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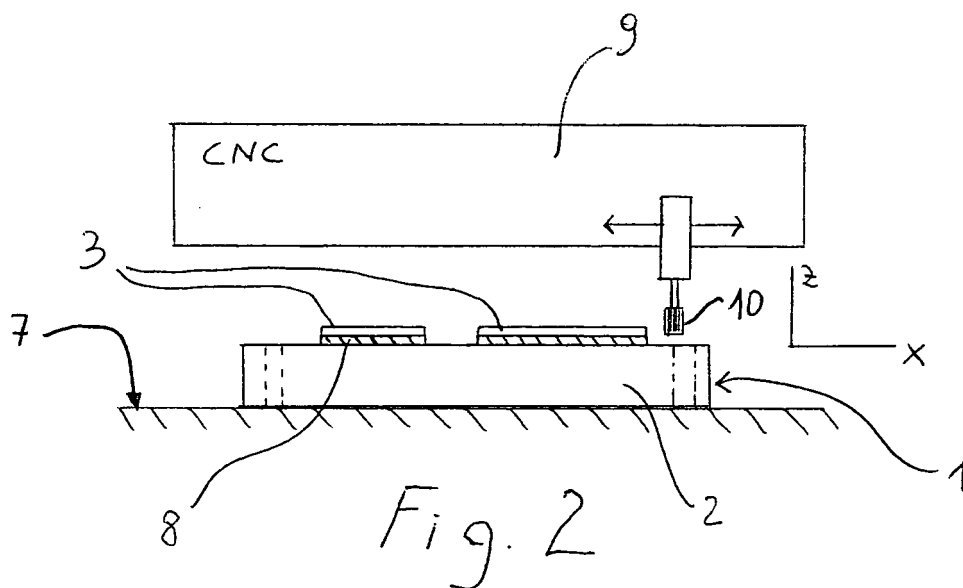
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(54) **Counter-die for blanking cardboard and related process for manufacturing the same**

(57) The present invention concerns a method for the set-up of a counter-die, which can be combined with the die of equipment for die-cutting/crease of sheets made of cardboard or card, for example. The method comprises the phases of preparing a supporting plate and at least one insert made of a hard material which can be fixed to the surface of the plate and obtaining one or more grooves on the surface of each insert. Each insert has the function of accommodating at least partly a cor-

responding blade of the die at the level of a cutting or perforating line of the relative blank. Unlike the traditional solutions, the phase of obtaining the grooves on the insert is performed subsequently to fixing of the insert to the supporting plate of the counter-die and not before fixing of the insert to the plate. Machining of the grooves is performed by computer numeric control (CNC) machines on the basis of geometric references present on the supporting plate.



Description

[0001] The present invention concerns a method for the set-up of a counter-die which can be combined with the corresponding die of an apparatus for die-cutting/perforating sheets of paper-based material, for example cardboard or card, and the counter-die directly obtained with said method.

[0002] In a traditional apparatus for die-cutting sheets of paper-based material, a die and a counter-die cooperate to perform cutting and/or crease of the sheets according to a predefined pattern. The die is provided with metal blades protruding from a supporting plate, generally made of wood or plywood. The blades are arranged according to a predefined pattern and protrude vertically with respect to the sheet positioned between die and counter-die. The counter-die comprises a plate positioned opposite the die and provided with appropriate grooves for housing, even only partially, blades protruding from the relative supporting plate. Die and counter-die move with respect to each other to provide male-female coupling of the blades with the respective grooves and obtain cutting and/or crease of the sheet at the level of said grooves. For example, a traditional machine for die-cutting is described in the United States patent US 6,189,414.

[0003] The traditional counter-dies comprise a supporting plate, generally made of steel, covered at least partly with an insert made of inexpensive material that can be milled. In particular, the insert is applied on the surface of the supporting plate opposite the blades of the corresponding die. The insert is generally made of a phenolic resin-based material, for example a multilayer comprising phenolic resin, paper or fabric. One of the materials commonly used for producing the inserts of the counter-dies is known under the trade name PERTINAX.

