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(54) **METHOD FOR MACHINING PANELS AND MACHINE TO CARRY OUT SUCH A METHOD**

(57) The present invention relates to a method for working panels (P1,...,Pn), such as cutting, drilling and/or milling of panels (P1,...,Pn), wherein said panels can be made of wood, plastic, fiberglass, aluminum and the like, by means of a working machine (1), wherein said method comprises the following steps: A. displaying a working program (W1,..,Wn) from a plurality of working programs (W1,..,Wn), wherein each working program (W1,..,Wn) is associated with a respective geometric shape (S1,..,Sn) to be created with one or more panels (P1,...,Pn); B determining the number of said panels (P1,...,Pn) necessary to obtain the respective desired geometric shape (S1,..,Sn) associated with the displayed working program (W1,..,Wn); and C. providing a plurality of positioning parameters (L1,...,Ln) for each panel (P1,...,Pn) for carrying out a sequence of working operations (T1,..,Tn) on said panels (P1,...,Pn).

The present invention also relates to a machine (1) for machining panels (P1,...,Pn).

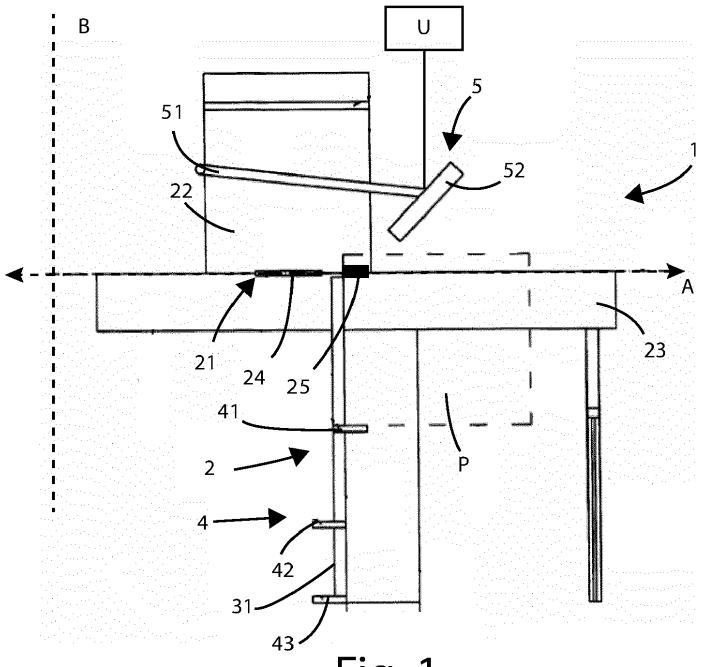

Fig. 1

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Description

[0001] The present invention relates to method for machining panels and a machine to carry out such a method.

Field of the invention

[0002] In more detail, the invention relates to a method of the above type, designed and implemented in particular for performing sequential and complex cuts of panels made of wood, plastic, fiberglass, aluminum, and the like.
[0003] In the following, the description will be directed to the use of cutting machines equipped with one or more circular blades, but it is clear that the same should not be considered limited to this specific use.

Prior art

[0004] Cutting machines for the sequential cutting of wooden panels by operators are currently known.
[0005] In particular, said machines typically comprise a supporting plane, for supporting a piece to be cut, having a slot, and a circular, rotating cutting blade arranged in said slot, to cut, generally in a through way, wooden panels.
[0006] The supporting plane comprises a fixed half-plane and a movable half-plane, also called carriage, movable along a direction parallel to said fixed half-plane.
[0007] The cutting machines according to the prior art also comprise one or more stop bars and abutments, slidingly movable on said abutment bars, able to allow, together with said abutment bar, the correct positioning of the piece to be machined.
[0008] Furthermore, known machines comprise control panels, typically equipped with a display and a central control unit, to allow the operator to move and position the panels to be processed on the cutting machine, to perform the desired cuts.
[0009] In particular, the known solutions allow optimizing and sequencing, by means of programs or applications installed in the central control unit, the cuts on the panels to be worked, so as to minimize the waste of material and save working time.
[0010] A drawback of the known solutions is that they do not allow the operator to create new and original working programs with respect to the predefined ones already installed or pre-stored in the central control unit of the cutting machines.
[0011] In fact, the operator can only select the desired working program from a series of programs, associated with respective predefined shapes, to perform regular cuts on the panels to be machined. Therefore, the operator can only use these predefined working programs.

Scope of the invention

[0012] In light of the above, it is, therefore, scope of the present invention to overcome the disadvantages mentioned above, providing a method for machining panels, which allows complex sequential cuts to be made on the panels to be processed, facilitating the operations performed of the operator, and limiting any positioning errors.
[0013] Another object of the invention is to provide a method for processing panels, which allows the operator to create new working programs with respect to the predefined working programs already present in the central control unit of the cutting machines.
[0014] A further object of the present invention is to provide the tools necessary for carrying out the method and the apparatuses which carry out this method.

Object of the invention

[0015] It is, therefore, specific object of the present invention a method for working panels, such as cutting, drilling and/or milling of panels, wherein said panels can be made of wood, plastic, fiberglass, aluminum and the like, by means of a working machine, wherein said method comprises the following steps: A. displaying a working program from a plurality of working programs, wherein each working program is associated with a respective geometric shape to be created with one or more panels; B. determining the number of said panels necessary to obtain the respective desired geometric shape associated with the displayed working program; and C. providing a plurality of positioning parameters for each panel for carrying out a sequence of working operations on said panels.
[0016] Advantageously according to the invention, said working machine may comprise at least one stop bar and positioning means, movable along said at least one stop bar, said method being characterized in that said step C comprises the following sub-step: C1. providing a graphic indication of the positioning of each of said panels with respect of said at least one stop bar and said positioning means, on the basis of said working program displayed in said step A.
[0017] Conveniently according to the invention, said method may comprise the further step: D. recording a personalized working program to be added to said working programs.
[0018] Always according to the invention, said step D may comprise the following sub-step: D1. entering the numerical values of one or more positioning parameters or parametric relationships between said numerical operating values for carrying out the different workings of said panels of each working step of said personalized working program.
[0019] Still according to the invention, said step D may comprise the following sub-step: D2. associating a graphic positioning indication to each one of said panels of said personalized working program for each working step.
[0020] Advantageously according to the invention, said step D may comprise the following sub-step: D3. acquiring images and/or videos associated with each

working step during the recording of said personalized working program.

[0021] Always according to the invention, said sub-step D3 the acquisition of images may be carried out by means of a mobile device, such as a camera, a tablet, or a smartphone, and the acquired images or videos are stored on a logic control unit of said working machine.

[0022] Conveniently according to the invention, in said sub-step D3 the acquisition of images may be carried out by means of an image acquisition unit, that associates one or more images and/or videos with the steps of the personalized working program.

[0023] Always according to the invention, said positioning parameters may be are selected from: the inclination of a cutting blade with respect to a supporting plane and/or the inclination of an engraving with respect to said supporting plane; the height adjustment of said cutting blade; the height adjustment of said engraving blade; the adjustment in translation of said engraving blade along an axis parallel to the rotation axis of said cutting blade; the adjustment in translation of said cutting blade along an axis parallel to the rotation axis of said cutting blade; the adjustment of the engraving thickness on each panel by means of said engraving blade; the position of a parallel guide; the inclination of said stop bar on which each panel to be worked or to be cut with respect to the cutting line of said cutting blade is to be abutted; the position of one or more abutments; a reference angle α for positioning each panel with respect to said cutting blade.

[0024] Still according to the invention, said displaying step A may be carried out by means of a displaying unit, such as a display and the like.

[0025] Advantageously according to the invention, each graphic indication may comprise at least one letter and/or at least one number and/or at least one reference mark on the respective panels to facilitate manual rotation of said panels during the working steps of said working program.

[0026] It is also object of the present invention a working machine for panels, wherein said working machine is a cutting machine comprising a supporting plane for supporting said panels, a circular blade for cutting said panels, installed on said supporting plane, at least one stop bar for positioning said panels on said supporting plane, positioning means arranged on said at least one stop bar, for allowing the positioning of said panels with respect to said at least one stop bar, a displaying unit and a logic control unit, connected to said displaying unit and configured to carry out said method according to any one of the preceding claims.

[0027] Advantageously according to the invention, said supporting plane may comprise a fixed half-plane and a mobile half-plane movable parallel to the fixed half-plane, wherein said circular blade is interposed between said fixed half-plane and said mobile half-plane.

[0028] Always according to the invention, said working machine may comprise an engraving blade for engraving each panel.

[0029] Advantageously according to the invention, said working machine may comprise an acquiring and processing unit, connected to said logic control unit, for acquiring and processing images and/or videos connected with the movement of said panels during the execution of said working programs.

[0030] It is also object of the present invention a computer program comprising instructions which, when the program is executed by a computer, cause the computer to execute the method steps.

[0031] It is also object of the present invention a computer readable storage medium comprising instructions which, when executed by a computer, cause the computer to execute the method steps.

Brief description of the figures

[0032] The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 shows, in a top view, an embodiment of manufacturing a cutting machine, according to the present invention;

figure 2 shows a display of the cutting machine, in which a list of working programs for panels to be machined is displayed;

figure 3 shows the display of the cutting machine, in which the information of a first geometric shape associated with the creation of a respective selected working program is displayed;

figure 4 shows the display of the cutting machine, which shows the number of panels to be machined necessary to create the first geometric shape associated with the respective selected working program;

figure 5 shows the display of the cutting machine, in which the dimensions of a first panel to be machined to create the first geometric shape of the respective selected working program are shown;

figure 6 shows the display of the cutting machine, in which the dimensions of a fifth panel to be machined to create the first geometric shape of the respective selected working program are shown;

figure 7 shows the display of the cutting machine, which shows the numerical values of the operating parameters for making a first cut of the first panel to be machined and a top view of the machine, on which the first panel to be machined is arranged in a first operational position;

figure 8 shows the display of the cutting machine, which shows the numerical values of the operating parameters for making a second cut of the first panel to be machined, on which the first cut was made, and a top view of the machine, on which the first panel to be machined is arranged in a second operating position;

figure 9 shows the display of the cutting machine, which shows the numerical values of the operating parameters for making a third cut of the first panel to be machined, on which the first and second cuts have been made, and a top view of the machine, on which the first panel to be machined is arranged in a third operating position;
figure 10 shows the display of the cutting machine, in which the numerical values of the operating parameters are visualized for carrying out a first cut of the fifth panel to be machined and a top view of the machine, on which the fifth panel to be machined is arranged in a first operational position;
figure 11 shows the display of the cutting machine, which shows the numerical values of the operating parameters for making a second cut of the fifth panel to be machined, on which the first cut was made, and a top view of the machine on which the fifth panel to be machined is arranged in a second operating position;
figure 12 shows the display of the cutting machine, which shows the numerical values of the operating parameters for making a third cut of the fifth panel to be machined, on which the first and second cuts have been made, and a top view of the machine, on which the fifth panel to be machined is arranged in a third operating position;
figure 13 shows the display of the cutting machine, which shows the numerical values of the operating parameters for making a fourth cut of the fifth panel to be machined, on which the first, second, and third cuts have been made, and a top view of the machine, on which the fifth panel to be machined is arranged in a fourth operating position;
figure 14 shows the display of the cutting machine, which shows an example of a new working program for panels to be machined;
figure 15 shows the display of the cutting machine, in which data entry fields of the new working program for the panels to be machined are displayed;
figure 16 shows the display of the cutting machine, in which the numerical values inserted for the new working program for the panels to be machined are shown;
figure 17 shows the display of the cutting machine, which shows a calculation tool for entering the numerical values associated with the new working program for the panels to be machined;
figure 18 shows the display of the cutting machine, which shows the calculation tool for entering further numerical values associated with the new working program for the panels to be machined;
figure 19 shows the display of the cutting machine, which shows the calculation tool for entering other numerical values associated with the new working program for the panels to be machined;
figure 20 shows the display of the cutting machine, in which the numerical values inserted for the new working program for the panels to be machined are shown; and
figure 21 shows the display of the cutting machine, in which a window is displayed for memorizing or deleting the new working program created.

[0033] In the various figures, similar parts will be indicated with the same reference numbers.

Detailed description

[0034] With reference to figure 1, the working machine, wholly indicated with the reference number 1, comprises a supporting plane 2, for supporting a panel P to be cut, having a slot 21, and a circular cutting blade 24, possibly movable through said slot 21 and rotating to cut through said panel P.

[0035] In the embodiment described, the working machine 1 is a cutting machine 1. However, in other embodiments of the present invention, the type of working machine 1 can be different from what is described. For example, the working machine 1 may be a panel drilling or milling machine.

