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(54) **WIRE BINDING MACHINE AND METHOD**

(57) A binding machine (1) adapted to bind an object, such as a bundle or a skein, comprises a wire-guide (5) adapted to guide a wire around a space (S) where the object to be bound is housed, the wire-guide (5) comprising at least two channels (5', 5'') to perform at least two turns of the wire around this space (S), feeding means (3) adapted to feed the wire to the wire-guide (5) and to retract the wire in order to tighten it around the object to be bound, as well as cutting means (7) of the wire adapted to separate from this wire a segment thereof, this segment being tightened around the object and comprising two free terminal portions. Conveniently, the binding machine (1) comprises folding means (8a, 8b) adapted to fold the terminal portions of the wire segment so as to form an eyelet (E), and a twisting device (4) adapted to twist these eyelet-shaped terminal portions.

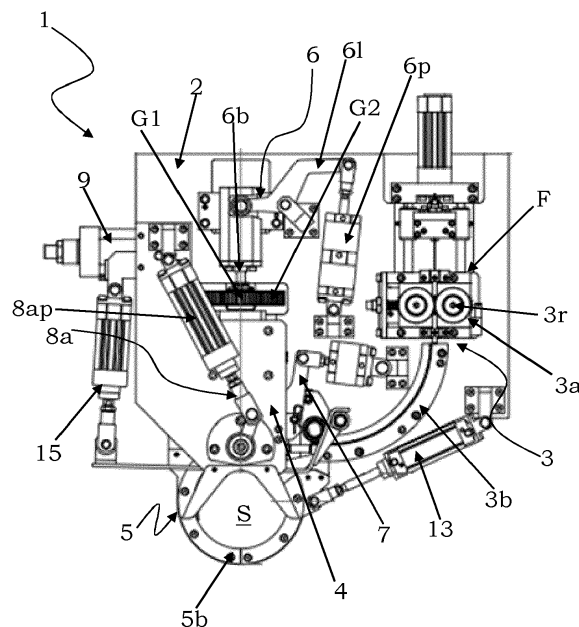


FIG. 1A

Description

Field of application

[0001] The present invention refers to a binding machine and to a related binding method for binding objects. More in particular, the present invention refers to a binding machine adapted to bind bundles or skeins, and the following description is made with reference to this application field with the only purpose of simplifying the exposition thereof.

Prior art

[0002] As it is well known in this specific technical field, a binding machine is capable of automatically binding objects, in particular bundles or skeins. By way of example, a binding machine is capable of binding metal bundles manufactured by a rolling plant, and more generally packages made of profiles, superimposed plates, billets, bars having various sections, and the like.

[0003] A binding machine comprises a wire-guide, generally having a round shape, adapted to guide a wire around a space where the bundle or skein to be bound is located. The wire, which is wound in the above-mentioned wire-guide, is suitably held within a twisting device and is subsequently retracted so that it can be tightened around the bundle to be bound. In this way, once it has been cut, the wire has two free terminal portions, which are subsequently twisted by means of the twisting device, thus completing the binding of the bundle.

[0004] However, the wire free terminal portions, which are twisted to each other, may represent a risk, since they have a protruding tip which may injure operators involved in the subsequent handling of the object bound by such wire. Thus, there is the need for binding machines capable of binding objects without entailing a risk for the operators.

[0005] The technical problem of the present invention is to provide a binding machine having structural and functional features such as to allow overcoming the limitations and drawbacks still affecting the known solutions, in particular capable of ensuring the safety of the operators using the object bound by it, ensuring at the same time an efficient binding process.

Summary of the invention

[0006] The solution idea at the basis of the present invention is to provide a binding machine wherein, before twisting the terminal portions of a wire tightened around an object to be bound, such terminal portions are suitably folded so as to form an eyelet, such wire being wound by at least two turns around the object to be bound.

[0007] Based upon this solution idea, the above-mentioned technical problem is solved by a binding machine for binding at least one object, comprising a wire-guide adapted to guide a wire around a space where the object

to be bound is housed, the wire-guide comprising at least two channels to perform at least two turns of said wire around said space, feeding means adapted to feed the wire to the wire-guide and to retract the wire in order to tighten it around the object to be bound, cutting means of the wire adapted to separate from this wire a segment thereof, this segment being tightened around the object and comprising two free terminal portions, folding means adapted to fold the terminal portions of this segment so as to form an eyelet, and a twisting device adapted to twist these eyelet-shaped terminal portions.

[0008] More particularly, the invention comprises the following additional characteristics, taken individually or in combination if required.

[0009] According to one aspect of the present invention, the wire-guide can comprise a body, this body having a substantially circular shape and including at least two adjacent portions shaped so as to form the at least two channels.

[0010] According to a further aspect of the present invention, the feeding means can comprise a puller and an introducing track of the wire.

[0011] In particular, the puller can comprise at least one pair of rollers adapted to drag the wire towards/from the wire-guide.

[0012] Furthermore, it is observed that at least the wire-guide can be made of quenched steel.

[0013] According to a further aspect of the present invention, the twisting device can comprise a rotating head connected to a first gear wheel, which engages with a second gear wheel that is rotated by a movable element to which the second gear wheel is connected, the rotation of the second gear wheel causing the rotation of the rotating head.

[0014] According to a further aspect of the present invention, the rotating head can comprise at least one channel communicating with the wire-guide to allow the passage and the holding of the wire in the twisting device.

[0015] According to yet a further aspect of the present invention, the folding means can comprise means adapted to house the terminal portions of the wire, these means being rotated by at least one piston.

[0016] According to yet a further aspect of the present invention, the binding machine can comprise locking means adapted to hold the wire during the retraction thereof by means of the feeding means, so as to tighten this wire around the object.

[0017] Finally, the binding machine can comprise a pneumatic system adapted to supply compressed air for moving its components, this pneumatic system being controlled by a central unit apt to monitor and control the binding machine.

[0018] The present invention also relates to a method for binding at least one object, comprising the steps of:

- feeding a wire into a wire-guide by means of feeding means;

- guiding, by means of the wire-guide, the wire around a space where the object to be bound is housed, this wire-guide comprising at least two channels to perform at least two turns of the wire around the space;
- retracting, by means of the feeding means, the wire in order to tighten it around the object to be bound;
- separating, by means of cutting means, from said wire a segment thereof, this segment being tightened around the object and comprising two free terminal portions;
- folding, by means of folding means, the terminal portions of the segment so as to form an eyelet at a twisting device; and
- twisting, by means of the twisting device, these eyelet-shaped terminal portions of the wire.

[0019] The features and advantages of the binding machine and of the binding method according to the invention will become apparent from the following description of an embodiment thereof, given by way of non-limiting example with reference to the accompanying drawings.

