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

Verfahren und Vorrichtung zum Entfernen der Bindschürre oder Drähte von einem Ballen, insbesondere einem Zellstoffballen

Procédé et appareil pour enlever les bandes ou fils de cerclage d'une balle, en particulier une balle de cellulose

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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 jaw 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 correspond-

ing 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 provided 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.

Patentansprüche

1. Verfahren zum Entfernen der Bindschnüre oder Drähte (2) von einem Ballen (3), insbesondere einem Zellstoffballen, mit den folgenden Schritten: Zerschneiden jeder erkannten Schnur oder jedes erkannten Drahts (2), Verbinden eines mittleren Abschnitts (67) jeder Schnur oder jedes Drahts (2) mit einem einzelnen ziehkopf (18) und Herausziehen der Schnüre oder Drähte (2) durch Verstellen des Ziehkopfs (18) zu einer station (7a) zum Deponieren der Schnüre oder Drähte (2), **dadurch gekennzeichnet**

- zeichnet, dass** das Verbinden der Schnüre oder Drähte (2) mit dem Ziehkopf (18) die folgenden Schritte beinhaltet: Verstellen des Ballens (3) und des Ziehkopfs (18) in Bezug aufeinander in vertikaler Richtung, um ein Paar kammförmiger Elemente (49) des Ziehkopfs (18), von denen jedes mit mehreren Sitzen (52) versehen ist, die einander entlang angeordnet sind, in eine Position, die zumindest teilweise jeweiligen Querflächen (16) des Ballens (3) zugeordnet sind, Verstellen der mittleren Abschnitte (67) der Schnüre oder Drähte (2) in solcher Weise, dass jeder Abschnitt (67) in einen entsprechenden Sitz (52) eingeführt wird, und Festklemmen der Schnur oder des Drahts (2) im entsprechenden Sitz (52).
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die mittleren Abschnitte (67) der Schnüre oder Drähte (2) in den jeweiligen Sitzen (52) in Abfolge gebracht werden und in den entsprechenden Sitzen (52), wiederum in Abfolge, festgeklemmt werden.
3. Verfahren nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, dass** das Festklemmen der Schnüre oder Drähte (2) dadurch erfolgt, dass jeder mittlere Abschnitt (67) am entsprechenden kammförmigen Element (49) ergriffen wird.
4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** das Festklemmen jeder Schnur oder jedes Drahts dadurch erfolgt, dass ein entsprechendes Klemmelement (54) entlang dem kammförmigen Körper (49) verstellt wird, bis es auf die entsprechende Schnur oder den entsprechenden Draht (2) trifft.
5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Verstellungen der Klemmelemente (54) unabhängig voneinander ausgeführt werden.
6. Verfahren nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** zum Verstellen jeder Schnur oder jedes Drahts (2) innerhalb der jeweiligen Sitze (52) die folgenden Schritte gehören: Bewegen des mittleren Abschnitts (67) der Schnur oder des Drahts um einen Abstand entfernt von der entsprechenden Querfläche (16) des Ballens (3); wobei das Entfernen durch Verbinden des mittleren Abschnitts (67) mit einem entsprechenden Greifer (37) ausgeführt wird, der sich nur in einer Richtung (23) rechtwinklig zur entsprechenden Querfläche (16) bewegen kann, und es wird ermöglicht, dass die Schnur oder der Draht (2) während des Verstellens des Greifers (37) in der genannten rechtwinkligen Richtung (23) in Bezug auf den Greifer (37) verrutschen kann.
7. Verfahren nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Verbinden der Schnüre oder Drähte (2) mit dem Ziehkopf (18) dadurch ausgeführt wird, dass die kammförmigen Elemente (49) fixiert bleiben und der Ballen (3) vertikal zu diesen selbst verstellt wird.
8. Verfahren nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verstellung des Ziehkopfs (18) zur genannten Deponierstation (7a) dadurch erfolgt, dass der Ziehkopf (18) in einer Richtung (46a) verstellt wird, die in einer vertikalen Ebene (P) liegt, die einen anderen Winkel (A) als 90° in Bezug auf eine im Wesentlichen horizontale Zuführrichtung (9) der Ballen (3) bildet.
9. Verfahren nach Anspruch 8, **dadurch gekennzeichnet, dass** die Ebene (P) einen anderen Winkel (A) als null und 90° in Bezug auf die Abschnitte der Schnüre oder Drähte (2) bildet, die auf der Oberseite des Ballens (3) liegen.
10. verfahren nach Anspruch 8 oder Anspruch 9, **dadurch gekennzeichnet, dass** die Ebene (P) einen Winkel von grob 45° in Bezug auf die genannte Zuführrichtung (9) der Ballen (3) bildet.
11. Maschine (1) zum Entfernen von Bindschnüren oder Drähten von einem Ballen (3), insbesondere einem Zellstoffballen, mit einer Schneideinrichtung (28) zum Durchschneiden jeder Bindschnur oder jedes Bindedrahts (2), einem einzelnen Ziehkopf (18) zum Wegziehen der durchgeschnittenen Schnüre oder Drähte (2), der über eine Festhalteeinrichtung (48) zum Festhalten eines mittleren Abschnitts (67) jedes der Schnüre oder Drähte (2) verfügt, und einer Führungseinrichtung (46) zum Führen des Ziehkopfs (18) zu einer Station (7a) zum Deponieren der Schnüre oder Drähte (2), **dadurch gekennzeichnet, dass** die Festhalteeinrichtung (48) ein Paar kammförmiger Elemente (49) aufweist, von denen jedes mit mehreren Sitzen (52) versehen ist, die einander entlang angeordnet sind, wobei zum Verstellen des Ballens (3) und des Ziehkopfs (18) in Bezug aufeinander in einer vertikalen Richtung, bis die kammförmigen Elemente (49) in Positionen gebracht sind, die zumindest teilweise entsprechenden Seitenflächen (16) des Ballens (3) zugewandt sind, eine erste Relativverstelleinrichtung (10) vorhanden ist, und wobei eine zweite Verstelleinrichtung für die Schnüre oder Drähte dazu vorhanden ist, den mittleren Abschnitt (67) in Eingriff mit einem entsprechenden Sitz (52) zu bringen; wobei der Ziehkopf (18) ferner für jede Schnur oder jeden Draht (2) Folgendes aufweist: ein Klemmelement (45), das in Bezug auf das entsprechende kammförmige Element (49) beweglich ist, um jede Schnur oder jeden Draht (2) innerhalb des entspre-

chenden Sitzes (52) festzuklemmen.

