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

(11) EP 1 072 519 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.01.2001 Bulletin 2001/05

(51) Int. Cl.[7]: **B65B 69/00**

(21) Application number: **00116307.0**

(22) Date of filing: **27.07.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **28.07.1999 IT TO990666**

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(54) Method and machine for removal of binding strings or wires from a bale, in particular a bale of cellulose

(57) Method for the removal of binding strings or wires (2) from a bale of cellulose (3), presenting the steps of identifying each of the binding strings or wires (2), of cutting the said strings or wires (2), and of coupling an intermediate portion (67) of each string or wire (2) to a single mobile drawing head (18) towards a depositing station (7a) in a given direction (46a); the drawing head (18) having a pair of comb-like members (49), each of which is provided with a plurality of seats (52) set alongside each other, and the coupling of the strings or wires (2) to the drawing head (18) being achieved by displacing the head (18) and the bale (3) with respect to one another in a vertical direction until the comb-like members (49) are brought into a position facing respective lateral surfaces (16) of the bale (3), separating the intermediate portions (67) of the strings or wires (2) until each intermediate portion (67) is inserted inside a corresponding seat (52), and clamping each intermediate portion (67) inside the corresponding seat (52) by means of a respective mobile clamping member (54).

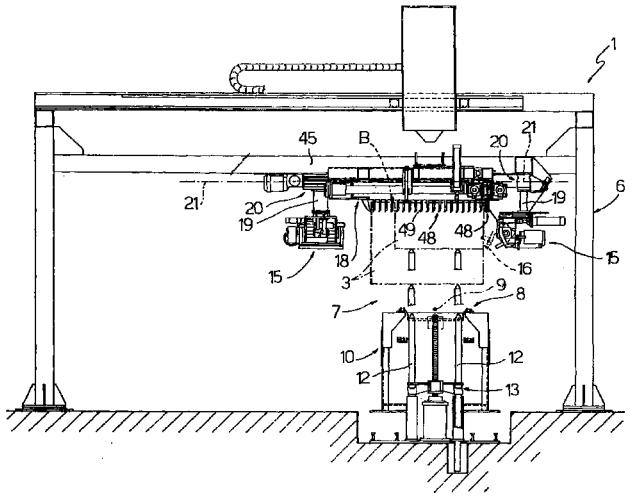

Fig.1

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Description

[0001] The present invention regards a machine for removing binding strings or wires from a bale, in particular, a bale of cellulose, to which the ensuing description will explicitly refer, without this implying any loss of generality.

[0002] As is known, a bale of cellulose comprises a plurality of cellulose sheets stacked on top of each other, an outer wrapping of paper material for wrapping the piled sheets, and two or more pairs of binding strings or wires, normally wires, extending outside the paper material. When the cellulose is to be used, the strings or wires are removed by means of a removing machine comprising a string-cutting or wire-cutting unit, generally of the type with translating blades, and an assembly for gripping and removing the cut strings or wires. The gripping and removing assembly generally consists of a gripping and moving head equipped with two pairs of scraper members, which are set on opposite sides of the bale and are made to slide one towards the other in contact with the upper surface of the bale itself. During their displacement, the scraper members hook onto the strings or wires and grip them together, after which the head is displaced in a direction parallel to a side surface of the bale and brought into an unloading station, where the strings or wires that have been taken away are released.

[0003] Even though the known machines of the type described above are currently in use, they are far from satisfactory in that they do not enable easy and reliable removal of the strings or wires independently of the geometrical characteristics of the bale. In fact, following upon transportation and/or storage or standing of the bales in relatively damp environments, localized swellings tend to form in the bales, whereby their lateral surfaces, which were originally flat, become undulated, and often the strings or wires themselves sink into the bale. In addition, again during handling of the bales, frequently the paper wrapping of the bales gets partially torn, with the formation of cavities and loose flaps of paper material distributed in a random manner. As a result, in such conditions the scraper members frequently fail to hook onto the strings or wires, which thus remain embedded in the bale even after displacement of the head towards the unloading station. Furthermore, in many cases, in the vicinity of a swelling the scraper members penetrate into the bale, further tearing in an unforeseeable way both the paper wrapping material and the sheets of cellulose, and generating a dangerous state of stress on the structure of the machine. High stresses on the machine structure are generated in any case also following on hooking up of the embedded strings or wires, which, when they are being pulled out, tear the sheets of cellulose to the extent, in certain cases, of shearing the edge portions of the bale completely. For these reasons, the known machines have supporting structures and assemblies for guiding and moving both the gripping elements and the head itself, which are particularly cumbersome and costly.

[0004] The purpose of the present invention is to provide a method for removal of binding strings or wires from a bale, in particular a bale of cellulose, which enables solution of the problems described above in a simple and economic way.

[0005] According to the present invention, a method is provided for the removal of binding strings or wires from a bale, in particular a bale of cellulose, the method comprising the steps of cutting each string or wire identified, coupling an intermediate portion of each string or wire to a single drawing head, and pulling out the said strings or wires by displacing the drawing head towards a station for depositing the strings or wires, the method being characterized in that coupling of the said strings or wires to the drawing head comprises the steps of displacing the bale and the said drawing head with respect to one another in a vertical direction so as to bring a pair of comb-like members of the said drawing head, each of the said members being provided with a plurality of corresponding seats set alongside one another, into a position at least partially facing the respective side surfaces of the bale, of displacing the said intermediate portions of the said strings or wires, each string or wire being engaged to a respective said seat, and of clamping each said string or wire inside the corresponding seat itself.

[0006] The present invention moreover regards a machine for the removal of binding strings or wires from a bale.

[0007] According to the present invention, a machine for removing binding strings or wires from a bale, in particular a bale of cellulose, is moreover provided, the machine comprising cutting means for cutting each binding string or wire, a single drawing head for pulling the cut strings or wires which comprises retention means for withholding an intermediate portion of each of the strings or wires, and guiding means for guiding the drawing head towards a station for depositing the strings or wires, the machine being characterized in that the said retention means comprise a pair of comb-like members, each provided with a plurality of seats set alongside one another, first means of relative displacement being provided for displacing the said bale and the said drawing head with respect to one another in a vertical direction until the said comb-like members are brought into positions at least partially facing respective lateral surfaces of the bale, and second means of movement of the said strings or wires being provided to bring each said intermediate portion to become engaged with a respective said seat; the said drawing head moreover comprising, for each said string or wire, a clamping element which is mobile with respect to the corresponding comb-like member for clamping each string or wire inside the corresponding said seat.

