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(54) Cutting machine

(57) The cutting machine (10) comprises a support structure (11) provided with a working table (100), a saw carriage (CRR) comprising at least one circular blade (SC), which is suited to slide along a cutting slot (FT) obtained on the working table (100), and at least one pusher device (14) for the positioning of the material to be cut (P, P1), which is provided with at least one gripper (PZn), whose bottom finger (APn) is suited to slide inside proper grooves (SCN) provided on the working table (100).

The cutting machine (10) comprises, furthermore, a closing device (200) to close the cutting slot (FT), which comprises a flexible closing element (201) to close the cutting slot (FT), which has a linear extension and is constrained to the saw carriage (CRR).

The upper surface (201A) of a first end side (LP) of the flexible closing element (201) is arranged nearly at the same level as the upper surface (SS) of the working table (100), whereas a second end side (LA), which is opposite to the first end side (LP), slides under the upper surface (SS) of the working table (100), so as to permit the passage of the bottom fingers (APn) or of other apparatuses through the cutting slot (FT) and above the second end side (LA), when the saw carriage (CRR) is in at least one given position along its stroke.

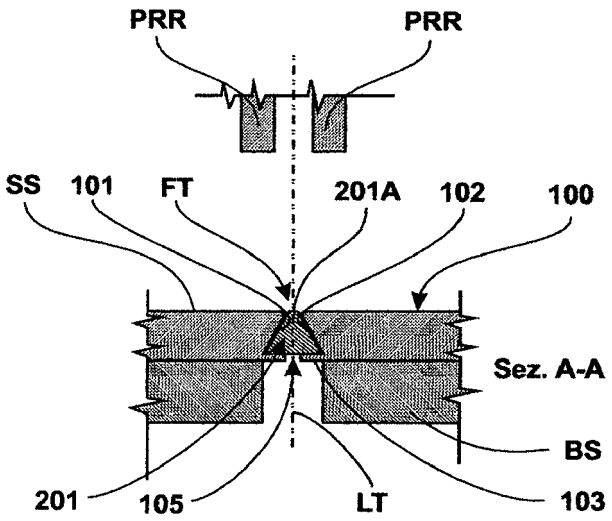


Fig. 5

EP 2 896 491 A1

Description

[0001] The present invention relates to a cutting machine.

[0002] Cutting machines according to the present invention, for example panel cutting machines, comprise a saw carriage, which is mobile along a base, which is designed to guide and support the panels to be cut. In the upper part of the machine a solid pressing unit is provided, which, during cutting operations, firmly locks the panels so as to prevent them from being moved during the sizing operation. This strong pressing action is essential for the achievement of a good cutting quality and of a good precision in the sizes of the panels cut. The correct and precise sizing of the panels in submultiples requires a trimming operation to be carried out along the entire perimeter of the panels themselves, since the four sides arranged on the outside are usually rough and with a level of finishing that is not acceptable.

[0003] The blade assembly, besides carrying out a horizontal sliding movement caused by said saw carriage, is also moved in a vertical direction, so as to allow the two blades, usually a cutting blade or circular blade and a scoring blade, to project from the working table only during the cutting operation, when the panels are locked by the upper pressing system.

[0004] When the saw carriage returns to the initial position, in order to repeat the cutting cycle, the blade unit is lowered under the working table so as to allow a simultaneous repositioning of the panels, which, in automatic machines, takes place by means of (automated and known) pushing elements, which are provided with grippers holding the panels themselves.

[0005] These grippers are provided, in particular, with bottom fingers, which are designed to slide on the inside of suitable grooves obtained on the working table. These bottom fingers, given their length for an optimal grip on the panels, must necessarily be enabled to extend beyond the cutting slot during the positioning of the panels for the last trimming or rear trim cut, so as not to limit the size of the trimming itself, which, must basically be as small as possible for a better future use of the panels.

[0006] Cutting machines can have usable cutting lengths up to 6 - 7 meters, since they are designed to cut panels made of wood, aluminium, plastic, etc., which have such lengths. On the same machine the panels can be cut in single strips, which then will have to be cut crosswise.

[0007] Therefore, as skilled people know, during longitudinal and transverse cutting operations, usually during trimming operations carried out on the four sides arranged on the outside, swarf can be produced, which, if small-sized, can fall through the cutting slot, which usually is some millimetres large, thus reaching the inside of the cutting machine, which can cause serious faults due to damages caused to the different inner organs of the machine itself.

