elsewhere along the first or second data bus, and they are forwarded to the control unit 150. The respective control device 151, 152 is arranged to send to the control unit 150 data packets indicative of the position of the respective first or second cutting member 101, 102. For this, the respective cutting member 101, 102 comprises a position sensor or a position calculator (not shown), and the data packets from the control device 151, 152 to the control unit 150 are based on signals from the position sensor or calculator.

[0058] A method of controlling the cutting members 101, 102 may be exemplified as follows.

[0059] In the example, the strips to be cut from the web are to be increased from a first width to a second width which is larger than the first width. The method comprises the control unit 150 registering the positions of the cutting members 101, 102 based on signaling as described above. The method further comprises moving the first knives 121 away from the second knives 122, whereby the first and second knives 121, 122 are moved out of their engagement with each other, and whereby a gap is presented between the first and second cutting members. For this movement, the first knives are arranged to be pneumatically actuated so as to move in relation to their respective carriers 103. More specifically, the first knives 121 are first moved a relatively short distance along the rotational axis of the respective first knife and away from the respective second knife 122. Thereupon, the first knives 121 are moved laterally to their respective rotational axis and further away from the second knives 122 whereby a gap as seen in the view of fig. 2 is created between the first and second knives 121, 122.

[0060] Thereupon, at least a sub-group of the first cutting members 101 are moved by means of the respective motors 105 so as to increase the distances between adjacent first cutting members. Each moving first cutting member 101 moves according to signals addressed to the respective first cutting member as described above. Thereby, the control devices 151 of the first cutting members 101 are arranged to control the respective motors 105.

[0061] As the first cutting members 101 are moved to their new positions, the second cutting members 102 are moved simultaneously by means of their respective motor 106, whereby the first and second cutting members 101, 102 of each pair of first and second cutting members 101, 102 move together along the guiding arrangements. During this movement, the distance between the first and second cutting members 101, 102 of each pair of first and second cutting members 101, 102 is substantially constant.

[0062] As mentioned, pairs of first and second cutting members 101, 102 are herein also referred to as cutting units. In the procedure described above, a move of one or more of the cutting units 101, 102, herein also referred to as primary cutting units, may be initiated, and while said move is undertaken, a move of one or more additional cutting units 101, 102, herein also referred to as secondary cutting units, may be initiated, without stopping the movement of the primary cutting units. Similarly, while a move of one or more primary cutting units is undertaken, a move of one or more secondary cutting units may be terminated, without stopping the movement of the primary cutting units.

[0063] The control unit is arranged, based on the information about the positions of the cutting members, to control the movements of the cutting members so as to avoid interference between the cutting members. For example, if two adjacent cutting members are to be moved in the same direction, the cutting member that is farthest ahead in the intended movement direction may have to be moved simultaneously with or before the other of the adjacent cutting members so that a collision is avoided.

[0064] In alternative embodiments, the first and second cutting members in each pair of first and second cutting members can be moved sequentially. For example, when the first cutting members 101 have been moved to their new positions, the second cutting members 102, forming respective pairs with the moved first cutting members 101, are moved along the second guiding arrangement 112, so that each moving second cutting member comes close to the respective first cutting mem-

ber 101 with which it forms a pair.

[0065] Once the movements by means of the motors 105, 106 have been completed, a distance, as seen along the guiding arrangements 111, 112, is left between the first and second knives 121, 122 in each pair of first and second cutting members 101, 102. The first knives 121 are moved pneumatically in relation to their respective carriers 103 so as to close the gap between the first and second knives 121, 122. Thereby the first and second knives 121, 122 in each pair of first and second cutting members 101, 102 overlap as seen along the guiding arrangements 111, 112. Subsequently, the first knives 121 are moved pneumatically in relation to their respective carriers 103 along the second guiding arrangement 112 so that each first knife 121 is moved into engagement with the respective second knife 122 in the respective pair of first and second cutting members 101, 102.

[0066] In the procedure described above, the web may or may not be present between the first and second cutting members 101, 102. In some embodiments, the first and second knives 121, 122 may stay engaged with each other and with the moving web, while the cutting members 101, 102 are moved along the guiding arrangements; such a procedure may be referred to as a web-in procedure.

