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METHOD FOR THE PREPARATION OF A CUTTING AND/OR PUNCHING AND/OR GROOVING TOOL

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Description:

The present invention relates to a method for producing a cutting and/or punching and/or grooving tool including a support plate for accommodating at least one
10 cutting and/or scoring and/or grooving line. Furthermore, the invention relates to a corresponding support plate as well as to a punching and/or scoring and/or grooving tool with at least one such support plate.

Punching, scoring and/or grooving tools for linearly cutting, scoring and/or
15 grooving foldable materials usually include support plates comprising accommodating slits, into which so-called cutting, scoring and/or grooving lines are inserted as insertion sections with a respectively desired progressive shape. Such punching, scoring and/or grooving tools are mainly used in the paper and cardboard processing to for example cut out blanks from foldable materials for
20 folding boxes and to provide them with folding or tear lines by scoring and/or line stamping. However, other suitable materials like corrugated paperboard, plastic foils and the like can basically also be processed. A combined grooving and cutting tool is for example described in EP 1 238 793 A1 and DE 38 31 393 A1. Therein, the tool includes scoring and grooving lines, which are pressed into slit-
25 shaped recesses of a support plate in force-fit manner. From WO 2013/060375 A1, US 5 855 149 A and EP 1 629 934 A2, methods for producing stamping and cutting tools are known, which disclose a generative construction of structures on a support plate, a support cylinder or a support sleeve. US 2013/0255346 A1 describes a material embossing punch or tool. An additive manufacturing machine
30 and material for producing a punch are mentioned.

However, the circumstance is to be regarded as disadvantageous in the known methods for producing such punching, scoring and/or grooving tools that changes in the layout of the punching and/or scoring and/or grooving tool can only be very expensively performed. This considerably increases the costs of and optionally
5 delays the production process of the punching and/or scoring and/or grooving tool.

Therefore, it is the object of the present invention to provide a generic method for producing a cutting and/or punching and/or grooving tool, which allows fast and economic manufacture even with possible corrections and/or change of the design
10 of the cutting and/or punching and/or grooving tool. A further object of the invention is in specifying a support plate for a cutting and/or punching and/or grooving tool as well as a corresponding cutting and/or punching and/or grooving tool, which allow a fast and economic manufacture even with possible corrections and/or change of the design of the cutting and/or punching and/or grooving tool.

15 According to the invention, the objects are solved by a method comprising the features of claim 1, by a support plate comprising the features of claim 14 as well as by a punching and/or scoring and/or grooving tool according to claim 15.

Advantageous configurations with convenient developments of the invention are
20 specified in the dependent claims.

A first aspect of the invention relates to a method for producing a cutting and/or punching and/or grooving tool including a support plate for accommodating at least one line from the group of the cutting and/or scoring and/or grooving lines, wherein
25 the support plate of the cutting and/or punching and/or grooving tool and at least one plastic or elastomer stripe to be arranged on the support plate are produced by means of a generative manufacturing method according to the invention.

Moreover, several plastic or elastomer stripes have different degrees of hardness relative to each other and/or a plastic or elastomer stripe has different degrees of
30 hardness within the individual stripe. Combinations of these lines are also understood by cutting and/or scoring and/or grooving lines, which are for example formed as perforating lines, roughening lines, wave lines, break-out lines or tear lines. By the use of a generative manufacturing method, a fast and economic

manufacture of cutting and/or punching and/or grooving tools is possible. In particular, there is the possibility of producing the cutting and/or punching and/or grooving tool in its entirety by means of the generative manufacturing method. This means that it is possible according to the invention to generatively produce
5 the support plate with the elements arranged thereon in a single method step.

In addition, there is the possibility that at least one or more of the lines from the group of the cutting and/or scoring and/or grooving lines are produced by means of the generative manufacturing method, wherein the generatively manufactured
10 lines may have different degrees of hardness relative to each other and/or within the line. Moreover, they may be arranged on the support plate as a separate element or formed integrally with the support plate. Also the plastic or elastomer strip to be arranged on the support plate is manufactured by a generative manufacturing method and can be arranged on the support plate as a separate
15 element. Moreover, it is possible to form at least one projection for receiving and fastening the at least one plastic or elastomer strip on the support plate, wherein the projection is generatively integrally formed with the support plate. In addition, it is possible that recesses, for example in groove shape, for accommodating a corresponding plastic or elastomer strip are formed in the support plate.

