(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 981 562 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**13.04.2022 Bulletin 2022/15**

(21) Application number: **21200890.8**

(22) Date of filing: **05.10.2021**

(51) International Patent Classification (IPC):
***B26D 1/04*** *(2006.01)* ***B26D 5/00*** *(2006.01)*
***B26D 7/20*** *(2006.01)* ***B26F 1/38*** *(2006.01)*
***G05B 19/18*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**B26F 1/3813; B26D 1/04; B26D 5/005; G05B 19/182;** B26D 7/20

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

(30) Priority: **07.10.2020 BE 202005692**

(71) Applicant: **FDPVision, commanditaire vennootschap**
**8200 Brugge (BE)**

(72) Inventor: **DEPREEUW, Filip Alfons H**
**8200 Brugge (BE)**

(74) Representative: **De Clercq, Krista et al**
**Bureau M.F.J. Bockstael NV**
**Arenbergstraat 13**
**2000 Antwerpen (BE)**

(54) **METHOD FOR CONTROLLING A CUTTING PLOTTER AND DEVICE FOR PERFORMING SUCH A METHOD**

(57) Method for controlling a cutting plotter (1), whereby the method consists of the following steps:
- providing a material (3) with figures (8) to be cut out thereon;
- bringing a blade (4) to a starting position (a) and lowering it into the cutting plane (7);
- moving the blade (4) according to a preset path (9) to cut out the figures (8);
whereby the method comprises the step of adjusting the section (a - d, d - g) of the path (9) between two figures (8) such that the cutting direction at the start of said section (a - d, d - g) corresponds with the cutting direction of the path (9) at the end of a figure (8) and such that the cutting direction at the end of said section (a - d, d - g) corresponds with the cutting direction of the path (9) at the start of a next figure (8).

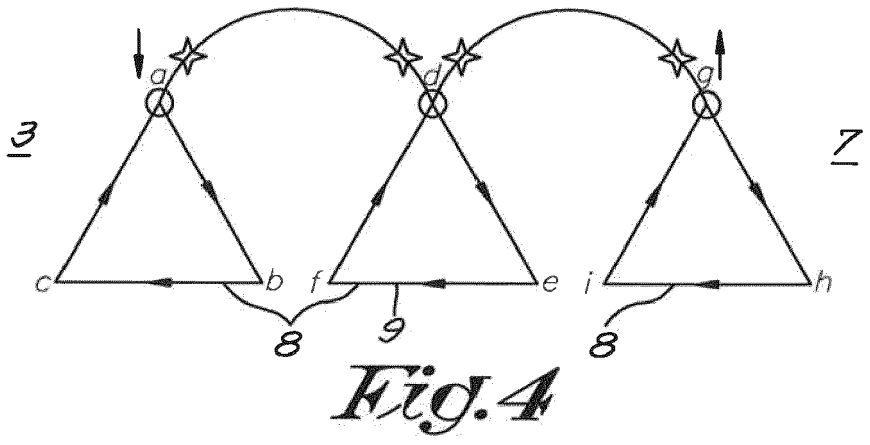


Fig.4

EP 3 981 562 A1

## Description

**[0001]** In particular, the invention is intended for drastically reducing the cutting time and improving the cutting quality of cutting plotters equipped with a blade.

**[0002]** Hereinafter 'cutting plotter' also refers to a flatbed cutting table.

**[0003]** It is known that cutting plotters are used for cutting all kinds of materials such as paper, cardboard, fabric, sticker film, plastic film, textile film, but also metal, wood and the like.

**[0004]** The material can be pre-printed with the desired design, for example, a pattern, text, figures, photos and the like. Typically, said designs are created with computer software.

**[0005]** In most cases many of the same shapes or figures are cut out of the material, said figures may or may not be pre-printed.

**[0006]** Using a cutting plotter said figures, texts, logos, shapes, designs can be cut out of the relevant material. Such cutting plotters are often computer-controlled nowadays, which is why they are referred to as CNC cutting plotters.

**[0007]** The possibly pre-printed material is put on the cutting plotter and subsequently, using the cutting plotter, said figures, texts, logos, shapes, designs can be cut out of the relevant material.

**[0008]** Essentially, two types of such cutting plotters are known, i.e. a laser cutting plotter and a blade cutting plotter.

**[0009]** The laser cutting plotter cuts the material using a laser. Such type is suitable for metal, but is also applied in other materials.

**[0010]** A blade cutting plotter cuts the material using a blade, the so-called cutting plotter blade. Such type is chiefly used for paper, cardboard, film, textile, and the like.

**[0011]** Two types of blade cutting plotters are distinguished hereby, on the one hand roll-to-roll cutting plotters, whereby mostly rolls or sheets of film, which are located on a holder, are cut and on the other hand flatbed cutting plotters, whereby the material is put on a table and can be cut.

**[0012]** For a cutting plotter, both laser and blade cutting plotters, it is important the residual material, i.e. the material that is not part of the figures, text, logos, shapes, designs and the like to be cut out or therefore the material between the figures, text, logos and shapes, remains in one piece such that it can be easily removed.