[0036] The supporting plane 2 comprises a fixed half-plane 22 and a mobile half-plane or carriage 23, movable along the direction indicated by the double-pointed arrow A, parallel to the fixed half-plane 22, so as to remain adjacent to it.

[0037] Furthermore, the cutting machine 1 comprises a stop bar 31, arranged perpendicularly to said movable half-plane 23.

[0038] In the embodiment described, said cutting machine 1 comprises one reference bar 31.

[0039] However, in other embodiments, more than one stop bars can be provided, without thereby departing from the scope of protection of the present invention. By way of example, the cutting machine 1 can comprise two or more stop bars arranged parallel to each other.

[0040] Said stop bar 31 can be rotated independently with respect to axes normal to the supporting plane 2, to allow the execution of inclined cuts of said panel P.

[0041] Positioning means or abutment means 4 are slidably arranged on said stop bar 31, to allow positioning of the panel P to be worked on the stop bar 31 and on the supporting plane 2.

[0042] In particular, said positioning means 4 comprise one or more abutments 41, 42, and 43, able to allow, together with said stop bar 31, the correct positioning of the panel P to be worked on the supporting plane 2 before cutting it by means of the circular cutting blade 24.

[0043] In an embodiment of the present invention, said abutments 41, 42, and 43 can be motorized.

[0044] In addition, with reference to figure 1, said cutting machine 1 also comprises a control panel or command panel 5, to allow the operator to select and program the appropriate working program to be performed by means of said machine 1.

[0045] Said control panel 5 is equipped with a support-

ing rod 51 and a display unit 52, such as a screen or a display, fixed to said supporting rod 51. In particular, by means of said supporting rod 51, the display 52 can be moved and positioned manually by the operator (not shown in the figures).

[0046] Furthermore, said control panel 5 comprises interface means (not shown in the figures), such as a keyboard and the like, to allow the operator to manually enter data and/or information associated with the machining of the panels P. In the present embodiment, said display 52 is equipped with said interface means. However, in other embodiments, said interface means can be, for example, separated from said machine 1 and connected to said control panel 5.

[0047] Finally, said cutting machine 1 also comprises a control logic unit U operatively connected with said display 52 by means of a telematic communication network (not shown in the figures) such as, for example, an Internet network, Bluetooth, or the like.

[0048] Said control logic unit U is also programmed in such a way as to execute working programs to carry out complex sequential cuts of the panels P. These working programs can be either "parametric" type programs, in which, once a shape has been chosen and given the main measurements, the installed program automatically calculates the different angles and inclinations of the panels P, making up the complex cut, as well as "non-parametric" programs, in which each operation is fixed on the basis of the numerical values entered by the operator.

[0049] In particular, these applications or programs are designed to create complex geometric shapes, including three-dimensional ones, by carrying out cutting operations on the panels to be worked P, facilitating the operations performed by the operator.

[0050] In one embodiment, said cutting machine 1 can comprise an acquisition and processing unit (not shown in the figures) for acquiring and processing images and/or videos associated with the movement of said panels P1,..., Pn during the execution of the working programs W1,..., Wn.

[0051] In particular, as better explained below, this acquisition and processing unit can be a software module, capable of acquiring the images taken in the various cutting or machining steps in general (such as drilling or milling, for example) by the operator with an image capture device, such as a camera or smartphone. In this latter case, the images or videos acquired from the processing step can be transmitted to the control logic unit U by means of wireless (e.g., Bluetooth®) or wireless transceiver means (not shown in the figures).

[0052] Alternatively, or in addition, said cutting machine 1 can be equipped with an optical image acquisition unit (not shown in the figure), comprising for example a video camera (not shown in the figures), which recognizes the movement of the panels P1, ... , Pn by associating it with the various machining steps.

[0053] Therefore, this acquisition unit, which can be connected to said control logic unit U, is capable of acquiring and processing the images and/or videos in order to supply the graphic and/or parametric information relating to the orientation of the panels P1, ..., Pn or parts of them to be worked (e.g., cut) in the various machining steps for the composition of the geometric shape to be obtained.

[0054] The operation of the method for cutting panels P1,..., Pn by means of the above-described cutting machine 1 is as follows.

[0055] When an operator has to perform sequential and complex cuts of panels P1 ,...,Pn, he/she visualizes the display 52 of said control panel 5.

[0056] Initially, as can be seen in figure 2, the display 52 shows various information to the operator.

[0057] In particular, the display 52 shows a plurality of working programs W1,.., Wn associated with respective geometric shapes S1,.., Sn to be created with suitable cutting operations on said panels P1,..., Pn.

[0058] In the embodiment described, said working programs W1,..,Wn are parametric programs selectable by the operator, and said geometric shapes S1,..,Sn are complex two- and three-dimensional geometric shapes. Since these programs are parametric, the user will simply have to enter the measurement of some parameters, so that the program will autonomously calculate the various angles of the profiles of each panel. By way of example, if the program relating to the construction of a wooden pyramid was selected, the user should at least enter the desired measurements of the side of the base and the height of the pyramid, in this way the program would automatically calculate the measurements of the four triangular side panels, as well as the angular cuts of the base and side panels, so as to coincide.

[0059] However, in other embodiments, the typology of said working programs W1,..,Wn and of said geometric shapes S1,..,Sn can be different from what is described. In particular, in some embodiments, it is the user who must enter all the parameters necessary for the realization of the desired geometric shape. The working machine 1 will then program the cutting sequences of the panels P1,...,Pn.

[0060] With reference to figure 3, when the operator starts one of said working programs W1,..,Wn, the portions of the geometric shape S1,..,Sn associated with the respective working program W1, are graphically shown on the selected display 52..,Wn.

[0061] In particular, in the present embodiment the selected geometric shape S1,..,Sn is a pyramid S1 and comprises a plurality of faces S11 and a base S12. These portions S11, S12 are made by cutting respective panels P1,..,Pn.

[0062] As can be seen from figure 3, the operator can modify the dimensions of this pyramid S1 according to needs. In more detail, the operator can indicate the dimensions such as, for example, side, base, height, thickness of the faces S11 and of the base S12 to be realized.

[0063] With reference to figure 4, on a first area 521 of the display 52 the portions S11, S12 of the pyramid S1

are graphically displayed together with the dimensions of the same portions S11, S12, previously indicated by the operator.

[0064] On the other hand, a second area 522 of the display 52 displays the number of panels P1,...,Pn to be machined, necessary to form the pyramid S1. In particular, said pyramid S1 comprises four faces S11, and a base S12. Therefore, in order to obtain said pyramid S1, five wooden panels P1,...,Pn are required.

[0065] Figure 5 shows the value of a cutting angle of the blade 24 for obtaining the face S11 of the pyramid S1, the height of the inclined side as well as an angle of the inclined side. Similarly, figure 6 shows the dimensions relating to the base S12 of the pyramid S1.

[0066] With reference to figure 7, when the operator starts the working program W1 relating to the pyramid S1, the graphic and parametric indications necessary to sequence the first cut of the first panel P1 are provided on the display 52.

[0067] In particular, the first area 521 of the display 52 shows (on the left portion of the screen 52) the numerical values of respective positioning parameters L1,...,Ln relating to the current state of the cutting machine 1 and (on the right portion of the screen 52) the numerical values of positioning parameters L1,...,Ln suggested by the control logic unit U of the cutting machine 1 for executing the first cut of the working program W1 selected.

[0068] Said positioning parameters L1,...,Ln can include the height of the cutting blade 24, the inclination angle of the cutting blade 24, which in some embodiments can be variable between -46° to +46°with respect to the vertical, which by definition has an angle of 0°, the height of an engraving blade 25 to engrave each panel P1,...,Pn, the inclination angle of the engraving blade 25, the position of the stop bar 31, the angle of inclination with respect to the cutting line, and the positioning of the abutments 41, 42 and 43 with respect to the stop bar 31.

[0069] In particular, in the embodiment described, these positioning parameters L1,...,Ln comprise a first parameter relating to the inclination of the blade 24 with respect to the supporting plane 2, which varies according to the height of the panel P1,...,Pn to be machined, a second parameter relating to the position of a parallel guide (not shown in the figures), a third related parameter or to the position of the abutment 41 and a fourth parameter relating to a reference angle α for the positioning of the panel P1,...,Pn with respect to the cutting blade 24.

[0070] However, in other embodiments, the number and type of said parameters positioning L1,...,Ln can be different from what is described, without thereby departing from the scope of protection of the present invention.

[0071] Furthermore, according to the value of said positioning parameters L1,...,Ln suggested by the control logic unit U, the electrical axes associated with the inclination of the blade 24, the lifting of the blade 24 as well as the movement of the parallel guide move automatically. In the embodiment described, the movement of the stop bar 31 is instead of the manual type.

[0072] In the second area 522, on the other hand, the arrangement of the first panel P1 to be cut on the cutting machine 1 is shown schematically.

[0073] Furthermore, it can be observed that a third portion or area 523 of the display 52 shows the indication of the panel P1,..., Pn in machining. In the specific case, the expression "Pyramid - Face 1/5" indicates the machining of the first panel P1.

[0074] On the other hand, a fourth area 524 of the display 52 shows the indication of the cut T1,...,Tn of said first panel P1 being machined. In this specific case, the expression "Face_Cut1 1/3" indicates the first cut T1 of the first panel P1.

[0075] Therefore, the operator is guided both analytically by means of said positioning parameters L1,...,Ln, and graphically by means of the images shown on the display 51, to execute the specific working program W1,...,Wn selected.

[0076] In particular, the first panel P1 is moved by means of the mobile semi-table 23 after having been positioned against the stop bar 31 and against the abutment 41 to perform the first cut T1 of the first panel P1 by means of the cutting blade 24.

[0077] Similarly to what has been said, with reference to figure 8, the display 52 provides the graphic and parametric indications necessary to sequence the second cut T2 of said first panel P1.

[0078] As can be seen, in this case, the reference bar 31 and, therefore, the first panel P1 are rotated with respect to the position, in which the first cut T1 was made.

[0079] Furthermore, the display of a graphic indication M1,...,Mn for positioning each of said panels P1,...,Pn with respect to the stop bar 31 and said positioning means 4, on the basis of said working program W1,..,Wn selected, is provided. In particular, each graphic indication M1,...,Mn comprises at least one letter and/or at least one number and/or at least one reference sign on the respective panels P1,...,Pn, associated by the working machine 1, to facilitate manual rotation of the panels P1,...,Pn during the machining steps, in order to avoid any manual positioning errors of the same panels P1,...,Pn and, consequently, the waste of material.

[0080] In this way, the operator is able to understand immediately, by directly inspecting the display 52 of the machine 1, whether he has to rotate the respective panel P1,...,Pn with respect, for example, to the stop bar 31 or to the cutting line.

[0081] With reference to figure 8, it appears immediate, in fact, to understand how to arrange the panel P1 in abutment with respect to the cutting line and the stop bar 31. In particular, in the specific case under examination, the graphic indication M1 "F1" can be seen graphically shown on panel P1.

[0082] Figure 9 shows the graphic and parametric indications provided on the display 52 to sequence the third cut T3 of the first panel P1. As can be seen, in this case, the panel P1 orientation changes, as is evident from the reversal of the graphic indication M1 "F1", which remains

in contact with the stop bar 31, but on the opposite side with respect to the previous cutting step shown in figure 8. Consequently, for the operator the risk of mistaking the positioning of the piece or of the panel P1 with respect to the stop bar 31, to the abutments 41, 42, and 43, and in particular to the cutting line, is greatly reduced.

[0083] Similarly, figures 10-13 show the graphic and parametric indications provided on the display 52 to sequence four cuts T1, T2, T3, and T4 of the fifth panel P5 to obtain the base S12 of the pyramid S1. In this case, of course, different graphical indications are used. For example, in figures 10-13 it is shown how to orient the panel P5 with respect to the working machine 1, the stop bar 31, and the abutments 41, 42, and 43 with respect to the movable half-plane or carriage 23 thanks to the graphic indication M5 " F2" shown directly on the surface of the panel P.

[0084] As indicated above, and as can be seen from figure 14, the operator can create and memorize customized working programs (parametric or non-parametric) with respect to the working programs W1,...,Wn already present in the control logic unit U of the machine 1. In particular, the operator can select, on a fifth area 525 of the display 52, the recording of a customized non-parametric working program W1,...,Wn.

[0085] In the image of the display 52 of figure 14 it can be seen how it is possible to adjust the height of the cutting blade 24 for each cut, which in the present case is adjusted by 80 mm in height, i.e. the inclination. As can be seen, in the display 52 shown, the cutting blade 24 is inclined by 0 °. Furthermore, it is also possible to adjust the height and inclination of the engraving blade 25, the one shown smaller in the lower left portion of the screen again in figure 14.