[0008] The invention will now be described with reference to the annexed drawings which illustrate a non-

limiting embodiment thereof and in which:

Figure 1 illustrates, in side elevation, a preferred embodiment of a machine for the removal of binding strings or wires from a bale of cellulose according to the present invention;

Figure 2 illustrates the machine of Figure 1 in plan view and according to an enlarged scale, with parts removed for reasons of clarity;

Figures 3, 4 and 5 illustrate three different items of Figure 1 partially in cross section and according to an enlarged scale;

Figure 4a is similar to Figure 4 and illustrates a variant of an item of Figure 4;

Figure 6 is a view of Figure 5 taken according to the line VI-VI, with parts removed for reasons of clarity; and

Figure 7 is a perspective view of a bale fed towards the machine 1.

[0009] In Figure 1, the reference number 1 indicates, as a whole, a machine for the removal of binding strings or wires 2 from a bale 3 of cellulose (Figures 1-4 and 7) presenting a basically parallelepipedal shape and comprising a stack of sheets of cellulose and an external wrapper 4 made of paper material, around which two pairs of strings or wires are wound in crosswise fashion (Figure 7).

[0010] The machine 1 comprises a portal-frame fixed structure 6 of its own, a station 7 for removal of the strings or wires 2, and a known feed conveyor 8 (Figure 1) for feeding a plurality of bales 3 in succession into the station 7 in a basically horizontal feeding direction 9. The station 7 houses a supporting and displacement assembly 10 which comprises a plurality of vertical struts 12 and a displacement device 13 of the screw-nut-screw type for displacing the struts 12, and hence the bale 3, in a vertical direction between one lowered position (Figure 1), in which the bale 3 is set on the conveyor 8, and one raised position for removal of the strings or wires 2. Once set in the raised position, the bale 3 extends between two assemblies 15 for detection, cutting and gripping of the strings or wires 2, the two assemblies being set in positions facing respective mutually perpendicular and adjacent side faces 16 of the bale 3 (Figures 1 and 4) and in a position close to a drawing head 18 for pulling the strings or wires 2 (Figures 1-3), which partially surrounds a top terminal portion of the bale 3 itself and is designed to withhold an intermediate portion of the strings or wires 2.

[0011] According to what is illustrated in Figure 1, and in particular in Figure 4, the assemblies 15 are identical to each other and comprise respective motor-driven supporting frames 19 which are coupled to the fixed structure 6 by means of respective guide and slide assemblies 20, which are already known and are not described in detail herein and which are free to move in opposite senses with respect to the structure 6 itself in respective horizontal directions 21 (Figure 1), the said horizontal directions 21 being mutually orthogonal and each being substantially parallel to the corresponding surface 16 of the bale 3 under the thrust exerted by the respective electric motors (not illustrated). According to what is illustrated, in particular in Figure 4, each frame 19 supports a slide 22 of its own, which is coupled to the corresponding frame 19 and can move, in a sliding manner, away from and towards the bale 3 in a direction 23 orthogonal to the corresponding direction 21 under the thrust exerted by a corresponding pneumatic linear actuator, designated by 24. Alternatively, according to what is illustrated in Figure 4a, the slide 22 is coupled to the frame 19 so that it can slide always according to the same direction 23, which is perpendicular to the corresponding direction 21, and so that it can rotate, with respect to the frame 19 and the bale 3, about an axis 22a of a hinge 22b, the axis being parallel to the corresponding direction 21 and to the corresponding side face of the bale itself, under the control of a linear actuator 22c interposed between the frame 19 and the slide 22. The actuator 22c is preferably of a pneumatic type and may be activated so as to rotate the slide 22 between two operating angular positions, or, alternatively, may be defined by a simple member that is elastically deformable, for example a compression spring, and is designed to oppose elastically the counterclockwise rotation of the slide 22 in Figure 4a.

[0012] Each slide 22 in turn supports a magnetic detector 25, in itself known, which is integrally connected to the end portions of a pair of supporting arms 26 (Figure 5), the opposite ends of which are hinged to the corresponding slide 22 in order to be able to rotate with respect to the slide 22 under the thrust exerted by a linear actuator 27 between an advanced operating position of detection, indicated by the dashed line in Figure 4, in which the magnetic detector 25 sets itself in contact with the bale 3, and a retracted, resting position, indicated by a continuous line in Figure 4.

[0013] According to what is illustrated in Figures 4 and 5, each slide 22 further supports a cutting device 28, which comprises two cutting blades 29, each of which is carried by a sleeve 30 of its own (Figure 5), the sleeve being coupled in a sliding way to a corresponding guide rod 31 which is integrally connected to the corresponding slide 22. The sleeves 30 are free to move along the corresponding rods 31 in opposite senses under the thrust exerted by an actuator assembly 32 of a screw-nut-screw type comprising a single motor-driven screw 33 which extends parallel to the rods 31 and has two threaded portions, one with a right-handed thread and the other with a left-handed thread, and for each portion a corresponding internal thread 34 integrally connected to the corresponding sleeve 30.

[0014] To each of the sleeves 30 is moreover integrally connected a corresponding law 36 which is flattened and shaped like a harpoon. The said jaw 36 forms part of a device 37 for gripping and moving the strings or

wires 2, the said device 37 also being carried by the corresponding slide 22. With reference to Figure 5, the jaws 36 extend above the blades 29 and are mobile between an opened position, in which they enable entry of the string or wire 2, and a closed position (Figure 6), in which they define a resting surface 38 for the string or wire 2. The string or wire 2 is forced against the resting surface 38 by a thrust-exerting head 39 which, as illustrated, in particular in Figure 6, is coupled to the corresponding slide 22 in a sliding manner so that it can move away from or move towards the resting surface 38 in a direction parallel to the direction 23. The head 39 is pushed towards the resting surface 38 by a helical spring 40 and may be moved away from the resting surface 38 by means of an element 41 with an inclined plane. The element 41 extends between a fixed shoulder carried by the slide 22 and a mobile shoulder carried by the head 39 and may be displaced orthogonally to the direction of displacement of the head 39 itself by means of a known linear actuator 43 carried by the slide 22.

[0015] According to what is illustrated in Figure 2, and in particular in Figures 1 and 3, the drawing head 18 for pulling the strings or wires 2 comprises a metal frame 44 of its own, which is integrally connected to a motor-driven carriage 45 (Figure 2) coupled to an overhead slide guide 46 which extends horizontally above the station 7 and above a station 7a (Figure 2) for unloading the strings or wires 2 that have been removed. The carriage 45, and hence the drawing head 18, are mobile, under the thrust exerted by a motor-driven actuator assembly (known and not illustrated), along the guide 46 itself in a direction 46a lying in a vertical plane, the trace of which is indicated by P in Figure 2, the said direction 46a forming, with respect to the direction of feed 9, an angle A other than 90° and preferably in the region of 45°, and forming with respect to the portions 2a of the said strings or wires 2 lying on an upper surface B of the said bale an angle other than zero and 90°. The frame 44 carries, integrally connected to it, two retention assemblies 48 for withholding the strings or wires 2, the said assemblies being identical to each other and comprising respective elongated comb-like members 49, which extend downwards from respective adjacent perimetral sides of the frame 44, and each of which, parallel to a respective direction 21 of displacement of the respective frame 19 so that each one sets itself parallel to and in a position at a distance from the corresponding surface 16 of the bale 3 when the bale 3 itself is set in its raised position.

