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

(11) EP 2 067 584 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.06.2009 Bulletin 2009/24

(51) Int Cl.:
B26F 1/20 *(2006.01)*

(21) Application number: **07023645.0**

(22) Date of filing: **06.12.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(71) Applicant: **M T C - Macchine Trasformazione Carta S.r.l.**
55016 Porcari (LU) (IT)

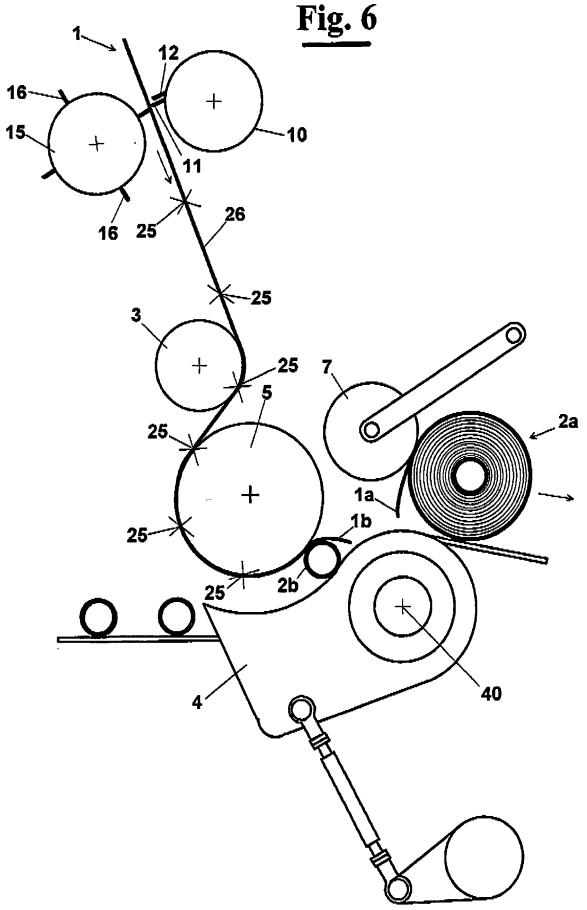
(72) Inventor: **De Matteis, Alessandro**
55100 Lucca (IT)

(74) Representative: **Celestino, Marco**
AB, Agenzia Brevetti & Marchi,
Viale Giovanni Pisano, 31
56123 Pisa (IT)

(54) Rewinding machine with perforating means and method

(57) A rewinding machine for making a log (2a) of paper comprises a feeding roller (3) of the web (1 and, downstream of, a cradle (4) adapted to put a core (20) in a winding zone (9) at which is made the production of the log (2a) same. The winding zone (9), according to the prior art, comprises a upper winding roller (5), a lower winding roller (6) and a pressure roller (7). The latter follows the growth of the log (2) with the task of assuring its continuous contact with the winding rollers (5, 6) controlling its diameter growth. Upstream from the feeding roller (3) a perforating roller (15) is provided having peripherally a plurality of blades (16) with helical profile arranged at a determined angular distance β from each other, for example four blades (16a-16d) arranged at 90°. The perforating roller (15) is mounted rotatable about its own axis of rotation (35) and interacts with a counter-roller (10), rotatable about an axis (30) arranged opposite to it with respect to the conveying direction of the web of paper (1), to provide on this transversal perforation lines. In particular, the counter-roller (10) has at least one first cutting profiled edge (11), having teeth distanced by a pitch p1 and at least one second cutting profiled edge (12), having teeth distanced by a pitch p2, with p1< p2, in order to selectively set the distance of the slits of the perforation line.

Fig. 6



EP 2 067 584 A1

Description

Field of the invention

[0001] The present invention relates to a rewinding method for making logs of web material, for example used for making rolls of toilet paper, household paper towel rolls, non woven fabric rolls, professional paper towel rolls and the like.

[0002] Furthermore, the invention relates to a rewinding machine that carries out this method.

Background of the invention

[0003] Rewinding machines are known where the winding step takes place on a log being formed whose surface contacts winding rollers and precisely an upper roller, a lower roller and a pressure roller.

[0004] For example, as described in EP 1232980 in the name of the same applicant, a core of cardboard, located on a movable support cradle, is brought into contact with the upper winding roller with the consequence that it is dragged into a winding zone along with an end of a web of paper. The rotation of the lower and upper rollers causes the core to rotate at the same speed thereof, starting to wind the web of paper on the core.

[0005] Suitable perforating means, having a rotating roller and a fixed counter-roller, during all the winding phase of the log, create on the web of paper being wound transversal perforation lines that run along all the width of the web and at a same distance from each other. This way, two next perforations define a panel of web of paper that can be torn when using the roll of paper.

[0006] Normally, before the winding step, a certain an amount of glue is previously applied on the surface of the tubular core, to allow the web of paper to stick on the core same and to start winding the log.

[0007] Once the log has achieved a predetermined diameter, by controlling the length of wound paper, the web is cut or torn and the formed log is pushed away from the winding zone. At the same time a new core of cardboard, by raising the cradle, is brought into contact with the web of paper running about the upper roller starting a new winding step.

[0008] A transversal cut of the paper, once achieved a desired diameter of the log, or in particular, the desired length of paper, can be carried out in various ways.

[0009] For example in IT1167982 a system is described for controlling and adjusting the speed of the pressure roller with respect to the lower and upper rollers. This way the web is stretched and consequently torn. Notwithstanding this system is very simple, there is often the drawback of a not acceptable quality of the final product.

[0010] One of the problems met is that when tensioning the web, by an acceleration of the pressure roller, the tearing point cannot be caused always at a desired perforation line corresponding to a predefined length of wound paper. This is also due to the many transversal perforations present along all the portion of tensioned web that extends between the completed log in the winding zone and the new core already inserted in the cradle, and not only one, and each of such transversal perforations can be a place for the tearing.

[0011] It is apparent that this problem can cause important drawbacks on the quality of the final product, since each obtained single roll is not likely to respect the specifications of the client, i.e. the metres of paper wound, and therefore the number of panels, every time different, for an amount that is minimum but cannot be neglected.

[0012] Furthermore, a risk is present that the tearing occurs partially on a perforation line and ends on another perforation line, causing the product to be in any case of lower quality and in many cases to be discarded, owing to problems that arise both in the winding phase, by the defect on the head o the tail portion of the torn web when gluing on the core or on the finished log.

[0013] An alternative system, which attempts to minimize the above cited drawback, is described in EP1554202. In this case a special separation finger is provided that contacts the web of paper pushing it against the upper roller and in the meantime rotates at a different speed, higher or lower, with respect to the upper winding roller, to cause the web to stretch and therefore tearing the same.

[0014] However, also in this case, similarly to IT1167982, there is the drawback that the tearing does not occur always in a same way and a the same point. In fact, in case the finger rotates at an angular speed higher than the upper roller, about which the web runs, the web stretched portion is that set between the new core inserted and the finger. In the contrary, i.e. if the angular speed of the finger is less than the upper winding roller, the web stretched portion is that set between finger and the completed log.

[0015] In both cases, however, the number of panels contained in the above described portions is generally more than one, and the tearing step is similarly not much reliable and precise.

[0016] It is also known to arrange on a same alternatively rotating perforating roller, a blade for making transversal perforation lines that can be easily torn and a blade for making perforation lines that cannot be easily torn. This way, on all the web of paper, there is an alternation of a perforation line that can be easily torn and a perforation line that cannot be easily torn. However, also in this case, there is not any guarantee on the exact tearing point since the number of perforations contained in the useful portion can be higher or equal to three and, for this reason, containing two weaker perforations, i.e. that can be easily torn. Furthermore, the quality of the final product is lower than the traditional rolls, having all the web of the roll a mixed perforation, that is less manageable by the user.

[0017] An alternative separation way of the web of pa-

per is a clean cut by means of a blade. In this case a special cutting blade creates a clean cut of separation of the web without the need of auxiliary devices. In particular, the upper winding roller has at least one longitudinal slit that extends for all its length and with which a retractable cutting blade can engage. The cutting blade mounted on a special cutting roller which counter-rotates at the same speed of the upper winding roller at a very short distance from it. Once achieved a predetermined length or the diameter of the log, a special handling system causes retractable blade to protrude engaging with the special slit of the upper winding roller, causing therefore a clean cut of the web. This solution solves the problem of placing a cutting line in a desired point of the web.

[0018] However, this further technical solution has several drawbacks. Firstly, a high structural complication that requires the presence of both a further cutting roller with a retractable blade system, and longitudinal slits along all the upper winding roller.

[0019] Furthermore, it is necessary a synchronization program of the rotations between the two above described rollers and the protrusion/withdrawal of the cutting blade. Then, whenever the blade has to be replaced, a long maintenance stop is required for mechanical substitution and phasing the blade with the longitudinal slit of the upper winding roller.

Summary of the invention

[0020] It is therefore a feature of the present invention to provide a rewinding machine that provides the division of the web at the end of winding a log with high precision, avoiding the above described drawback of the prior art.

[0021] It is, furthermore, a feature of the present invention to provide a rewinding machine for eliminating completely maintenance stops due to the replacement of cutting tools, and at the same time maintaining a high separation precision of the web.

[0022] These and other objects are achieved by a rewinding machine of a web of paper for making a log, in particular, for making rolls of toilet paper, household towel paper rolls, non woven fabric rolls, professional paper towel roll and the like, comprising:

- feeding means of a web of paper along a feeding direction;
- perforating means adapted to make a plurality of transversal perforation lines on the web of paper, each of said transversal perforation lines comprising a plurality of slits aligned along a transversal direction distanced of a predetermined pitch;
- a winding cradle arranged downstream of said perforating means, in said winding cradle the production of the log being carried out by winding said web of paper;
- means for tearing the web of paper at one of said transversal perforation lines making a formed log tail end and a web head end for a new log,
- means for removing the formed log,

whose main feature is that said perforating means comprises, furthermore, means for adjusting the pitch of said slits.

[0023] This way, it is possible to provide transversal perforation lines with slits having a suitable pitch that can be easily torn only in a determined point of the web where the separation has to be created, and for the remainder of the web all perforation lines with slits having a suitable pitch that is more difficult to be torn automatically, which can be torn manually by the user for separating panels during the use.

[0024] Advantageously, the perforating means having the means for adjusting the pitch of the slits of said transversal perforation lines comprises:

- a perforating roller having peripherally a plurality of blades with a helical profile, said perforating roller being mounted rotatable about its own axis of rotation, said axis of rotation extending, in use, transversally to the web of paper;
- a counter-roller arranged opposite to said perforating roller with respect to said web of paper, said counter-roller having at least one first cutting profiled edge having cutting teeth with a first pitch p1 and at least one second cutting profiled edge having cutting teeth with a second pitch p2, wherein said first and said second cutting profiled edges are arranged on said counter-roller rotationally spaced of a determined angle α;
- means for moving rotationally said counter-roller between a first position and a second position, for arranging said counter-roller selectively to contact said web of paper respectively with said first, or said second cutting profiled edge, to provide transversal perforation lines with correspondingly distanced slits.

