



(51) International Patent Classification:

B21D 26/02 (2011.01) **B21D 22/10** (2006.01)

(21) International Application Number:

PCT/IT2010/000398

(22) International Filing Date:

21 September 2010 (21.09.2010)

(25) Filing Language:

Italian

(26) Publication Language:

English

(30) Priority Data:

MC2009A000202 22 September 2009 (22.09.2009) IT

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

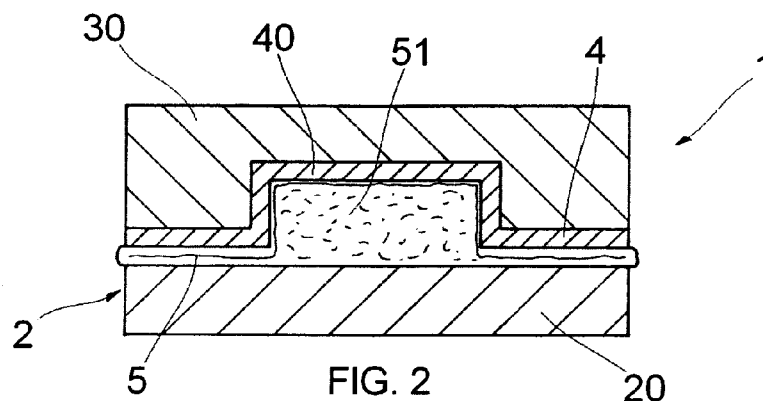
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: EQUIPMENT AND METHOD FOR PRINTING MATERIAL IN SHEET FORM, IN PARTICULAR METAL PLATES



(57) Abstract: An equipment (1) and method for printing of plates (4) are described. The equipment comprises a mold (2) composed of a base (20) and a die (30) provided with at least one cavity (31) to shape the plate (4). The equipment also comprises a cushion (5) situated between said base (20; 120) and plate (4). The cushion (5; 105) contains a fluid (51) that flows inside it to allow for deforming the cushion according to the shape of said at least one cavity (31) of the die.

Description

Equipment and method for printing material in sheet form, in particular metal plates.

The present patent application for industrial invention relates to an equipment and method for printing material in sheet form, in particular metal plates.

Although reference is made hereinafter to metal plates, such as silver
5 plates, the present invention also extends to non-metal material in sheet form, for example rigid or semi-rigid plates of plastic materials of any composition, such as polymers, methacrylate, PVC, polyethylene and similar, or also natural and synthetic leather, wood and veneer wood, fabric, paper and similar.

10 As it is known, the printing process of metal sheets provides for positioning the plate in a forming press composed of two semi-dies. The first semi-die, defined as die, has a plurality of cavities; whereas the second semi-die, defined as male die holder, has a plurality of protruding parts (males) designed to be inserted in the cavities of the die in order to deform and shape
15 the plate arranged between the two semi-dies. The two semi-dies are moved by means of a suitable actuation mechanism that is electrically, hydraulically or pneumatically actuated.

Such a printing process is extremely complicated and expensive due to the constructive complexity of the male die holder that must be provided
20 with a plurality of males registered with the cavities of the die.

It must be considered that both the female die and male die holder must be changed whenever production is changed. Consequently, a plurality of semi-dies must be stored in the warehouse according to the type of production to be carried out.

25 A molding-blowing process is also known according to which, once the mold is hermetically closed, pressurized air is injected or air is extracted, in such a way that the product to be molded takes on the shape of the die

cavity.

The purpose of the present invention is to eliminate the inconveniences of the prior art, by devising an equipment and method for printing of material in sheet form that is ductile, versatile, inexpensive and easy to make and install.

Another purpose of the present invention is to devise such equipment that allows for an efficient, effective, rapid and versatile process for printing material in sheet form.

Said purposes are achieved according to the invention, with the equipment the characteristics of which are listed in the enclosed independent claim 1 and with the method the characteristics of which are listed in the enclosed independent claim 10.

Advantageous embodiments are disclosed in the dependent claims.

The equipment for printing of plates according to the invention comprises a mold composed of a base and a die in which at least one cavity is obtained to form the plate. The equipment also comprises a cushion situated between the base and the plate. The cushion contains a fluid and deforms according to the shape of said at least one cavity of the die, in such a way that when the mold is closed, the fluid inside the cushion flows, taking the cavity space and suitably deforming the plate that is arranged between said cushion and die.

The advantages of the equipment of the invention are evident, since it allows for printing plates of different type effectively and rapidly, with dies of different types and dimensions, always using the same cushion, without having to use different types of male die holders according to the type of die.

