(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 117 975 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.01.2017 Bulletin 2017/03

(21) Application number: **16178171.1**

(22) Date of filing: **06.07.2016**

(51) Int Cl.:
B27C 5/06 *(2006.01)* ***B27C 9/04*** *(2006.01)*
B27D 5/00 *(2006.01)* ***B23Q 1/01*** *(2006.01)*
B27M 1/08 *(2006.01)* ***B23Q 7/04*** *(2006.01)*
B27B 5/06 *(2006.01)* ***B27C 9/02*** *(2006.01)*
B27C 9/00 *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **14.07.2015 IT UB20152164**

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(54) CUTTING MACHINE, PARTICULARLY FOR WOODEN PANELS AND THE LIKE

(57) Cutting machine (1), particularly for wooden panels and the like (3), of the type with moveable panel (3) with means (4) for gripping and pushing the panel (3) over a plane (2) against at least one cutting means (9, 10), preferably a milling tool (10), translatable on the surface (2) at least in the direction transversal to the advancement direction of the panel (3), particularly suitable for implementing automatic methods for optimising the cutting of flat elements, so-called nesting processes, comprising at least one continuous or segmented line of pressure means (13, 14) interacting with at least one continuous or segmented line of antagonist counter means (19, 20) for holding and guiding the panel (3) and the cutting thereof suitable to engage and disengage the panel (3) and the cuttings thereof extending linearly in continuous or segmented section (13, 14, 19, 20) in the direction of advancement of the panel (3) and, with respect to said direction of advancement, transversely transposable as a block or in segments (13, 14, 19, 20) in a zone operating upstream and/or downstream and/or astride the cutting transversal line (8).

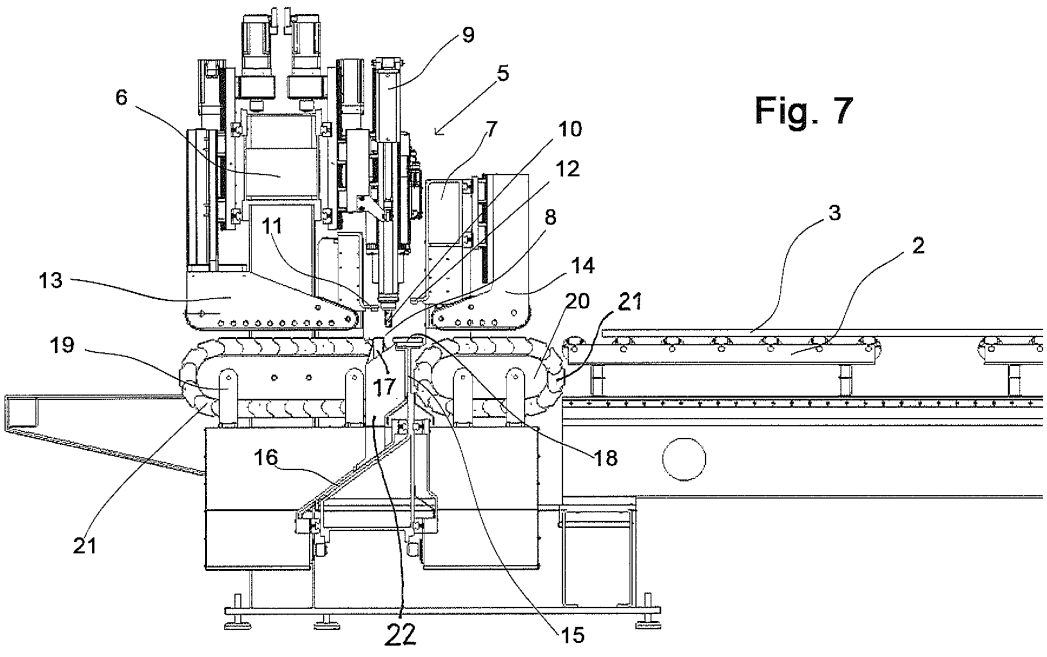

Fig. 7

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Description

DETAILED DESCRIPTION

Field of the art

[0001] Machines for cutting wooden panels, wood surrogates and the like, adapted to cut at least one extended panel of commercial dimensions into a plurality of panel sections or panels dimensional-wise defined as a function of the products they contribute to obtain, are known in the wood processing industry in general and in the furnishing industry in particular; these machines being suitable for the implementation of automatic methods for optimising the cutting of flat elements, the so-called nesting processes:

> Among these, one category is structured with a fixed parent panel and mobile cutting tools, according to three Cartesian axes or even in any planar direction on the parent panel;
> Another category is structured with a parent panel moveable through gripping, pushing and/or pulling means, which forcedly translate against the moveable cutting tools substantially only transversely with reference to the direction of advancement of the parent panel.

[0002] Not only is this second category is easier, quick and economic to obtain but it also allows the detachment of the aforementioned cut panel one at a time, the supply of the panels to be planar and vertical alongside other handling advantages.
A cutting machine as set forth in the preamble of claim 1 is disclosed in WO 99/08834.

Limits of the prior art

[0003] Such second category of machines for cutting panels according to the prior art, suitable for implementing automatic methods for optimising the cutting of flat elements, so-called nesting process, though simple and economic, do not allow cutting out the shaped panels with curved sides, in that the panels are not sufficiently held and guided in all events of such operations, thus the segment constituting the residual isthmus before the detachment of the shaped section being potentially small, so that it starts vibrating at a given contingent level before the completion of the cut-outs due to the action of the millers, thus obtaining unacceptable precision results.

Objects of the invention

[0004] In this context, the main object of the present invention is to provide an innovative and functional cutting machine, particularly for wooden panels and the like, of the type with advancement of the parent panel against the transversely mobile milling cutters, so as to guarantee the guiding and retention of the cut-out panel portions during the cutting and detachment even when the isthmus made of residual material to join the panel arising from the obtained panel is small and progressively reducing in minimum terms and finally be eliminated in the definition of shaped panels and arched in particular.