[0067] It should be noted that changing the width of the strip to be cut from the web may, in addition to moving cutting members along the guiding arrangements, involve moving the knives in some of the pairs of cutting members away from the web, so that such cutting member pairs do no participate in the cutting procedure. Cutting members may also be removed from the machine, where the width of the strips are to be increased.

Claims

1. A machine for cutting a moving elongated web of paper or nonwoven fabric, the machine comprising a plurality of movable first cutting members (101) each arranged for cutting the web along the direction of movement (WM) of the web, each first cutting member (101) being movable along a first guiding arrangement (111) extending transversely to the web movement direction and in parallel to a lateral extension (LE) of the web, **characterized in that** each of at least a plurality of the first cutting members (101) comprises a motor (105) arranged to drive the respective first cutting member (101) along the first guiding arrangement (111).

2. A machine according to claim 1, further comprising plurality of movable second cutting members (102), the first cutting members (101) each comprising a first knife (121), the second cutting members (102) each comprising a second knife (122), the first and second cutting members (101, 102) being adapted to form pairs in which the first and second knives (121, 122) are adjacent to each other and cooperate for the cutting of the web, each second cutting member (102) being movable along a second guiding arrangement (112) extending in parallel with the first guiding arrangement (111), wherein each of at least a plurality of the second cutting members (102) comprises a motor (106) arranged to drive the respective second cutting member (102) along the second guiding arrangement (112).

3. A machine according to any one of the preceding claims, wherein the first guiding arrangement (111) comprises one or more rails (113) extending transversely to the web movement direction (WM) and in parallel to the lateral extension (LE) of the web.

4. A machine according to any one of the preceding claims, wherein the motors (105) of the first cutting members (101) are each arranged to drive one or more wheels (107), wherein each wheel (107) is arranged to engage with a wheel engagement arrangement (115) of the first guiding arrangement (111).

5. A machine according to any one of the preceding claims, wherein each of the first cutting members (101) comprises a locking mechanism (171) arranged to lock the respective first cutting member (101) to the first guiding arrangement (111).

6. A machine according to any one of the preceding claims, wherein the machine comprises a central control unit (150), and each first cutting member (101) comprising a motor (105) comprises a control device (151) arranged to control the respective motor (105), the control device (151) being arranged to receive data signals from the central control unit (150), which signals are indicative of desired first cutting member (101) movements and/or positions.

7. A machine according to claim 6, wherein the respective control device (151) is arranged to send to the control unit (150) signals indicative of the position of the respective first cutting member (101).

8. A machine according to any one of claims 6-7, comprising a first data bus (151, 157, 161) connecting the control unit (150) to the control devices (151).

9. A machine according to claim 8, wherein the first data bus (151, 157, 161) comprises a plurality of flexible data communication wires (157), each of at least a plurality of the wires (157) extending from one of the first cutting members (101) to another of the first cutting members (101), whereby the wire (157) is arranged to provide data communication between the control devices (151) of the first cutting members (101) between which the wire (157) extends.

10. A cutting member (101, 102) arranged to be mounted to, and movable along, a guiding arrangement (111, 112) of a machine for cutting a moving elongated web of paper or nonwoven fabric, **characterized in that** the cutting member (101, 102) comprises a motor (105, 106) arranged to drive the cutting member (101, 102) along the guiding arrangement (111, 112).