Brief description of the drawings

[0020] In these drawings:

- figures 1A and 1B schematically show lateral views of a binding machine according to the present invention;
- figures 2A and 2B schematically show a detail, according to different views, of the binding machine of the present invention, whereas figure 2C shows a detail of figure 2A, in particular showing a wire passing through a channel in a twisting device;
- figure 3 shows a wire binding a skein, this wire having been applied to this skein by means of the binding machine of the present invention;
- figures 4A and 4B schematically show a front view and a top view, respectively, of the binding machine of the present invention;
- figure 5 schematically shows a further detail of the binding machine of the present invention; and
- figures 6A and 6B schematically show a lateral view and a front view, respectively, of a wire-guide of the binding machine of the present invention;

Detailed description

[0021] With reference to those figures, and in particular

to the example of figures 1A and 1B, a binding machine according to the present invention is globally and schematically indicated with 1.

[0022] It is worth noting that the figures represent schematic views and are not drawn to scale, but instead they are drawn so as to emphasize the important features of the invention. Moreover, in the figures, the different elements are depicted in a schematic manner, their shape varying depending on the application desired. It is also noted that in the figures the same reference numbers refer to elements that are identical in shape or function.

[0023] The binding machine 1 of the present invention is used to bind at least one object, in particular to bind bundles or skeins made of various materials and having various sections, in a fast, automatic, effective and safe manner.

[0024] As illustrated in figure 1A, the binding machine 1 of the present invention comprises a support plate 2, on which all the main components thereof are arranged to perform the binding of bundles or skeins.

[0025] In particular, the binding machine 1 comprises suitable feeding means 3 for feeding the wire therein, this wire generally being a metal wire and having a section varying according to the object to be bound. By way of example, in case of small bar bundles or small skeins or reels of wire to be bound, a metal wire having a diameter of about 2mm is used.

[0026] In an embodiment of the present invention, the feeding means 3 comprise a puller 3a apt to drag the wire inside the machine 1 starting from a free terminal portion thereof (this portion being indicated herein as the upstream portion of the wire), such wire being initially wound so as to form a coil and being arranged near the binding machine 1.

[0027] The feeding means 3 further comprise an introducing track 3b associated with the puller 3a, the introducing track 3b facilitating the feeding and the subsequent retraction of the wire.

[0028] As illustrated in figure 1A, the puller 3a comprises at least one pair of rollers 3r for feeding/retracting the wire, these rollers 3r being supported by a suitable frame F fixed to the support plate 2.

[0029] The wire fed by the feeding means 3 passes through a twisting device 4 (which will be shown in more detail hereinafter) and then it is fed in a wire-guide 5 communicating with the twisting device 4, such wire-guide 5 being adapted to guide the wire around a space S where the object to be bound is housed, the dimensions of such wire-guide obviously varying depending on the object to be bound arranged in the space S defined by it.

[0030] In order to tighten the wire (which is initially only housed in the wire-guide 5) around the object to be bound, it is retracted by the feeding means 3, in a direction opposite to the feeding direction. For this purpose, the binding machine 1 comprises locking means 6 adapted to hold the wire during the retraction thereof by means of the feeding means 3. In this way, while the rollers 3r of the feeding means 3 rotate in a direction opposite to

the feeding direction, the wire, which is suitably held by the locking means 6, is caused to adhere to the object to be bound housed in the space S.

[0031] According to an embodiment of the present invention shown in figure 1A, the locking means 6 comprise a body 6b generally having circular or rod-like shape, which is driven by a piston 6p connected thereto, such connection being a direct connection or an indirect connection by means of a connection portion, such as a lever 61.

[0032] Obviously, also other embodiments for the locking means 6 are provided by the present invention, the figures being provided only by way of indicative and non-limiting example of the scope of the present invention.

[0033] In other words, on the one hand the feeding means 3 are adapted to feed the wire into the binding machine 1, on the other hand, in conjunction with the locking means 6, they are adapted to retract the wire to perform the proper binding of the object housed in the space S.

[0034] The locking means 6 fix the wire at a point within the twisting device 4. Accordingly, the body 6b of the locking means 6, suitably driven by the piston 6p, performs an alternating movement wherein it enters a cavity of the twisting device 4 in order to block at one point the wire introduced therein, in particular the terminal thereof.

[0035] For this purpose, with reference now to figures 2A and 2B, the twisting device 4 comprises a rotating head 4a connected to a first gear wheel G1, which engages with a second gear wheel G2 that is rotated by a movable element or actuator 9 to which the second gear wheel G2 is connected. In particular, the movable element 9 is preferably a cylinder capable of performing a translational movement, such translational movement causing the rotation of the second gear wheel G2, and therefore the rotation of the first gear wheel G1 engaged with it. In other words, the binding machine 1 comprises means to transform the translational movement of the movable element 9 into the rotation of the second gear wheel G2 in order to cause the rotation of the rotating head 4a of the twisting device 4, such movable element 9 and such gear wheel G2 forming a rotating actuator.

[0036] According to the embodiment illustrated in the figures, the twisting device 4 and the movable element 9 are arranged on opposite sides with respect to the support plate 2, the engagement between the first gear wheel G1 and the second gear wheel G2 being ensured by a recess R formed in the supporting plate 2.

[0037] Furthermore, the twisting device 4 comprises at least one channel 4' formed in the rotating head 4a, such channel 4' communicating with the wire-guide 5 so as to allow the passage, the housing and the fixing of the wire in the twisting device 4.

[0038] For the sake of convenience, figure 2C shows the machine of figure 2A with a wire W being visible, such wire passing through the various components, in particular the channel 4' in the rotating head 4a.

[0039] Referring again to figure 1A, the binding ma-

chine 1 further comprises cutting means 7 adapted to cut at a specific point the wire held and fixed to the object to be bound. Specifically, the cutting means 7 separate from the wire fed to the binding machine 1 a segment thereof, in particular the segment of wire tightened around the object, which after being cut comprises two free terminal portions, a terminal portion being the upstream portion (which may be held by locking means 6) of the wire, the other portion being the portion at which the cut is performed. Such terminal portions are then superimposed at a point within the twisting device, in particular within the channel 4', and they extend from such point.

[0040] Advantageously according to the present invention, the binding machine 1 comprises folding means adapted to fold the terminal portions of the wire segment wound around the object, so as to form an eyelet E starting therefrom.

[0041] In the present specification, the term eyelet means a ring-shaped portion of wire, obtained by means of the above-mentioned folding of the terminal portions of the wire, which portions could be otherwise dangerous for the operator. Figure 3 shows a wire W having the eyelet E formed with the machine of the present invention.

[0042] As shown in more detail in figures 4A and 4B, the binding machine 1 comprises a first folding means 8a and a second folding means 8b, these folding means 8a and 8b being arranged on opposite faces of the support plate 2, each of them acting on a single terminal portion of the wire segment so as to form the above-mentioned eyelet-shaped portion by means of a rotating movement thereof.

[0043] In particular, the folding means 8a and 8b comprise suitable means for holding (or housing) the terminal portions to be folded of the wire.