12. Maschine nach Anspruch 11, **dadurch gekennzeichnet, dass** jedes kammförmige Element (49) mehrere entsprechende längliche Zähne (51) aufweist, die die Sitze (52) begrenzen; wobei jedes Klemmelement (54) mindestens einen Druckausübungsabschnitt (55) aufweist, der so ausgebildet ist, dass er jeden der genannten mittleren Abschnitte (67) gegen einen entsprechenden Zahn (51) hin ergreift. 5
13. Maschine nach Anspruch 11, **dadurch gekennzeichnet, dass** der Ziehkopf (18) ferner eine Führungseinrichtung (58, 59) aufweist, um jedes Klemmelement (54) entlang dem kammförmigen Element (49) zu führen, und er, für jedes Klemmelement (54), eine jeweilige Stellgliedbaugruppe (57) aufweist, die unabhängig von den anderen Stellgliedbaugruppen (57) betätigt werden kann. 10
14. Maschine nach Anspruch 13, **dadurch gekennzeichnet, dass** jede Stellgliedbaugruppe (57) einen elektrischen Linearmotor (60) aufweist. 15
15. Maschine nach einem der Ansprüche 11 - 13, **dadurch gekennzeichnet, dass** sie ferner eine Scharniereinrichtung (22b) aufweist, die so ausgebildet ist, dass sie von sich aus eine Drehung der zweiten Verstelleinrichtung (37) in Bezug auf einen Halterahmen (19) und um eine Scharnierachse (22a) ermöglicht, die einer entsprechenden Querfläche (16) des Ballens (3) parallel zu dieser zugewandt ist; wobei zwischen die zweite Verstelleinrichtung (37) und den Rahmen (19) eine Gegenkrafteinrichtung (22c) eingefügt ist, um einer Drehung der zweiten Verstelleinrichtung (37) um die Scharnierachse (22a) entgegen zu wirken. 20
16. Maschine nach einem der Ansprüche 11 - 15, **dadurch gekennzeichnet, dass** die zweite Verstelleinrichtung (37) eine Greifeinrichtung (36, 39), die so konzipiert ist, dass sie mit jeder Schnur oder jedem Draht (2) koppelt, und eine Stellgliedeinrichtung (22, 24) zum Verstellen der Greifeinrichtung (36, 39) in einer Richtung (23), die im Wesentlichen horizontal und rechtwinklig zur entsprechenden Querfläche (16) verläuft, aufweist, wobei die Greifeinrichtung (36, 39) eine Ruheeinrichtung (38) und eine nachgiebige Festhalteeinrichtung (39, 40) aufweist, die so ausgebildet ist, dass sie ein Verstellen der Schnur oder des Drahts in Bezug auf die Ruheeinrichtung (38) ermöglicht, während die Greifeinrichtung (36, 39) in der genannten im Wesentlichen horizontalen Richtung (23) verstellt wird. 25
17. Maschine nach Anspruch 16, **dadurch gekennzeichnet, dass** die Festhalteeinrichtung einen

Druckausübungskopf (39) zum Drücken der Schnur oder des Drahts (2) gegen die Ruheeinrichtung (38) und eine elastische Einrichtung (40) zum Drücken des Druckausübungskopfs (39) zur Ruheeinrichtung (38) aufweist.

18. Maschine nach Anspruch 17, **dadurch gekennzeichnet, dass** die Greifeinrichtung darüber hinaus eine Steuereinrichtung (41, 43) mit schräger Ebene aufweist, um auf den Druckausübungskopf (39) eine Wirkung auszuüben, die derjenigen entgegengesetzt ist, die von der elastischen Einrichtung (40) ausgeübt wird. 30

19. Maschine nach Anspruch 17 oder Anspruch 18, **dadurch gekennzeichnet, dass** die Ruheeinrichtung für jede Schnur oder jeden Draht (2) zwei harpunenförmige Klemmeinrichtungen (36) aufweist; wobei eine Stellgliedeinrichtung (33, 34) zum Verstellen der Klemmeinrichtungen (36) in Bezug aufeinander weg von einer Position und nahe an diese hin, in der sie eine Ruhefläche (38) für die Schnur oder den Draht (2) bilden, vorhanden ist. 35

20. Maschine nach einem der Ansprüche 11 - 19, **dadurch gekennzeichnet, dass** sie eine fixierte Konstruktion (6) aufweist, und die kammförmigen Elemente (49) an Positionen angeordnet sind, die vertikal in Bezug auf die fixierte Konstruktion (6) fixiert sind. 40

21. Maschine nach einem der Ansprüche 11 - 20, **dadurch gekennzeichnet, dass** sich die zwei kammförmigen Elemente (49) in zueinander rechtwinkligen Richtungen erstrecken. 45