[0005] Another object of the present invention is to attain the previous object through a machine adapted to implement the automatic methods of optimisation of the cutting of flat elements, the so-called nesting process.

[0006] Another object of the present invention is to attain the previous objects through a machine that does not imply the extension of cutting times in any manner whatsoever.

[0007] Another object of the present invention is to attain the previous objects without substantial change of dimensions and structurisations of the machine in the loading and unloading step, so as to make it perfectly suitable for the nesting cutting machines according to the prior art in the existent production lines.

[0008] Still, a further object of the present invention is to attain any one of the previous objects through a machine that is simple and efficient, safe to use and relatively inexpensive considering the actual results attained therewith.

Summary of the solution concept

[0009] These and other objects are attained using the cutting machine 1, particularly for wooden panels and the like 3, according to the present invention, of the type with moveable panel 3 with means 4 for gripping and pushing the panel 3 over a plane 2 against at least one cutting means 9, 10, preferably a milling cutter 10, translatable on the surface 2 at least in the direction transversal to the advancement direction of the panel 3, particularly suitable for implementing automatic methods for optimising the cutting of flat elements, so-called nesting processes, comprising at least one continuous or segmented line of pressure means 13, 14 interacting with at least one continuous or segmented line of antagonist counter means 19, 20 for holding and guiding the panel 3 and the cutting thereof suitable to engage and disengage the panel 3 and the cuttings thereof developing linearly in continuous or segmented section 13, 14, 19, 20 in the direction of advancement of the panel 3 and, with respect to said direction of advancement, transversely transposable as a block or in segments 13, 14, 19, 20 in a zone operating upstream and/or downstream and/or astride the cutting transversal line 8.

Description of the attached drawings

[0010] Further characteristics and advantages of the cutting machine of the type with moveable panel according to the present invention shall be more apparent from the following detailed description of a preferred but non-exclusive embodiment thereof, represented solely by

way of non-limiting example with reference to the seven attached drawings, wherein:

Figure 1 illustrates an embodiment of the cutting machine, particularly for wooden panels and the like, according to the present invention, in a front perspective view;
Figure 2 illustrates an embodiment of the cutting machine, particularly for wooden panels and the like, according to the present invention, in a rear perspective view;
Figure 3 illustrates an embodiment of the cutting machine, particularly for wooden panels and the like, according to the present invention, in a plan view;
Figure 4 illustrates an embodiment of the cutting machine, particularly for wooden panels and the like, according to the present invention, in a lateral view;
Figure 5 illustrates an enlargement of a portion of figure 1;
Figure 6 illustrates an enlargement of a portion of figure 2;
Figure 7 illustrates an enlargement of a portion of figure 4.

Static description of the embodiment

[0011] With reference to such figures, an embodiment of the cutting machine according to the present invention, comprising a plane 2 for supporting and translating at least one extended panel 3 of commercial dimensions, or parent-panel, or a panel sheet, supplied therein in a known fashion, laterally or from above, usually singularly or superimposed in pairs.

[0012] As per the prior art, the plane 2 for supporting and translating the panel 3 is provided with a series of lateral gripping and pushing means 4, i.e. a battery of grippers 4 adapted to grip the panel 3 along a smaller side and push-displace it on the support and translation plane 2.

[0013] On the other side of the plane 2 for supporting and translating the panel 3, a cutting station 5, comprising - at the height of the plane 2 for supporting and translating the panel 3 - two bridges 6 and 7, constituted by respective beams, identified by the same reference number 6 and 7, parallel to a cutting line 8 interposed therebetween and engraved on the support and translation plane 2 transversely to the direction of advancement of the panel sheet 3, said beams 6 and 7 being supported by a compact element accommodating the transversal dimension of the panel 3.

[0014] The beam 6 downstream of the transversal cutting line 8, with reference to the direction of advancement of the panel sheet 3, supports:

two cutting units 9 vertically and transversely independently moveable along the beam 6 through appropriate actuators, bearing - at the lower part - respective electro-spindles for holding and activating milling tools 10, with parallel operating axes located on the transversal cutting line 8 orthogonal to the direction of advancement of the panel 3;
a pressure crosspiece 11, vertically moveable through an appropriate actuator, downstream and parallel to the transversal cutting line 8;
a linear segment of pressure belt 13 with rollers and possibly pinions, vertically and transversely moveable through appropriate actuators, downstream and extending perpendicularly to the transversal cutting line 8, idle or driven as an alternative to functional solutions better outlined in the dynamic description hereinafter.

[0015] The beam 7 upstream of the transversal cutting line 8, with reference to the direction of advancement of the sheet or panel 3, supports:

a pressure crosspiece 12, vertically moveable through an appropriate actuator, upstream and parallel to the transversal cutting line 8;
a linear segment of pressure belt 14 with rollers and possibly pinions, vertically and possibly transversely moveable through appropriate actuators, downstream and perpendicularly to the transversal cutting line 8, idle or driven as an alternative to functional solutions better outlined in the dynamic description hereinafter.

[0016] The cutting station 5 also comprises - beneath the height of the plane 2 for supporting and translating the panel 3 - a lower transversal longitudinal beam 15, delimiting the cutting line 8 engraved on the support and translation plane 2 transversely to the direction of advancement of the panel 3, shaped with a chute portion 16 for collecting the discarded material on the side downstream of the transverse cutting line 8, with reference to the direction of advancement of the panel 3.

[0017] The lower transversal longitudinal beam 15, delimiting the cutting line 8, supports:

a pair of transversal abutments 17 and 18, coplanar to the plane 2 for supporting and translating the panel 3, for the respective abutment of the pressure crosspiece 11 vertically moveable on the beam 6 downstream of the transversal cutting line 8 and of the pressure crosspiece 12 vertically moveable on the beam 7 upstream of the transversal cutting line 8.