**[0013]** Partly because of this a special path or special route is followed by the blade or the laser for cutting out all figures, letters, logos, shapes, designs and the like, whereby at certain points in the path or the route after cutting out a figure or the like, the blade is stopped and lifted up or the laser is switched off to, after moving the blade above the material or moving the laser, lower the blade again and set it in motion or to switch on the laser again to cut out the next figure or the like.

**[0014]** In this way the residual material does not get cut through and any figure to be cut out is not cut through either if the path or the route also passes across a figure.

**[0015]** Said path or said route is also chosen to minimise the rest time between the different figures and the like that are cut out

**[0016]** The blade or the laser is controlled by a control unit, provided with CAD-CAM software or a driver, which based on the design created by the drawing program moves the laser or the blade according to the predefined path or the predefined route, whereby on said path the necessary on/off actions for the laser or the necessary stop and start points and up-and-down motions of the blade are preprogrammed.

**[0017]** The figures are often designed in a drawing program, which is read into a special CAD-CAM program to control the cutting plotter. It is not excluded this involves one single computer program, whereby the drawing software also comprises a control module for the cutting plotter.

**[0018]** For a laser cutting plotter it is easy to do this quickly by calculating a certain cutting path. The on/off actions of the laser involve no further measures or limitations.

**[0019]** The problem with blade cutting plotters is that the deceleration of the blade during the performance of a cut to bring the cutting blade to a standstill to be able to lift the blade and the acceleration of the blade to be able to perform a next cut to allow the blade to be set in motion again after having been lowered, involves extra time compared to simply switching a laser on or off.

**[0020]** Indeed, in the known blade cutting plotters the blade is only lifted up and down when the blade has completely stopped to avoid the blade breaking.

**[0021]** The blade of blade cutting plotters will also have to be stopped in between to rotate the blade according to the cut to be made, when the path or route contains a (sharp) angle, in practice this angle is adjustable and usually set between 10 and 45 degrees, which takes even more additional time compared to a laser cutting plotter.

**[0022]** Moreover, the cut that the blade makes when decelerating to bring the cutting blade to a standstill after the performance of a cut and when accelerating to allow the blade to be set in motion again before the next cut is not guaranteed to be clean and nice.

**[0023]** While cutting, the X and Y motions of the blade need to be perfectly synchronised to be able to make a nice and clean cut in the material to be cut. Said synchronisation is difficult to achieve and guarantee, during an acceleration or deceleration of the cutting blade, such that during an acceleration or deceleration of the cutting blade, the cut will not be clean and sleek. The edges of the cut out figure or the like may be ragged.

**[0024]** The purpose of the present invention is to provide a solution to at least one of the aforementioned and other disadvantages relating to blade cutting plotters.

**[0025]** The object of the present invention is a method for controlling a cutting plotter, comprising a cutting sur-

face to mount the material to be cut on, and a blade which in cutting position is positioned perpendicular to a cutting plane, whereby the method essentially consists of the following steps:

- mounting a material to be cut on the cutting surface with, optionally pre-printed, figures or the like to be cut out;
- bringing the blade to a starting position;
- lowering the blade into the cutting plane;
- the progress of the knife in the cutting plane and above the cutting plane according to a preset path to cut out the figures or the like to be cut out;
- lifting the blade out of the cutting plane;
- removing residual material and the cut out figures or the like;

characterised in that the method comprises the step of making a pre-cut and/or post-cut in front of and/or behind every figure or the like to be cut out or in case of sharp angles in the figure to be cut out, and/or that the method comprises the step of adjusting the section of the path between two figures or the like to be cut out such that the cutting direction at the start of said section of the path corresponds with the cutting direction of the path at the end of a figure or the like to be cut out and such that the cutting direction at the end of said section of the path corresponds with the cutting direction of the path at the start of a next figure or the like to be cut out.

**[0026]** The blade of the cutting plotter is mounted in a blade holder which is part of a tool holder.

**[0027]** Cutting plane refers to the geometric plane in which the blade performs a cutting motion and will practically coincide with the surface of the material 6 that is being cut.

**[0028]** Figures and the like refer to patterns, texts, letters, numbers, figures, photographs, logos, shapes or other designs.

**[0029]** Residual material refers to the material that is not part of said figures and the like, said material will be discarded as waste or processed further after cutting out the figures and the like.

**[0030]** This provides the advantage that the blade does not accelerate or decelerate while cutting out the figure, but that this can occur during the pre-cut and post-cut, such that the lines of the figures are cut out by the blade progressing at a constant speed. Consequently the lines of the figures will be cut sleekly and cleanly.

**[0031]** The advantage of a pre- or post-cut at sharp angles in the figure is that the actions of stopping and restarting the blade, whereby the blade will decelerate or accelerate, can be done in or during the pre-cut and post-cut.

**[0032]** In this way it is possible to ensure that all the edges of the figures to be cut out are cut out cleanly and sleekly.

**[0033]** The length of the pre-cut and post-cut must be long enough to give the blade the time to gather speed or come to a standstill.

**[0034]** This will depend on the speed and the acceleration of the blade during said motions. A typical speed of the blade for an X-Y motion, i.e. a motion in or parallel with the cutting plane is 1m/s, whereas a typical acceleration of the blade amounts to 9.81m/s$^2$.