22. Maschine nach einem der Ansprüche 11 - 21, **dadurch gekennzeichnet, dass** sie einen Förderer (8) zum Verstellen einer geordneten Reihenfolge der Ballen (3) in einer im Wesentlichen horizontalen Zuführrichtung (9) aufweist und dass die Führungseinrichtung eine einzelne Führungs- und Gleitbaugruppe (45, 46) aufweist, um den Ziehkopf (18) in einer geraden Richtung (46a) zu führen, die in einer vertikalen Ebene (P) liegt, die einen anderen Winkel (A) als 90° in Bezug auf die Richtung (9) bildet, in der die Ballen (3) zugeführt werden. 50

23. Maschine nach Anspruch 22, **dadurch gekennzeichnet, dass** die genannte vertikale Ebene (P) einen Winkel von grob 45° in Bezug auf die genannte Richtung (9) bildet, in der die Ballen (3) zugeführt werden. 55

Revendications

1. Méthode pour l'élimination de ficelles ou de fils mé-

- talliques d'une balle (3), en particulier d'une balle de cellulose, cette méthode comprenant les étapes consistant à découper chaque ficelle ou fil métallique (2) identifié, coupler une portion intermédiaire (67) de chaque ficelle ou fil métallique (2) avec une tête d'étirage unique (18) et extraire par traction lesdites ficelles ou fils métalliques (2) en déplaçant la tête d'étirage (18) vers une station (7a) en vue de déposer les ficelles ou fils métalliques (2), cette méthode étant **caractérisée en ce que** le couplage desdites ficelles ou fils métalliques (2) à la tête d'étirage (18) comprend les étapes consistant à déplacer la balle (3) et ladite tête d'étirage (18) l'une par rapport à l'autre dans une direction verticale de manière à amener une paire d'éléments semblables à des peignes (49) de ladite tête d'étirage (18) dont chacun est prévu avec une pluralité de sièges (52) répartis le long l'un de l'autre, dans une position où au moins des surfaces latérales respectives se faisant partiellement face (16) de la balle (3), déplacer lesdites portions intermédiaires (67) desdites ficelles ou fils métalliques (2) de manière telle que chaque portion (67) soit insérée à l'intérieur d'un siège correspondant (52) et à pincer chacune desdites ficelles ou fils métalliques (2) à l'intérieur du siège correspondant (52).
2. Méthode selon la revendication 1, **caractérisée en ce que** lesdites portions intermédiaires (67) desdites ficelles ou fils métalliques (2) sont amenées successivement à l'intérieur des sièges respectifs (52) et pincées, à nouveau de manière successive à l'intérieur des sièges respectifs (52).
3. Méthode selon la revendication 1 ou la revendication 2, **caractérisée en ce que** le pincement desdites ficelles ou fils métalliques (2) est obtenu par accrochage de chaque portion intermédiaire (67) sur l'élément en forme de peigne correspondant.
4. Méthode selon la revendication 3, **caractérisée en ce que** le pincement de chaque ficelle ou fil métallique est obtenu par déplacement d'un élément de pincement correspondant (54) le long dudit corps semblable à un peigne (49) jusqu'à ce qu'il rencontre ledit ficelle ou fil métallique correspondant (2).
5. Méthode selon la revendication 4, **caractérisée en ce que** les déplacements desdits éléments de pincement (54) sont réalisés indépendamment l'un de l'autre.
6. Méthode selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le déplacement desdites ficelles ou fils métalliques (2) à l'intérieur desdits sièges respectifs (52) comprend les étapes consistant à déplacer ladite portion intermédiaire (67) de ladite ficelle ou dudit fil métallique sur une distance s'écartant de la surface latérale correspondante (16) de ladite balle (3), ledit éloignement étant réalisé en couplant ladite portion intermédiaire (67) à un organe d'accrochage correspondant (37) qui est libre de ne se déplacer que selon une direction (23) orthogonale par rapport à ladite surface latérale (16) et en permettant à la ficelle ou au fil métallique (2) de glisser par rapport à l'organe d'accrochage (37) au cours du déplacement de l'organe d'accrochage (37) dans ladite direction orthogonale (23).
7. Méthode selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le couplage desdites ficelles ou fils métalliques (2) à ladite tête d'étirage (18) est réalisé en maintenant fixes lesdits éléments semblables à des peignes (49) et en déplaçant la balle (3) verticalement vers les éléments semblables à des peignes (49) eux-mêmes.
8. Méthode selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les déplacements de ladite tête d'étirage (18) vers ladite station de dépôt (7a) sont réalisés en déplaçant la tête d'étirage (18) dans une direction (46a) située dans un plan vertical P formant un angle A autre que 90° par rapport à une direction pratiquement horizontale (9) d'alimentation desdites balles (3).
9. Méthode selon la revendication 8, **caractérisée en ce que** ledit plan P forme un angle A autre que 0 et 90° par rapport aux portions des ficelles ou fils métalliques (2) reposant sur une surface supérieure de ladite balle (3).
10. Méthode selon la revendication 8 ou la revendication 9, **caractérisée en ce que** ledit plan P forme un angle grossièrement de 45° par rapport à ladite direction d'alimentation (9) desdites balles (3).
11. Machine (1) pour éliminer les ficelles ou fils métalliques de liaison d'une balle (3) en particulier une balle de cellulose, la machine (1) comprenant des moyens de découpe (28) destinés à couper chaque ficelle ou fil métallique de liaison (2), une tête d'étirage unique (18) destinée à tirer les fils métalliques ou ficelles (2) qui ont été coupés, la tête d'étirage (18) comprenant des moyens de rétention (48) destinés à retenir une portion intermédiaire (67) de chacune des ficelles ou fils métalliques (2) et des moyens de guidage (46) destinés à guider la tête d'étirage (18) vers une station (7a) en vue de déposer les ficelles ou fils métalliques (2), la machine (1) étant **caractérisée en ce que** lesdits moyens de rétention (48) consistent en une paire d'organes semblables à des peignes (49) dont chacun présente une pluralité de sièges (52) répartis le long l'un de l'autre, des premiers moyens de déplacement

