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(54) **DEVICE AND METHOD FOR SPREAD COATING A PASTE OVER A LAYER OF SUBSTRATE, FOR EXAMPLE FOR PRODUCING SURFACE COVERING ELEMENTS**

(57) A device for spread coating a paste over a layer of substrate (20), the device comprising:

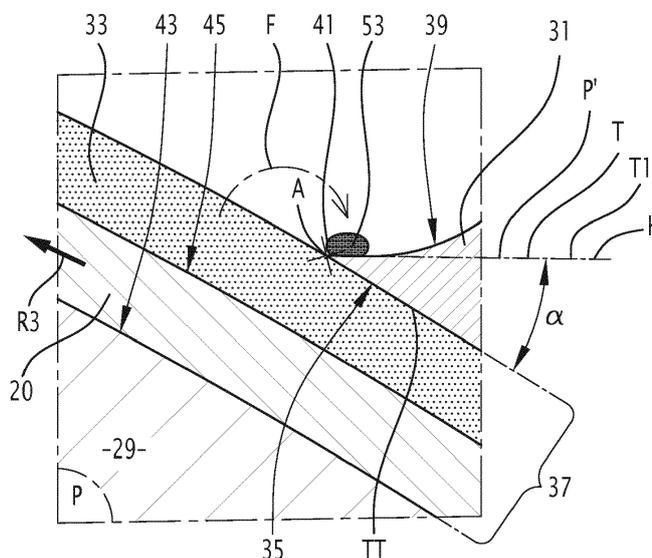
- a chassis,
- at least one roll (29) mounted on the chassis and rotatable on itself about a rotation axis and configured to support and optionally drive the layer of substrate along a circulation path, and
- a knife (31) mounted on the chassis and having:
  - a first surface (35) facing the roll in a working position of the knife, the first surface and the roll defining a gap (37) through which the layer of substrate is intended to circulate and to drive the paste by friction from upstream

the knife for forming a layer (33) of the paste downstream of the knife, and

- a second surface (39) forming a sharp edge (41) with the first surface.

In the working position of the knife, in cross section along a plane (P) perpendicular to the rotation axis, a tangent (T) to the second surface at the sharp edge has an upstream part (T1) with respect to the sharp edge which is either horizontal, or located below a horizontal line (H) drawn from the sharp edge.

Corresponding method.



**FIG. 3**

## Description

**[0001]** The present invention deals with a device for spread coating a paste over a layer of substrate, the device comprising:

- a chassis,
- at least one roll mounted on the chassis, the roll being rotatable with respect to the chassis on itself about a rotation axis and configured to support and optionally drive the layer of substrate along a circulation path, and
- a knife mounted on the chassis, the knife having:
  - a first surface facing the roll in a working position of the knife with respect to the chassis, the first surface and the roll defining a gap through which the layer of substrate is intended to circulate and to drive the paste by friction from upstream the knife for forming a layer of the paste downstream of the knife, and
  - a second surface forming a sharp edge with the first surface, the paste being intended to slide against the first surface until the sharp edge.

**[0002]** The invention also deals with a corresponding method.

**[0003]** The invention also deals with an installation for producing surface covering elements, such as tiles and sheets, comprising such a device, and with a method for producing surface covering elements.

**[0004]** The layer of substrate may be a thermoplastic layer, based on PVC, or a material only serving as carrier and intended or not intended to remain in the surface covering element.

**[0005]** Spread coating is efficient in order to rapidly lay a paste over an existing layer of substrate. It can be used successively to obtain several superimposed layers. One of the most used tool to apply a layer of paste is the knife over roll process.

**[0006]** However, under particular conditions, a coating defect may occur. The defect appears as droplets of paste which are constantly released on the substrate while coating. This is detrimental to the uniformity and quality of the layer of paste.

