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(54) EDGE MILLING UNIT AND EDGE BANDING MACHINE

(57) This invention relates to an edge milling unit (1) for machining a panel (P) in an edge banding machine comprising a support plane (S) for supporting the panel (P), and a movement system for moving the panel (P) along a feed direction (F) parallel to the support plane (S), the edge finishing unit (1) comprising a first support (5) connectable to the edge banding machine; a tool (2), connected to the first support (5) so as to be movable along a configuration direction (L) which is inclined with respect to the support plane (S) and which lies in a configuration plane (YZ) perpendicular to the feed direction (F), the tool (2) having three different cutting profiles (21, 22, 23, 24); a first actuator (52), connected to the tool (2) and configured to position the tool (2) at three working positions of the tool (2) along the configuration direction (L), wherein at each working position of the tool (2), a respective cutting profile of the three cutting profiles (21, 22, 23, 24) is configured to carry out a different machining process on the panel (P). This invention also relates to an edge banding machine.

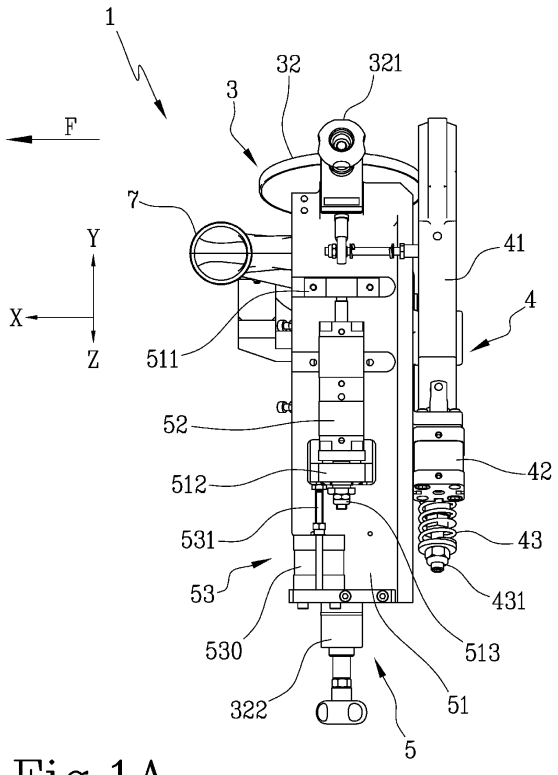

Fig.1A

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Description

[0001] This invention relates to an edge milling unit for machining a panel, in particular, a panel made of wood or comparable materials, such as, for example, wood by-products, metal, plastic and composites.

[0002] This invention also relates to an edge banding machine.

[0003] As is well known, an edge milling unit is a machining unit, used typically in an edge banding machines, to machine one or more corners of an edge of a panel to be machined. Edge banding machines (also called edging machines, or simply edge banders) are designed to create an aesthetically pleasing surface finish on the edges of the *rough* panels. By "rough" panel is meant a panel, made typically of particleboard material, covered by two sheets, one above and one below, of ennobling material, which, after being cut to size by panel sawing or nesting processes, have one or more edges, called rough edges, where the inner core of particleboard material is visible. In the edge banding machine, a strip or band is glued to the rough edge of the panel to cover it. Each single panel may run through an edge banding station one or more times or it may run through several edge banding stations located one after another in order to cover all the rough edges of a single panel.

[0004] The band is applied so it projects outwards, since it is larger in area than the rough edge it is intended to cover so that it is sure to cover the rough edge entirely.

[0005] To obtain a panel which is also finished along the rough edge, therefore, further machining is necessary to cut the projecting parts of the band so that the band is exactly the same size as the rough edge of the panel. This process on the edge band is carried out by one or more finishing stations (or machining units) following the one in which the edge band was glued to the rough edge. These finishing stations may, for example, comprise two or more substations (or sub-units), each responsible for carrying out a specific machining process on the edge band.

[0006] Described below purely by way of example is a typical sequence of machining processes performed on the edge band to make the band the same size as the rough edge of the panel and, if necessary, give its profile the desired shape (for example, rounded, sharp-cornered, bevelled) so as to obtain a panel that is aesthetically pleasing also round the edges.

[0007] The panel advances through the edge banding machine along a feed direction which is horizontal, that is, parallel to the supporting surface of the edge banding machine, which typically defines the longitudinal axis of the edge banding machine itself. As it advances, the panel meets a first machining unit, comprising at least one tool which performs an operation known as end cropping, whereby the edge band is cropped to create sharp corners at its front and back ends so one of its dimensions is the same size as the panel edge, in particular so it is the same length.

[0008] Next, the panel meets a second machining unit, comprising another tool which is adapted to perform an operation known as trimming, in which the excess parts along the top and bottom of the edge band are removed, so that another of its dimensions is the same size as the panel edge, in particular so it is the same height.

[0009] Furthermore, depending on the type of edge band applied to the rough edge of the panel, the corner of the edge may be machined in several different ways. For example, for thin edge bands, a typical machining process is a simple process with a flat-faced tool, in particular, a tool whose face is inclined by 10°. Thicker edge bands, on the other hand, made typically of plastic material, are typically machined with contoured tools to obtain what is known as a *radiused* edge. Contoured tools may have different curvature radiuses so as to make differently radiused edges, for example, as a function of the thickness of the edge band applied. Edge bands may also be made of solid wood (in which case they are called solid wood strips), which are typically machined with flat-faced tools specific for solid wood.

[0010] It is evident that it is necessary to change the type of machining process, hence the type of tool, for example every time the size of the panel, the type of edge band applied to it and/or the desired edge surface finish changes.

[0011] Known in the prior art are edge banding machines where the operator changes the tool and adjusts the machining unit every time what is known as a *change-over* takes place, i.e. every time the size of the panel, the type of edge band applied to it and/or the desired edge surface finish changes. It is evident, however, that these operations carried out manually by the operator make the edge banding machine extremely inefficient.

[0012] Also known are edge banding machines provided with a series of machining units which perform the same machining process (we might also speak of a single machining unit comprising two or more sub-units) but which are equipped with different tools so that the result of the machining process is different. These machining stations are activated alternately according to the type of panel, the type of edge band and the desired surface finish. In this case, intervention by an operator to change the tools or adjust the machining units at each change-over is not necessary. It is evident, however, that these edge banding machines are particularly expensive and complex. Moreover, their size, in particular their length, is a function of the number of machining units or sub-units they are equipped with. Therefore, these edge banding machines are particularly large, hence expensive in terms of occupied space in a production facility.

[0013] This invention has for an aim to provide an edge milling unit and a machine to overcome the above mentioned disadvantages of the prior art.

[0014] In particular, the aim of this invention is to provide an edge milling unit and an edge banding machine which allow different machining processes to be performed on the panel flexibly and fully automatically with-

out an operator having to intervene to change the tool or make any adjustments.

[0015] Another aim of this disclosure is to provide an edge milling unit and an edge banding machine which are economical and easy to make.

[0016] This aim is fully achieved by the edge milling unit and the edge banding machine as characterized in the appended claims.

[0017] This disclosure provides an edge milling unit and an edge banding machine. Advantageously, the edge milling unit may be configured for machining a panel in an edge banding machine comprising, for example, a support plane for supporting the panel, and a movement system for moving the panel along a feed direction parallel to the support plane.

[0018] Additionally, the edge milling unit may comprise, for example, a first support, connectable to the edge banding machine; a tool, connected to the first support so as to be movable along a configuration direction which is inclined with respect to the support plane and which lies in a configuration plane perpendicular to the feed direction.

[0019] In particular, the tool may have three different cutting profiles. More specifically, the tool may have at least three cutting profiles. Furthermore, the cutting profiles may be different from each other.

[0020] Advantageously, the edge milling unit may also comprise a first actuator, connected to the tool and configured to position the tool, for example, at least at three tool working positions along the configuration direction. At each tool working position, a respective cutting profile of the at least three cutting profiles may be configured to carry out a different machining process on the panel.

[0021] Advantageously, the first support may comprise a fixed stop, the tool is solidly connected to a movable stop, and the first actuator may be configured to move the movable stop relative to the fixed stop along the configuration direction. That way, the tool may be positioned along the configuration direction at the at least three tool working positions. Additionally, the first actuator may be connected to the movable stop by a movable stop adjuster. The movable stop adjuster may, for example, be configured to adjust the distance between the first actuator and the movable stop.

