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- (54) Benævnelse: **FREM GANGSMÅDE TIL FREMSTILLING AF EN TRYK- ELLER PRÆGNINGSCYLINDER ELLER ET TRYK- ELLER PRÆGNINGSHYLSTER**
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METHOD FOR THE PREPARATION OF A PRINTING OR EMBOSSING CYLINDER
OR A PRINTING OR EMBOSSING SLEEVE

Description

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The present invention relates to a method for producing a printing and/or stamping cylinder or a printing and/or stamping sleeve to be arranged on a support each including a structured formed cylinder jacket exterior surface for generating a printing and/or stamping structure on a material or a material web.

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Printing or stamping cylinders as well as printing or stamping sleeves to be arranged on a support are required and used for a plurality of printing methods.

Here, relief printing methods for cylinder printing presses and rotary presses as well as the flexographic and gravure printing are exemplarily mentioned. Besides

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imprinting very different materials such as for example paper, cardboard or plastic foils, these materials can also be stamped. Surface structures of very different

kind are applied to the material to be stamped via corresponding stamping cylinders or stamping sleeves arranged on supports. Such stamping structures are

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for example applied to wallpapers or cigarette boxes as well as also other

packagings of cardboard or plastic. In the packaging field, finishing of the corresponding packaging is to be achieved by the additional stamping of the packaging surface. Usual stamping methods are the so-called

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embossing/debossing and the blind stamping. In the embossing/debossing method, two cylinders matching each other with their surface structures, namely

the so-called patrix and matrix, are respectively manufactured, wherein the material to be stamped is passed between the two cylinders. In the so-called blind

stamping, a stamping cylinder stamps the material to be provided with the structure against a smooth cylinder.

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The production of such printing and/or stamping cylinders or corresponding printing and/or stamping sleeves is known from the prior art. Thus, EP 1 837 202 B1 for example describes a method for producing a seamless stamping cylinder, wherein 3D structures are incorporated onto a prepared cylinder by means of a laser or electron beam system and this energetic incorporation is effected by

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directly removing and/or evaporating metal, ceramic or other substances with the

aid of the laser or electron beam system. Here, a seamless cylinder exterior surface can be achieved, which is advantageous for the mentioned printing and stamping methods. However, the subsequent processing of the cylinder surface by means of a laser or electron beam system is very expensive and costly. From DE 101 59 084 A1, EP 2 537 675 A1 and EP 1 449 648 A1, methods for producing a printing and/or stamping cylinder or a printing and/or stamping sleeve to be arranged on a support each including a structured formed cylinder jacket exterior surface are known as they are described in the preamble of claim 1.

10 It is the object of the present invention to provide a generic method for producing a printing and/or stamping cylinder or a printing and/or stamping sleeve to be arranged on a support, which allows fast and economic manufacture of printing and/or stamping cylinders or printing and/or stamping sleeves with a seamless cylinder exterior surface. A further object of the invention is providing a printing and/or stamping cylinder or a printing and/or stamping sleeve each including a structured formed cylinder jacket exterior surface, which can be fast and economically produced.

20 According to the invention, the objects are solved by a method having the features of claim 1 as well as by a printing and/or stamping cylinder or a printing and/or stamping sleeve according to claim 13. Advantageous configurations with convenient developments of the invention are specified in the dependent claims.

25 A method according to the invention for producing a printing and/or stamping cylinder or a printing and/or stamping sleeve to be arranged on a support each including a structured formed cylinder jacket exterior surface for generating a printing and/or stamping structure on a material or a material web is characterized in that the cylinder jacket exterior surface is produced by means of a generative manufacturing method. Therein, the surface of the printing and/or stamping cylinder or the printing and/or stamping sleeve facing the material to be printed or stamped is understood by cylinder jacket exterior surface. By the use of a generative manufacturing method, a fast and economic manufacture of printing and/or stamping cylinders or printing and/or stamping sleeves with a seamless cylinder exterior surface is possible. In addition, the printing and/or stamping cylinder or the printing and/or stamping sleeve to be arranged on a support is

produced in its entirety by means of the generative manufacturing method. This means that it is possible according to the invention not only to provide the cylinder jacket exterior surface determining the printing and/or stamping image with corresponding printing and/or stamping data, but also to generatively
5 produce the cylindrical body of the printing and/or stamping cylinder in a single method step. According to the invention, the printing and/or stamping cylinder or the printing and/or stamping sleeve is therefore formed integrally with the structured cylinder jacket exterior surface and generatively produced. Since the number of manufacturing steps can be minimized, the method according to the
10 invention can be particularly fast and inexpensively performed. In addition, there is the possibility of being able to very fast and flexibly react to possible changes in the printing and/or stamping design.

In advantageous configurations of the method according to the invention, the
15 generative production method is a stereolithography method, a digital light processing method, a 3D printing method, a fused deposition modeling method, a multi jet modeling method, a selective laser sintering or selective laser fusing method, an electron beam fusing method or a combination of these methods. The use of individual or a combination of these manufacturing methods is determined
20 by the product to be produced.