[0086] Generally, the cutting blade 24 and the engraving blade 25 are integral between them in the inclination adjustment, to ensure that the inclination of the two blades 24, 25 is always the same, so as to guarantee an optimal cut of the panels P1,...,Pn.

[0087] In other embodiments, the inclination of the two blades 24, 25 can, however, be managed independently.

[0088] The engraving blade 25 can be further adjusted in translation along an axis B parallel to its axis of rotation and perpendicular to the cutting direction, so as to always ensure perfect alignment with the cutting blade 24 in a plane of rotation of the blades 24, 25. The same translational adjustment along said axis B can also be performed for the cutting blade 24.

[0089] Furthermore, it is possible to adjust the thickness of the cut made with the engraving blade 25.

[0090] In a first embodiment, the engraving blade 25 is provided with a plurality of teeth with a trapezoidal section. In this type of engraving blade 25 the engraving width on the panel P1,...,Pn can vary according to the thickness of the trapezoidal tooth in correspondence with the engraving plane, which corresponds to the supporting plane 2.

[0091] A second embodiment provides, on the other hand, an engraving blade 25 of the double blade type (or with a blade divided into two halves) mechanically coupled and with mechanical or assisted adjustment of its engraving width by means of a movement device. Each single blade is equipped with its own teeth, which when coupled produce a corresponding tooth.

[0092] On the right side of the screen 52, on the other hand, fields are shown, in which the measurements of the geometric shape S1,..,Sn desired after cutting can be entered. As mentioned, the creation of programs is of the "non-parametric" type. Therefore, the user must recalculate the size of the various panels that may be necessary for the creation of the cutting program. In this way, manually or with the help of the program of the working machine 1 (or of the logic control unit U), the position and inclination of the stop bar 31 with respect to the cutting line and of the abutments 41, 42, or 43 are calculated.

[0093] With reference to figure 15, it can be observed how the operator can enter a name and a description for the personalized non-parametric working program W1,...,Wn.

[0094] With reference to figures 16-20, the operator manually enters the desired numerical values, making use, for example, of pre-set calculation means, for the respective desired denominations T1 ,...,Tn. This insertion operation is performed by the operator for each cutting step. Furthermore, in each cutting step, the operator can acquire images of the machining or, and preferably, of the positioning of the panel with respect to the stop bar 31 and to the abutments 41, 42, and 43. Each of the acquired images, which can be only one or more than one for each machining-cutting step, can be loaded by the program and associated precisely with the specific machining step.

[0095] If the working machine 1 was equipped with the image acquisition unit, then the system autonomously, each time a machining step of a panel or piece of the same is recorded, will associate autonomously acquired images to the created working program.

[0096] Finally, as can be seen from figure 21, the operator can store the working program W1,...,Wn created, which will be stored in the list of parametric working programs W1,...,Wn for cutting machine 1 previously defined.

[0097] When the operator has to run the memorized cutting program again, which, as mentioned, is not parametric but with fixed parameter values, he/she can recall it from the program list, which will obviously have been updated with the new memorized program, following the instructions on the video. In each cutting step, in particular, the position of the blade, the inclination of the blade itself, the position of the stop bar 31, and of the one or more abutments 41, 42, and 43 will be indicated. Each step will be accompanied by the images that may have loaded for each machining-cutting step, or from the video that may have been acquired by the image acquisition unit. In this way, the user can add the programs he/she wants by recalling and playing them when necessary.

Advantages

[0098] A first advantage of the method according to the present invention is that of performing complex sequential cuts, to obtain respective complex geometric shapes, on the panels to be worked, facilitating the operations performed by the operator.

[0099] A further advantage of the method according to the present invention is that of allowing the creation of new working programs with respect to the predefined working programs already present in the central control unit of the cutting machines.

[0100] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Method for working panels (P1,...,Pn), such as cutting, drilling and/or milling of panels (P1,...,Pn), wherein said panels can be made of wood, plastic, fiberglass, aluminum and the like, by means of a working machine (1), wherein said method comprises the following steps:

   A. displaying a working program (W1,..,Wn) from a plurality of working programs (W1,..,Wn), wherein each working program (W1,..,Wn) is associated with a respective geometric shape (S1,..,Sn) to be created with one or more panels (P1,...,Pn);
   B. determining the number of said panels (P1,...,Pn) necessary to obtain the respective desired geometric shape (S1,..,Sn) associated with the displayed working program (W1,..,Wn); and
   C. providing a plurality of positioning parameters (L1,...,Ln) for each panel (P1,...,Pn) for carrying out a sequence of working operations (T1,..,Tn) on said panels (P1,...,Pn).

2. Method according to the preceding claim, wherein said working machine (1) comprises at least one stop bar (31) and positioning means (4), movable along said at least one stop bar (31), said method being **characterized in that** said step C comprises the following sub-step:
   C1. providing a graphic indication (M1,...,Mn) of the positioning of each of said panels (P1,...,Pn) with respect of said at least one stop bar (31) and said positioning means (4), on the basis of said working program (W1,..,Wn) displayed in said step A.

3. Method according to any one of the preceding claims, **characterized in that** it comprises the further step:
   D. recording a personalized working program to be added to said working programs (W1,..,Wn).

4. Method according to the preceding claim, **characterized in that** said step D comprises the following sub-step:
   D1. entering the numerical values of one or more positioning parameters (L1,...,Ln) or parametric relationships between said numerical operating values for carrying out the different workings of said panels (P1,...,Pn) of each working step of said personalized working program.

5. Method according to any one of claims 3 or 4, **characterized in that** said step D comprises the following sub-step:
   D2. associating a graphic positioning indication (M1,...,Mn) to each one of said panels (P1,...,Pn) of said personalized working program for each working step.

6. Method according to any one of claims 3 - 5, **characterized in that** said step D comprises the following sub-step:
   D3. acquiring images and/or videos associated with each working step during the recording of said personalized working program.

7. Method according to any one of claims 3 - 6, **characterized in that** in said sub-step D3 the acquisition of images is carried out by means of a mobile device, such as a camera, a tablet, or a smartphone, and the acquired images or videos are stored on a logic control unit (U) of said working machine (1).

8. Method according to any one of claims 6 - 7, **characterized in that** in said sub-step D3 the acquisition of images is carried out by means of an image acquisition unit, that associates one or more images and/or videos with the steps of the personalized working program.

9. Method according to any one of the preceding claims, **characterized in that** said positioning parameters (L1,...,Ln) are selected from:

   - the inclination of a cutting blade (24) with respect to a supporting plane (2) and/or the inclination of an engraving (25) with respect to said supporting plane (2);
   - the height adjustment of said cutting blade (24);
   - the height adjustment of said engraving blade (25);
   - the adjustment in translation of said engraving blade (25) along an axis (B) parallel to the rotation axis of said cutting blade (25);

- the adjustment in translation of said cutting blade (24) along an axis (B) parallel to the rotation axis of said cutting blade (24);
- the adjustment of the engraving thickness on each panel (P1,...,Pn) by means of said engraving blade (25);
- the position of a parallel guide;
- the inclination of said stop bar (31) on which each panel (P1,...,Pn) to be worked or to be cut with respect to the cutting line of said cutting blade (24) is to be abutted;
- the position of one or more abutments (41, 42, 43);
- a reference angle α for positioning each panel (P1,...,Pn) with respect to said cutting blade (24).

10. Method according to any one of the preceding claims, **characterized in that** said displaying step A is carried out by means of a displaying unit (52), such as a display and the like.

11. Method according to any one of the preceding claims, **characterized**
in that each graphic indication (M1,...,Mn) comprises at least one letter and/or at least one number and/or at least one reference mark on the respective panels (P1,...,Pn) to facilitate manual rotation of said panels (P1,...,Pn) during the working steps of said working program (W1,...,Wn).

12. Working machine (1) for panels (P1,...,Pn), wherein said working machine (1) is a cutting machine (1) comprising

a supporting plane (2) for supporting said panels (P1,...,Pn),
a circular blade (24) for cutting said panels (P1,...,Pn), installed on said supporting plane (2),
at least one stop bar (31) for positioning said panels (P1,...,Pn) on said supporting plane (2),
positioning means (4) arranged on said at least one stop bar (31), for allowing the positioning of said panels (P1,...,Pn) with respect to said at least one stop bar (31),
a displaying unit (52) and
a logic control unit (U), connected to said displaying unit (52) and configured to carry out said method according to any one of the preceding claims.

13. Working machine (1) according to the preceding claim, **characterized in that** said supporting plane (2) comprises

a fixed half-plane (22) and
a mobile half-plane (23) movable parallel to the fixed half-plane (22),
wherein said circular blade (24) is interposed between said fixed half-plane (22) and said mobile half-plane (23).

14. Working machine (1) according to any one of claims 12-13, **characterized in that** it comprises an engraving blade (25) for engraving each panel (P1,...,Pn).

15. Working machine (1) according to any one of claims 12-14, **characterized in that** it comprises an acquiring and processing unit, connected to said logic control unit (U), for acquiring and processing images and/or videos connected with the movement of said panels (P1,...,Pn) during the execution of said working programs (W1,...,Wn).

16. Computer program comprising instructions which, when the program is executed by a computer, cause the computer to execute the method steps A-D according to any one of claims 1-11.

17. Computer readable storage medium comprising instructions which, when executed by a computer, cause the computer to execute the method steps according to any one of claims 1-11.

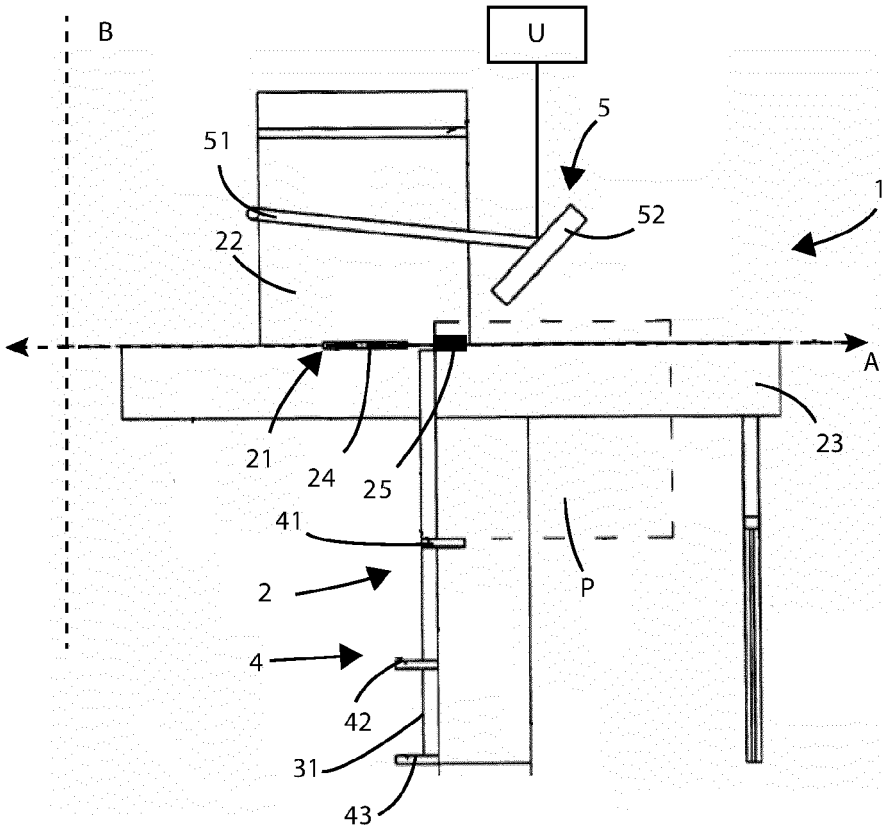
B
U
5
51
52
1
22
A
21
24
25
23
41
P
2
4
42
31
43