- relatifs (10) étant prévus en vue de déplacer ladite balle (3) et ladite tête d'étirage (18) l'un par rapport à l'autre dans une direction verticale jusqu'à ce que lesdits organes semblables à des peignes (49) soient amenés dans des positions faisant au moins partiellement face à des surfaces latérales correspondantes (16) de la balle (3) et de seconds moyens de déplacement desdites ficelles ou fils métalliques étant prévus en vue d'amener chacune desdites portions intermédiaires (67) au contact desdits sièges respectifs (52), ladite tête d'étirage (18) comprenant au surplus, pour chaque ficelle ou fil métallique (2) un élément de pincement (54) qui est mobile par rapport à l'organe semblable à un peigne (49) en vue de pincer chaque ficelle ou fil métallique (2) à l'intérieur dudit siège (52) correspondant.
12. Machine selon la revendication 11, **caractérisée en ce que** chaque organe semble à un peigne (49) comprend une pluralité de dents allongées correspondantes (51) délimitant lesdits sièges (52), chacun desdits éléments de pincement (54) comprenant au moins une portion exerçant une poussée (55) en vue d'accrocher chacune desdites portions intermédiaires (67) contre l'une desdites dents correspondantes (51).
13. Machine selon la revendication 11, **caractérisée en ce que** ladite tête d'étirage (18) comprend au surplus des moyens de guidage (58, 59) destinés à guider chacun desdits éléments de pincement (54) le long dudit organe semblable à un peigne (49) et, pour chacun desdits éléments de pincement (54), comprend un ensemble d'actionnement respectif (57) qui peut être actionné indépendamment des autres ensembles d'actionnement (57).
14. Machine selon la revendication 13, **caractérisée en ce que** chacun des ensembles d'actionnement (57) comprend un moteur électrique linéaire (60).
15. Machine selon l'une quelconque des revendications 11-13, **caractérisée en ce qu'elle** comprend au surplus des moyens de pivotement (22b) destinés à permettre une rotation desdits seconds moyens de déplacement (37) par rapport à un châssis de support (19) par eux-mêmes et autour d'un axe de rotation (22a) faisant face parallèlement à une surface latérale correspondante (16) de la balle (3), des moyens de comptage (22c) étant interposés entre lesdits seconds moyens de déplacement (37) et ledit châssis (19) de manière à s'opposer à la rotation des seconds moyens de déplacement (37) autour dudit axe de rotation (22a).
16. Machine selon l'une quelconque des revendications 11-15, **caractérisée en ce que** lesdits seconds moyens de déplacement (37) comprennent des moyens d'accrochage (36, 39) destinés à s'accoupler à chacun desdits ficelles ou fils métalliques (2) et des moyens d'actionnement (22, 24) destinés à déplacer lesdits moyens d'accrochage (36, 39) dans une direction (23) qui est pratiquement horizontale et orthogonale par rapport à ladite surface latérale correspondante (16), lesdits moyens d'accrochage (36, 39) comprenant des moyens de repos (38) et des moyens de rétention souples (39, 40) destinés à permettre un déplacement de ladite ficelle ou dudit fil métallique (2) par rapport audit moyen de repos (38) au cours du déplacement des moyens d'accrochage (36, 39) dans ladite direction pratiquement horizontale (23).
17. Machine selon la revendication (16), **caractérisée en ce que** lesdits moyens de rétention consistent en une tête exerçant une poussée (39) en vue de repousser lesdites ficelles ou fils métalliques (2) contre lesdits moyens de repos (38) et des moyens élastiques (40) destinés à pousser ladite tête exerçant une poussée (39) vers lesdits moyens de repos (38).
18. Machine selon la revendication 17, **caractérisée en ce que** les moyens d'accrochage comprennent au surplus des moyens de contrôle (41, 43), avec un plan incliné en vue d'exercer sur ladite tête exerçant une poussée (39) une action contrecarrant celle exercée par lesdits moyens élastiques (40).
19. Machine selon la revendication 17 ou la revendication 18, **caractérisée en ce que** lesdits moyens de repos comprennent, pour chaque ficelle ou fil métallique (2) deux mâchoires en forme de harpon (36), des moyens d'actionnement (33, 34) étant prévus pour déplacer les mâchoires (36) par rapport l'une à l'autre depuis et vers une position fermée dans laquelle elles définissent une surface de repos (38) pour ladite ficelle ou ledit fil métallique (2).
20. Machine selon l'une quelconque des revendications 11-19, **caractérisée en ce qu'elle** comprend une structure fixe (6) et **en ce que** lesdits organes semblables à des peignes (49) sont répartis dans des positions fixes verticalement par rapport à ladite structure fixe (6).
21. Machine selon l'une quelconque des revendications 11-20, **caractérisée en ce que** les deux organes semblables à des peignes (49) s'étendent dans des directions mutuellement orthogonales.
22. Machine selon l'une quelconque des revendications 11-21, **caractérisée en ce qu'elle** comprend un convoyeur (8) pour déplacer successivement des balles (3) dans une direction d'alimentation pra-

tiquement horizontale (9) et **en ce que** lesdits moyens de guidage comprennent un ensemble unique de guidage et de coulissement (45, 46) en vue de guider ladite tête d'étirage (18) dans une direction rectilinéaire (46a) située dans un plan vertical P formant un angle A autre que 90° par rapport à ladite direction (9) dans laquelle les balles (3) sont alimentées. 5

23. Machine selon la revendication 22, **caractérisée en ce que** ledit plan vertical P forme un angle d'approximativement 45° par rapport à ladite direction (9) dans laquelle les balles (3) sont alimentées. 10