[0018] A linear segment of a track 19 with links 21, vertically and transversely moveable through appropriate actuators, downstream of the transversal cutting line 8, perpendicular to the transversal cutting line 8, idle or driven as an alternative to functional solutions better outlined in the dynamic description hereinafter, for the antagonist contrast against the linear segment of the pressure means 13 carried by the upper beam 6 downstream of the transversal cutting line 8.

[0019] At least one pneumatic or hydraulic actuator 22, associated to said track line 19 vertically and transversely moveable downstream of the transversal cutting line 8, carrying a series of concealable cylinders 17 constituting said transversal abutment 17 coplanar to the plane 2 for supporting and translating the panel 3, for the abutment of the pressure crosspiece 11 vertically moveable on the beam 6 downstream of the transversal cutting line 8.

[0020] Possibly, at least one element for suctioning dust and sawdust, not illustrated, associated to said linear segment of tracks 19 vertically and transversely moveable downstream of the transversal cutting line 8.

[0021] A linear segment of a track 20 with links 21, vertically and transversely moveable through appropriate actuators, upstream of the transversal cutting line 8, perpendicular to the transversal cutting line 8, idle or driven as an alternative to functional solutions better outlined in the dynamic description hereinafter, for the antagonist contrast against the linear segment of the pressure means 14 carried by the upper beam 7 upstream of the transversal cutting line 8; for the functions outlined hereinafter.

Dynamic description of the embodiment

[0022] Thus, having completed the static description of a preferred embodiment the configuration of the cutting machine of the type with moveable panel according to the present invention, following is the dynamic description of the same, i.e. the relative operation.

[0023] The cutting machine 1 of the type with moveable panel 3 according to the present invention, just like and more than the machines for cutting wooden panels and the like according to the prior art of the furnishing industry, is particularly suitable for the implementation of the automatic methods of optimisation as concerns the cutting of flat elements, so-called nesting process; thus, all relative mechanisms shall be deemed driven by a computerised logic; in particular by a manager, as a function of the contingent optimisation criteria adjusted with the priority appropriateness as concerns the cutting and unloading of semi-finished cut panels, decides:

- the advancement parameters of the panel sheet 3 on the support and translation plane 2 through the thrust of the gripping grippers 4;
- the location parameters of the milling devices 10 and the relative mobility along the cutting line 8 for coupling the panel 3 and the positioning of the portion in front of the panel to be cut-out;
- the location parameters of the milling tools 10 and the relative mobility along the cutting line 8 for coupling the panel 3 and the shaping as well as the decoupling of semi-finished cut panel;
- the transversal positioning parameters with respect to the direction of advancement of the panel 3 of the segment of the pressure means 13 with antagonist contrast track 19 downstream of the cutting line 8;
- the transversal positioning parameters with respect to the direction of advancement of the panel 3 of the segment of the pressure means 14 with antagonist contrast track 20 upstream of the cutting line 8;
- the movement parameters of the pressure means 13 and 14 interacting with the antagonist contrast tracks 19 and 20 in solutions where the latter are fully or partly driven;
- the parameters for the engagement and disengagement of the panel 3 by the pressure means 13 and 14 interacting with the antagonist contrast tracks 19 and 20.

[0024] With specific reference to such line of pressure means 13 and 14 interacting with said line of antagonist contrast tracks 19 and 20, constituting the exemplifying embodiment subject of the present invention, in control implementations subject of such computerised logic:

- The segment of the pressure means 14, with the relative antagonist contrast track 20 upstream of the cutting line 8, are arranged at a substantially median position of the front part of the coupling of the two milling tools 10 and however substantially at the median position of the front part of the panel section being cut-out and they grip it, in a combined fashion to reduce the lateral forces and vibrations arising on the panel 3 during the cutting and on the section being detached as the panel 3 advances, especially when the panel 3 has already been subjected to prior cutting and the residual portion subject of the coupling of the milling tools 10 is relatively marginal;
- The segment of the pressure means 13, with the relative antagonist contrast track 19 downstream of the cutting line 8, are also arranged substantially at the median of the front part of the coupling of the two milling tools 10 and however substantially at the median of the front part of the panel section being cut-out and they grip it, i.e. in line with the segment of the pressure means 14 and the relative antagonist contrast track 20 upstream of the cutting line 8, so as to grip - in a combined fashion - the section being detached as the panel 3 advances immediately after the cutting line 8, thus performing an even more efficient function of guiding the more and more detached panel section and reducing the lateral forces and the vibrations arising on the section increasingly being subjected to detachment, until the latter is cut and isolated from the panel 3, thus maintaining it guided and stable even in cases where the cut is shaped and the final cutting isthmus is extremely minimal in the shaped cut-outs, thus avoiding any uncontrolled final effect related to the breaking of the residual isthmus in any position.

[0025] Should the segment of the pressure means 13, with the relative antagonist contrast track 19 downstream of the cutting line 8, and the segment of pressure means

14, with the relative antagonist contrast track 20 upstream of the cutting line 8, be driven, they can also be driven in a master-slave relation with the pressure means 4 for pushing the panel 3, so as to boost the guiding function as well as the function of removing the cut-out and detached sections.

[0026] The segment of the pressure means 13, with the relative antagonist track 19 downstream of the cutting line 8, and the segment of pressure means 14, with the relative antagonist contrast track 20 upstream of the cutting line 8, may also be joined by only one uninterrupted line astride the cutting line 8; in this case, there may be conceived a track whose links 21 are guided in their rolling to form a loop receding into the trajectory of the track in question, at said transversal cutting line 8, so as to define a concavity, so as not to interfere with the milling devices 10.