[0044] Each of the folding means 8a and 8b comprises a piston, respectively indicated by the reference number 8ap and 8bp, which piston causes the rotation, for example by means of a piston rod or other means, of the means that hold the terminal portions of the wire. Preferably, these means rotate around a same rotational axis, indicated in figures 4A and 4B as axis H-H, on bearings arranged around this axis H-H. At the end of the rotation of the means that hold the terminal portions of the segment of wire, the tips of these terminal portions are located in the area between the object to be bound and the rotating head 4a of the twisting device 4, namely just below the twisting device 4, according to the local reference system of the figures. In other words, the eyelet-shaped terminal portions are wound around an end portion of the rotating head 4a of the twisting device 4, in particular they are housed in the channel 4', the tips being folded below such rotating head 4a. In this way, four portions of the wire segment can be defined, namely two portions adhering to the object to be bound and two eyelet-shaped portions housed in the channel 4' and folded below the rotating head 4a.

[0045] According to a preferred embodiment of the

present invention, illustrated in figure 5, the means that hold the terminal portions to be folded preferably have the shape of suitably shaped paddles 8al and 8bl mounted on levers, such paddles 8al and 8bl holding and folding, during their rotation, the terminal portions around the rotating head 4a with respect to their rotation axis H-H. In particular such paddles 8al and 8bl are shaped so as to include a suitable recess or housing seats where the terminal portions of the wire are housed.

[0046] The twisting device 4, by means of the rotating movement of its rotating head 4a, is therefore capable of twisting the eyelet-shaped terminal portions of the wire segment wound around the object.

[0047] It is observed the figure 5 does not show the wire passing through the various components of the machine, but it is evident that the wire passes through the channel 4' of the twisting device 4 (as shown in figure 2C) and the housings in the paddles 8al and 8bl, so that the free ends of the wire segment, after the cut of the wire, can be folded by these blades 8al and 8bl in order to form the above-mentioned eyelet E.

[0048] Suitably, in order to improve the binding process, the wire-guide 5 comprises at least two channels for the sliding of the wire, herein indicated as channels 5' and 5", in order to perform at least two turns of the wire around the space S, as illustrated more in detail in figures 6A and 6B.

[0049] In particular, the wire-guide 5 comprises a main body 5b, which has a substantially circular shape and includes at least two adjacent portions shaped so as to form the above-mentioned channels 5' and 5".

[0050] Furthermore, the body 5b of the wire-guide 5 is interrupted by an empty space 10 which allows the housing and the communication with the rotating head 4a of the twisting device 4.

[0051] The wire (in particular the upstream portion or head portion thereof), after being fed into the binding machine 1 by the feeding means 3, passes through the cutting means 7, then it passes through the twisting device 4 through its channel 4', then it travels along the first channel 5' of the wire-guide 5 communicating with the channel 4', and (without passing through the channel 4' of the twisting device 4) it is launched into the second channel 5" of the wire-guide 5 passing below the rotating head 4a of the twisting device 4, and it is finally redirected in the channel 4' to cross with the rear portion thereof.

[0052] The wire-guide 5 is fixed to the support plate 2 by means of a connection portion 11 thereof connected to the circular body 5b. Once it has been fixed to the support plate 2 by means of the connection portion 11, the circular body 5b of the wire-guide 5 protrudes from it, in particular it protrudes from its lower part, according to the local reference system of the figures.

[0053] In particular, the connection portion 11 comprises hubs 12 provided with bearings, such hubs 12 being fixed to the support plate 2. In this way, by means of a piston 13 which drives a lever 14 associated with the hubs 12 and connected to the body 5b of the wire-guide

5, it is possible to switch the wire-guide 5 from an open configuration to a closed configuration wherein the space S is formed and the two channels 5' and 5" are defined.

[0054] Suitably, at least the wire-guide 5 is made of quenched steel, so as to facilitate the sliding of the wire in the channels 5' and 5" thereof, reducing the wear and increasing the overall performance of the binding machine 1.

[0055] Referring again to figures 1A and 1B, the binding machine 1 further comprises a bundle releasing device 15, which comprises a piston that is driven at the end of the binding process with the purpose of facilitating the eyelet bow to come out of the twisting device 4, so as to form a highly automated binding machine 1.

[0056] The binding machine 1 is managed by a central unit adapted to monitor and control it, this central unit being connected to a user interface for the monitoring and the command entry by a user.

[0057] Furthermore, the binding machine 1 comprises a pneumatic system (not shown in the figures) which supplies compressed air in order to move the above-described components.

[0058] In particular, the pneumatic system is controlled by a programmable logic controller (PLC), which is included in the central unit and is apt to monitor and control the components of the binding machine 1, such components being moved according to a specific sequence, so as to perform the binding process in the most effective and automatic way.

[0059] Although the use of a pneumatic system is considered preferred, it is obviously also possible to use a hydraulic system which supplies hydraulic oil if the circumstances and/or needs require it.

[0060] In other words, to summarize, the binding machine 1 of the present invention comprises at least the following components successively crossed by the wire: the feeding means 3 which move the wire, the twisting device 4 which comprises the channel 4' firstly crossed by the wire, the wire-guide 5 within which the wire passes after passing through the twisting device 4 the first time, such wire-guide 5 having at least one channel communicating with the channel 4'. At the end of the second turn in the wire-guide 5, the wire returns into the twisting device 4 and a portion thereof (preferably near or at the upstream or head end) is fixed therein. The machine then comprises the folding means acting at the twisting device 4; in particular, after the retraction of the wire by means of the feeding means 3 (and therefore after the tight winding thereof around the bundle or reel) and after the cutting thereof by means of the cutting means 7 (which can be arranged in any suitable manner), the ends of the segment of the cut wire are eyelet-like folded by the paddles of the folding means which are located at such ends, as described above, and then the twisting is performed; finally, the wire is released by the bundle releasing device.

[0061] The present invention also refers to a method for binding an object, such as a bundle or a skein, such method comprising a preliminary step of providing the

object to be bound at a wire-guide 5 being in an open configuration, such wire-guide 5 being subsequently closed around the object to be bound, defining a space S wherein the object to be bound is housed.

[0062] Such steps are then followed by a step of feeding a wire to the wire-guide 5 by means of suitable feeding means 3.

[0063] The feeding step is then followed by a step of guiding, by means of the wire-guide 5, the wire around the space S where the object to be bound is housed, such wire-guide 5 comprising at least two channels 5' and 5'' to perform at least two turns of the wire around such space S.

[0064] In order to tighten the wire around the bundle or reel to be bound, the method comprises a step of retracting the wire by means of the above-mentioned feeding means 3, such step being followed by a step of separating from such wire a segment thereof by means of cutting means 7. Specifically, the wire segment formed at the end of the cutting step is tightened around the object and comprises two free terminal portions.

[0065] Suitably, the method comprises a step of folding, by means of folding means 8a and 8b, the terminal portions of the segment of wire so as to form from them an eyelet E at a twisting device 4, such eyelet E being wound around an end portion of the twisting device 4 through a channel 4'.

[0066] The method then comprises a step of twisting the eyelet-shaped ends of the wire segment by means of the twisting device 4.

[0067] Obviously, the step of retracting the wire is performed after a step of fixing such wire, such fixing being preferably performed within the twisting device 4.

[0068] Finally, at the end of the twisting, the method comprises a step of opening the wire-guide 5, a step of opening the channel 4' by means of a suitable piston (whose action allows two portions of the rotating head 4a to be separated for the opening of the channel 4'), and the subsequent detachment of the bound object, this step being facilitated by the presence of a bundle releasing device 15.