**[0035]** Another advantage is that by adjusting the path between two figures to be cut out in the extension of the figures to be cut out, there will be no big angles in said section of the path, such that there will be little or no need to slow down during the path between the figures. Consequently the cutting speed will be increased. It is not necessary either to lift the blade between two figures to be cut out. The blade can therefore continue to cut on the path between two figures, which implies even greater time savings.

**[0036]** Although this can mean that the path, and therefore the distance that the blade must travel becomes longer, the eventual time savings as a result of no longer having to decelerate the blade and/or no longer having to lift and lower the blade are greater than the time needed to cover the (slightly) longer distance.

**[0037]** Important to note here is neither the total length of the path, nor the greatest distance on the X axis or on the Y axis, is decisive for the time that the blade needs to cover the path. If adjusting the path does not lengthen the greatest distance on the X axis or Y axis, the time that the blade needs to cover the adapted path is therefore the same.

**[0038]** Preferably, the method comprises the step of lowering the blade into the cutting plane or increasing the pressure the blade exercises on the material to be cut out during said pre-cut and/or lifting the blade out of the cutting plane or decreasing the pressure the blade exercises on the material to be cut out during said post-cut.

**[0039]** This provides the advantage that the blade does not have to come to a standstill between two consecutive figures to cover the path between two consecutive figures, such that the time to cut out the figures or the like, can be reduced.

**[0040]** Indeed, the blade will not be brought to a standstill for lifting and lowering the blade. In this way the entire path or the entire route can be travelled without accelerating or decelerating the blade, which will result in a great time saving.

**[0041]** By completely lifting the blade, the residual material is not cut through but will stay in one piece. In this way it can be easily removed.

**[0042]** However, in some cases it is not necessary to completely lift the blade, but it is sufficient to decrease the pressure that the blade exercises. The blade will then only slightly scratch the material, such that the residual material is not cut through either.

**[0043]** In said embodiment, the length of the pre-cut and post-cut must be long enough to give the blade the time to come out of or go into the material or to sufficiently decrease or increase the pressure it exercises.

**[0044]** Preferably, said pre-cut and/or post-cut lie in the extension of the figure to be cut out.

**[0045]** Such method has the advantage that it prevents the moving blade from breaking when being lifted or lowered because lifting or lowering occurs during the post-cut and the pre-cut which can be made in the extension of the path of the figures.

**[0046]** Alternatively the method comprises the step of lifting the blade out of the cutting plane, or decreasing the pressure the blade (4) exercises on the material (3) to be cut out after cutting out a figure or the like and after a possible post-cut, during the motion of the blade according to the section of the path to the next figure or the like to be cut out and of lowering the blade into the cutting plane, or increasing the pressure that the blade (4) exercises on the material (3) to be cut out before cutting out the next figure or the like and before possible pre-cut, during the motion of the blade according to said section of the path to the next figure to be cut out.

**[0047]** In other words, in said embodiment the blade is lifted and lowered in the path between two consecutive figures and in particular in the path between a possible post-cut and a pre-cut.

**[0048]** The advantages are the same as in the previous embodiment, whereby this occurred during the pre-cut and post-cut.

**[0049]** The method also relates to a device for performing a method according to the invention, characterised in that the device comprises one or more of the following components:

- driver, CAM-CAD software or system, a control unit of the cutting plotter or the like, configured to perform the steps of the method according to any one of the previous claims;
- driver CAM-CAD software or system, a control unit of the cutting plotter or the like, configured to calculate or simulate the best path using computer software;
- a cutting plotter, configured to perform the motions of the blade (4) in three directions or according to three axes in a simultaneous and synchronised way.

**[0050]** CAD-CAM stands for "computer-aided design - computer-aided manufacturing".

**[0051]** In other words: the method according to the invention can be performed by a CAD-CAM or a driver, but also by a control unit of the cutting plotter.

**[0052]** With the intention of better showing the characteristics of the invention, a few preferred applications of the method for controlling a cutting plotter according to the invention and a device for performing such method are described hereinafter by way of an example, without any limiting nature , with reference to the accompanying drawings, wherein:

figure 1 schematically shows a cutting plotter;
figures 2 and 3 schematically show a method according to the invention;
figures 4 to 7b schematically show alternative embodiments of a method according to the invention.

**[0053]** The cutting plotter 1 schematically shown in figure 1 essentially comprises a cutting surface 2 on which a material 3 to be cut out can be mounted and a blade 4 which is mounted in a tool holder 5.

**[0054]** The tool holder 5 is controlled, for example by a computer or another control unit 6 which is schematically shown in figure 1, to be moved over the cutting surface 2 according to a certain pattern.

**[0055]** The blade 4 can be lowered into a cutting plane 7, said cutting plane 7 being the plane in which the blade 4 can make a cut.

**[0056]** When the blade 4 is located in the cutting plane 7, it is in the cutting position and the blade is positioned perpendicular to said cutting plane 7. In said position the blade 4 can cut, or make a cut in the material 3 to be cut.

**[0057]** Practically, said cutting plane 7 coincides with the material 3 to be cut. Said material 3 is for example, but not necessarily for the invention, paper.