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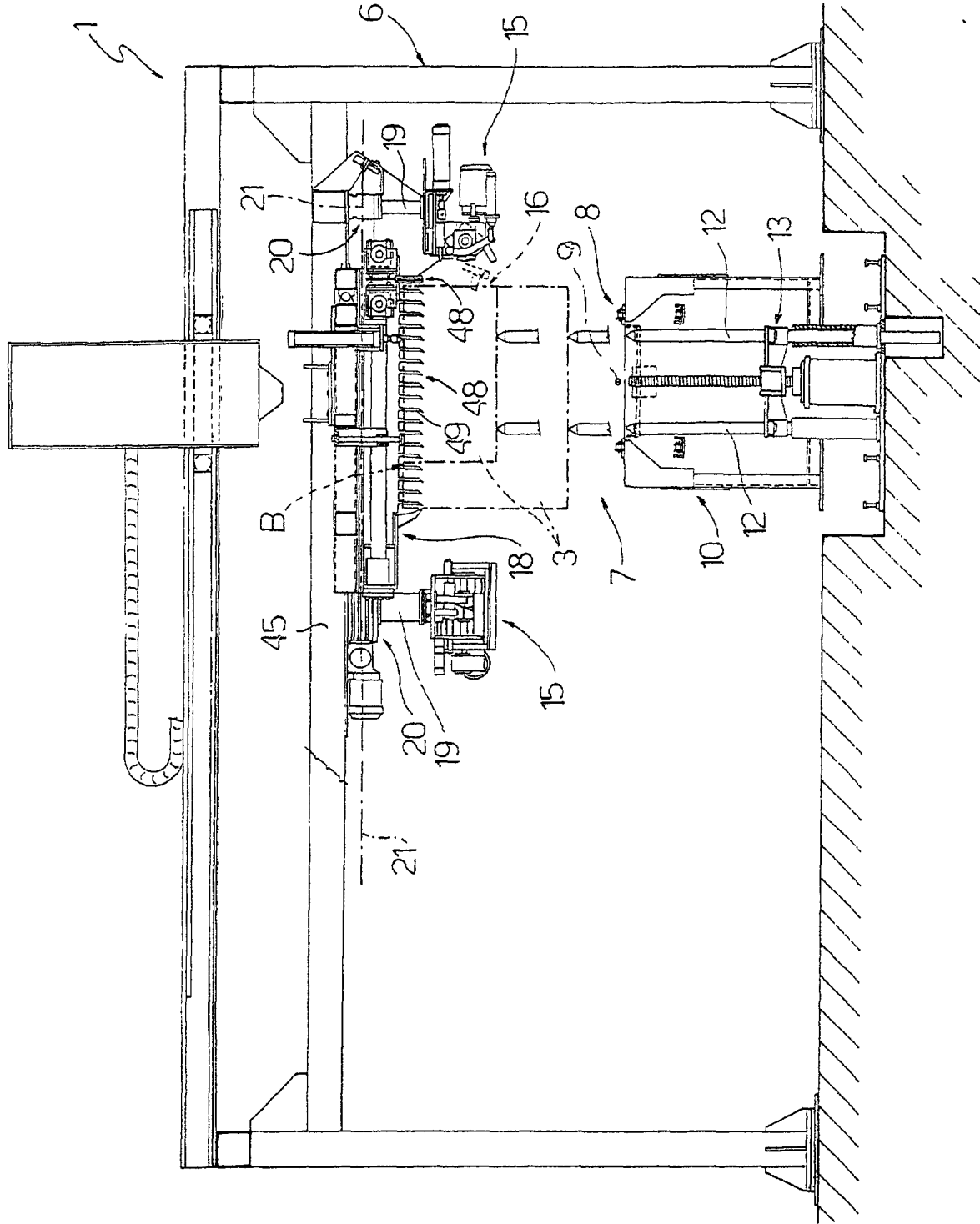
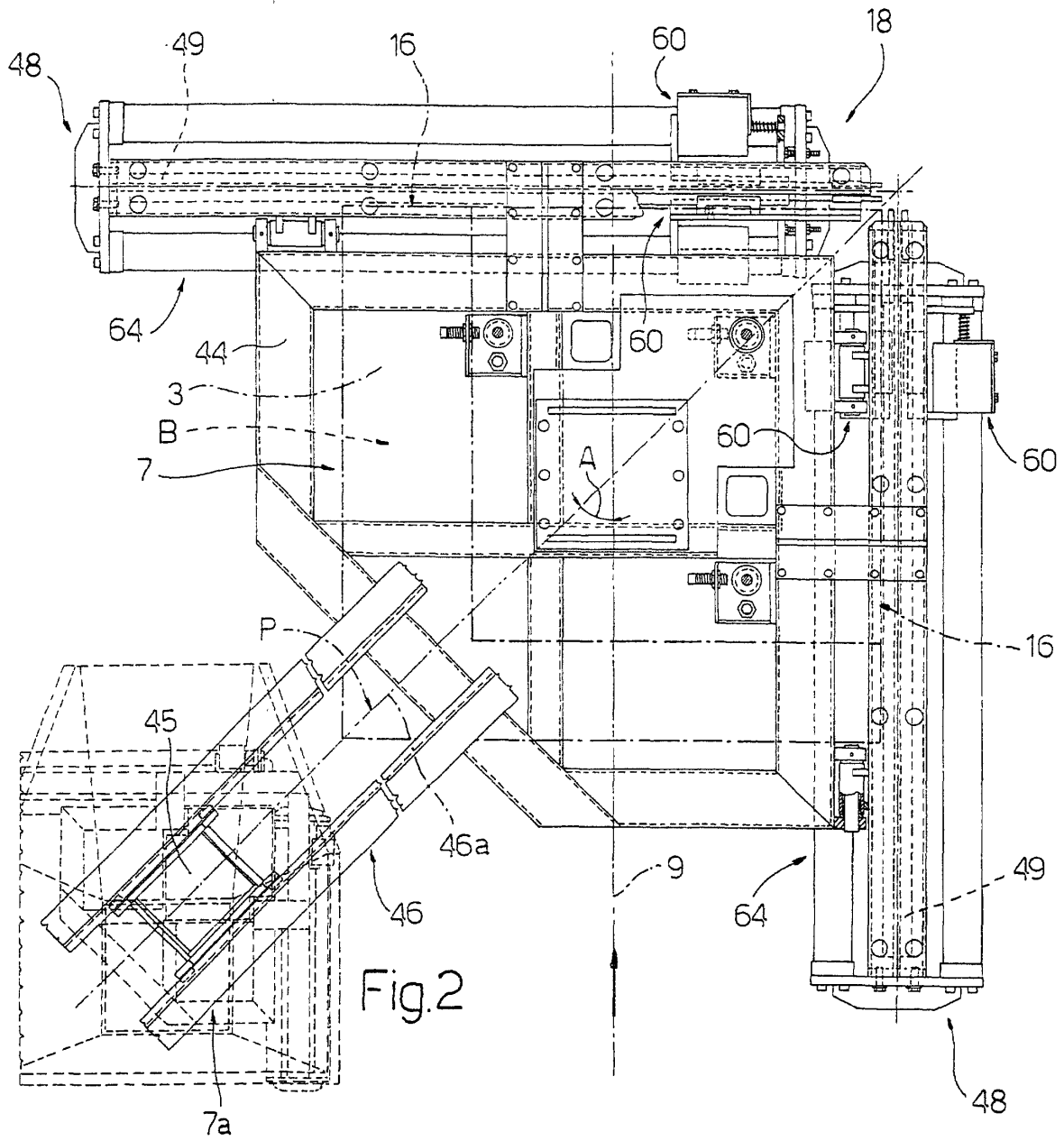


