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(54) **ATTACHMENT MECHANISM FOR ATTACHING A PRINTING PLATE TO A PLATE CYLINDER FOR A FLEXOGRAPHIC PRINTING PROCESS AND METHOD OF USING THE MECHANISM**

(57) The present disclosure relates to a method of attaching a printing plate to a plate cylinder for a flexographic printing process comprising the steps of: a) laying the printing plate (4) onto the plate cylinder (6) so that the printing plate surrounds the plate cylinder, and so that two opposite edges (10) of the printing plate are arranged parallel to the plate cylinder's longitudinal axis (28); and b) clamping the two edges to an outer surface (12) of the plate cylinder by means of a clamping mechanism (2) comprising at least one clamp (8), each clamp having an attachment means (14) adapted to detachably attach the clamp to the plate cylinder. The present disclosure further relates to a clamp (8) for attaching a printing plate (4) to a plate cylinder (6) for a flexographic printing process, the clamp having an attachment means (14) adapted to detachably attach the clamp to the plate cylinder.

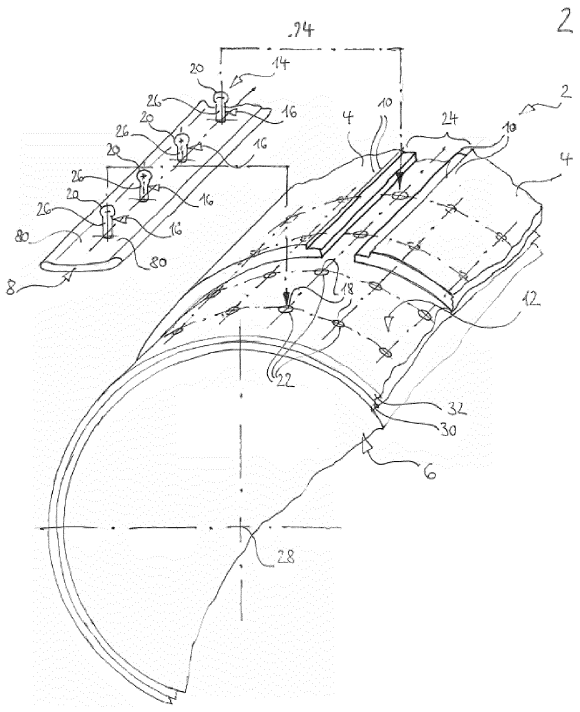

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a method of attaching a printing plate to a plate cylinder for a flexographic printing process, an attachment mechanism, a plate cylinder comprising the attachment mechanism, a set of two or more plate cylinders, the use of the attachment mechanism in a flexographic printing process, and a printing system comprising the plate cylinder and a flexographic printing plate.

BACKGROUND ART

[0002] In a flexographic printing process there are several known methods of attaching a printing plate to a plate cylinder. The most widely used method was the simple use of double-sided adhesive tape. Another method involves the use of an adhesive printing plate attachment layer that includes an adhesive photopolymer to attach the printing plate to the plate cylinder. This method is described for instance in WO 95/19267.

[0003] The use of a double-sided adhesive tape is problematic in that difficulties may occur in removing the tape from the plate cylinder and/or from the printing plate. Also, the double-sided adhesive tape frequently leaves residues behind which will later interfere with the reuse of the printing plate or will deteriorate the printing performance in subsequent printing operations. Attaching the double-sided adhesive tape uniformly and without causing surface irregularities that impair the printed image is also a cumbersome manual operation. In addition, the use of multiple pieces of double-sided adhesive tape, as is generally required, makes alignment of the printing plate on the plate cylinder difficult, especially since removal and repositioning is difficult.

[0004] For example, WO 95/19267 describes the use of an adhesive printing plate attachment layer to replace the double-sided adhesive tapes. The document mentions that the adhesive printing plate attachment layer is able to maintain its adherent properties even during continued use and re-use, and that residues can be easily removed, while no residual photopolymeric material remains on the printing plate. There is however still an adhesive layer, so that disadvantages of the mentioned state of art may be improved, but not overcome.

SUMMARY

[0005] It is an object of the present disclosure to overcome at least one of the above-cited deficiencies, and to promote attaching a printing plate to a plate cylinder for a flexographic printing process in a fast and reliable manner.

[0006] A method of attaching a printing plate to a plate cylinder for flexographic printing in accordance with the present disclosure is defined in claim 1. A mechanism for attaching a printing plate to a plate cylinder for a flexographic printing process is defined in claim 2. Dependent claims relate to preferred embodiments.