**[0058]** Figure 2 shows a top view of the cutting plane 7 according to the arrow F2 in figure 3, in which the material 3 to be cut, i.e. a sheet of paper, is visible, with a number of figures 8 to be cut out, which in this case, but not necessarily are pre-printed on the material 7.

**[0059]** In this case, said figures are schematically shown as three triangles 8. However, in most cases this will be very many identical figures 8, which are printed according to a regular pattern on the material 3.

**[0060]** Controlling the cutting plotter 1 from figure 1 is as follows.

**[0061]** The method for controlling the cutting plotter 1 essentially comprises the following steps.

**[0062]** In a first step the material 3 to be cut out with figures 8 to be cut out printed thereon, is mounted on the cutting surface 2, as shown in figure 1.

**[0063]** Subsequently, the blade 4 is put in the starting position a by moving the tool holder 5.

**[0064]** In the example of figure 2, the starting position a is at point a.

**[0065]** Subsequently, the blade 4 is lowered into the cutting plane. This is indicated with the downward arrow at point a on figure 2. The blade 4 ends up in the starting position a shown by the circle at point a on figure 2, this is the point where the cutting motion will start.

**[0066]** Subsequently the blade 4 will progress in the cutting plane 7, and also above the cutting plane 7, according to a preset path 9 for cutting out the figures to be cut out.

**[0067]** Specifically, in the example of figure 2, the blade 4 will first cut out the section a - b - c - a of the path 9. Between the points a and d, the blade 4 in this case, but not necessarily for the invention, will progress above the cutting plane 7.

**[0068]** At point d, the blade 4 will perform a cutting motion again according to the cut d - e - f - d of the path 9.

Between the points d and g, the blade 4 will progress again above the cutting plane 7, to subsequently, when it has reached point g, cut out the last triangle 8 according to path g - h - i - g.

**[0069]** This means that the 'lines' a - d and d - g on figure 2 in this case are not cutting lines of the blade 4, but 'progress lines' whereby the blade 4 is moved above the cutting plane 7 or above the material 3.

**[0070]** The circles at points a, d and g represent the locations where the blade 4 starts and stops cutting in the material 3, the arrows next to said points represent the vertical motion of the blade 4, i.e. the motion according to a direction perpendicular to the cutting plane 7.

**[0071]** After cutting out the last triangle 8, in point g the blade 4 is lifted again out of the cutting plane 7.

**[0072]** The entire path 9 that the blade travels, is: a - b - c - a - d - e - f - d - g - h - i - g. Hereby a - b - c - a; d - e - f - d and g - h - i - g are sections of the path 9 whereby a cutting motion is performed by the blade 4, and a - d and d - g are sections of the path 9 whereby the blade 4 in this case, but not necessarily for the invention, progresses above the material 3.

**[0073]** Subsequently the residual material and the cut out figures 8 can be removed from the cutting surface 2. Note that the residual material in this case is not cut through and therefore can be removed in one piece. Consequently it is easy to separate the residual material from the cut out figures 8.

**[0074]** In this case, the method comprises the step of lifting the blade 4 out of the cutting plane 7 during the motion of the blade 4 according to the section a - d, d - g of the path 9 to the next figure 8 or the like to be cut out after cutting out a figure 8 or the like and before cutting out the next figure 8 or the like, lowering the blade 4 again into the cutting plane 7 during the motion of the blade 4 according to said section a - d, d - g of the path 9 to the next figure 8 to be cut out.

**[0075]** Figure 3 shows a side view according to the arrow F3 in figure 1, which shows how the blade 4 is lifted and lowered during the section a - d of the path 9. Analogously, this applies to the section d - g.

**[0076]** At the start of said motion, the blade 4 is lifted to subsequently, with a constant height h above the cutting plane 7, continue the path 9, whereby at the end of the motion the blade 4 is lowered again into the cutting plane 7, to be able to cut out the next figure 8.

**[0077]** A star in figure 3 shows up to what point the blade 4 rises and from which point the blade 4 will drop again. Between the two stars the blade 4 progresses at a constant height h.

**[0078]** It is important to note that the blade 4 is not brought to a standstill for lifting and lowering the blade 4. The result is that the time needed to cut out the figures 8 will be much shorter.

**[0079]** To avoid that the blade 4 breaks when being lifted out of, and lowered into, the cutting plane 7, the method comprises the step of adjusting the section a - d, d - g of the path 9 between two figures 8 or the like to be cut out such that the cutting direction at the start of said section a - d, d - g of the path 9 corresponds with the cutting direction of the path 9 at the end of a figure 8 or the like to be cut out and such that the cutting direction at the end of said section a - d, d - g of the path 9 corresponds with the cutting direction of the path 9 at the start of a next figure 8 or the like to be cut out.

**[0080]** This is shown in figure 4, where the sections a - d, d - g of the path 9 between two consecutive figures 8 to be cut out have taken on an arch shape.

**[0081]** In this way the cutting direction of for example section c - a connects to the cutting direction of section a - d and the cutting direction of section a - d connects to the cutting direction of section d - e.

**[0082]** The stars in figure 4 indicate up to which point the blade 4 rises and from which point the blade 4 will drop again, similar to what is shown in figure 3.