**[0007]** An aim of the invention is to obtain a layer on the substrate layer with an improved quality.

**[0008]** To this end, the invention proposes a device of the type described above, wherein, in the working position of the knife, in cross section along a plane perpendicular to the rotation axis, a tangent to the second surface at the sharp edge has an upstream part with respect to the sharp edge which is:

- either horizontal, or
- located below a horizontal line drawn from the sharp edge.

**[0009]** In other embodiments, the method comprises one or several of the following features, taken in isolation or any technically feasible combination:

- 5 - in cross section along said plane:
  - said tangent to the second surface and a tangent to the first surface at the sharp edge define a first angle,
  - 10 - an uppermost point of the roll and the sharp edge define a second angle which respect to the rotation axis, the second angle being equal to, or larger than the first angle, and the second angle being smaller than 90°, the sharp edge being located upstream of the uppermost point around the axis of rotation;
  - the second angle is comprised between 15° and 90°;
  - the second angle is comprised between 25° and 50°;
  - 20 - in the working position of the knife, in cross section along any plane perpendicular to the rotation axis, a tangent to the second surface at the sharp edge has an upstream part with respect to the sharp edge which is:
    - 25 - either horizontal, or
    - located below a horizontal line drawn from the sharp edge;
  - 30 - the sharp edge is a straight line and, at any point of the sharp edge, the second surface is tangent to a same plane; and
  - the device further comprises a retention system located upstream of the knife, the retention system having a retention surface adapted for creating a bank of said paste, the bank being intended to be in contact with the retention surface, layer of substrate and an upstream face of the knife.
  - 35
- 40 **[0010]** The invention also relates to an installation for producing surface covering elements comprising at least one device as described above.
- [0011]** The invention relates as well to a method of spread coating a paste over a layer of substrate, the method comprising the steps of:
  - 45 - providing a device as described above;
  - rotating the roll with respect to the chassis on itself about the rotation axis;
  - 50 - supporting and optionally driving, by the roll, the layer of substrate along the circulation path, and
  - putting the knife in the working position;
  - circulating the layer of substrate through the gap; and
  - driving the paste by friction against the layer of substrate through the gap from upstream the knife for forming a layer of the paste downstream of the knife, the paste sliding against the first surface until the sharp edge.
  - 55

**[0012]** In a particular embodiment, the method comprises providing a retention system located upstream of the knife, the retention system having a retention surface for creating a bank of said paste, the bank being in contact with the retention surface, the layer of substrate and an upstream face of the knife.

**[0013]** The invention also relates to a method for producing surface covering elements, using the above mentioned method.

**[0014]** The invention and its advantages will be better understood upon reading the following description, given solely by way of example and with reference to the appended drawings, in which:

- Figure 1 is a partial schematic cross sectional view of an installation according to the invention, showing a spread coating device according to the invention,
- Figure 2 is a detailed view of Figure 1, centered on the knife shown in Figure 1, and
- Figure 3 is a detailed view of Figure 2, centered on the sharp edge of the knife shown in Figures 1 and 2.

**[0015]** With reference to the Figure 1, an installation 1 for producing surface covering elements (not shown), such as tiles or sheets, is described.

**[0016]** The surface is for example a floor or a wall.

**[0017]** The installation 1 comprises a device 10 for spread coating a paste 15 over a layer of substrate 20, and advantageously a retention system 25.

**[0018]** The installation 1 comprises other devices. The other devices are not shown because they are classical modules, known in themselves, for producing surface covering elements, and they do not differ from prior art ones.

**[0019]** The surface covering elements are also not shown. They do not differ from prior art ones.

**[0020]** The substrate 20 is for example a future layer in one or several surface covering elements. The substrate 20 can be a glass veil, a glass scrim, a fabric, a release paper, or a felt.

**[0021]** The paste 15 is for example a plastisol, preferably comprising at least 20wt% of PVC or another polymer.

**[0022]** The device 10 comprises a chassis 27, at least one roll 29 mounted on the chassis, and a knife 31 also mounted on the chassis.

**[0023]** By "spread coating" it is meant that the device 10 is adapted for coating a layer 33 of the paste 15 over the layer of substrate 20.