Fig. 1



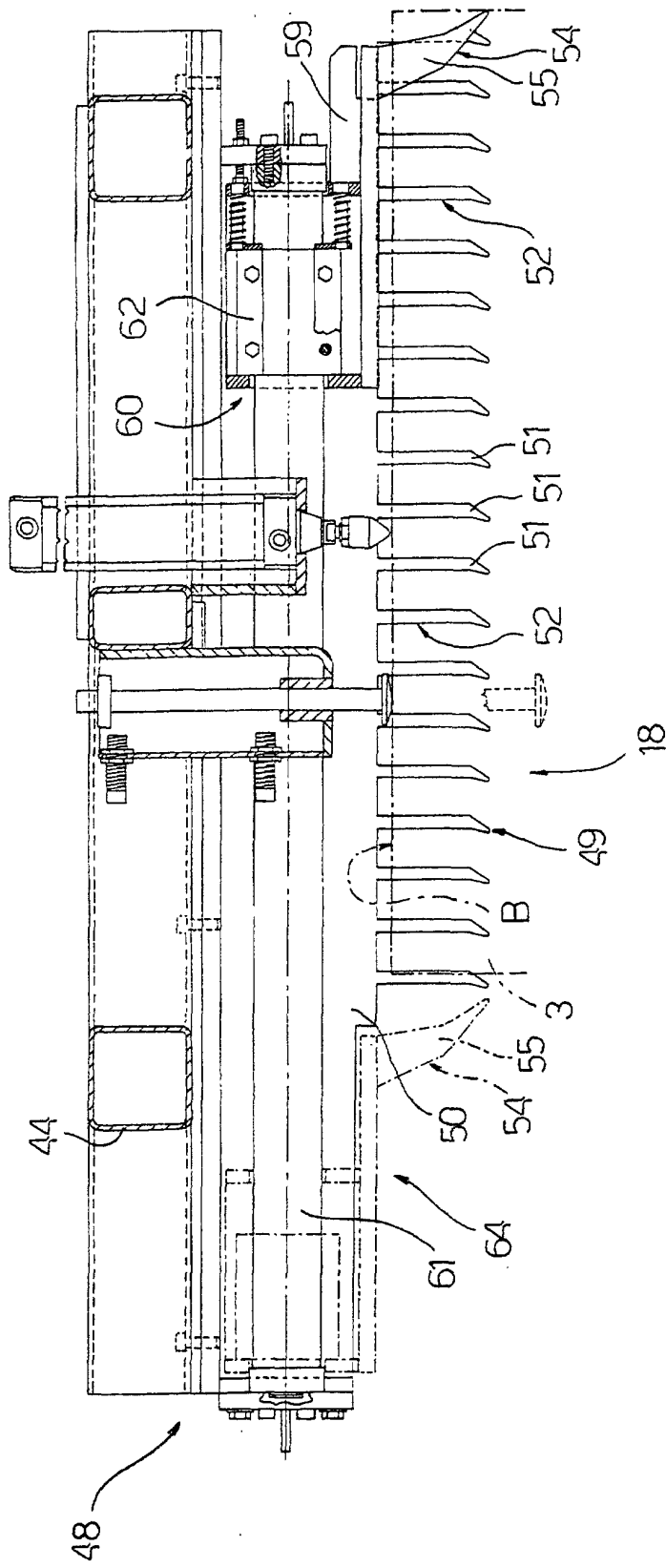
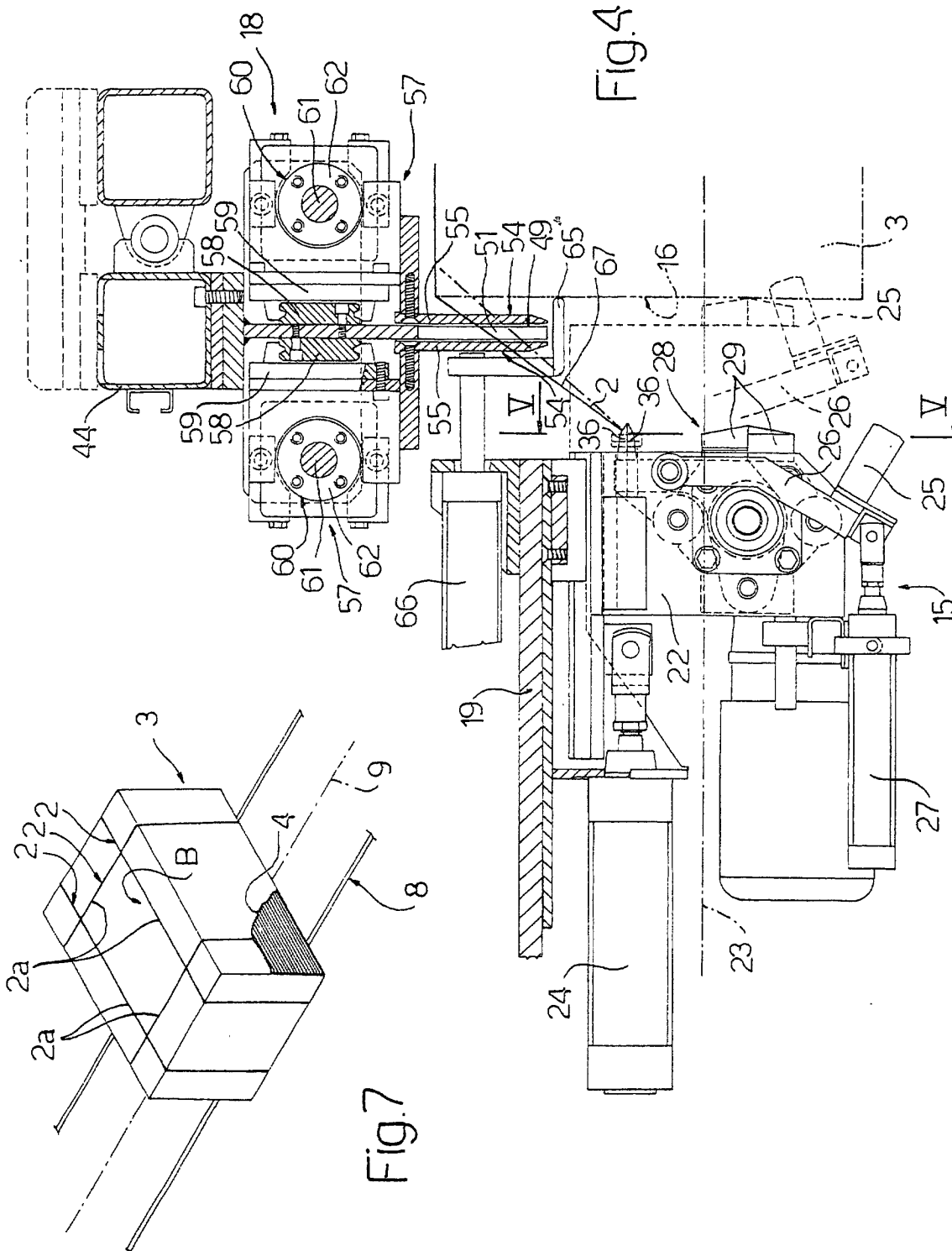