[0025] This way, the perforating roller has always a same blade with a helical profile, whereas the blade on the counter-roller can be chosen selectively between one that has transversal perforation lines having a first pitch p1 and one that has transversal perforation lines having a second pitch p2.

[0026] More in detail, the counter-roller is put normally in the first position so that the first cutting profiled edge of the blade mounted on the counter-roller contacts the web of paper, ready for engaging with quick succession the blade of the perforating roller, and to provide transversal perforation lines having a first pitch p1, corresponding to a stronger resistance to tearing, adapted to a manual tearing of the paper. When making the transversal perforation lines where a formed log has to be separated from the web being wound, the counter-roller is rotated to the second position, in order to arrange the second cutting profiled edge having a pitch p2, corresponding to a weaker resistance to tearing, to engage, only once, a blade of the perforating roller. Immediately

after the engagement the counter-roller is moved back to the first position.

[0027] Advantageously, the first and the second cutting profiled edge can be made at two different toothed blades. Alternatively the two cutting profiled edges can be made on a single toothed blade, consisting of two different rotationally shifted cutting profiled edges.

[0028] Advantageously, furthermore, means are provided for measuring the unwound length of the web of paper, and input means are provided for establishing a desired length of the web of paper, a control unit being provided that is operatively connected to the means for adjusting the pitch of the transversal perforation lines to provide transversal perforation lines having a predetermined pitch when the wound web length achieves the desired length.

[0029] Advantageously, the means for adjusting the pitch of the transversal perforation lines can comprise a device selected from the group comprised of:

- a rod torsion operatively connected at one end of the perforating roller;
- a motor.

[0030] Advantageously, the counter-roller is split into two halves capable of rotating independently from each other, each half having a first cutting profiled edge having cutting teeth with a first pitch p1 and at least one second cutting profiled edge having cutting teeth with a second pitch p2, wherein said first and said second cutting profiled edges are arranged on each half rotationally spaced of a determined angle α. Furthermore, means are provided for operating in turn the rotation of said two halves, for moving from the first to the second position.

[0031] More in detail, if a fixed toothed blade of the counter-roller instantly fits two different points of two different helical blades, said means for operating causes the rotation of said two halves so that while a helical blade of the perforating roller engages with a cutting profiled edge having cutting teeth with the second pitch p2 with a "weaker" tearing line on a first half, the previous helical blade is still engaged on the second half with a cutting profiled edge having cutting teeth with the first pitch p1 with a "stronger" tearing line. Then, the second half, once completed the engagement with the previous helical blade, moves to the second position, for engaging with the cutting profiled edge with cutting teeth p2 and completing the perforation line with a "weaker" tearing line started by the first half, which at the same time has moved back to first position for engaging with the cutting profiled edge having cutting teeth with pitch p2.

[0032] In particular, there is a instant when making the transversal perforation lines, wherein one of the two halves of the counter-roller fits with one of the two cutting profiled edges, i.e. arranged to contact one helical blade of the perforating roller, whereas the other half of the two halves of the counter-roller has both cutting profiled edges distant from the helical blades of the perforating roller. This allows rotating each portion about its own axis without impeding the perforating step, when moving from a perforation line having a determined pitch to a perforation line having a different pitch. This way, it is possible to rotate alternatively the two halves of the counter-perforating roller for stopping a perforation line being made with one of the two cutting profiled edges and starting to make the next perforation line with the other cutting profiled edge.

[0033] According to another aspect of the invention, a method for winding a web of paper for making a log, in particular, for making rolls of toilet paper, household towel paper rolls, or non woven fabric rolls, professional paper towel rolls or the like, comprises the following steps:

- feeding said web of paper along a feeding direction;
- making a plurality of transversal perforation lines on said web of paper, each of said transversal perforation lines comprising a plurality of slits aligned along a transversal direction distanced of a predetermined pitch;
- winding said web of paper about a core at a winding cradle;
- tearing the web of paper at one of said transversal perforation lines making a formed log tail end and a web head end for a new log,
- removing said formed log;

and wherein, furthermore, the step is provided of:

- changing said pitch of said slits at determined perforation lines of said web of paper. Advantageously, the perforation lines are made by:
- a perforating roller having peripherally a plurality of blades with a helical profile, said perforating roller being mounted rotatable about its own axis of rotation, said axis of rotation extending, in use, transversally to the web of paper;
- a counter-roller arranged opposite to said perforating roller with respect to said web of paper, said counter-roller having at least one first toothed blade having a first pitch p1 and at least one second toothed blade having a second pitch p2, said first and said second toothed blade being arranged on said counter-roller rotationally spaced of a determined angle α.

[0034] In particular, the variation of the pitch of the slits is obtained causing a rotation of an angle α, of the counter-perforating roller about its own axis in order to position selectively one among the first and the second cutting profiled edges to contact the web of paper to provide transversal perforation lines with slits having a corresponding pitch.

Brief description of the drawings

[0035] Further characteristic and the advantages of the rewinding machine, according to the invention, will be made clearer with the following description of an exemplary embodiment thereof, exemplifying but not limi-

tative, with reference to the attached drawings, in which like reference characters designate the same or similar parts, throughout the figures of which:

- Figures from 1 to 6 show diagrammatically elevational side views of a possible succession of steps obtainable by the rewinding machine, according to the invention, for making a log, in particular, for making rolls of toilet paper, household towel paper rolls, non woven fabric rolls, professional paper towel rolls and the like starting from a web of paper;
- Figures 1A and 3A show in detail respectively a perforation line with slits having pitch p1 and a perforation line with slits having pitch p2;
- Figures 7 and 8 show in detail elevational side views of the roller and the counter-roller in two different operative conditions;
- Figures 9A and 9B show elevational side views of an exemplary embodiment of the counter-roller of figures 7 and 8 in two different operative conditions;
- Figure 10 shows diagrammatically a perspective elevational side view of a first exemplary embodiment of the counter-perforating roller that can be associated with the rewinding machine, according to the invention;
- Figures from 11 to the 13 show diagrammatically a possible succession of steps through which the rewinding machine, according to the invention, achieves the perforation of the web of processed paper if the toothed blade fits in a single point with a single helical blade;
- Figure 14 shows diagrammatically a perspective elevational side view of an exemplary embodiment for the counter-perforating roller of figure 10 in which the toothed blade fits in two different points with two different helical blades;
- Figures from 15 to 19 show diagrammatically a possible succession of steps through which the rewinding machine of figure 14 carries out the perforation of the web of paper.

Description of a preferred exemplary embodiment

[0036] With reference to figure 1, a rewinding machine for making a log 2a comprises a feeding roller 3 for the web 1 and, downstream of it, a cradle 4 adapted to put a core 20 in a winding zone 9 at which the production of log 2a is made. Core 20 is supplied into cradle 4 by suitable introduction means, for example a loading unit 28.

[0037] Winding zone 9, according to the prior art, comprises an upper winding roller 5, a lower winding roller 6 and a pressure roller 7. The latter follows the growth of log 2 with the task of assuring its continuous contact with the winding rollers 5 and 6, controlling its growth of diameter (figures 1-6).

[0038] Upstream from the feeding roller 3, a perforating roller 15 is provided having peripherally a plurality of blades 16 with helical profile arranged at a determined angular distance β from each other, for example four blades 16a-16d arranged at 90°.

[0039] As shown in detail in figure 10, perforating roller 15 is mounted rotatable about its own axis of rotation 35 and interacts with a counter-roller 10, rotatable about an axis 30, arranged opposite to it with respect to the conveying direction of the web of paper 1, to provide transversal perforation lines on it.

[0040] According to the invention, counter-roller 10 has at least one first cutting profiled edge 11, having teeth distanced by a pitch p1, and at least one second cutting profiled edge 12, having teeth distanced by a pitch p2, with p1< p2, in order to make perforations at a corresponding pitch in the paper (see in this connection figures 1A and 3A).

[0041] In particular, cutting profiled edges 11 and 12 are made on two different toothed blades 11 and 12 arranged on the counter-roller 10 rotationally spaced of a determined angle α (figures 7 and 8). Alternatively, the two cutting profiled edges 11' and 12' can be made on a same toothed blade at rotationally shifted teeth 11' and 12' that are selectively operated to make on the web of paper 1 a perforation having a corresponding pitch (figures 9A and 9B).

[0042] Counter-roller 10 can be rotated about axis 30 between a first position and a second position, for arranging said counter-roller selectively to contact the web of paper 1 respectively with the first or the second cutting profiled edge of toothed blades 11 and 12, so that one of them fits helical blades 16a-16d of perforating roller 15, to provide on web of paper 1 transversal perforation lines 25, or 25' of a corresponding pitch.

[0043] In figures from 1 to 6 a succession of steps is diagrammatically shown of the rewinding machine according to the invention.

[0044] In particular, in figure 1 a normal step is shown of growth of a log 2a about a core 20a. In this configuration counter-roller 30 is arranged such that toothed blade 11 fits on web of paper 1 (figures 1 and 2) to provide on web of paper 1 perforation lines 25 having a pitch p1 forming a "stronger" tearing line. They correspond to the tearing lines for the user, arranged on all the web of log of paper 2a, that allow the separation of a panel of paper 26 from a following panel during the use of the roll of paper obtained after a cutting-off step of the log.

[0045] As the diameter grows of log 2a (figure 2), a core 20b is located on cradle 4 still distanced from winding roller 5, by feeding means 28. When the length of paper wound about log 2a, or its diameter, is close to a predetermined value, suitable means for controlling and measuring the wound paper, not shown in the figure, operate a rotation of an angle α of counter-roller 10 about its axis 30 bringing it from the first to the second position.

[0046] This way, as shown in figure 3, blade 12 having a pitch p2 for a "weaker" tearing line enters into contact with blade 16 of perforating roller 15, obtaining a perforation line 25' having a corresponding pitch p2. In particular, perforation lines 25', divide a log of paper from a

following one, and is at such lines that the web of paper 1 is separated from log 2a, through an acceleration of pressure roller 7 (figure 6).

[0047] Then, as shown in figure 4, once made perforation line 25', counter-roller 10 counter-rotates for an angle α bringing it back to the original position since blade 11 comes into contact with web 1. This way, by resetting the corresponding operative conditions perforation lines 25, for a "weaker" tearing are obtained on a new log being wound.

[0048] In the meantime, new core 20b is brought into contact with upper winding roller 5 by a rotation of cradle 4, on which it had been previously located, about fulcrum 40 (figure 5). In particular, the contact of core 20b with upper roller 5 is carried out when perforation lines 25' is located in the portion set between the core and almost completed log 2a.