Additional characteristics of the invention will appear more evident from the following detailed description that refers to merely illustrative, not limiting embodiments, illustrated in the enclosed drawings, wherein:

Fig. 1 is an exploded cross-sectional diagrammatic view of a first embodiment of the equipment for printing material in sheet form according to the invention;

Figs. 2 and 3 are two views as Fig. 1 that show two consecutive steps

of the printing process of material in sheet form according to the invention;

Fig. 4 is a cross-sectional diagrammatic view of a second embodiment of the equipment for printing material in sheet form according to the invention;

Figs. 5 and 6 are two views as Fig. 4 that show two consecutive steps
5 of the printing process of material in sheet form according to the invention;
and

Fig. 7 is the same view as Fig. 1, except for it shows a third embodiment of the equipment according to the invention.

With reference to Figs. 1 to 3, a first embodiment of the equipment for
10 printing material in sheet form according to the invention, which is generally
indicated with numeral (1).

The equipment (1) comprises a mold (2). The mold (2) comprises a
base (20) and a die (30). The base (20) has a basically flat surface (21)
facing towards the die (30). The die (30) has one or more cavities (31) facing
15 towards the base (30). The cavity (31) of the die is shaped according to the
shape to be given to a plate (4) of material in sheet form, such as a metal
plate.

The equipment also comprises a cushion (5) that is situated between
the plate (4) and the base (20), when the mold is open. The term "cushion"
20 indicates gaseous or liquid fluid hermetically contained in a case, but also a
pasty fluid, such as silicone paste or gel, which must not be necessarily
closed in a case.

In the embodiment shown in Figs. 1 - 3, the cushion (5) has a case
(50) that hermetically contains a fluid (51).

25 The case (50) is made of deformable fluid-tight tear-resistant material,
which can also be slightly expandable. The case can also be made, for
example, of plastic film of suitable thickness or also fabric or non-woven
fabric (TNT) which is waterproofed and eventually elasticated.

The fluid (51) can be of any type:

- 30
- gaseous, such as air,
 - liquid, such as water or oil,
 - semi-solid or pasty, such as silicone paste or gel.

In case of incompressible fluid, such as water or oil, the volume of the fluid (51) inside the cushion must be basically equal to the volume defined by the cavity (31) of the die (30). In any case the volume of the fluid (51) must not be higher than the volume defined by the cavity (31). In fact, if the volume
5 of the fluid is higher than the volume of the cavity, waste is obtained in case of pasty material.

In case of compressible fluid, such as air or foam, the volume of the fluid at the maximum pressure, which corresponds to the pressure exerted on the cushion when the mold is closed, must be basically equal to the volume
10 defined by the cavity (31) of the mold (30). On the contrary, the volume of compressible fluid at atmospheric pressure is higher than the volume of the cavity (31) of the die. In view of the above, during the closing pressure of the mold, the fluid is compressed deforming the cushion that tends to occupy the cavity of the mold.

Referring to Fig. 2, when the mold (2) is closed, by means of a press
15 (not shown in the figures) the die (30) is moved close to the base (20). Consequently, the cushion (5) is compressed and deformed. In fact, the fluid (51) tends to flow towards the area of the cavity (31) of the die, exerting pressure on the plate (4) that is exactly deformed in the cavity (31) of the die,
20 forming a protuberance (40) that takes the shape of the cavity of the die.

The fluid (51) inside the cushion (5) tends to entirely fill the volume of the cavity (31) of the die, in such a way to perfectly deform the plate (4) that takes the shape of the cavity of the die.

Referring to Fig. 3, when the mold (2) is open, the cushion (5) resumes
25 the original configuration shown in Fig. 1 and the shaped plate (4) can be extracted from the mold. So the cushion (5) can be reused for another printing cycle.

In the following description identical elements or elements that correspond to the ones described above are indicated with the same
30 numerals, omitting a detailed description.

Referring to Figs. 4 to 6, a second embodiment of the equipment for printing material in sheet form according to the invention is described, which

is generally indicated with numeral (100).

In the equipment (100), the base (120) of the mold (2) is provided with a recessed housing (121) that is covered by a cover (150), in such a way to form a hermetic chamber (105) that contains the fluid (51). The chamber
5 (105) acts as fluid cushion, exactly like in the first embodiment.

The cover (150) can be made of the same material used for the case (50) of the first embodiment.