[0008] Patent EP 1716955 B1, in order to solve this problem, discloses a closing system to close the cutting slot, which is longitudinal to the cutting direction and uses a strip that is windable and slides on the inside of a guide obtained on the inner walls of the cutting slot. This necessarily causes the upper surface of the closing strip to be arranged at a lower level compared to the working table, where the panels are supported and slide, thus creating a channel whose depth is determined by the thickness of the table portions arranged above the guide segments provided for the closing strip.

[0009] These table portions must necessarily be very thick in order to prevent the table from crushing or bending during the panel locking operation carried out by the upper pressing unit, which would jeopardize the cutting quality and prevent the closing strip from properly sliding. Furthermore, in order not to interfere with the bottom fingers of the grippers of automatic machines, this strip must necessarily be arranged at a lower level compared to the thickness of the bottom fingers of the grippers themselves. In this way a channel is formed, which can collect small-sized swarf or small-sized trimming residues, which, only in manual machines, can be manually removed by the operator before moving the panels.

[0010] Obviously, this step of manually removing the swarf from the cutting channel cannot be performed in automatic machines and, therefore, this system cannot be used in these machines, since the small-sized swarf collected on the inside of the channel can cause problems or faults both during the sliding movement of the closing strip and during the movement of the panels, which would tend to slide above the trimming residues piled up on the inside of the channel. By the way, the fact that the problem discussed above actually exists is also confirmed by the proprietor of the patent, who explicitly mentions possible systems to remove small-sized trimming residues from the strip by means of air jets and/or brushes, which, in any case, are both not suited to fulfil the task.

[0011] Utility model DE 20009611 U1 describes a system to close a cutting slot, said system consisting of a rigid or semi-rigid plate, whose cross-section has the shape of an upside-down T, so as to have a base, which can freely slide on the inside of relative horizontal guides obtained on the inner walls of the cutting slot, and a central vertical portion, which completely closes the cutting slot up to the level of the working table. In this way the central portion of the closing plate, by being arranged at the same level as the plane, causes small-sized swarf or trimming residues to slide on the plane without getting trapped.

[0012] This solution is exclusively suited for extremely short cutting machines, as the rigid or semi-rigid closing plate could hardly be handled in cutting machines with usable cutting lengths up to 6 - 7 meters; as a matter of fact, when the saw carriage is in the rest or initial position, the rigid or semi-rigid plate would necessarily project outwards from the cutting machine, with all the undoubted drawbacks and dangers resulting therefrom.

[0013] Therefore, the object of the present invention is

to provide a cutting machine provided with a cutting slot closing device having features that allow it to be arranged at the same level as the panel supporting and sliding plane, so as to allow trimming residues to be easily removed, so as to be able to move within the normal sizes of cutting machines and so as to be able to be mounted on automatic or semi-automatic machine provided with panel grippers or similar apparatuses.

[0014] Hence, the present invention provides a cutting machine according to the independent claim or to any of the claims that directly or indirectly depend on said independent claim.

[0015] The present invention will be best understood upon perusal of the following detailed description of a preferred embodiment, which is provided by way of example and is not limiting, with reference to the accompanying drawings, in which:

- figure 1 shows, in a plan view, a cutting machine provided with the flexible cutting slot closing element, with two possible panel cutting patterns pointed out;
- figure 2 shows a front view of the cutting machine of figure 1, which highlights the saw carriage in some positions of its during the working cycle and the cutting slot closing element;
- figure 3 shows a schematic transverse view of the saw carriage and of the flexible cutting slot closing element;
- figure 4 schematically shows a cross section of the working table, which highlights the passage of the bottom fingers of the grippers in the grooves in correspondence to the cutting slot when the saw carriage is in the position taken on at the beginning of the cutting procedure;
- figure 5 shows cross-section A-A of figure 3 concerning the area of the cutting slot with the cross-section of the closing element.

[0016] In figures 1 and 2, number 10 indicates, as a whole, a cutting machine according to the present invention.