[0022] More advantageously, the tool may have four different cutting profiles.

[0023] In particular, the edge milling unit may comprise a limiter. The limiter may have an active configuration, where it limits a travel length of the movable stop relative to the fixed stop along the configuration direction, and an inactive configuration, where it does not limit the travel length of the movable stop relative to the fixed stop. That way, the first actuator and the limiter may cooperate to position the tool at an additional tool working position along the configuration direction so that at each tool working position, a respective cutting profile of the four cutting profiles may be configured to perform a different machining process on the panel.

[0024] More specifically, the limiter may comprise an adjustable stop and a limiter actuator. The limiter actuator may be configured to move the adjustable stop to an active position, where it interferes with the movable stop and thus limits the travel length of the movable stop relative to the fixed stop along the configuration direction. Furthermore, the limiter actuator may be configured to move the adjustable stop to an inactive position, where it does not interfere with the movable stop and thus does not limit the travel length of the movable stop relative to the fixed stop along the configuration direction. Advantageously, the limiter actuator may be configured to move the adjustable stop along the configuration direction between the active position and the inactive position.

[0025] More advantageously, the adjustable stop may be extensible along the configuration direction and its extension may be adjustable so that the travel length of the movable stop relative to the fixed stop is made variable. Furthermore, the first actuator and the limiter actuator may each be a pneumatic cylinder. Additionally, the cylinder of the limiter actuator may have a larger bore than the cylinder of the first actuator, so that the limiter actuator can overcome the thrust of the first actuator.

[0026] In particular, the edge milling unit may comprise a lateral copier coupled to the tool and configured to move into abutment against the panel so as to reference the position of the tool (and of the first support) relative to the panel along a transverse axis perpendicular to the feed direction and lying in the support plane.

[0027] More specifically, the edge milling unit may comprise a bottom copier coupled to the tool and configured to move into abutment against the panel so as to reference the position of the tool (and of the first support) relative to the panel along a vertical axis perpendicular to the support plane. Furthermore, the edge milling unit may comprise a lateral copier adjuster, configured to adjust the position of the tool (and of the first support) relative to the lateral copier, and a bottom copier adjuster, configured to adjust the position of the tool (and of the first support) relative to the bottom copier. Advantageously, the edge milling unit may comprise a second support, solidly connectable to the edge banding machine, and a second actuator. In particular, the first support is coupled to the second support movably along the transverse axis.

[0028] More specifically, the second actuator is configured to move the first support relative to the second support along the transverse axis. That way, the first actuator and the second actuator may cooperate to position the tool at an additional tool working position along the configuration direction.

[0029] This disclosure also provides an edge banding machine which may comprise a support plane for supporting a panel, a movement system for moving the panel along a feed direction which is parallel to the support plane, a gluing station for gluing a strip onto an edge of the panel, and a plurality of machining units, located downstream of the gluing station, to perform a plurality of machining processes on the edge of the panel and/or

on the strip glued to the edge of the panel.

[0030] Advantageously, at least one machining unit of the plurality of machining units is an edge milling unit according to the invention.

[0031] This and other features will become more apparent from the following description of a preferred embodiment, illustrated purely by way of non-limiting example in the accompanying drawings, in which:

- Figure 1a shows a bottom view of an edge milling unit according to the invention in a first operating configuration;
- Figure 1b shows a lateral view of the edge milling unit according to the invention in a first operating configuration;
- Figure 1c shows a schematic side view of a tool of the edge milling unit according to the invention;
- Figure 2a shows a bottom view of the edge milling unit according to the invention in a second operating configuration;
- Figure 2b shows a lateral view of the edge milling unit according to the invention in a second operating configuration;
- Figure 3a shows a bottom view of the edge milling unit according to the invention in a third operating configuration;
- Figure 3b shows a lateral view of a detail of the edge milling unit according to the invention in a third operating configuration;
- Figure 4a shows a bottom view of the edge milling unit according to the invention in a fourth operating configuration;
- Figure 4b shows a lateral view of a detail of the edge milling unit according to the invention in a fourth operating configuration;
- Figure 5a shows a bottom view of the edge milling unit according to the invention in a fifth operating configuration; and
- Figure 5b shows a lateral view of the edge milling unit according to the invention in a fifth operating configuration.

[0032] Hereinafter in this disclosure, directional terms such as "right", "left", "front", "rear", "top", "bottom", "upper", "lower", "lateral" etc. are used with reference to the accompanying drawings. Since components and/or elements and/or embodiments of this invention may be positioned and/or operated in several different orientations, the directional terms are used solely by way of non-limiting example.

[0033] Figures 1a and 1b show an edge milling unit 1 for machining a panel P made of wood or comparable material.

[0034] The edge milling unit 1 is configured to be able to be used, for example, in an edge banding machine (not shown in the drawings). The edge banding machine may comprise, for example, a support plane S for supporting the panel P, and a movement system for moving the panel P along a feed direction F parallel to the support plane S. The support plane S may be substantially horizontal, i.e. it may be substantially parallel to a supporting surface, such as a floor, which supports the edge banding machine. The feed direction F may be parallel to a longitudinal axis X of the edge banding machine. The edge banding machine may comprise a gluing station for gluing a strip onto an edge of the panel P, in particular a rough edge, and one or more finishing stations (or machining units), located downstream of the gluing station, to perform machining processes on the edge of the panel P and/or on the strip glued to the edge of the panel P. For example, the edge banding machine may comprise one or more edge milling units 1. In particular, the edge banding machine may comprise two edge milling units 1, positioned and oriented in such a way as to machine the top part of the edge of the panel P and the bottom part of the edge of the panel P, respectively. More specifically, the edge banding machine may comprise four edge milling units 1, positioned and oriented in such a way as to machine the top and front part of the edge of the panel P, the top and rear part of the edge of the panel P, the bottom and front part of the edge of the panel P and the bottom and rear part of the edge of the panel P, respectively. Via the movement system, the panel P may move through the edge banding machine, meeting the gluing station and the one or more machining units.

[0035] Hereinafter in this disclosure, reference is made mainly to an edge milling unit 1 configured and positioned to machine the bottom corner of the edge of the panel P. It is understood, however, that the edge milling unit 1 of this invention might be configured and positioned to machine any of the corners of the edge of the panel P, while remaining within the scope of protection defined by the appended claims.

[0036] With reference to Figures 1a and 1b, the edge milling unit 1 may comprise a second support 4 that is solidly connectable to the edge banding machine. In particular, the second support 4 may be connectable to the frame, or base, of the edge banding machine. The second support 4 may comprise a second frame 41.

[0037] The edge milling unit 1 may comprise a first support 5. The first support 5 may be coupled to the second support 4 movably along a transverse axis Y, lying in the support plane S and perpendicular to the feed direction F. In particular, the first support 5 may comprise a first frame 51, and the first frame 51 may be coupled to the second frame 41 so as to be movable along the transverse axis Y.

[0038] The second support 4 may comprise a system of linear guides such as, for example, prismatic or cylindrical guides. The system of linear guides of the second support 4 may be configured to guide the relative movement between the first support 5 and the second support 4 and, in particular, between the first frame 51 and the second frame 41. The prismatic or cylindrical guides of the system of linear guides of the second support 4 may be positioned parallel to the transverse axis Y.

[0039] Furthermore, the second support 4 may comprise a second actuator 42, configured to move the first support 5 relative to the second support 4 along the transverse axis Y. In particular, the second actuator 42 may be, for example, a pneumatic cylinder or an electric motor, either asynchronous or synchronous. In the example shown in Figures 1a and 1b, the second actuator 42 is a pneumatic cylinder, comprising a cylinder and a piston, which may act between the first frame 51 and the second frame 41. In particular, the cylinder of the second actuator 42 may be fixed relative to the first frame 51 and the piston of the second actuator 42 may act on, i.e. push, the second frame 41, thus making the first frame 51 move relative to the second frame 41 by reaction. The second support 4 may also comprise a spring 43, configured to return and hold the first frame 51 in place relative to the second frame 41 when the second frame 41 is not being pushed by the piston of the second actuator 42. The second support 4 may comprise a spring adjuster 431 to adjust the force with which the spring 43 acts on the first frame 51. The second support 4 may comprise a stop element 44 (or stop grub screw 44) to define and adjust the position of the first frame 51 relative to the second frame 41 when the second frame 41 is not being pushed by the piston of the second actuator 42, and is thus subject only to the elastic force of the spring 43.