Fig. 1

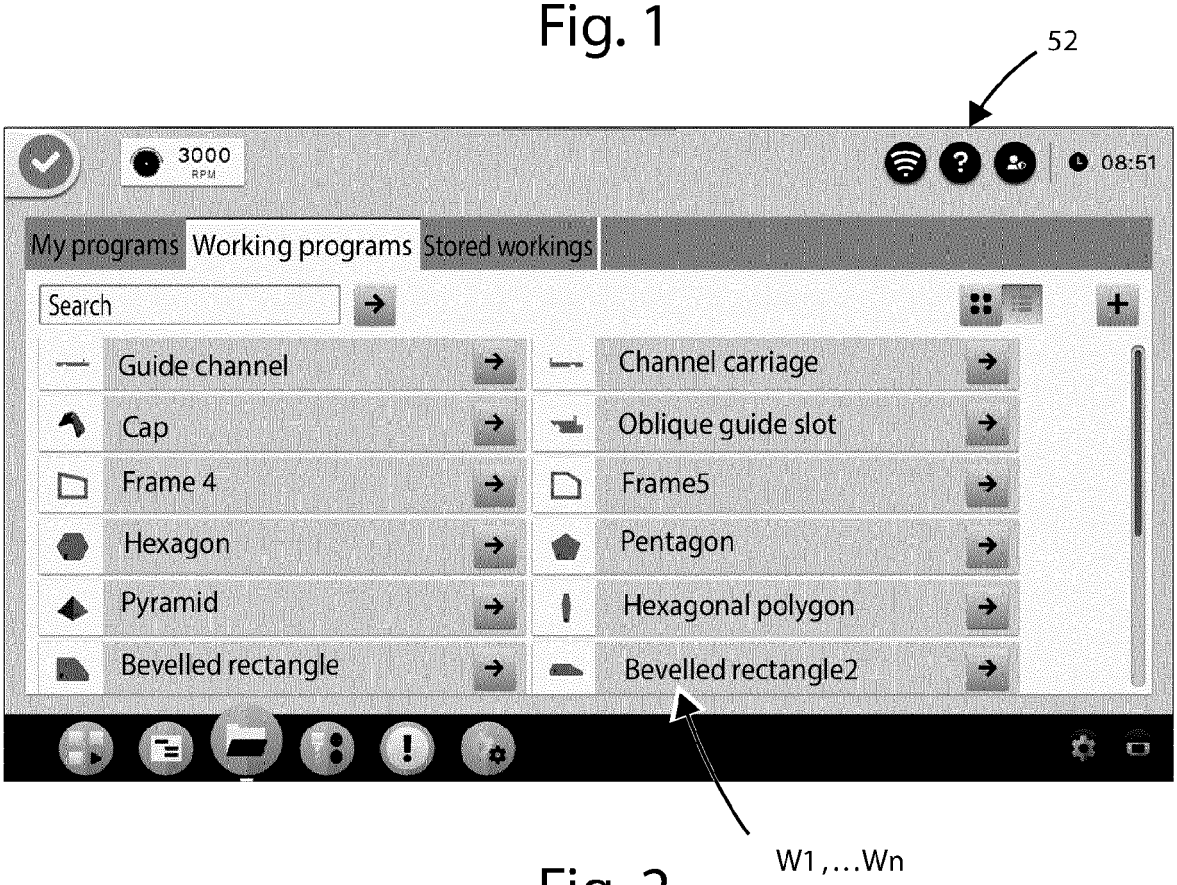
52
3000
RPM
08:51
My programs
Working programs
Stored workings
Search
Guide channel
Channel carriage
Cap
Oblique guide slot
Frame 4
Frame5
Hexagon
Pentagon
Pyramid
Hexagonal polygon
Bevelled rectangle
Bevelled rectangle2
W1,...Wn

Fig. 2

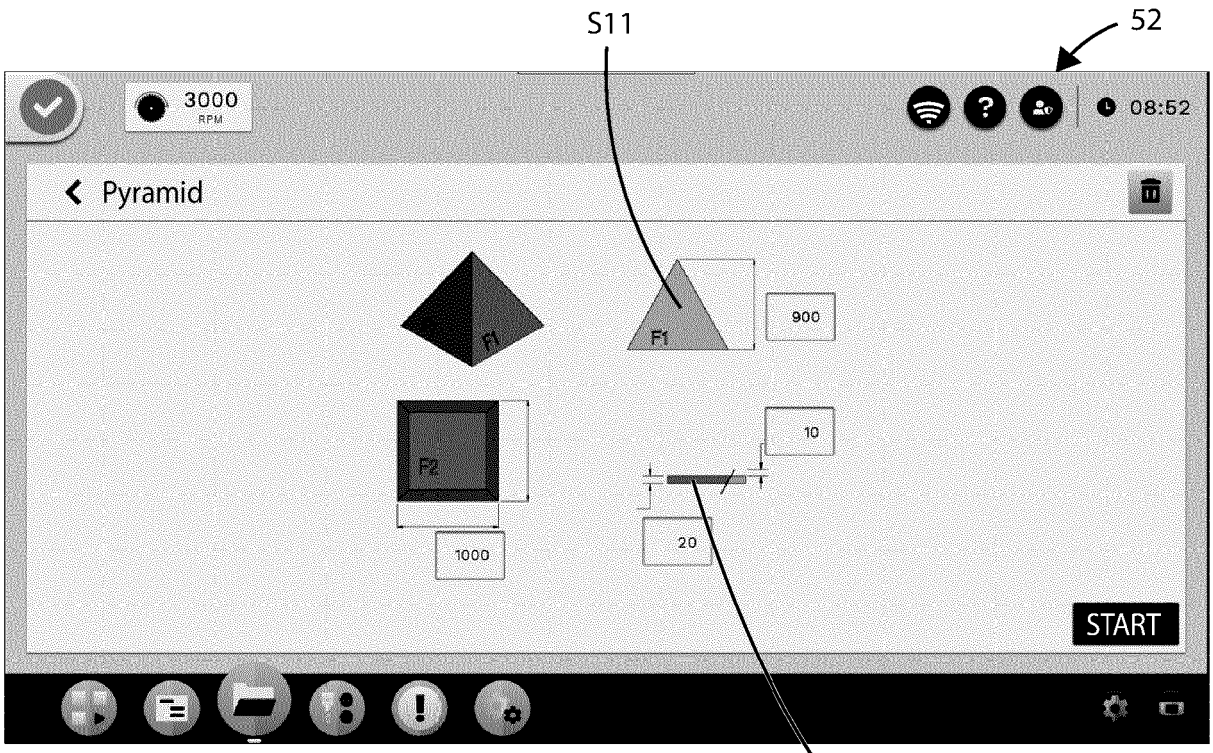
S11
52
3000
RPM
08:52
Pyramid
F1
F1
900
F2
10
1000
20
START
S12

Fig. 3

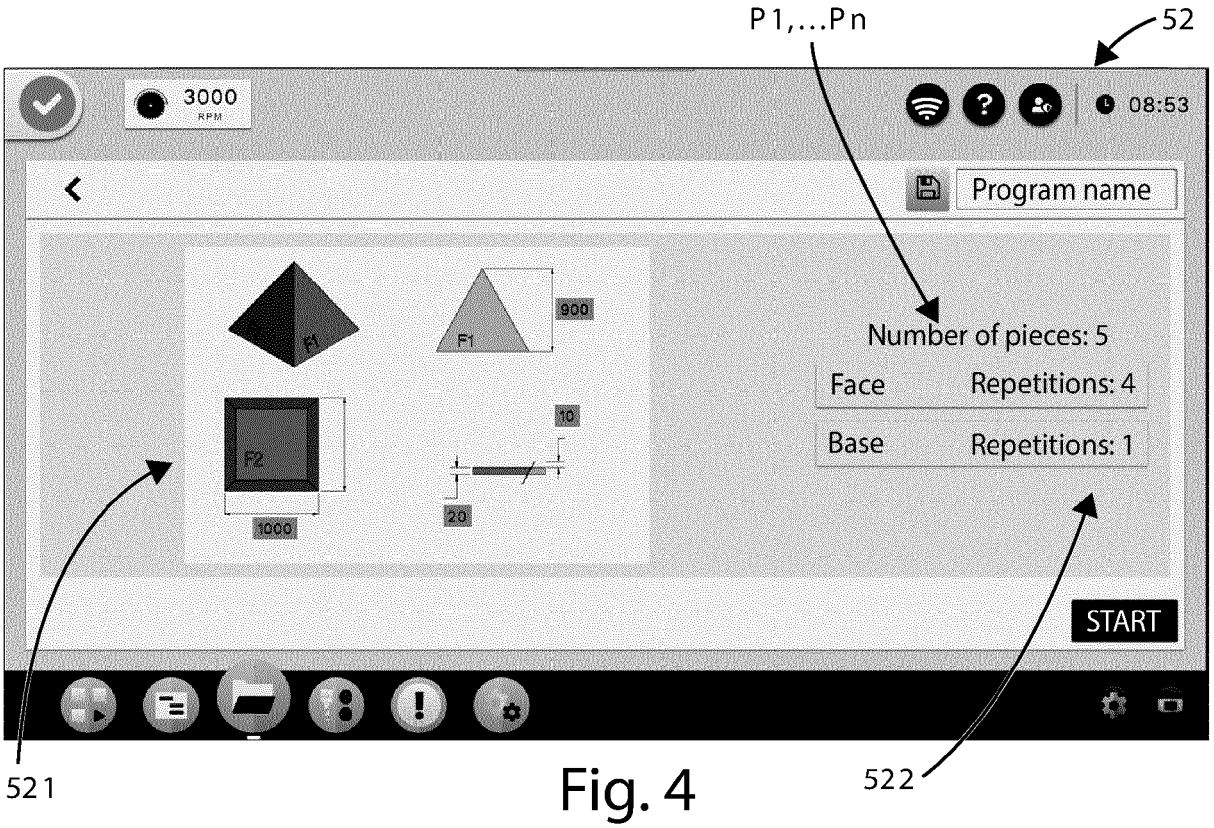
P1,...Pn
52
3000
RPM
08:53
Program name
F1
F1
900
F2
10
1000
20
Number of pieces: 5
Face
Repetitions: 4
Base
Repetitions: 1
START
521
522

Fig. 4

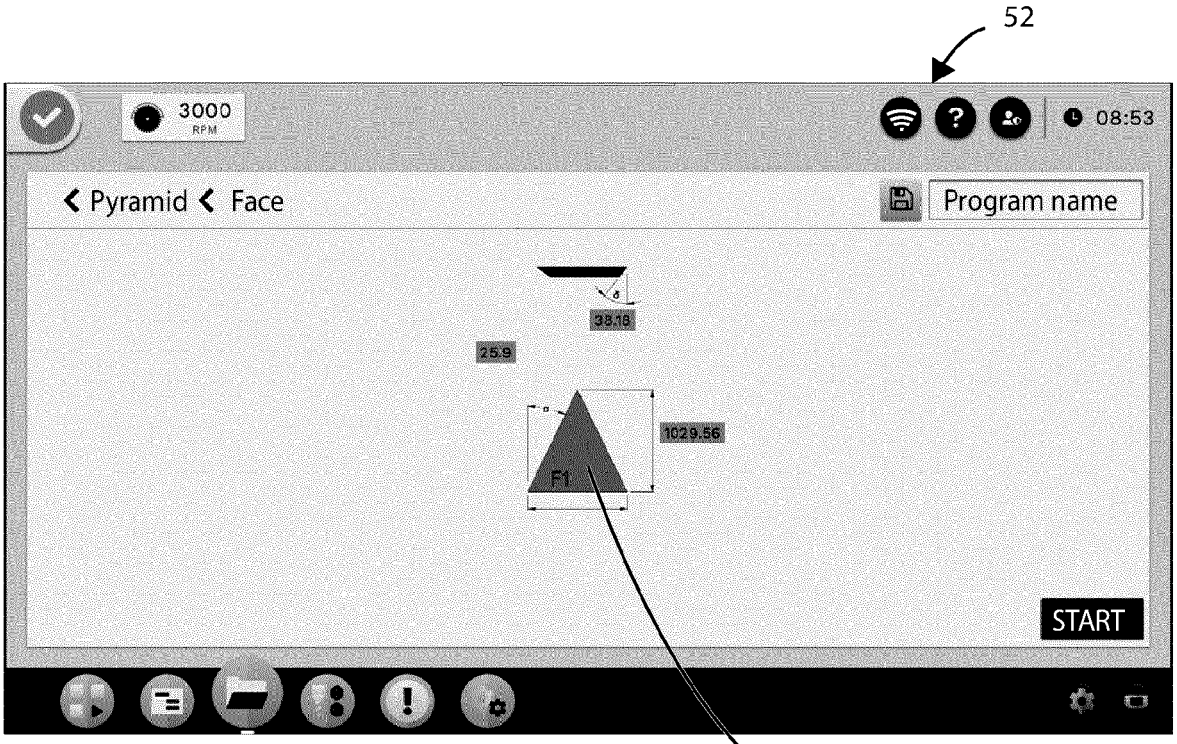
52
3000
RPM
08:53
Pyramid
Face
Program name
38.18
25.9
1029.56
F1
START
S1 1