**[0083]** This concretely means that the blade 4 in point a is still located in the cutting plane 7, and from point a is lifted up to the star. From the star up to the next star, near point d, the blade 4 will continue the path 9 at a constant height h. Only from the star near point d, the blade 4 will be lowered again until it reaches the cutting plane 7 in point d.

**[0084]** Figures 5 and 6 show a method according to the invention, whereby the method comprises the step of making a pre-cut 10 and/or post-cut 11 in front of and/or behind every figure 8 or the like to be cut out.

**[0085]** A pre-cut 10 and post-cut 11 means that the blade 4 already starts cutting in the material 3 before the blade 4 starts cutting out the actual figure 8 and that the blade 4 still continues to cut in the material 3 after the figure 8 is cut out.

**[0086]** In other words, the pre-cut 10 and post-cut 11 will therefore be in the residual material.

**[0087]** As shown in figure 9, in this case the pre-cut 10 and post-cut 11 will each have the same cutting direction as the sections of the path 9 which coincide with the edges of the figures 8 to be cut out.

**[0088]** Making the pre-cut 10 or post-cut 10 at the start, respectively end of the path 9, has the advantage that the blade 4 can accelerate or decelerate in said pre-cut 10 or post-cut 11, such that the blade 4 has a constant speed, when it cuts out the figures 8 to be cut out.

**[0089]** The advantage of making pre-cuts 10 and post-cuts 11 during the path 9 is that it is possible to lower the blade 4 during said pre-cut 10 and/or lift the blade 4 during said post-cut 11.

**[0090]** Preferably, the method according to figure 5 in which the pre-cuts 10 and/or post-cuts 11 are applied, will also comprise this step.

**[0091]** When the blade 4 is lifted during a post-cut 11 after having cut out a first figure 8, whereby consequently the blade 4 keeps cutting in the same direction, it will be ensured that the blade 4 cannot break.

**[0092]** Subsequently the blade 4 can be moved according to the path above the cutting plane 7 or cutting surface 2, up to the next pre-cut 10.

**[0093]** In this embodiment as well, the blade 4 no longer needs to be stopped between two figures 8 to be cut out, and the blade 4 cannot break during lifting or lowering.

**[0094]** Alternatively, instead of lifting the blade 4 out of the cutting plane 7 or lowering the blade 4 into the cutting plane 7, it is also possible to increase or decrease the pressure that the blade exercises on the material 3 to be cut out, by not completely lifting the blade out of the cutting plane 7 or not completely lowering it into the cutting plane 7. The blade 4 will hereby scratch in the cutting plane 7, rather than effectively cut the material 3, in the path 9 between two figures 8.

**[0095]** Making a pre-cut 10 or post-cut 11 can also be applied for sharp angles in the figure 8 to be cut out. This is schematically shown in figure 6.

**[0096]** Said pre-cuts 10 and post-cuts 11 can be used to bring the blade 4 to a standstill or to set it in motion again, such that the blade 4 can be moved between a pre-cut 10 and post-cut 11. Accelerating or decelerating the blade 4 therefore does not occur while cutting out the figures 8 themselves.

**[0097]** During said pre-cuts 10 and post-cuts 11 the blade 4 can also be lifted or lowered, consequently not only do the pre-cut 10 and post-cut become shorter 11, but also less time will be needed because the blade 4 does not have to be brought to a complete standstill.

**[0098]** In this case, but not necessarily for the invention, the method comprises the step of calculating or simulating the best path 9, using computer software based on an algorithm to solve the travelling salesman problem, such that the time needed to cut out all figures 8 or the like, is minimal.

**[0099]** In this way, the sequence, among others, in which the different figures 8 or the like are cut out, will be optimised.

**[0100]** Alternatively the method comprises the step of calculating the best path 8 based on artificial intelligence using data collected during previous cutting operations, data relating to the material 3 to be cut, data relating to the figures 8 to be cut out, and the like.

**[0101]** Such method is particularly useful if many similar cutting operations or cutting jobs have to be performed, such that the obtained information or data are usable and relevant for a next cutting operation.

**[0102]** It is possible that all said data and information are kept in a database.

**[0103]** In an alternative embodiment the method comprises the step of dissecting the figures 8 to be cut out in different vectors, whereby each vector is considered a separate figure 8 to be cut out.

**[0104]** For example in the case of figure 1, every triangle 8 can be dissected in its three sides, whereby each side is a so-called vector.

**[0105]** Such method offers many more degrees of freedom such that it permits many more possible options of paths 8, such that chances are that a faster, more efficient path 8 can be found.

**[0106]** Figures 7a and 7b show another alternative method, whereby the method comprises the step of choosing starting point a, d, g of every figure 8 to be cut out and/or choosing the order in which the figures 8 to be cut out are cut out such that the path 9 between two figures 8 does not cross a figure 8 to be cut out.

**[0107]** Figure 7a shows a method, whereby the starting point a, d, g and the order are not optimised.

**[0108]** Consequently, the path 9, more specifically the sections a - d, d - g of the path 9 between two consecutive figures 8, runs through the figures 8 or the like to be cut out.

**[0109]** The consequence of this is that there is a risk that during the upward and downward motions of the blade 4 between two consecutive figures 8, the blade 4 will cut into the actual figures or the like. In the case of figure 7a, the blade 4 will cut into the figure 8 in any case during the downward motion of the blade 4 between two consecutive figures 8.