[0017] The cutting machine 10 comprises a support structure 11, a working table 100, and a saw carriage (CRR), the latter being provided, as usual, with an incisor (INC), not essential, and with a circular blade (SC) (figures 1, 3, 4). Said blades (INC, SC) project from an upper surface (SS) (figures 1, 2, 3) of the working table 100 only during the cutting operation, which takes place, according to a direction represented by arrow F1 (figure2), when the panel, the panel stack or, anyway, the material to be cut is pressed by a pressing unit (PRR) (figures 1, 2, 5), generally acting on both sides of a cutting line (LT), against the upper surface (SS) of the working table 100.

[0018] Said pressing unit (PRR) basically performs its active pressing action, aimed at locking the material to be cut, along the entire length of the working table 100.

[0019] When the saw carriage (CRR) returns to the initial position, according to a direction represented by arrow F2 (figure 2), in order to repeat the cutting cycle, said blades (INC, SC) are lowered below the upper surface (SS) by means of known means, which are not shown.

[0020] The support structure 11 comprises tow lateral supports 12, 13, on which the wheels (WL) (only one of them is shown in figure 2) of a transverse pusher carriage 14 rest, said transverse pusher carriage 14 being designed to position the panels (P, P1) to be cut and being provided with a plurality of grippers (PZ1), (PZ2), (PZ3),...(PZn) distributed along the pusher carriage (14) itself.

[0021] Furthermore, each gripper (PZ1), (PZ2), (PZ3),... (PZn) is respectively equipped with two bottom fingers (AP1), (AP2), (APn) (figures 1, 2, 4).

[0022] The transverse pusher carriage 14, which rests on the wheels (WL), is provided with known driving means, which allow the entire transverse pusher carriage 14 to be moved according to the two directions indicated by a doubleheaded arrow (DR). This causes the panels (P, P1) to slide on the upper surface (SS) of the working table 100 from and to a transverse cutting line (LT) (figures 1, 5), which is associated with a cutting slot (FT) (figure 5), which, during the active cutting step, is run through by the incisor (INC) and by the circular blade (SC).

[0023] The cutting machine 10 is also provided with projecting tables (TV) and with a lateral square (SQ) (figure 1).

[0024] The working table 100, as already mentioned above, is provided with a series of grooves (SCN), which permit the passage of respective grippers (PZ1), (PZ2), (PZ3),...(PZn) (see figures 1, 2, 4).

[0025] In a known manner and with reference to figures 1, 2, 4, the working table 100 comprises, as already mentioned above, the upper surface (SS) to support the panels (P, P1). Said upper surface (SS) is transversely engaged by the cutting slot (FT), which is some millimetres large and features, defined at the centre thereof, the theoretical cutting line (LT), which corresponds to the middle line of the circular blade (SC).

[0026] Generally speaking, current cutting machines have a working table 100 consisting of an iron base (BS) (figure 5), which is an integral part of the guide base of the saw carrier. On this iron base there is generally fixed the actual working table 100, on which the panels (P, P1) slide and which is generally made of an anti-scratch material, given the delicate nature of the panels (P, P1) to be cut.

[0027] The panels (P, P1), which are manually loaded by operators on the side of the front tables (TV) or are loaded in an automatic manner with known means in automated machines, are firmly locked by the grippers (PZ1), (PZ2), (PZ3),...(PZn) of the pusher device 14. The panels, after having been locked in this way, are fed to the cutting line (LT) to produce the first or front trim cut, which is pushed during the following panel feeding steps, until it reaches an area that is arranged on the outside

of a body or base (CBM) (figure 1) of the cutting machine, where it can be manually or automatically removed. The cutting cycle goes on with further feeding and cutting procedures, until the panels (P, P1) are positioned for the last trimming or rear trim cut. This trim cut, in automatic machines, is subsequently removed from the working table due to the thrust exerted by the new panels undergoing the following cutting cycle or by means of specific apparatuses. During this step, the trim cuts must necessarily move past the cutting slot (FT) in order to reach the area arranged on the outside of the machine body (CBM), where they can be removed.