The second embodiment is provided with feed means (125) to feed the fluid (51) in the chamber (105) of the base of the mold, according to the
10 volume of fluid (51) required for the printing process.

Referring to Figs. 4 to 6, if the fluid (51) is pasty, such as a silicone paste, the formation of a hermetic chamber is not necessary. Therefore the cushion (105) can be made of silicone paste (51) only. In fact, when the mold is closed, the shavings of the silicone paste that crosses the air spaces
15 between base (120) and die (30) are very limited.

In such a case, a sheet (150) is positioned on the silicone paste (51) provided on the base (120) in order not to get the plate dirty.

Fig. 7 describes a third embodiment of the equipment (200) according to which the base (220) of the mold is provided with two cavities (223) in
20 correspondence with flat surfaces (33) of the die (30). In such a case two cushions of fluid (5) are situated between the flat surfaces (33) of the die and the plate (4) in correspondence with the two cavities (223) of the base.

Numerous variations and modifications can be made to the present embodiments of the invention by an expert of the field, while still falling within
25 the scope of the invention as claimed in the enclosed claims.

Claims

- 1) Equipment (1; 100; 200) for printing plates (4) comprising a mold (2) composed of a base (20; 120) and a die (30) in which at least one cavity (31) is obtained to form the plate (4), characterized in that it also comprises a cushion (5; 105) situated between the base (20; 120) and the plate (4), said
5 cushion (5; 105) comprising a fluid (51) that, due to pressure exerted when closing the mould (2), flows in such a way to exert pressure on said plate (4) and deform the plate (4) according to the shape of said at least one cavity (31) of the die.
- 2) Equipment (100) as claimed in claim 1, characterized in that said
10 cushion (105) comprises a pasty fluid (51), such as silicone paste or gel.
- 3) Equipment (1) as claimed in claim 1 or 2, characterized in that said cushion (5) comprises a fluid-tight case (50) that hermetically contains said fluid (51).
- 4) Equipment (100) as claimed in claim 1 or 2, characterized in that
15 said cushion (105) is composed of a hermetic chamber obtained in said base (120) of the mould by means of a recessed housing (121) and a fluid-tight cover (50) coupled with the housing (121) of the mould base.
- 5) Equipment (100) as claimed in claim 4, characterized in that it comprises feed means (125) to feed the fluid (51) in the hermetic chamber
20 (105) of the mold base.
- 6) Equipment as claimed in any one of the preceding claims, characterized in that said case (50) and/or cover (150) is made of deformable fluid-tight tear-resistant material, such as plastic film or waterproof non-woven fabric.
- 7) Equipment as claimed in any one of the preceding claims,
25 characterized in that the fluid (51) contained in the cushion (5; 105) is incompressible and the volume of the fluid (51) is basically equal to the volume of the at least one cavity (31) of the die.
- 8) Equipment (200) as claimed in any one of the preceding claims,
30 characterized in that the base (220) is provided with at least one cavity (223)

in a flat surface (33) of the die and at least one cushion (5) situated between said flat surface (33) of the die and the plate (4) in the at least one cavity (233) of the base.

9) Equipment as claimed in any one of the preceding claims,
5 characterized in that the plate (4) is a metal plate.

10) Printing method of plates (4) with equipment as claimed in any one of the preceding claims, characterized in that it comprises the following operations:

- positioning of a fluid cushion (5, 105) between the base (20; 120) and
10 the plate (4) when the mold (2) is open, and
- closing of the mold to compress the cushion of fluid that flows exerting pressure on the plate (4) and deforms the plate (4) according to the shape of the at least one cavity (31) of the die.