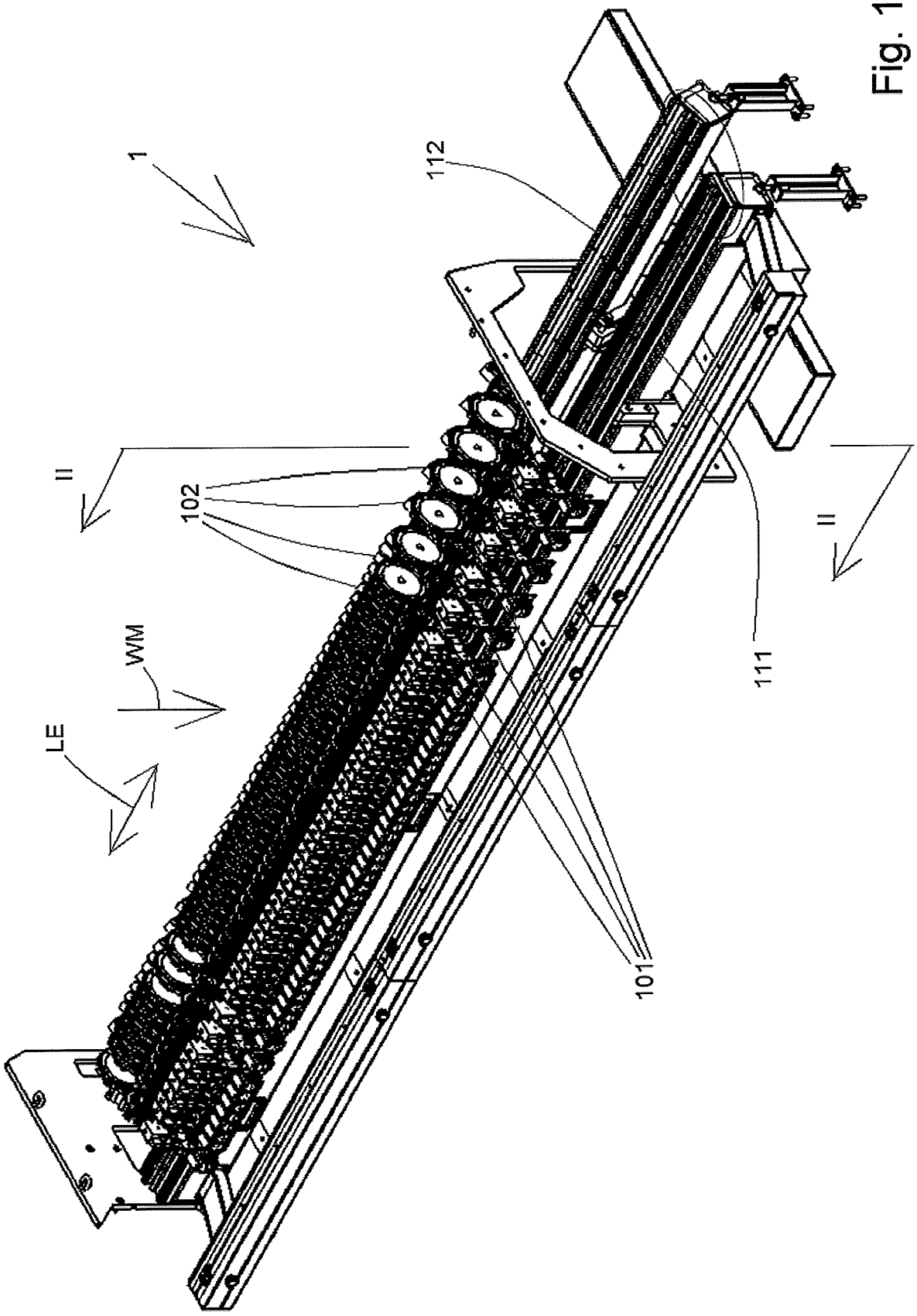

Fig. 1

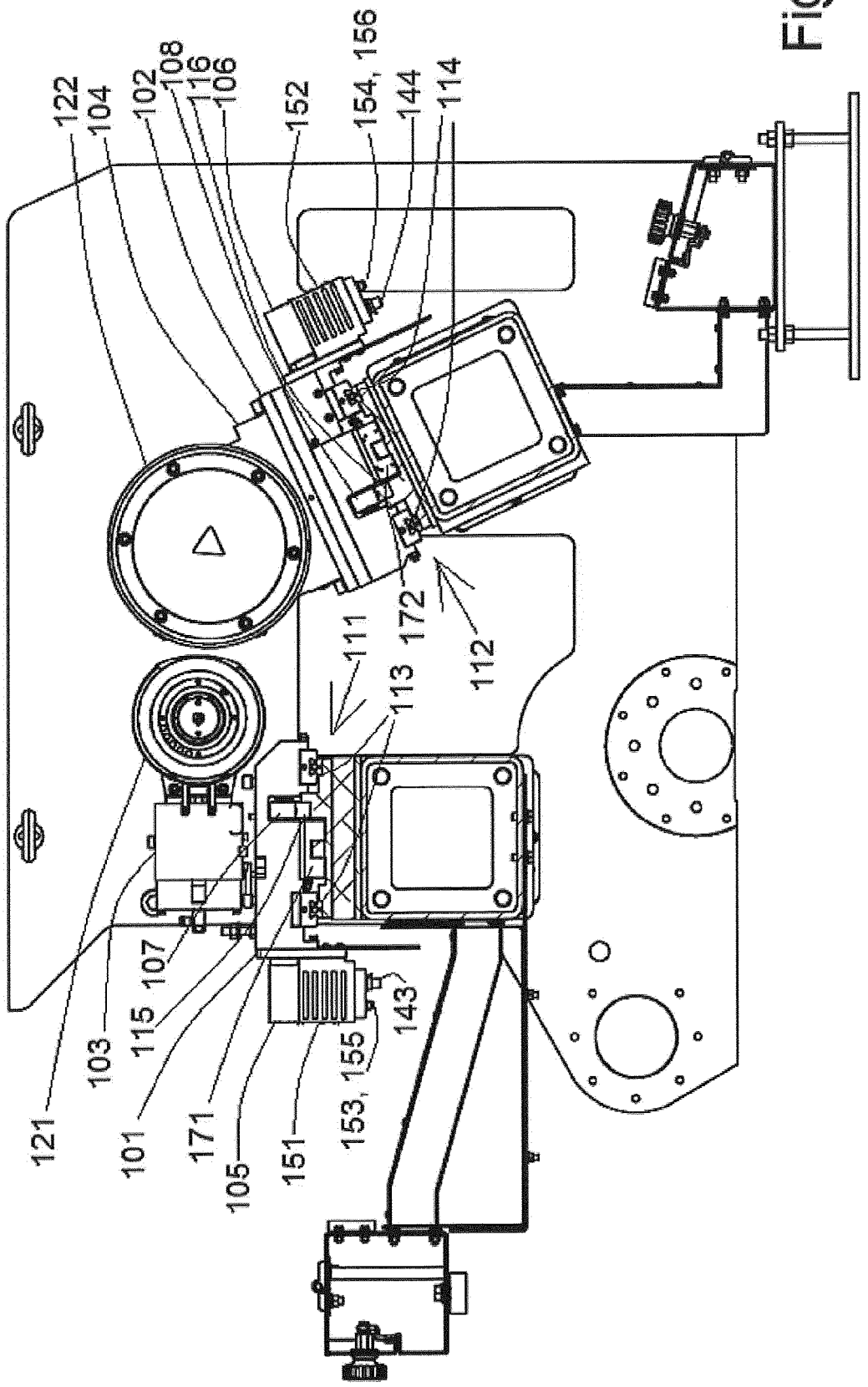