[0004] During set-up of the counter-dies of the traditional die-cutting systems, the insert is milled and subsequently glued to the supporting plate. Milling of the insert provides the grooves for the temporary housing of at least one portion of the blades protruding from the corresponding die, when the die engages with the counter-die during cutting and/or crease of the sheet.

[0005] The use of inserts means that the supporting plate material is not machined directly (which would be very costly). In this way the same plate can be re-used with different inserts, when necessary. An example of counter-die provided with insert made of an easily machinable material for provision of the grooves corresponding to the blades of the die is given in the United States patent US 5,517,880.

[0006] One of the main problems of the known technique consists in the fact that the fixing of one or more inserts on a supporting plate of a counter-die requires extreme precision, accuracy and experience and, therefore, negatively affects the times and costs of set-up of the counter-die and relative die-cutting equipment.

[0007] In practice, the set-up of a traditional counter-

die initially involves the positioning of one or more inserts, already milled, on the surface of the supporting plate. The lower surface of the inserts is adhesive, i.e. an adhesive layer is provided between the inserts and the supporting plate. The adhesive fixes the inserts when they are pressed against the surface of the supporting plate. The inserts must be positioned so that the relative grooves are all aligned with the corresponding blades protruding from the die. The alignment or "centring" of the inserts is usually performed by specialist technicians and may take more than one hour, to the detriment of the production rate of the die-cutting equipment.

[0008] Usually the technician checks the centring precision of the inserts glued to the relative supporting plate by performing a trial die-cutting operation, i.e. by engaging the die with the counter-die to die-cut a sheet of paper-based material. When the die and counter-die are centred, i.e. when the inserts of the counter-die are correctly positioned on the relative supporting plate, the blades of the die and the relative grooves obtained in the inserts are aligned and the cutting and crease lines obtained on the sheet correspond to the expected quality standards. If the centring is not satisfactory, the technician detaches the inserts from the supporting plate and re-positions them.

[0009] Methods have been proposed for setting up counter-dies which involve direct machining of the metal supporting plate to obtain the grooves. These methods entail high costs. Furthermore the supporting plate cannot be re-used if it is necessary to modify the characteristics of the blanks to be produced. For example, DE 19800374 describes a method for machining the stainless steel supporting plate of the counter-die with jets of water at high pressure. The jets of water impress the grooves on the surface of the plate. Any errors in machining of the metal cannot be easily remedied and can negatively affect use of the plate.

[0010] The object of the present invention is to make available a method for the set-up of counter-dies, which can be combined with the corresponding dies of equipment for die-cutting/crease, which provides high savings in terms of time and costs with respect to the traditional technical solutions.

[0011] A further object of the present invention is to make available a method for the set-up of counter dies, which can be combined with the corresponding dies of die-cutting/crease equipment, for maximising the quality of the cutting and crease lines that can be obtained on the relative blanks.

[0012] These and further objects are obtained by the method for the set-up of a counter-die characterised according to claim 1.

[0013] The present invention furthermore concerns a counter-die directly obtained with the set-up method of claim 1.

[0014] According to the present invention, the method for set-up of a counter-die, which can be combined with the die of apparatus for die-cutting/crease of sheets

made of cardboard or card for example, comprises the phases of providing a supporting plate and at least one insert which can be fixed to the surface of the plate and obtaining one or more grooves on the surface of each insert. Each groove has the function of accommodating at least partly a corresponding blade of the die at the level of a cutting or crease line of the relative blank. Unlike the traditional solutions, the phase of obtaining the grooves on the insert is performed after fixing of the insert to the supporting plate of the counter-die and not before fixing of the insert to the plate.

[0015] The grooves are machined using automatic machines. The position of each groove to be machined is determined according to one or more geometric references on the supporting plate.

[0016] The method does not involve other phases for gluing of the inserts apart from the one cited, i.e. the inserts are not glued to a second supporting plate for the removal of excess material after machining of the grooves. In other words, the supporting plate on which the insert has been machined is provided directly in the die-cutting equipment, without the need to transfer one or more machined inserts onto other supporting plates.