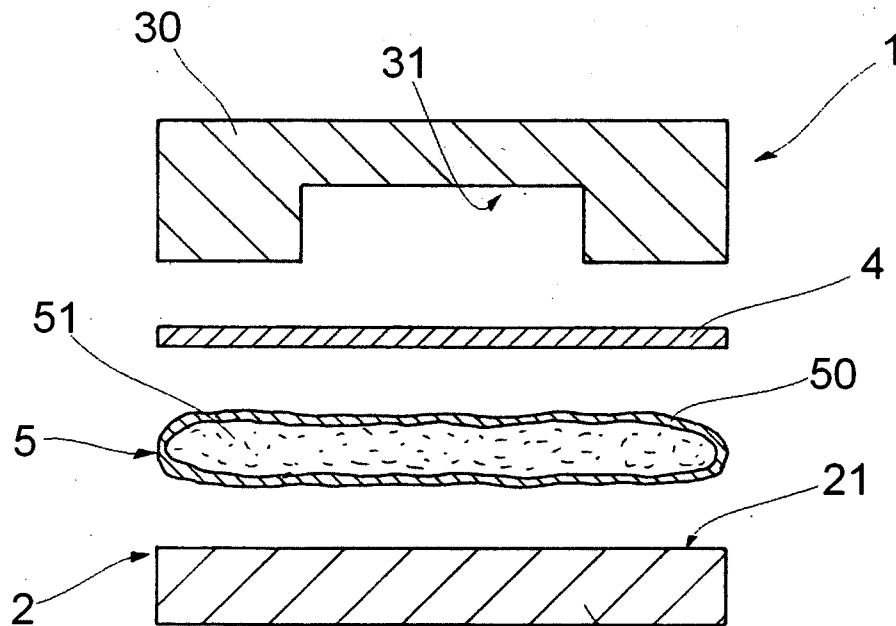


FIG. 1

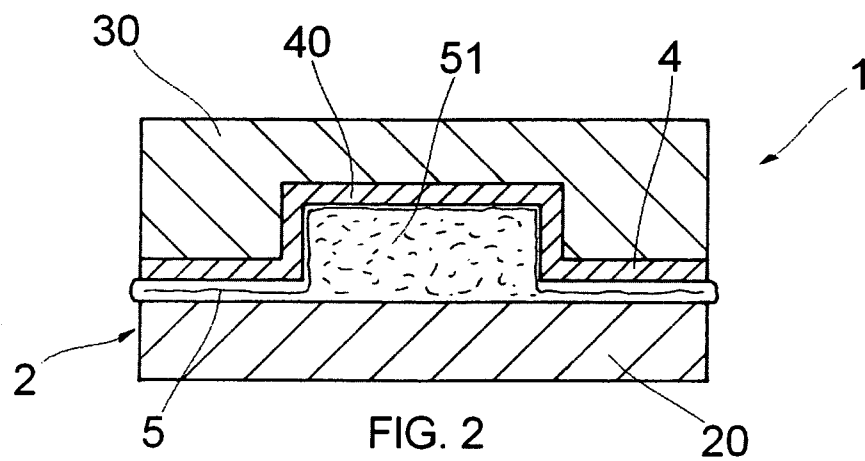


FIG. 2

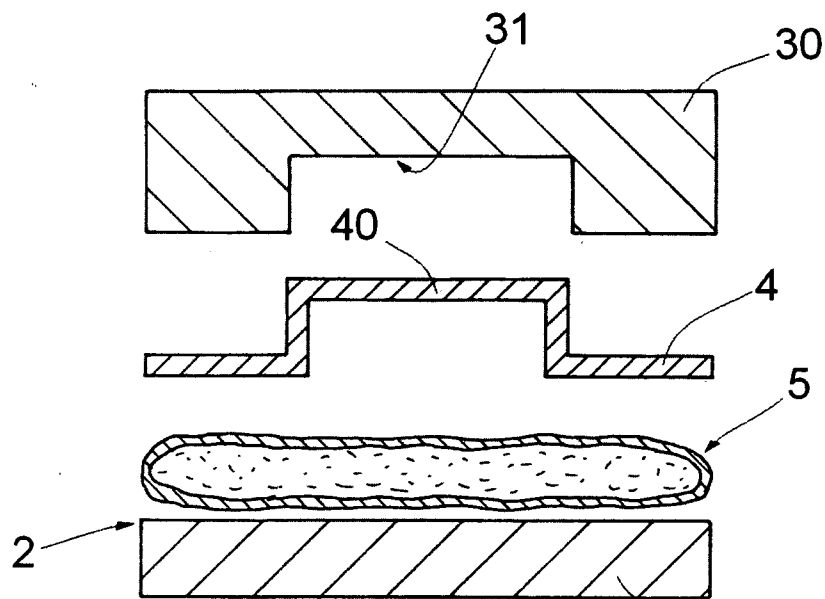