The plastic or elastomer strip can also be inserted with a clamping effect. The mentioned plastic or elastomer strip can be a so-called rubber lining, which ensures rebound of the material to be punched by means of the cutting and/or punching and/or grooving tool. The material to be punched can be paper,
20 cardboard or plastic, in particular for producing packaging blanks or packaging foils. Other materials are also conceivable. Furthermore, the method according to the invention offers the possibility that individual or also all of the elements of the cutting and/or punching and/or grooving tool to be produced can be generatively constructed on a prefabricated, generatively manufactured support plate. Therein,
25 the support plate can for example be composed of a composite material, in particular a carbon fiber reinforced composite material, and/or of at least one material from the group of multiplex wood (not generatively manufactured), in particular hardened multiplex wood, steel, aluminum and plastic at least in certain

areas. In addition, it is possible that the support plate comprises at least one fit and/or opening for accommodating and/or attaching the stamping element. The generatively manufactured elements of the cutting and/or punching and/or grooving tool have identical or different degrees of hardness relative to each other and/or within the individual element. Thus, a line can for example have different hardnesses. The same applies to the plastic or elastomer strips. Thereby, different requirements to the generatively manufactured elements can be readily satisfied corresponding to the respective purpose of use with a minimum method effort.

Since the number of manufacturing steps can overall always be minimized compared to conventional production methods of cutting and/or punching and/or grooving tools, the method according to the invention can be particularly fast and inexpensively performed. In addition, there is the possibility to be able to very fast and flexibly react to possible changes in the design of the cutting and/or punching and/or grooving tool.

In advantageous configurations of the method according to the invention, the generative manufacturing method is a stereolithography method, a digital light processing method, a 3D printing method, a melt coating method, a multi jet modeling method, a selective laser sintering or selective laser melting method, an electron beam melting method or a combination of these methods. The use of individual or a combination of these manufacturing methods complies with the product to be produced. Thus, a cutting and/or grooving line and a corresponding support plate can for example be produced from different materials and by different generative manufacturing methods. In a particularly advantageous configuration of the invention, even in using different materials and different generative manufacturing methods, respectively, they are selected such that different elements of the cutting and/or punching and/or grooving tool can be manufactured in a generative manufacturing step.

If a stereolithography method is used as the generative manufacturing method, thus, at least one liquid, photosensitive plastic material and/or a synthetic resin and/or a photosensitive varnish can in particular be used as the material. At least

one plastic, synthetic resin, metal, metal alloy or ceramic or a combination of these materials in powder form can be used as the material for the selective laser sintering or selective laser melting method. In addition, there is the possibility of using at least one UV curing varnish and/or at least one UV curing ink as the material for the 3D printing method. Further, not explicitly mentioned materials for generative manufacturing methods as well as further, not mentioned generative manufacturing methods can also be used according to the invention.

In further advantageous configurations of the method according to the invention, the support plate can comprise at least one recess for accommodating a cutting and/or scoring and/or grooving line. Therein, it is possible that the recess has a width, which is slightly less than the width of the cutting and/or scoring and/or grooving line. Thereby, the corresponding line can be subsequently inserted into and attached to the support plate in clamping and accurately fitting manner.

Furthermore, there is the possibility that the at least one recess is generated with a predetermined oversize with respect to the line and the method includes the following further steps: filling the recess with a curable filling material; curing the filling material in the recess; generating at least one further second recess in the cured filling material for dimensionally accurately accommodating the line and inserting the line into the dimensionally accurate second recess. In other words, it is provided that at least one first recess oversized with respect to the lines to be inserted is first introduced into the support plate. Therein, the recess or notch can be basically generated groove-shaped, hole- or elongated hole-shaped, interrupted and/or continuous depending on the line to be later inserted.

Subsequently, the first recess is filled with the curable filling material. Therein, the first recess can basically be completely or only partially filled. Similarly, it can be provided that multiple different filling materials are successively or simultaneously filled into the first recess. After curing the filling material or the filling materials in the first recess, a second, dimensionally accurate recess is generated in the cured filling material, into which the cutting and/or scoring and/or grooving line is finally inserted. By this aspect of the method according to the invention, various advantages are realized. Since the first recess should only approximately correspond to the contour of the cutting and/or scoring and/or grooving line to be