[0049] A following acceleration of pressure roller 7 causes tearing the web 1 at perforation lines 25' generating a web head end 1b that engages with core 20b to start winding a new log 2b and a tail end 1a of completed log 2a.

[0050] With reference now to figure 11, the blades having a helical profile 16 can be arranged on the perforation roller surface 15 at an angular distance such that fixed toothed blade 11, or 12, of counter-roller 10 fits in a single point of a single profile helical. In this way, once completed the last perforation for "stronger" tearing having a pitch p1 and therefore at the chosen length of paper, the rotation is operated of counter-roller 10 for bringing into contact blade 12 having pitch p2 for a weaker tearing to provide therefore the new perforation.

[0051] However, notwithstanding the blades with helical profile 16 are arranged on the perforation roller surface 15 at a angular distance such that the fixed toothed blade 11, or 12, of counter-roller 10 fits in a single point of a single helical profile, the above described angular distance is so reduced that the time required for carrying out the rotation of counter-roller 10 is enough to reach the next helix in the contact zone. That is to say that, in this case, the contact between blade 12 and helical blade 16 is carried out in an advanced point with respect to the edge end of the helical blade 16. This way, during the rotation of counter-roller 10 to move from a "stronger" tearing line to a "weaker" tearing line, there is a step wherein there is not any contact between the blade with helical profile 16 and the blade 12 of fixed roller 10, with the subsequent result of a perforation "weaker" tearing line made partially along all the width of web of paper 1.

[0052] For overcoming the above described drawback, a division of counter-roller 10 can be made in at least two halves 10a and 10b capable of rotating independently from one another (figure 14). This way, the rotation of the first half 10b making a "weaker" tearing line can be anticipated when the second half 10a is still completing the perforation for "stronger" tearing lines.

[0053] Alternatively, the helical blades 16 of the perforating roller 15 can be arranged on the perforation roller surface at a angular distance such that the fixed toothed blade 11, or 12, instantly fits at two different points A and B belonging to two different helical blades (figures 12 and 13).

[0054] In this case, as described in figure 13, in the moment when the rotation of the counter-roller 10 is operated to start a perforation 25' having a pitch p2 at point C, the previous perforation line 25 having a pitch p1 has not yet been finished. Therefore, the perforation line 25 would be ended by the toothed blade 12 having pitch p2 obtaining a mixed perforation line, i.e. with a portion 25' having pitch p2.

[0055] Also in this case, in order to solve this drawback, counter-roller 10 can comprise at least two halves 10a and 10b movable independently with respect to each other in rotation about axis 30 (figure 14).In particular, both half 10a and half 10b comprise toothed blade 11 having pitch p1 and toothed blade 12 having pitch p2. This way, when changing the type of perforation line, the half 10a and half 10b are made rotate in turn independently with respect to each other for causing the corresponding toothed blades 11a, 11b and 12a, 12b to contact the web of paper 1.

[0056] More in detail, in figure 15 the step is shown of beginning a perforation line 25' having a pitch p2 at point C on helical blade 16d. In this case, the rotation of counter-roller 10 for bringing the blade 12 having pitch p2 to contact the web 1 relates only to half 10b of counter-roller 10. Instead, half 0a of counter-roller 10 is still fitting with blade 11a having pitch p1 on helical blade 16c for continuing the perforation 25 having a pitch p1.

[0057] Then, as shown in figure 16, the perforation 25' having pitch p2 is approached to half 10a of counter-roller 10 while at the same time perforation 25a having pitch p1 is close ending the winding step.

[0058] When point C exits from half 10b of counter-roller 10, the rotation of half 10a is operated, causing the blade 12a with a pitch p2 to contact the web of paper 1 in order to completing perforation line 25' (figure 17). At the same time half 10b is caused to counter-rotate, in order to move back to a starting condition, where a blade 11b having a pitch p1 that is into contact with the web of paper 1 to start a perforation line 25 at point D of helical blade 16a (figure 18).

[0059] Once ended perforation line 25' by blade 12a and by helical blade 16d, a counter-rotation of half 10a resets the conditions of figure 19 where both half 10a and half 10b have respective blades 11a and 11b contacting the web of paper 1 and providing perforation lines 25 having a pitch p1.

[0060] For simplicity and without any limitation for the present invention, both perforating roller 15 and counter-roller 10 have been shown in figures 12, 13 and from 15 to the 19, neglecting the angle of the helical blades, so that the perforations are inclined. For compensating this inclination, the above described rollers are normally mounted at an angle.

[0061] The foregoing description of a specific embod-

iment will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such an embodiment without further research and without parting from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiment. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Claims

1. Rewinding machine of a web of paper for making a log, in particular, for making rolls of toilet paper, household towel paper rolls, non woven fabric rolls, professional paper towel rolls and the like, comprising:

   - feeding means of a web of paper along a feeding direction;
   - perforating means adapted to make a plurality of transversal perforation lines on the web of paper, each of said transversal perforation lines comprising a plurality of slits aligned along a transversal direction distanced of a predetermined pitch;
   - a winding cradle arranged downstream of said perforating means, in said winding cradle the production of the log being carried out by winding said web of paper;
   - means for tearing the web of paper at one of said transversal perforation lines making a formed log tail end and a web head end for a new log;
   - means for removing the formed log,

   characterised in that said perforating means comprises, furthermore, means for adjusting the pitch of said slits.

2. Rewinding machine, according to claim 1, wherein said perforating means having said means for adjusting the pitch of said slits of said transversal perforation lines comprises:

   - a perforating roller having peripherally a plurality of blades with a helical profile, said perforating roller being mounted rotatable about its own axis of rotation, said axis of rotation extending, in use, transversally to the web of paper;
   - a counter-roller arranged opposite to said perforating roller with respect to said web of paper, said counter-roller having at least one first cutting profiled edge having cutting teeth with a first pitch p1 and at least one second cutting profiled edge having cutting teeth with a second pitch p2, wherein said first and said second cutting profiled edges are arranged on said counter-roller rotationally spaced of a determined angle α;
   - means for moving rotationally said counter-roller between a first position and a second position, for arranging said counter-roller selectively to contact said web of paper respectively with said first, or said second, cutting profiled edge, to provide transversal perforation lines with correspondingly distanced slits.

3. Rewinding machine, according to claim 2, wherein said first and said second cutting profiled edges are made on two different blades.

4. Rewinding machine, according to claim 1, wherein, furthermore, means are provided for measuring the unwound length of the web of paper, and input means are provided for establishing a desired length of the web of paper, a control unit being provided that is operatively connected to the means for adjusting the pitch of the transversal perforation lines to provide transversal perforation lines having a predetermined pitch when the wound web length achieves the desired length.

5. Rewinding machine, according to claim 2, wherein said means for adjusting said pitch of said transversal perforation lines causes a rotation of an angle α to said counter-perforating roller about its own axis, in order to position selectively one among said first and said second cutting profiled edges to contact said web of paper, i.e. by arranging said cutting profiled edge with a pitch that is adapted for an automatic tearing of the paper.

6. Rewinding machine, according to claim 2, wherein said counter-roller is split into two halves capable of rotating independently from each other, each half having a first cutting profiled edge having cutting teeth with a first pitch p1 and at least one second cutting profiled edge having cutting teeth with a second pitch p2, wherein said first and said second cutting profiled edges are arranged on each half rotationally spaced of a determined angle α, being furthermore, provided means for operating in turn the rotation of said two halves, for moving from the first to the second position.

7. Rewinding machine, according to claim 6, wherein said first and said second halves of said counter-roller are operated in turn so that a same perforation line is started and ended by cutting profiled edges corresponding to said first and said second portion.

8. Method for winding a web of paper for making a log, in particular, for making rolls of toilet paper, household towel paper rolls, non woven fabric rolls, professional paper towel rolls or the like, comprising the following steps:

- feeding said web of paper along a feeding direction;
- making a plurality of transversal perforation lines on said web of paper, each of said transversal perforation lines comprising a plurality of slits aligned along a transversal direction distanced of a predetermined pitch;
- winding said web of paper about a core at a winding cradle;
- tearing said web of paper at one of said transversal perforation lines making a formed log tail end and a web head end for a new log,
- removing said formed log;

characterised in that of providing, furthermore, the step of:

- changing said pitch of said slits at determined transversal perforation lines.

9. Method for winding a web of paper for making a log, according to claim 8, wherein said perforation lines are made by means:

- a perforating roller having peripherally a plurality of blades with a helical profile, said perforating roller being mounted rotatable about its own axis of rotation, said axis of rotation extending, in use, transversally to the web of paper;
- a counter-roller arranged opposite to said perforating roller with respect to said web of paper, said counter-roller having at least one first cutting profiled edge having cutting teeth with a first pitch p1, and at least one second cutting profiled edge having cutting teeth with a second pitch p2, said first and said second cutting profiled edges being arranged on said counter-roller rotationally spaced of a determined angle α.

10. Method for winding a web of paper for making a log, according to claim 8, wherein said variation of said pitch is obtained causing a rotation of an angle α of said counter-perforating roller about its own axis, in order to position selectively one among said first and said second cutting profiled edges for contact of said web of paper to provide correspondingly distanced perforation lines.