[0016] With reference to Figure 3, each comb-like member 49 comprises an elongated horizontal portion 50 and a plurality of teeth 51 extending downwards parallel to one another and defining between them a plurality of elongated seats 52 that are set alongside each other, and each of which is designed to accommodate an intermediate portion of a corresponding string or wire 2. Each string or wire 2 is withheld inside any one of the above-mentioned seats 52 by means of a corresponding fork-like clamping element 54, which comprises two curved arms 55 set on opposite sides of the corresponding comb-like member 49 substantially in contact with the teeth 51 (Figure 4), and is connected to a corresponding guiding and movement device which can be actuated and controlled independently of the other guiding devices 57 to grip the string or wire 2 against a corresponding tooth 51. In particular, each device 57 comprises a corresponding guide 58 (Figure 4) which is integrally connected to the frame 44 and extends parallel to the corresponding comb-like member 49 and to the direction 21 of displacement of the frame 19 of the corresponding assembly 15, and a carriage 59 coupled to the corresponding guide 58 in a sliding manner. Each carriage 59 is free to move along the corresponding guide 58 in opposite senses under the thrust exerted by a corresponding linear motor 60 which comprises a corresponding rod 61 that is integrally connected to the frame 44 parallel to the guides 58, and a tubular slide 62 which is free to slide along the rod 61 itself and is integrally connected to the carriage 59.

[0017] The operation of the machine 1 will now be described considering, for reasons of simplicity of exposition, a single comb-like member 49 and a single assembly 15 for detection, cutting and gripping, and starting from the condition in which a bale 3 is set in the station 7 underneath the drawing head 18, the supporting and movement assembly 10 extends beneath the conveyor 8, both of the fork-like clamping elements 54 are set in a waiting station 64 of their own (Figure 2), and the assemblies 15 for detecting, cutting and gripping are kept close to one end of the corresponding comb-like member 49.

[0018] Starting from this condition, the assembly 10 is operated, which raises the bale 3 until it takes the comb-like member 49 into a position facing the corresponding side surface 16, after which the detector 25 is brought into its advanced position, and the corresponding frame 19 is advanced in the corresponding direction 21. During this advance, the detector 25 comes into sliding contact with the bale 3 and, as soon as it locates the first string or wire 2 of the corresponding pair of strings or wires, the frame 19 is blocked and, after bringing both the blades 29 and the jaws 36 into their open position, the slide 22 is advanced towards the bale 3 in the direction 23 until it sets both the blades 29 and the jaws 36 on either side of the string or wire 2 that has been located. During this advance, the head 39 can be kept in one of its set-back positions by displacement of the element 41 with inclined plane into one of its forward positions. Now both the blades 29 and the jaws 36 close, causing shearing of the string or wire 2 and insertion of the latter between the jaws 36, after which the head 39 is released from the constraint with the element 41 and, under the thrust exerted by the spring 40, clamps the string or wire 2 by friction against the resting surface 38, and the slide 22 is brought back into its set-

back position. At the same time as the slide 22 moves back, a pusher member 65 carried by the frame 19 is advanced by means of a linear actuator 66 towards the bale 3 and forced against the lateral surface 16 so as to keep the wrapping 4 in contact with the sheets of cellulose. Again while the slide 22 is moving backwards, the intermediate portion 67 of the string or wire 2 (Figure 4), which is coupled by friction to the device 37, moves progressively away from the surface 16, running between the jaws 36, and is lifted up until it engages a seat 52 of the comb-like member 49 (Figure 4). At this point, one of the motors 60 is activated, and the corresponding fork-like element 54 is advanced along the member 49 itself towards the seat 52, which is engaged by the portion 67 of the string or wire 2, until it grips the portion 67 against one of the two teeth 51 that delimits the seat 52, and both the blades 29 and the jaws 36 are then brought back into their open position. Next, the detector 25 is once more brought forward towards the surface 16, and the frame 19 is once more brought forward in the direction 21 until it locates the second string or wire 2 of the pair of strings or wires, the said string or wire then being connected to the head 18 according to the steps described previously.

[0019] As soon as all the binding strings or wires 2 are firmly connected to the comb-like members 49, the head 18 is displaced in the direction 46a towards the station 7a for depositing the strings or wires 2, so causing the latter to be pulled out of the bale 3. Once the depositing station 7a has been reached, the fork-like elements 54 are brought back into their open position, thus releasing the strings or wires 2 from the constraint with the comb-like members 49, after which the bale 3, which has been released from the strings or wires 2, is lowered onto the conveyor 8, which takes it away from the station 7.

[0020] From what has been said above it emerges clearly that the presence of the comb-like members 49 and the corresponding clamping elements 54 which may be displaced along the corresponding comb-like members 49 independently of one another enable stable connection of the strings or wires 2 to the head 18, whatever may be the position of the strings or wires 2 in the bale 3, and above all whatever may be the positions assumed by the portions 67 of the strings or wires 2 with respect to the corresponding resting surfaces 16 and with respect to the corresponding edge of the bale 3 after the gripping devices 37 have moved back. In fact, as soon as the portion 67 of the string or wire 2 detaches from the corresponding surface 16, it engages the mouth of the corresponding seat 52 and, already in this position, the corresponding clamping element 54 is able to pick it up, take it inside the seat 52 itself, and clamp it there. The use of magnetic linear motors enables a predetermined clamping force to be exerted and above all a force that does not vary over time, the overall dimensions of the equipment being at the same time kept to a minimum.

[0021] The particular constructional features of the assemblies 15 for detecting, cutting and gripping further enable precise location, cutting and above all hooking-up of each string or wire 2 irrespective of the depth at which the string or wire 2 is set in the bale 3, without causing substantial damage either to the wrapping 4, which moreover during the phase in which the jaws 36 are moving away is held in position by the member 65, or to the sheets of cellulose themselves.