[0017] The advantages offered by the method according to the invention, with respect to the known technique, are considerable and, as will be seen from the following description, concern the times and costs involved in setting up, i.e. preparing, the counter-dies.

[0018] The insert is a plastic blade, having a surface hardness equivalent to or higher than that of PERTINAX, which can be fixed to the surface of said supporting plate by gluing. For example, the inserts can be sheets made of PERTINAX or a material known under the trade name VINILPRINT, or a phenolic resin-based material or another plastic material. The thickness of the inserts is chosen according to the traditional criteria and depends on the thickness of the cardboard or card to be die-cut by the die and counter-die. Preferably the inserts are fixed to the surface of the counter-die supporting plate (the surface that will interact with the corresponding die) by means of double-sided tape.

[0019] Alternatively, the insert is obtained by applying, with uniform thickness, a resin or a plastic substance in liquid form on the counter-die supporting plate. As it dries, the resin or plastic substance hardens and adheres to the surface of the supporting plate, forming a rigid insert.

[0020] The grooves are obtained on the free surface of the relative insert by machining, which preferably comprises at least one milling phase. The milling is performed, for example, with a micro-milling cutter of a computer numeric control (CNC) machine directly on the inserts integral with the relative supporting plate.

[0021] One particular aspect of the present invention is therefore that of machining the inserts with automatic numeric control machines when said inserts are integral with the supporting plate of the counter-die to be set up. This allows the geometric references on the supporting plate to be used for initialisation or "pre-setting" of the

numeric control machine. In other words, operation of the machine that machines the grooves of the inserts, as generally provided for by CNC machines, requires detection of the machine datum point, i.e. a reference point for measurement of the machining dimensions. Since the inserts are integral with the supporting plate, the computer numeric control (CNC) machine uses the reference points present on the plate to define the machine datum point, enormously simplifying the pre-setting phase. The numeric control machine operates automatically, on the basis of the processing of electronic files, obtaining the inserts rapidly and with extreme dimensional precision. The geometric reference points of the supporting plate can be various, for example they can be the centring holes of the plate on the die-cutting equipment or the edges or corners of the plate itself, etc..

[0022] Once the numeric control machine has acquired the geometric references necessary for definition of the machine datum point, it performs milling of the insert or inserts fixed to the supporting plate, removing part of the material of the insert to obtain the grooves corresponding to the blades of the die.

[0023] The data relative to the geometry of each groove, for example the data relative to the length, depth, curvature, form in cross section etc., are stored electronically in the form of files that can be accessed by the machine control unit.

[0024] Advantageously, said files can be the same CAD files as those used for laser cutting of the wooden supporting plate of the die, or specific CAD files for the counter-die.

[0025] By directly machining the inserts already fixed to the supporting plate of the counter-die (which will be set in the die-cutting equipment) it is no longer necessary to perform centring of the inserts, i.e. it is no longer necessary to check correct alignment of the grooves with respect to the blades of the corresponding die. The method according to the present invention permits a saving of 30 to 60 minutes for set-up of the counter-die with respect to the known solutions.

[0026] The precision in machining of the grooves of the inserts, which can be obtained with the numeric control machines currently available on the market, is high, in the order of one hundredth of a millimetre, with evident advantages in terms of the quality of the blanks.

[0027] The present invention will now be described in detail with reference to the accompanying drawings attached as a non-limiting example, in which:

- figure 1 is a perspective view of a counter-die according to the present invention in a first phase of the set-up, not yet completed;
- figure 2 is a view in section A-A of figure 1 of the counter-die during performance of a second set-up phase according to the present invention;
- figure 3 is a perspective view of the counter-die shown in figure 1, set up and completed;
- figure 4 is a view in section B-B of the counter-die

shown in figure 3, combined with a corresponding die.