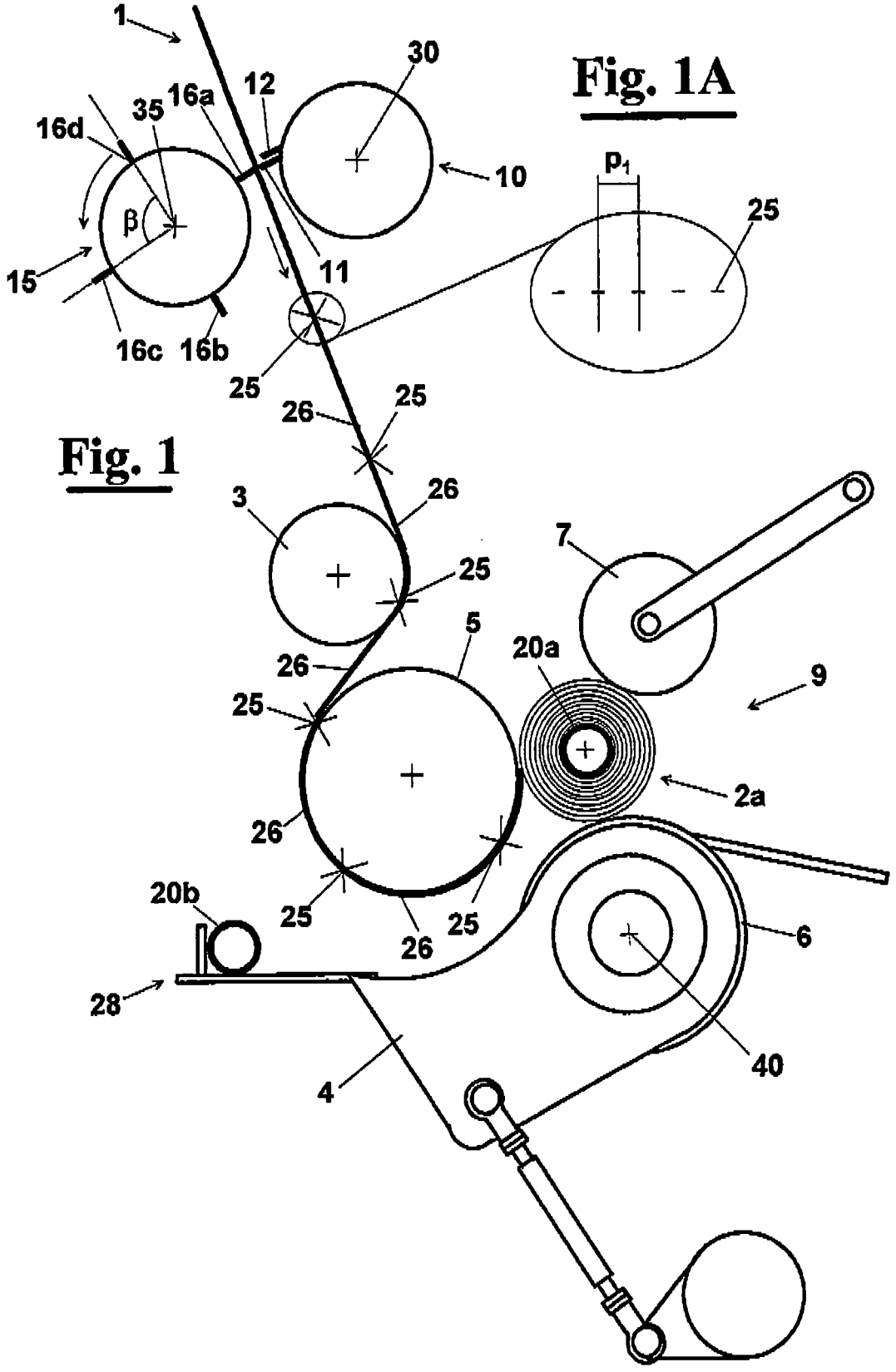

1
30
12
16a
35
16d
10
β
15
11
16c
16b
25
26
3
7
5
20a
9
2a
20b
6
28
4
40

Fig. 1

p1
25

Fig. 1A

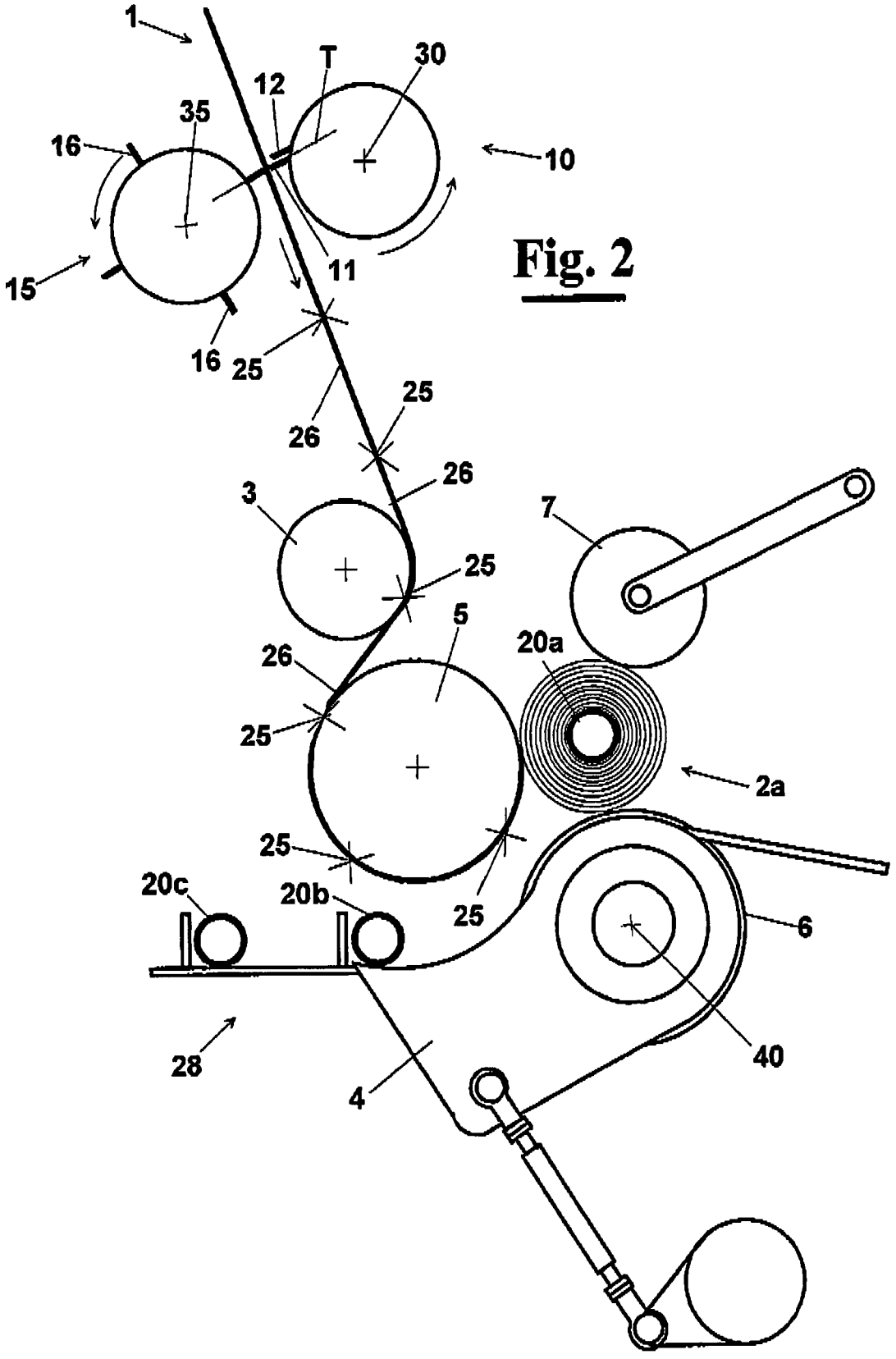

1
T
30
12
35
16
10
15
11
16
25
26
25
26
3
7
25
5
20a
26
25
2a
25
20c
20b
25
6
28
4
40

Fig. 2

Fig. 3A

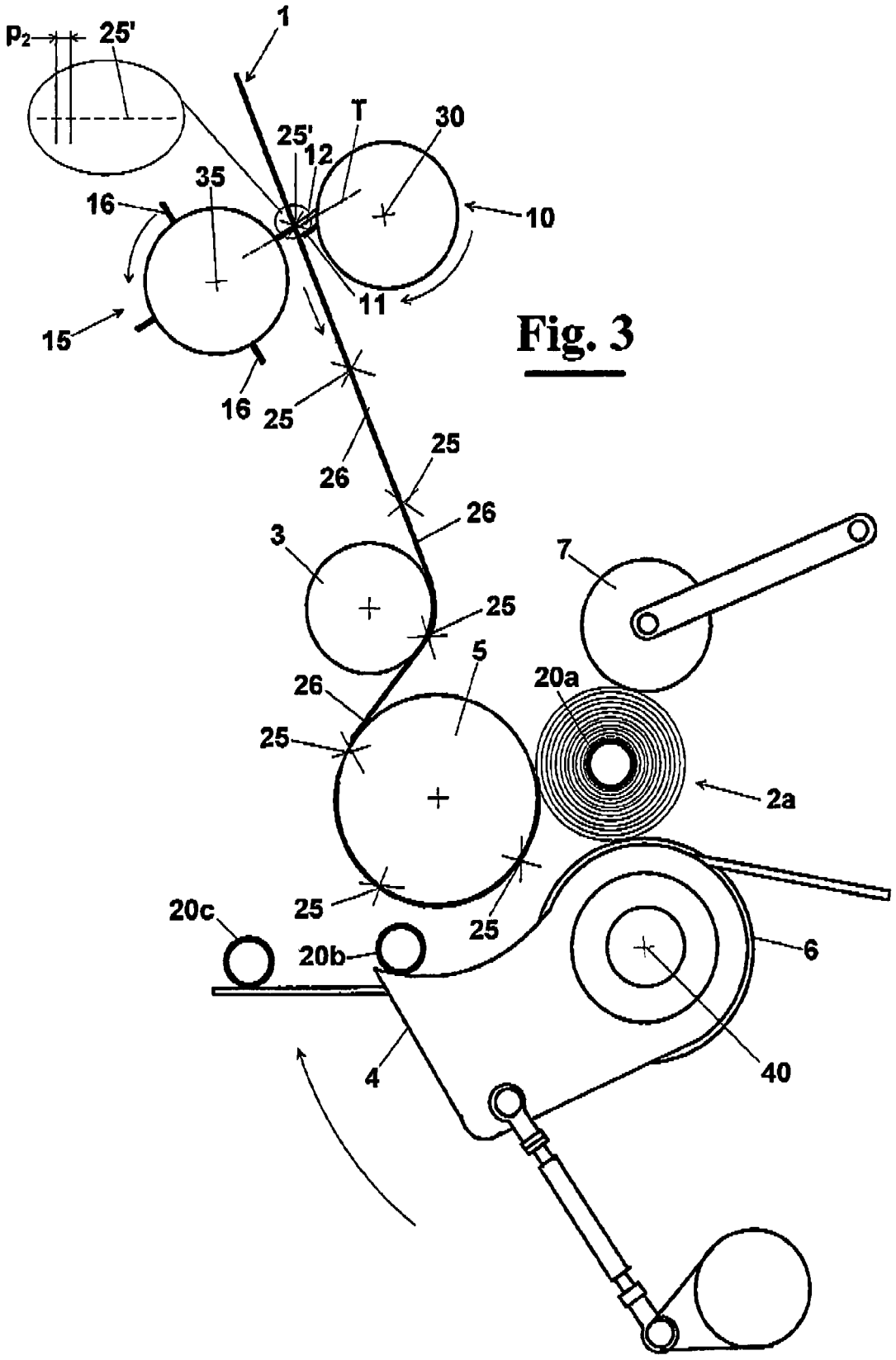

p2
25'
1
T
30
25'
12
35
16
10
11
15
16
25
26
25
26
3
7
25
5
20a
26
25
2a
20c
25
25
20b
6
4
40