[0069] In other words, according to the present invention, once the wire has been fed into the binding machine 1, the upstream end (or head end) of such wire firstly passes through the twisting device 4, in particular the channel 4' therein, then it passes through the wire-guide 5, through which it performs at least two turns around the object to be bound and, at the end of the second turn, it returns again in the twisting device 4, within which it is fixed. After cutting the wire, the terminal portions thereof are eyelet-like folded by means of the folding means 8a and 8b and, after the folding, the twisting is finally performed. Once these steps are completed, the wire and the object bound by it are released by the binding machine 1, possibly with the help of a bundle releasing device 15.

[0070] In conclusion, the present invention provides a binding machine wherein, before twisting the terminal

portions of a wire tightened around an object to be bound, such terminal portions are suitably folded so as to form an eyelet, such wire being wound by at least two turns around the object to be bound.

[0071] Advantageously according to the present invention, the eyelet-like folding of the terminal portions of the wire ensures that there are no protruding and pointed ends (tips) at the end of the binding process, with a significant increase in safety for the operators. Substantially, the binding machine of the present invention forms a safety eyelet bow, such eyelet contributing at the same time to the improvement of the mechanical performances of the binding bow, which is formed on four wires.

[0072] Furthermore, the possibility to perform two binding turns around the object to be bound significantly increases the efficiency of the binding machine of the present invention, since a double turn ensures a tighter binding, thus preventing the binding wire from moving once it has been tightened around the object.

[0073] In other words, the double turn ensures a better adherence of the wire to the bundle or reel to be bound, and therefore a better tightness of the binding. Furthermore, it is observed that also the latter aspect contributes to the improvement in safety of the binding obtained.

[0074] The combination of the presence of folding means forming the eyelet-like portion and the presence of a double channel to obtain the double turn of the wire is therefore particularly advantageous, thus ensuring a safer and a more resistant binding.

[0075] Obviously, a person skilled in the art, in order to meet particular needs and specifications, can carry out several changes and modifications to the binding machine and to the binding method described above, all included in the protection scope of the invention as defined by the following claims.

Claims

1. A binding machine (1) for binding at least one object, comprising:

- a wire-guide (5) adapted to guide a wire around a space (S) where the object to be bound is housed, said wire-guide (5) comprising at least two channels (5', 5'') to perform at least two turns of said wire around said space (S);
- feeding means (3) adapted to feed said wire to said wire-guide (5) and to retract said wire in order to tighten it around the object to be bound;
- cutting means (7) of said wire adapted to separate from said wire a segment thereof, said segment being tightened around the object and comprising two free terminal portions;
- folding means (8a, 8b) adapted to fold said terminal portions of said segment so as to form an eyelet (E); and
- a twisting device (4) adapted to twist said eye-

let-shaped terminal portions.

2. The binding machine (1) according to claim 1, **characterized in that** said wire-guide (5) comprises a body (5b), said body (5b) having a substantially circular shape and including at least two adjacent portions shaped so as to form said at least two channels (5', 5"). 5
3. The binding machine (1) according to claim 1 or 2, **characterized in that** said feeding means (3) comprise a puller (3a) and an introducing track (3b) of said wire. 10
4. The binding machine (1) according to claim 3, **characterized in that** said puller (3a) comprises at least one pair of rollers (3r) adapted to drag said wire towards/from said wire-guide (5). 15
5. The binding machine (1) according to any one of the preceding claims, **characterized in that** at least said wire-guide (5) is made of quenched steel. 20
6. The binding machine (1) according to any one of the preceding claims, **characterized in that** said twisting device (4) comprises a rotating head (4a) connected to a first gear wheel (G1), which engages with a second gear wheel (G2) that is rotated by a movable element (9) to which said second gear wheel (G2) is connected, the rotation of said second gear wheel (G2) causing the rotation of said rotating head (4a). 25 30
7. The binding machine (1) according to claim 6, **characterized in that** said rotating head (4a) comprises at least one channel (4') communicating with said wire-guide (5) to allow the passage and the holding of said wire in said twisting device (4). 35
8. The binding machine (1) according to any one of the preceding claims, **characterized in that** said folding means (8a, 8b) comprise means adapted to house said terminal portions of said wire, said means being rotated by at least one piston (8ap, 8bp). 40 45
9. The binding machine (1) according to any one of the preceding claims, **characterized in that** it comprises locking means (6) adapted to hold said wire during the retraction thereof by means of said feeding means (3), so as to tighten said wire around the object. 50
10. The binding machine (1) according to any one of the preceding claims, **characterized in that** it comprises a pneumatic system adapted to supply compressed air for moving its components, said pneumatic system being controlled by a central unit apt to monitor and control said binding machine (1). 55

11. A method for binding at least one object, comprising the steps of:

- feeding a wire into a wire-guide (5) by means of feeding means (3);
- guiding, by means of said wire-guide (5), said wire around a space (S) where the object to be bound is housed, said wire-guide (5) comprising at least two channels (5', 5") to perform at least two turns of said wire around said space (S);
- retracting, by means of said feeding means (3), said wire in order to tighten it around the object to be bound;
- separating, by means of cutting means (7), from said wire a segment thereof, said segment being tightened around the object and comprising two free terminal portions;
- folding, by means of folding means (8a, 8b), said terminal portions of said segment so as to form an eyelet (E) at a twisting device (4); and
- twisting, by means of said twisting device (4), said eyelet-shaped terminal portions of said wire.

