(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 680 203 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.07.2020 Bulletin 2020/29

(51) Int Cl.:
B65H 18/26 *(2006.01)* ***B65H 19/22*** *(2006.01)*
B65H 19/30 *(2006.01)*

(21) Application number: **19219509.7**

(22) Date of filing: **23.12.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **09.01.2019 IT 201900000241**

(71) Applicant: **Toscotec S.p.a.**
55012 Capannori (LU) (IT)

(72) Inventor: **Dettori, Andrea**
I-55100 Lucca (IT)

(74) Representative: **Mincone, Antimo**
Viale Europa 101
50126 Firenze (IT)

(54) WINDING MACHINE FOR FORMING REELS OF WEB-LIKE MATERIALS

(57) Winding machine for forming reels of web-like material, comprising a winding roller (1) on which the web-like material intended to be wound passes, wherein the winding roller (1) cooperates with a winding rod (2) on which the web-like material winds up to form a reel (B), wherein the winding roller (1) is positioned in a structure (3) provided with sides (30) on which two corresponding linear guides (31) are formed parallel to each other and oriented according to a predetermined direction (L) which defines a direction of advancement of the winding rod (2) while the respective reel (B) is forming on the rod itself, wherein the winding roller (1) is oriented transversely to said sides, wherein the machine (M) is served by a storage (32) in which several winding rods (2) can be stored and by a mechanism of removal of the rods (2) from the storage (32), and wherein said mechanism of removal of the rods comprises a pair of arms (45) each of which is arranged on a corresponding side of the machine. Each of said arms (45) consists of two elements (4, 5) hinged to each other with a hinge axis (A45) parallel to the rotation axis (1A) of the winding roller (1), an element (5) being hinged on one side of the machine with a hinge axis parallel to the axis (1A) of the winding roller (1), the other element (4) being provided with gripping means (42) adapted to engage a corresponding end (20) of a rod (2) on the storage (32), and to move it towards the winding roller (1) and along a pre-determined path (T) with a section parallel to the outer surface of the winding roller (1).

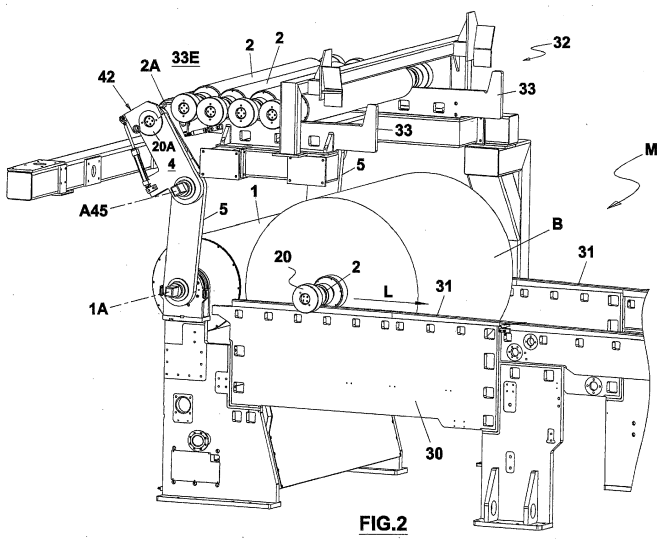

FIG.2

EP 3 680 203 A1

Description

[0001] The present invention relates to a machine for winding web-like materials.

[0002] In various industrial fields web-like materials are packaged in the form of reels obtained by winding the web-like materials on suitable rods that act as supports during the winding. When a reel has been completed, its rod is removed for reuse. The web-like materials wound as reels are generally intended to undergo different transformations according to the specific applications and they can be, for example, paper or non-woven fabric. The transformations can include, for example, the unwinding and a new rewinding of the material in order to produce rolls with a diameter smaller than that of the starting reels, intermediate embossing operations between the unwinding and the subsequent rewinding, the transversal cutting of the rolls to obtain products of axial length shorter than that of the starting reel, etc. The machines by which the winding is carried out are generally called "winders" and they typically include a structure that allows the web-like material to pass over a winding roller against which the rod on which the reel is formed is pushed. The reel, during its formation, is kept in contact with the winding roller due to the thrust exerted through the rod which, in turn, is held by suitable supports allowing it to be translated along the guides formed in the aforementioned structure. Cyclically, when a reel is completed, i.e. it has a diameter of a predetermined value, the web-like material is interrupted, the completed reel is distanced from the winding roller moving it to an unloading station while it is still on the relative winding rod, and another winding rod is positioned on the winding roller to form a new reel.

[0003] The winding rods are generally stored in a superstructure of the machine in a position above the winding roller. It is therefore necessary to provide a mechanism for removing the winding rods from the storage point and positioning them in the area of the machine where the reels are formed.

[0004] US4744526A discloses a machine for winding web-like material in the form of reels, comprising a winding roller on which the web-like material intended to be wound passes, wherein the winding roller cooperates with a winding rod on which the web-like material is wound to form a reel, wherein the winding roller is positioned in a corresponding containment structure, wherein the winding roller is oriented transversely to said structure, and wherein the machine is served by a storage in which several winding rods can be stored and by a mechanism for removing the rods from said storage. The pick-up mechanism of the rods consists of a pair of pick-up arms, with one arm on each side of the aforementioned structure. The pick-up arms are rotatably mounted around the axis of the winding roller and are actuated by an actuator, arranged on the lower part of the winding roller containment structure, by means of two connecting levers, with a first lever that is hinged on one side to the actuator stem and on the other side to the second lever while in the centre it is hinged to said structure in a position spaced from the axis of the winding roller, and a second lever that is hinged on one side to the first lever and on an opposite side to a rear appendix of the respective pick-up arm. When the two pick-up arms are rotated around the axis of the winding roller, there is a phase in which the rods thus picked up are moved parallel to the outer surface of the winding roller. The pick-up mechanism described in US4744526 determines machine dimensions that are incompatible with the current production needs which increasingly aim at reducing the space required for the installation of these machines.

[0005] US4768730A also discloses a machine for winding web-like materials in the form of reels, comprising a winding roller over which the web-like material intended to be wound passes, wherein the winding roller cooperates with a winding rod on which the web-like material is wound to form a reel, wherein the winding roller is positioned in a corresponding containment structure, wherein the winding roller is oriented transversely to said structure, and wherein the machine is served by a storage in which several winding rods can be stored and a mechanism for removing the rods from said storage. The mechanism for picking up the rods from the storage consists of several distinct groups of arms which exchange with each other the rods taken from the storage in such a way that each arm is intended to perform a specific operation: a first arm picks up the rods and delivers them to a second arm, the second arm receives the rods from the first arm and subsequently delivers them to a third arm which, in turn, moves them parallel to the winding roller to start a winding cycle. Also in this case, the problems relating to the spaces required for the installation and operation of the machine remain unresolved. EP0849202A1 also discloses a machine for winding web-like materials in the form of reels, comprising a winding roller over which the web-like material intended to be wound passes, wherein the winding roller cooperates with a winding rod on which the web-like material is wound to form a reel, wherein the winding roller is positioned in a corresponding containment structure, wherein the winding roller is oriented transversely to said structure, and wherein the machine is served by a storage in which several winding rods can be stored and a mechanism for removing the rods from said storage. Also in this case the picking of the rods from the storage is managed by means of arms which are distinct from those which move the rods around the winding roller.

[0006] The present invention relates, in particular, to the removal of the winding rods from the respective storage point and to their movement during the winding of the web material and it aims at providing a system for controlling the winding rods that is structurally simple, precise, reliable and more compact than the known pick-up mechanisms.

[0007] This result has been achieved, in accordance with the present invention, by adopting the idea of making a machine having the features indicated in claim 1. Other

features of the present invention are the subject of the dependent claims.

[0008] Thanks to the present invention, it is possible to realize a machine for winding web-like materials which ensures an improved continuity in the growth of the diameter of the reels progressively formed and a remarkable precision in positioning the rods in correspondence with the winding roller without however involving a particular mechanical complexity. Furthermore, a system for picking up and positioning the rods in a machine in accordance with the present invention allows to control the nip pressure at the winder roller/reel interface and offers the possibility of improving the control of the movement of the reels towards the parking point of the finished rolls.

[0009] These and further advantages and characteristics of the present invention will be more and better understood by each person skilled in the art thanks to the description that follows and the annexed drawings, provided by way of example but not to be considered in a limiting sense, in which:

- Fig.1 represents a schematic perspective view of an arm for moving the winding rods in a machine in accordance with a possible example of embodiment of the present invention;
- Figs. 2-5 schematically represent a machine in accordance with a possible embodiment of the present invention in different production phases of a reel of web material, with machine parts not shown to better highlight others;
- Fig.6 schematically represents a machine according to a further embodiment of the present invention;
- Fig. 7 represents a schematic plan view of a rod;
- Figs. 8 and 9 show a further example of embodiment of a machine in accordance with the present invention;
- Fig.10 is a simplified block diagram relating to a possible configuration of a control system for the movements of the arms in accordance with the present invention;
- Fig.11 represents a schematic perspective view of an arm for moving the winding rods in a machine in accordance with another example of embodiment of the present invention;
- Fig. 12 schematically represents a machine in accordance with another example of embodiment of the present invention which foresees the use of the arm of Fig. 11.