[0040] Again with reference to Figures 1a and 1b, the edge milling unit 1 may comprise a chuck 6, in particular an electric chuck. The chuck 6 may support - removably, for example -, and rotationally carries a tool 2 which is configured to perform one or more stock removal machining processes on the panel P, in particular on an edge of the panel P, for example the edge which is parallel to a work plane XZ perpendicular to the support plane S and parallel to the feed direction F.

[0041] The edge milling unit 1 may comprise a suction hood 7 configured to be coupled to a vacuum generating system and to extract the shavings produced by the tool 2 during machining of the panel P.

[0042] The chuck 6 may be connected to the first support 5 so as to be movable along a configuration direction L which is inclined with respect to the support plane S and which lies in a configuration plane YZ perpendicular to the feed direction F. In particular, the chuck 6 may be coupled to the first frame 51 so as to be movable along the configuration direction L.

[0043] The first support 5 may comprise a system of linear guides such as, for example, prismatic or cylindrical guides. The system of linear guides of the first support 5 may be configured to guide the relative movement between the chuck 6 and the first support 5 and, in particular, between the chuck 6 and the first frame 51. The prismatic or cylindrical guides of the system of linear guides of the second support 5 may be positioned parallel to the configuration direction L.

[0044] Furthermore, the edge milling unit 1 may comprise a first actuator 52, configured to move the chuck 6, hence the tool 2, relative to the first support 5 along the configuration direction L. In particular, the first actuator 52 may be, for example, a pneumatic cylinder or an electric motor, either asynchronous or synchronous. In the example shown in Figures 1a and 1b, the first actuator 52 is a pneumatic cylinder, comprising a cylinder and a piston, which may act between the first frame 51 and the chuck 6. As shown, for example, in Figures 1a and 1b, the first support 5 may comprise a fixed stop 511. Additionally, the chuck, hence the tool 2, may be solidly coupled to a movable stop 512. For example, the first actuator 52 may be configured to move the movable stop 512 relative to the fixed stop 511 along the configuration direction L, so as to position the tool 2 at one or more working positions of the tool 2 along the configuration direction L. In particular, the cylinder of the first actuator 52 may be coupled, for example fixedly, or solidly, to the movable stop 512. Furthermore, the piston of the first actuator 52 may act on, i.e. push, the fixed stop 511, thus making the chuck 6 move relative to the first frame 51 by reaction. The edge milling unit 1 may also comprise an additional spring (not shown in the drawings), configured to return and hold the chuck, hence the tool, in place relative to the first frame 51 when the first frame 51 is not being pushed by the piston of the first actuator 52.

[0045] Additionally, the first actuator 52 may be connected to the movable stop 512 by a movable stop adjuster 513. The movable stop adjuster 513 may be configured to adjust the distance between the cylinder of the first actuator 52 and the movable stop 512, so as to adjust the position of the chuck 6, hence of the tool 2, along the configuration direction L. That way, machining of the panel P can be made more precise.

[0046] Furthermore, the first actuator 52 may be a pneumatic cylinder having, for example, three operating positions. In particular, the pneumatic cylinder of the first actuator 52 may have three independent compressed air inlets so as to be able to drive the pneumatic cylinder of the first actuator 52. When air is fed to one of the three compressed air inlets, the piston of the pneumatic cylinder of the first actuator 52 may be positioned at one of the three operating positions: a fully retracted position, a fully extended position and an intermediate position. Consequently, the tool 2 may be positioned at three corresponding working positions along the configuration direction L. It should be noted that also the movement of the first support 5 along the transverse axis Y may cause the tool 2 to move along the configuration direction L, since the transverse axis Y has a component along the configuration direction L. Therefore, it is possible to combine, for example, the movement of the first support 5 via the second actuator 42, with one of the three, or all of the three, movements of the tool 2 via the first actuator 52, so as to position the tool 2 at one or more of the working positions along the configuration direction L.

[0047] Again with reference to Figures 1a and 1b, the edge milling unit may comprise a limiter 53. The limiter 53 may be configured to limit the travel length of the tool 2, relative to the first support 5, along the configuration

direction L, in particular of the movable stop 521 relative to the fixed stop 511. By "travel length" is meant the extent of the movement, i.e. the distance travelled by the movable part during its movement relative to the fixed part. Therefeore, the limiter 53 may have an active configuration, where it limits a travel length of the movable stop 512 relative to the fixed stop 511 along the configuration direction L. Furthermore, the limiter may have an inactive configuration, where it does not limit the travel length of the movable stop 512 relative to the fixed stop 511.

[0048] In the example shown in Figures 1a and 1b, the limiter may comprise a limiter actuator 530 and an adjustable stop 531. The limiter actuator 530 may be configured to move the adjustable stop 531 to an active position, corresponding to the active configuration of the limiter 53, where it interferes with the movable stop 512. At that position, the adjustable stop 531 may limit the travel length of the movable stop 512 relative to the fixed stop 511 along the configuration direction L. Furthermore, the limiter actuator 530 may be configured to move the adjustable stop 531 to an inactive position, corresponding to the inactive configuration of the limiter 53, where it does not interfere with the movable stop 512. At that position, the adjustable stop 531 may not limit the travel length of the movable stop 512 relative to the fixed stop 511 along the configuration direction L.

[0049] In particular, as shown, for example, in Figures 1a and 1b, the limiter actuator 530 may be configured to move the adjustable stop 531 along the configuration direction L, between the active position and the inactive position, and vice versa. The adjustable stop 531 may extend along the configuration direction L and its extent may be adjustable. That way, it is possible to vary the travel length of the movable stop 512 relative to the fixed stop 511, limited by the adjustable stop 531. For example, the limiter 53 may be a pneumatic cylinder, where the limiter actuator 530 may coincide with a cylinder of the pneumatic cylinder of the limiter 53, and where the adjustable stop 531 may coincide with the piston of the pneumatic cylinder of the limiter 53. Furthermore, the piston of the adjustable stop 531 may be embodied by a screw so as to be able to adjust its extent, or length. That way, it is very easy to adjust, or vary, the travel length of the movable stop 512 relative to the fixed stop 511, limited by the adjustable stop 531. In effect, simply screwing or unscrewing the screw which embodies the adjustable stop 531 will vary the travel length of the movable stop 512.

[0050] In the example of Figures 1a and 1b, the first actuator 52 and the limiter 53 may be viewed as two pneumatic cylinders in series, where the limiter 53 may oppose or, rather, limit the movement produced by the first actuator 52. Therefore, it is possible, for example, to combine the movement of the movable stop 512 with the movement of the adjustable stop 513 so as to position the tool 2 at one or more working positions along the configuration direction L.

[0051] The pneumatic cylinder which may embody the limiter 53 has to overcome the thrust of the pneumatic cylinder which may embody the first actuator 52. Since both are connected to the same compressed air system, however, for this to be possible, the cylinder 530 of the limiter actuator 53 may have a larger bore than the cylinder of the first actuator 52.

[0052] As is evident from this disclosure, therefore, the tool 2 may be positioned at three working positions by moving the chuck 6 relative to the first support 5 along the configuration direction L via the first actuator 52. Furthermore, the limiter 53 may cooperate with the first actuator 52 to position the tool 2 at at least one additional working position, limiting the travel length of the movable stop 512 relative to the fixed stop 511. Additionally, the second actuator 42 may cooperate with the first actuator 52 to position the tool 2 at at least one additional working position, moving the first support 5 relative to the second support 4 along the transverse axis Y, which has a component along the configuration direction L, via the second actuator 42. As a result, the tool 2 may be positioned at multiple working positions along the configuration direction L.

[0053] Figure 1c shows an example of the tool 2 which the edge milling unit 1 can be equipped with. The tool 2 may comprise, for example, one or more cutting profiles 21, 22, 23, 24. In particular, the tool 6 may comprise at least three cutting profiles 21, 22, 23, 24, i.e. three, four, five, six or more cutting profiles.

