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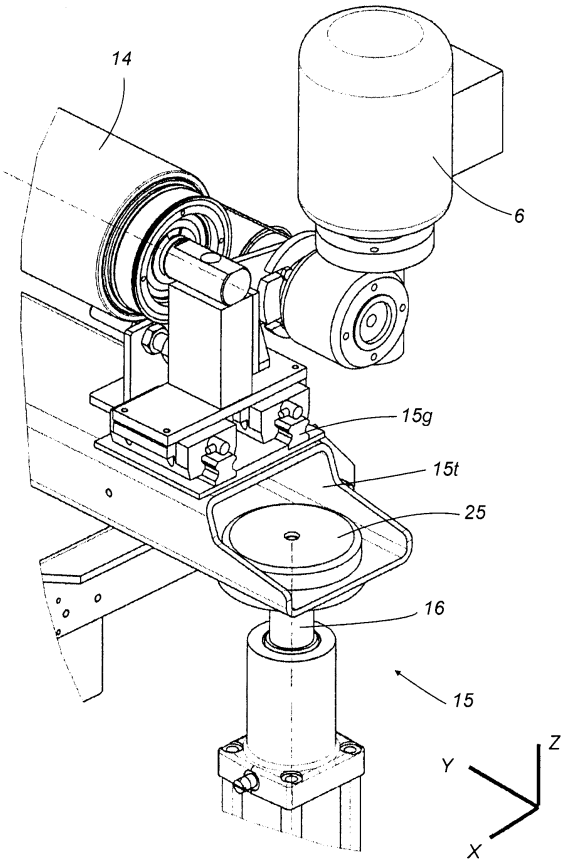
(54) Method and machine for sanding wooden panels

(57) A method of tensioning and operating a belt is applied to a sanding machine comprising an endless abrasive belt (3) trained around an operating unit (2) equipped with an orbiting sanding platen (4) at the bottom of the unit. A roller (14) at the top of the unit (2) is supported by supports (15) and comprises rotational drive means (6). While it operates, the belt (3) is kept in the tensioned state by means (16) for lifting the roller (14), and the tensioned state holds the belt (3) against the active surface (5) of the platen (4).

The turning of the belt (3) is enabled or inhibited by the rotation or stopping of the roller (14) during the steps of changing the working part (10) of the belt (3) and of sanding the panels (1), respectively.

The kinematic coupling between the roller (14) and the belt (3) is achieved by the friction produced by the tensioning action.

FIG.4



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Description

[0001] This invention relates to a method and machine for sanding wooden panels and the like, of a type whose basic architecture is substantially known and which is used in the field of secondary machining of wooden parts, especially for sanding flat parts or panels for the furniture and building industries, for example for making tables or cabinet sides for kitchen units or door and window frames for buildings.

[0002] Machines of this kind and their respective operating modes are designed to remove a thin layer of wooden stock from the panel using an abrasive belt or tool which is driven in a direction tangent to the surface of the part in such a way as to perfectly smooth and finish the surface.

[0003] In these sanding machines, the panels are fed in one after the other and made to advance, usually by means of a rubber belt, under at least one sanding unit equipped with a moving abrasive belt.

[0004] The teachings of prior art regarding the methods used by sanding units to machine the panels in transit include several different methods, each applied most advantageously in a specific field. Some methods use sanding units with belts that move continuously in one direction relative to the machine, like endless belts, others use orbital units to which the machine imparts flat orbiting translational motion on the surface of the panel being worked, the former being suitable for sanding wooden parts with a straight grain, whilst the latter are more suitable for sanding crossed grain parts.

[0005] The prior art described below refers in particular to orbital sanding units, which this invention applies to.

[0006] The solutions adopted to obtain the orbiting motion, whether simple or composite, that is to say, combining two simple orbiting motions, are well known.

[0007] An important reference document for making units of this kind is European patent EP 0543947, to Haney, which describes in detail the solution used to impart the double orbital motion to a platen.

[0008] The overview of sanding systems based on orbiting belts can be extended to include also European patent EP 1053827 to Costa Levigatrici, and United States patents US 5707273 and US 4651474 to Timesavers.

[0009] These documents provide a solid prior art basis for technical solutions used to impart orbiting motion, whether single or double, to a platen or generic belt. A solution of this type as included in this description, therefore, will only be outlined very briefly. The double orbiting mechanism shown in the drawings of this invention can be traced to the prior art solution with the two orbiting elements, the first of which orbits around the machine frame and the second - consisting of the platen itself - orbits around the first, so that the resulting platen motion is a combination of two orbiting motions. These single orbiting motions are accomplished as follows: the first orbiting motion, by the action of first power-driven shafts with synchronised eccentric parts interposed between the frame and the first orbiting element; and the second orbiting motion by the action of second power-driven shafts with eccentric parts interposed between the first orbiting element and the platen, where the first shafts impart a slow circular and relatively wide orbiting motion, whilst the second shafts impart fast circular and relatively narrow orbiting motion, in such a way that each single abrasive particle follows a sort of circular cycloidal path whose total amplitude is equal to the sum "e" of the eccentricities of the two component motions.

[0010] It is also important to mention the prior art regarding the methods and devices for holding the abrasive belt under the orbiting platen in the sanding units since it is this aspect that is the most relevant to this invention. In the most common solution, also widely used on the Applicant's own machines, a rectangular portion of the abrasive belt approximately as large as the active surface of the platen was supported by a perimetral frame adapted to hold the belt under the platen, or - more simply - was supported by two metal bars associated with the long sides of the rectangular belt portion to be inserted into respective guides made in the long sides of the platen itself, where a tube, upon inflation, caused the metal bars to be pressed against the guides on the platen.