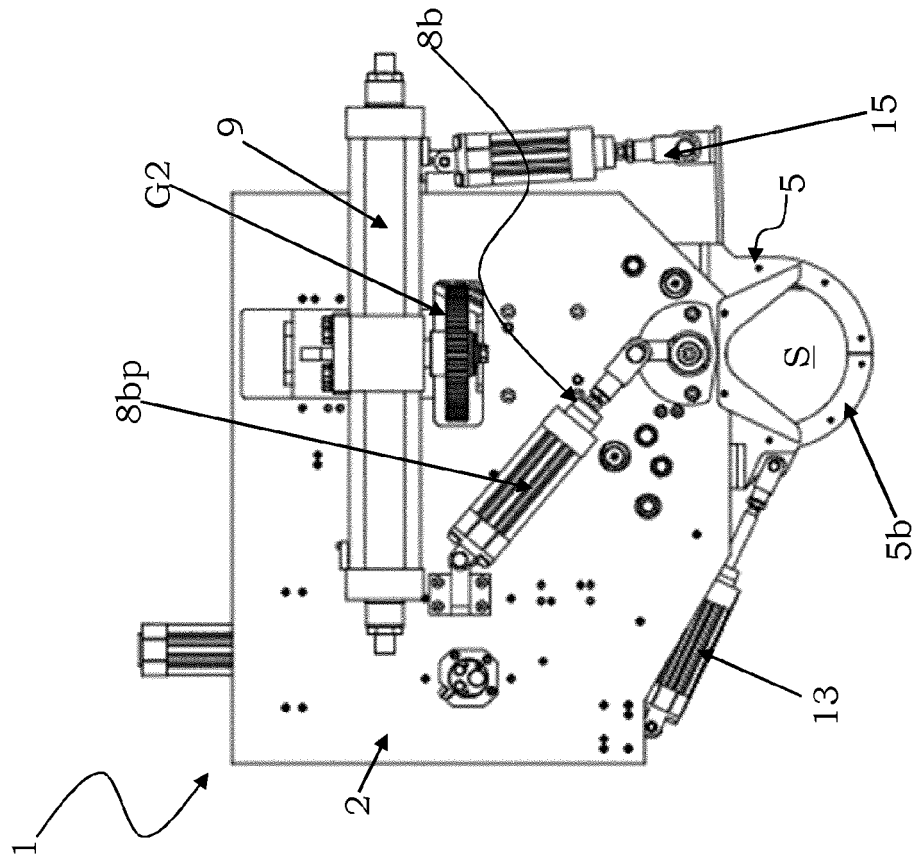


FIG. 1B

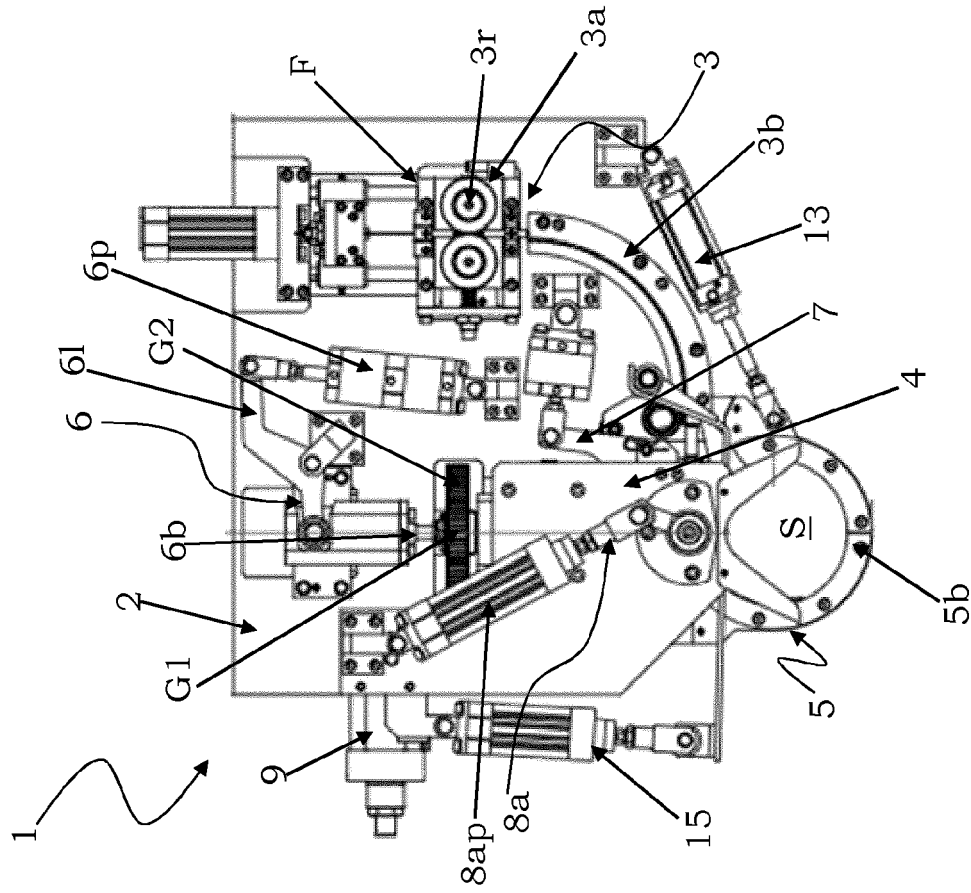


FIG. 1A

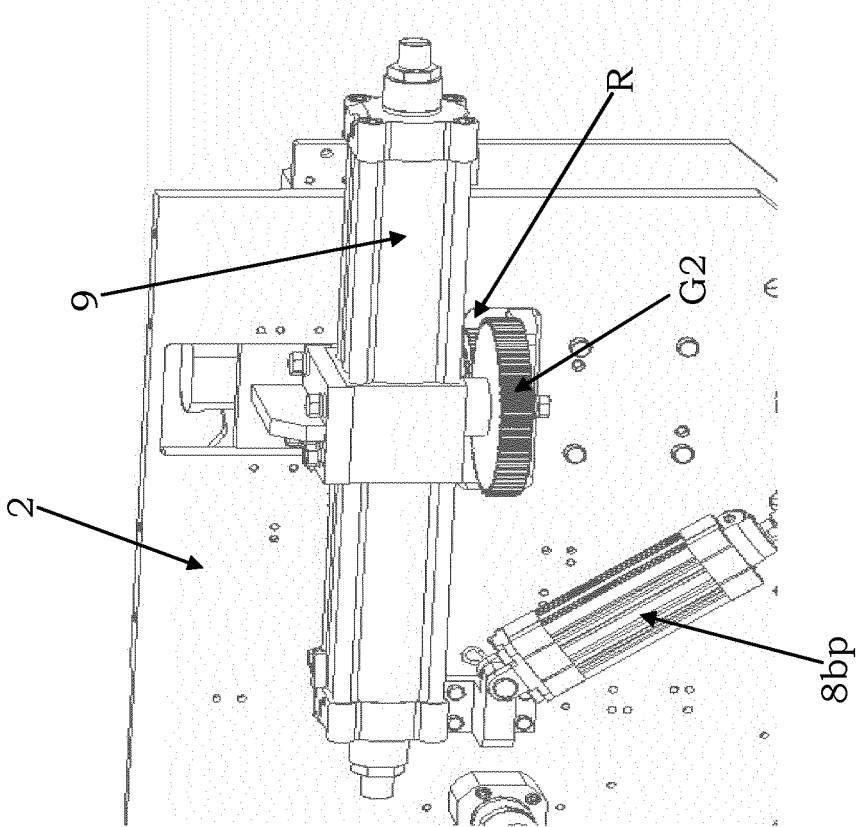


FIG. 2B

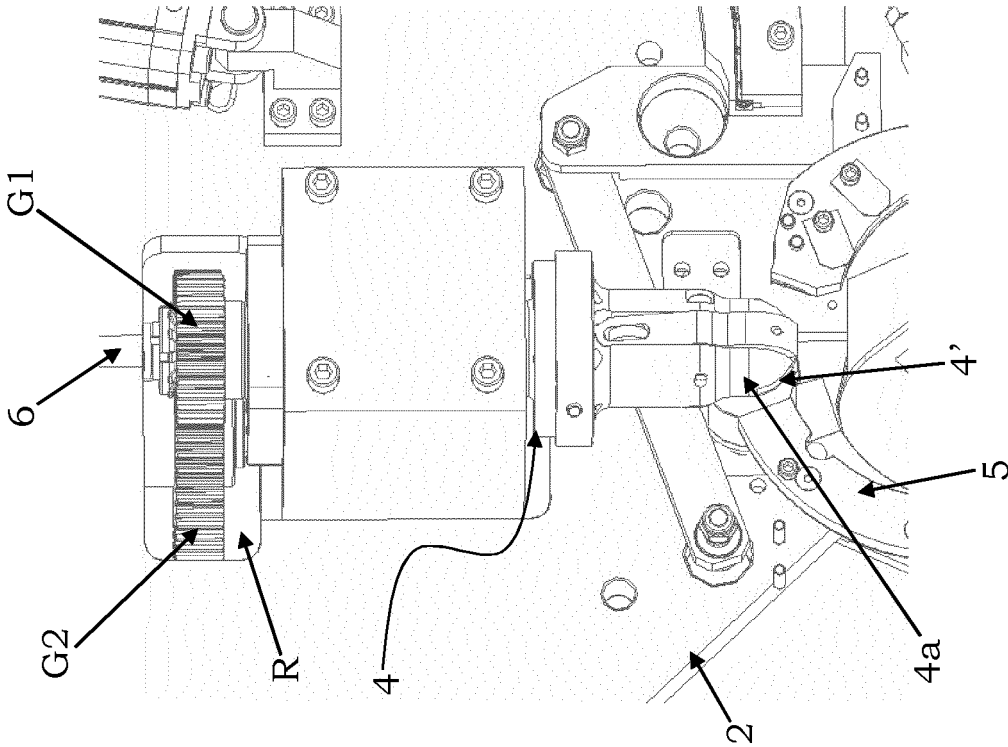