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 printing and/or stamping
25 cylinder or the printing and/or stamping sleeve 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
30 and/or a photosensitive varnish can in particular be used as the substance.

Therein, the method according to the invention can include the following steps: a) providing digitized data representing the three-dimensional construction of the printing and/or stamping cylinder and/or the printing and/or stamping sleeve and the structured cylinder jacket exterior surface; b) locally setting the photosensitive
35 plastic material and/or the photosensitive varnish in layers for supplying energy in

the area of a construction and setting zone; c) lowering the arising intermediate product in layers by a predefined layer thickness; and d) repeating the preceding steps b) to c) until completion of the printing and/or stamping cylinder or the printing and/or stamping sleeve and the cylinder jacket exterior surface. Therein, laser energy is usually supplied in the method step b). Furthermore, there is the possibility that a further setting process is performed by means of UV radiation after method step d).

In an advantageous configuration of the method according to the invention, at least one UV setting varnish and/or at least one UV setting ink can be used as the substance for a 3D printing method. This alternative method according to the invention can again include the following steps: a) providing digitized data representing the three-dimensional construction of the printing and/or stamping cylinder or the printing and/or stamping sleeve and the structured cylinder jacket exterior surface; b) locally setting the at least one UV setting varnish and/or the at least one UV setting ink in layers by supplying UV light in the area of a construction and setting zone; and c) repeating the preceding step b) until completion of the printing and/or stamping cylinder or the printing and/or stamping sleeve and the cylinder jacket exterior surface. The use of such a 3D printing method offers advantages in particular for the configuration of the cylinder jacket exterior surface, that is for applying in particular image and/or stamping information.

In further advantageous configurations of the method according to the invention, at least one plastic, synthetic resin, metal, a metal alloy or ceramic or a combination of these substances in powder form is used as the substance for the selective laser sintering or selective laser fusing method. Herein, elements of the printing and/or stamping cylinders and printing and/or stamping sleeves, respectively, which are for example made of aluminum or an aluminum alloy, can in particular be generatively manufactured. In using the selective laser sintering or selective laser fusing method, the following steps can be executed according to the invention: a) providing digitized data representing the three-dimensional construction of the printing and/or stamping cylinder or the printing and/or stamping sleeve and/or the structured cylinder jacket exterior surface; b) applying at least one powdery component substance in layers to a component platform in

the area of a construction and joining zone; c) locally fusing and/or sintering the component substance in layers by supplying energy in the area of the construction and joining zone; d) lowering the component platform in layers by a predefined layer thickness; and e) repeating the steps b) to d) until completion of the printing and/or stamping cylinder and the printing and/or stamping sleeve and the cylinder jacket exterior surface. Therein, laser energy is usually supplied in the method step c).

The generative manufacturing methods described above only exemplarily represent the possibilities of the generative manufacture of printing and/or stamping cylinders or of printing and/or stamping sleeves or parts of these cylinders or sleeves according to the invention. Further generative manufacturing methods are conceivable. The generatively produced structures of the cylinder jacket exterior surface are for example printing and/or stamping screens, which are usually dot-shaped constructed. Furthermore, there is the possibility that at least individual areas of the cylinder jacket exterior surface are hardened. This can for example be effected by chrome-plating these areas such that these areas are protected from erosion, premature wear or contaminations. Furthermore, there is the possibility that the surface of the cylinder jacket exterior surface is at least partially also coated with other advantageous materials after completion.

The structures produced in the cylinder jacket exterior surfaces according to the invention can be formed as so-called 2D or 3D structures. Therein, in the field of the printing and stamping technology, by 2D structures, those are understood, which are only surface-modulated developed. In contrast, structures are understood by actual 3D structures, which actually give rise to clearly volume describing structures. It can also be spoken of single-step, that is two-dimensional stampings, and multi-step stampings, that is three-dimensional stampings.

The invention further relates to a printing and/or stamping cylinder or a printing and/or stamping sleeve each including a structured formed cylinder jacket exterior surface for generating a printing and/or stamping structure on a material or a material web produced according to the method according to the invention described above. Such printing and/or stamping cylinders and/or printing and/or stamping sleeves can be fast and economically produced. The correspondingly

provided digitized data representing the three-dimensional construction of the printing and/or stamping cylinder and/or the printing and/or stamping sleeve and a structured formed cylinder jacket exterior surface of these elements can be readily provided to a corresponding generative manufacturing device. The

5 generative manufacturing device then manufactures the corresponding printing and stamping cylinder or the printing and/or stamping sleeve with the corresponding cylinder jacket exterior surface according to the communicated data. Since the number of manufacturing steps can thus be minimized, the method according to the invention and the corresponding printing and/or

10 stamping cylinders, printing and/or stamping sleeves and the corresponding cylinder jacket exterior surfaces of these elements according to the invention can be particularly fast and inexpensively produced. This also applies in using different materials for producing the above mentioned products. In addition, there is the possibility of being able to very fast and flexibly react to possible changes in the

15 printing and/or stamping design.