**[0110]** In figure 7b the starting point a, d, g of every figure 8 and the order are adapted or optimised, such that the path 9 does not run through the figures to be cut out.

**[0111]** Consequently, any cutting operations performed by the blade 4 during the upward and downward motions of the blade 4 between two consecutive figures 8 can never be in an actual figure 8.

**[0112]** Furthermore, it will be possible to place the figures 8 to be cut out closer to each other in the case of figure 7b compared to the case of figure 7a and the distance which the blade 4 needs to travel between two consecutive figures 8 to be cut out is shorter in figure 7b.

**[0113]** The present invention is by no means limited to the embodiments described as an example and shown in the figures, but such method for controlling a cutting plotter and a device for performing such method can be realised according to different variants without departing from the scope of the invention.

## Claims

1. Method for the controlling a cutting plotter (1), comprising a cutting surface (2) to mount the material (3) to be cut on, and a blade (4) which in cutting position is positioned perpendicular to a cutting plane (7), whereby the method essentially consists of the following steps:

    - mounting on the cutting surface (2) a material (3) to be cut with, optionally pre-printed, figures (8) or the like to be cut out thereon;
    - bringing the blade (4) to a starting position (a);
    - lowering the blade (4) into the cutting plane (7);
    - the progress of the blade (4) in the cutting plane (7) and above the cutting plane (7) according to a preset path (9) to cut out the figures (8) or the like to be cut out;

- lifting the blade (4) out of the cutting plane (7);
- removing residual material and the cut out figures (8) or the like;

**characterised in that**:

- the method comprises the step of making a pre-cut (10) and/or post-cut (11) in front of and/or behind every figure (8) or the like to be cut out or in case of sharp angles in the figure (8) to be cut out; and/or
- the method comprises the step of adjusting the section (a
- d, d - g) of the path (9) between two figures (8) or the like to be cut out such that the cutting direction at the start of said section (a - d, d - g) of the path (9) corresponds with the cutting direction of the path (9) at the end of a figure (8) or the like to be cut out and such that the cutting direction at the end of said section (a - d, d - g) of the path (9) corresponds with the cutting direction of the path (9) at the start of a next figure (8) or the like to be cut out.

**2.** Method according to claim 1 **characterised in that** the method comprises the step of lowering the blade (4) into the cutting plane (7) or increasing the pressure the blade (4) exercises on the material (3) to be cut out during said pre-cut (10) and/or of lifting the blade (4) out of the cutting plane (7) or decreasing the pressure the blade (4) exercises on the material to be cut out during said post-cut (11).

**3.** Method according to claim 1, **characterised in that** the method comprises the step of lifting the blade (4) out of the cutting plane (7), or decreasing the pressure the blade (1) exercises on the material (8) to be cut out after cutting out a figure (8) or the like and after a possible post-cut (11), during the motion of the blade (4) according to the section (a - d, d - g) of the path (9) to the next figure (8) or the like to be cut out and before cutting out the next figure (8) or the like and before a possible pre-cut (10) lowering the blade again into the cutting plane, or increasing the pressure that the blade (4) exercises on the material (8) to be cut, during the motion of the blade (4) according to said section (a - d, d - g) of the path (9) to the next figure to be cut out (8).

**4.** Method according to any one of the previous claims, **characterised in that** said pre-cut (10) and/or post-cut (11) lie in the extension of the figure to be cut out (8).

**5.** Method according to any one of the previous claims, **characterised in that** the method comprises the step of choosing a starting point (a, d, g) of every figure to be cut out (8) and/or choosing the order in which the figures (8) to be cut out are cut out such that the path (9) between two figures (8) does not cross a figure (8) to be cut out.

**6.** Method according to any one of the previous claims, **characterised in that** the method comprises the step of dissecting the figures (8) to be cut out in different vectors, whereby each vector is considered a separate figure (8) to be cut out.

**7.** Device for performing a method according to any one of the previous claims, **characterised in that** the device comprises one or more of the following components:

- driver, CAM-CAD software or system, a control unit of the cutting plotter or the like, configured to perform the steps of the method according to any one of the previous claims;
- driver, CAM-CAD software or system, a control unit of the cutting plotter (1) or the like, configured to calculate or simulate the best path (9) using computer software;
- a cutting plotter (1), configured to perform the motions of the blade (4) in three directions or according to three axes in a simultaneous and synchronised way.