[0028] Trimming residues, when they are smaller than the width of the cutting slot (FT) and, anyway, when the thickness of the panels (P) is smaller than the width of the cutting slot itself, naturally tend, given their flexible nature, to completely or - even worse - partially fall through the cutting slot. As a matter of fact, in the latter case, the panels (P, P1) pushed by the pusher device 14 during the following feeding procedure naturally tend to slide on top of the trimming residues that partially fell into the cutting slot (FT) and now partially lie on the working table, thus forcing operators to stop the cutting cycle in order to manually remove the trimming residues, reposition the panels and then restart the cycle that has been interrupted. Obviously, these steps are extremely difficult to be carried out when dealing with large panels or panel stacks that are cut in automatic or semi-automatic machines that can be hardly accessed to reach the inside.

[0029] The length of the bottom fingers (AP1), (AP2), (APn) of the grippers (PZ1), (PZ2), (PZ3),...(PZn), for an optimal grip on the panels (P), must definitely be greater than the width of the last or rear trimmed edge. Because of this, the fingers (AP1), (AP2), (APn) must necessarily extend beyond the cutting slot (FT) so as to be able to position the panels without any limitation of the width of the trim cuts. After the panels have been positioned for the last trim cut, the pressing unit (PRR), which usually has suitable recesses to avoid the grippers, is lowered and, as soon as the panels are locked, the grippers (PZn) are opened and moved backwards so as to allow the cutting procedure to be carried out.

[0030] Other generic apparatuses can be mounted on the machine 10, for example those needed to remove the last rear trim cut, which need to move above the cutting line (LT) and, anyway, under the upper surface (SS) of the working table 100.

[0031] In order to prevent trimming residues from totally or partially falling into the cutting slot (FT), the cutting machine 10 is provided with a closing device 200 (figures 2, 3) to close the cutting clot (FT), whose structure and functions will be better explained below.

[0032] The closing device 200 comprises, in particular, a flexible closing element 201 (figures 2, 4), which is designed to slide immediately under the cutting slot (FT) in a phase relationship with the saw carriage (CRR) during the movement thereof.

[0033] The upper surface 201A (figures 3, 5) of the flexible closing element 201 is arranged nearly at the same level as the upper surface (SS) of the working table 100, so as to make it easier for trimming residues to slide while they are being removed on the cutting slot (FT).

[0034] The flexible closing element 201 is totally comprised within the body of the machine 10 and is constrained at its ends to opposite sides of the saw carriage (CRR). In order to guide the aforesaid closing element 201, the closing device 200 comprises, furthermore, restraining means 210 (figure 2), which consist of a plurality of pulleys arranged close to the corners of the lower part of the machine 10 or, anyway, in positions in which there is no need to cause a change of direction of the aforesaid flexible closing element 201.

[0035] In this context, for an optimal mechanical resistance to the bending of the working table 100 during the panel stack locking action performed by the upper pressing unit (PRR), its part facing the cutting slot (FT) is shaped with two inclined profiles 101, 102 (figure 5), which act as guide of the flexible closing element 201. The latter is supported, on the lower side, by a suitable shaping of the working table 100. The aforesaid inclined profiles 101, 102 and shaping 103 define, underneath the working table 100, a guide and support groove 105 for the flexible closing element 201, inside which said element can freely slide.

[0036] The guide system 105 described above and, in particular, the support elements 103 ensure, along the entire cutting slot (FT), an optimal support of the flexible closing element 201, which otherwise would tend to bend towards the inside of the cutting machine 10 both due to its weight and due to the weight of the trimming residues that said flexible element 201 has to support.

[0037] The flexible closing element 201, in a first embodiment thereof, can advantageously consist of a normal and very cheap trapezoidal belt (figure 5), which is used to transmit the motion of pulleys and, therefore, is suited to be flexible and slide on the inside of two inclined recesses.

[0038] According to the present invention, the flexible closing element 201 comprises (figures 2, 3, 4) a first end side (LP) and a second end side (LA), which are both constrained to opposite sides of the saw carriage (CRR). In particular, the first end side (LP) is constrained to the rear side of the saw carriage (CRR), so that its upper surface (201A) (figure 5) is nearly at the same level as the upper surface of the working table 100.

[0039] The second end side (LA) of the flexible closing device 201, which is opposite to the first end side (LP), is constrained to the front side of the saw carriage (CRR) in a lower position relative to the first end side and is guided by the restraining means 210 under the upper surface (SS) of the working table 100. In this way, when the saw carriage (CRR) is in its initial position (PIT) and is about to start cutting (figures 2, 4), the upper surface (201A) of the second end side (LA) is spaced apart from the upper surface (SS) of the working table 100 so as to permit the passage of the bottom fingers (APn) of the

grippers (PZn) or of other apparatuses through the cutting slot (FT) and above the second end side (LA).