[0011] The disadvantage of the solution just mentioned was that the working life of the abrasive belt was reduced to just a few hours, after which the machine had to be stopped in order to change the belt. Further, the intensive use made of the working belt portion - in practice until it was totally worn - meant that sanding efficiency tended to diminish towards the end of the belt's working life, when the belt became clogged with process dust.

[0012] To overcome these problems, the Applicant developed and patented a more sophisticated solution, whose details are described in the Italian patent document corresponding to application number BO97A000506.

[0013] This solution combined the concept of an abrasive belt reservoir with the orbiting platen solution in a sanding machine where the sanding belt was of the open-ended type, of considerable length, and trained around two reels located in the vicinity of the short sides of the platen, with their axes parallel to the short sides themselves. Lengths of the abrasive belt could be reciprocally wound/unwound onto and from the reels, the belt being guided in such manner that it passed under the platen in the direction of the latter's long sides, transversally to the panel feed direction. The operation of the machine included a step of changing the working length of the belt under the platen by unwinding a length of the belt from one reel, causing it to slide under the platen and winding onto the other reel, and a step of pressing the belt against the platen to enable orbital sanding to be carried out. The patent also taught that the belt could be held securely against the platen by means of a generic vacuum chamber located between the belt and the platen and, according to the drawings, exactly under the flat part of the plat-

en.

[0014] After this solution was patented, the Applicant developed another machine, which was patented against application number RN2002U000011, in order to overcome the disadvantages that had been brought about by the previous machine configuration.

[0015] The new machine proposed the use of an endless abrasive belt of the standard, economical type used in sanding units with continuous motion, and positioned lengthways with respect to the direction of panel feed so as not to damage the edge of the belt as happened all too often when the belt was positioned transversally. The novelty of this invention lay in the solution adopted to hold the belt against the platen. The solution consisted of a vacuum applied to the back of the belt, between belt and platen and created by two prismatic suction elements running symmetrically along both sides of the platen in the vicinity of two opposite edges of the active surface in a non-operating zone of the belt, and having on their flat surfaces, facing the back of the belt, a number of holes leading to a vacuum chamber. The vacuum enabled the belt - thanks also to the angle of the flat surfaces with the holes made in them - to adhere to the platen at an appropriate angle and to keep the belt taut and pressed against the platen even after the action of the tensioners had ceased.

[0016] The first problems mentioned above in connection with the first method with the belt portion the same size as the platen and associated with a frame for manual substitution, were overcome by the sanding machine with the orbiting operating unit with the structure described which, however, posed another set of problems, described below.

[0017] As regards the two reels, it should be observed that they encumbered the sanding unit, making it larger than the continuous sanding units that had been used until then, which were much more compact, and thus increased the overall size of the machine, making it clumsier and less satisfactory even in terms of appearance.

[0018] The problem posed was not, however, merely one of appearance, since the larger size of the unit meant that it was not interchangeable with other sanding units and, because it could not be fitted on the same machine base as the other units, the entire machine structure lost its very important feature of modularity.

[0019] Indeed, the two reels required much more space than the standard sanding units that had been used until then.

[0020] In terms of maintenance too, considerable disadvantages arose on account of the amount of abrasive belt stored on the two reels, which was in the order of several ten of metres in length. It was not uncommon for the belt to break during normal operation and when this happened, the entire belt had to be discarded.

[0021] It should also be mentioned that the reels required special tools to be correctly loaded and fitted.

[0022] As regards the vacuum chamber made at the bottom of the platen applying suction to the back of the belt in the area below the platen corresponding to the working section of the belt, it should be observed that the effectiveness of this solution was not very satisfactory, as subsequent tests on it were to show.

[0023] In particular, it was noticed that if the panels were fed in a direction transversal to the direction in which the belt was tensioned, the belt itself was soon damaged at the edge and tended to break easily, whereas positioning the belt in such a way that it was tensioned in the same direction as panel feed meant that the width of the belt (and of the reels) had values approximately equal to the working width of the machine and hence disadvantageous in terms of overall size and replacement cost in the event of breakage.

[0024] The problems of excessive size and belt damage were undoubtedly overcome in the machine configuration with the prismatic suction elements located next to the active surface, although even this solution proved unreliable since the edge of the belt tended to come away from the surface of the prismatic suction elements at even the slightest vibration - in practice, every time a panel was sanded - eventually causing the belt to slacken along the entire length of the suction elements.

[0025] It will be appreciated therefore that the sanding units and operating methods described above each suffer from a number of disadvantages that significantly reduce the possibility of their being successfully adopted.

[0026] As a result, a sanding machine made according to prior art, equipped with orbital units of one of the types described above, inevitably has significant limitations to its use, linked to the factors listed above which - even if accepted to some extent in the past - today constitute an increasingly serious problem because manufacturing companies are no longer prepared to tolerate frequent machine shutdowns that become a bottleneck for other processes in the line which the machine forms part of and which have become faster and faster; nor are they are prepared to tolerate the high extraordinary maintenance costs (due to frequent breakage of expensive abrasive belts) which inevitably lead to a higher production cost. Moreover, these problems become all the more serious when we consider the considerable cost of the machine itself, which is at the high end of the market.

[0027] A convenient solution to the above mentioned problems, on the other hand, would be provided by a sanding machine equipped with an orbiting sanding unit capable of using a traditional endless abrasive belt of the standard, economical type used in sanding units with continuous motion and positioned lengthways with respect to the direction of panel feed so as not to damage the edge of the belt in the manner typical of belts positioned transversally, and whose operating method was such that belt tension would be guaranteed at practically all times, irrespective of system disturbances.