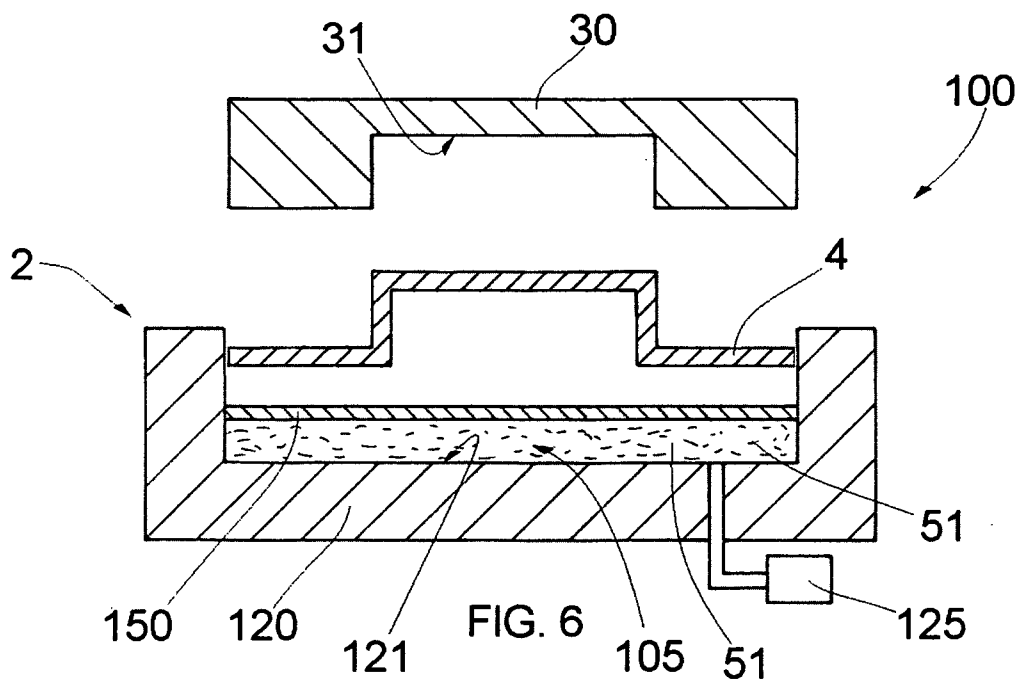
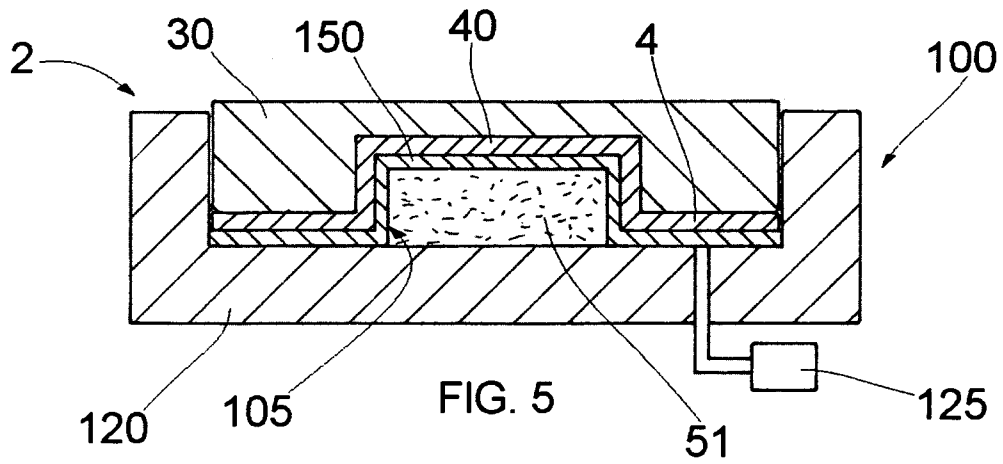
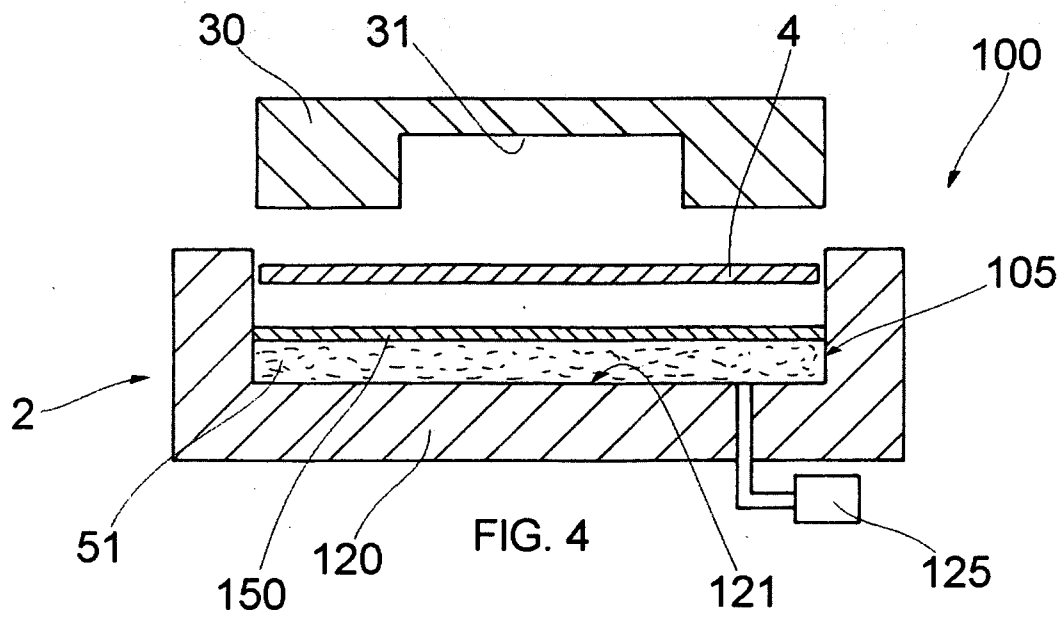