[0022] The fact that the strings or wires 2 are pulled out by displacing the head 18 in an inclined direction both with respect to the direction 9 of advance of the bales 3 and with respect to the directions in which the strings or wires 2 extend on the upper surface of the bale 3 enables convenient extraction of the strings or wires 2 even when the bale 3 is deformed and the strings or wires 2 are partially embedded in the bale 3 itself. In particular, it has been possible to note that the displacement of the head 18 in the aforesaid direction prevents, as compared to the known solutions, the formation of loose flaps which render the subsequent manipulation of the wrapper 4 and sheets of cellulose difficult, but above all prevents shearing of corner portions of the bale 3 by the embedded strings or wires, and hence the undesirable loss of material.

[0023] In particular, the only forces necessary for removing the binding strings or wires are those required for deformation of the binding strings or wires until the portion of string or wire that is not in contact with the bale reaches a length equal to the sum of the length/width of the bale in plan view and the height of the bale. The fact that the device 28 and the jaws 36 can turn with respect to the frame 19 about the hinge axis 22a and are forced, during use, against the bale by the actuator 22c makes it possible to achieve excellent results as regards cutting and gripping even in the case of bales having lateral surfaces or sides that are not perpendicular.

[0024] The fact that the drawing head 18 is coupled to the structure 6 in a vertically fixed position and that the bale 3 is displaced away from and towards the drawing head 18 enables simplification and reduction in the weight of the structure 6 itself, given that in this way it is no longer subjected to bending stresses resulting from the vertical displacement of the drawing head 18, as well as enabling reduction of cycle times.

[0025] From the foregoing description it clearly emerges that modifications and variations may be made to the machine 1 described herein without thereby departing from the sphere of protection of the present invention. In particular, a different mode of clamping of the strings or wires 2 on the comb-like members 49 could be envisaged, and the assemblies 15 for detecting, cutting and gripping described herein could be replaced by different assemblies. In addition, the lifting assembly 10 could be provided solely for disengaging the bale from the feed conveyor, and the drawing head 18 could be connected to an actuator assembly

designed to displace the drawing head 18 vertically away from and towards the bale.

Claims

1. Method for the removal of binding strings or wires (2) from a bale (3), in particular a bale of cellulose, the method comprising the steps of cutting each string or wire (2) identified, of coupling an intermediate portion (67) of each string or wire (2) to a single drawing head (18), and of pulling out the said strings or wires (2) by displacing the drawing head (18) towards a station (7a) for depositing the strings or wires (2), the method being characterized in that coupling of the said strings or wires (2) to the drawing head (18) comprises the steps of displacing the bale (3) and the said drawing head (18) with respect to one another in a vertical direction so as to bring a pair of comb-like members (49) of the said drawing head (18), each of which is provided with a plurality of seats (52) set alongside each other, into a position at least partially facing respective lateral surfaces (16) of the bale (3), of displacing the said intermediate portions (67) of the said strings or wires (2) so that each portion (67) is inserted inside a corresponding seat (52), and of clamping each said string or wire (2) inside the corresponding seat (52).

2. Method according to Claim 1, characterized in that the said intermediate portions (67) of the said strings or wires (2) are brought in succession inside the respective seats (52) and clamped, again in succession, inside the respective seats (52).

3. Method according to Claim 1 or Claim 2, characterized in that clamping of the said strings or wires (2) is achieved by gripping each intermediate portion (67) onto the corresponding said comb-like member (49).

4. Method according to Claim 3, characterized in that clamping of each string or wire is achieved by displacing a corresponding clamping member (54) along the said comb-like body (49) until it meets up with the corresponding said string or wire (2).

5. Method according to Claim 4, characterized in that the displacements of the said clamping members (54) are carried out independently of one another.

6. Method according to any one of the foregoing claims, characterized in that the displacement of each said string or wire (2) inside the respective said seat (52) comprises the steps of moving the said intermediate portion (67) of the said string or wire to a distance away from the corresponding lateral surface (16) of the said bale (3); the said removal being carried out by coupling the said intermediate portion (67) to a corresponding gripper (37) which is free to move only according to a direction (23) orthogonal to the corresponding said lateral surface (16) and by allowing the string or wire (2) to slide with respect to the gripper (37) during displacement of the gripper (37) in the said orthogonal direction (23).

7. Method according to any one of the foregoing claims, characterized in that coupling of the said strings or wires (2) to the said drawing head (18) is achieved by keeping the said comb-like members (49) fixed and displacing the bale (3) vertically towards the comb-like members (49) themselves.

8. Method according to any one of the foregoing claims, characterized in that the displacement of the said drawing head (18) towards the said depositing station (7a) is achieved by displacing the drawing head (18) in a direction (46a) lying in a vertical plane (P) forming an angle (A) other than 90° with respect to a substantially horizontal direction (9) of feeding of the said bales (3).

9. Method according to Claim 8, characterized in that the said plane (P) forms an angle (A) other than zero and 90° with respect to the portions of the said strings or wires (2) lying on a top surface of the said bale (3).

10. Method according to Claim 8 or Claim 9, characterized in that the said plane (P) forms an angle of roughly 45° with respect to the said feed direction (9) of the said bales (3).

11. Machine (1) for removing the binding strings or wires from a bale (3), in particular a bale of cellulose, the machine (1) comprising cutting means (28) for cutting each binding string or wire (2), a single drawing head (18) for pulling the strings or wires (2) that have been cut, the drawing head (18) comprising retention means (48) for withholding an intermediate portion (67) of each of the strings or wires (2), and guiding means (46) for guiding the drawing head (18) towards a station (7a) for depositing the strings or wires (2), the machine (1) being characterized in that the said retention means (48) comprise a pair of comb-like members (49), each of which is provided with a plurality of seats (52) set alongside each other, first relative displacement means (10) being provided for displacing the said bale (3) and the said drawing head (18) with respect to each other in a vertical direction until the said comb-like members (49) are brought into positions at least partially facing corresponding side surfaces (16) of the bale (3), and second displacement means for the said strings or wires being pro-

vided for bringing each said intermediate portion (67) to engage into a respective said seat (52); the said drawing head (18) moreover comprising, for each said string or wire (2), a clamping element (54), which is mobile with respect to the corresponding comb-like member (49) to clamp each string or wire (2) inside the corresponding said seat (52).

12. Machine according to Claim 11, characterized in that each said comb-like member (49) comprises a plurality of corresponding elongated teeth (51) delimiting the said seats (52); each said clamping element (54) comprising at least one thrust-exerting portion (55) designed to grip each said intermediate portion (67) against a corresponding said tooth (51).

13. Machine according to Claim 11, characterized in that the said drawing head (18) further comprises guiding means (58, 59) for guiding each said clamping element (54) along the said comb-like member (49) and, for each said clamping element (54), comprises a respective actuator assembly (57) that may be actuated independently of the other actuator assemblies (57).