[0040] In other words, the upper surface (201A) of the second end side (LA) is arranged at a lower level than the lower surface (APnL) (figure 4) of the fingers (APn) of the grippers (PZn).

[0041] In an embodiment that is not shown in the figures, the feature described above can also be obtained by properly shaping the second end side (LA). As a matter of fact, the cross-section of the second end side (LA) can be decreased in height relative to the one of the first end side to an extent that is such as to allow anyway the passage of the bottom fingers of the grippers; guiding and supporting of said front end side (LA), on the lower side, can take place by means of the same suitable shaping 103 of the working table 100 provided for the rear end side (LP). In the latter case, obviously, the restraining means (210) at the end of the cutting machine could be arranged at the same level.

[0042] In this way the cutting slot is always completely closed, even though at different levels, thus increasing the degree of safety of the cutting machine.

[0043] The main advantages of the cutting machine described above are the following:

- With the closing element arranged almost at the same level as or aligned with the table on which the panels slide and are supported, trimming residues can be easily removed without causing them to fall into the cutting machine 10 or get trapped between the cutting slot and the panels pushed by the pusher device 14;
- The movement of the flexible element is carried out through the movement of the saw carriage, thus being very cheap to be performed;
- The flexibility of the closing element 201 used to close the cutting slot (FT) allows it to be completely housed on the inside of the cutting machine 10;
- The particular shaping of the guides on the inner walls of the cutting slot (FT) permits an effective support of the flexible closing element 201, which can slide under the cutting slot itself without having to undergo any bending both due to its own weight and due to the trimming residues to be supported; furthermore, it ensures a remarkable mechanical resistance to bending on that part of the working table 100;
- The closing element 201 can consist of a normal trapezoidal belt, which is commonly available in stores and, therefore, is very cheap;
- The particular shape of the closing element 201 and of its fixing to the saw carriage (CRR) allows it to be used on cutting machines 10 provided with grippers (PZn) for the panels (P, P1) that are suited to extend beyond the cutting slot (FT), so as not to limit the size of the last trim cuts.

Claims

1. A cutting machine (10) comprising:

- a support structure (11) provided with a working table (100) having an upper surface (SS);
- a saw carriage (CRR) comprising at least one circular blade (SC), which is suited to slide, during the cutting operation, along a cutting slot (FT) obtained on said working table (100);
- at least one pressing unit (PRR) acting upon the material (P, P1) to be cut on at least one side of said cutting slot (FT); and the cutting machine comprising at least one closing device (200) to close the cutting slot (FT), so as to prevent swarf from falling through;
- at least one pusher device (14) for the positioning of the material to be cut, which is provided with at least one gripper (PZn), whose bottom finger (APn) is suited to slide inside a proper groove (SCN) provided on the working table (100);

the cutting machine (10) being **characterised in that** said closing device (200) comprises: a guide and support groove (105), which is provided along the cutting slot (FT), immediately under the latter; a flexible closing element (201) to close the cutting slot (FT), which has a linear extension, mobile with a phase relationship relative to the movement of the saw carriage (CRR) and suited to slide under the working table (100); restraining means (210) to restrain said flexible closing element (201) being provided under the working table (100) to completely keep said flexible closing element (201) within the inner body of the cutting machine (10); said flexible closing element (201) comprising a first end side (LP), which is constrained to the rear side of said saw carriage (CRR) and is suited to slide along said guide and support groove (105), the upper surface (201 A) of said first end side (LP) being arranged nearly at the same level as the upper surface (SS) of the working table (100); said flexible closing element (201) to close the cutting slot (FT) comprising, furthermore, a second end side (LA), which is opposite to said first end side (LP), constrained to the front side of said saw carriage (CRR) and guided by said restraining means (210) under the upper surface (SS) of the working table (100), so that, when said saw carriage (CRR) is in at least one given position along its stroke, the upper surface (201 B) of said second end side (LA) is in a lower position relative to the upper surface (SS) of the working table (100) and to the lower end (APnL) of the bottom finger (APn) of the at least one gripper (PZn), so as to permit the passage of said bottom fingers (APn) or of other apparatuses through the cutting slot (FT) and above said second end side (LA) of said flexible closing

element (201).