[0007] The method of attaching a printing plate to a plate cylinder for a flexographic printing process in accordance with the present disclosure comprises the steps of:

a) Placing the printing plate onto the plate cylinder so that the printing plate at least partly surrounds the plate cylinder and so that two opposite edges of the printing plate are positioned parallel to the plate cylinder's longitudinal axis (i.e., the plate cylinder's rotary axis); and

b) Clamping the two opposite edges radially inwards to an outer surface of the plate cylinder by means of a clamping mechanism comprising at least one clamp, each of said clamps having an attachment means adapted to detachably attach the clamp to an outer surface of the plate cylinder.

[0008] A clamp for attaching a printing plate to a plate cylinder for a flexographic printing process comprises an attachment means adapted to detachably attach the clamp to an outer surface of the plate cylinder. Preferably, the clamp is adapted to push and hold (at least sections of) opposite edges of the printing plate onto the outer circumferential surface of the plate cylinder. For this purpose, the attachment means may be adapted to the plate cylinder and may comprise at least one connector detachably connectable to the plate cylinder. In particular, the attachment means may be configured to be connected to a corresponding counter-connector of the plate cylinder. Preferably, the attachment means comprises a form fitting structure detachably connectable to a form fitting counter-structure of the plate cylinder.

[0009] The printing plate is adapted to fit onto the plate cylinder so that the printing plate at least partially surrounds the plate cylinder. Preferably in the circumferential direction of the plate cylinder, two opposite and/or at least partially parallel edges of the printing plate are positioned at a distance (forming a gap in between them) or are adjacent to each other, preferably without any overlap of the edges. Preferably, the attachment means of the clamp is adapted to detachably attach the clamp to an outer surface of the plate cylinder via such a gap. Each of the opposite ends of the printing plate may be clamped with separate clamps, in particular two clamps.

[0010] Preferably, the form fitting structure of the attachment means comprises a knob or head (preferably at the end of a small post protruding from the clamp) that is detachably connectable to the form fitting counter-structure of the plate cylinder. The form fitting structure preferably comprises a hole. The knob acting as a connector may be adapted to fit into this hole acting as a counter-connector. The knob and/or the hole may comprise means and/or shape(s) and/or dimension(s) providing for the detachable connectability of the knob in the

hole. For example, the knob may be spherical and may have a slightly larger diameter than the hole. In this case, the hole preferably has a circular cross-section. The knob is made of a resilient material that allows to press the knob through the hole formed in the outer surface of the plate cylinder. If being pushed through the hole, the knob is allowed to expand at the other side of the hole. As a result, the clamp is able to retain a printing plate on the outer surface of the plate cylinder using a snap fit. Since the knob can also be pulled out of the hole, the attachment means provides for a detachable connectability of the clamp.

[0011] Preferably, for clamping the edges along a predetermined length (up to the full length of the plate cylinder), the attachment means comprises a plurality of connectors (for example, small posts protruding from the clamp carrying small resilient knobs at the end) detachably connectable to a plurality of counter-connectors (for example, small holes having a slightly smaller diameter than the resilient knobs - or, as another example, comprising lever springs tightening the opening of the respective hole and resiliently giving way to the - in this example rather non-resilient - knob while entering) of the plate cylinder. The plurality of counter-connectors may be arranged in a line parallel to the axis of the plate cylinder with specific (preferably equal) intervals (distances) between adjacent counter-connectors. The plurality of connectors of the clamp may likewise be arranged in a line, with corresponding specific (preferably equal) intervals (distances) between adjacent connectors. In other words, the pattern of connectors preferably corresponds to the pattern of counter-connectors so that connectors and counter-connectors are able to engage each other. For example, three or more, four or more, five or more, six or more, seven or more, eight or more, nine or more, ten or more, twenty or more connectors and/or counter-connectors may be provided in a line. Preferably, the interval between two adjacent connector or counter-connectors is at least three millimeters, at least five millimeters, or at least ten millimeters.

[0012] These configurations allow to (detachably) attach the clamp (or multiple clamps in a row and/or parallel to each other) to the line of counter-connectors after the printing plate is placed onto the plate cylinder so that the two opposite edges are each positioned adjacent to (at least part of) at least one line of counter-connectors. The clamp is adapted to fixate the opposite edges of the printing plate to the outer circumferential surface of the plate cylinder by means of clamping when the connector(s) of the clamp(s) is/are in engagement with the counter-connectors of the plate cylinder. The counter-connectors of the plate cylinder preferably hold the connectors of the plate using a snap-fit engagement. The at least one connector protrudes from a clamp body configured to extend along an edge of a printing plate. Preferably, the printing plate has a stepped edge so that the clamp body does not radially protrude beyond the printing surface of the printing plate.