[0010] Reduced to its essential structure and with reference to the attached drawings, a machine (M) in accordance with the present invention comprises a winding roller (1) on which the web-like material intended to be wound is made to pass. The winding roller (1) cooperates with a winding rod (2) on which the web-like material is wound to form a reel (B). The winding roller (1) is positioned in a structure (3) provided with sides (30) on which two corresponding linear guides (31) are formed parallel to each other and oriented according to a predetermined direction (L) which defines a direction of advancement of the winding rod (2) while the respective reel (B) is forming on the same rod. The winding roller (1) is oriented transversely to said sides, so that its rotation axis (1A) is horizontal. The machine is served by a storage in which several winding rods (2) can be stored and by a mechanism for removing the rods (2) from the storage (S). The rods (2), according to a configuration known per se, have ends (20) adapted to be gripped by a gripping device. In practice, the rods (2) have a central cylindrical body (21) which is the very winding surface, i.e. the surface on which the web-like material is wound, and two circular ends (20) that define two corresponding rod gripping portions. As shown in Fig. 7, between the central body (21) and each of the ends (20), the rods (2) have annular grooves that define both the rolling surfaces (22) of the rods on the aforementioned guides (31) and further parts (23) graspable by gripping means as further described below.

[0011] For example, the web-like material is paper produced by a papermaking machine. Preferably, said storage consists of a superstructure (32) of the machine arranged at a greater height than the winding roller (1) and comprising supports (33) for supporting and rolling the winding rods (2) with an exit side (33E) from which the rods (2) can be taken, as further described below.

[0012] In accordance with the present invention and with reference to the example shown in Figs. 1-5, the mechanism for removing the rods (2) from the storage (S) comprises two arms (45), that is, one arm (45) for each side of the structure (3). Each arm consists of two elements (4, 5) hinged to each other with a hinge axis (A45) parallel to the rotation axis of the winding roller (1). With reference to the example shown in the attached drawings, said arms (45) are positioned externally on the sides (30) of the machine. As further disclosed below, the first element (4) of each arm (45) can rotate around the axis (A45) of the respective hinge connection with the second arm (5) and the second element (5) can rotate around the winding roller axis (1). In this way, the first element (4) of each arm (45) can rotate with respect to the second element (5) which, in turn, can rotate around the axis of the winding roller (1). The second element (5) can be connected to the base structure of the machine (M) by means of a hinge connection having the axis coinciding with the axis (1A) of the winding roller (1), as in the example shown in Figs. 2-5, or it can be constrained to the superstructure (32) of the machine (M) by means of a hinge connection with axis parallel to the axis (1A) of the winding roller (1), as in the example shown in Fig. 6.

[0013] Preferably, the rotation of the first element (4) of each arm around the axis (A45) is controlled by a first electric gear motor (M4) and the rotation of the second element (5) around the axis (1A) of the winding roller (1) is controlled by a second electric gear motor (M5). In this configuration, the gearmotors (M4, M5) are controlled independently, so that the rotation of each element (4,

5) can be controlled independently from the rotation of the other element of the same arm.

[0014] With reference to the example shown in the attached drawings, said elements (4, 5) are formed by metal plates, that is, by bodies with a predominantly longitudinal development in which two dimensions are prevalent with respect to the third, and are hinged to each other in proximity of two respective end portions (40, 50) side by side. The first element (4) of each arm (45) has a gripping device suitable for gripping a corresponding end of a winding rod (2), as further described below.

[0015] For example, said gripping device is formed by a gripper (42) comprising a jaw (420) hinged on a free end (421) of the first element (4), which acts as a fixed jaw of the gripper. Said free end (421) is concave, with the concavity facing outwards, and the jaw (420) is mobile, being hinged on the free end of the element (4), and has an internal side (422) which also is concave, so that the concavities (421, 422) respectively presented by the fixed jaw and the movable jaw define, in cooperation with each other, a seat suitable for receiving a corresponding end of a winding rod (2). With reference to the example shown in the drawings, said seat, seen laterally, has a substantially circular shape. For example, the movable jaw (420) can be rotated on the end (421) of the first element (4) by means of a linear actuator (43) which is mounted on one side on an appendix (423) of the first element (4) and, on the opposite side, on an appendix (424) of the same movable jaw (420). For example, the appendix (423) is an upper wing of the first element (4). The appendix (424) of the movable jaw (420) can also be an upper appendix of the latter, so that the actuator (43) does not interfere with the gripping of the winding rods (2). The connection between the jaw (420) and the first element (4) of the arm (45) can be made, for example, by means of a hinge (425) with axis transversal to the first element (4) and to the jaw (420). The actuator (43) controls the rotation of the movable jaw (420) around the axis of the hinge (425) as schematically indicated by the double arrow in Fig.1. In Fig.1 the jaw (420) is in the gripping configuration, being rotated towards the fixed jaw formed on the free end of the first element (4). In practice, the actuator (43) determines the opening and closing of the seat for gripping one end of a winding rod (2) by rotating the movable jaw (420) to and from the first element (4) around the axis of the hinge (425). Preferably, the movable jaw (420) is formed by a metal plate placed laterally offset with respect to the end (421) of the first element (4). The device described above is therefore a gripper arranged on the first element (4) of each arm (45) for gripping and respectively releasing the winding rods (2). The movable jaw (420) can be moved by an actuator different from the one described above, such as for example a rotary actuator (not shown in the drawings) applied on the element (4) and acting on the movable jaw (420).

[0016] Each arm (45) has an external side, turned towards the outside of the machine (M), and an internal side turned towards the machine (M).

[0017] For each arm (45), the first gearmotor (M4) is applied on the external side of the first element (4), at the point of connection with the second element (5). In the example of Fig.1, the stator of the gearmotor (M4) is on the element (4), while the rotor is connected to the element (5). It is understood, however, that the stator of the gearmotor (M4) can be on the element (5) and in this case the rotor will be connected to the element (4). Similarly, the second gearmotor (M5) is applied on the external side of the second element (5), at the point of connection of the latter to the respective side (30) of the machine (M). In the example of Figs. 2-5, the stator of the gearmotor (M5) is on the element (5), while the rotor is connected to the connection point of the element (5) with the respective side (30) of the machine (M). However, the stator of the gearmotor (M5) can be on said connection point and in this case the rotor will be connected to the element (5).

[0018] Figs. 2-5 illustrate a possible cycle of engagement, movement and release of a winding rod (2A) by means of two arms (45) made as described above. In Figs. 2-5 the rod picked up and moved by the arms (45) is indicated with the reference "2A" to distinguish it from the rods that remain on the superstructure (32).

[0019] In Fig.2 is shown a reel (B) being completed, still close to the winding roller (1). In the same Fig.2 are shown the arms (45) in the position of picking up a rod (2A) from the exit side (33E) of the superstructure (32), with the grippers (42) of the ends (20) of the same rod (2A).

[0020] In Fig.3 the arms (45) are positioning the rod (2A), previously taken from the superstructure (32), on the winding roller (1). In the passage from the configuration of Fig.2 to the configuration of Fig.3, the first element (4) of each arm (45) rotates around the axis (A45), while the second element (5) rotates around the axis (1A). The combined rotation of the elements (4, 5) of the arms (45) determines the positioning of the rod (2A) against the winding roller (1) on the upper side of the latter. Meanwhile, on the exit side (33E) of the superstructure (32) another rod (2) has taken the place of the one previously taken by the arms (45). In correspondence with the positioning of the rod (2A) on the winding roller (1), it is determined the interruption of the web material by which the reels are formed.

[0021] In Fig.4A is shown the rod (2) placed by the arms (45) in front of the winding roller (1) and the material that forms the new reel (NB) has been wound on it. The completed reel (B) has been moved away. Also in the transition from the configuration of Fig.3 to the configuration of Fig.4A the combined rotation of the elements (4, 5) around the axes (45) and (1A) determines the movement of the rod (2A). In the passage between the position of Fig.3 and the position of Fig.4A the longitudinal axis (X) of the rod (2A) moves along a trajectory which is first parallel to the external surface of the winding roller (1) and then follows the direction of the guides (31), as

schematically illustrated in Fig.4B. In the meantime, as a result of the dragging carried out by the winding roller (1), the rod (2A) rotates around its axis, winding the web-like material on it, material which is fed along a predetermined feeding direction upstream of the winding roller (1) in ways known per se.

[0022] Fig. 5 shows a further configuration of the arms (45), upon reaching the predetermined diameter of the reel (NB) with the material (W).

[0023] The arms (45) support the ends (20A) of the rod (2A) on the guides (31) of the machine (M) as the diameter of the reel being formed (NB) increases.

[0024] As previously said, the annular grooves (22) facilitate the rolling of the rods (2), and therefore of the reels (NB), on the guides (31) of the machine.

[0025] It goes without saying that the grippers (42) mounted on the arms (45) do not block the ends (20) of the rods (2) so as not to prevent the rolling of the same on the guides (31). In practice, the grippers (42) define a removable constraint which allows the arms (45) to move the rods (2) from the superstructure (32) to the position of contact with the winding roller (1) and along the guides (31), without however preventing the rods (2) from rotating around their longitudinal axes.