[0028] This invention therefore has for an aim to overcome the above mentioned problems by introducing a special orbital sanding unit in the sanding machine; in particular by fitting the sanding machine with an orbiting

unit that uses a commercial endless belt that operates according to a method whereby the belt turns in such a way as to create a reservoir of operating portions that follow each other to work under the platen, guaranteeing that the belt is tensioned to such an extent that it can turn and at the same time remain firmly pressed against the active surface of the platen.

The invention, as characterised in the claims, accordingly provides a sanding machine, with a related operating method, equipped with at least one orbiting sanding unit used for sanding panels and adapted to perform sanding operations without creating the above mentioned problems, overcoming all the disadvantages due to unwanted machine shutdowns caused by the breakage of expensive abrasive belts, excessive size and non-modularity, being at once simple in its construction and versatile in its operation and at the same time maintaining the functional features of sanding machines known in prior art, and in fact improving on them.

[0029] The invention disclosed herein achieves the above mentioned aims through a sanding machine fitted with an orbiting sanding unit of the type stated above, normally mounted above the path followed by the panels in transit through the machine.

[0030] More specifically, the invention relates to a wide, endless belt sanding machine whose basic architecture is of substantially known type but which implements a novel abrasive belt tensioning and sanding method. In this machine, and according to this method, the panels are fed along the X-axis of a right-angled X Y Z coordinate system in a horizontal plane XY and are made to pass under an operating unit with an orbiting platen comprising:

- a roller and its supports, positioned lengthways along the Y-axis at the top of the operating unit to guide and tension the abrasive belt;
- means for rotationally driving the roller, comprising an electric drive motor and able to be switched from a first, active state in which they rotationally drive the roller and a second, inactive state in which the roller is stopped;

  the novelty of the invention lying in the fact that the endless belt is kept in the tensioned state during the orbital working movement by the action, in the Z-axis, of lifting means which raise the roller, and in the fact that the tension produced by the lifting means causes the back of the belt to be held against the active surface of the platen; turning the belt is also possible and is enabled during the step of changing the working part of the belt under the platen or inhibited during the step of sanding the panel, by turning or stopping the roller, respectively, the lateral surface of the roller being kinematically coupled with the back of the belt through the friction created by the tensioning action applied by the above mentioned lifting means.

[0031] Another novel feature is the introduction in the kinematic chain of at least one degree of freedom allowing movement along the Y-axis for the roller, whose supports comprise a beam positioned lengthways along the Y-axis and fitted with respective linear guides on which the roller can move in the Y-axis; the lifting means acting on the beam in such a way as to raise and lower the beam and the roller.

[0032] Further characteristic features pertaining to other specific embodiments lie in the fact that the means for lifting the main roller in the Z-axis are fluid-operated cylinders.

[0033] The advantages achieved by the machine according to the invention, derive, as already stated, mainly from the excellent functionality and reliability of the means for holding the belt - which is a commercially available, endless type belt - through the constant tensioning action applied by the lifting means and made possible by the inclusion of at least one degree of freedom to move the roller in the Y direction, distinguishing them from common prior art solutions based on vacuum holding means; and without forgetting the advantages of significantly reducing the costs of maintenance.

[0034] It will be easily appreciated that a machine made according to this invention can be used to optimum advantage to achieve greater savings compared to prior art machines, enabling it - amongst other things - not only to be used more intensively (thus improving investment profitability) but also to obtain a high commercial value for the products made thanks to lower production costs and higher quality results.

[0035] The invention will now be described in more detail with reference to the accompanying drawings, which illustrate a non-restricting preferred embodiment of it, referring to an orbital sanding unit 2 and to its operating method constituting the innovational aspects of the machine compared to prior art. In the drawings, some parts are cut away in order to better illustrate others.

[0036] In the drawings, with reference to a right-angled X Y Z coordinate system, where the X- and Y-axes define the horizontal plane in which the panels 1 are fed, and using sanding machine terminology usual in the trade:

- Figure 1 represents the main cross section of the operating unit 2; and shows, from the top down, the roller 14 and the related rotational drive means 6; the roller 14 is supported on the machine frame 17 by a kinematic chain constituting the means 15 for supporting the roller 14, which comprise the roller 14 means lifting 16 mounted at the bottom of the machine frame 17. Also shown are two pairs, an upper pair and a lower pair, of belt 3 guide rollers 18. Continuing downwards, the illustration shows the first orbiting element 19, driven by first eccentric shafts 20 which impart a slow, wide translational motion, and the platen 4, driven by second eccentric shafts 21, which impart a fast, narrow translational motion. All these parts are enclosed by the endless abrasive

belt 3 that is trained around the roller 14, the rollers 18 and the active surface 5 of the platen 4.

- Figure 2 is a front view of the unit 2; and shows all the parts listed for Figure 1, as well as an infeed zone 22 where the panels 1 move under the platen 4 in the direction of the X-axis normal to the plane of the drawing, and the motor units 23 which impart the orbiting movement through the eccentric shafts. The first motor unit 23, providing the orbiting motion of the first element 19, is positioned with its horizontal axis normal to the plane of the drawing; the second motor unit 23, providing the further orbiting motion of the platen 4 relative to the first element 19 is positioned with its axis vertical.
- Figure 3 is a front view of the roller 14 and of its supports 15, together substantially constituting a subassembly of the unit illustrated in Figure 2.
- Figure 4 is an enlarged axonometric view of the circled detail in Figure 3. It shows the roller 14 and the related rotational drive means 6, the former being mounted on the shoes 24 running on the linear guides 15g which are in turn mounted on the beam 15t, at the end of which there is shown a part of one of the two fluid-operated cylinders 16 fixed to the beam 15t through an interposed elastomeric anti-vibration support, which, in practice, constitutes a damping disc 25.