[0054] Hereinafter in this disclosure, reference is made mainly to an edge milling unit 1 comprising a tool 2 having four cutting profiles 21, 22, 23, 24. It should be borne in mind, however, that the edge milling unit 1 of this invention could comprise a tool 2 having at least three cutting profiles 21, 22, 23, 24, while remaining within the scope of protection defined by the appended claims. Each cutting profile 21, 22, 23, 24 of the tool 2 may, for example, be different from the others, so that the edge milling unit 1 can perform different machining processes on the panel P.

[0055] With reference to the example shown in Figure 1c, the tool 2 may have a first cutting profile 21 which is suitable, for example, for machining the edge of the panel P in the case where a thin edge band has been used. The first cutting profile 21 may substantially be a straight profile which is parallel to the transverse axis Y when the axis of the tool is positioned along the configuration direction L. That way, a sharp corner is made along the edge of the panel P.

[0056] Furthermore, following the first cutting profile 21, the tool 2 may have a second cutting profile 22 which is suitable, for example, for machining the edge of the panel P in the case where a thick edge band, made of plastic material, for example, has been used. The second cutting profile 22 may have a radius, in particular a minor radius, configured to radius the edge band, thereby making a transitional portion between the edge band and the panel P to create a rounded effect. The second cutting profile 22 may be configured to round the edge of the

panel P when the axis of the tool is positioned along the configuration direction L.

[0057] Additionally, following the second cutting profile 22, the tool 2 may have a third cutting profile 23 which is suitable, for example, for machining the edge of the panel P in the case where a thick edge band, made of plastic material, for example, has been used. The third cutting profile 23 may have a radius, in particular a major radius, larger than the minor radius of the second cutting profile 22, configured to radius the edge band, thereby making a transitional portion between the edge band and the panel P to create a rounded effect. The third cutting profile 23 may be configured to round the edge of the panel P when the axis of the tool is positioned along the configuration direction L.

[0058] Furthermore, following the third cutting profile 23, the tool 2 may have a fourth cutting profile 24 which is suitable, for example, for machining the edge of the panel P in the case where an edge band, made of solid wood, for example, has been used. The fourth cutting profile 24 may substantially be a straight profile which is parallel to the transverse axis Y when the axis of the tool is positioned along the configuration direction L. That way, a sharp corner is made along the edge of the panel P.

[0059] With reference to the example shown in Figures 1a and 1b, the edge milling unit 1 may comprise a system of copiers 3 configured to reference the tool 2 relative to the edge of the panel P to be machined. In particular, the system of copiers 3 is configured to reference the first support 5 relative to the edge of the panel P to be machined. More specifically, the system of copiers 3 may comprise a lateral copier 31 coupled to the tool 2 and configured to move into abutment against the panel P so as to reference the position of the tool 2 relative to the panel P along a transverse axis Y perpendicular to the feed direction F and lying in the support plane S. The lateral copier 31 may be a disc configured to move into contact with and into abutment against the edge of the panel P to be machined. Additionally, the system of copiers 3 may comprise a bottom copier 32 coupled to the tool 2 and configured to move into abutment against the panel P so as to reference the position of the tool 2 relative to the panel P along a vertical axis Z perpendicular to the support plane S. The bottom copier 32 may be a disc configured to move into contact with and into abutment against an underside face of the panel P facing the support plane S. If the edge milling unit 1 were configured and positioned to machine the upper corner of the edge of the panel P, the bottom copier 32 would be a top copier configured to move into contact with and into abutment against a top face of the panel P, opposite the underside face.

[0060] Furthermore, the edge milling unit 1 may comprise a bottom copier adjuster 321, configured to adjust the position of the bottom copier 32 relative to the first support 5, hence relative to the tool 2. Furthermore, the edge milling unit 1 may comprise a lateral copier adjuster 322, configured to adjust the position of the lateral copier 31 relative to the first support 5, hence relative to the tool 2. Described below is an example of how the edge milling unit 1 according to the invention operates.

[0061] With reference to the example shown in Figures 1a and 1b, the lateral copier 31 and the bottom copier 32 are in abutment against the panel P to be machined, thus referencing the position of the first support 5, hence of the tool 2, relative to the panel P. The second actuator 42 does not act on the second support 4, as is evident from the example of Figure 1b. The limiter 53 is in the inactive configuration and therefore, the adjustable stop 531 does not interfere with, and does not limit the travel length of, the movable stop 512, as is evident from the example of Figure 1a. The first actuator 52 is at the fully extended operating position, so the movable stop 512 is at a position distal to the fixed stop 511. The tool 2 is thus at a first working position along the configuration direction L. At this first working position of the tool 2, the first tool profile 21 is in contact with the panel P to be machined, to make a sharp corner. This configuration of the edge milling unit 1 may be particularly suitable in the case of thin edge bands.

[0062] With reference to the example shown in Figures 2a and 2b, the lateral copier 31 and the bottom copier 32 are in abutment against the panel P to be machined, thus referencing the position of the first support 5, hence of the tool 2, relative to the panel P. The second actuator 42 acts on the second support 4, as is evident from the example of Figure 2b, thus producing a movement between the first support 5 and the second support 4, hence moving the tool 2 along the configuration direction L. The limiter 53 is in the inactive configuration and therefore, the adjustable stop 531 does not interfere with, and does not limit the travel length of, the movable stop 512, as is evident from the example of Figure 2a. The first actuator 52 is at the fully retracted operating position, so the movable stop 512 is at a position proximal to the fixed stop 511. The tool 2 is thus at a second working position along the configuration direction L. At this second working position of the tool 2, the fourth tool profile 24 is in contact with the panel P to be machined, to make a sharp corner. This configuration of the edge milling unit 1 may be particularly suitable in the case of edge bands made of solid wood.

[0063] With reference to the example shown in Figures 3a and 3b, the lateral copier 31 and the bottom copier 32 are in abutment against the panel P to be machined, thus referencing the position of the first support 5, hence of the tool 2, relative to the panel P. The second actuator 42 does not act on the second support 4, as is evident from the example of Figure 3b. The limiter 53 is in the inactive configuration and therefore, the adjustable stop 531 does not interfere with, and does not limit the travel length of, the movable stop 512, as is evident from the example of Figure 3a. The first actuator 52 is at the intermediate operating position, so the movable stop 512 is at an intermediate position relative to the fixed stop 511. The tool 2 is thus at a third working position along the con-

figuration direction L. At this third working position of the tool 2, the third tool profile 23 is in contact with the panel P to be machined, to make a radiused, i.e. rounded, corner, with a maximum radius. This configuration of the edge milling unit 1 may be particularly suitable in the case of thick edge bands, in particular made of plastic material.

[0064] With reference to the example shown in Figures 4a and 4b, the lateral copier 31 and the bottom copier 32 are in abutment against the panel P to be machined, thus referencing the position of the first support 5, hence of the tool 2, relative to the panel P. The second actuator 42 does not act on the second support 4, as is evident from the example of Figure 4b. The limiter 53 is in the active configuration and therefore, the adjustable stop 531 interferes with, and limits the travel length of, the movable stop 512, as is evident from the example of Figure 4a. The first actuator 52 is driven to move to the fully extended operating position but the adjustable stop 531 limits the chord of the movable stop 512, which moves to an additional intermediate position relative to the fixed stop 511. The tool 2 is thus at a fourth working position along the configuration direction L. At this third working position of the tool 2, the second tool profile 22 is in contact with the panel P to be machined, to make a radiused, i.e. rounded, corner, with a minimum radius. This configuration of the edge milling unit 1 may be particularly suitable in the case of thick edge bands, in particular made of plastic material.

[0065] With reference to the example shown in Figures 5a and 5b, the lateral copier 31 and the bottom copier 32 are in abutment against the panel P to be machined, thus referencing the position of the first support 5, hence of the tool 2, relative to the panel P. The second actuator 42 acts on the second support 4, as is evident from the example of Figure 5b, thus producing a movement between the first support 5 and the second support 4, hence moving the tool 2 along the configuration direction L. The limiter 53 is in the inactive configuration and therefore, the adjustable stop 531 does not interfere with, and does not limit the travel length of, the movable stop 512, as is evident from the example of Figure 5a. The first actuator 52 is at the fully extended operating position, so the movable stop 512 is at a position distal to the fixed stop 511. The tool 2 is thus at a non-working position along the configuration direction L. At this non-working position, the tool 2 is excluded from machining the panel P.