[0027] The transversal mobility of the segment of the pressure belt 13 with the relative antagonist contrast track 19 downstream of the cutting line 8 on the cutting site, has a series of possibilities of associating the array of concealable abutments 17 to the motion thereof, the abutments contrasting upon completing their functions so as to facilitate the fall of dust and waste material along the chute portion 16, and possible means, not illustrated, for suctioning the dust.

Alternative embodiments

[0028] It is obvious that the alternative embodiments, still falling within the innovative concept of the embodiment illustrated above and claimed below, the cutting machine of the type with moveable panel according to the present invention shall also be implemented and obtained differently, through equivalent technical and mechanical solutions, or provided with further supplementary solutions, same case applying to all construction characteristics which may vary in a manner suitable for the purpose;
in particular,
like in the prior art, the machine may be conceived milling cutter.

[0029] Pressure means and tracks may also serve the function of advancing the panel replacing the gripping and pushing means, i,e. the grippers, or possibly replacing them for an advancement section of the panel.

[0030] The segment of the pressure belt with the relative antagonist contrast track downstream of the cutting line and the segment of the pressure belt with the relative antagonist contrast track upstream of the cutting line may be independently moveable in the direction parallel to the cutting line.

[0031] The segment of the pressure belt with the relative antagonist contrast track downstream of the cutting line and the segment of the pressure belt with the relative antagonist contrast track upstream of the cutting line may be mutually constrained by coupling means transversal to the cutting line 8.

[0032] The segment of the pressure belt with the relative antagonist contrast track upstream of the cutting line may be fixed in the position where it is most effective for its function, i.e. on the side where the panel sheet is weaker due to the previous detachment of portions.

[0033] The bridge upstream of the cutting line may alternatively carry - projecting - elastic pressure means suitable to perform the functions of said at least one pressure segment upstream of the cutting line with reference to the direction of advancement of the panel.

[0034] The segment of the pressure belt with the relative antagonist contrast track downstream of the cutting line and the segment of the pressure belt with the relative antagonist contrast track upstream of the cutting line may be capsized in the arrangement thereof, i.e. inverted in the respective functional arrangement, so that said pressure means lie on said support and translation plane and said antagonist contrast means overlie said support and translation plane.

[0035] The tracks, in any relative position, may have a have a homokinetic rolling structure with the aim of improving their functional performance.

Advantages of the invention

[0036] As observable from the preceding detailed description of a preferred embodiment, the cutting machine of the type with moveable panel according to the present invention offers an advantages corresponding to the attainment of these and other preset objects:

as a matter of fact, it integrates a functional, modular, polyvalent and economic cutting machine of the type with moveable panel adapted to attain the cutting of commercial panel structures in production of variously shaped panel structures.

KEY TO REFERENCE NUMBERS

[0037]

1) cutting machine in its entirety
2) support and translation plane
3) panel
4) gripping and thrust grippers
5) cutting station in its entirety
6) upper bridge / beam downstream of the cutting line
7) upper bridge / beam upstream of the cutting line
8) cutting line
9) cutting operative units
10) milling tools
11) pressure crosspiece downstream of the transversal cutting line
12) pressure crosspiece upstream of the transversal cutting line
13) linear segment of the pressure means downstream of the transversal cutting line
14) linear segment of the pressure means upstream

of the transversal cutting line
15) lower transversal longitudinal beam
16) chute portion of the lower longitudinal beam for collecting waste material
17) cylinder abutment with concealable pressure strips downstream of the cutting line
18) abutment with pressure strips upstream of the cutting line
19) linear track segment downstream of the transversal cutting line (counter means)
20) linear track segment upstream of the transversal cutting line (counter means)
21) track links
22) hydraulic actuator

Claims

1. Cutting machine (1), particularly for wooden panels and the like (3), of the type with moveable panel (3) with means (4) for gripping and pushing the extended panel of commercial dimensions, or parent-panel, or panel sheet (3) on a surface (2) against at least one cutting means (9, 10), preferably a milling tool (10), translatable on the surface (2) at least in the direction transversal to the advancement direction of the panel (3), particularly suitable for implementing automatic procedures for optimising the cutting of flat elements, so-called *nesting processes*, comprising at least one continuous or segmented line of pressure means (13, 14) interacting with at least one continuous or segmented line of antagonist counter means (19, 20) for holding and guiding the panel (3) suitable to engage and disengage the panel (3), extending linearly in continuous or segmented sections (13, 14, 19, 20) in the direction of advancement of the panel (3) **characterized in that** said pressure and counter means, operating upstream and/or downstream and/or astride the cutting transverse line (8), are transversely transposable as a block or in segments (13, 14, 19, 20) with regard to the feed direction.

2. Cutting machine according to claim 1, **characterised in that** said pressure means (13, 14) and also said antagonist counter means (19, 20) are driven to exert a traction on the panel (3) and/or its cut parts.

3. Cutting machine according to claim 1 or 2, **characterised in that** said pressure means (13, 14) is constituted by at least one continuous or segmented line of rolling pressure means (13, 14) or belt pressure means (13, 14) or driven conveyor pressure means (13, 14).

4. Cutting machine according to claim 1 or 2, **characterised in that** said pressure means (13, 14) is constituted by at least one continuous or segmented line of driven or non-driven belt pressure means (13, 14) interacting with at least one continuous or segmented line of driven or non-driven tracks (19, 20) suitable to simultaneously reduce the lateral thrusts occurring on the panel (3) when cutting and to remove the defined sections.

5. Cutting machine according to any one of claims 1 to 4, **characterised in that** said pressure means (13, 14) is constituted by two coaxial segments of belt pressure means (13, 14) divided by an interruption at the cutting line (8) interacting with two respective coaxial segments of antagonist counter tracks (19, 20) divided by an interruption at the cutting line (8) so as to constitute at least one pressure segment with counter element (13, 19) downstream and at least one pressure segment with counter element (14, 20) upstream of the cutting line (8) with reference to the direction of advancement of the panel (3).

6. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one pressure segment with counter element (13, 19) downstream and said at least one pressure segment with counter element (14, 20) upstream of the cutting line (8) are independently moveable in a direction parallel to the cutting line.

7. Cutting machine according to any one of claims 1 to 5, **characterised in that** said at least one pressure segment with counter element (13, 19) downstream and said at least one pressure segment with counter element (14, 20) upstream of the cutting line (8) are mutually constrained by coupling means transversal to the cutting line (8) and jointly moveable in a direction parallel to the cutting line (8).

8. Cutting machine according to any one of claims 1 to 5, **characterised in that** said at least one pressure segment with counter element (14, 20) upstream of the cutting line (8) is fixed.

9. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one pressure segment with counter element (13, 19) downstream of the cutting line (8) is associated to an array of concealable abutment means (17) of upper pressure means (11) of the panel (3) developing along the cutting line (8) and in relative adjacency.

10. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one pressure segment with counter element (13, 19) downstream of the cutting line (8) is associated to dust and sawdust suctioning means.

11. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one continuous or segmented line of pressure means

(13, 14) is supported by two bridges (6, 7) surmounting said support and translation surface (2) constituted by respective beams (6, 7) parallel to the cutting line (8) interposed therebetween.

12. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one continuous or segmented line of antagonist counter means (19, 20) interacting with said at least one continuous or segmented line of pressure means (13, 14) is supported by a transversal longitudinal member (15) laying on said support and translation surface (2) and delimiting said cutting line (8).

13. Cutting machine according to claim 11 or 12, **characterised in that** the bridge upstream (7) of the cutting line (8) carries projecting elastic pressure means suitable to perform the functions of said at least one pressure segment (14) upstream of the cutting line (8) with reference to the direction of advancement of the panel (3).

14. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one continuous or segmented line of pressure means (13, 14) is capsized in its arrangement, so that said pressure means (13, 14) lay on said support and translation plane (2) and said antagonist counter means (19, 20) lay above said support and translation plane (2).

15. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one continuous or segmented line of driven pressure means (13, 14) also perform the functions of advancing the panel (3) on said support and translation surface (2) without the help or with only partial help of said means (4) for gripping and pushing the panel (3).

16. Cutting machine according to any one of the preceding claims, **characterised in that** said at least one continuous or segmented line of driven pressure means (13, 14) interacting with said counter means (19, 20) possibly driven for holding and guiding the panel (3) and its cuttings, suitable to engage the panel (3) and its cuttings, are arranged in master-slave relation with said means (4) for gripping and pushing the panel (3) and have a homokinetic rolling structure.

17. Cutting machine according to any one of the preceding claims, **characterised in that** said pressure segment with counter element (13, 19) downstream and said pressure segment with counter element (14, 20) upstream of the cutting line (8) are arranged in a master-slave relation with said means (4) for gripping and pushing the panel (8) and have a homokinetic rolling structure.

18. Cutting machine according to any one of the preceding claims, **characterised in that** said line of driven antagonist counter means (19, 20) is constituted by tracks (19, 20) whose links (21) are guided in their rolling to shape a loop recessed in the trajectory of the track (19, 20) at said transversal cutting line (8) ad defining a dynamic concavity therein.