[0037] The sanding unit 2, which the sanding machine according to this invention is equipped with, is innovative - and at once extremely simple - thanks to the technical solution it embodies, especially as regards its operating method. This specification mainly describes the details that characterise the proposed solution whereas the prior art documents mentioned above are incorporated herein by reference insofar as concerns the parts of the machine that provide the orbiting motion, which are well within the knowledge of those familiar with the trade.

[0038] Therefore, in a preferred embodiment of the arrangement for holding the belt 3 by tensioning it, the sanding unit 2 comprises a standard double orbiting system where the platen 4, as is customary, constitutes the second orbiting element. In cross section it has the shape of an upturned U extending upwards towards the first orbiting element 19 and has a rectangular active surface 5 which, during work, comes into contact with the back of the belt 3 over the panel. The surface 5, like the platen 4, is positioned with its short sides extending in the X-axis direction of panel 1 feed, and with its long sides extending transversally in the Y-axis direction.

[0039] Between the two orbiting elements, there are elements 26, in the form of elongated cylinders, made of a resilient rubber material, ending in the cavity of the U and having the function of spacers and dampers. Above the U of the platen 4, on both sides, there are two pairs of idle rollers 18 for guiding the belt 3, the first pair being mounted on the part of the unit 2 that is attached to the machine frame 17. These parts, and practically the entire general structure of the unit 2, lie in a plane of symmetry YZ that passes through the centre line of the platen 4, as shown in the drawings.

[0040] In the preferred embodiment being described, the belt 3 is of the endless type. Following the path of the two branches of the belt 3 leading away from the lower pair of rollers 18, and proceeding towards the top of the unit 2, the two branches join - thus closing the belt 3 - at the top of a rubber-coated roller 14 mounted in the upper section of the unit 2.

[0041] The main roller 14 is rotationally driven by means 6 which enable the belt 3 to turn and which are comprised of an electric motor 7 and an associated reduction gear unit. They constitute the kinematic drive chain 8 that causes the roller 14 to turn.

[0042] The parts of the unit 2 described up to now form both the system for holding the belt 3 on the platen 4 and the system for turning the belt 3 in the unit 2, based on a single, power-driven roller 14 located at the top of the unit 2.

[0043] The roller 14 is in turn supported by suitable supporting means 15 that form a mechanism having one degree of freedom for movement in the Y-axis and at least one degree of freedom for movement in the Z-axis. More specifically, there is a beam 15t lying under and parallel to the roller 14 and mounting an arrangement of linear guides 15g on which the roller 14 itself runs, through interposed shoes 24 mounted at the two ends of it, allowing it to move in Y; two pneumatic cylinders 16 acting vertically between the machine frame 17 and the ends of the beam 15t being provided to lift the beam 15t in Z, thus lifting the roller 14 with it in such manner as to adjust the tension of the belt 3 itself.

[0044] The beam 15t has symmetrically associated with it the upper pair of idle rollers 18, which, like the lower pair, advantageously enable the belt 3 to extend around the roller 14 at a suitable angle.

[0045] A photocell 27 for detecting the presence/absence of the belt 3 is mounted on the beam 15t at the edge of the belt 3. This photocell generates an on/off signal used in a customary circuit for aligning the belt 3 on the roller 14 in the Y direction, applying different pressure levels to the pneumatic cylinders 16 in such a way that the latter produce slight adjustments to the angle of the roller 14 in the YZ plane.

[0046] Functionally, the sanding machine equipped with the operating unit 2 structured in this way, achieves the preset aims thanks not only to the mutual arrangement of the different elements, as illustrated, but also to an innovative operating method, without altering the remaining, basic existing structure of the sanding machine.

[0047] Below is a description of the machine operating cycle, which is divided into several steps. Starting from a condition in which the used part 10 of the belt 3 working under the active surface 5 of the platen 4 has lost its abrasiveness and must be changed, the drive motor 7 causes the roller 14 to turn and to turn the belt 3 with it in the unit 2, including the working part of the belt 3 under

the platen 4 and until that working part is different from the used part that has just finished working. This used part, as the belt 3 turns, reaches a blowing station 9 - of known type and therefore not described - located on the path of the belt 3 and designed to blow dust off it in order to regenerate it.

[0048] Once the belt 3 has been turned far enough to exchange the used part of it with a regenerated part, the roller 14 is stopped; this in turn causes the belt 3, which continues to be kept in the tensioned state by the pneumatic cylinders 16, to stop turning.

[0049] During the step of sanding the panels 1, the mechanism that imparts the double orbiting motion to the platen 4 through the action of the first and second power-driven eccentric shafts 20 and 21 is in operation.

[0050] The tensioning action exerted by the pneumatic cylinders 16 does not cease when the orbiting motion of the platen 4 starts. In order to prevent tension that might break the belt 3 when its orbiting motion is started, the roller 14 may follow the Y-axis components of the oscillatory movements of the platen 4, running on the linear guides 15g on the beam 15t under the pulling action of the belt 3 itself which is in turn following the oscillating motion of the platen.

[0051] The X-axis components of the oscillatory movements, on the other hand, are absorbed by the flexibility inherent in various parts of the system, including first of all, the layer of rubber that covers the roller and a certain degree of elasticity in the circumferential directions of the belt. For limiting the effect of high-amplitude, low-frequency forces inherent in the first orbital movement and applied by the belt 3 to the parts of the operating unit 2, dampers 25 are provided at the ends of the beam 15t, in the vicinity of the supports of the upper rollers 18, where the belt 3 is usually tauter.