[0028] Figure 1 shows, in a perspective view, a counter-die **1** for set-up with the method according to the present invention to operate in combination with the die of a die-cutting machine (not shown). The counter-die **1** in general comprises a supporting plate **2**, preferably made of metal, for example steel or aluminium, on the upper surface **22** of which one or more inserts **3** can be fixed. During production of the blanks, the upper surface **22** of the supporting plate **2** is positioned opposite the corresponding die of the equipment and the sheets to be die-cut are fed in an intermediate position between the die and the counter-die **1**.

[0029] The dimensions of the supporting plate can vary according to the use of the counter-die **1**, i.e. according to the type of blanks to be produced. For example, for a generic application in the field of packets of medicines or cosmetics, the supporting plate **2** can have dimensions equal to 60x50x0.5 cm, respectively along the reference axes X, Y and Z shown in figure 1.

[0030] On the supporting plate **2** there is at least one geometric reference, for example an assembly hole **23**, a notch **24**, a groove, or one of the corners **25** of the plate itself, etc.

[0031] The inserts **3** can be made of a plastic material which can be easily fixed to the upper surface **22** of the supporting plate **2**. Preferably, the inserts **3** are plastic sheets having a gauged thickness. The material of the inserts **3** is chosen to obtain a surface hardness equivalent to or higher than that of PERTINAX. Suitable materials for the purpose are, for example, PERTINAX and VINILPRINT. The hardness of the material is important to prevent rapid wear of the inserts following die-cutting. For this reason, pressboard, for example, is not suitable.

[0032] The inserts **3** shown in figure 1 are intact, as the counter-die **1** is not completed. In other words, the inserts **3** shown in figure 1 still have to be machined to obtain the grooves necessary for accommodating, even only partially, the blades of a corresponding die and to remove the excess material.

[0033] The inserts **3** are fixed to the supporting plate **2** by interposition of an adhesive material, preferably double-sided tape, i.e. tape with two opposite adhesive surfaces.

[0034] Alternatively, the inserts **3** can be obtained by depositing a layer of plastic in liquid form which, as it dries, solidifies and fixes to the supporting plate **2**. Figure 2 shows the counter-die **1** during machining of the grooves. In particular, the counter-die **1**, shown in section along the line A-A of figure 1, is positioned fixed on the work surface **7** of an automatic manufacturing machine **9**. The inserts **3** and the double-sided tape **8** for fixing to the supporting plate **2** can be seen. The dimensions of the inserts **3**, of the tape **8** and plate **2** shown in figures 1 and 2 are not real, since said elements are shown enlarged for greater clarity. The machine **9** is preferably a

computer numeric control (CNC) machine provided with at least one tool **10**, which can move on the surface along the axes X, Y and height-wise along the Z axis (three-axis machine). The tool **10** is a milling cutter or a micro milling cutter, for example.

[0035] According to one embodiment of the present invention, set-up of the counter-die **1** entails the machine **9** operating automatically for machining of the grooves and removal of the excess material from the inserts **3**. In this way set-up times and costs are minimised.

[0036] One of the important aspects of the present invention is that the machine **9** detects at least one geometric reference present on the supporting plate **2**, for example the position and/or direction of an assembly hole **23**, notch **24**, one of the corners **25**, etc., and on the basis of said detection operates the tool **10** to obtain one or more grooves in the inserts **3**. In other words, the geometric references **23**, **24**, **25** present on the supporting plate **2** are acquired by the CNC machine **9** for definition of the machine datum point during pre-setting of said machine **9**, i.e. for definition of the machining dimensions. This characteristic permits machining of the inserts **3**, obtaining the grooves and removing the material with extreme positioning precision. The result obtained is shown in figure 3.

[0037] Figure 3 is a perspective view of the counter-die **1** set up, i.e. completed and ready for the production of blanks. The numeric control machine **9** has machined a plurality of grooves **31** on the surface of the inserts **3** and has removed excess material at the edges **32** of the inserts **3**. Said grooves **31** can be oriented in various ways on the surface, and can be straight or curved. The position of the grooves **31** with respect to the geometric references taken into consideration on the plate **2** is extremely accurate and is equal to the positioning precision of the tool **10** of the machine **9**, for example in the order of one hundredth of a millimetre.