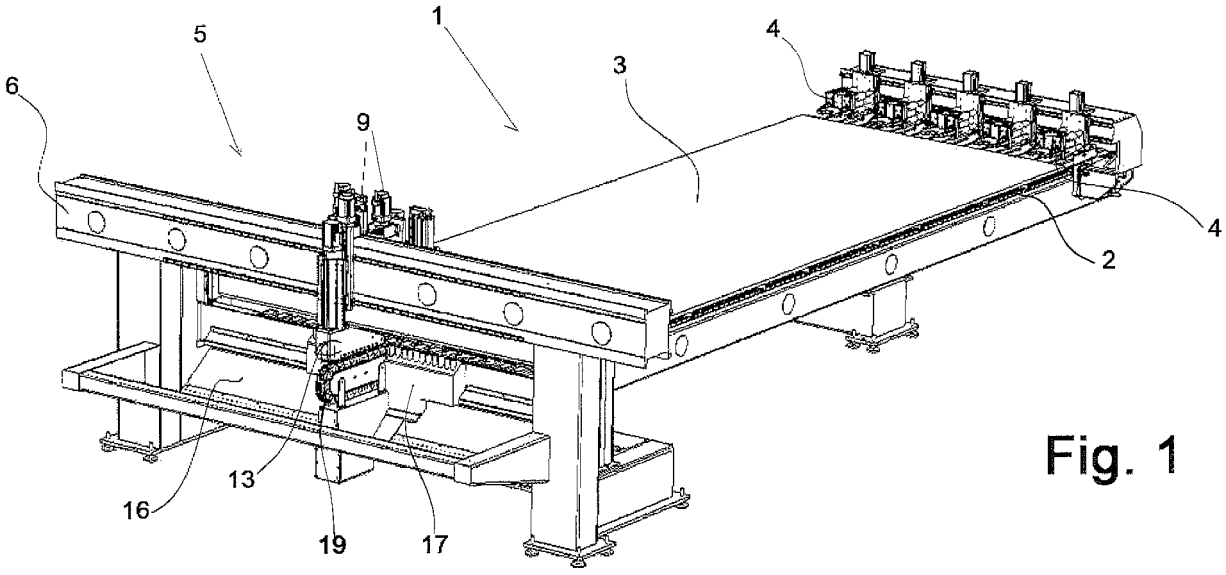


Fig. 1

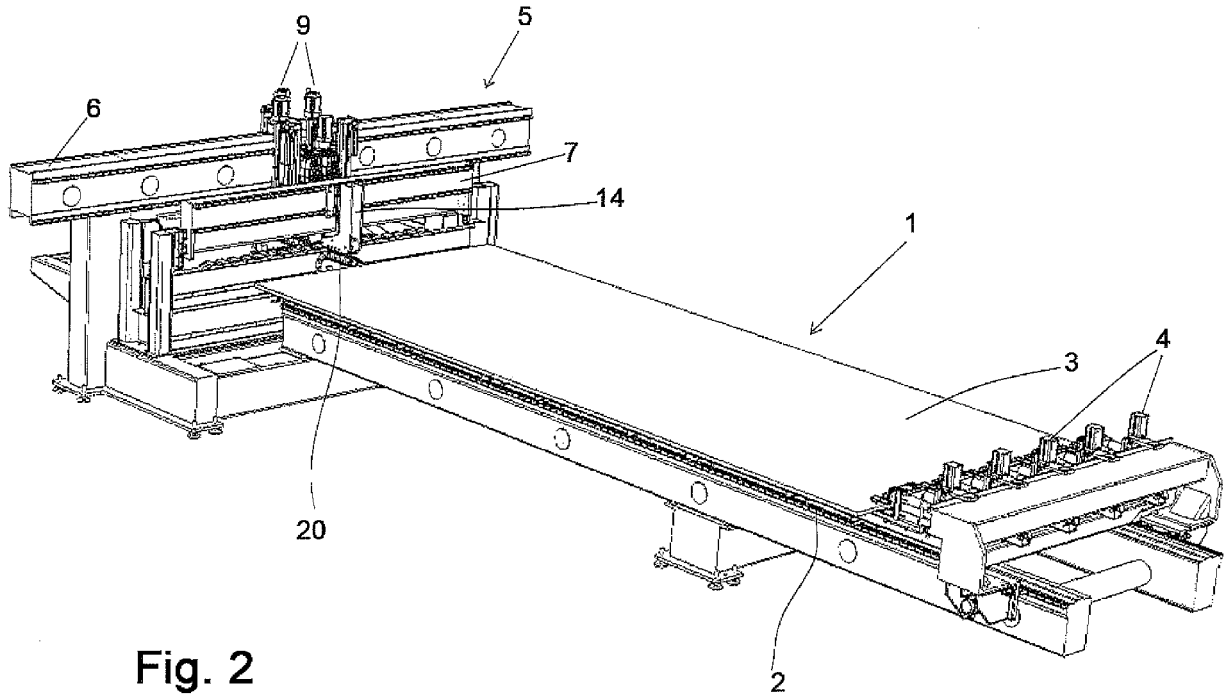


Fig. 2

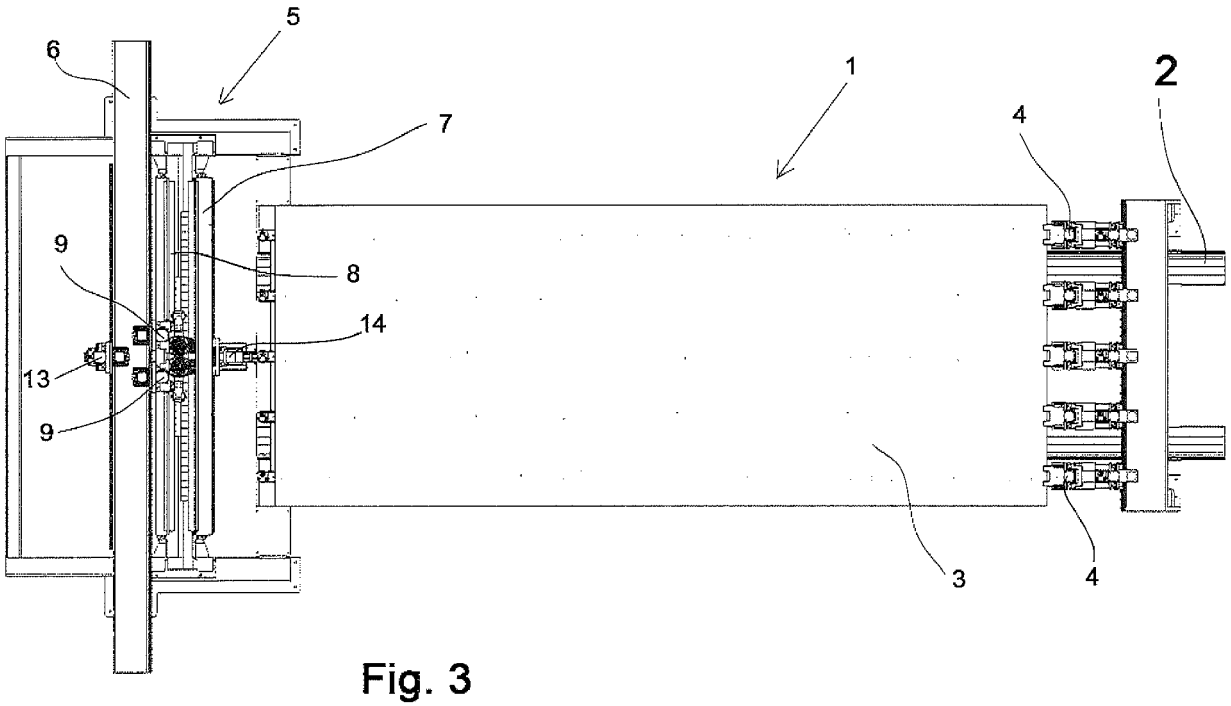