Patentkrav

1. Fremgangsmåde til fremstilling af en tryk- og/eller prægningscylinder eller et tryk- og/eller prægningshylster der skal indrettes på en bærer der hver omfatter en struktureret udformet cylinderkappeyderflade til at danne en tryk- og/eller
- 5 prægningsstruktur på et materiale eller en materialebane, hvor cylinderkappeyderfladen er fremstillet ved hjælp af en generativ fremstillingsfremgangsmåde, **kendetegnet ved, at** tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret er integreret i den strukturerede cylinderkappeyderflade og fremstillet generativt.
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2. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** den generative fremstillingsfremgangsmåde er en stereolitografifremgangsmåde, en digital light processing-fremgangsmåde, en 3D-printfremgangsmåde, en smeltelagdelingsfremgangsmåde, en multi jet modeling-
- 15 fremgangsmåde, en selektiv lasersinter- eller selektiv lasersmeltefremgangsmåde, en elektronstrålesmeltefremgangsmåde eller en kombination af disse fremgangsmåder.
3. Fremgangsmåde ifølge krav 2, **kendetegnet ved, at** mindst et flydende,
- 20 fotosensitivt plastmateriale og/eller en syntetisk resin og/eller en fotosensitiv lak anvendes som stoffet til stereolitografifremgangsmåden.
4. Fremgangsmåde ifølge krav 3, **kendetegnet ved, at** fremgangsmåden til fremstilling af tryk- og/eller prægningscylinderen eller tryk- og/eller
- 25 prægningshylsteret og den strukturerede cylinderkappeyderflade omfatter følgende trin:
- a) tilvejebringelse af digitaliserede data der repræsenterer den tredimensionelle konstruktion af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og den strukturerede
- 30 cylinderkappeyderflade;
- b) lagvis og lokal hærdning af det fotosensitive plastmateriale og/eller den fotosensitive lak ved tilførsel af energi i området af en konstruktions- og hærdningszone;

c) lagvis sænkning af det opståede mellemprodukt med en foruddefineret lagtykkelse; og

d) gentagelse af de foregående trin b) og c) indtil færdiggørelse af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og cylinderkappeyderfladen.

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5. Fremgangsmåde ifølge krav 4, **kendetegnet ved, at** der tilføres laserenergi i fremgangsmådetrin b).

10 **6.** Fremgangsmåde ifølge krav 4 eller 5, **kendetegnet ved, at** der efter fremgangsmådetrin d) udføres en yderligere hærtningsproces ved hjælp af UV-bestråling.

15 **7.** Fremgangsmåde ifølge krav 2, **kendetegnet ved, at** der som materiale til 3D-printfremgangsmåden anvendes mindst en UV-hærdende lak og/eller mindst et UV-hærdende farvestof.

20 **8.** Fremgangsmåde ifølge krav 7, **kendetegnet ved, at** fremgangsmåden til fremstilling af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og den strukturerede cylinderkappeyderflade omfatter følgende trin:

a) tilvejebringelse af digitaliserede data der repræsenterer den tredimensionelle konstruktion af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og den strukturerede cylinderkappeyderflade;

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b) lagvis og lokal hærtning af den mindst ene UV-hærdende lak og/eller det mindst ene UV-hærdende farvestof ved tilførsel af UV-lys i området af en konstruktions- og hærtningszone; og

c) at gentage det foregående trin b) indtil færdiggørelse af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og cylinderkappeyderfladen.

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9. Fremgangsmåde ifølge krav 2, **kendetegnet ved, at** der som materiale til den selektive lasersinter- eller lasersmeltefremgangsmåde anvendes mindst et plastmateriale, en syntetisk resin, et metal, en metallegering eller et keramisk stof eller en kombination af disse materialer i pulverform.

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10. Fremgangsmåde ifølge krav 9, **kendetegnet ved, at** fremgangsmåden til fremstilling af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og den strukturerede cylinderkappeyderflade omfatter følgende trin:

- 10 a) tilvejebringelse af digitaliserede data der repræsenterer den tredimensionelle konstruktion af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og den strukturerede cylinderkappeyderflade;
- 15 b) lagvis anvendelse af mindst et pulverformet byggedelsmateriale til en byggedelsplatform i området med en konstruktions- og sammenføjningszone;
- c) lagvis og lokal smeltning og/eller sintring af byggedelsmaterialet ved tilførsel af energi i området af en konstruktions- og sammenføjningszone;
- d) lagvis sænkning af byggedelsplatformen med en foruddefineret lagtykkelse; og
- 20 e) gentagelse af trinnene b) til d) indtil færdiggørelse af tryk- og/eller prægningscylinderen eller tryk- og/eller prægningshylsteret og cylinderkappeyderfladen.

25 **11.** Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** der tilføres laserenergi i fremgangsmådetrin c).

12. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** overfladen af cylinderkappeyderfladen mindst delvist
30 coats efter færdiggørelse.

13. Tryk- og/eller prægningscylinder eller tryk- og/eller prægningshylster der hver omfatter en struktureret udformet cylinderkappeyderflade til at danne en tryk- og/eller prægningsstruktur på et materiale eller en materialebane fremstillet ifølge en fremgangsmåde ifølge et hvilket som helst af kravene 1 til 12.