2. A cutting machine according to claim 1, **characterised in that** said restraining means (210) comprises a plurality of pulleys, which are mounted in correspondence to the direction changes of said flexible closing element (201).

3. A cutting machine according to claim 1, **characterised in that** the rear end side (LP) of the flexible closing element (201) is supported, along the cutting slot (FT), by proper support profiles (103) belonging to said guide and support groove (105), so as to prevent the closing element (201) itself from bending, thus ensuring that its upper surface (201A) is kept nearly at the same level as the upper surface (SS) of the working table (100) along the entire cutting slot (FT).

4. A cutting machine according to claim 1, **characterised in that** said flexible closing element (201) to close the cutting slot (FT) has a substantially trapezoidal section with the upper surface (201A) of its shorter base being the one arranged nearly at the same level as the upper surface (SS) of the working table (100).

5. A cutting machine according to claim 4, **characterised in that** said cutting slot (FT) has a shape that is substantially complementary to the one of said flexible closing element (201).

6. A cutting machine according to claim 1, **characterised in that** the second end side (LA) of said flexible closing element (201) used to close the cutting slot (FT), which is opposite to the first end side (LP), is constrained to the front side of the saw carriage (CRR) in a lowered position relative to said first end side.

7. A cutting machine according to claim 1, **characterised in that** the second end side (LA) of said flexible closing element (201) used to close the cutting slot (FT), which is opposite to the first end side (LP), is constrained to the front side of the saw carriage (CRR) in a substantially coplanar position relative to said first end side, and **in that** the cross-section of said second end side (LA) is lowered relative to the one of the said first end side to an extent that is such as to allow the passage of the aforesaid bottom fingers (Apn) of the grippers (PZn) or of other apparatuses.