Fig.3



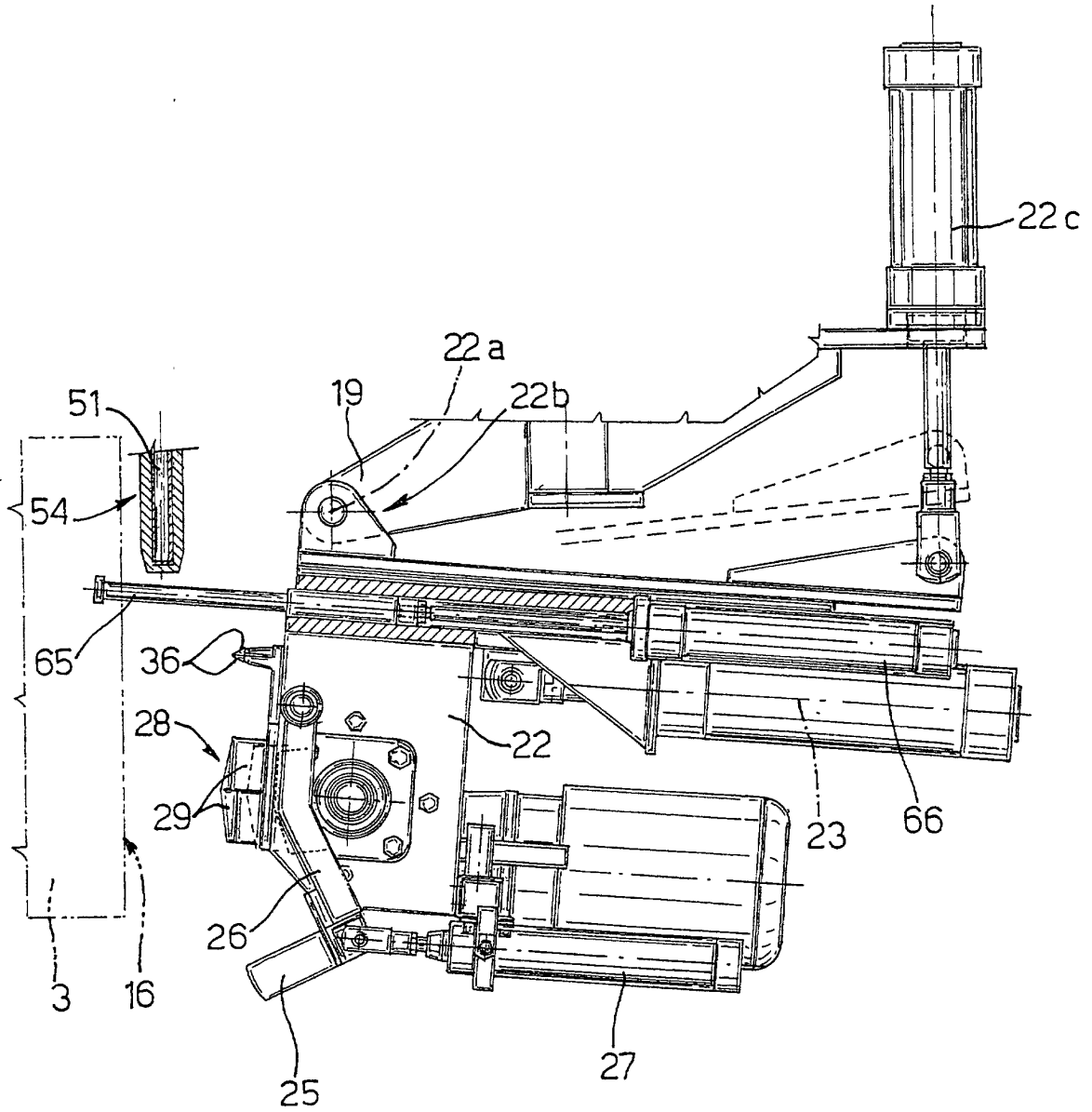


Fig. 4a