[0026] Upon reaching a predetermined final diameter of the new reel (NB), the grippers (42) release the respective ends (20A) of the rod (2A) and the arms (45) can be returned to the position of picking up another rod from the superstructure (32) to start a new cycle. The completed reel is then removed from the machine (M) in ways known per se. With reference to the example shown in Fig. 6, the second element (5) of each arm (45) is hinged on the superstructure (32). Everything previously said in relation to the structure and operation of the arms (45) and, more generally, of the machine (M) remains valid. Also in this case, the movements of the rods (2) along the path between the aforementioned storage and the winding station where the winding roller (1) acts is determined by the combination of the rotary movements of the first and second elements (4, 5) of each arm (45).

[0027] As shown in Figs. 8 and 9, the machine (M) is provided with a carriage (6) mounted on the external side of each of its sides (30) and movable parallel to the same sides of the machine bidirectionally to and from the winding roller (1) by means of a corresponding drive unit (not visible in the drawings). On said carriage (6) there is a gripper (60) controlled by a corresponding actuator (61) also mounted on the carriage (6). This device is known per se (in technical jargon it is commonly called "secondary arm") and, therefore, it is not described in greater detail. A possible way of using the carriages (6) in the context of the present invention is the following. The carriages (6) are brought closer to the rod (2) on which the reel (NB) is being formed, keeping the grippers (60) open. Subsequently, each gripper (60) is closed on a corresponding annular groove (22) to engage the respective end of the rod (2A) next to the gripper (42) of the corresponding arm (45) which, at this point, is opened. In this way, the carriages (6) engage the reel (NB) being formed, ensuring its support until the final diameter is reached and until the selected parking position on the guides (31) is reached. In the meantime, the arms (45) can be brought to the pick-up position of another rod (2) from the superstructure (32). Fig.8 shows the exchange, i.e. the phase in which the carriages (6) engage the completed reel (B) which is released by the grippers (42) mounted on the arms (45). The carriages (6) can engage the new reel in formation even if the final diameter of the latter is compatible with the length of the arms (45). Therefore, the arms (45) can anticipate the picking up of the rods (2) with respect to reaching the final diameter of the reel to be formed. In Fig.9 the arms (45) have already picked up a rod and have positioned it in contact with the winding roller (1) while the reel is almost completed and is engaged by the carriages (6) which can also carry out a "pusher" function by accompanying the completed reel to a predetermined parking point downstream.

[0028] In the context of the present description, "length of the arms (45)" means the sum of the lengths of the elements (4) and (5).

[0029] The arms (45) can also be used to adjust the pressure of the nip at the winder roller / reel interface. This pressure, which in general is within the minimum and maximum values set according to the nature or structure of the web (W) and the winding speed imposed by the winding roller (1), can be regulated through the reciprocal rotation of the elements (4, 5) of each arm (45) which causes a greater or lesser thrust of the rod (2A) against the winding roller (1). For this purpose, a torque load cell (C4) in the hinge for attachment of the first element (4) to the second element (5) and a torque load cell (C5) in the attachment hinge of the second element (5) to the machine structure (M) can also be provided. The load cells (C4, C5) of each arm can be connected to a programmable unit (UE) which controls the gearmotors (M4, M5) of the arms (45) according to a program residing in one of its memory sections. The diagram in Fig.10 illustrates a possible configuration of the connections between the load cells (C4, C5) with the control unit (UE) to which position sensors (P4, P5) are also connected, suitable for detecting the angular position of the elements (4, 5). The unit (UE) can be programmed not only to carry out the movements of the arms (45) as described above but also to adjust the nip pressure according to the readings of the load cells (C4, C5). It goes without saying that the movements of the arms (45), i.e. the movements of the elements (4) and (5) of the arms (45), are synchronized with each other, so that on the two sides of the machine (M) the movements of the arms are coordinated.

[0030] In accordance with the present invention, the removal of the rods (2) from the storage of the same is performed by two arms (45) which, in addition to the removal of the rods (2), also perform the movement of the same rods along a predefined path which includes their positioning against the unwinding roller (1). Preferably, the arms (45) also control the translation of the rods (2)

along the guides (31) as the diameter of the reels being formed increases, until reaching a predetermined diameter.

[0031] In accordance with the examples described above, the two arms (45) are each formed of two elements (4, 5) hinged to each other so that the aforementioned path is formed by a combination of rotary movements around two axes parallel to each other. One of these axes can coincide with the rotation axis (1A) of the winding roller (1). Alternatively, both said axes can be distinguished from the rotation axis (1A) of the winding roller (1), as shown by way of example with reference to Fig. 6. Preferably, the two elements (4, 5) are each operated by a corresponding actuator (M4, M5) so that the rotation of each of them can be controlled independently.

[0032] In accordance with a further embodiment of the invention, a rotary actuator (7) can be mounted on the external side of the first element (4) of each arm (45), such as for example an electric motor, which can be used to control the rotation of the rods (20) around the respective longitudinal axes with predetermined angular speed. With reference to the example shown in Fig.11, the actuator (7) is supported by a bracket (70) cantilevered on the external side of the first element (4) of the arm (45) and has an output shaft, oriented parallel to the axis (A45) of the hinge connecting the first and second elements of the arm itself, and facing the gripper (42). For example, a friction disk (71) is applied to said shaft. The actuator (7) is positioned on the bracket (70) so that the friction disc (71) can come into contact with the outer face of the end (20A) of any rod engaged by the respective gripper (42). In practice, the rotation of the discs (71) in contact with the external faces of the two ends (20) of a rod (2) determines the rotation of the latter around its longitudinal axis with angular speed imposed by the actuator (7). The actuator is mounted on a carriage (72) to allow it to be moved on the bracket (70), to and from the end of the arm (45) on which the gripper (42) is mounted. In Fig.11 said movement of the actuator (7) on the bracket (70) is indicated by the arrow "FA". Movement (FA) is controlled by a corresponding motor not visible in the drawings. The actuator (7) is moved towards the end of the rod engaged by the gripper (42) when it is desired to drag the rod into rotation due to the contact between the end of the latter and the friction disc (71). Conversely, the opposite movement of the actuator (7) determines the disengagement of the rod from the friction disc (71). This mechanism can be useful when the rotation of the rod (2) during the formation of a reel must not be ensured exclusively by the pressure against the winding roller (1).

[0033] Fig. 12 illustrates by way of example the use of the arms (45) provided with the actuator (7) on the machine (M) in the configuration of Fig. 8.

[0034] In relation to what has been described above, a machine for winding web-like materials in the form of reels in accordance with the present invention comprises a winding roller (1) on which the web-like material intended to be wound passes, wherein the winding roller (1) cooperates with a winding rod (2) on which the web-like material winds up to form a reel (B), wherein the winding roller (1) is positioned in a structure (3) provided with sides (30) on which two corresponding linear guides (31) are formed parallel to each other and oriented according to a predetermined direction (L) which defines a direction of advancement of the winding rod (2) while the respective reel (B) is formed on the rod itself, wherein the winding roller (1) is oriented transversely to said sides, and wherein the machine (M) is served by a storage (32) in which several winding rods (2) can be stored and by a mechanism per picking up the rods (2) from the storage (32), said mechanism for picking up the rods being constituted by a pair of arms (45) each of which is arranged on a corresponding side of the machine and consists of two elements (4, 5) hinged to each other with a hinge axis (A45) parallel to the axis (1A) of rotation of the winding roller (1), an element (5) being hinged on one side of the machine with a hinge axis parallel to the axis (1A) of the winding roller (1) or coinciding with said axis (1A), the other element (4) being provided with gripping means (42) adapted to engage a corresponding end (20) of a rod (2) on the storage (32), and move it towards the winding roller (1) and along a predetermined path (T) with a section parallel to the outer surface of the winding roller (1). Said path (T) can comprise a second section parallel to the guides (31).

[0035] In a preferred embodiment, said elements (4, 5) of each arm (45) are each moved by a respective actuator (M4, M5).

[0036] Preferably, said elements (4, 5) of each arm (45) consist of metal plates with a predominantly longitudinal development.

[0037] In a possible embodiment, an element (5) of each arm (45) is hinged on the machine (M) with a hinge axis coinciding with the axis (1A) of the winding roller (1).

[0038] In an alternative embodiment, an element (5) of each arm (45) is hinged on said superstructure with a hinge axis parallel to the axis (1A) of the winding roller (1).

[0039] In a possible embodiment, said gripping means (42) are gripper means with two jaws which, in cooperation with each other, define a gripping seat.

[0040] In a possible embodiment, said gripper means comprise a fixed jaw formed on one end of an element (4) of the arm (45) and a movable jaw (420) controlled by an actuator (43). In accordance with this embodiment, the fixed jaw has a concave side (421) facing the movable jaw (420) and the movable jaw (420) has a concave side (422) facing the fixed jaw.

[0041] Furthermore, in a possible embodiment of the present invention said arms (45) are controlled by a programmable unit (UE) which receives signals from load cells (C4, C5) mounted on the two elements (4, 5) of each arm and controls the rotation of these elements through corresponding independent actuators (M4, M5).

[0042] In another embodiment of the present invention, the machine comprises a carriage (6) mounted on each of its sides and provided with gripping means (60) adapt-

ed to pick up the rods (2) from said arms (45).

[0043] In each of the examples described above, the trajectory of the rods (2) is determined by the rotation of the element (4) around the axis (A45) and by the rotation of the element (5) around the axis of the respective connection hinge with a fixed part of the machine (M) which can be, for example, a side (30) of the latter or a superstructure (32) placed at a higher level of the winding roller (1) with respect to the base on which the machine rests.