14. Machine according to Claim 13, characterized in that each said actuator assembly (57) comprises a linear electric motor (60).

15. Machine according to any one of Claims 11-13, characterized in that it further comprises hinge means (22b) designed to enable a rotation of the said second displacement means (37) with respect to a supporting frame (19) of their own and about a hinge axis (22a) facing and parallel to a corresponding said lateral surface (16) of the bale (3); countering means (22c) being interposed between the said second displacement means (37) and the said frame (19) to oppose rotation of the second displacement means (37) about said hinge axis (22a).

16. Machine according to any one of Claims 11-15, characterized in that the said second displacement means (37) comprise gripping means (36, 39) designed to couple to each said string or wire (2), and actuator means (22, 24) for displacing the said gripping means (36, 39) in a direction (23) which is substantially horizontal and orthogonal to the corresponding said lateral surface (16); the said gripping means (36, 39) comprising resting means (38) and compliant retention means (39, 40) designed to enable a displacement of the said string or wire (2) with respect to the said resting means (38) during displacement of the gripping means (36, 39) in the said substantially horizontal direction (23).

17. Machine according to Claim 16, characterized in that the said retention means comprise a thrust-exerting head (39) for forcing the said string or wire (2) against the said resting means (38) and elastic means (40) for pushing the said thrust-exerting head (39) towards the said resting means (38).

18. Machine according to Claim 17, characterized in that the said gripping means moreover comprise control means (41, 43) with inclined plane to exert on the said thrust-exerting head (39) an action countering the one exerted by the said elastic means (40).

19. Machine according to Claim 17 or Claim 18, characterized in that the said resting means comprise, for each said string or wire (2), two harpoon-shaped jaws (36); actuator means (33, 34) being provided for displacing the jaws (36) with respect to one another away from and towards a close position in which they define a resting surface (38) for the said string or wire (2).

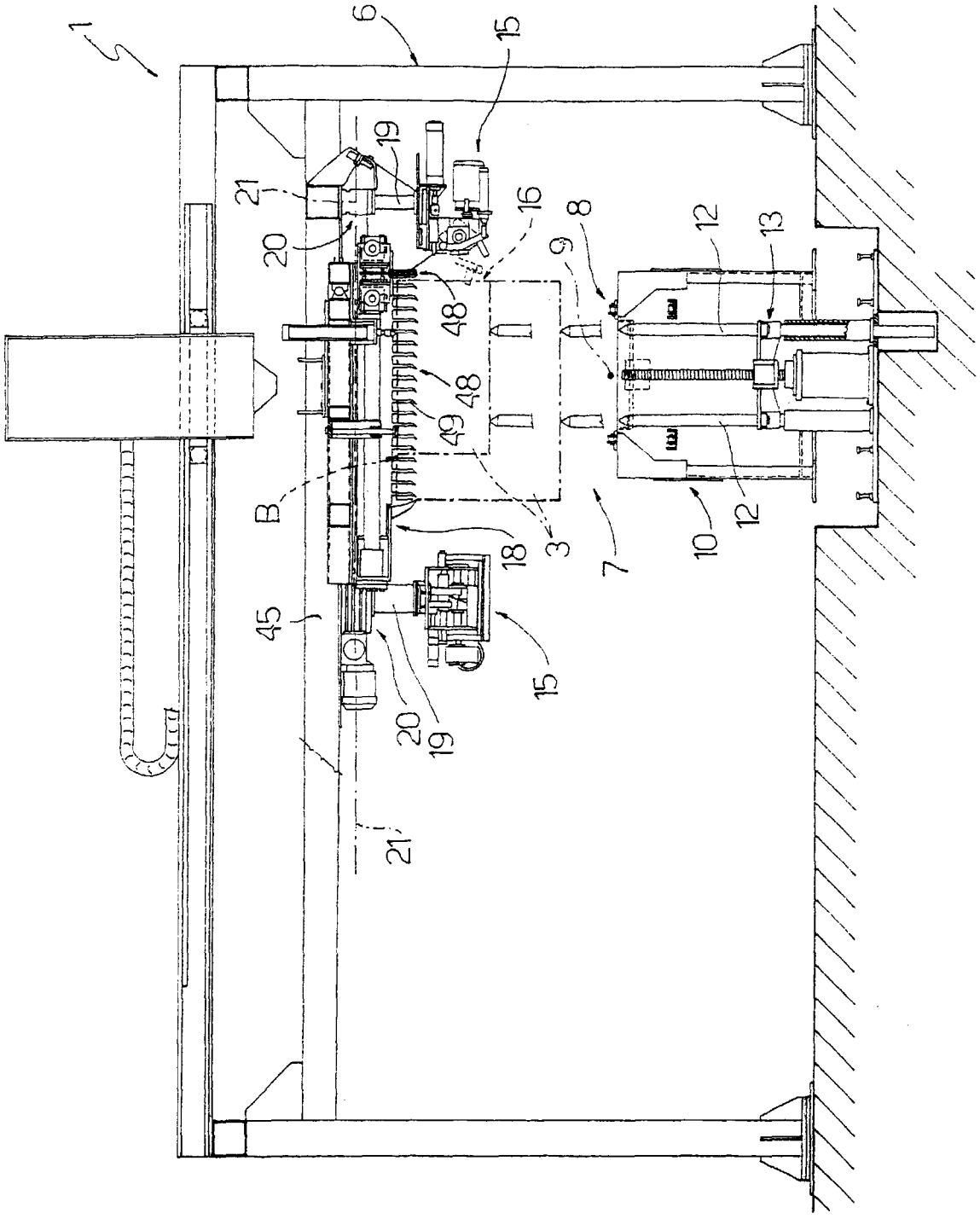
20. Machine according to any one of Claims 11-19, characterized in that it comprises a fixed structure (6) and in that the said comb-like members (49) are arranged in positions vertically fixed with respect to the said fixed structure (6).

21. Machine according to any one of Claims 11-20, characterized in that the said two comb-like members (49) extend in directions that are mutually orthogonal.

22. Machine according to any one of Claims 11-21, characterized in that it comprises a conveyor (8) for displacing an ordered succession of bales (3) in a substantially horizontal feed direction (9), and in that the said guiding means comprise a single guide and slide assembly (45, 46) for guiding the said drawing head (18) in a rectilinear direction (46a) lying in a vertical plane (P) forming an angle (A) other than 90° with respect to the said direction (9) in which the bales (3) are fed.

23. Machine according to Claim 22, characterized in that the said vertical plane (P) forms an angle of roughly 45° with respect to the said direction (9) in which the bales (3) are fed.