[0066] As described in this disclosure, it is clear that to ensure that the edge milling unit 1, hence the edge banding machine too, are economical, i.e. low cost and easy to construct, the edge milling unit 1 according to the invention may be equipped with a tool 2 having one or more cutting profiles 21, 22, 23, 24, in particular, at least three cutting profiles 21, 22, 23, 24, so as to be able to perform one or more machining processes on the edge of the panel P. Each working position of the tool 2 can be associated with a respective cutting profile 21, 22, 23, 24. That way, moving the tool 2 along the configuration direction L makes it possible to perform different machining processes on the panel without necessitating the intervention of an operator to change the tool or adjust the edge milling unit 1.

[0067] Moreover, to ensure that the edge milling unit 1, hence the edge banding machine too, are economical, i.e. low cost and easy to construct, the first actuator 52, the second actuator 42 and/or the limiter actuator 530 may advantageously be embodied, for example, as pneumatic cylinders, or discrete actuators, which usually cost less and are easier to control and drive. In this case, the multiple working positions along the configuration direction L are discrete positions, i.e., the motion along the configuration direction L of the tool 2 is not continuous motion but is performed in discrete steps, passing through predetermined, known working positions. Furthermore, advantageously, the edge milling unit may comprise one or more adjustments of the position of the tool 2 along the configuration direction L: the stop element 44, the movable stop adjuster 513 and/or the standard stop. That way, while comprising discrete actuators such as pneumatic cylinders, for example, it is possible to position the tool 2 precisely and accurately.

[0068] This invention has been described by way of non-limiting illustration with regard to its preferred embodiments but it is understood that variants and/or modifications can be made by experts in the trade without thereby departing from the scope of protection afforded by the claims appended hereto.

Claims

1. An edge milling unit (1) for machining a panel (P) in an edge banding machine comprising a support plane (S) for supporting the panel (P), and a movement system for moving the panel (P) along a feed direction (F) parallel to the support plane (S), the edge finishing unit (1) comprising

   - a first support (5) connectable to the edge banding machine;
   - a tool (2), connected to the first support (5) so as to be movable along a configuration direction (L) which is inclined with respect to the support plane (S) and which lies in a configuration plane (YZ) perpendicular to the feed direction (F), the tool (2) having three different cutting profiles (21, 22, 23, 24); and
   - a first actuator (52), connected to the tool (2) and configured to position the tool (2) at three working positions of the tool (2) along the configuration direction (L),

   wherein, at each working position of the tool (2), a respective cutting profile of the three cutting profiles (21, 22, 23, 24) is configured to carry out a different machining process on the panel (P).

2. The edge milling unit (1) according to claim 1, where-

in the first support (5) comprises a fixed stop (511), wherein the tool is solidly connected to a movable stop (512), and wherein the first actuator (52) is configured to move the movable stop (512) relative to the fixed stop (511) along the configuration direction (L), so as to position the tool (2) at the three working positions of the tool (2) along the configuration direction (L).

3. The edge milling unit (1) according to claim 2, wherein the first actuator (52) is connected to the movable stop (512) by a movable stop adjuster (513), the movable stop adjuster (513) being configured to adjust the distance between the first actuator (52) and the movable stop (512).

4. The edge milling unit (1) according to claim 2 or 3, wherein the tool (2) has four different cutting profiles (21, 22, 23, 24), and wherein the edge milling unit (1) comprises a limiter (53) having an active configuration, where it limits the travel length of the movable stop (512) relative to the fixed stop (511) along the configuration direction (L), and an inactive configuration, where it does not limit the travel length of the movable stop (512) relative to the fixed stop (511), the first actuator (52) and the limiter (53) cooperating to position the tool (2) at a further working position of the tool (2) along the configuration direction (L), so that at each working position of the tool (2), a respective cutting profile of the four cutting profiles (21, 22, 23, 24) is configured to carry out a different machining process on the panel (P).

5. The edge milling unit (1) according to claim 4, wherein the limiter (53) comprises an adjustable stop (531) and a limiter actuator (530), the limiter actuator (530) being configured to move the adjustable stop (531) between an active configuration, in which it interferes with the movable stop (512) and thus limits the travel length of the movable stop (512) relative to the fixed stop (511) along the configuration direction (L), and an inactive configuration, in which it does not interfere with the movable stop (512) and thus does not limit the travel length of the movable stop (512) relative to the fixed stop (511) along the configuration direction (L).

6. The edge milling unit (1) according to claim 5, wherein the limiter actuator (530) is configured to move the adjustable stop (531) along the configuration direction (L) between the active position and the inactive position, wherein the adjustable stop (531) extends along the configuration direction (L) and its extension is adjustable so the limitation of the travel length of the movable stop (512) relative to the fixed stop (511) is made variable.

7. The edge milling unit (1) according to claim 5 or 6, wherein the first actuator (52) and the limiter actuator (530) are each a pneumatic cylinder, and wherein the cylinder of the limiter actuator (530) has a larger bore size than the cylinder of the first actuator (52).

8. The edge milling unit (1) according to any one of the preceding claims, comprising a lateral copier (31), coupled to the tool (2) and configured to move into abutment against the panel (P) so as to reference the position of the tool (2) relative to the panel (P) along a transverse axis (Y) perpendicular to the feed direction (F) and lying in the support plane (S), and a bottom copier (32), coupled to the tool (2) and configured to move into abutment against the panel (P) so as to reference the position of the tool (2) relative to the panel (P) along a vertical axis (Z) perpendicular to the support plane (S).

9. The edge milling unit (1) according to claim 8, comprising a lateral copier adjuster (322), configured to adjust the position of the tool (2) relative to the lateral copier (31), and a bottom copier adjuster (321), configured to adjust the position of the tool (2) relative to the bottom copier (32).

10. The edge milling unit (1) according to any one of the preceding claims, comprising a second support (4), solidly connectable to the edge banding machine, and a second actuator (42), wherein the first support (5) is coupled to the second support (4) movably along the transverse axis (Y), wherein the second actuator (42) is configured to move the first support (5) relative to the second support (4) along the transverse axis (Y), the first actuator (52) and the second actuator (42) cooperating to position the tool (2) at an additional working position of the tool (2) along the configuration direction (L).

11. An edge banding machine comprising

- a support plane (S), for supporting a panel (P);
- a movement system for moving the panel (P) along a feed direction (F) which is parallel to the support plane (S);
- a gluing station for gluing a strip onto an edge of the panel (P); and
- a plurality of machining units (1), located downstream of the gluing station, to perform a plurality of machining processes on the edge of the panel (P) and/or on the strip glued to the edge of the panel (P),

wherein at least one machining unit of the plurality of machining units (1) is an edge milling unit (1) according to any one of the preceding claims.