FIG. 2A

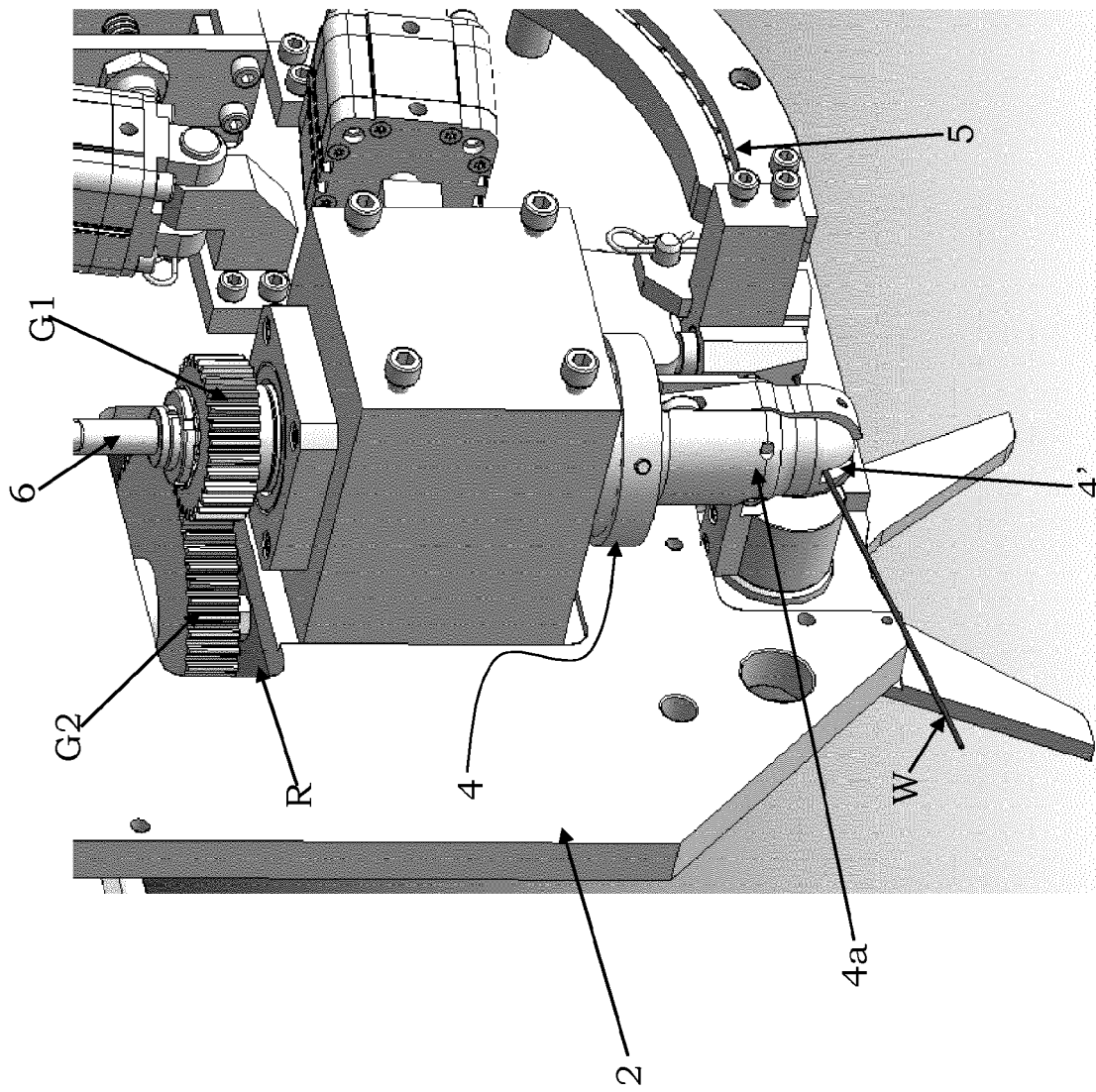


FIG. 2C

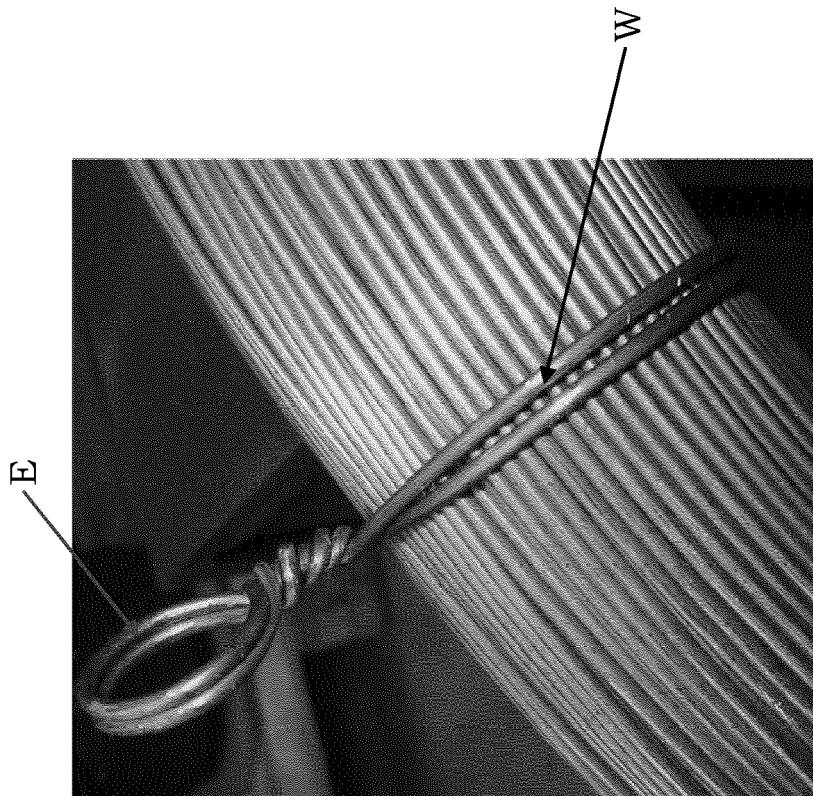


FIG. 3

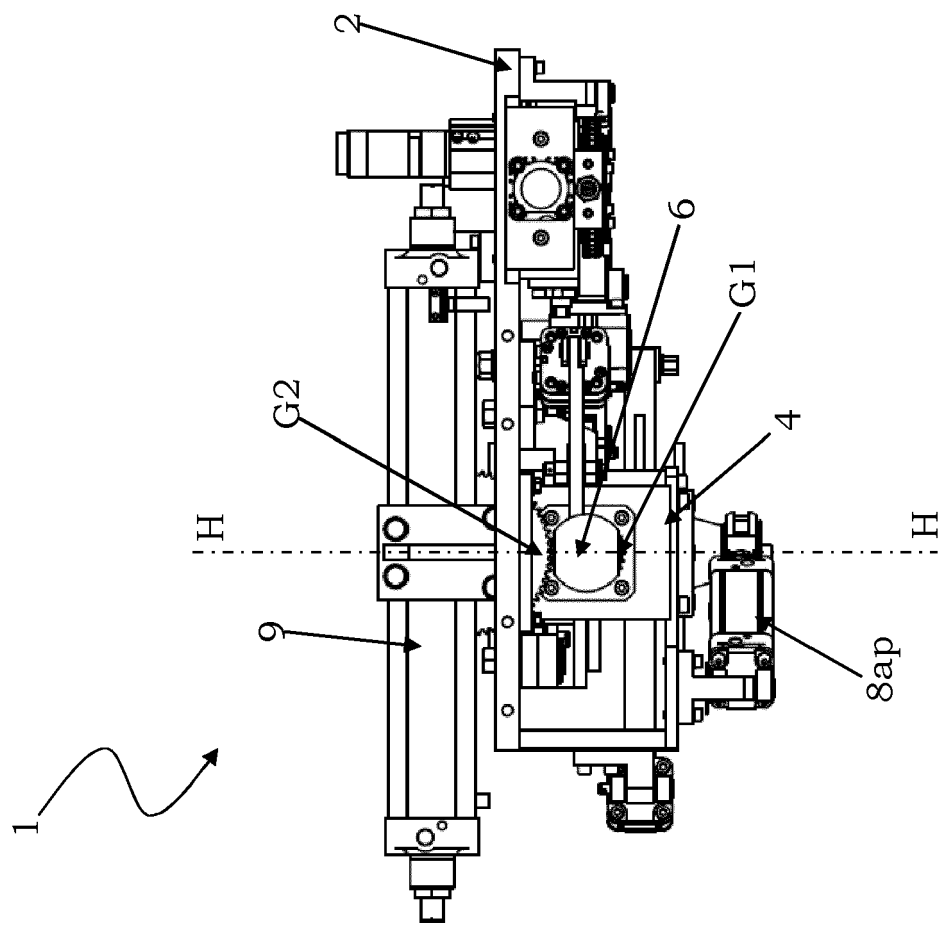


FIG. 4B

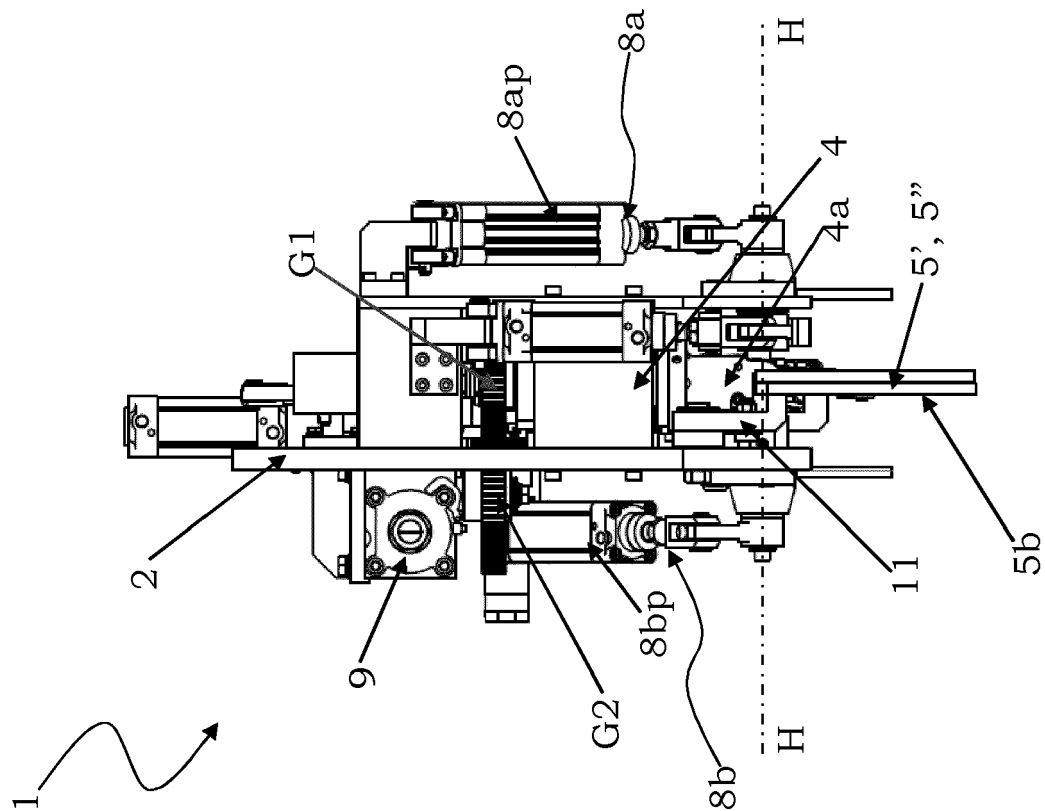