Fig. 5

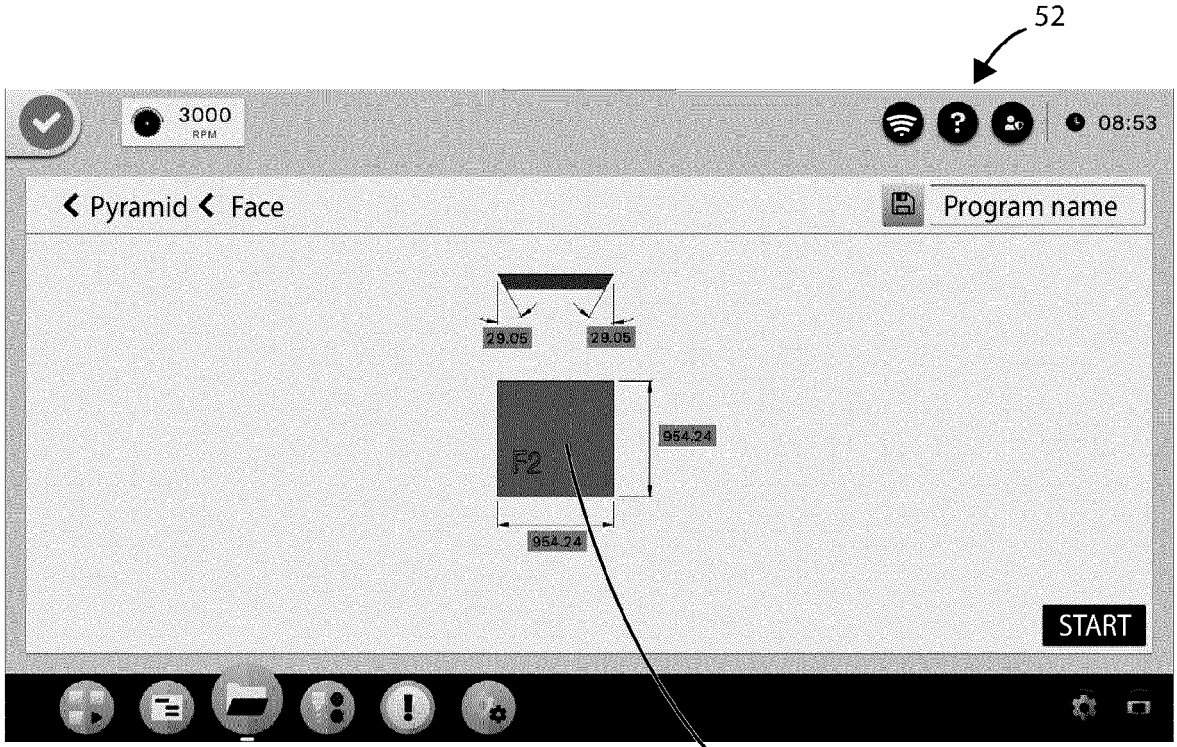
52
3000
RPM
08:53
Pyramid
Face
Program name
29.05
29.05
954.24
F2
954.24
START
S12

Fig. 6

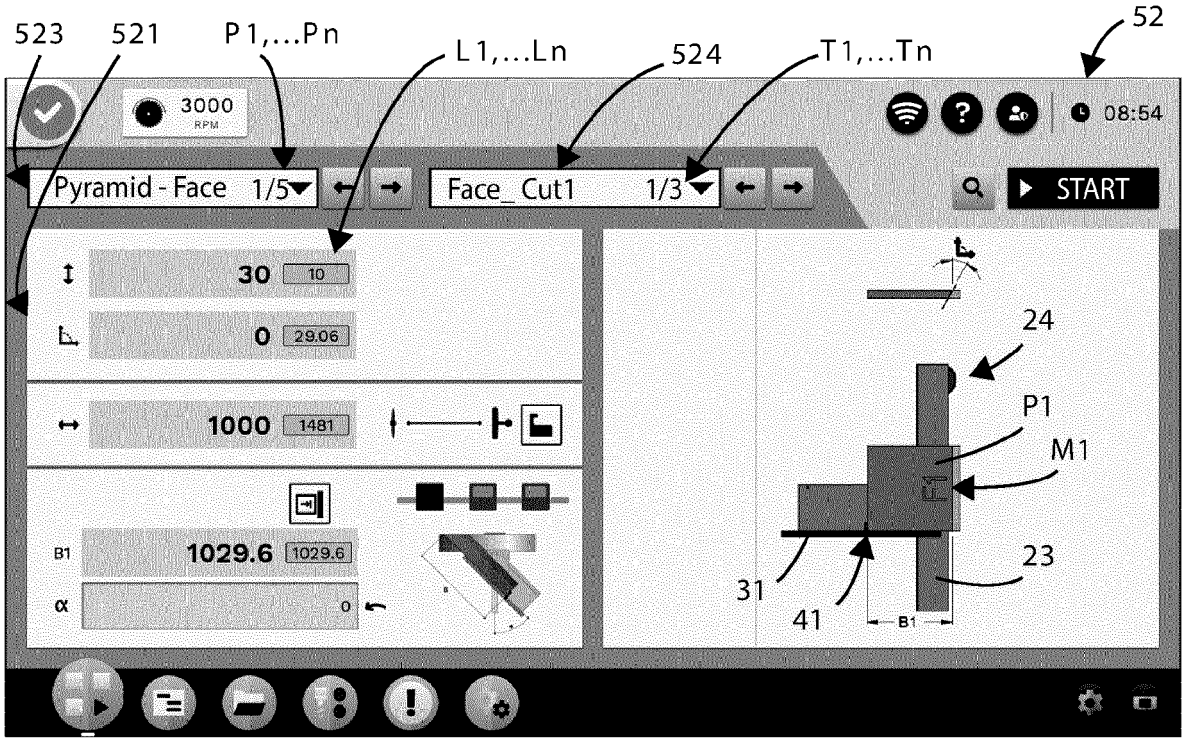
523
521
P1,...Pn
L1,...Ln
524
T1,...Tn
52
3000
RPM
08:54
Pyramid - Face 1/5
Face_ Cut1 1/3
START
30
10
0
29.06
1000
1481
B1
1029.6
1029.6
α
0
24
P1
M1
23
31
41
B1

Fig. 7

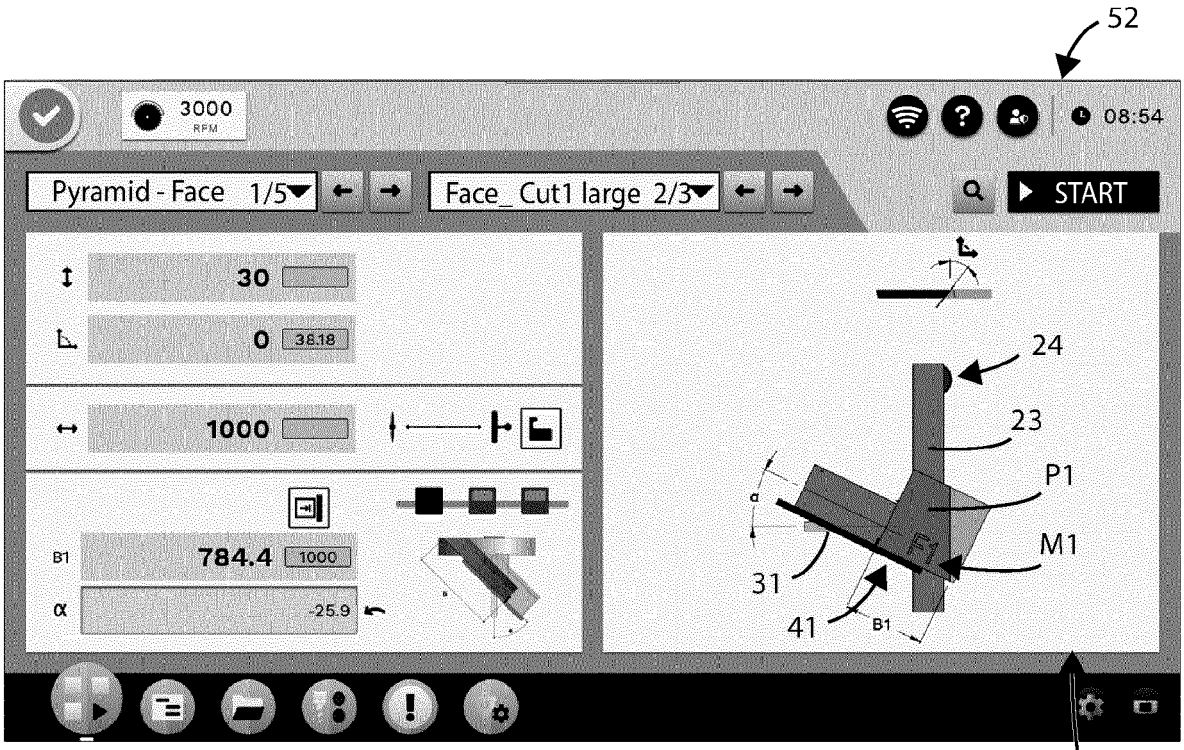
52
3000
RPM
08:54
Pyramid - Face 1/5
Face_ Cut1 large 2/3
START
30
0
36.18
1000
B1
784.4
1000
α
-25.9
24
23
P1
M1
31
41
B1
522

Fig. 8

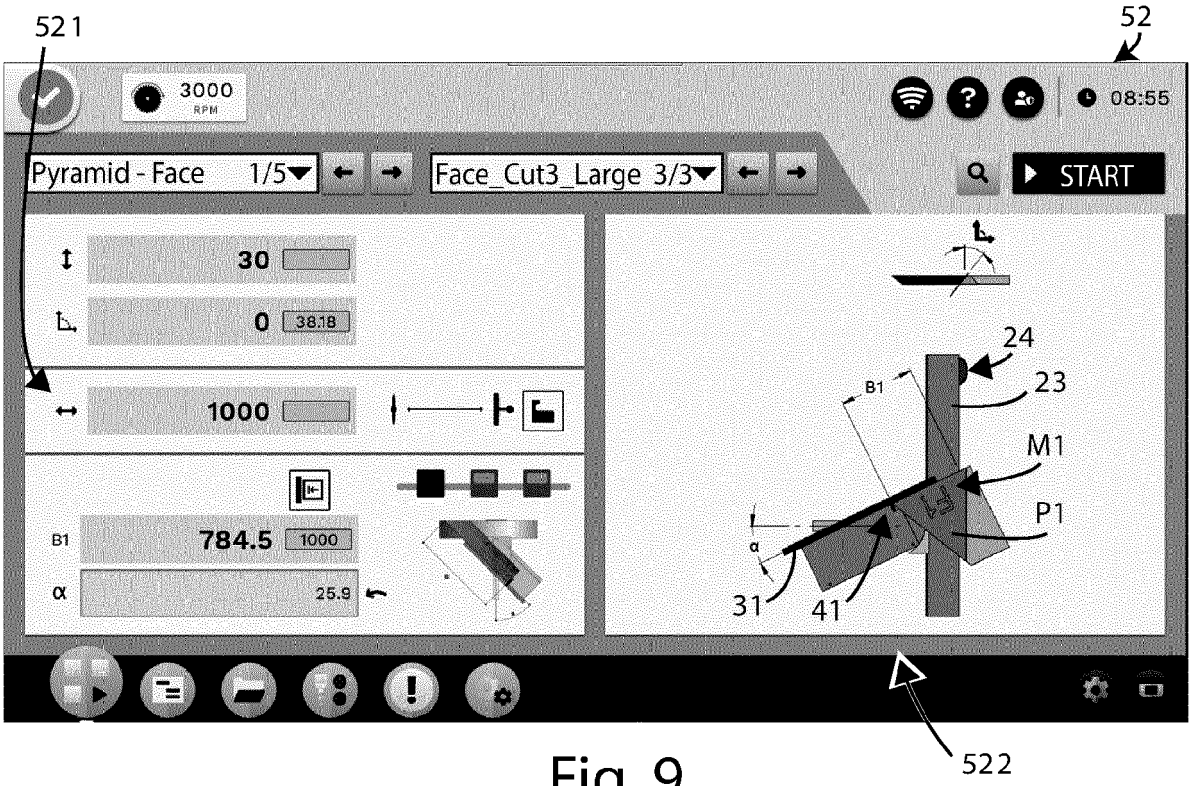
521
52
3000
RPM
08:55
Pyramid - Face 1/5
Face_Cut3_Large 3/3
START
30
0
38.18
1000
B1
784.5
1000
α
25.9
24
23
M1
P1
B1
α
31
41
522