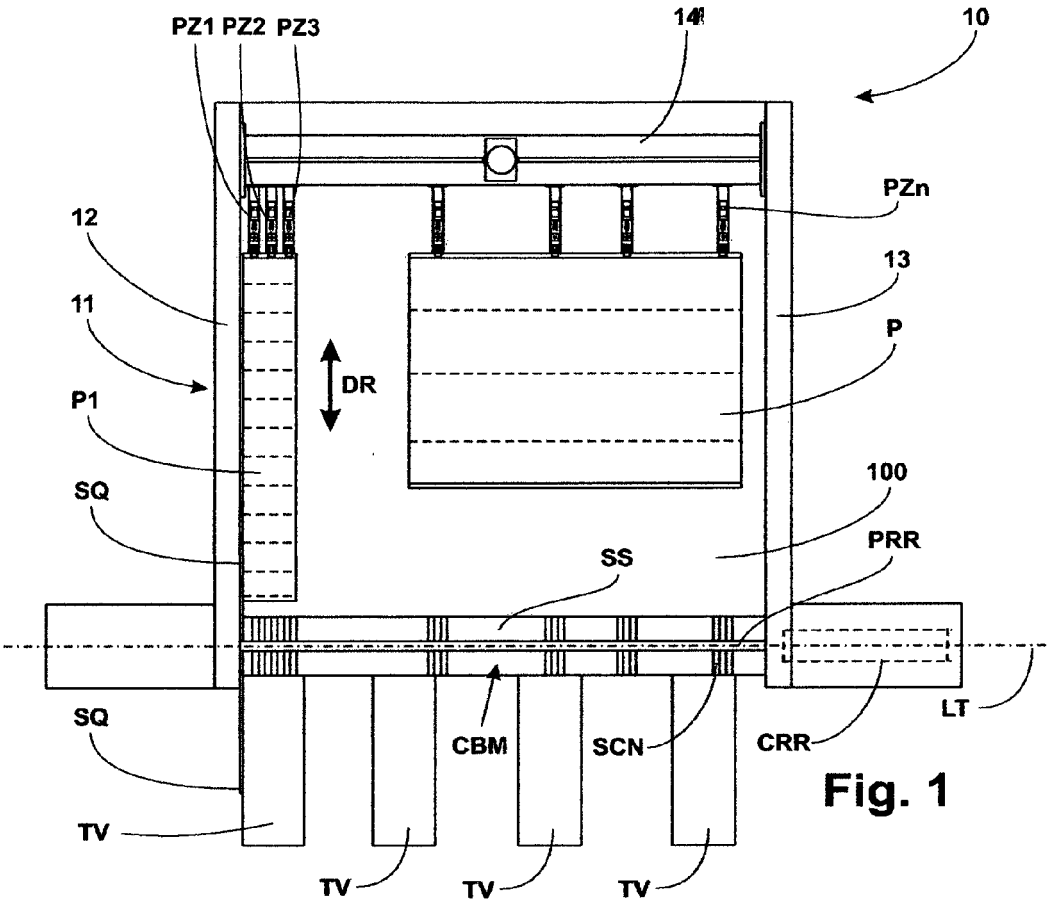
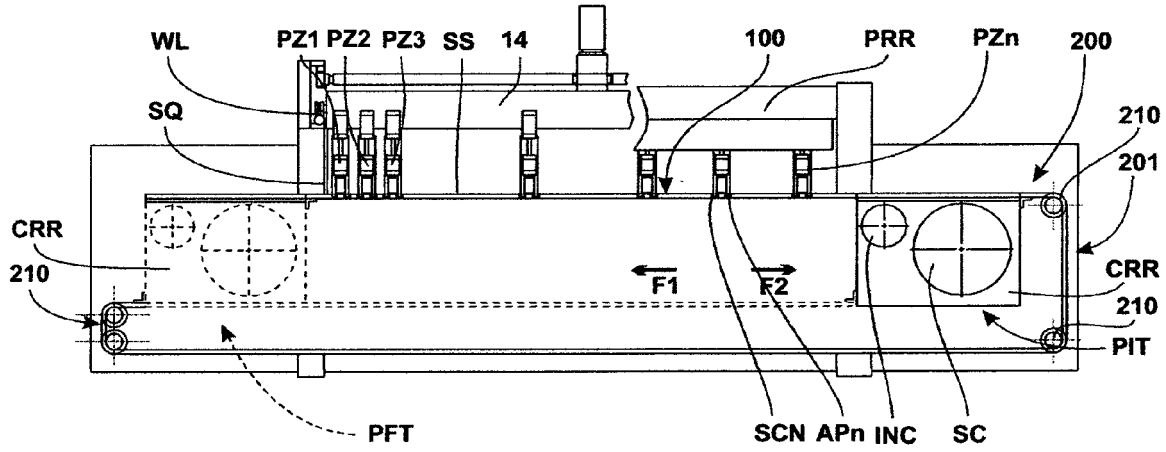

PZ1 PZ2 PZ3
14
10
PZn
12
13
11
P
DR
P1
SQ
100
PRR
SS
SQ
CBM
SCN
CRR
LT
TV
TV
TV
TV

Fig. 1


WL
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SS
14
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PRR
PZn
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SCN
APn
INC
SC