[0013] The outer circumferential surface of the plate cylinder may comprise a resilient outer layer and/or an outer layer providing for increased friction and/or for adhesion between the inner circumferential surface of the printing plate and the outer circumferential surface of the plate cylinder.

[0014] For being able to place the printing plate on the circumference of the plate cylinder more freely (e. g. the printing plate does not completely surround the circumferential surface so that the two opposite edges are not positioned at a single row of counter-connectors), the counter-connectors are preferably arranged along multiple lines distributed around the circumference of the plate cylinder. Each of these lines is preferably arranged parallel to the longitudinal axis of the plate cylinder. As already described above, the counter-connectors of each line are arranged in specific (preferably equal) intervals. The row of connectors of the clamp extending from a clamp body are then also arranged along a line and in specific (preferably equal) intervals between the connectors corresponding to the arrangement or pattern along each of the lines of the counter-connectors.

[0015] For fixing a printing plate to a plate cylinder, each of two opposite edges of the printing plate are positioned adjacent to at least one of preferably multiple lines of counter-connectors. Consequently, the more lines or rows of counter-connectors are provided along the plate cylinder, the more freely the printing plate can be positioned on the outer circumferential surface of the plate cylinder. For example, two or more lines, three or more lines, five or more lines, eight or more lines, ten or more lines or twenty or more lines of counter-connectors may be provided, preferably equally spaced, around the outer circumferential surface of the plate cylinder. Preferably adjacent lines of counter-connectors are provided at an interval of at least three millimeters, at least five millimeters, or at least ten millimeters.

[0016] In accordance with the present disclosure, a printing system may be provided that comprises at least one clamp as described above, a plate cylinder as described above and at least one flexographic printing plate. In this printing system, opposite edges of the flexographic printing plate are attached to the plate cylinder by virtue of the clamp. The clamp comprises a clamp body with an outer surface facing radially outwards with respect to the plate cylinder.

[0017] Preferably, the plate cylinder and/or the printing plate of the printing system is configured such that the outer surface of the clamp is flush with the outer circumferential surface of the flexographic printing plate or is arranged radially inwards in relation to this surface than the printing surface of the flexographic printing plate.

[0018] For example, the plate cylinder's outer circumferential surface may comprise at least one recess extending along its longitudinal direction, said recess accommodating the two opposite edges of the flexographic printing plate. The recess may accommodate the counter-connectors, which are preferably arranged in a line

as described above. Further, a plurality of recesses may be provided on the outer circumferential surface of the plate cylinder. Preferably, the locations of the plurality of recesses correspond to the locations of the lines of counter-connectors that may be distributed around the outer circumferential surface of the plate cylinder.

[0019] Alternatively or additionally, the opposite ends of the printing plate for attaching the printing plate to the plate cylinder may have a stepped configuration. This stepped configuration of the printing plate provides a clamping surface to the clamp body of the clamp so that the outer surface of the clamp body does not protrude from the printing surface of the printing plate and is preferably located radially inwards in relation to this surface.

[0020] Either or both configurations of the printing system prevent contact between the clamp and the medium to be printed on and, thus, help to prevent printing artefacts.

[0021] The above-described plate cylinders for attaching a flexographic printing plate (i.e. printing form) may be configured as printing cylinders. Alternatively, the plate cylinders may be hollow cylinders configured as a printing sleeve to be mounted onto a printing cylinder and to support a flexographic printing plate.

BRIEF DESCRIPTION OF DRAWINGS

[0022] The following figures illustrates a preferred embodiment of the present disclosure. This embodiment is not to be construed as limiting but merely to enhance the understanding of the disclosure together with the following description. In the figures, same reference signs refer to features that have the same or an equivalent function and/or structure. In summary, the figures illustrate the following:

Fig. 1 shows a schematic exploded sectional side view of a mechanism for attaching a printing plate to a plate cylinder according to the disclosure; and

Fig. 2 shows a schematic sectional perspective view of the mechanism of Fig. 1 for attaching a printing plate to a plate cylinder according to the disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0023] Fig. 1 and Fig. 2 show a clamping mechanism 2 for attaching a flexographic printing plate 4 to a plate cylinder 6 for a printing process. The mechanism 2 comprises a clamp 8 with a clamping body 80, which is adapted to push and hold two opposite edges 10 of the printing plate 4 onto the outer surface 12 of the plate cylinder 6. The printing plate 4 is placed onto the plate cylinder 6 so that the printing plate surrounds the plate cylinder with two opposite parallel edges 10 of the printing plate coming into position adjacent to each other without overlap of the edges.