FIG. 4A

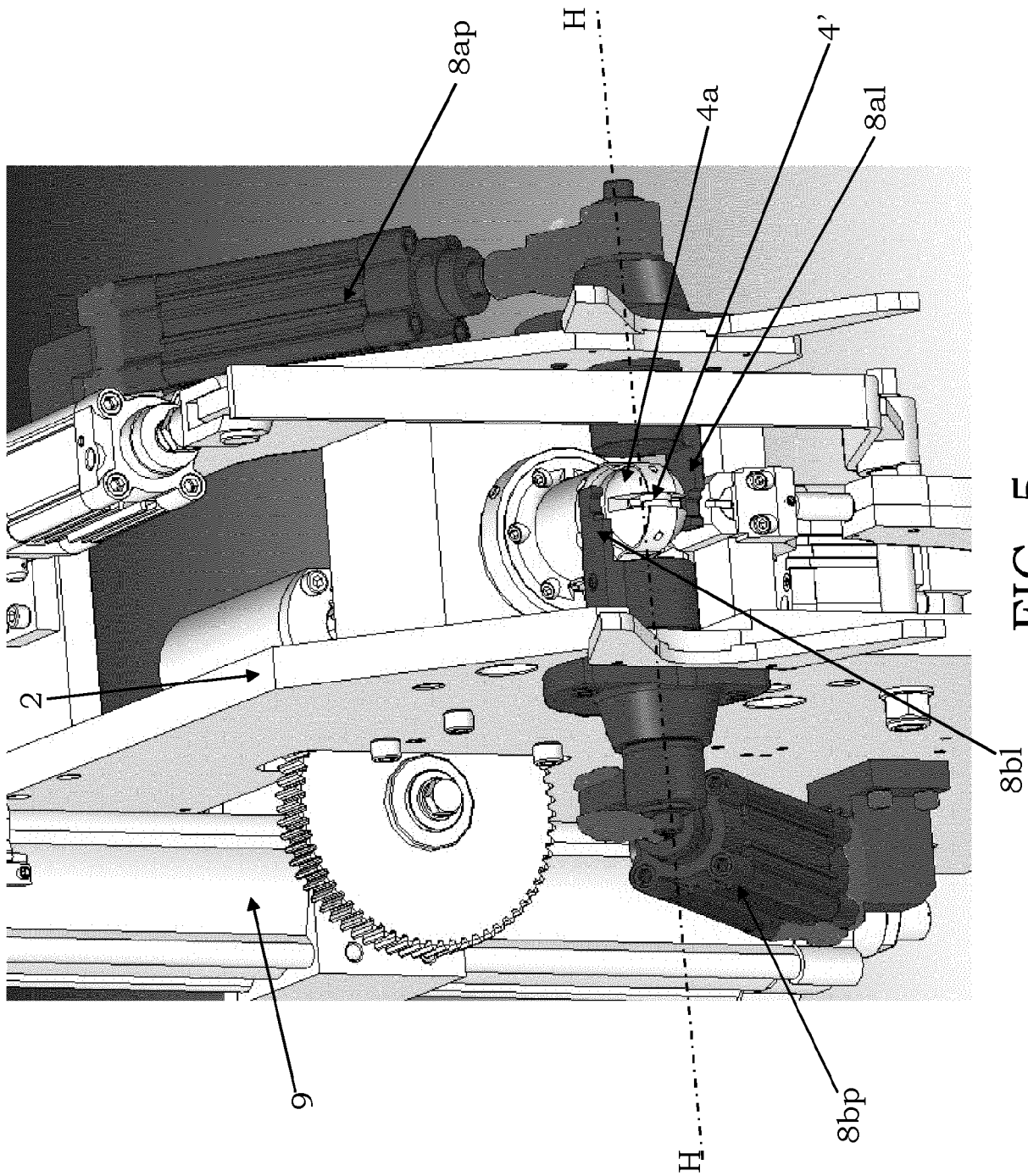


FIG. 5

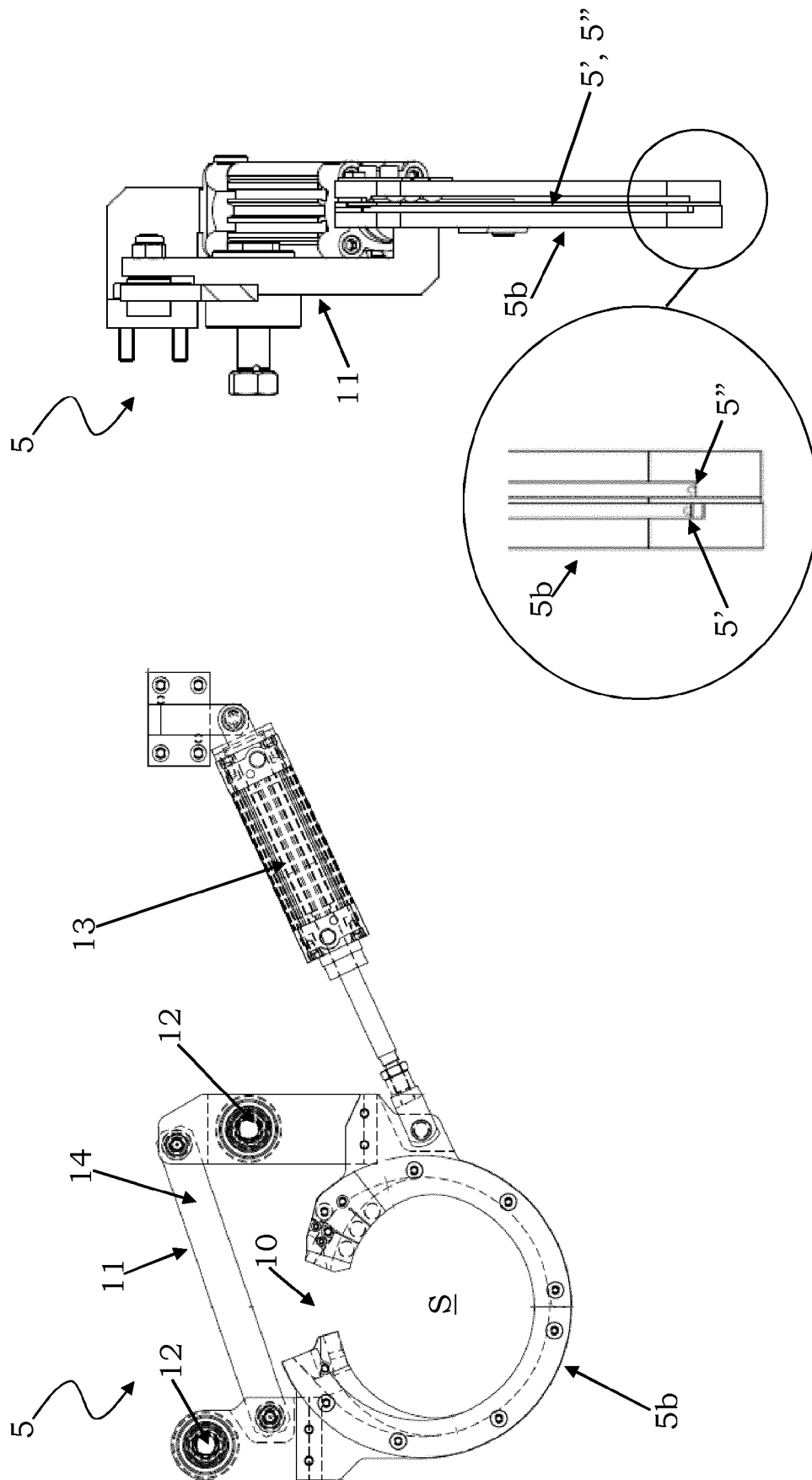


FIG. 6B

FIG. 6A



EUROPEAN SEARCH REPORT

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Place of search Munich		Date of completion of the search 11 October 2018	Examiner Paetzke, Uwe
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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