Fig. 9

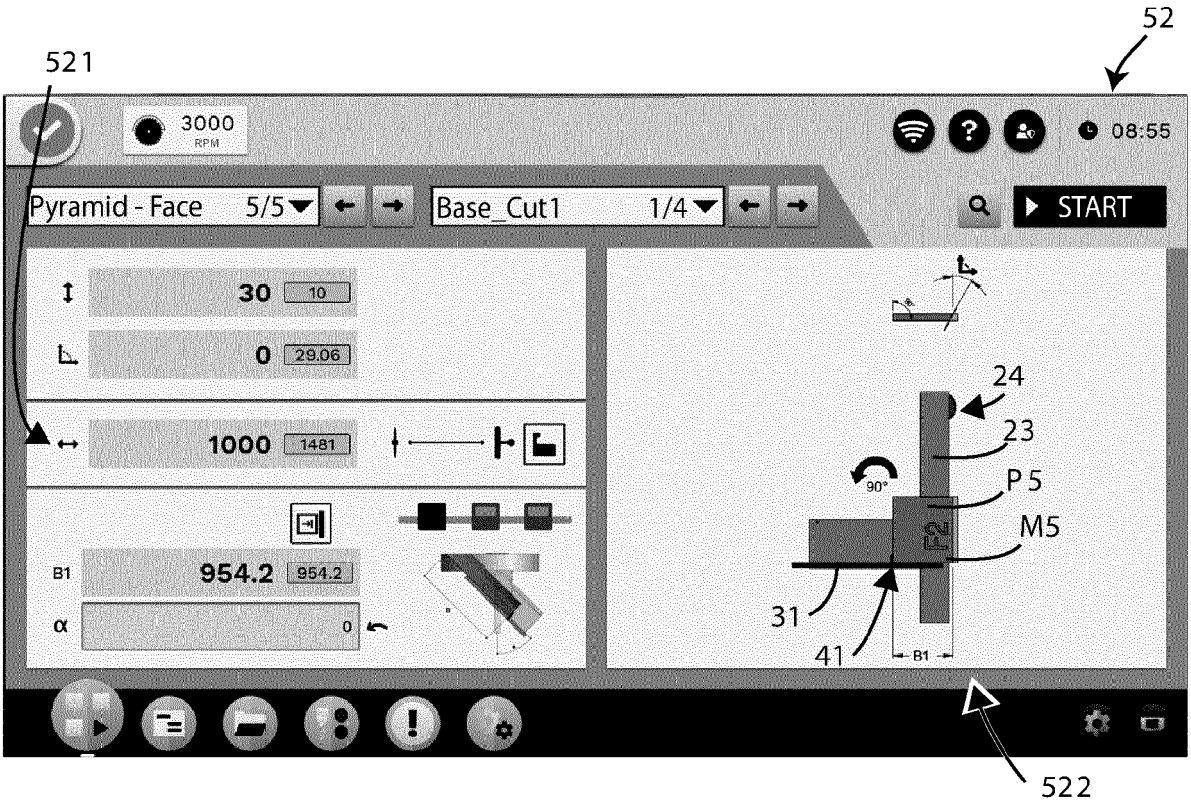
521
52
3000
RPM
08:55
Pyramid - Face 5/5
Base_Cut1 1/4
START
30
10
0
29.06
1000
1481
B1
954.2
954.2
α
0
24
23
90°
P5
M5
31
41
B1
522

Fig. 10

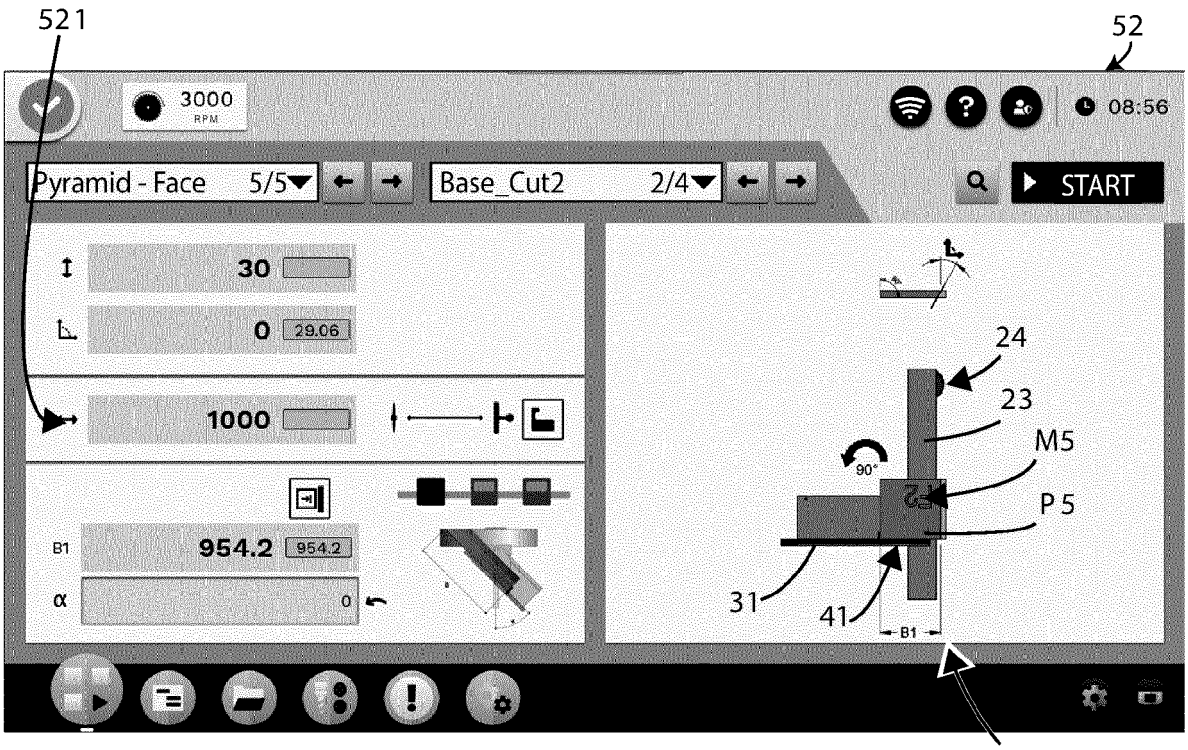
521
52
3000
RPM
08:56
Pyramid - Face 5/5
Base_Cut2 2/4
START
30
0
29.06
1000
B1
954.2
954.2
α
0
24
23
M5
P5
90°
31
41
B1
522

Fig. 11

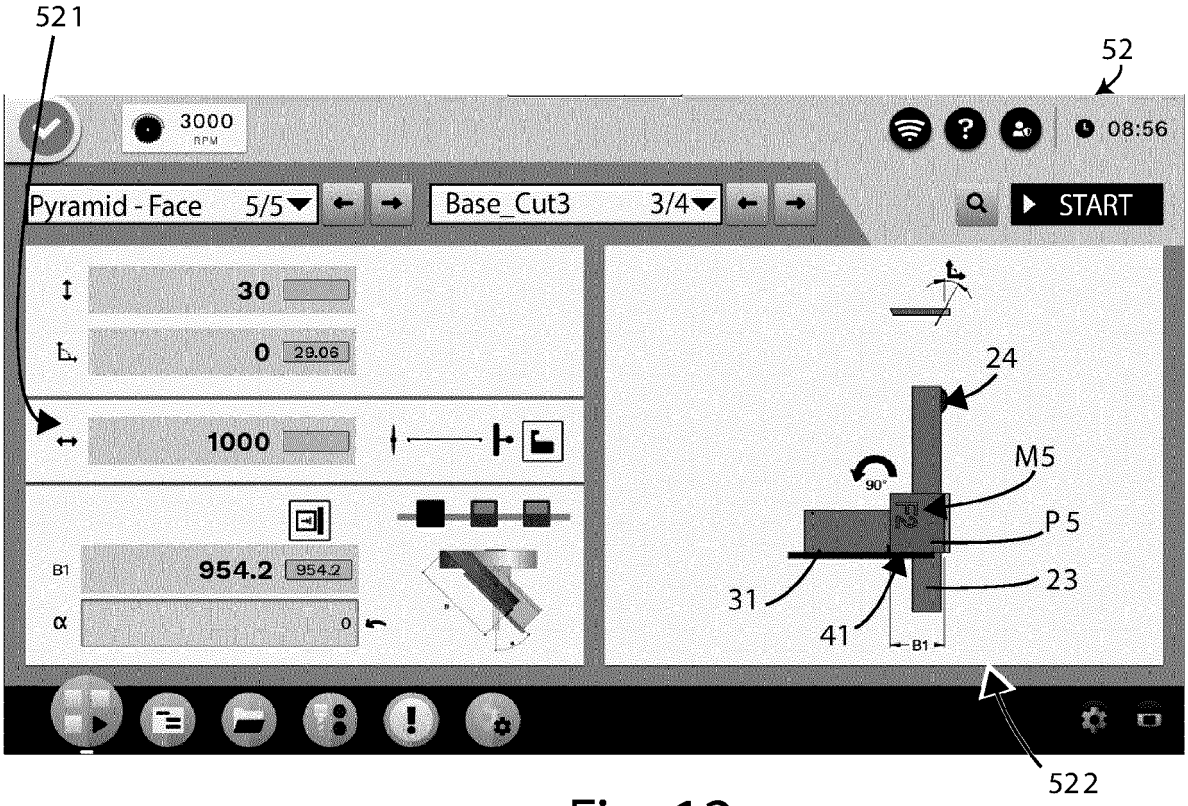
521
52
3000
RPM
08:56
Pyramid - Face 5/5
Base_Cut3 3/4
START
30
0
29.06
1000
B1
954.2
954.2
α
0
24
M5
P5
23
90°
31
41
B1
522

Fig. 12

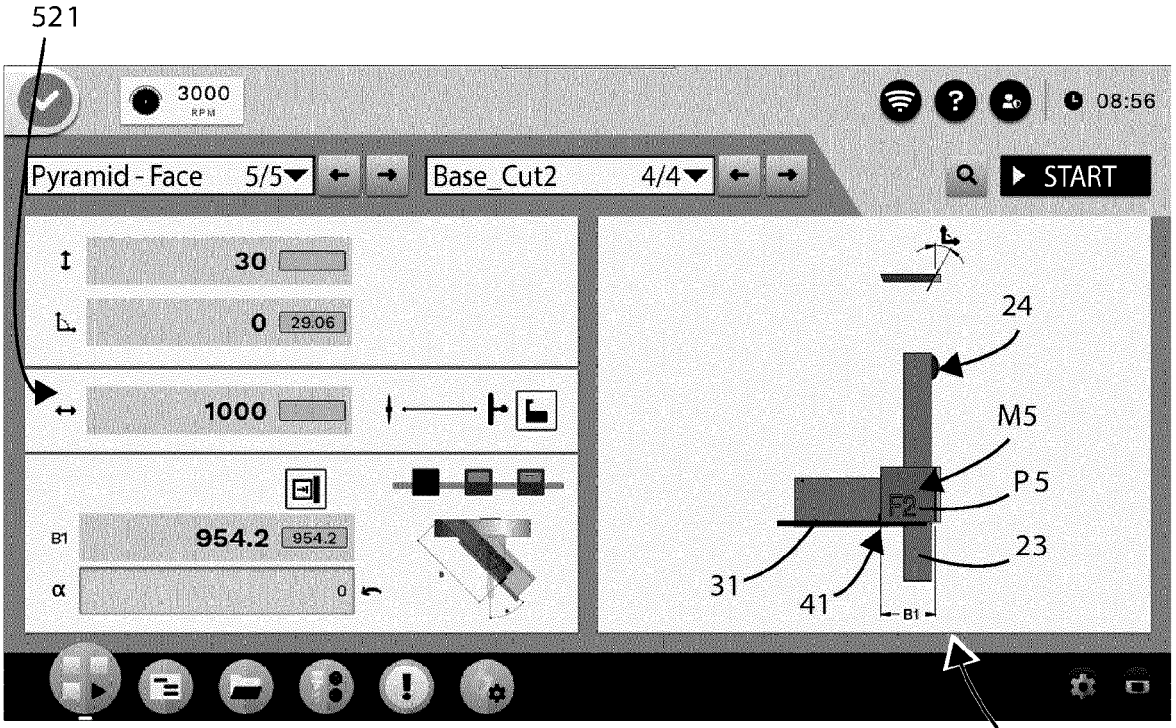
521
3000
RPM
08:56
Pyramid - Face 5/5
Base_Cut2 4/4
START
30
0
29.06
1000
B1
954.2
954.2
α
0
24
M5
P5
F2
23
31
41
B1
522