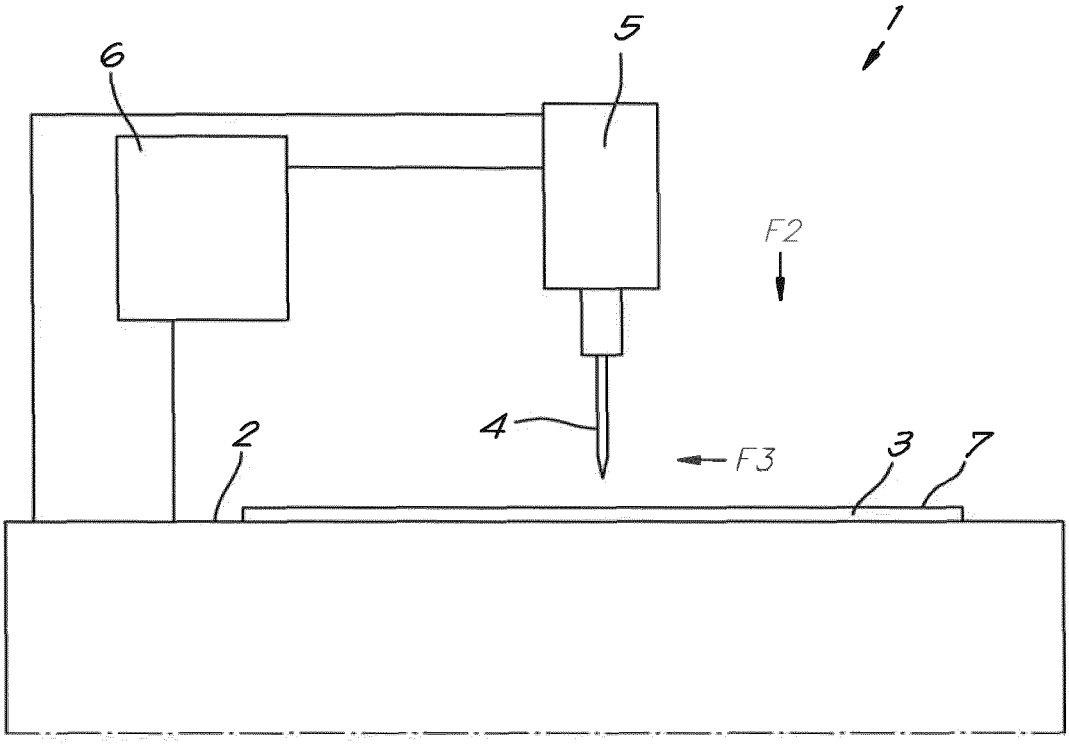


Fig.1

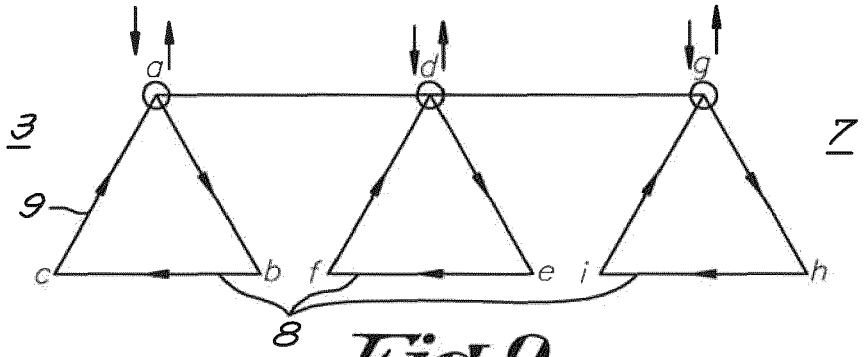


Fig.2

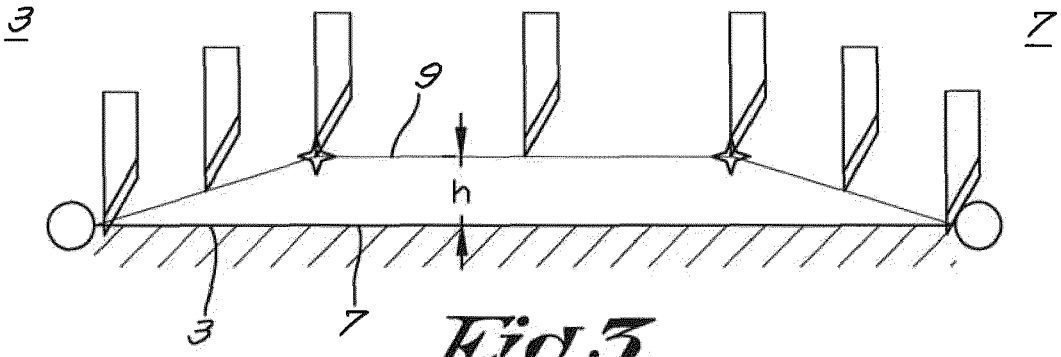


Fig.3

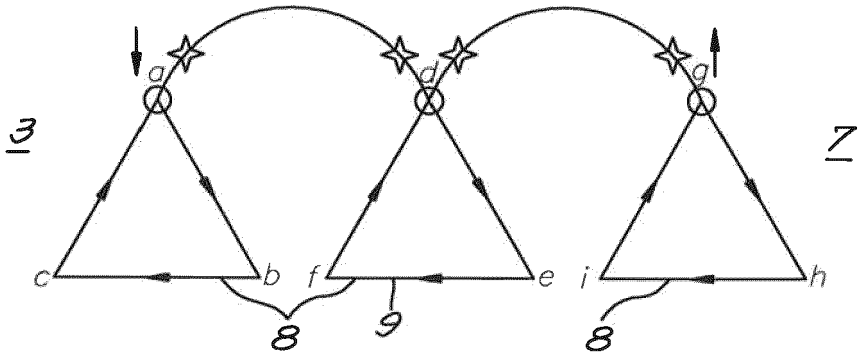


Fig.4

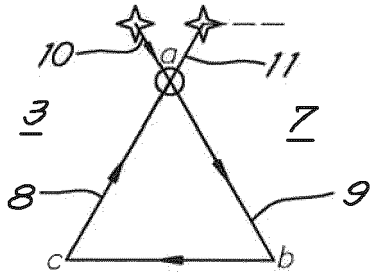


Fig.5

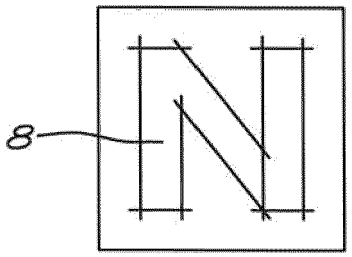


Fig.6

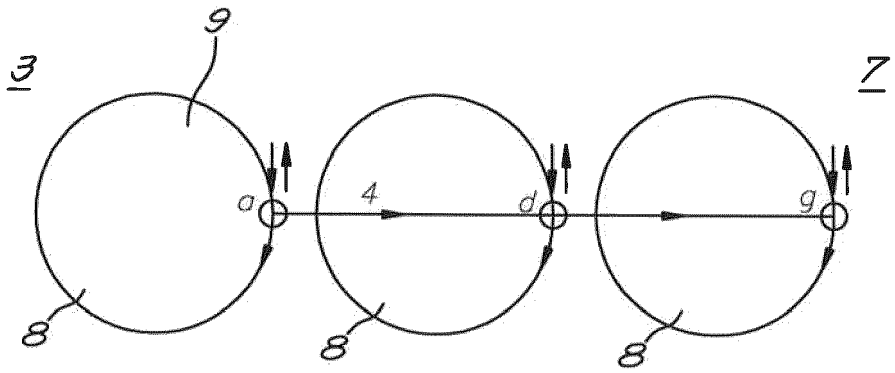


Fig.7A

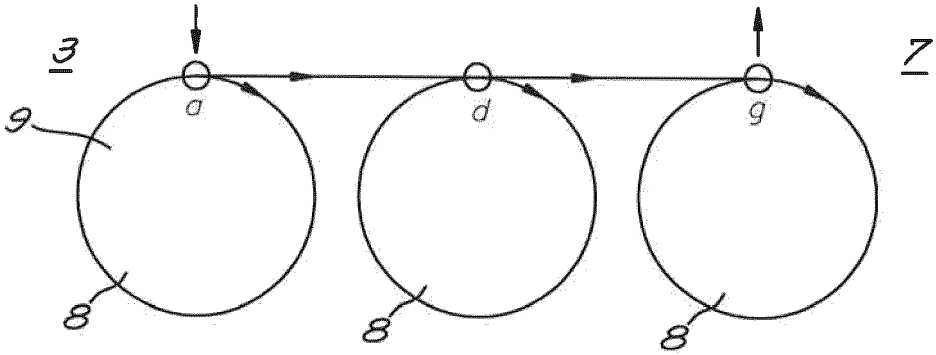


Fig.7B

Europäisches Patentamt
European Patent Office
Office européen des brevets

# EUROPEAN SEARCH REPORT

Application Number
EP 21 20 0890

## 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 3 838 618 A (HOEBER W ET AL)<br>1 October 1974 (1974-10-01)<br>* column 4, line 21 - column 17, line 46; figures 1-3 * | 1-7 | INV.<br>B26D1/04<br>B26D5/00<br>B26D7/20<br>B26F1/38 |
| X | DE 23 20 564 B1 (KRAUSS & REICHERT SPEZIALMASCH) 10 January 1974 (1974-01-10)<br>* column 3, line 7 - column 4, line 62; figure 1 * | 1-7 | G05B19/18 |
| X | US 3 855 887 A (PEARL D ET AL)<br>24 December 1974 (1974-12-24)<br>* column 5, line 7 - column 8, line 51; figures 1,2-5 * | 7 | |

TECHNICAL FIELDS SEARCHED (IPC)

B26F
B26D
G05B

2 The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 11 February 2022 | De Backer, Tom |

CATEGORY OF CITED DOCUMENTS

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

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

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 20 0890

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-02-2022

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 3838618 A | 01-10-1974 | DE 2253573 A1 | 22-05-1974 |
| | | FR 2217128 A1 | 06-09-1974 |
| | | GB 1435170 A | 12-05-1976 |
| | | IT 1003168 B | 10-06-1976 |
| | | JP S5019077 A | 28-02-1975 |
| | | NL 7315010 A | 06-05-1974 |
| | | SE 396309 B | 19-09-1977 |
| | | US 3838618 A | 01-10-1974 |
| DE 2320564 B1 | 10-01-1974 | NONE | |
| US 3855887 A | 24-12-1974 | DE 2361200 A1 | 27-06-1974 |
| | | FR 2210132 A5 | 05-07-1974 |
| | | GB 1450445 A | 22-09-1976 |
| | | US 3803960 A | 16-04-1974 |
| | | US 3855887 A | 24-12-1974 |
| | | US 3864997 A | 11-02-1975 |

EPO FORM P0459

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