Fig. 3

Fig. 4

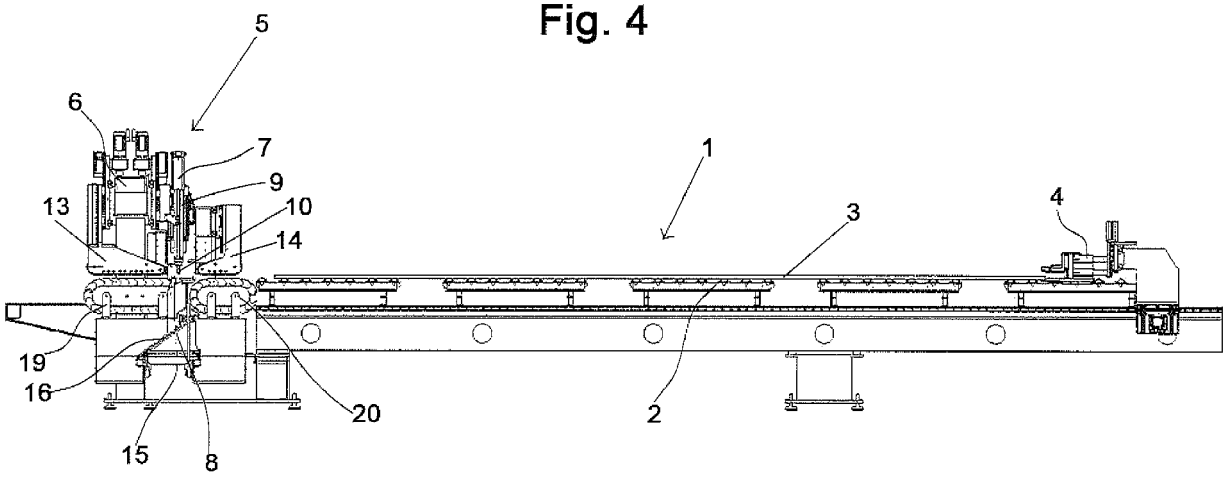


Fig. 5

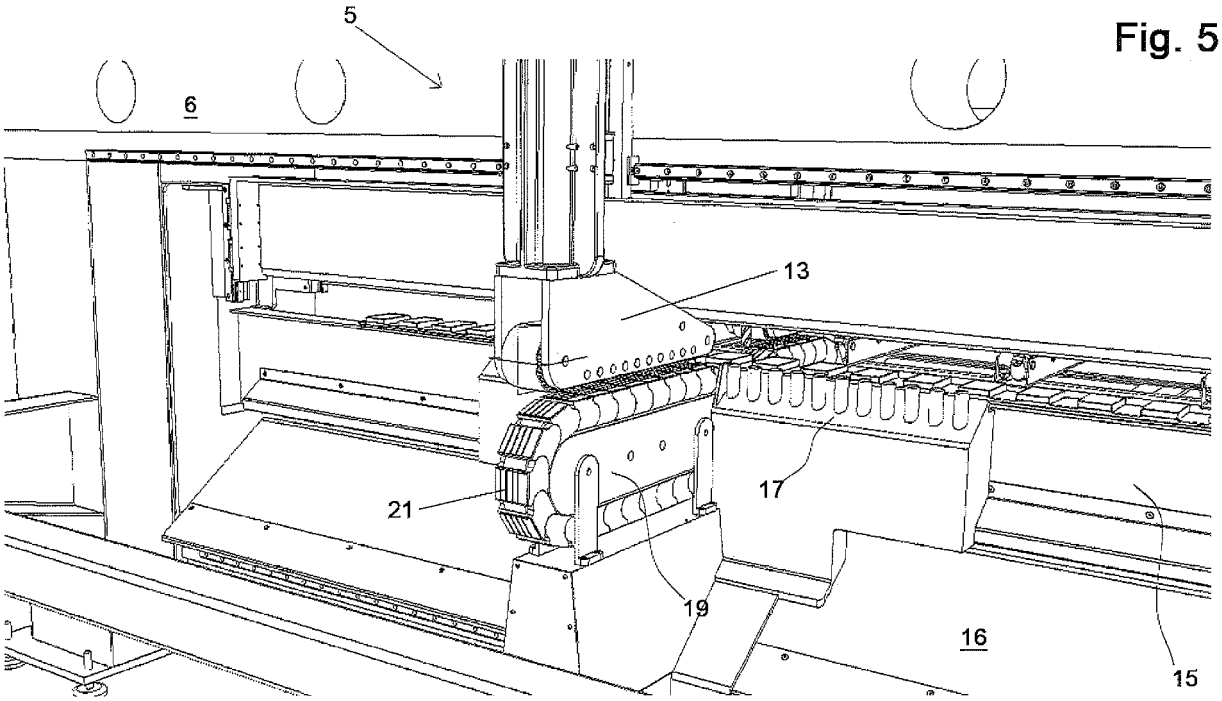
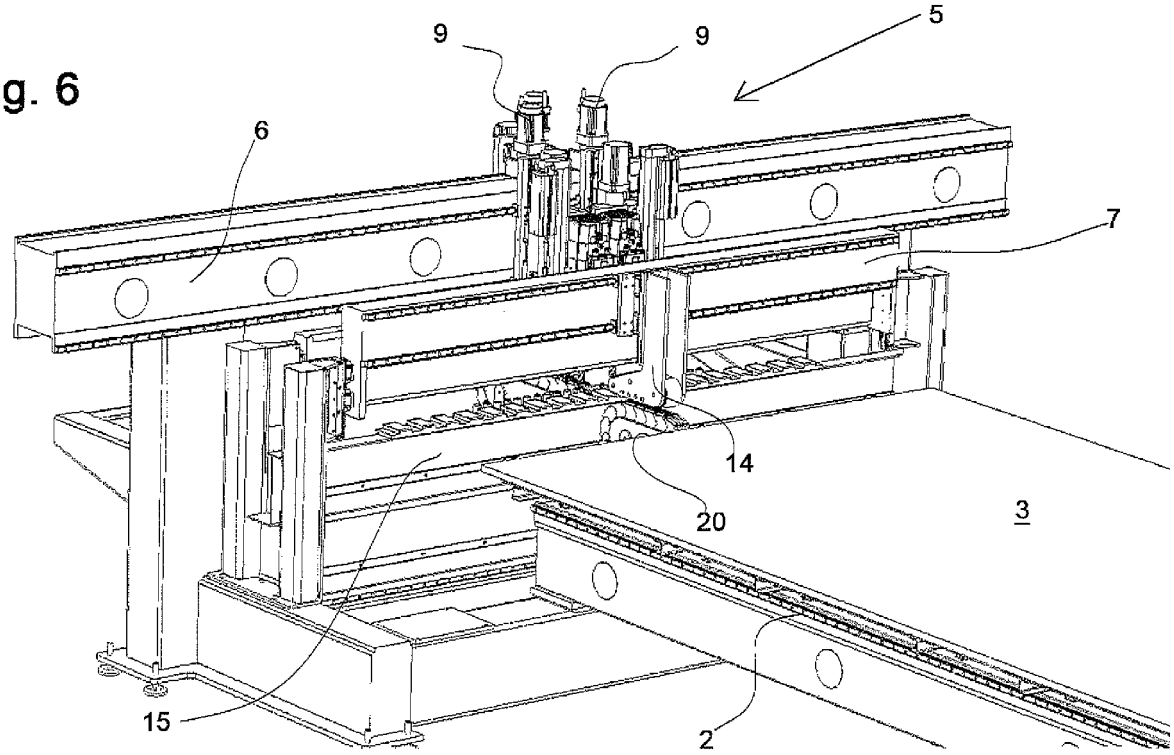