Fig. 3

Fig. 4

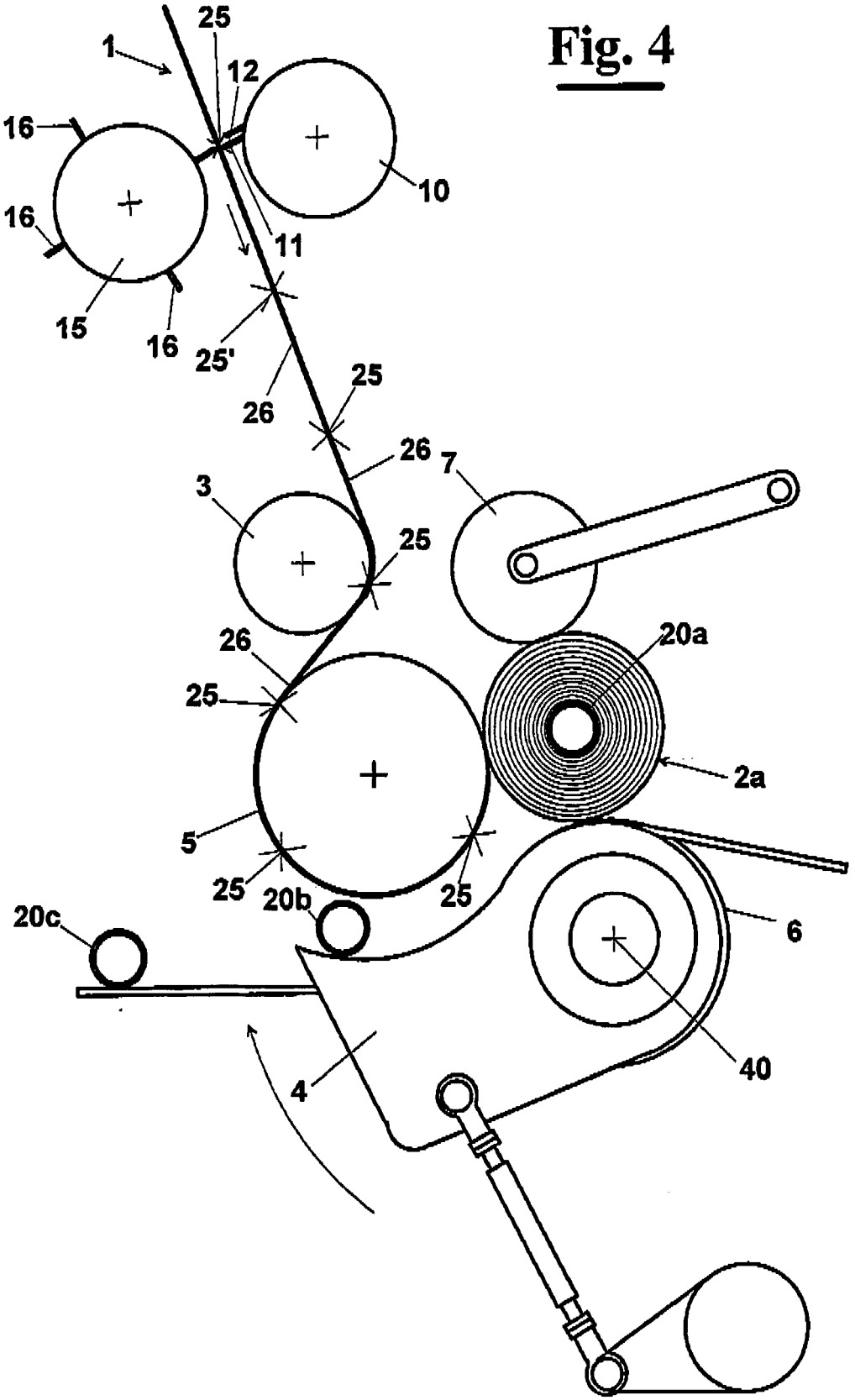

25
1
12
16
10
16
11
15
16
25'
26
25
26
7
3
25
26
20a
25
2a
5
25
20b
25
20c
6
4
40