Fig. 2

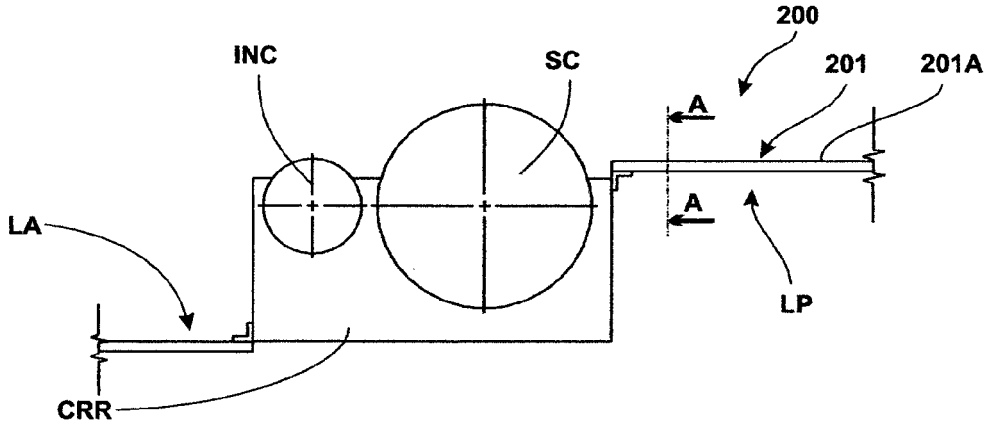

Fig. 3

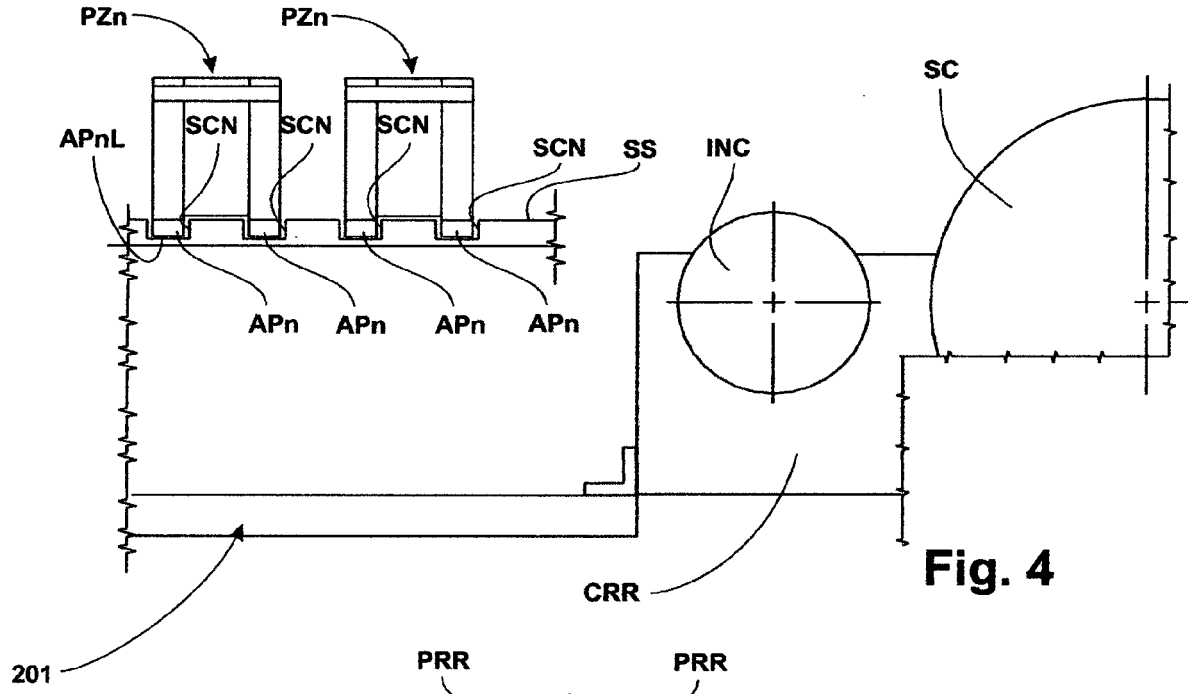

Fig. 4

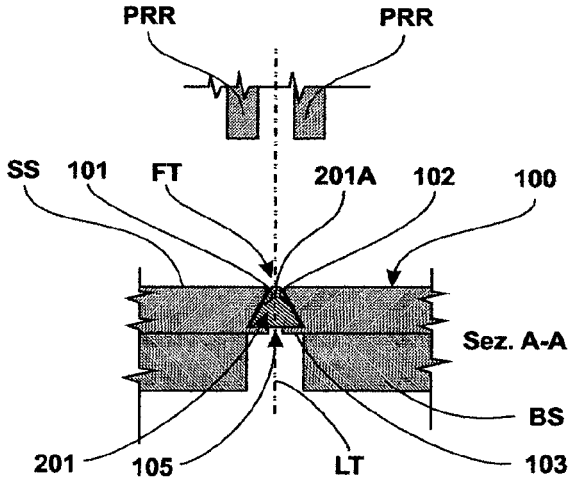

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 15 00 0100

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	EP 2 620 246 A1 (NALDI VALTER [IT]) 31 July 2013 (2013-07-31) * paragraphs [0030], [0035]; figures 1-6 *	1-7	INV. B27B5/065 B27B5/18
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A	EP 1 905 525 A1 (GIBEN INT SPA [IT]) 2 April 2008 (2008-04-02) * paragraph [0020]; figure 2 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B27B B23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 March 2015	Matzdorf, Udo

CATEGORY OF CITED DOCUMENTS

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16-03-2015

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REFERENCES CITED IN THE DESCRIPTION

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