Fig.1



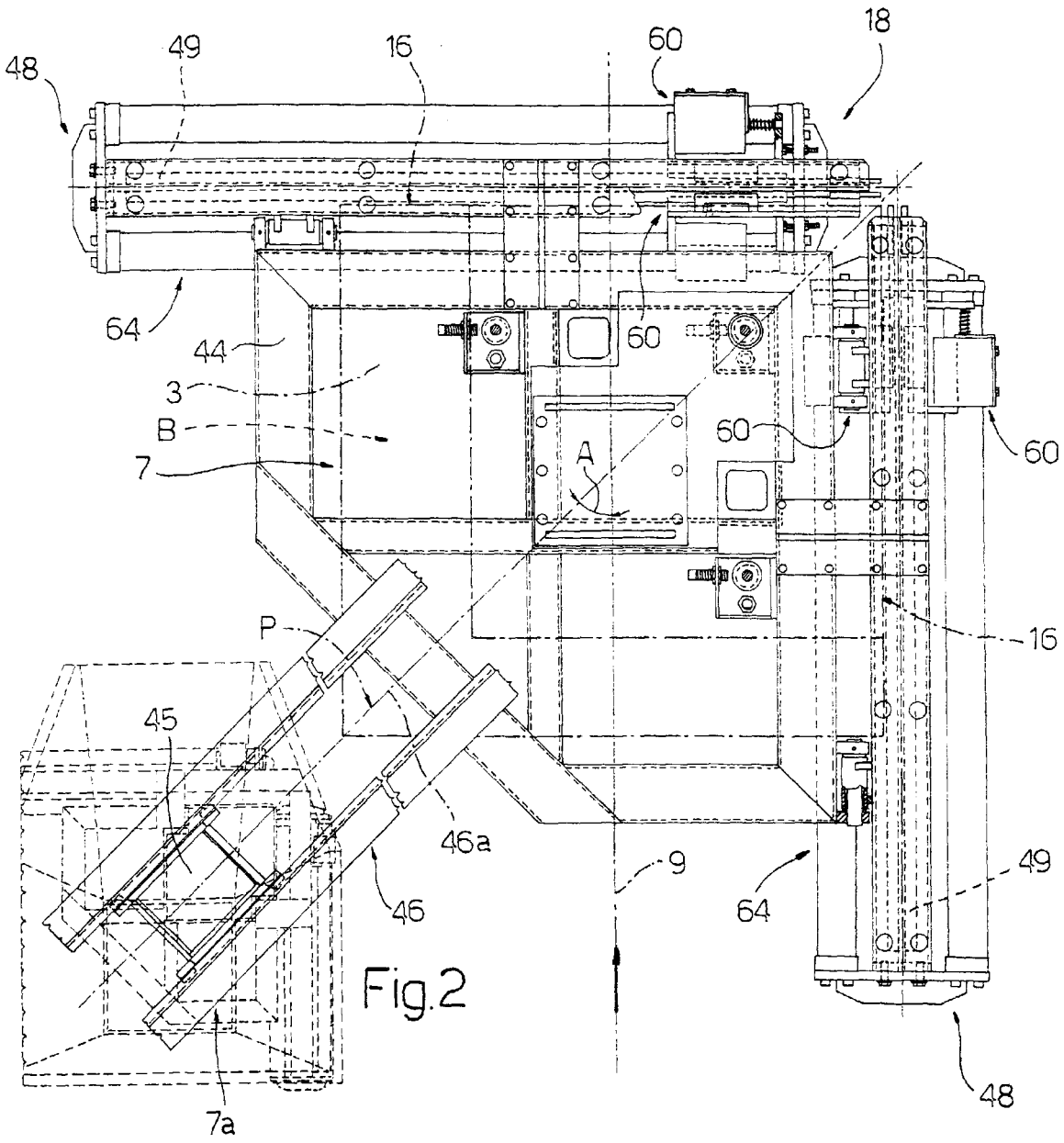


Fig.2

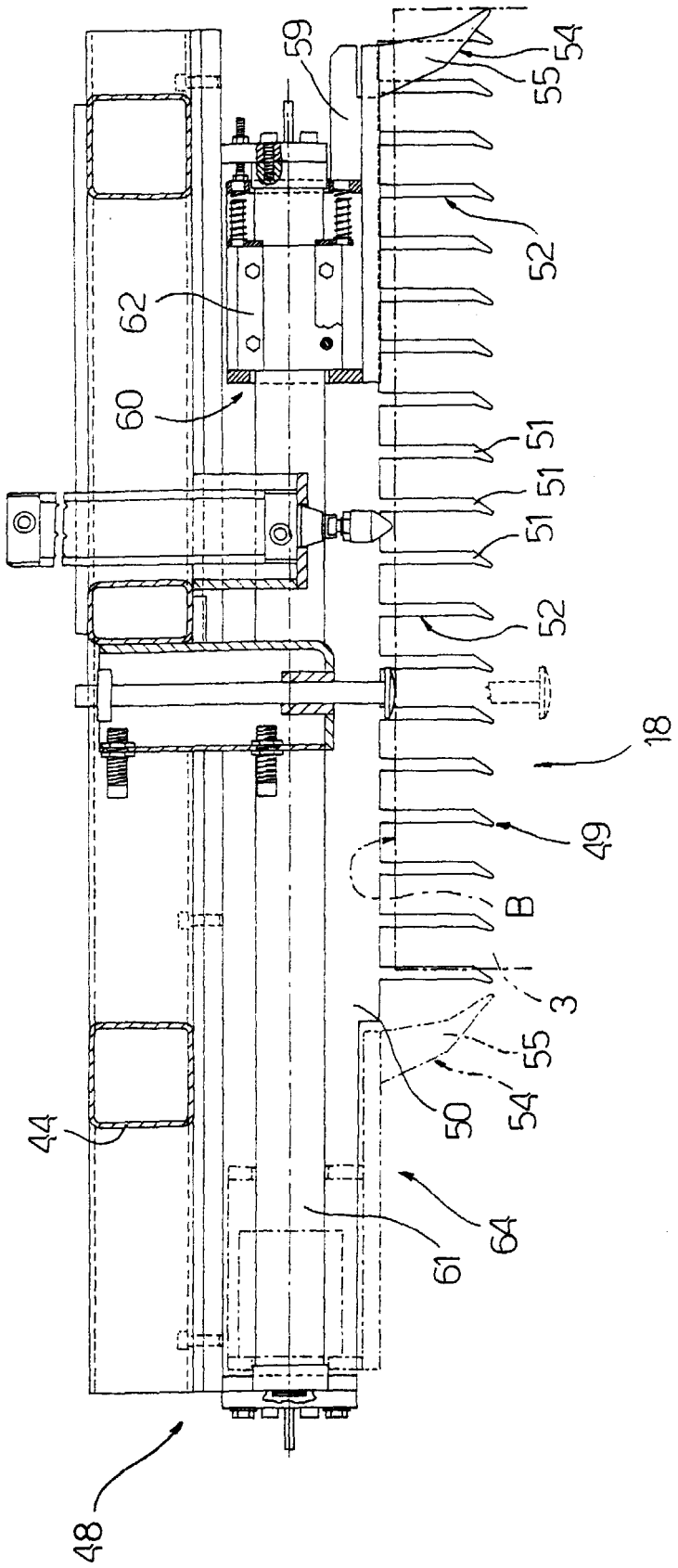


Fig.3

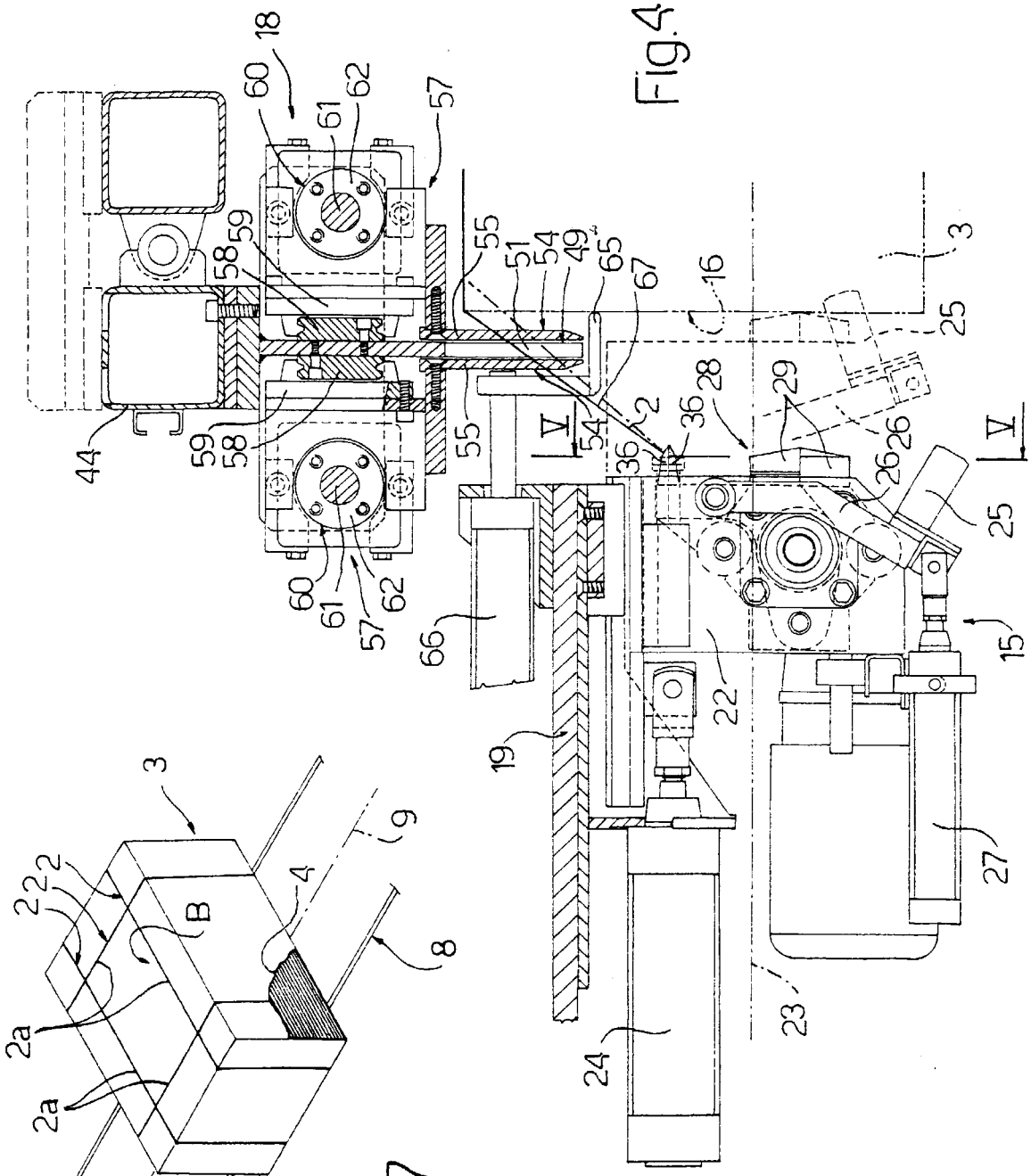

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Fig.4