FIG. 3



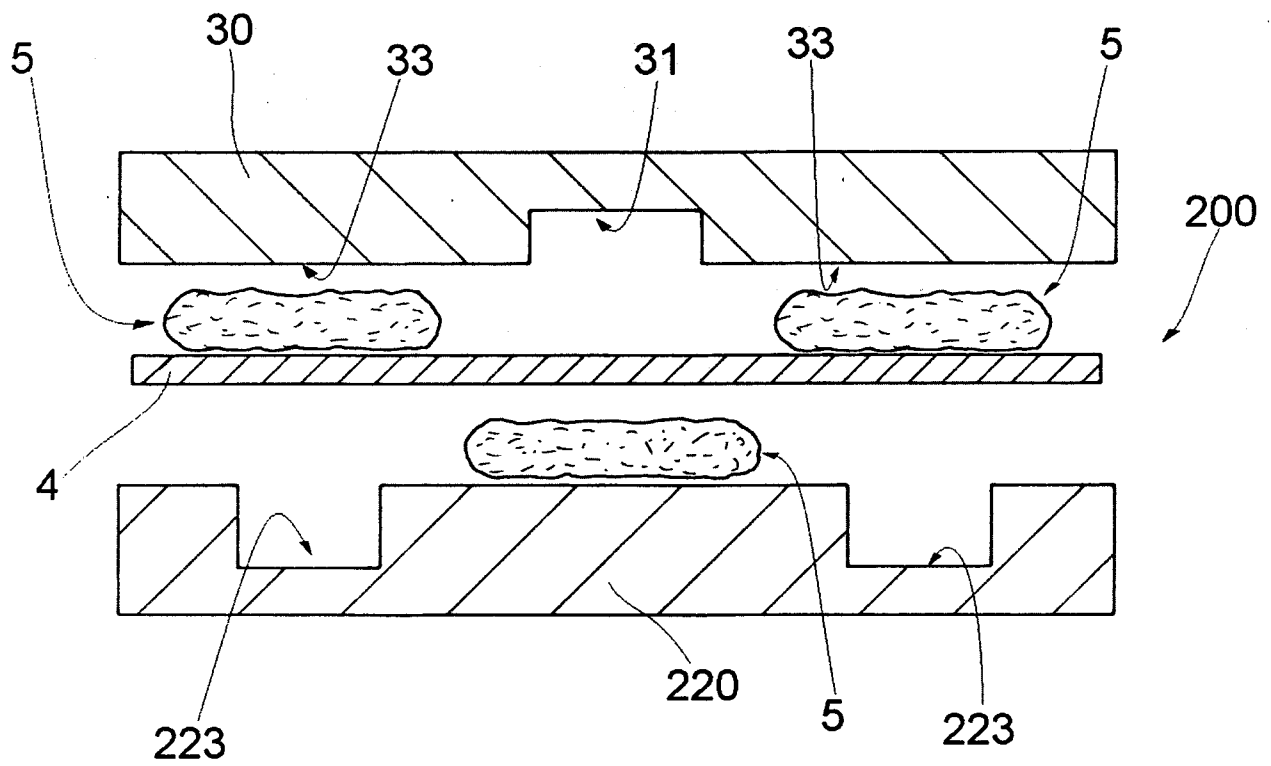


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2010/000398

A. CLASSIFICATION OF SUBJECT MATTER
INV. B21D26/02 B21D22/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

21 January 2011

Date of mailing of the international search report

31/01/2011

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
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