[0038] High quality blanks can be obtained with the counter-die **1**. Figure 4 shows the counter-die **1** in cross section along the line B-B of figure 3, combined with a corresponding die **11** of a machine for die-cutting sheets of cardboard or card **12**. The counter-die **1** is fixed on a work surface and the die **11** moves vertically in an alternating manner on the Z axis to die-cut sheets **12** fed in an intermediate position. Alternatively, the die **11** can be fixed and the counter-die can move along the Z axis.

[0039] The die **11** comprises a supporting plate **14**, preferably made of wood or plywood, and a plurality of blades **13**, for example metal strips vertically inserted in slots obtained in the wood, protruding from the lower surface. A groove **31** in the insert **3** of the opposite counter-die **1** corresponds to each blade **13**. When the blades **13** are lowered and enter, even only partially, the corresponding grooves **31**, creating a male-female coupling with play, the sheet **12** is die-cut.

[0040] According to a preferred embodiment of the present invention, the numeric control machine **9** operates on the basis of processing of information in elec-

tronic form, for example information relative to the geometry of the die **11** and/or of the counter-die **1**, coded in CAD files. This permits considerable simplification of the pre-setting phases of the machine **9**. It is possible to use the CAD files relative to the die **11**, such as for example the files used for laser cut of the grooves in which the blades **13** are inserted, for operation of the tool **10** in machining of the grooves **31**. In other words, it is possible to machine the inserts **3** to obtain the incisions **31** and remove the excess material, processing the same CAD files as those used for set-up of the die **11**, directly obtaining centring between die **11** and counter-die **1**.

[0041] Advantageously the set-up method according to the present invention permits realisation of the counter-die **1** with the inserts **3** fixed on the surface **22** already centred with respect to the corresponding blades **13**, i.e. without the need for a specialist technician to intervene to check or correct the centring (positioning of the inserts **3** with respect to the blades **13**), with evident savings in terms of time and cost and an increase in production rate. The counter-die set up in this way is ready for use without further delays or machining operations.

[0042] High dimensional precision of the grooves **31** (depth, section profile, length etc.), in addition to high-precision positioning of said grooves is ensured. Modern numeric control machines guarantee precision in the order of one hundredth of a millimetre.

Claims

1. Method for set-up of a counter-die (1) which can be combined with the die (11) of an apparatus for die-cutting/crease of sheets (12), comprising the phase of preparing a supporting plate (2) and at least one insert (3) that can be fixed to the surface (22) of said plate (2) and the phase of obtaining one or more grooves (31) on the surface of said at least one insert (3), each groove (31) being intended to accommodate at least partly a corresponding blade (13) of said die (11) in correspondence of a cutting or perforating line of the relative blank, **characterised in that** the phase of obtaining the grooves (31) on the relative insert (3) is performed after fixing of the insert (3) to the supporting plate (2), using one or more geometric references (23, 24, 25) present on the supporting plate (2) to determine the position of each groove (3).
2. Method as claimed in claim 1, **characterised in that** said insert (3) is a plastic sheet which can be fixed to the surface (22) of said supporting plate (2) by gluing.
3. Method as claimed in claim 1 or 2, **characterised in that** said grooves (31) are obtained on the free surface of the relative insert (3) by means of a machining operation.
4. Method as claimed in claim 3, **characterised in that** said machining operation is performed with automatic machines (9) and comprises at least one milling phase.
5. Method as claimed in claim 3 or 4, **characterised in that** said machining operation is performed directly on said at least one insert (3), fixed to the supporting plate (2), by means of one or more computer numeric control (CNC) machines (9).
6. Method as claimed in claim 5, **characterised in that** it comprises the phase of coding in files in electronic format the information relating to the geometric characteristics of said grooves (31).
7. Method as claimed in claim 6, **characterised in that** said numeric control machines (9) perform the pre-setting and operate on the basis of processing of said files.
8. Method as claimed in claim 6 or claim 7, **characterised in that** it comprises the phase of initialising said numeric control machines (9), or preparing them for machining of the insert (3), on the basis of geometric references (23, 24, 25) present on said supporting plate (2).
9. Method as claimed in any one of the preceding claims 1-8, **characterised in that** the material of said at least one insert (3) has a surface hardness equivalent to or higher than that of PERTINAX.
10. Method as claimed in any one of the preceding claims 1-9, **characterised in that** said at least one insert (3) is made of a material chosen from PERTINAX, VINILPRINT, a phenolic resin-based material, FORMICA.
11. Counter-die (1) which can be combined with the die (11) of an apparatus for die-cutting/crease of sheets (12), **characterised in that** it is directly obtained by means of the method according to any one of the claims 1-10.