**[0024]** The device 10 may have other rolls (not represented) analogous to the roll 29.

**[0025]** The chassis 27 is either for the whole installation 10 or just for the device 10.

**[0026]** The roll 29 is mounted rotatable on itself with respect to the chassis 27 about a rotation axis  $\Delta$  and configured to support, and optionally drive, the layer of substrate 20 along a circulation path  $\Gamma$ . The rotation of the roll 29 is symbolized by arrows R1, R2, R3 on the

Figures.

**[0027]** For example, the roll 29 can be made of metal, or metal covered by a soft layer (rubber, nitrile...).

**[0028]** The rotation axis  $\Delta$  is for example approximately horizontal at  $\pm 1^\circ$ .

**[0029]** The knife 31 is adapted to occupy a working position with respect to the chassis represented in the Figures. Advantageously, the knife 31 may be movable to at least another position, further from the roll 29, for example a rest position.

**[0030]** The knife 31 comprises a first surface 35 (Figure 3) facing the roll 29 in the working position, and defining a gap 37 with the roll through which the layer of substrate 20 is intended to circulate and to drive the paste 15 by friction from upstream the knife for forming the layer 33 downstream of the knife.

**[0031]** In the present document, "upstream" and "downstream" are defined by the rotation of the roll 29, creating a flow of the paste 15.

**[0032]** The knife 31 also comprises a second surface 39 forming a sharp edge 41 with the first surface 35.

**[0033]** In cross section along a plane P (Figures 2 and 3) perpendicular to the rotation axis  $\Delta$ , the first surface 35 is for example flat.

**[0034]** In a particular embodiment, the first surface 35 is approximately parallel to a peripheral surface 43 of the roll 29, and to a surface 45 of the layer of substrate 20 that is not in contact with the roll 29.

**[0035]** In other embodiments (not shown), the first surface 35 is slightly inclined with respect to the peripheral surface 43, so that the gap 37 is slightly convergent along the path  $\Gamma$ . For example, an angle (not shown) between the peripheral surface 43 and the first surface 35 is between  $0^\circ$  and  $25^\circ$ .

**[0036]** The second surface 39 is for example curved in cross section along the plane P.

**[0037]** In the working position of the knife 31, in cross section along the plane P, a tangent T to the second surface 35 at the sharp edge 41 has an upstream part T1 with respect to the sharp edge which is horizontal.

**[0038]** As a variant (not shown), the upstream part T1 is located below a horizontal line H drawn from the sharp edge 41. In this case, an angle (not shown) between the horizontal line H and the upstream part T1 of the tangent T is for example comprised between  $0^\circ$  and  $10^\circ$ .

**[0039]** Said tangent T to the second surface 39 and a tangent TT to the first surface 35 at the sharp edge 41 define a first angle  $\alpha$ .

**[0040]** The first angle  $\alpha$  is for example comprised between  $15^\circ$  and  $45^\circ$ . In the example shown in the Figures, the first angle  $\alpha$  is approximately  $30^\circ$ .

**[0041]** In cross section along the plane P, the sharp edge 41 defines a point A which forms a second angle  $\beta$  with an uppermost point B (Figure 1) of the roll 29 with respect to the rotation axis  $\Delta$ .

**[0042]** The second angle  $\beta$  is smaller than  $90^\circ$ , the sharp edge 41 being located upstream of the uppermost point B around the axis of rotation  $\Delta$ . In other words, the

device 10 is configured so that the layer of substrate 20 goes up from the knife 31 toward the uppermost point B.

**[0043]** The second angle  $\beta$  is preferably comprised between  $15^\circ$  and  $90^\circ$ , and more preferably between  $25^\circ$  and  $50^\circ$ . In the example, the second angle  $\beta$  is approximately  $30^\circ$ .