inserted and since the inserted line is embedded in the cured filling material in the finished support plate, the material of the support plate only plays a minor role in this respect such that a substantially higher flexibility in the selection of the support plate material is given compared to the prior art. The curable filling material, which
5 later retains the line on the support plate, can be selected independently of the support plate material. For example, a filling material can be used, which has a higher clamping effect after curing compared to the support plate material. The second recess, which can basically also be generated groove-shaped, hole- or elongated hole-shaped, interrupted and/or continuous depending on the line to be
10 inserted, can be precisely introduced into the cured filling material instead of the support plate material. Upon incorrect positioning of one or more cutting, scoring and/or grooving lines, the filling material can be removed, e.g. by milling out, without the support plate being destructed. Newly filling the first recess with further filling material and the new formation of the second recess for accommodating a
15 line are readily possible. It is also possible that only the incorrectly positioned second recess is again filled with filling material. After newly curing the filling material, the second recess can be newly produced. The production of the tool can in turn be inexpensively effected since a completely new tool does not have to be produced and a new support plate does not have to be used, respectively, upon
20 possible corrections of the positioning of the lines.

A second aspect of the invention relates to a support plate of a tool from the group of the cutting and/or punching and/or grooving tools with at least one line from the group of the cutting and/or scoring and/or grooving lines. Therein, it is provided
25 according to the invention that the support plate is obtainable and/or obtained by means of a method according to one of the embodiments of the first inventive aspect. Hereby, the support plate can be simply and inexpensively produced. Further features resulting from it and the advantages thereof can be taken from the descriptions of the first inventive aspect, wherein advantageous configurations
30 of the first inventive aspect are to be regarded as advantageous configurations of the second inventive aspect.

A third aspect of the invention relates to a cutting and/or punching and/or grooving tool with at least one support plate, which includes at least one line from the group of the cutting and/or scoring and/or grooving lines. Therein, it is provided according to the invention that the support plate is obtainable and/or obtained by means of a method according to one of the embodiments of the first inventive aspect.

The cutting and/or punching and/or grooving tool according to the invention can be precisely, simply and inexpensively produced. Further features resulting from it and the advantages thereof can be taken from the descriptions of the first inventive aspect, wherein advantageous configurations of the first inventive aspect are to be regarded as advantageous configurations of the third inventive aspect.

There shows:

Fig. 1 a schematic representation of a first embodiment of a punching tool according to the invention; and

Fig. 2 a schematic representation of a second embodiment of a punching tool according to the invention.

Fig. 1 shows a schematic representation of a punching tool 10, wherein the punching tool 10 comprises a support plate 12. One recognizes that a recess 24 is formed in the support plate 12, into which a cutting line 14 is inserted. Therein, the cutting line 14 is composed of steel and was subsequently inserted into the recess 24 of the support plate 12. Therein, the edge of the cutting line 14 protrudes beyond a surface of the support plate 12 facing the material to be punched during the punching operation. The same applies to a grooving line 16 also formed on this surface. One recognizes that the grooving line 16 is formed integrally with the support plate 12. Therein, the production of the support plate 12 and the grooving line 16 is effected in a generative manufacturing step. Thus, the support plate 12 and the grooving line 16 can for example be composed of metal, a metal alloy or plastic. In addition, projections 22 are formed on the surface facing the material to be punched during the punching operation, which serve for accommodating

corresponding elastomer strips 18 (rubber lining). The projections 22 are again produced integrally with the support plate 12 and the grooving line 16 in a generative manufacturing step. However, there is also the possibility that all of the shown elements of the punching tool 10 are generatively produced.

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Fig. 2 shows a schematic representation of a second embodiment of a punching tool 10. One recognizes that the support plate 12 is formed as a basis with fits and bores 26. The fits and bores 26 serve for accommodating and attaching a stamping element 20. In the illustrated embodiment, the stamping element 20 is attached to the support plate 12 by means of screws 28. The fits and bores 26 of the support plate 12 are generatively manufactured with it. The stamping element 20 can also be generatively manufactured. One recognizes that the stamping element 20 has a structure 30 towards a material to be processed during a punching and stamping operation, which is stamped into the corresponding material.

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P a t e n t k r a v

5 1. Fremgangsmåde til fremstilling af et skære- og/eller stanse- og/eller notværktøj (10), omfattende en bæreplade (12) til at optage mindst én linje (14, 16) fra gruppen af skære- og/eller rille- og/eller notlinjer,

kendetegnet ved, at

10 bærepladen (12) til skære- og/eller stanse- og/eller notværktøjet (10) og mindst én plast- eller elastomerstrimmel (18), der skal anbringes på bærepladen (12), fremstilles ved hjælp af en generativ fremstillingsfremgangsmåde, hvor flere plast- eller elastomerstrimler (18) har forskellige hårdhedsgrader i forhold til hinanden, og/eller én plast- eller elastomerstrimmel (18) har forskellige hårdhedsgrader inden for den enkelte strimmel.