[0044] In practice, the details of execution can however vary in an equivalent manner as regards the individual elements described and illustrated without thereby abandoning the technical solution adopted and therefore remaining within the limits of the protection conferred by this patent in accordance with the attached claims.

Claims

1. Winding machine for forming reels of web-like material, comprising a winding roller (1) on which the web-like material intended to be wound passes, wherein the winding roller (1) cooperates with a winding rod (2) on which the web-like material winds up to form a reel (B), wherein the winding roller (1) is positioned in a structure (3) provided with sides (30) on which two corresponding linear guides (31) are formed parallel to each other and oriented according to a predetermined direction (L) which defines a direction of advancement of the winding rod (2) while the respective reel (B) is forming on the rod itself, wherein the winding roller (1) is oriented transversely to said sides, wherein the machine (M) is served by a storage (32) in which several winding rods (2) can be stored and by a mechanism of removal of the rods (2) from the storage (32), and wherein said mechanism of removal of the rods comprises a pair of arms (45) each of which is arranged on a corresponding side of the machine, **characterized in that** each of said arms (45) consists of two elements (4, 5) hinged to each other with a hinge axis (A45) parallel to the rotation axis (1A) of the winding roller (1), an element (5) being hinged on one side of the machine with a hinge axis parallel to the axis (1A) of the winding roller (1), the other element (4) being provided with gripping means (42) adapted to engage a corresponding end (20) of a rod (2) on the storage (32), and to move it towards the winding roller (1) and along a pre-determined path (T) that comprises a section parallel to the outer surface of the winding roller (1).

2. Machine according to claim 1 **characterized in that** said path (T) comprises a further section parallel to the guides (31).

3. Machine according to claim 1 **characterized in that** said elements (4, 5) of each arm (45) are each controlled by a corresponding actuator (M4, M5).

4. Machine according to claim 1 **characterized in that** said elements (4, 5) of each arm (45) consist of metal plates with a predominantly longitudinal development.

5. Machine according to claim 1 **characterized in that** an element (5) of each arm (45) is hinged on the machine (M) with a hinge axis coinciding with the axis (1A) of the winding roller (1).

6. Machine according to claim 1, wherein the storage (32) of the rods (2) consists of a superstructure of the machine (M) arranged above the winding roller (1), **characterized in that** an element (5) of each arm (45) is hinged on said superstructure with a hinge axis parallel to the axis (1A) of the winding roller (1).

7. Machine according to claim 1 **characterized in that** said gripping means (42) are grippers with two jaws which, in cooperation with each other, define a gripping seat.

8. Machine according to claim 7 **characterized in that** said gripper means comprise a fixed jaw formed on one end of an element (4) of the arm (45) and a mobile jaw (420) controlled by an actuator (43).

9. Machine according to claim 7 **characterized in that** the fixed jaw has a concave side (421) facing the movable jaw (420) and the movable jaw (420) has a concave side (422) facing the fixed jaw.

10. Machine according to any of the preceding claims, **characterized in that** said arms (45) are controlled by a programmable unit (UE) which receives signals from load cells (C4, C5) mounted on the two elements (4, 5) of each arm and which controls the rotation of these elements through corresponding actuators (M4, M5).

11. Machine according to any one of the preceding claims, **characterized in that** it comprises a carriage (6) mounted on each of its sides and provided with gripping means (60) adapted to pick up the rods (2) from the said arms (45).

12. Machine according to claims 1 and 2 **characterized in that** said movement along the predetermined path (T) is given by the coordinated rotation of said elements (4, 5) around said axes (A45) and (1A).

13. Machine according to any one of the preceding claims, **characterized in that** each of said arms (45) is provided with a rotary actuator (7) adapted to engage a corresponding end (20) of a rod (2) to control

its rotation with predetermined angular speed around the relative longitudinal axis.

14. Machine according to claim 1 and claim 13 **characterized in that** said rotary actuator (7) is supported by a bracket (70) arranged on an external side of the first element (4) of the arm (45) and has a shaft outlet, oriented parallel to the axis (A45) of the hinge connecting the first and second elements of the arm itself, and facing the gripping means (42), said rotary actuator being mounted on a carriage (72) to allow its movement on the bracket (70), from and to the side of the arm (45) on which the gripping means (42) are mounted.