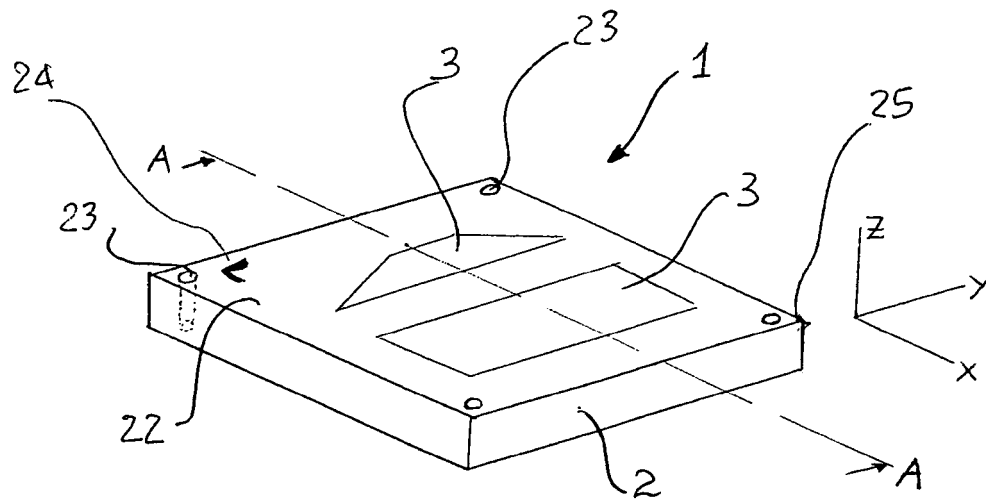


Fig. 1

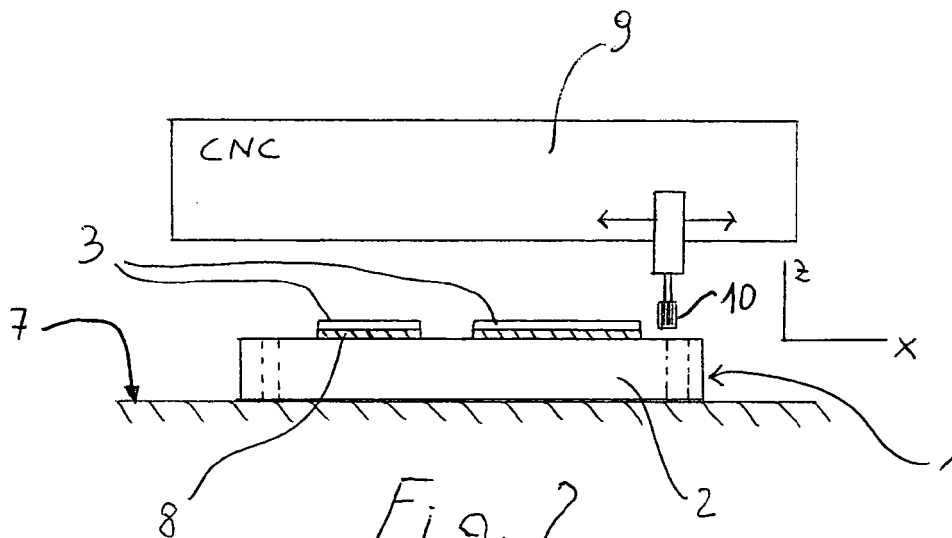
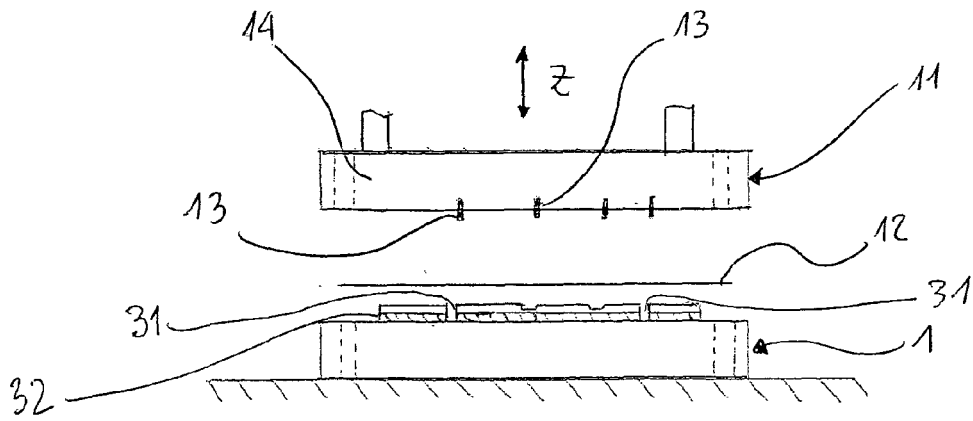
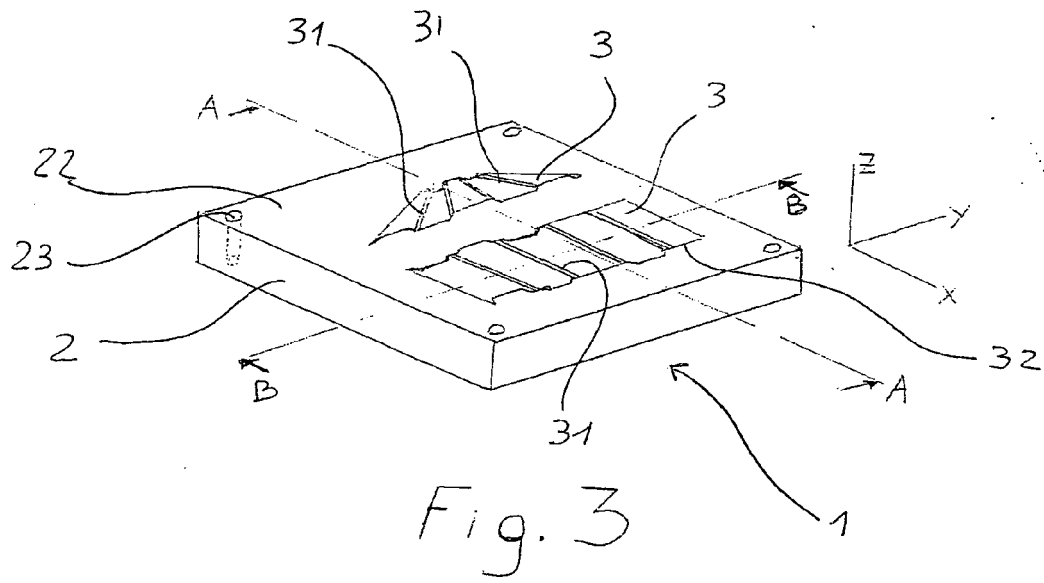


Fig. 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5562

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 38 31 393 A1 (GREBE WOLFGANG PROF DR ING [DE]) 22 March 1990 (1990-03-22)	11	INV. B23P15/40 B26F1/44
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Place of search		Date of completion of the search	Examiner
Munich		25 January 2008	Canelas, Rui
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 42 5562

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
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