15 2. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at** mindst én linje (14, 16) fra gruppen af skære- og/eller rille- og/eller notlinjer fremstilles ved hjælp af en generativ fremstillingsfremgangsmåde, hvor de generativt fremstillede linjer (14, 16) har forskellige hårdhedsgrader i forhold til hinanden eller inden for linjen (14, 16).

20 3. Fremgangsmåde ifølge krav 1 eller 2, **kendetegnet ved, at** mindst én eller flere af linjerne (14, 16) fra gruppen af skære- og/eller rille- og/eller notlinjer genereres ved hjælp af en generativ fremstillingsfremgangsmåde og er anbragt på bærepladen (12) som et separat element eller dannet i ét stykke med bærepladen (12).

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4. Fremgangsmåde ifølge krav 1, 2 eller 3, **kendetegnet ved, at** plast- eller elastomerstrimlen (18), der skal anbringes på bærepladen (12), er anbragt på bærepladen (12) som et separat element.

30 5. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** mindst én fremspring (22) til at optage og fastgøre den mindst ene plast-

eller elastomerstrimmel (18) er dannet på bærepladen (12), hvor fremspringet (22) er fremstillet generativt i ét stykke med bærepladen (12).

5 **6.** Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** den generative fremstillingsfremgangsmåde er en stereolitografisk metode, en digital lysbehandlingsfremgangsmåde, en 3D-printfremgangsmåde, en smeltet deponeringsmodelleringsfremgangsmåde, en multijetmodelleringsfremgangsmåde, en selektiv lasersintring eller selektiv lasersmeltefremgangsmåde, en elektronstrålesmeltefremgangsmåde eller en kombination af disse fremgangs-
10 måde.

7. Fremgangsmåde ifølge krav 6, **kendetegnet ved, at** mindst ét flydende, lysfølsomt plastmateriale og/eller en syntetisk harpiks og/eller en lysfølsom lak anvendes som materiale til den stereolitografiske fremgangsmåde.

15 **8.** Fremgangsmåde ifølge krav 6, **kendetegnet ved, at** mindst én plast, syntetisk harpiks, metal, metallegering eller keramik eller en kombination af disse materialer i pulverform anvendes som materiale til selektiv lasersintring eller selektiv lasersmeltnings.

20 **9.** Fremgangsmåde ifølge krav 6, **kendetegnet ved, at** mindst én UV-hærdende lak og/eller mindst én UV-hærdende blæk anvendes som materiale til 3D-printfremgangsmåden.

25 **10.** Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** bærepladen (12) omfatter mindst én fordybning (24) til at optage en skæreo- og/eller rille- og/eller notlinje (14, 16).

30 **11.** Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** fordybningen (24) har en bredde, der er en smule mindre end bredden af skæreo- og/eller rille-

og/eller notlinjen (14, 16).

12. Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** den mindst ene fordybning (24) genereres med et forudbestemt overskud i forhold til linjen (14, 16), og fremgangsmåden omfatter følgende yderligere trin:

- fyldning af fordybningen (24) med et hærdbart fyldningsmateriale;
- hærdning af fyldmaterialet i fordybningen (24);
- dannelse af mindst én yderligere anden fordybning i det hærdede fyldmateriale for dimensionsnøjagtig tilpasning af linjen (14, 16); og
- indsættelse af linjen (14, 16) i den dimensionsnøjagtige anden fordybning.

13. Fremgangsmåde ifølge et af de foregående krav, **kendetegnet ved, at** bærepladen (12) omfatter mindst én pasform og/eller åbning (26) til at optage og/eller fastgøre prægeelementet (20).

14. Bæreplade til et værktøj (10) fra gruppen af skære- og/eller stanse- og/eller notværktøjer, med mindst én linje (14, 16) fra gruppen af skære- og/eller rille- og/eller notlinjer, **kendetegnet ved, at** bærepladen (12) kan opnås og/eller opnås ved hjælp af en fremgangsmåde ifølge et hvilket som helst af kravene 1 til 13.

15. Skære- og/eller stanse- og/eller notværktøj med mindst én bæreplade (12), som omfatter mindst én linje (14, 16) fra gruppen af skære- og/eller rille- og/eller notlinjer, **kendetegnet ved, at** stanse- og/eller rille- og/eller notværktøjet (10) fremstilles ved hjælp af en fremgangsmåde ifølge et hvilket som helst af kravene 1 til 13.