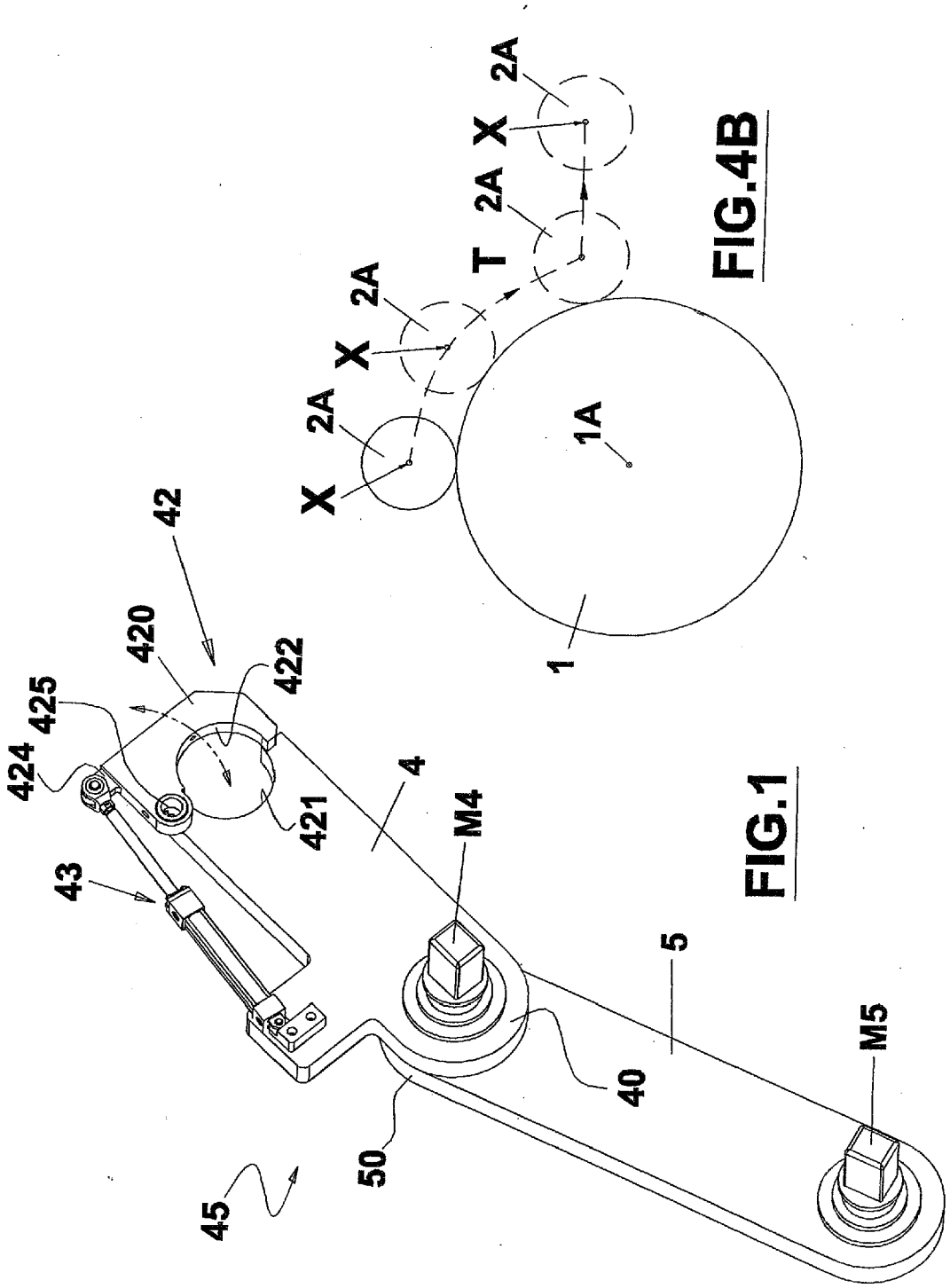

FIG.4B

FIG.1

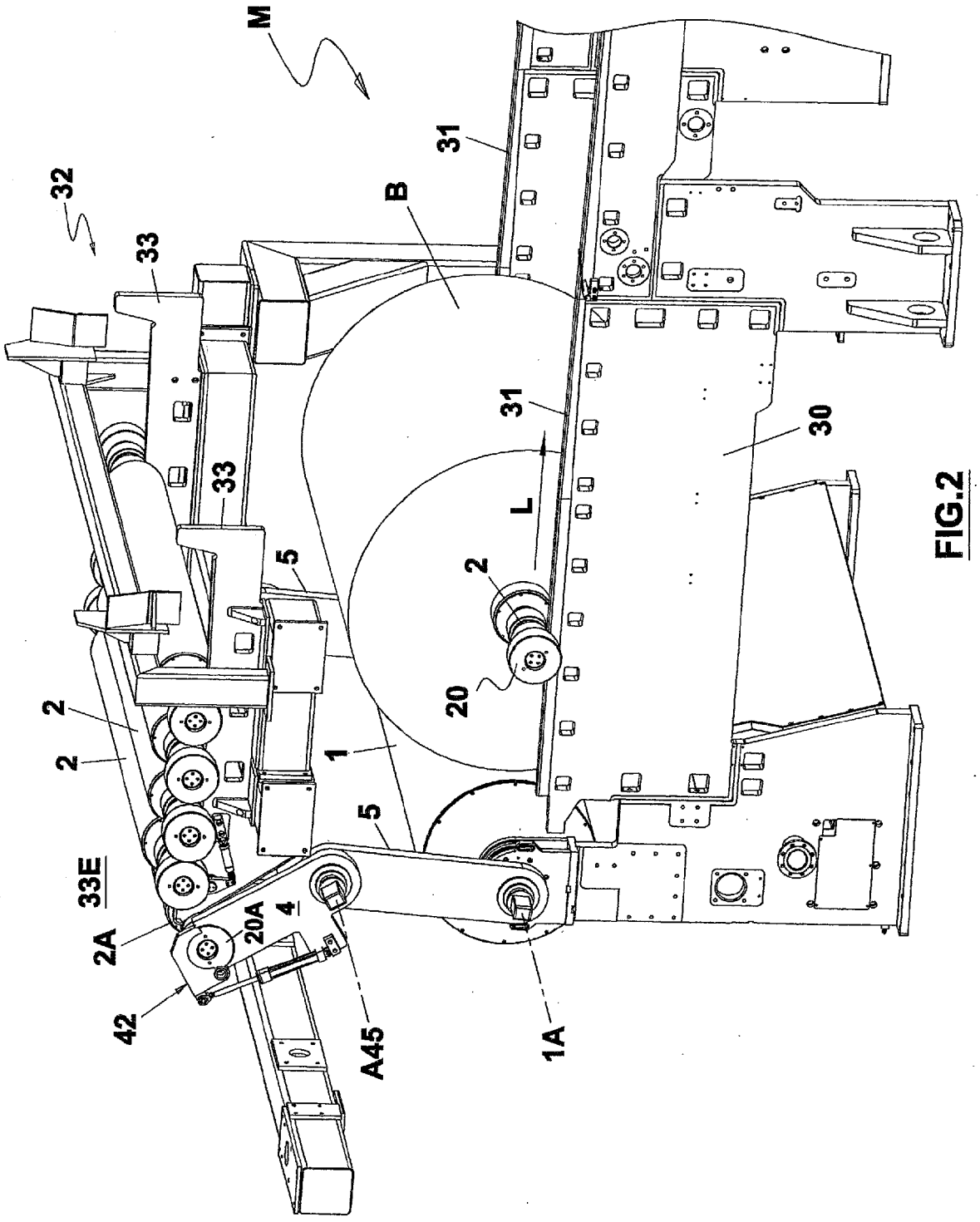

FIG.2

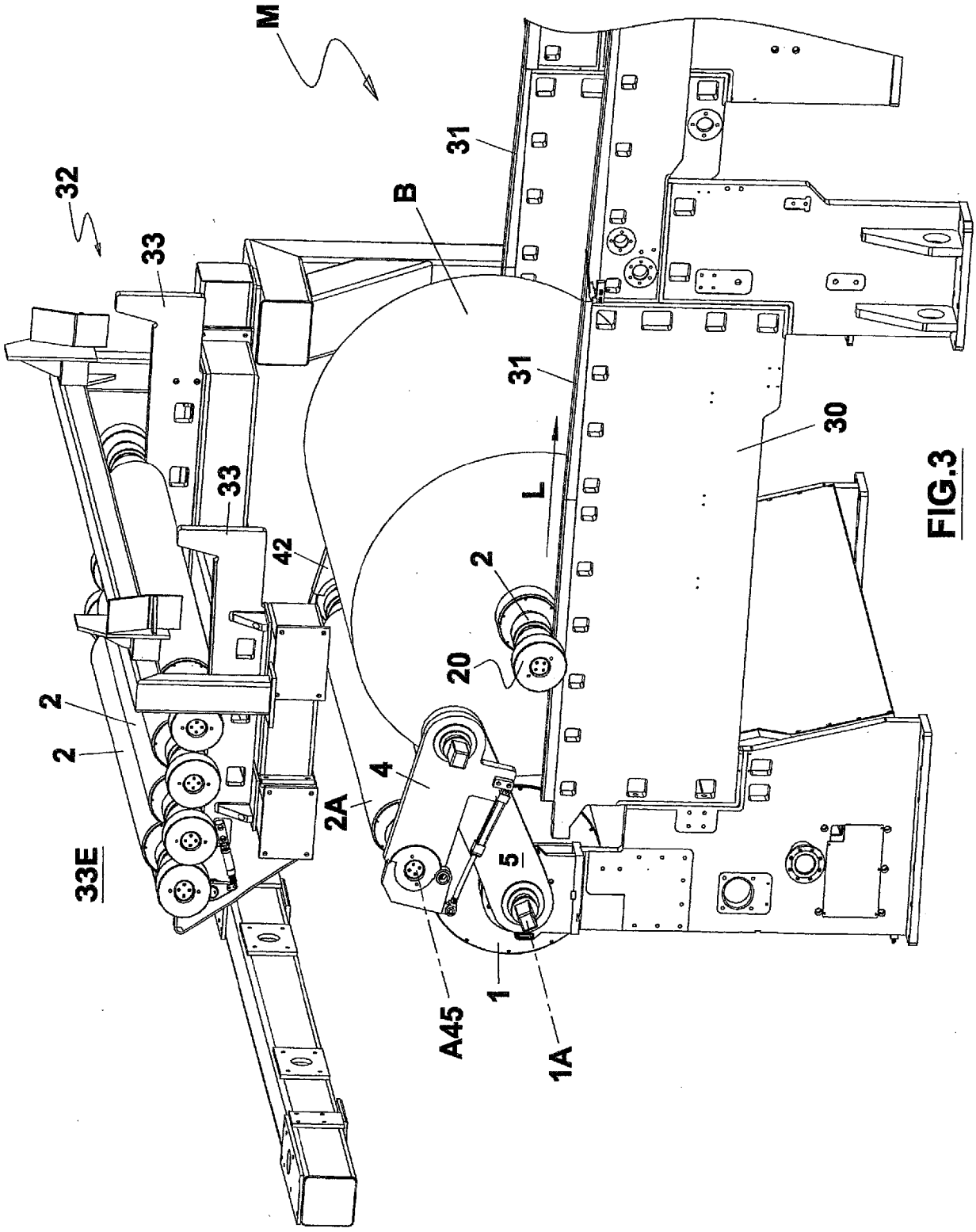

FIG.3

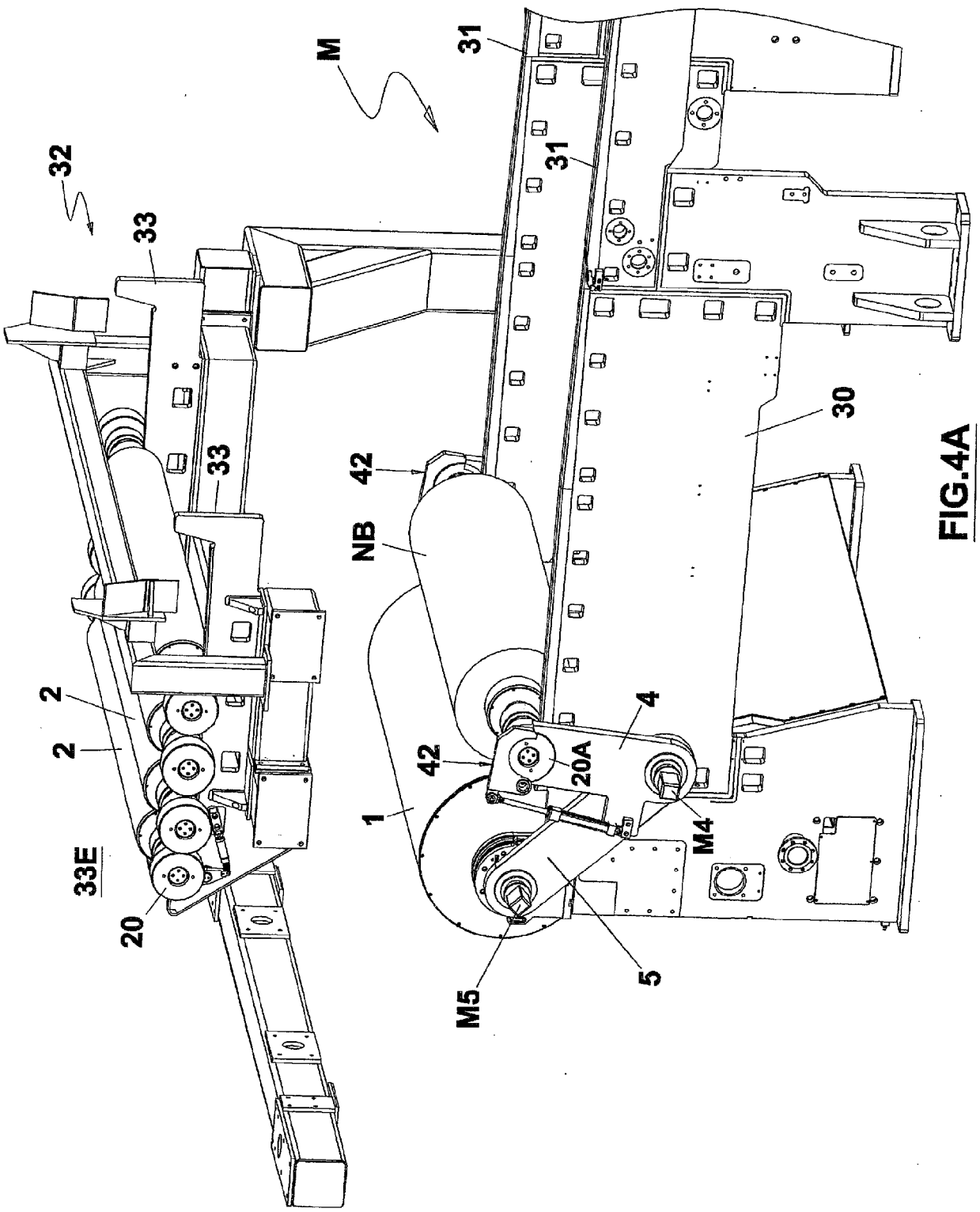

FIG.4A

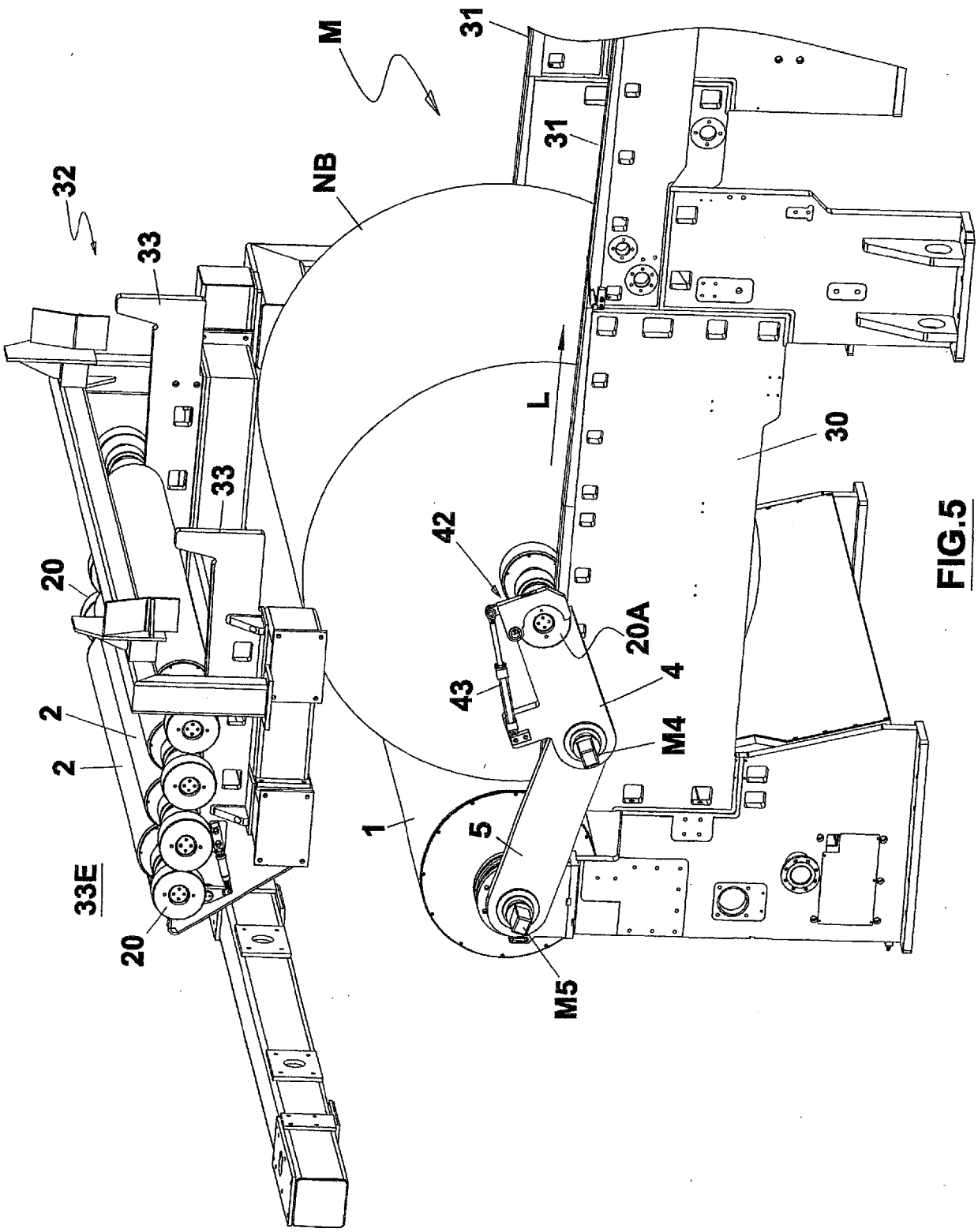

FIG.5

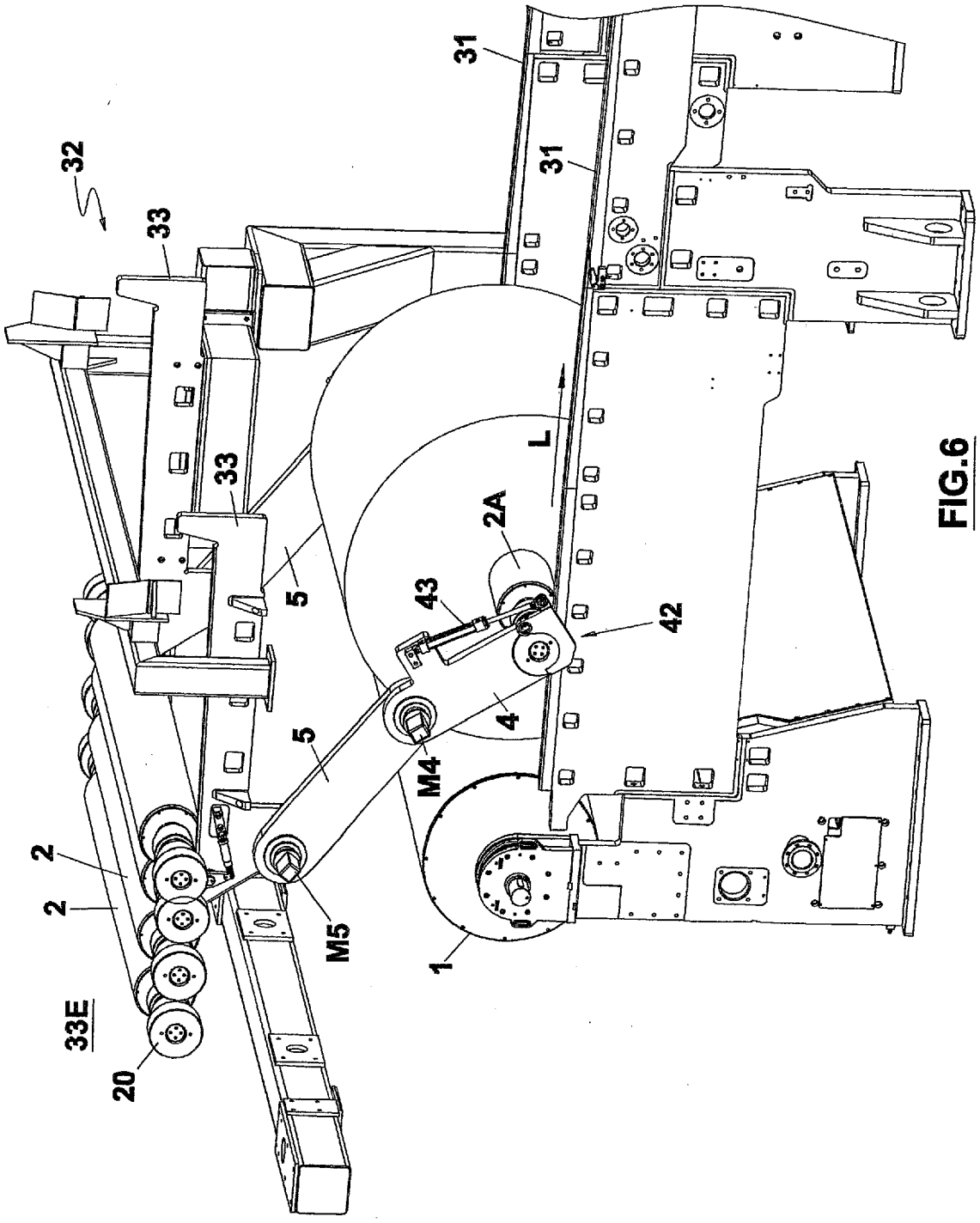

FIG.6

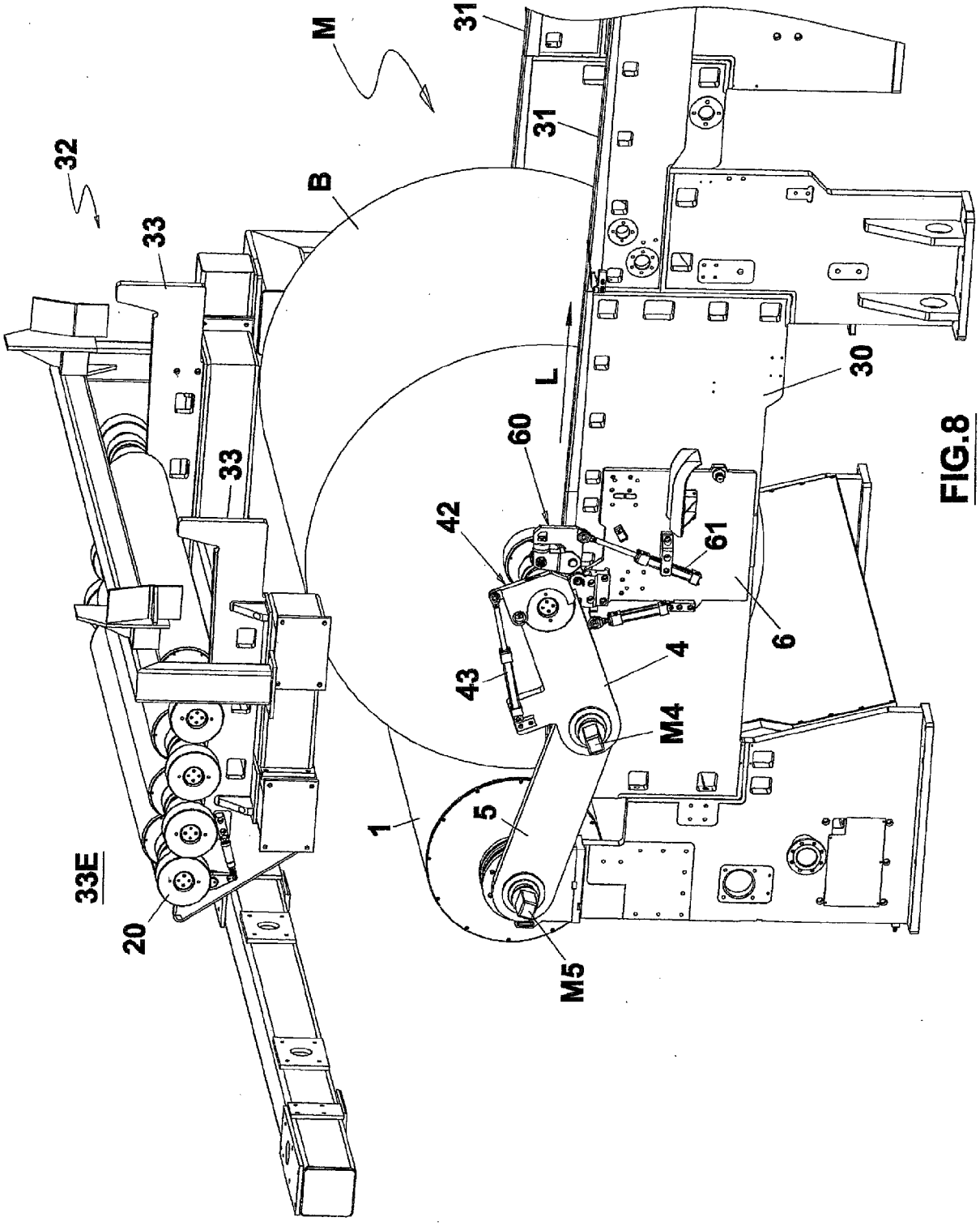

FIG.8

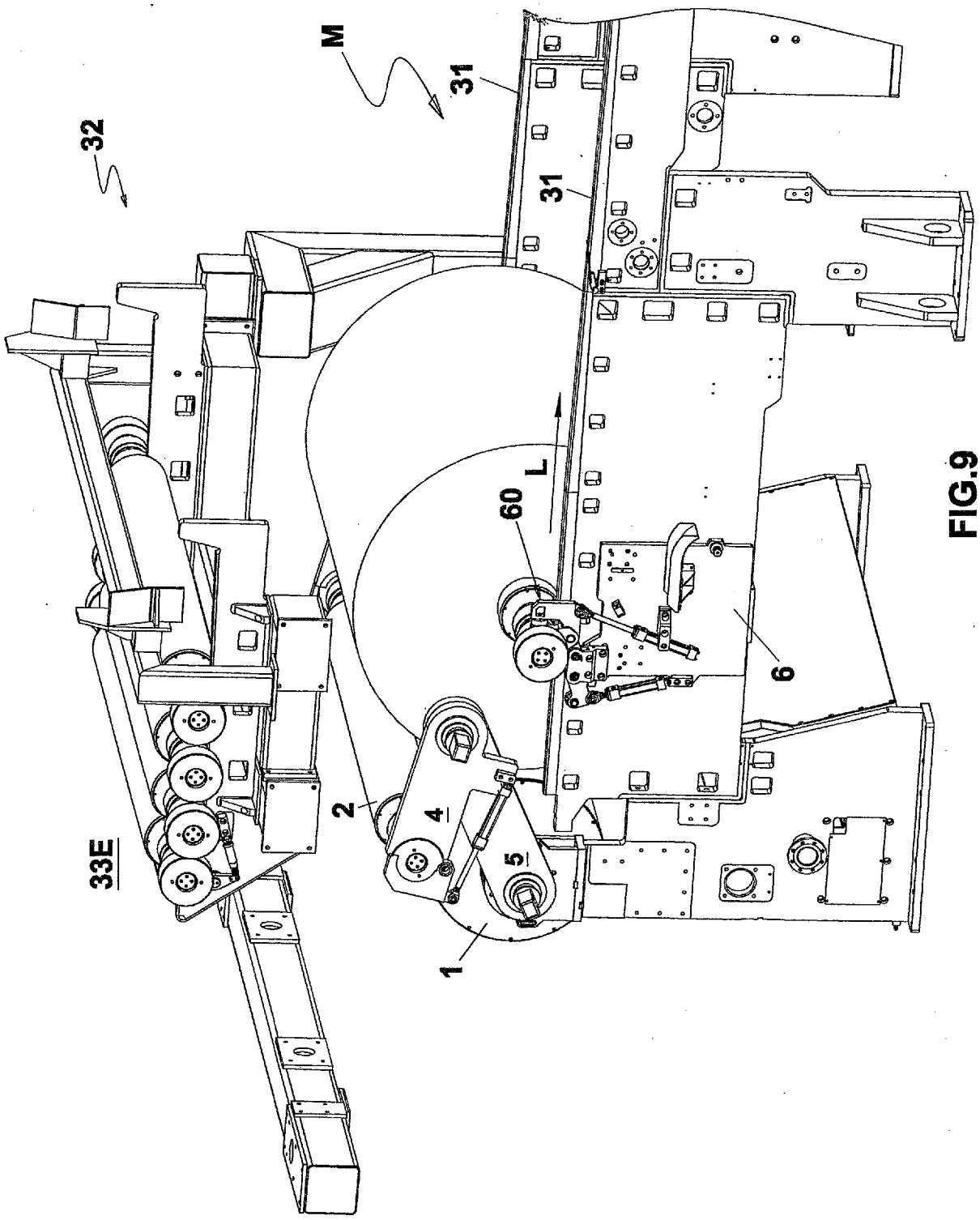

FIG.9

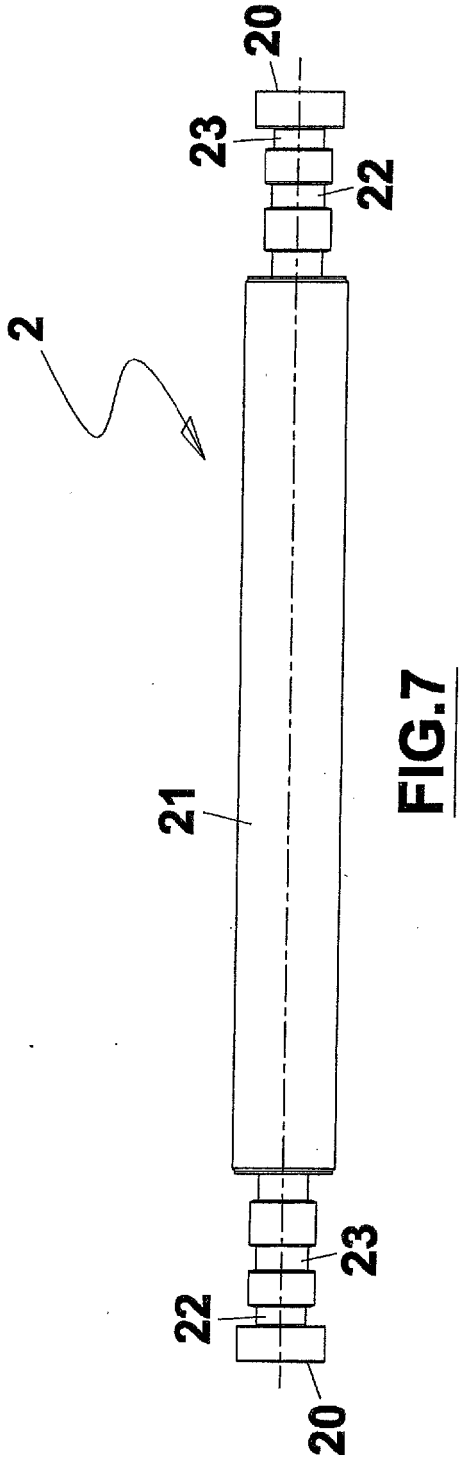

FIG.7

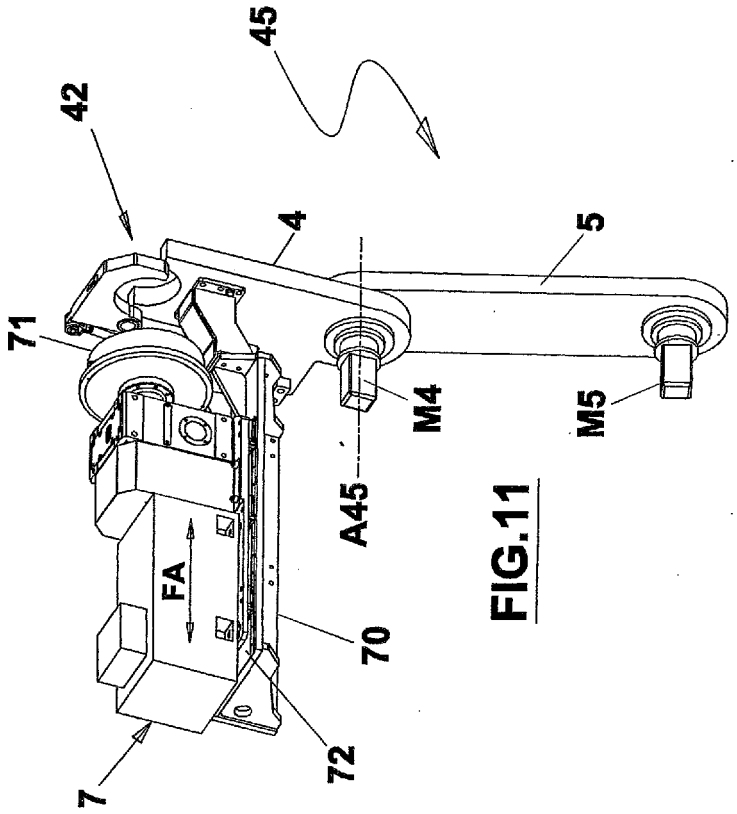

FIG.11

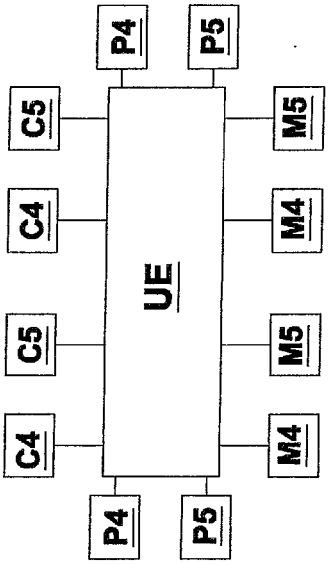

FIG.10

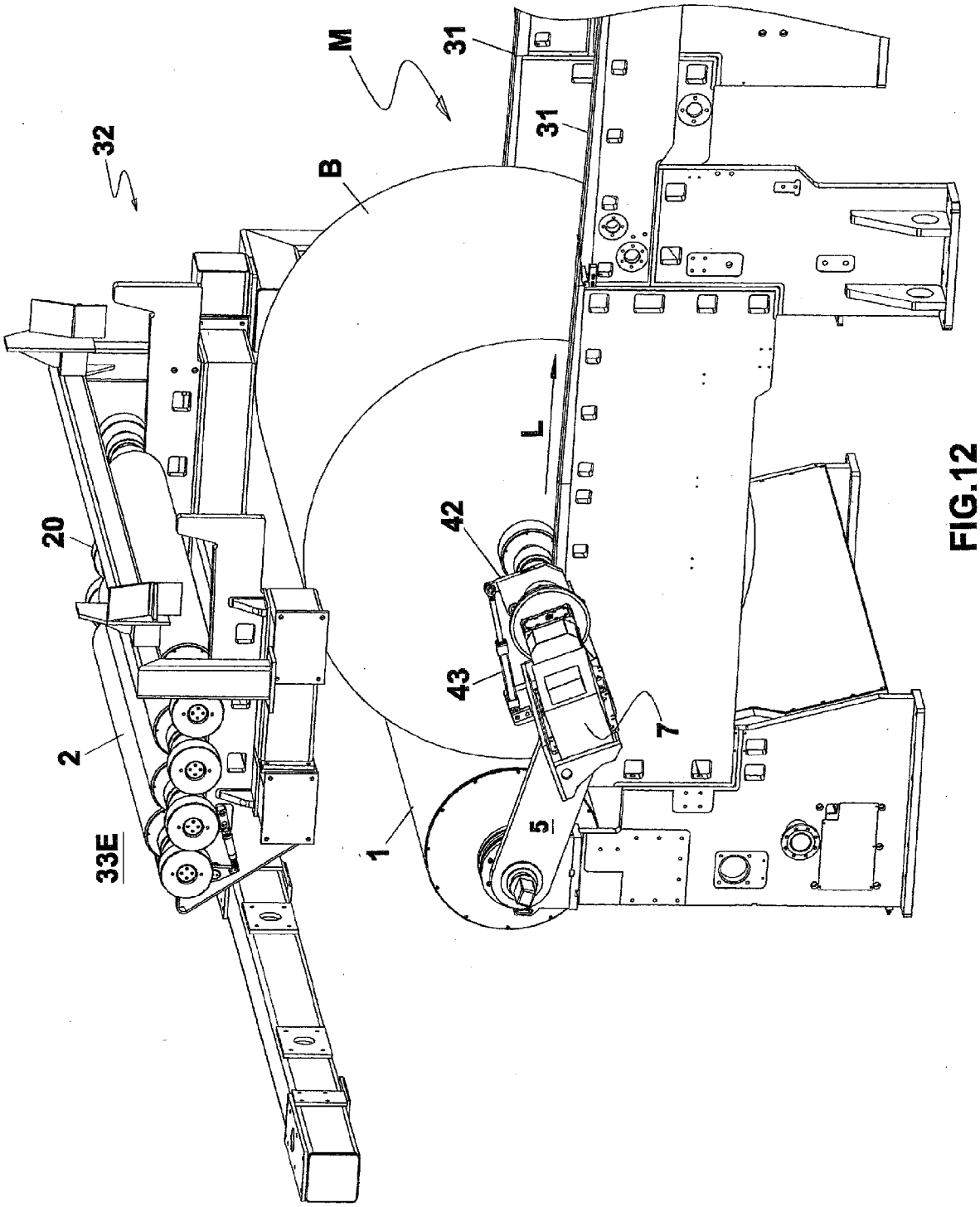

FIG.12

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 21 9509