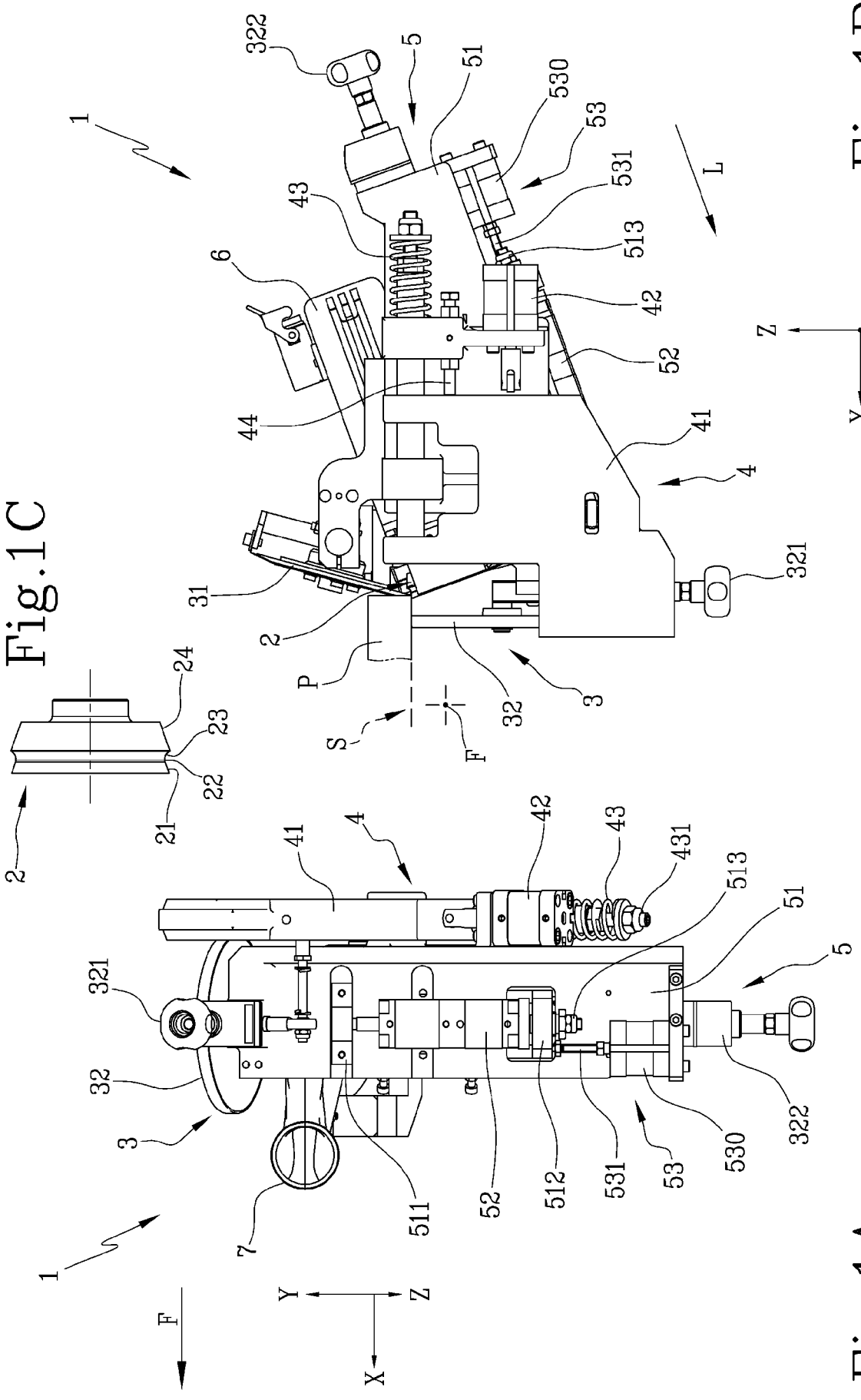

Fig.1C

Fig.1B

Fig.1A

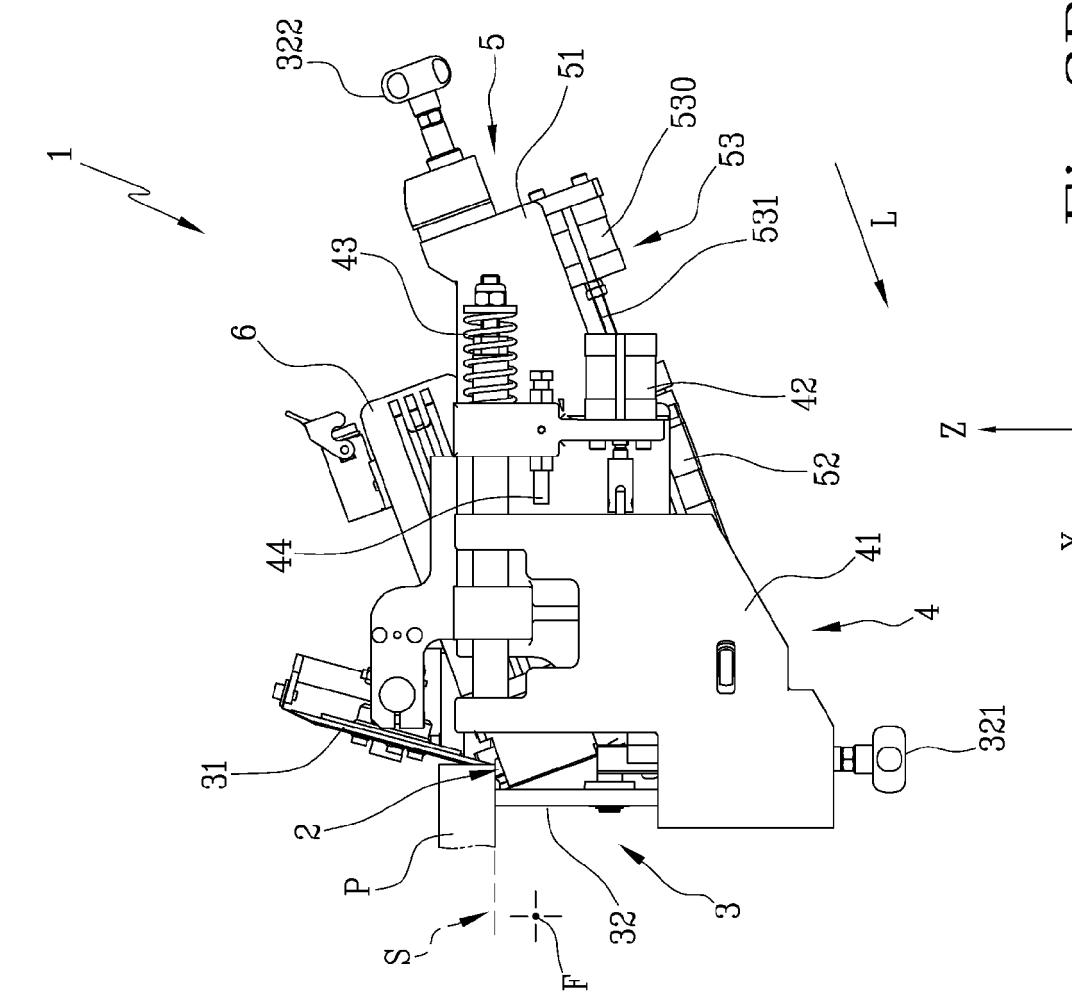
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Fig.2B

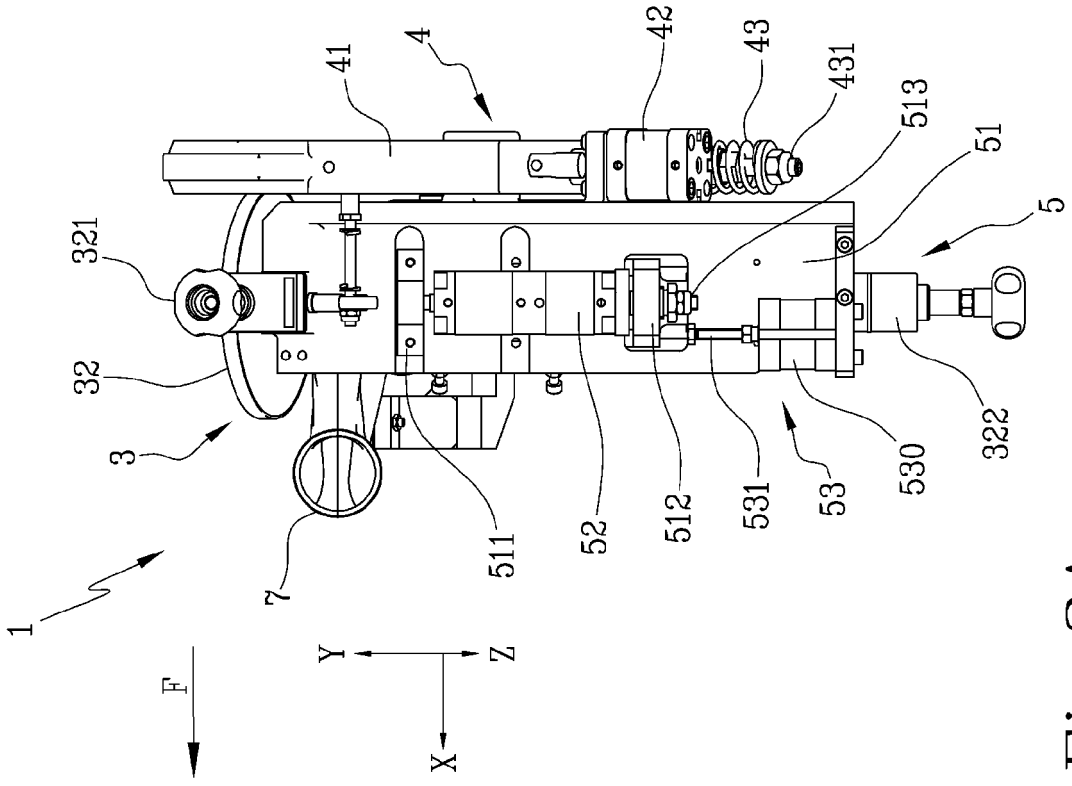
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Fig.2A