[0052] There is therefore a major difference between the customary operating method of a prior art system for holding the belt 3 by suction and the method according to this invention which enables the operating unit 2 to alternate between steps of sanding the panels 1 and changing the working part 10 of the belt 3 while keeping the latter stretched tight at all times and overcoming the problems caused by stress on the belt 3 and by the transmission of vibrations to the machine parts, which made it extremely difficult to use the operating unit 2 based on its old configurations and operating methods.

[0053] When the belt 3 is completely worn and cannot be regenerated by blowing, or when production requires a different abrasive grit, the belt 3 must be substituted. For this purpose, the unit 2 comprises a spacer 28 that can be extracted by hand to enable the old belt 3 to be pulled out of the unit 2 and the new one inserted into the space created between the structures of the unit 2 and of the machine frame 17, in the vicinity of one end of the platen 4, when the spacer 28 is removed.

[0054] Lastly, the system for aligning the belt 3 on the roller 14 is described briefly, although it is of known type. Indeed, it is obvious that an endless belt 3 turning around a sanding unit 2 is not stable and that the belt 3 tends to slide out of the unit 2 in one of the two Y-axis directions of the roller 14.

[0055] Thus, according to this invention, too, the photocell 27 positioned at the edge of the belt 3, detects the presence of the belt 3 itself and its absence when it moves out of position in the axial direction. The on/off output signal of the photocell 27 varies the pressure in the two lift cylinders 16 at the respective ends of the roller 14, so that the end of the roller 14 towards which the belt 3 is moving is lifted a little more than the other end in a succession of small oscillating movements about the centre of the belt 3 on the roller 14 which, as is known, cannot be kept fixed on account of disturbances within the system.

[0056] The invention as described above and illustrated in the drawings may be modified and adapted in several ways without thereby departing from the scope of the inventive concept as defined in the claims below. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A method of tensioning and operating an endless abrasive belt (3) in a wide belt sanding machine, whose structure is of a substantially known type, for wooden panels advancing along the X-axis of a right-angled X Y Z coordinate system in a horizontal plane XY under an operating unit (2) with an orbiting platen (4), the operating unit (2) comprising:

   - a roller (14) and its supports (15), positioned lengthways along the Y-axis at the top of the operating unit (2) to guide and tension the belt (3);
   - means (6) for rotationally driving the roller (14), comprising an electric drive motor and able to be switched from a first, active state in which they rotationally drive the roller (14) and a second, inactive state in which the roller (14) is stopped; said tensioning and operating method being

   characterised in that

   - the endless belt (3) is kept in the tensioned state during the orbital working movement by the action, in the Z-axis, of lifting means (16) which raise the roller (14);
   - the tension produced by the lifting means (16) causes the endless belt (3) to be held against the active surface (5) of the platen (4);
   - turning the endless belt (3) with respect to the operating unit (2) is enabled or inhibited by turning or stopping the roller (14), respectively; the turning motion being enabled during the step of changing the working part (10) of the belt (3) under the active surface (5) with a different part

of it, and being inhibited during the step of sanding the panel, when the working part (10) of the belt (3) is held still with respect to the active surface (5);
- the kinematic coupling between the lateral surface of the roller (14) and the back of the belt (3) to enable or inhibit belt turning is accomplished by the friction created by the tensioning action applied to the belt (3) by the roller (14) when the latter is raised by the lifting means (16).

2. A wide belt sanding machine for implementing the method according to claim 1, equipped with an endless abrasive belt (3) for sanding panels advancing along an X-axis of a right-angled X Y Z coordinate system in a horizontal plane XY under an operating unit (2) with an orbiting platen (4), the operating unit (2) comprising:

- a roller (14) and its supports (15) relative to the machine, positioned lengthways along the Y-axis at the top of the operating unit (2) to guide and tension the belt (3); the supports (15) comprising lifting means (16) acting in the Z-axis to raise the roller (14) and tension the endless belt (3) in the unit (2) between the active surface (5) of the platen (4) and the lateral surface of the roller (14);
- means (6) for rotationally driving the roller (14), comprising an electric drive motor and able to be switched from a first, active state in which they rotationally drive the roller (14) and a second, inactive state in which the roller (14) is stopped; the machine being **characterised in that** the supports (15) form a kinematic chain that allows the roller (14) at least one degree of freedom to move in the Y-axis.

3. The machine according to claim 2, **characterised in that**:

- the supports (15) comprise a beam (15t) positioned lengthways along the axis Y and fitted with respective longitudinal linear guides (15g) on which the roller (14) can move in the axis Y;
- the lifting means (16) act on the beam (15t) in such a way as to raise and lower the beam (15t) and the roller (14).

4. The machine according to claim 2 or 3, **characterised in that** the lifting means (16) are fluid-operated cylinders (16).

5. The machine according to claim 4 **characterised in that** the fluid-operated cylinders (16) are supplied in coordinated fashion so as to move the beam (15t) along the axis Z and to tension the belt (3); or to incline the beam by predetermined angles in such manner that the belt (3) oscillates sideways around a stable position of equilibrium.

6. The machine according to claim 5 **characterised in that** the fluid-operated cylinders (16) that incline the axis of the roller (14) by predetermined angles are activated by a photocell (27) positioned in the vicinity of the edge of the belt (3) and designed to detect the latter's presence or absence.