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Fig.7

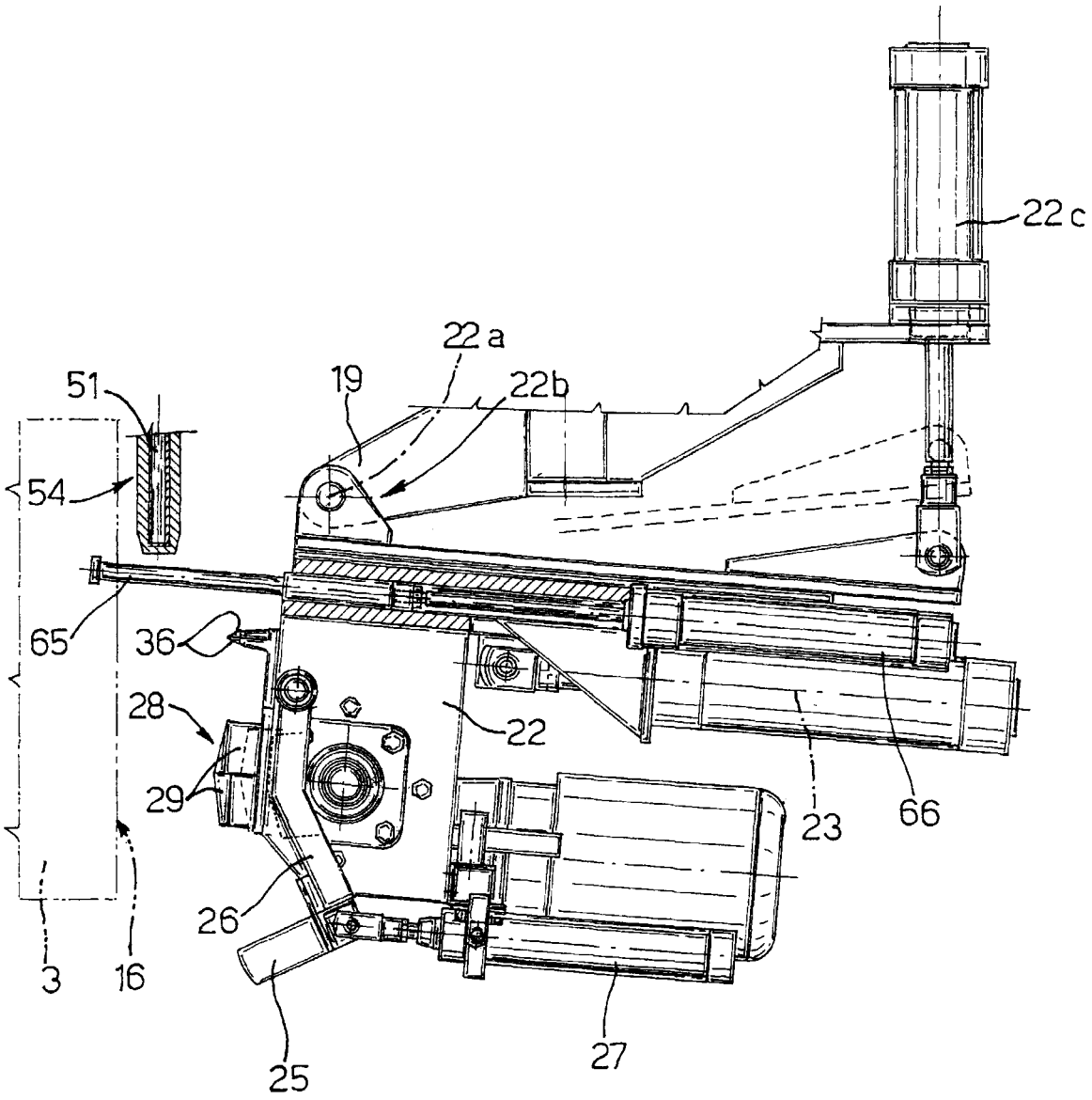

Fig. 4a

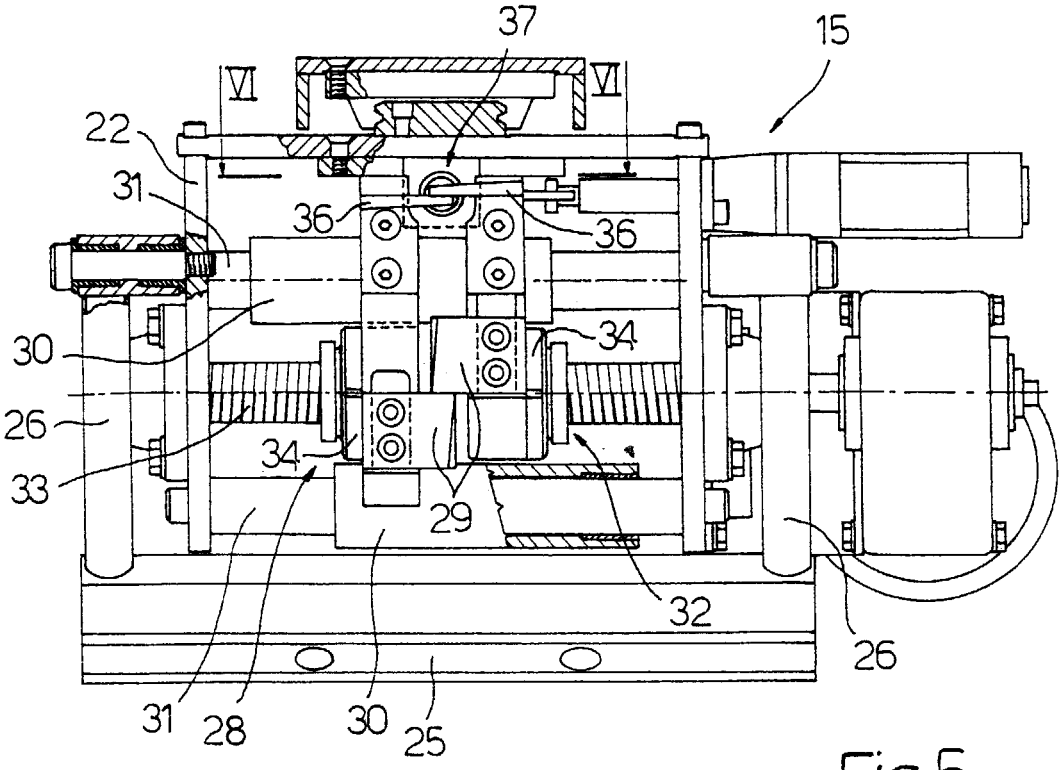
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Fig.5

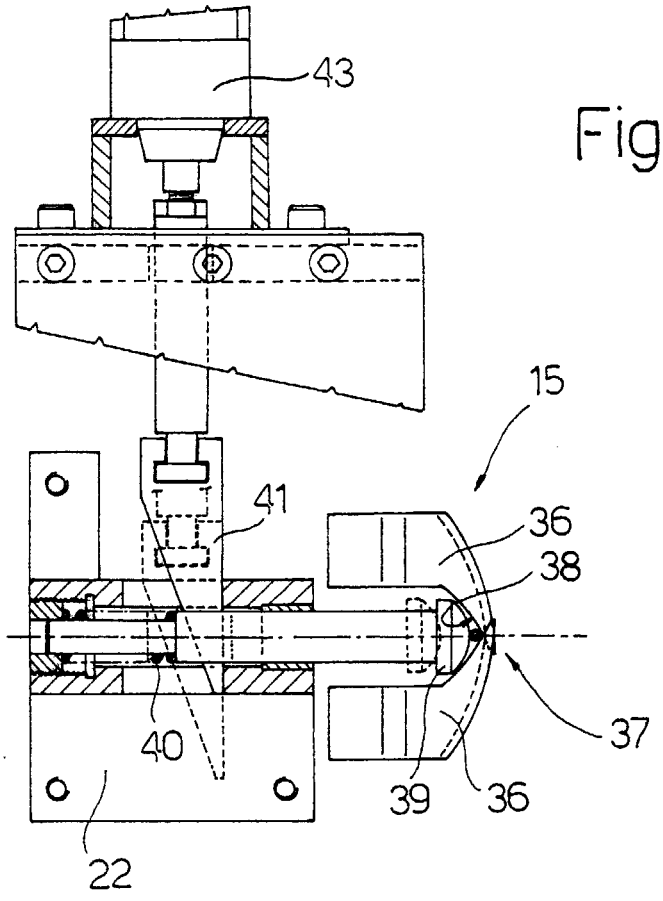
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Fig.6

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
THE HAGUE	7 November 2000	Jagusiak, A

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