Fig. 13

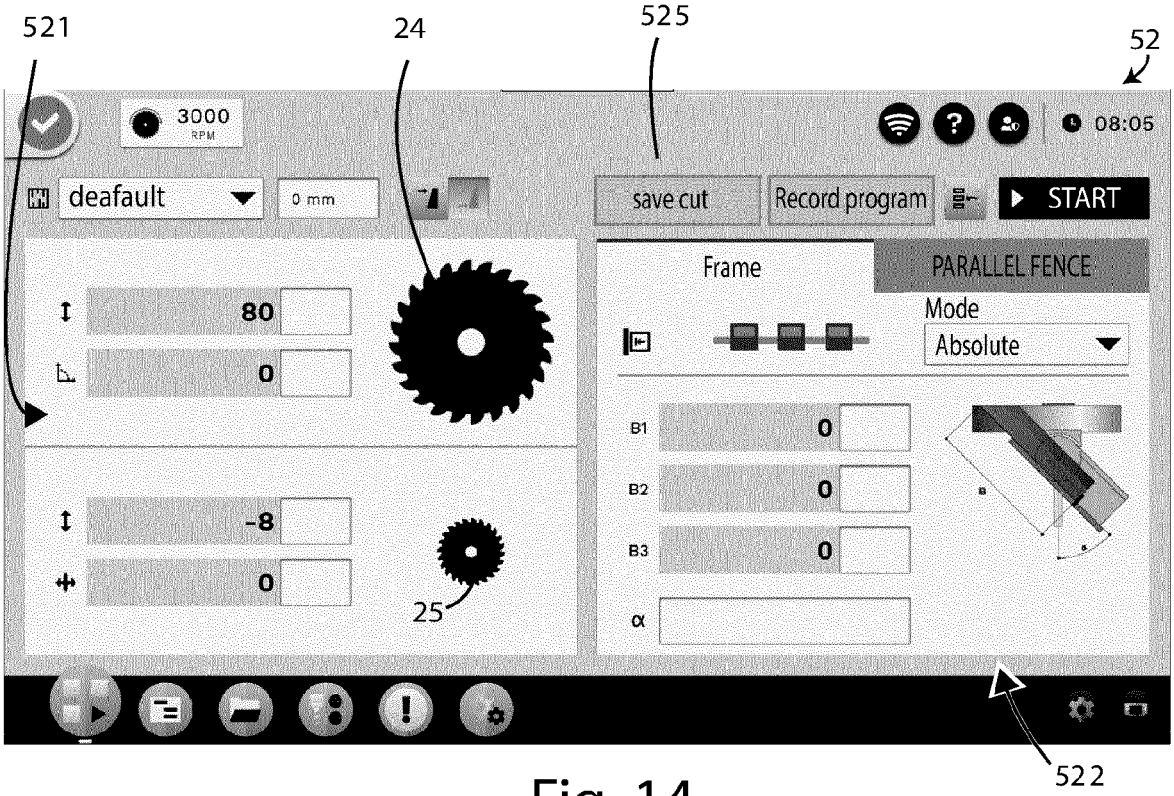
521
24
525
52
3000
RPM
08:05
deafault
0 mm
save cut
Record program
START
Frame
PARALLEL FENCE
Mode
Absolute
80
0
-8
0
25
B1
0
B2
0
B3
0
α
522

Fig. 14

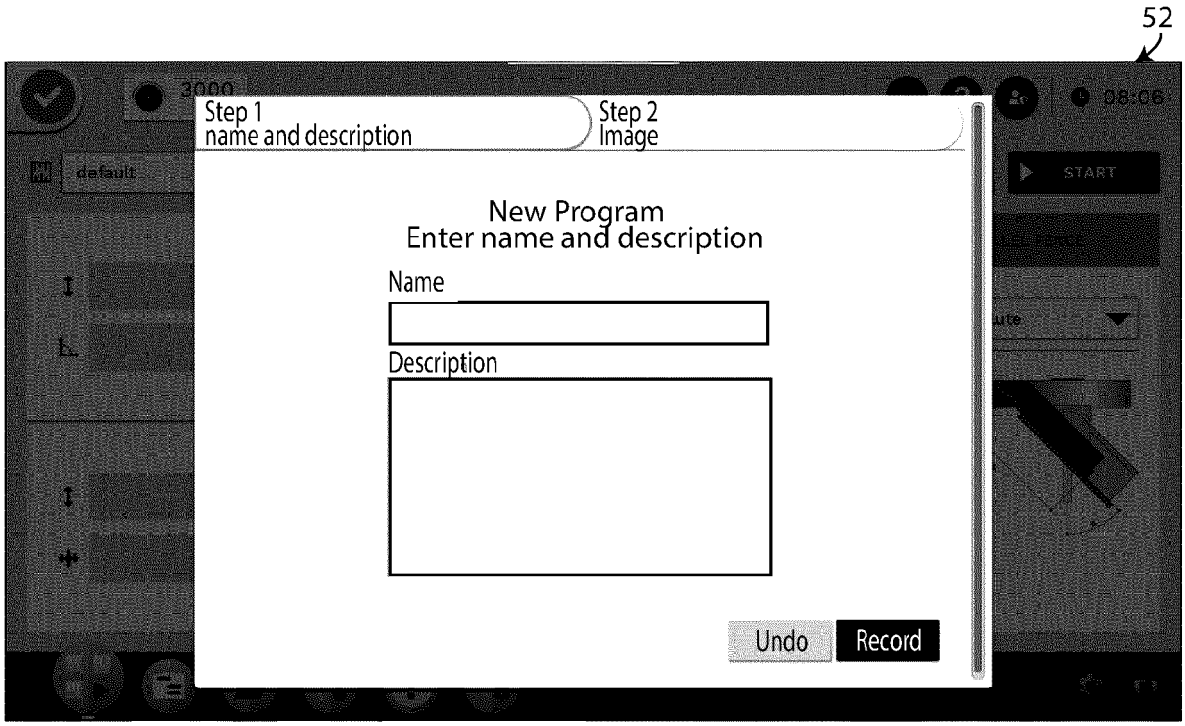
52
Step 1
name and description
Step 2
Image
New Program
Enter name and description
Name
Description
Undo
Record
START

Fig. 15

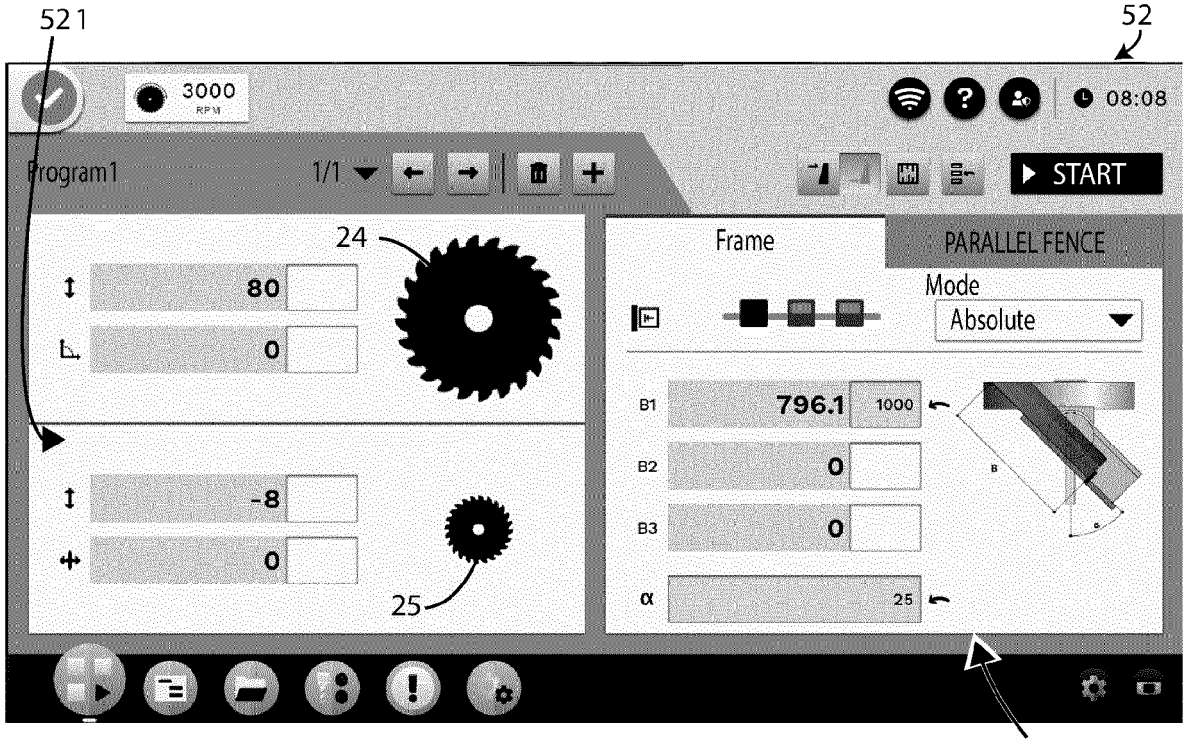
521
52
3000
RPM
08:08
Program1
1/1
START
24
80
0
-8
0
25
Frame
PARALLEL FENCE
Mode
Absolute
B1
796.1
1000
B2
0
B3
0
α
25
522

Fig. 16

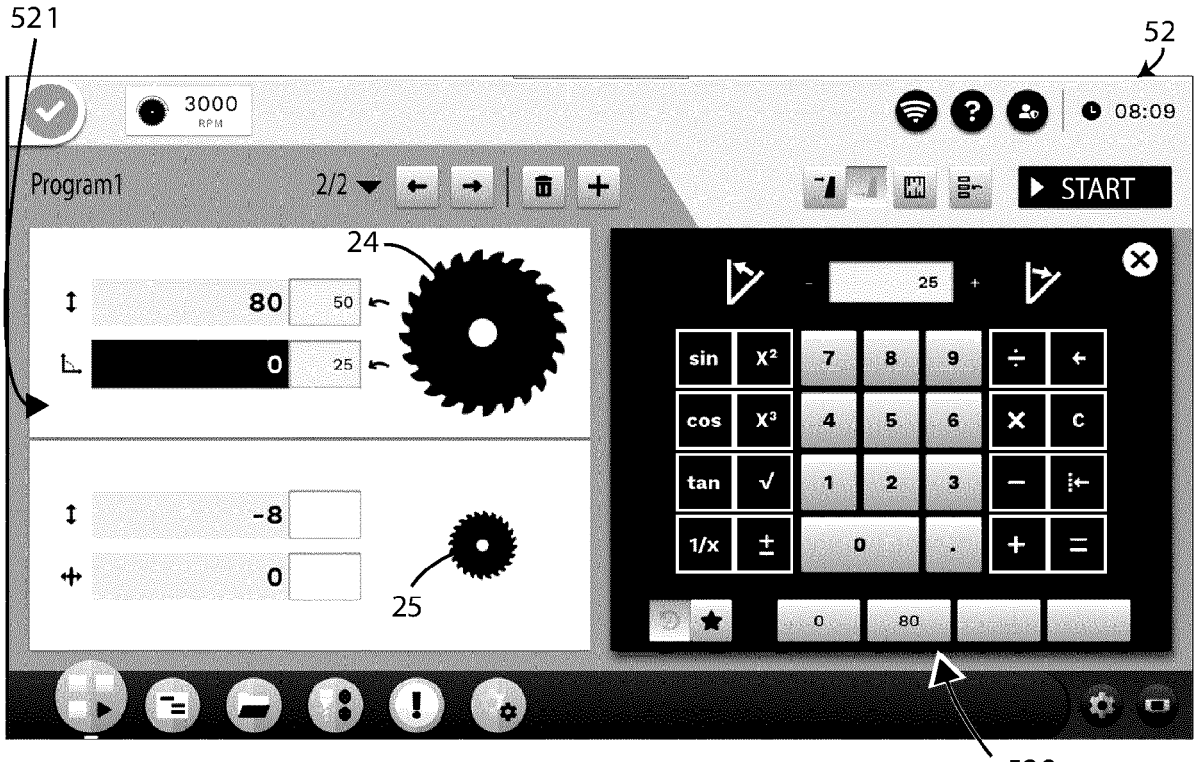
521
52
3000
RPM
08:09
Program1
2/2
START
24
80
50
0
25
-8
0
25
sin
X²
7
8
9
cos
X³
4
5
6
C
tan
√
1
2
3
1/x
±
0
.
0
80
522