Fig. 5

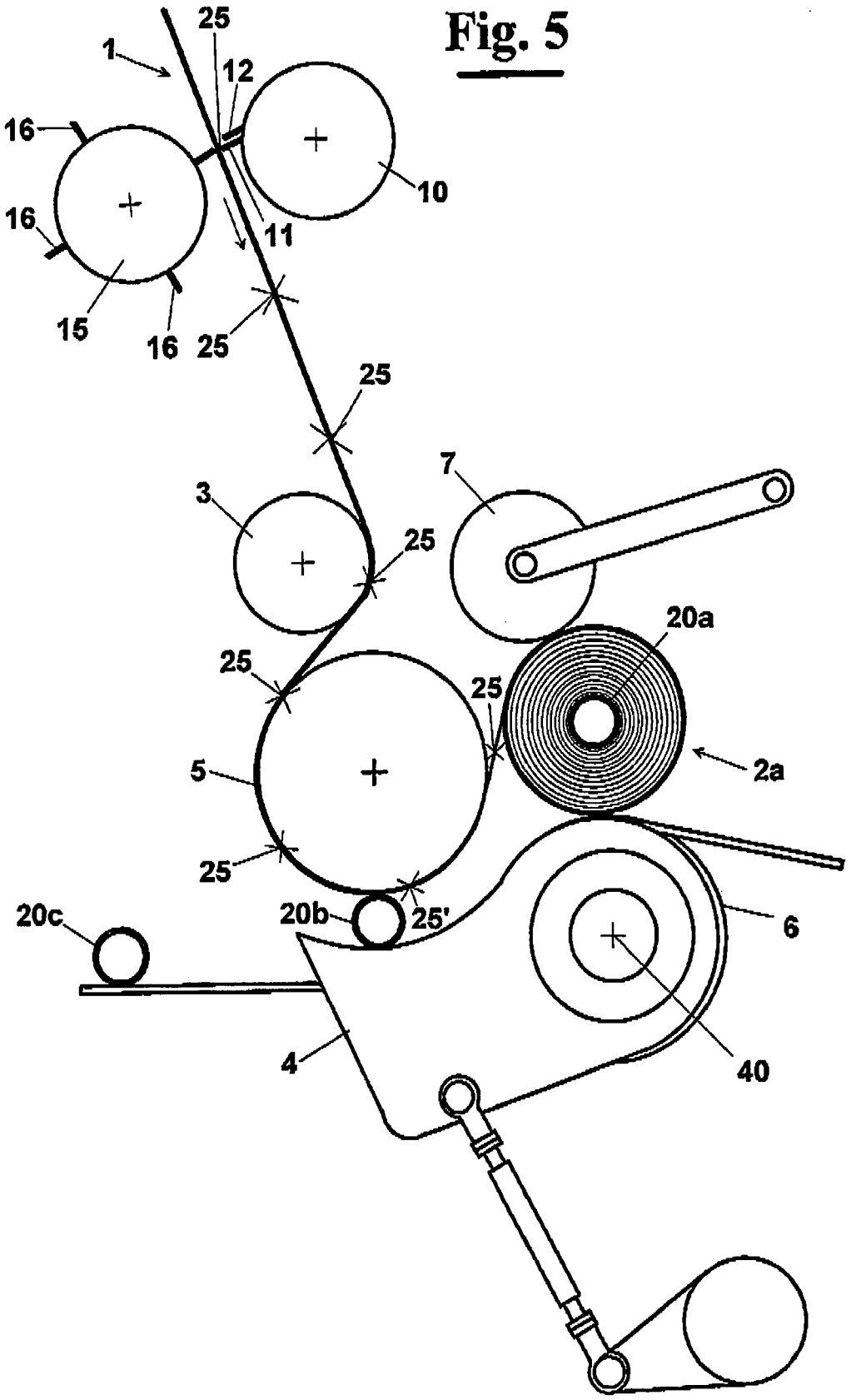

25
1
12
16
10
16
11
15
16
25
25
25
7
3
25
20a
25
25
2a
5
25
20c
20b
25'
6
4
40

Fig. 6

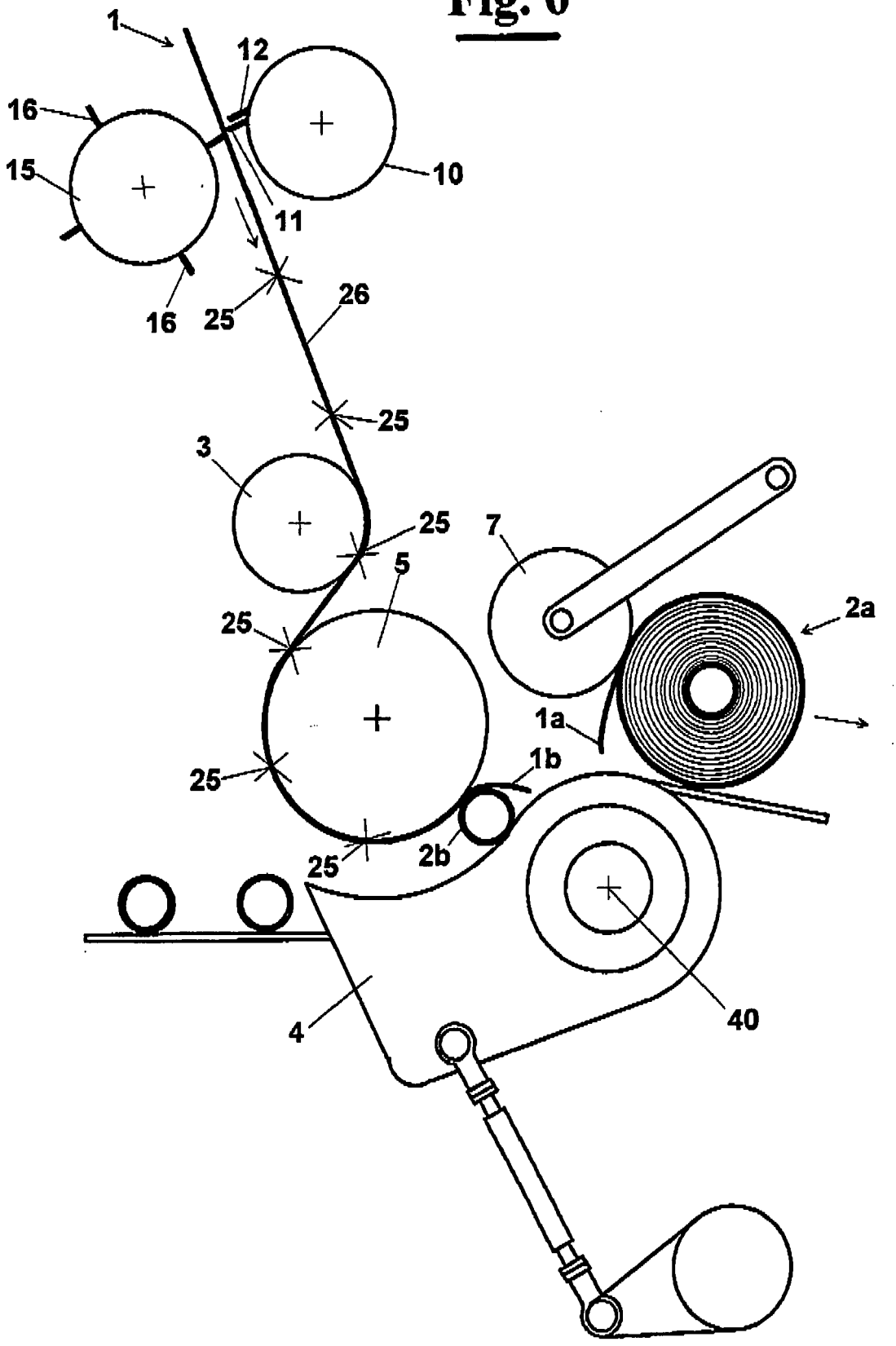


Fig. 7

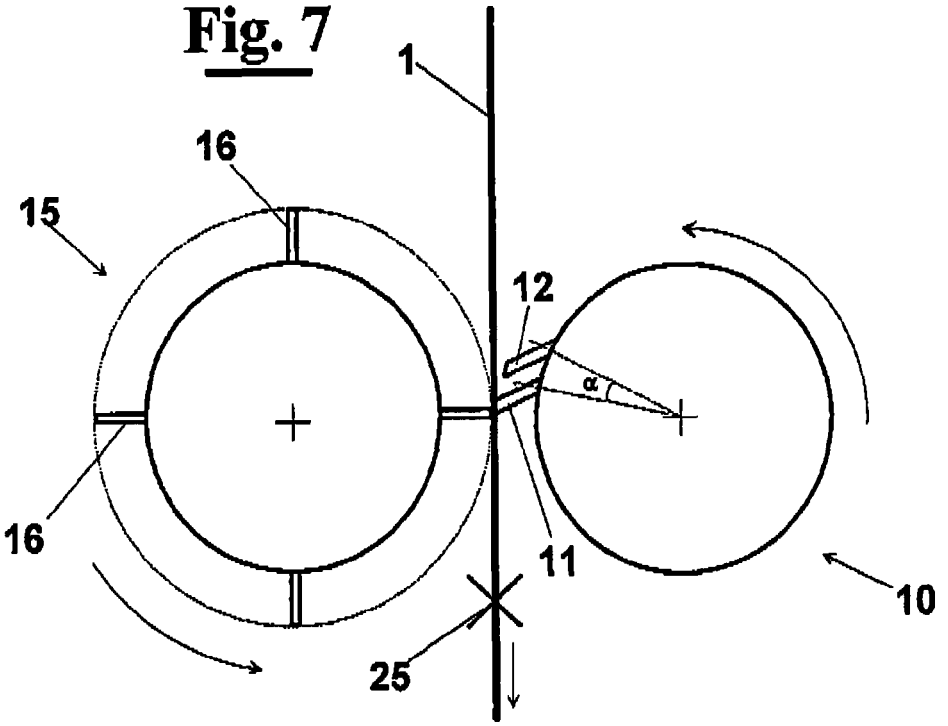


Fig. 8

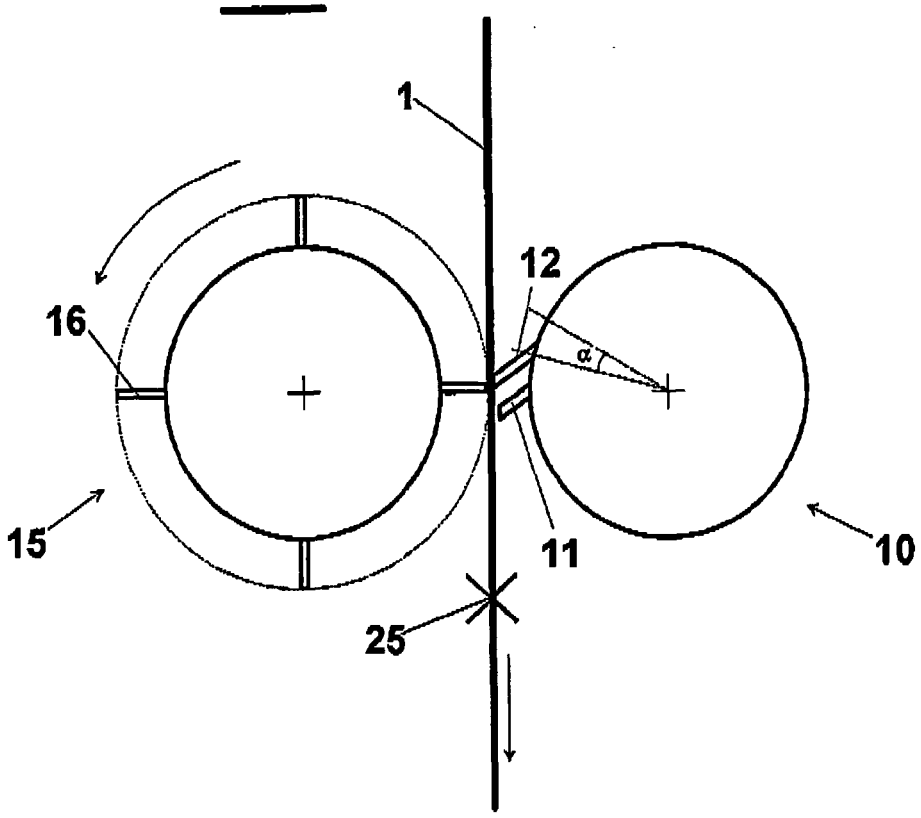


Fig. 9A

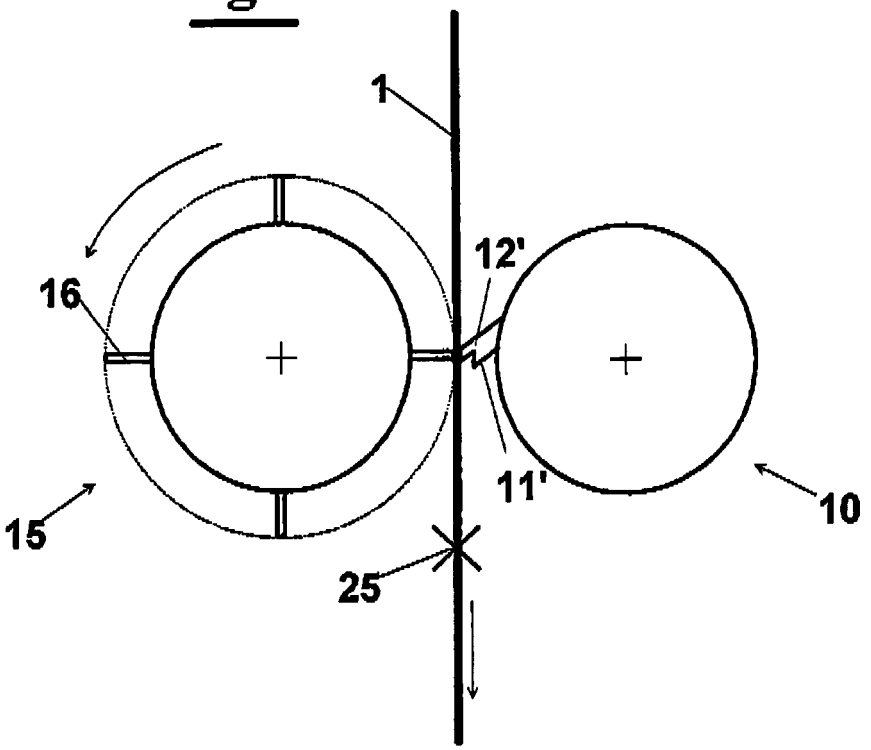
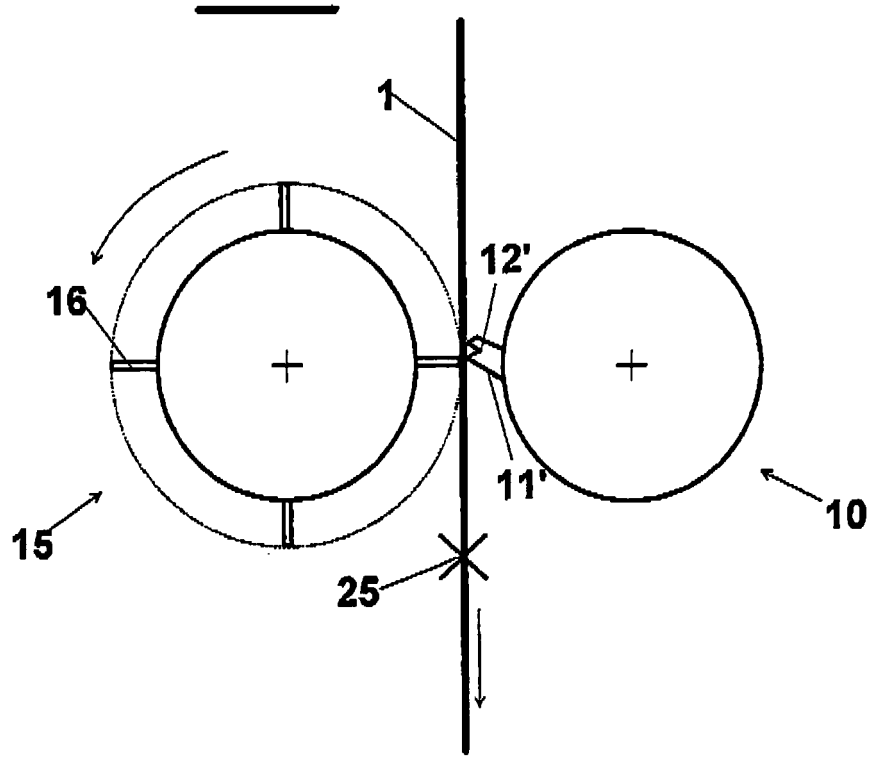