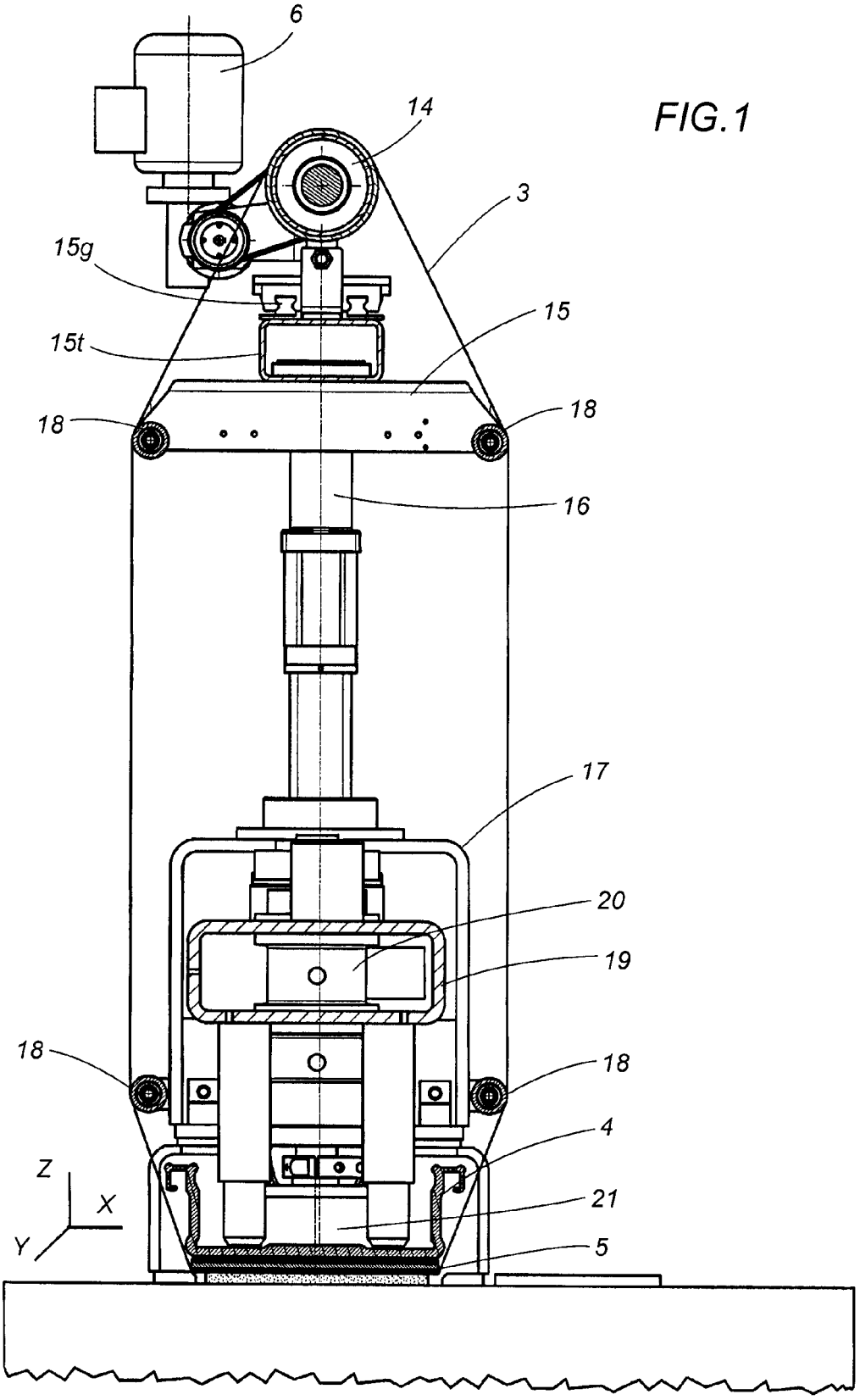


FIG.1

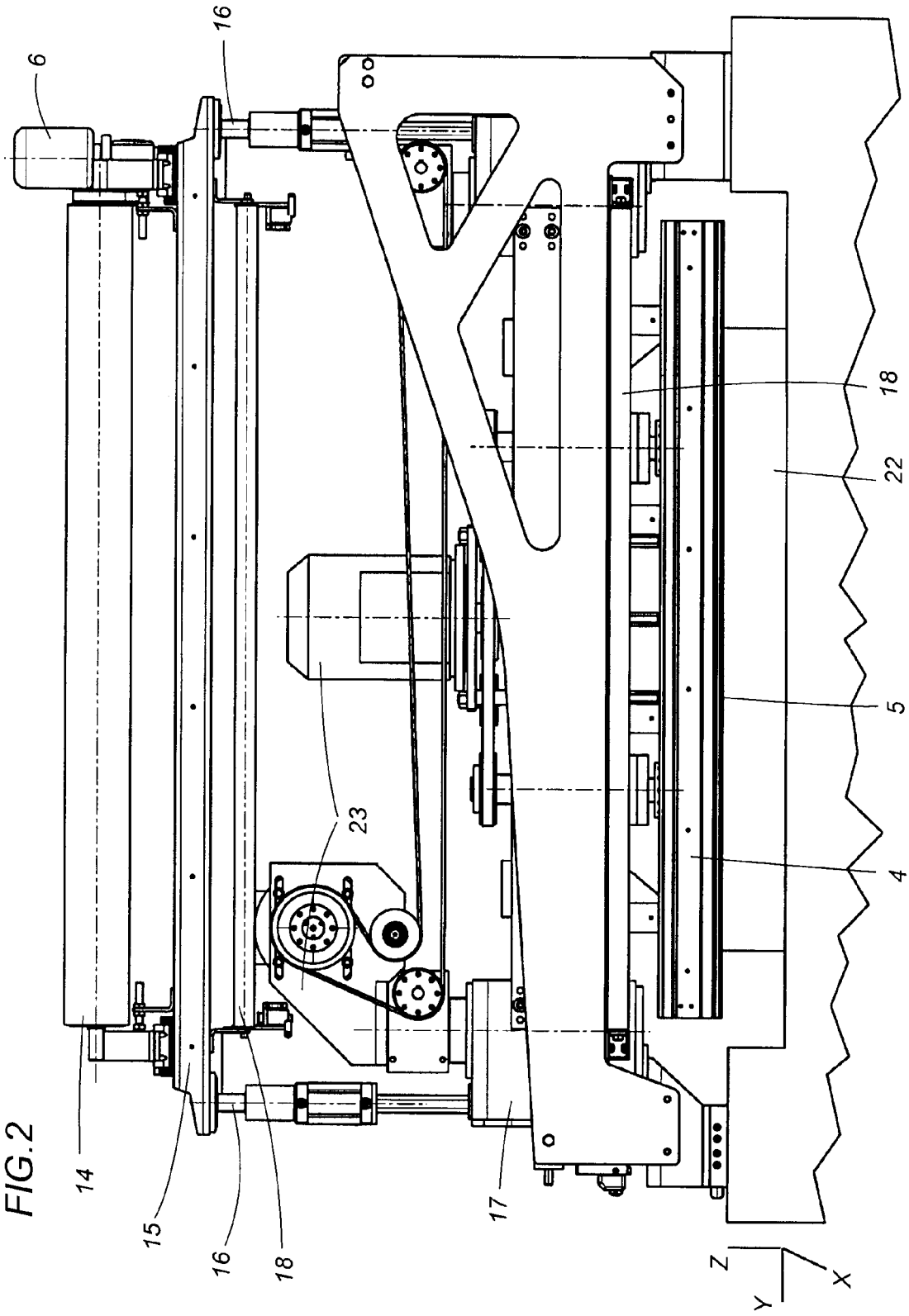


FIG.2

FIG.3

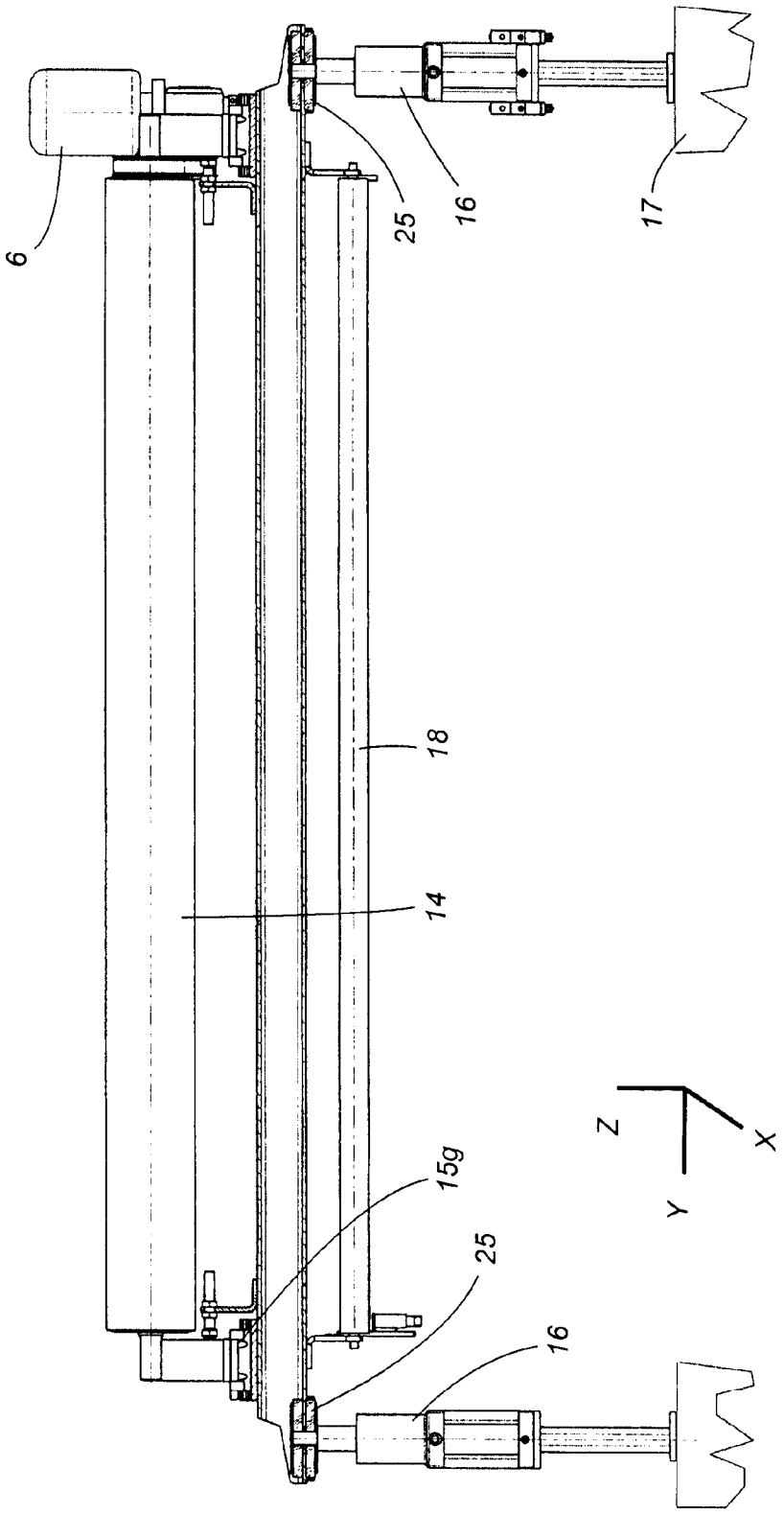
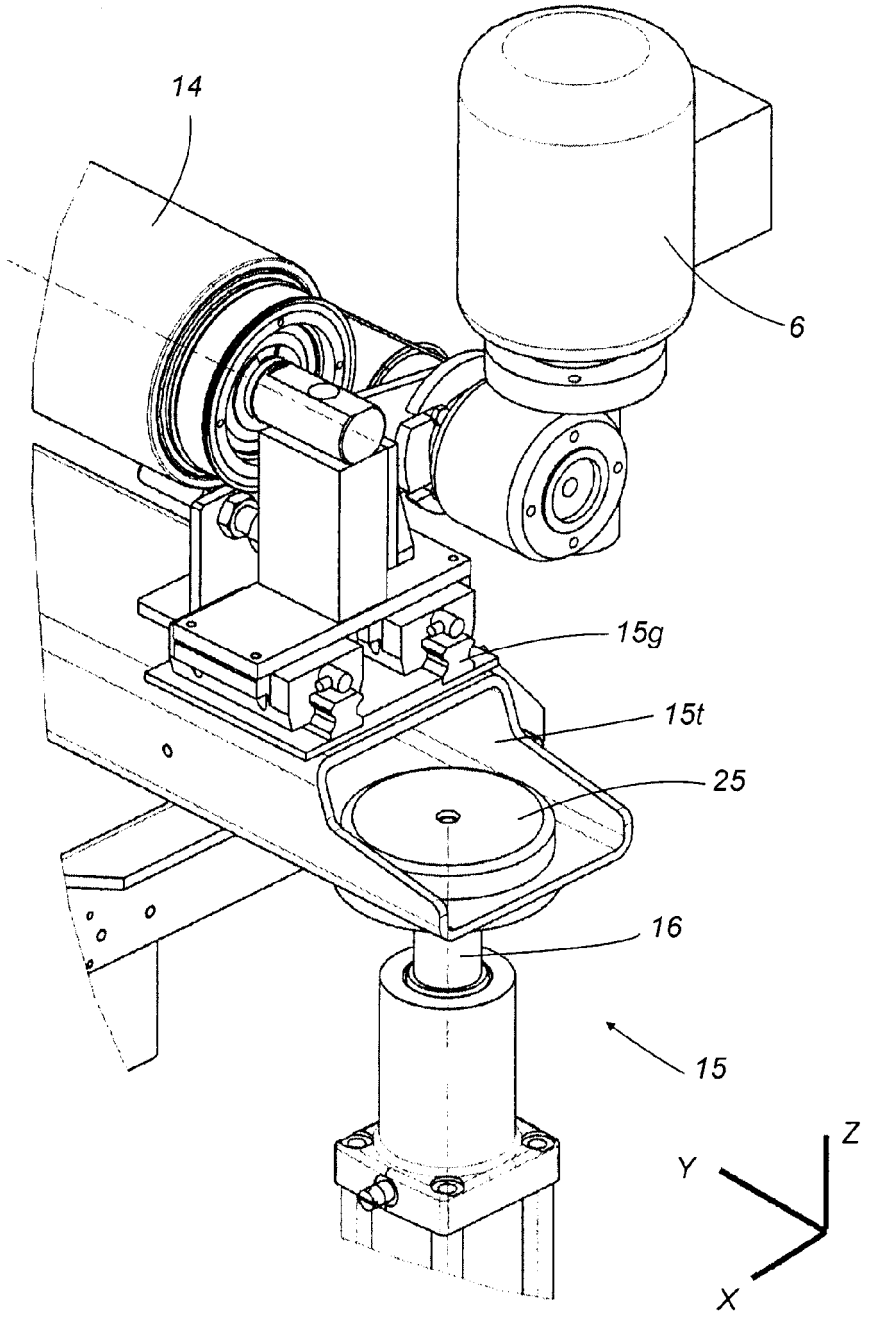


FIG.4



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 11 1798

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	EP 1 053 827 A (COSTA LEVIGATRICI SPA) 22 November 2000 (2000-11-22)	1	B24B21/06 B24B21/22
X	* abstract; figures 1-3 *	2-5	B24B7/06
Y	* paragraph [0016] *	6	B24B7/28 B24B47/22
A	US 4 369 601 A (GERBER ET AL) 25 January 1983 (1983-01-25)	5	B24B21/18 B24B21/20
Y	* abstract *	6	
A	US 4 742 650 A (SAUDER, JR. ET AL) 10 May 1988 (1988-05-10) * column 7, lines 12-28; figure 5 *	1	
A	US 5 179 805 A (NUMAO ET AL) 19 January 1993 (1993-01-19) * claims 1,4; figures 3,4 *	1	
A	US 5 184 424 A (MILLER ET AL) 9 February 1993 (1993-02-09) * abstract *	5,6	

TECHNICAL FIELDS SEARCHED (IPC)

B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 April 2006	Zeckau, A

CATEGORY OF CITED DOCUMENTS

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

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

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claim: 1

Method of tensioning and operating an endless abrasive belt comprising enabling a turning movement of the belt for changing the working part of the belt under the active surface of a platen and comprising inhibiting the turning movement of the belt during the step of sanding the panel, whereby enabling / inhibiting the turning movement of the belt is accomplished by raising / lowering a drive roller and thereby controlling the friction between the drive roller and the belt.

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2. claims: 2-6

Wide belt sanding machine comprising a drive roller mounted on supports comprising lifting means for raising the roller and tensioning the belt, whereby the supports form a kinematic chain that allows the roller at least one degree of freedom to move in a direction parallel to the roller axis.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 11 1798

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.

04-04-2006

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