**[0044]** In the example, the second angle  $\beta$  is approximately equal to the first angle  $\alpha$ , ensuring that the tangent T is horizontal. In embodiments where the gap 37 shows an angle of convergence, the second angle  $\beta$  is equal to the first angle  $\alpha$  plus the angle of convergence in order to ensure that the tangent T is horizontal.

**[0045]** In other embodiments (not shown), the second angle  $\beta$  is larger than the first angle  $\alpha$ , or larger than the first angle  $\alpha$  plus the angle of convergence of the gap 37, ensuring that the upstream part T1 of the tangent T is located below the horizontal line H.

**[0046]** Advantageously, the above features mentioned in cross section along the plane P are verified in cross section along any plane perpendicular to the rotation axis  $\Delta$ .

**[0047]** For example, at any point of the sharp edge 41 the second surface 39 is tangent to a same plane P'.

**[0048]** The retention system 25 is located upstream of the knife 31. The retention system 25 has a retention surface 47 adapted for creating a bank 49 of the paste 15.

**[0049]** The bank 49 is adapted for being in contact with the retention surface 47, the layer of substrate 20 and an upstream face 51 of the knife 31.

**[0050]** The operation of the installation 1 stems from its structure and will be now briefly described. It illustrates a method according to the invention.

**[0051]** The installation 1 is provided, including the device 10.

**[0052]** The roll 29 is rotated with respect to the chassis 27 on itself about the rotation axis  $\Delta$ , following the arrows R1, R2, R3 in Figures 1, 2 and 3. The roll 29 supports the layer of substrate 20 along the circulation path  $\Gamma$ .

**[0053]** In a particular embodiment, an actuator (not shown) drives the rotation of the roll 29. In this case, the roll 29 also drives the layer of substrate 20 along the circulation path  $\Gamma$ .

**[0054]** The knife 31 is put in the working position. This can be advantageously performed after installing the layer of substrate 20 on the roll 29.

**[0055]** The paste 15 is brought in contact with the layer of substrate 20 upstream of the knife 31, where it forms a bank 49 also in contact with the retention surface 47 and the upstream face 51 of the knife 31. The layer of substrate 20 circulates through the gap 37.

**[0056]** By friction against the layer of substrate 20, the paste 15 is driven from the bank 49 into the gap 37. The paste 15 slides on the first face 35 of the knife 31 until the sharp edge 41 (Figure 3) and then leaves the knife, thereby forming the layer 33 coated on the substrate layer 20.

**[0057]** When leaving the sharp edge 41, under particular conditions, the paste 15 tends to stick to the sharp

edge 41 and a small amount of paste called "deposit" 53 (arrow F) accumulates on the second surface 39 of the knife 31.

**[0058]** In prior art devices, the deposit 53 builds up until it reaches a critical size. Afterwards, additional deposit falls back on the coated layer in the shape of droplets, thereby lowering the quality of the coated layer.

**[0059]** In the invention, thanks to orientation of the second surface 39 (upstream part T1 horizontal or inclined towards the upstream side), the deposit 53 remains on the second surface, at least enough time for producing the layer 33 with an improved quality. Advantageously, the deposit 53 is evacuated from the second surface 39 or periodically removed.

**[0060]** The retention system 25 creates the bank 49 and advantageously prevents it from sliding or falling upstream.

**[0061]** The layer of substrate 20 and the layer 33 are then used to produce the surface covering element in a manner known in itself.