Fig. 9B



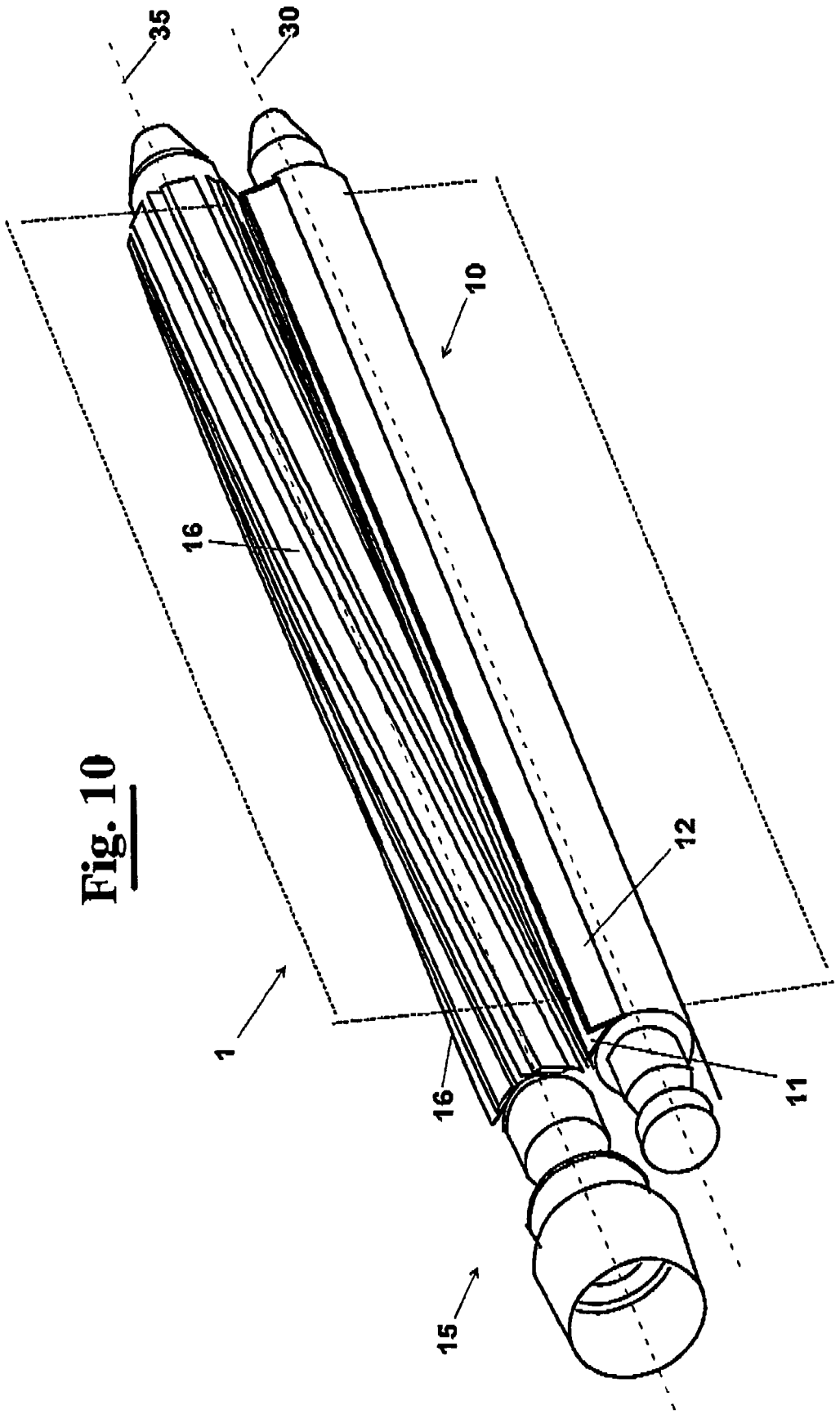


Fig. 10

Fig. 11

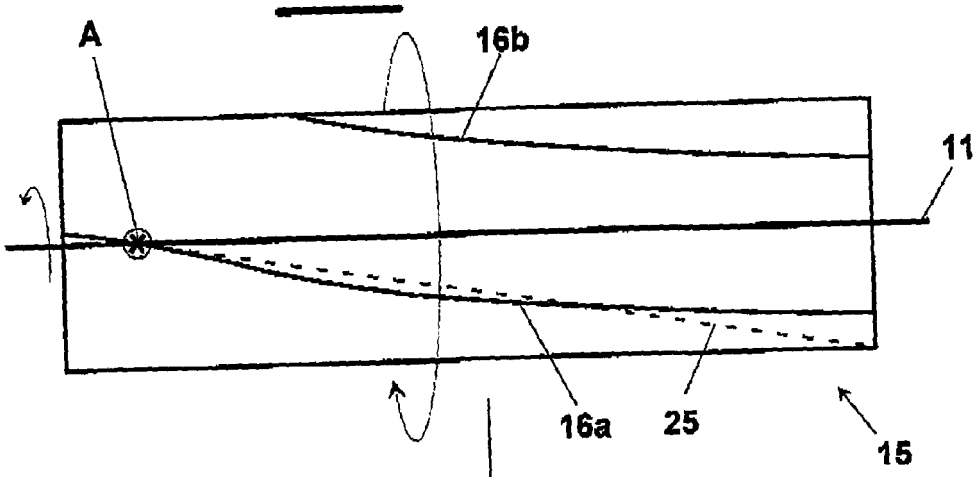


Fig. 12

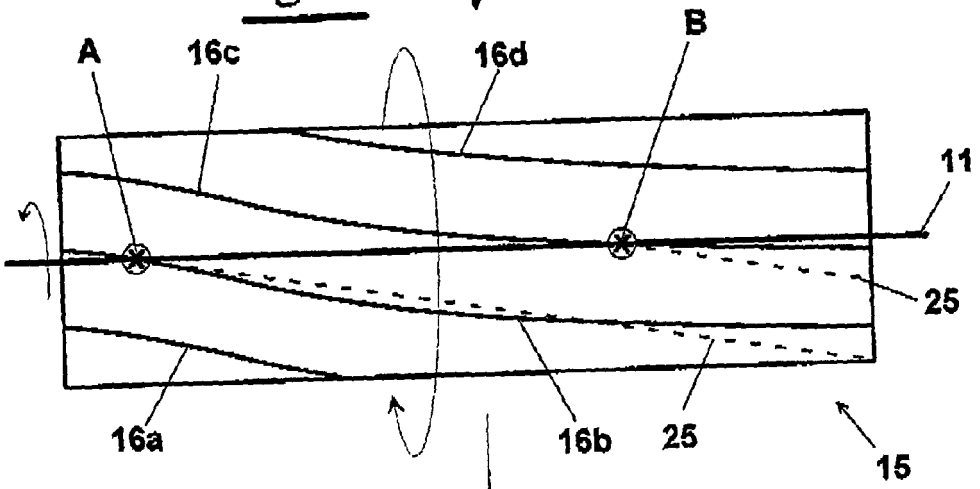
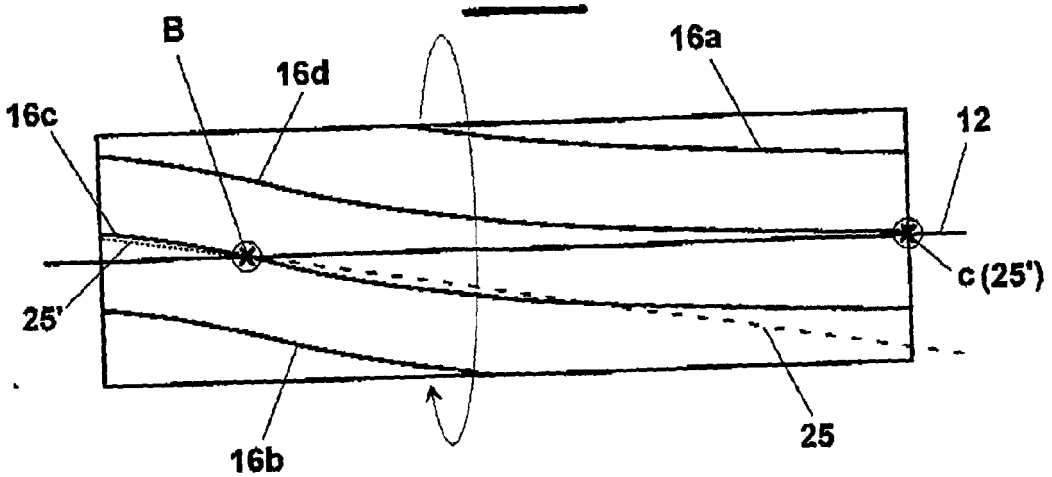