Fig. 6



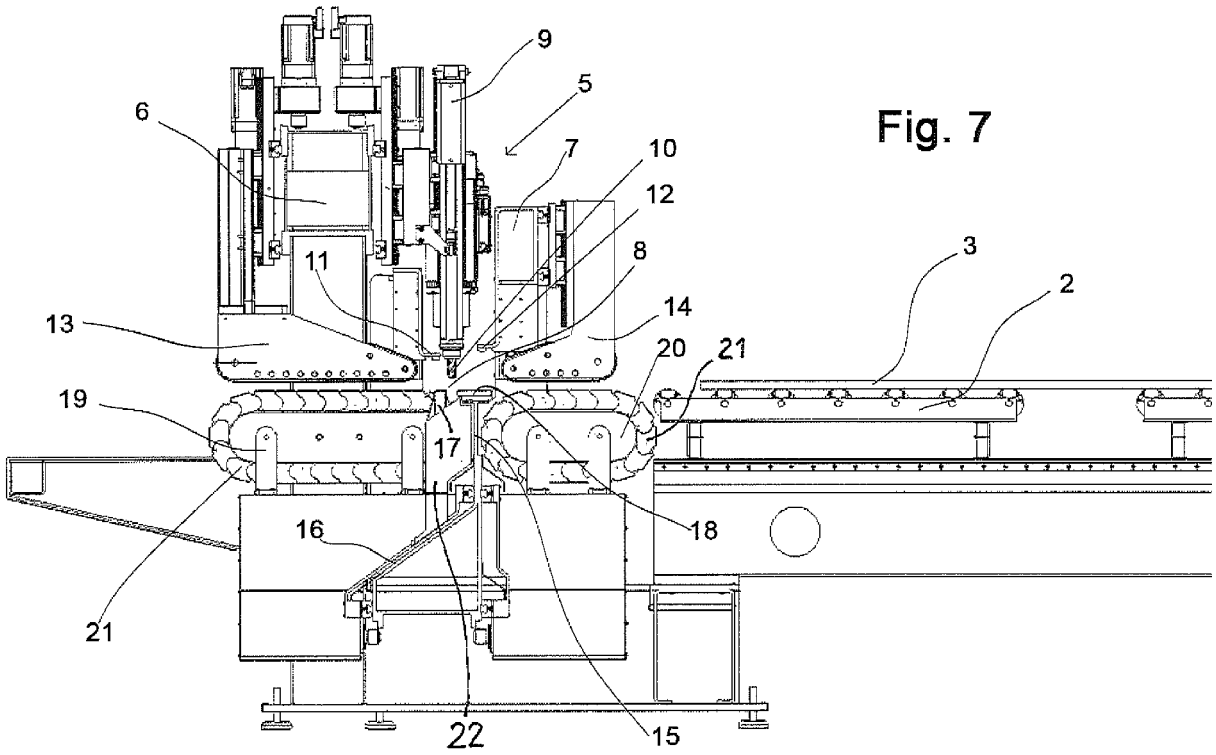


Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 8171

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 99/08834 A1 (SHOWAN NICHOLAS [GB]) 25 February 1999 (1999-02-25) * abstract; figure 1 * -----	1	INV. B27C5/06 B27C9/04 B27D5/00
A	WO 92/12816 A1 (BERGE HALLVARD [NO]) 6 August 1992 (1992-08-06) * page 7, line 9 - line 31; figure 1 * -----	1	B23Q1/01 B27M1/08 B23Q7/04 B27B5/06
A	EP 1 136 185 A2 (SCM GROUP SPA [IT]) 26 September 2001 (2001-09-26) * abstract; figure 2 * -----	1	B27C9/02 B27C9/00
A	DE 10 2013 008368 A1 (BIESSE SPA [IT]) 21 November 2013 (2013-11-21) * abstract; figure 3 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B27C
B27D
B23Q
B27M
B27B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 November 2016	Huggins, Jonathan

CATEGORY OF CITED DOCUMENTS

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