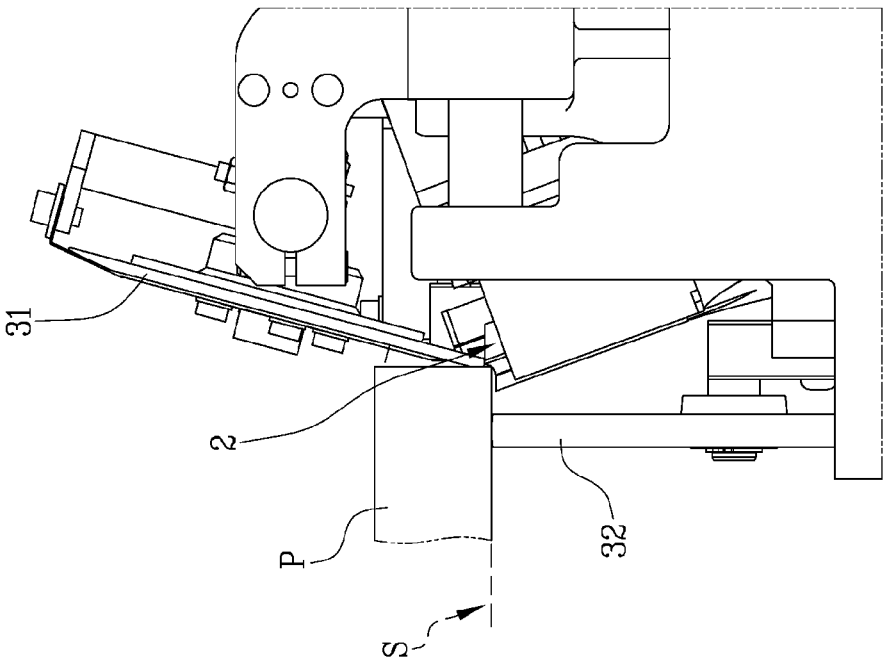
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Fig.3B

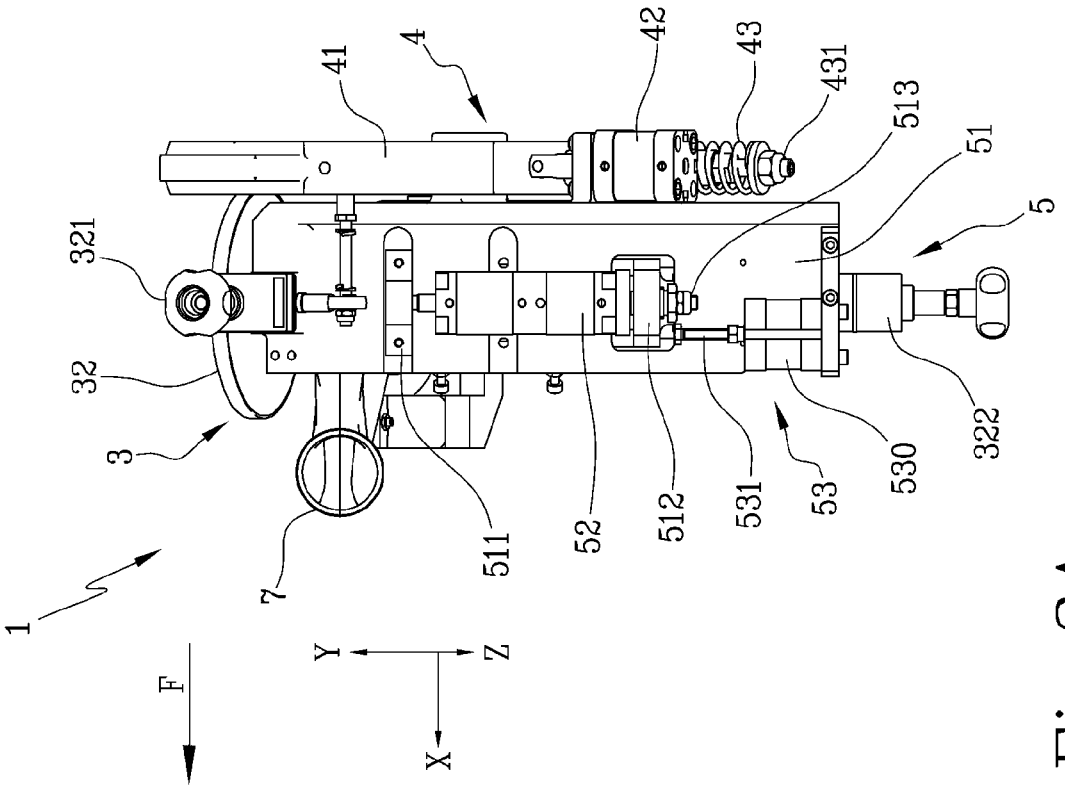
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Fig.3A

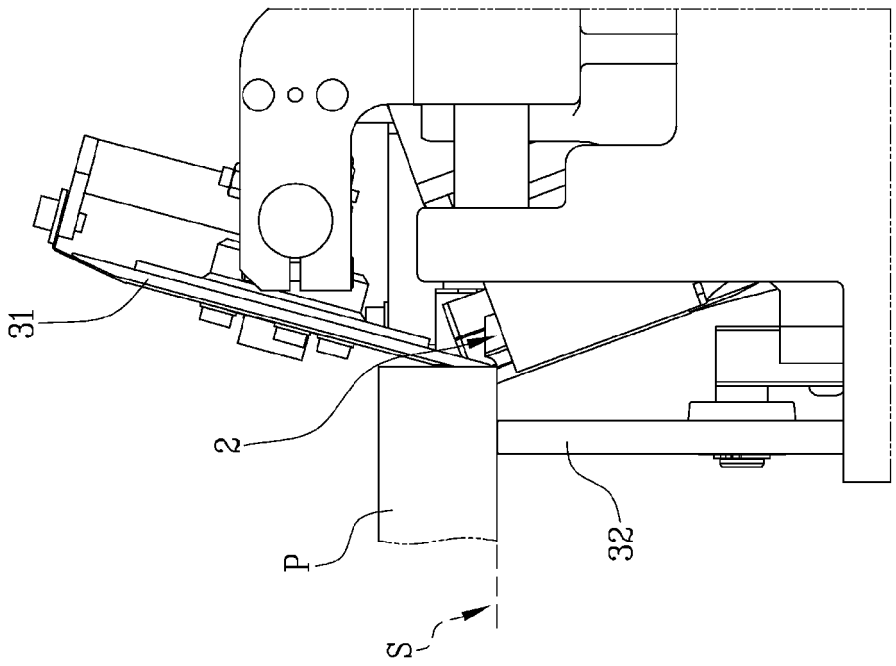
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Fig.4B