Fig. 13



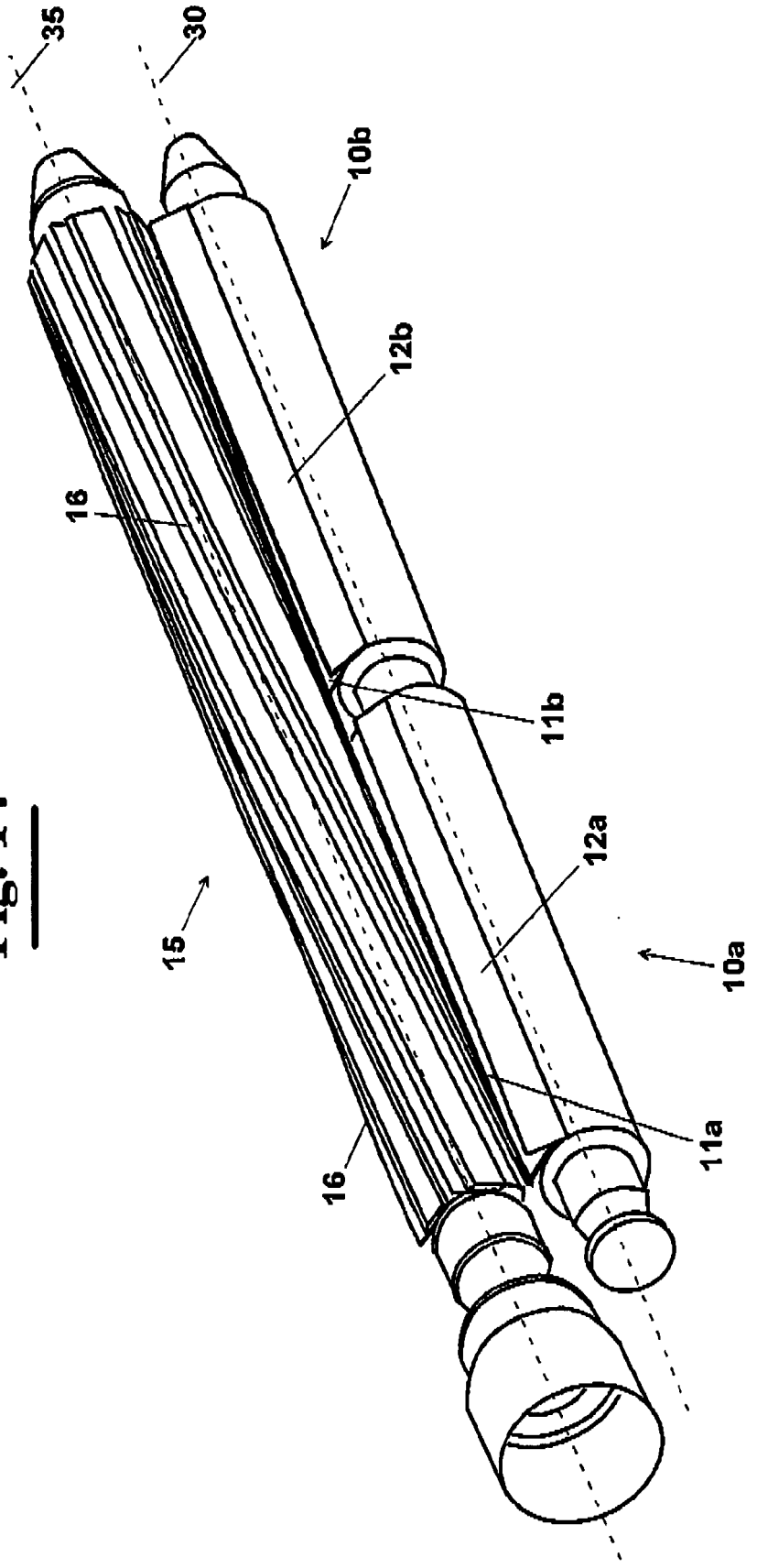


Fig. 14

Fig. 15

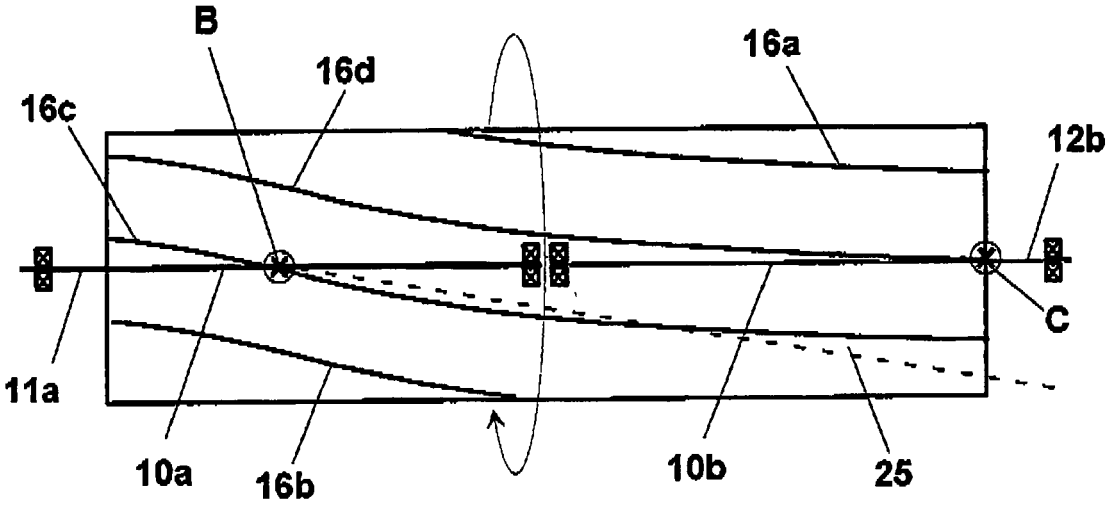

B
16d
16a
16c
12b
C
11a
10a
16b
10b
25

Fig. 16

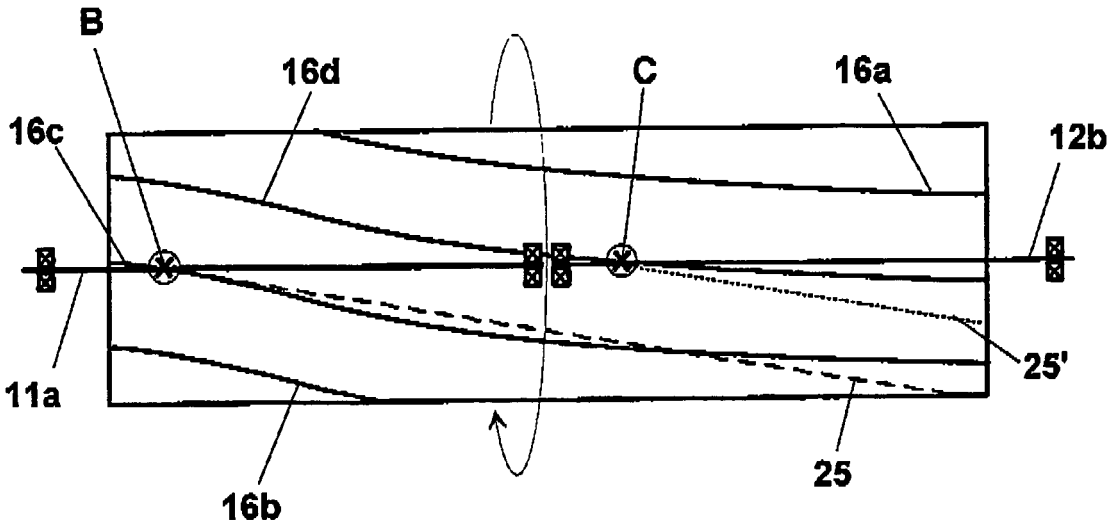

B
16d
C
16a
16c
12b
25'
11a
16b
25

Fig. 17

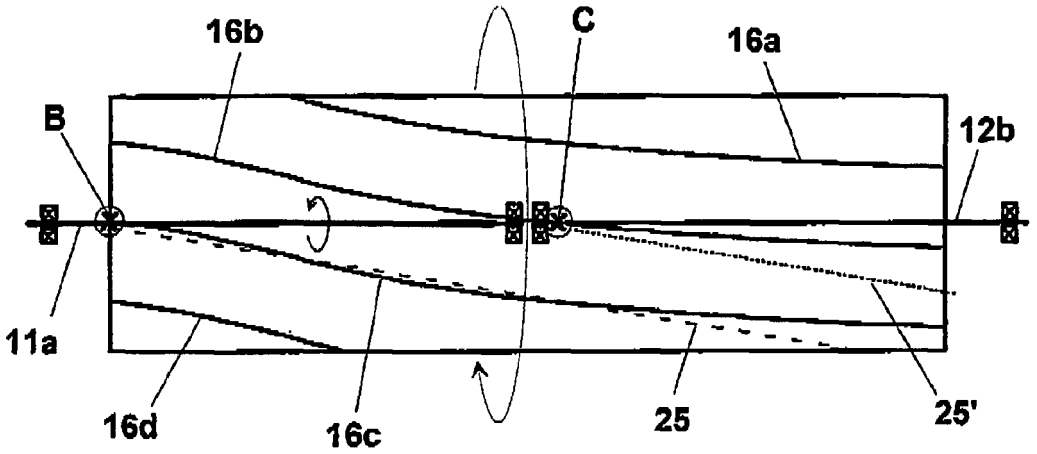


Fig. 18

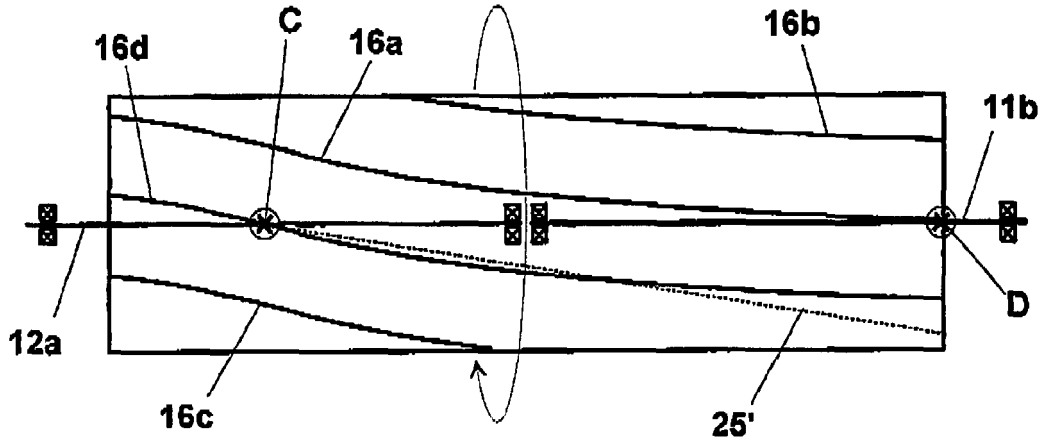
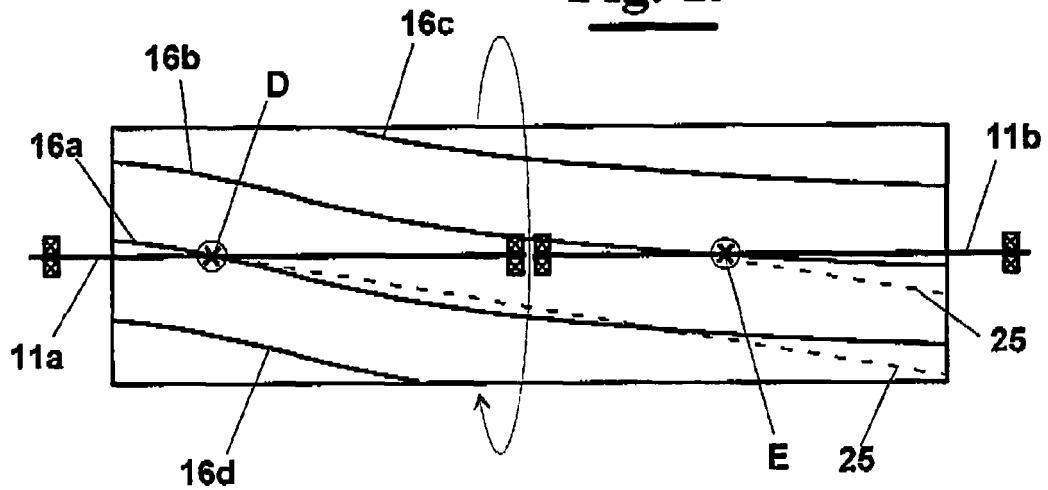


Fig. 19



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 07 02 3645

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 00/06351 A (PERINI FABIO SPA [IT]; BIAGIOTTI GUGLIELMO [IT]) 10 February 2000 (2000-02-10) * abstract; figures * -----	1,8	INV. B26F1/20

TECHNICAL FIELDS SEARCHED (IPC)

B26F
B26D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 October 2008	Vaglienti, Giovanni

CATEGORY OF CITED DOCUMENTS

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

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

& : member of the same patent family, corresponding document

4

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 02 3645

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-10-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0006351 A	10-02-2000	AT 213450 T	15-03-2002
		AU 5192599 A	21-02-2000
		BR 9912467 A	17-04-2001
		CA 2338720 A1	10-02-2000
		CN 1311728 A	05-09-2001
		DE 69900919 D1	28-03-2002
		DE 69900919 T2	19-09-2002
		EP 1100659 A1	23-05-2001
		ES 2172997 T3	01-10-2002
		IT FI980081 U1	27-01-2000
		JP 2002521226 T	16-07-2002
		PL 345667 A1	02-01-2002
		US 6431491 B1	13-08-2002
		ZA 200100394 A	14-08-2001

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- EP 1232980 A **[0004]**
- IT 1167982 A **[0009]**
- EP 1554202 A **[0013]**
- IT 1167982 **[0014]**