**[0062]** Thanks to the above features, the layer 33 shows an improved quality.

## 25 Claims

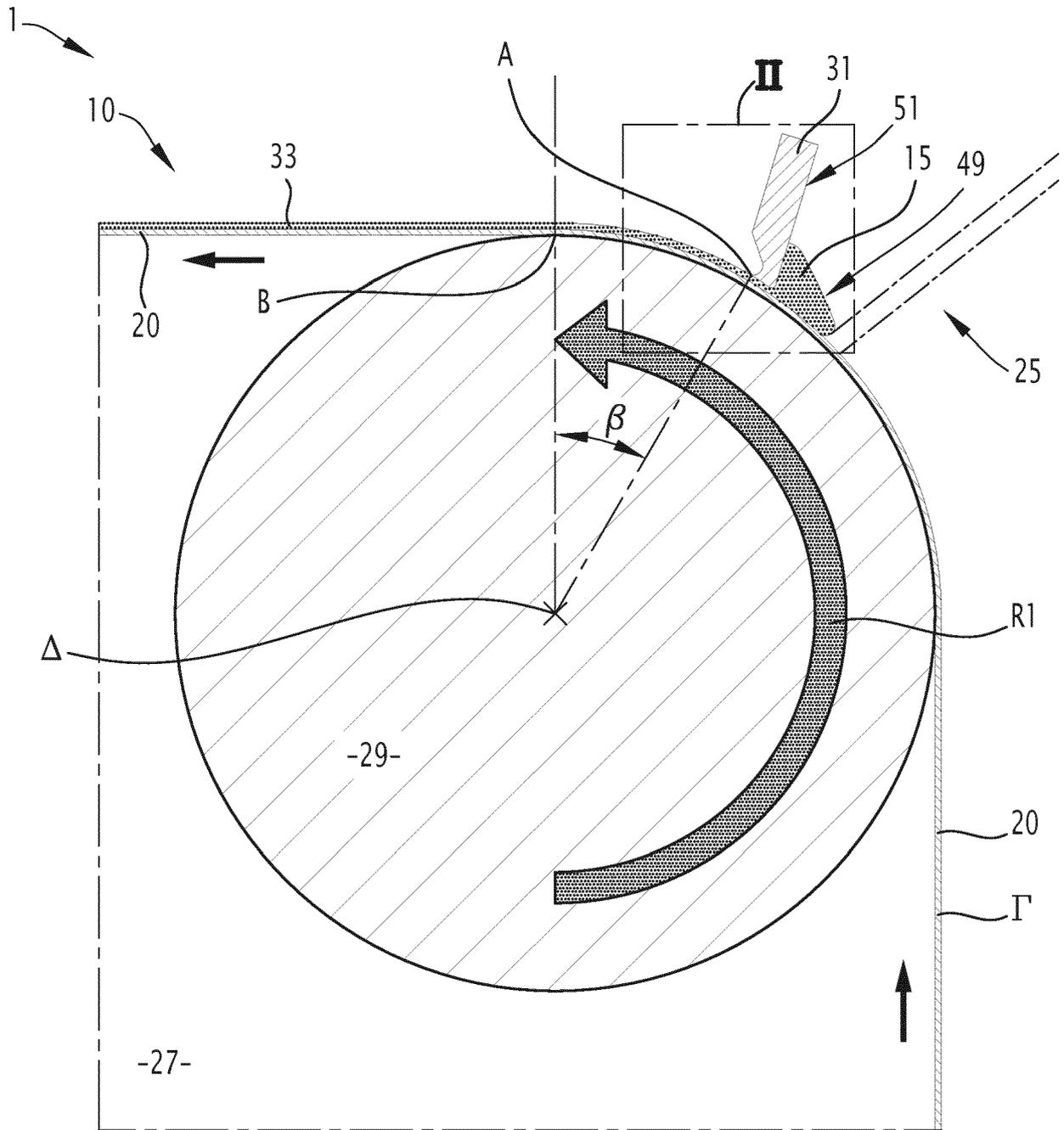
1. A device (10) for spread coating a paste (15) over a layer of substrate (20), the device (10) comprising:

- a chassis (27),
- at least one roll (29) mounted on the chassis (27), the roll (29) being rotatable with respect to the chassis (27) on itself about a rotation axis ( $\Delta$ ) and configured to support and optionally drive the layer of substrate (20) along a circulation path ( $\Gamma$ ), and
- a knife (31) mounted on the chassis (27), the knife (31) having:

- a first surface (35) facing the roll (29) in a working position of the knife (31) with respect to the chassis (27), the first surface (35) and the roll (29) defining a gap (37) through which the layer of substrate (20) is intended to circulate and to drive the paste (15) by friction from upstream the knife (31) for forming a layer (33) of the paste (15) downstream of the knife (31), and
- a second surface (39) forming a sharp edge (41) with the first surface (35), the paste (15) being intended to slide against the first surface (35) until the sharp edge (41),

**characterized in that**, in the working position of the knife (31), in cross section along a plane (P) perpendicular to the rotation axis ( $\Delta$ ), a tangent (T) to the second surface (39) at the sharp edge (41) has an

- upstream part (T1) with respect to the sharp edge (41) which is:
- either horizontal, or
  - located below a horizontal line (H) drawn from the sharp edge (41).
- 5
2. The device (10) according to claim 1, wherein, in cross section along said plane (P):
- said tangent (T) to the second surface (39) and a tangent (TT) to the first surface (35) at the sharp edge (41) define a first angle ( $\alpha$ ),
  - an uppermost point (B) of the roll (29) and the sharp edge (41) define a second angle ( $\beta$ ) which respect to the rotation axis ( $\Delta$ ), the second angle ( $\beta$ ) being equal to, or larger than the first angle ( $\alpha$ ), and the second angle ( $\beta$ ) being smaller than  $90^\circ$ , the sharp edge (41) being located upstream of the uppermost point (B) around the axis of rotation ( $\Delta$ ).
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3. The device (10) according to claim 2, wherein the second angle ( $\beta$ ) is comprised between  $15^\circ$  and  $90^\circ$ .
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4. The device (10) according to claim 3, wherein the second angle ( $\beta$ ) is comprised between  $25^\circ$  and  $50^\circ$ .
- 20
5. The device (10) according to any of claims 1 to 4, wherein, in the working position of the knife (31), in cross section along any plane (P) perpendicular to the rotation axis ( $\Delta$ ), a tangent (T) to the second surface (39) at the sharp edge (41) has an upstream part (T1) with respect to the sharp edge (41) which is:
- either horizontal, or
  - located below a horizontal line (H) drawn from the sharp edge.
- 25
6. The device (10) according to any of claims 1 to 5, wherein the sharp edge (41) is a straight line and, at any point of the sharp edge (41), the second surface (39) is tangent to a same plane (P').
- 30
7. The device (10) according to any of claims 1 to 6, further comprising a retention system (25) located upstream of the knife (31), the retention system (25) having a retention surface (47) adapted for creating a bank (49) of said paste (15), the bank (49) being intended to be in contact with the retention surface (47), layer of substrate (20) and an upstream face (51) of the knife (31).
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8. An installation (1) for producing surface covering elements, comprising at least one device according to any of claims 1 to 7.
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9. A method of spread coating a paste (15) over a layer of substrate (20), the method comprising the steps of:
- providing a device (10) according to any of claims 1 to 6,
  - rotating the roll (29) with respect to the chassis (27) on itself about the rotation axis ( $\Delta$ ),
  - supporting and optionally driving, by the roll (29), the layer of substrate (20) along the circulation path ( $\Gamma$ ), and
  - putting the knife (31) in the working position,
  - circulating the layer of substrate (20) through the gap (37),
  - driving the paste (15) by friction against the layer of substrate (20) through the gap (37) from upstream the knife (31) for forming a layer (33) of the paste (15) downstream of the knife (31), the paste (15) sliding against the first surface (35) until the sharp edge (41).
- 45
10. The method according to claim 9, further comprising providing a retention system (25) located upstream of the knife (31), the retention system (25) having a retention surface (47) for creating a bank (49) of said paste (15), the bank (49) being in contact with the retention surface (47), the layer of substrate (20) and an upstream face (51) of the knife (31).
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11. A method for producing surface covering elements, using a method according to claim 9 or 10.
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**FIG.1**





EUROPEAN SEARCH REPORT

Application Number  
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Place of search The Hague		Date of completion of the search 21 December 2018	Examiner Ciotta, Fausto
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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