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 A	US 4 744 526 A (KREMAR DJURO [CA]) 17 May 1988 (1988-05-17) * abstract * * column 4, line 52 - column 6, line 52 * * the whole document * -----	1-9,12, 13 10 14	INV. B65H18/26 B65H19/22 B65H19/30
X	US 4 768 730 A (LAINE PAAVO [FI]) 6 September 1988 (1988-09-06) * the whole document * -----	1,11	
A	EP 0 849 202 A1 (ANDRITZ PATENTVERWALTUNG [AT]) 24 June 1998 (1998-06-24) * the whole document * -----	1-13	
Y	WO 93/24401 A1 (BELOIT TECHNOLOGIES INC [US]) 9 December 1993 (1993-12-09) * abstract * -----	10	
A	DE 10 2008 000042 A1 (VOITH PATENT GMBH [DE]) 2 April 2009 (2009-04-02) * abstract * * figures 1-4 * * paragraph [0076] - paragraph [0077] * * paragraph [0078] * * paragraph [0092] - paragraph [0093] * * the whole document * -----	1,14	

TECHNICAL FIELDS SEARCHED (IPC)
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 April 2020	Piekarski, Adam

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 21 9509

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-04-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4744526 A	17-05-1988	CA 1316893 C	27-04-1993
		US 4744526 A	17-05-1988
US 4768730 A	06-09-1988	CA 1276923 C	27-11-1990
		DE 3710959 A1	08-10-1987
		GB 2188619 A	07-10-1987
		SE 464190 B	18-03-1991
		US 4768730 A	06-09-1988
EP 0849202 A1	24-06-1998	AT 404824 B	25-03-1999
		DE 59706672 D1	25-04-2002
		EP 0849202 A1	24-06-1998
WO 9324401 A1	09-12-1993	AU 4390493 A	30-12-1993
		BR 9306406 A	15-09-1998
		CA 2117909 A1	09-12-1993
		DE 69304533 D1	10-10-1996
		EP 0642460 A1	15-03-1995
		FI 945462 A	21-11-1994
		JP 2587396 B2	05-03-1997
		JP H07502721 A	23-03-1995
		KR 950701296 A	23-03-1995
		PL 171410 B1	30-04-1997
		TW 231285 B	01-10-1994
		US 5611500 A	18-03-1997
		WO 9324401 A1	09-12-1993
DE 102008000042 A1	02-04-2009	CN 101873984 A	27-10-2010
		DE 102008000042 A1	02-04-2009
		EP 2205512 A2	14-07-2010
		WO 2009040278 A2	02-04-2009

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

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4744526 A **[0004]**
- US 4768730 A **[0005]**
- EP 0849202 A1 **[0005]**