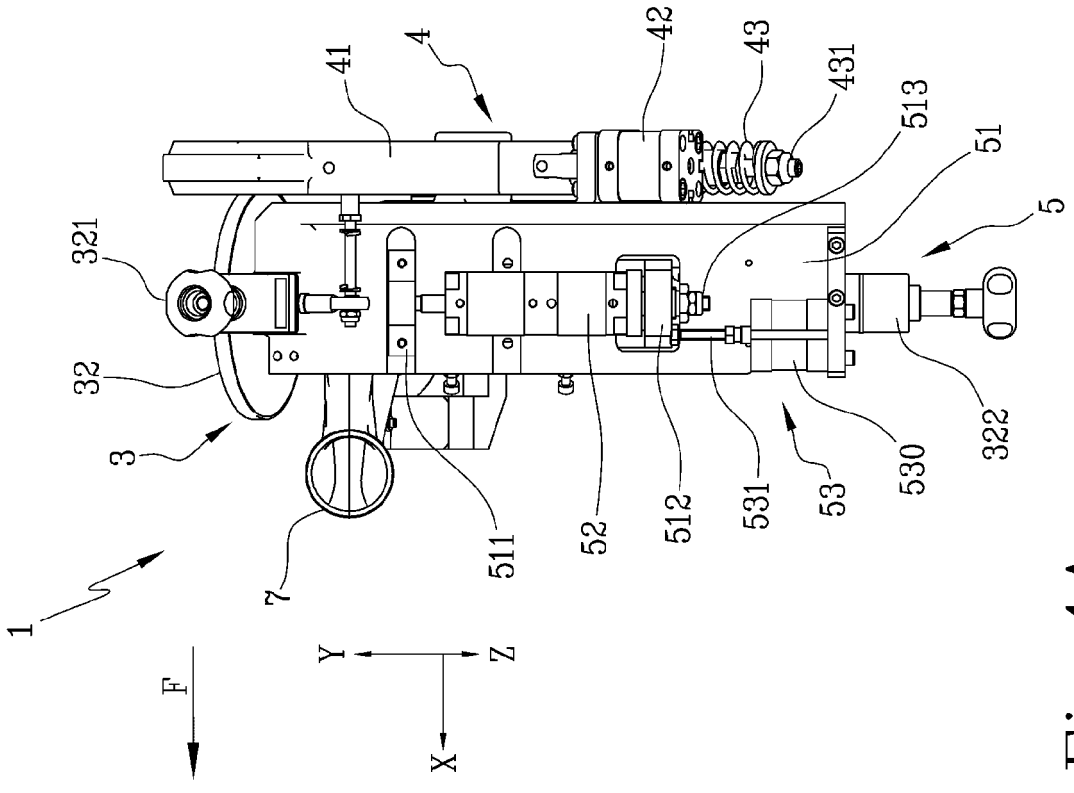
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Fig.4A

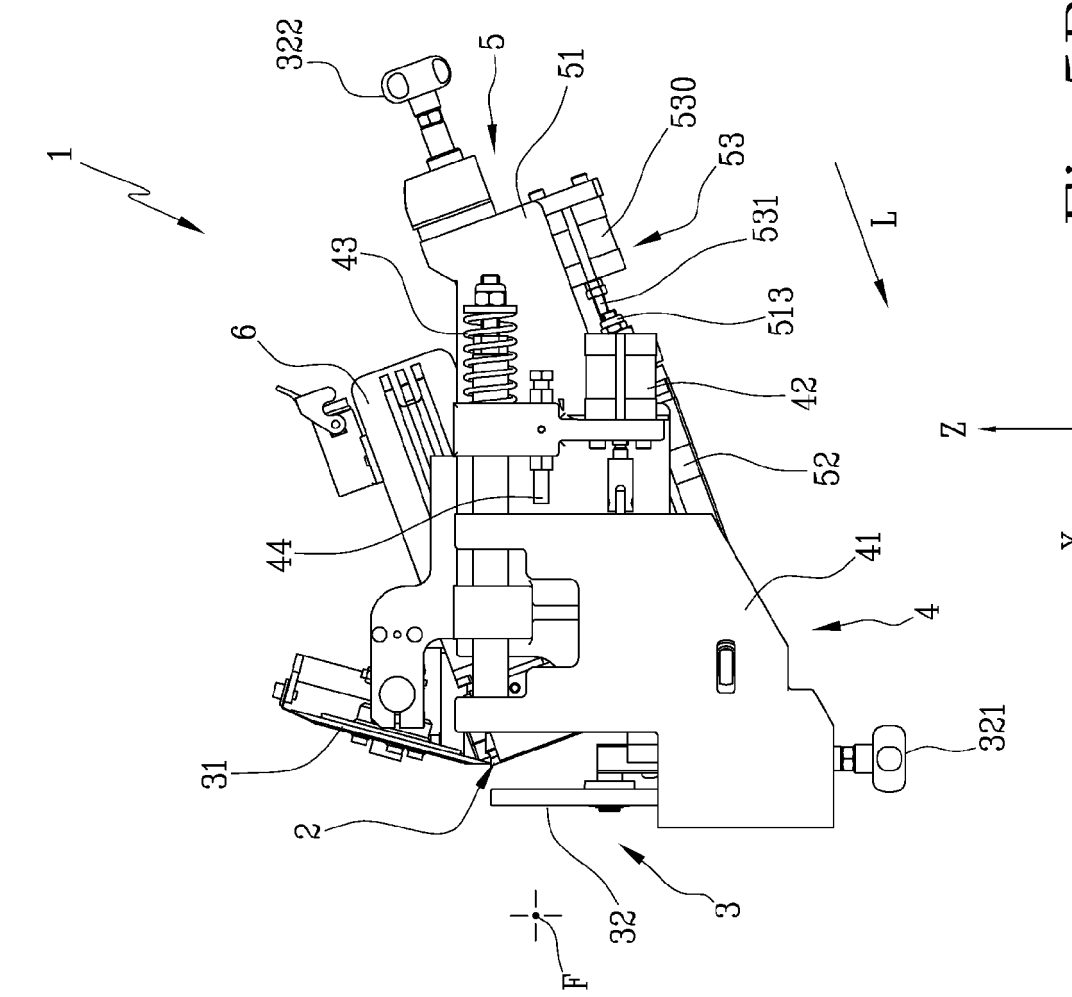
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Fig.5B

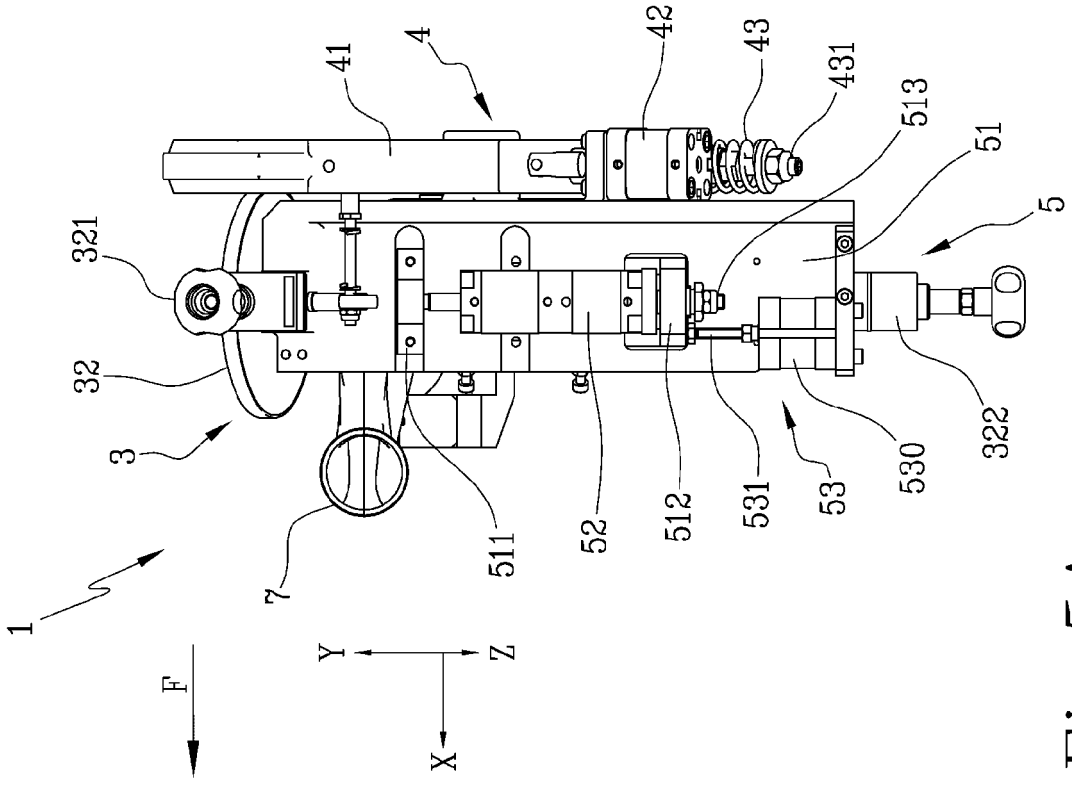
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Fig.5A

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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 3846

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* column 6, lines 7-10 * * column 5, line 58 - column 6, line 10 * * column 6, line 57 - line 67 * * figures *	7-9	
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A	* the whole document *	7-9	
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A	* paragraph [0012] * * claims; figures *	7-9	
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A	* claims; figures *	2,3,5-10	B27D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 December 2024	Hamel, Pascal

CATEGORY OF CITED DOCUMENTS

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