Fig. 17

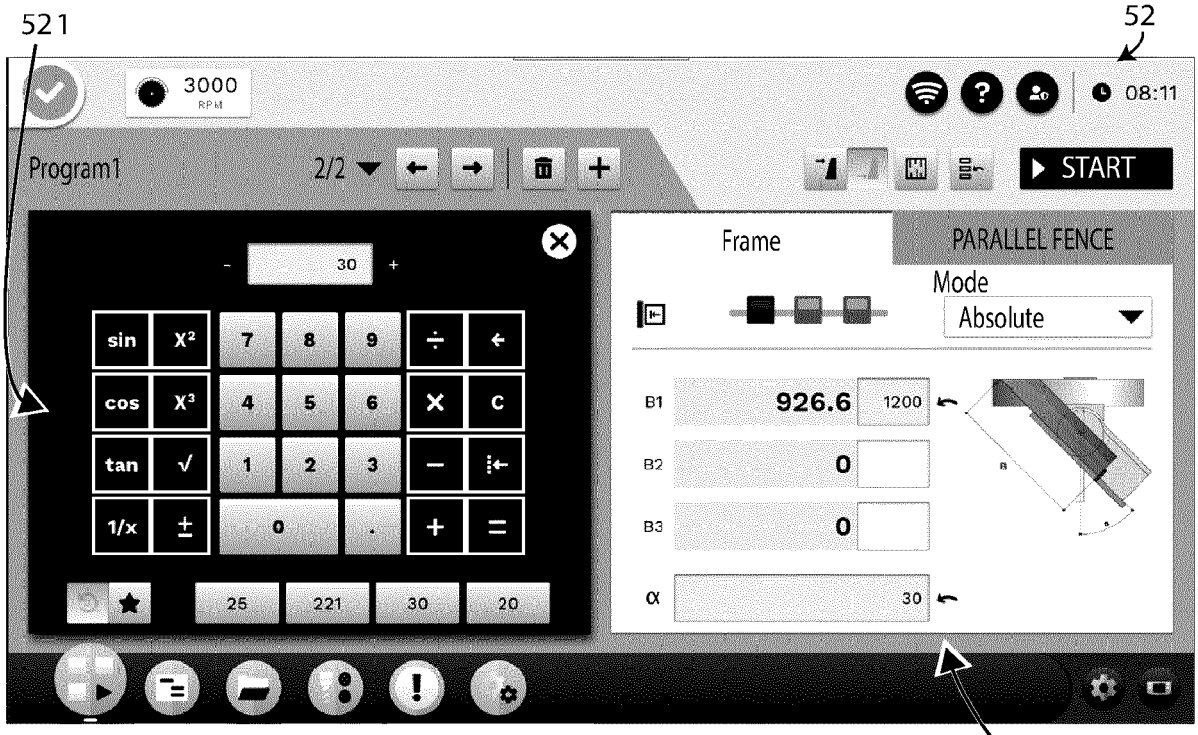
521
52
3000
RPM
08:11
Program1
2/2
START
30
sin
X²
7
8
9
cos
X³
4
5
6
C
tan
√
1
2
3
1/x
±
0
.
25
221
30
20
Frame
PARALLEL FENCE
Mode
Absolute
B1
926.6
1200
B2
0
B3
0
α
30
522

Fig. 18

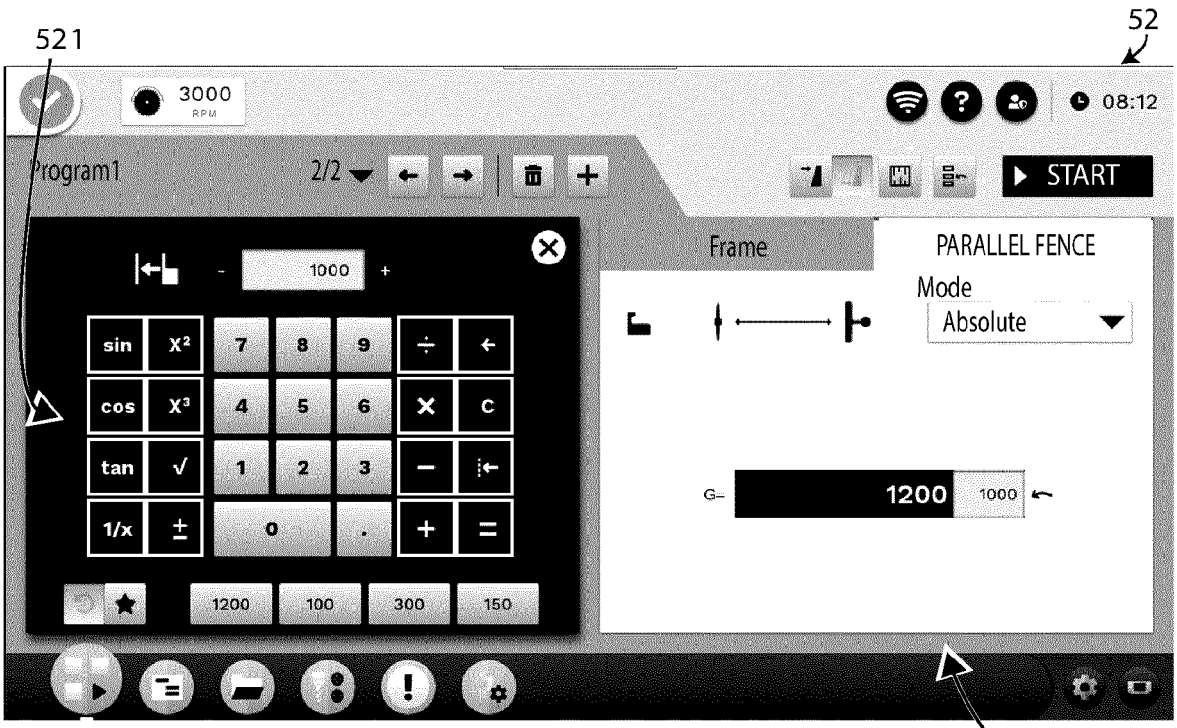
521
52
3000
RPM
08:12
Program1
2/2
START
1000
Frame
PARALLEL FENCE
Mode
Absolute
sin
X²
7
8
9
cos
X³
4
5
6
C
tan
√
1
2
3
1/x
±
0
.
1200
100
300
150
G=
1200
1000
522

Fig. 19

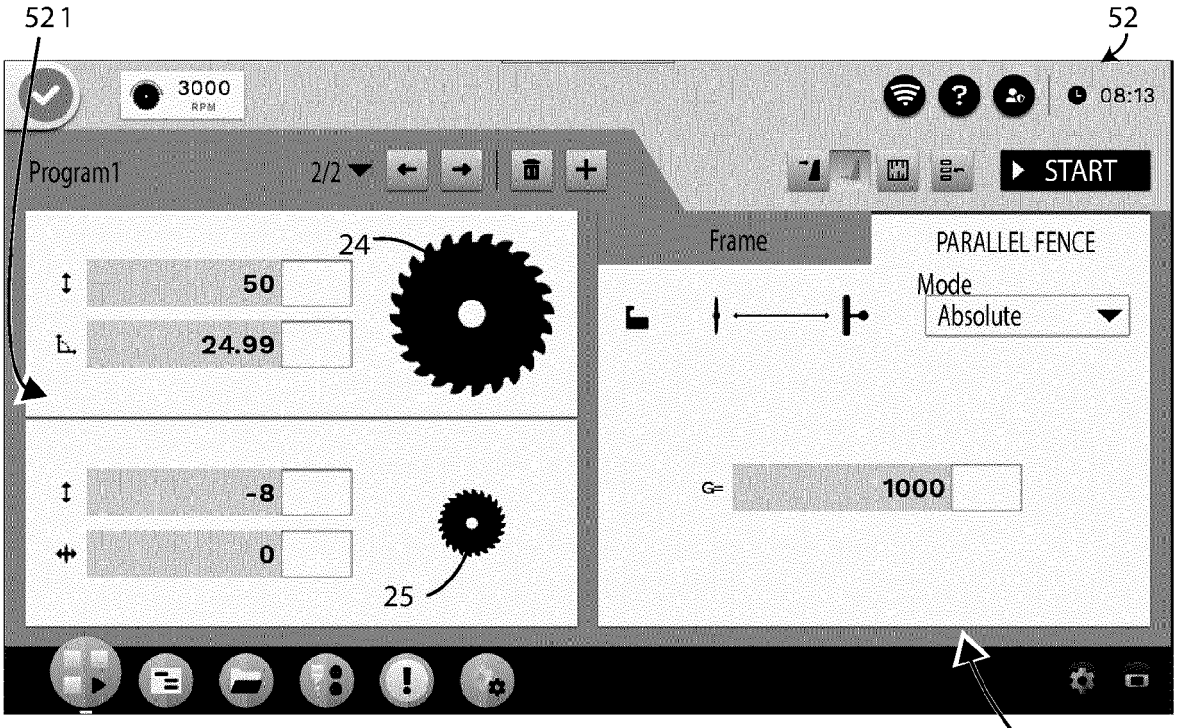
521
52
3000
RPM
08:13
Program1
2/2
START
24
50
24.99
Frame
PARALLEL FENCE
Mode
Absolute
-8
0
25
G=
1000
522

Fig. 20

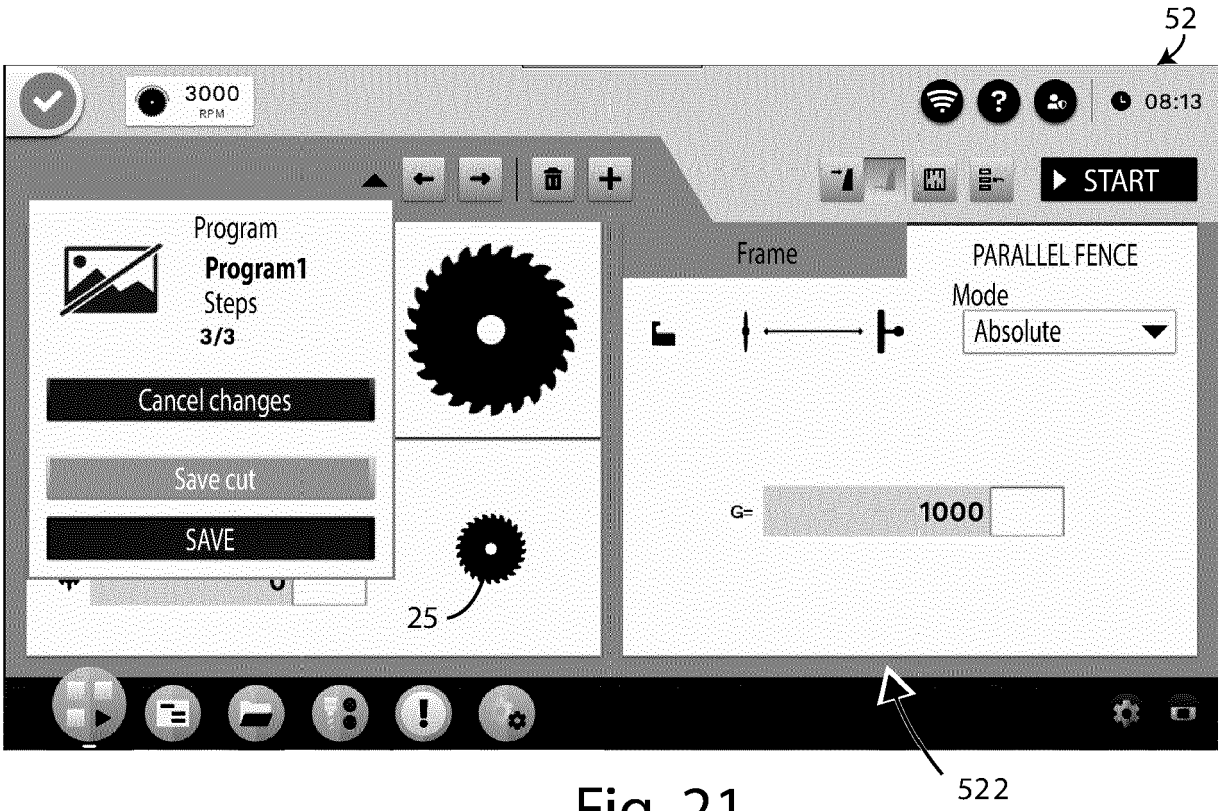
52
3000
RPM
08:13
START
Program
Program1
Steps
3/3
Cancel changes
Save cut
SAVE
25
Frame
PARALLEL FENCE
Mode
Absolute
G=
1000
522

Fig. 21

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 20 0469

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/277104 A1 (MORIMOTO SHINJI [JP] ET AL) 15 December 2005 (2005-12-15) * paragraphs [0038], [0039], [0033], [0042], [0036], [0037], [0008], [0009], [0010], [0057], [0056]; claims * * figures *	1-17	INV. B27M1/08
X	CN 107 438 494 A (GLOWFORGE INC) 5 December 2017 (2017-12-05) * claims * * figures *	1,12,16, 17	
X	EP 3 795 313 A1 (SCM GROUP SPA [IT]) 24 March 2021 (2021-03-24) * paragraphs [0012] - [0031] * * figures *	1,12,16, 17	
X	AU 2010 251 162 A1 (ALTENDORF WILHELM GMBH CO KG [DE]) 22 December 2011 (2011-12-22) * the whole document *	1,12,16, 17	TECHNICAL FIELDS SEARCHED (IPC)
X,P	EP 4 005 715 A1 (SCM GROUP SPA [IT]) 1 June 2022 (2022-06-01) * claims; figures *	1,12,16, 17	B27M
X	US 6 073 058 A (COSSEN EDWARD J [US] ET AL) 6 June 2000 (2000-06-06) * claims; figures *	1,12,16, 17	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 February 2023	Hamel, Pascal

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 20 0469

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21-02-2023

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		US 2019310604 A1	10-10-2019
		US 2020064806 A1	27-02-2020
		US 2020089184 A1	19-03-2020
		US 2020089185 A1	19-03-2020
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