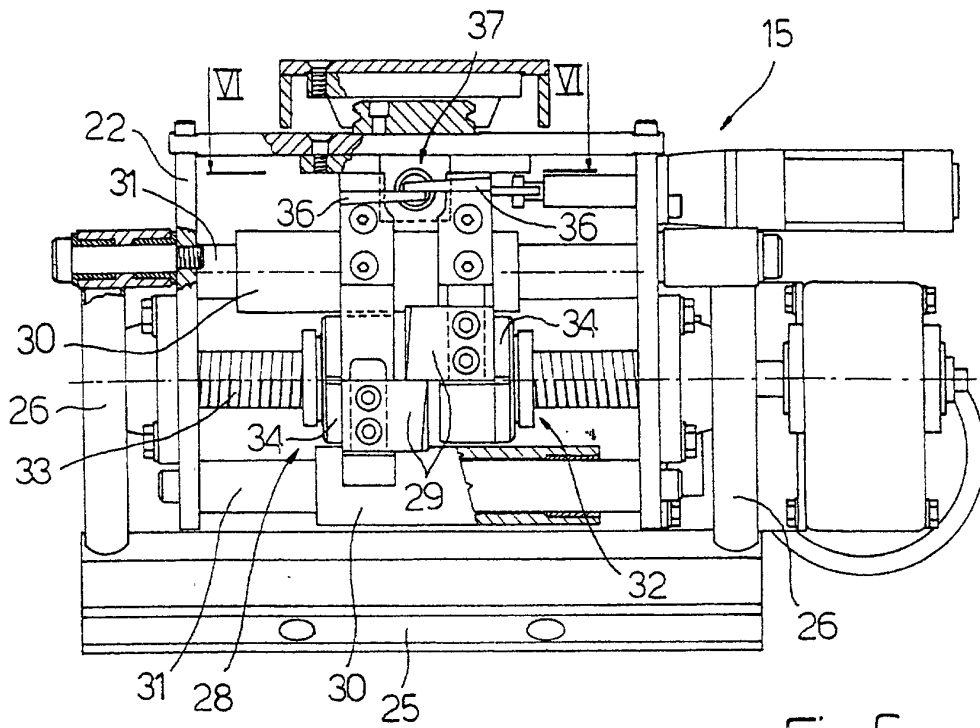


Fig.5

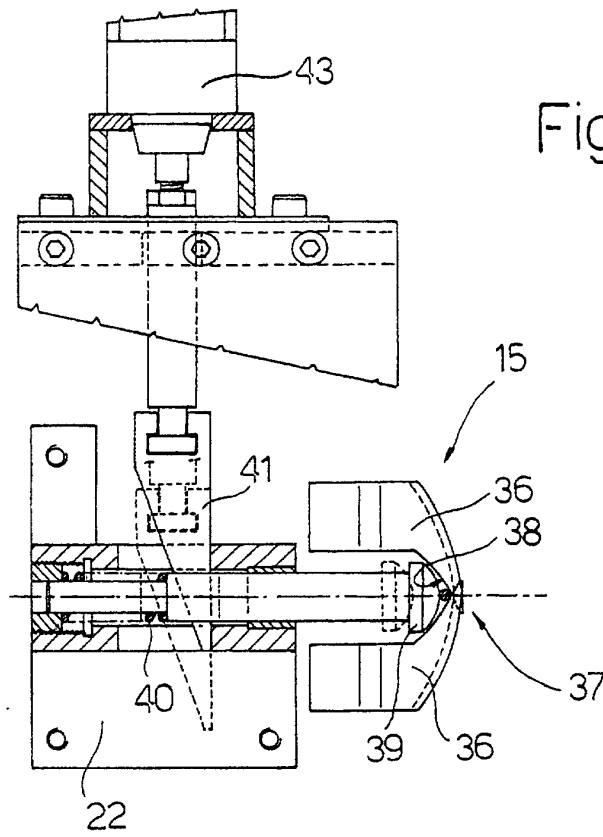


Fig.6