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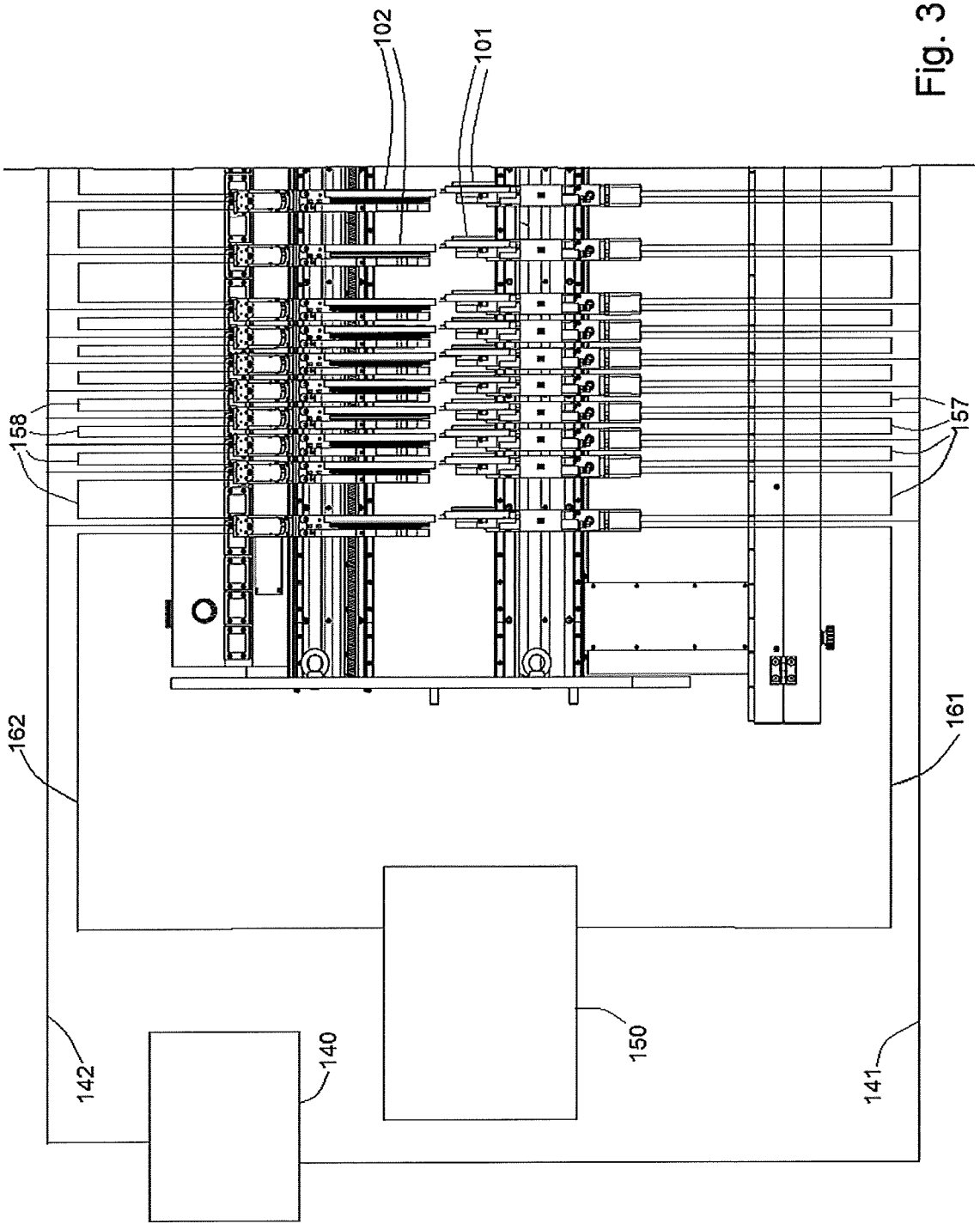
Fig. 2

Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 3037

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	GB 2 088 093 A (BELOIT CORP) 3 June 1982 (1982-06-03) * page 1 - page 4; figures 1-8 *	1-10	INV. B26D7/26 B26D5/00 B26D1/24
X	EP 1 997 596 A1 (TIDLAND CORP [US]) 3 December 2008 (2008-12-03)	1,3-10	B26D1/18
A	* paragraph [0064] - paragraph [0103]; figures 2-6 *	2	
X	US 2014/121085 A1 (KWARTA BRIAN J [US] ET AL) 1 May 2014 (2014-05-01)	1,3-10	
A	* paragraph [0058] - paragraph [0149]; claims 1-6; figures 2-6 *	2	

TECHNICAL FIELDS SEARCHED (IPC)

B26D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 September 2017	Maier, Michael

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-09-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2088093 A	03-06-1982	CA 1177147 A	30-10-1984
		DE 3144714 A1	01-07-1982
		GB 2088093 A	03-06-1982
		JP S57136204 A	23-08-1982
EP 1997596 A1	03-12-2008	EP 1997596 A1	03-12-2008
		ES 2564308 T3	21-03-2016
		US 2008295664 A1	04-12-2008
		US 2011303063 A1	15-12-2011
US 2014121085 A1	01-05-2014	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5125301 A **[0004]**