[0024] The clamp 8 of the clamping mechanism 2 further comprises an attachment means 14, which is adapted to detachably attach the clamp to the outer surface 12 of the plate cylinder 6. For this purpose, the attachment means 14 is adapted to the plate cylinder 6 by comprising at least one connector 16 detachably connectable to an accordingly prepared counter-connector 18 of the plate cylinder-and, in particular, by comprising a form fitting structure 20 detachably connectable to a form fitting counter-structure 22 of the plate cylinder.

[0025] The printing plate 4 is adapted to fit onto the plate cylinder 6 so that the printing plate at least partially surrounds the plate cylinder with the two opposite edges 10 of the printing plate coming into position adjacent to each other. As shown in figures 1 and 2, there is no overlap of the edges and they are parallel to each other forming a gap 24 between the adjacent edges. Preferably, the printing plate 4 is dimensioned in relation to the plate cylinder 6 so that this gap 24 is always present for an easy access to the counter-structure 22 of the plate cylinder (i. e. without having to pass through the flexographic printing plate 4).

[0026] In the exemplary embodiment of figures 1 and 2, the two opposite edges 10 are positioned adjacent to a single row or line of counter-connectors 18. As described above, the flexographic printing plate 4 may be dimensioned so that one of the opposite edges 10 is positioned adjacent to one line of counter-connectors 18 and the other one the opposite edges 10 is adjacent to another line of counter-connectors 18. In this case, two clamps 8 may be used to fixate the printing plate 4 to the plate cylinder 6.

[0027] The attachment means 14 of the clamp 8 is adapted to detachably attach the clamp to the outer surface 12 of the plate cylinder 6 through this gap 24. The attachment means 14 comprises a form fitting structure 20. The form fitting structure 20 includes connectors 16. Each connector 16 comprises a head or knob 20 at the end of a post 26 protruding from the clamp body 80 of the clamp 8. The connectors 16 are adapted to the counter-structure 22 of the plate cylinder 6 so that they are detachably connectable to this form fitting counter-structure, preferably by a form fit and even more preferably by a snap-fit. In particular, the form fitting counter-structure 22 of the exemplary embodiment illustrated in figures 1 and 2 is formed as holes. The knobs 20 of the connectors 16 are adapted to fit into these holes that act as counter-connectors 18. The knob 20 may have a spherical shape and, as described above, preferably has a slightly larger diameter than the hole. The hole preferably has a circular shape. The knobs 20 are made of a material that provides the resilience so that the knobs 20 can be pushed through a hole of the counter-connectors 18, thus providing for a detachable connectability of the knob in the hole.

[0028] For clamping the edges 10 of the printing plate

4, the attachment means 14 of the clamp 8 are configured as a row of connectors 16 detachably connectable to a row of counter-connectors 18 provided to the plate cylinder 6. As shown in the exemplary embodiment, the row of counter-connectors 18 is preferably arranged along a straight line parallel to the longitudinal axis 28 of the plate cylinder 6. Further, the counter-connectors 18 are preferably arranged with equal intervals or distances between the counter-connectors 18. Accordingly, the row of connectors 16 of the clamp 8 is arranged along a straight line and the connectors 16 are separated along this line in intervals corresponding to the intervals of the counter-connectors 18.

[0029] By engaging the connectors 16 of the clamp 8 with the counter-connectors 18, the attachment mechanism 2 is adapted to push and hold the edges 10 of the printing plate 4 by means of the clamp body 80 onto the outer surface 12 of the plate cylinder. As described above, the printing plate 4 has a reduced thickness at the opposing edges 10 so that the clamp body 80 does not affect the printing process. In the illustrated embodiment, the reduced thickness is achieved by providing the opposing edges 10 of the printing plate 4 with a stepped configuration. Alternatively, a gradual reduction in thickness may be provided. Alternatively or additionally, the plate cylinder 6 may be provided with at least one recess at the counter-structure 22 and in particular along each of the rows of counter-connectors 18.

[0030] As illustrated in figures 1 and 2. the outer surface 12 of the plate cylinder 4 may comprise a resilient outer layer 30 for damping and/or an outer frictional layer 32 for an increased friction between the underside of the printing plate 4 and the outer surface of the plate cylinder 6.

[0031] For placing the printing plate 4 on the outer circumference of the plate cylinder 6 more freely (without considering the two opposite edges 10 to come into position exactly adjacent to only one line of the counter-connectors), the counter-connectors 18 are arranged, as already mentioned, in an amount of straight lines distributed around the circumference of the plate cylinder 6. Each line is preferably parallel to the longitudinal axis 28 of the plate cylinder 6. The counter-connectors 18 along each line are arranged in the specific (preferably equal) intervals. As described above, the row of connectors 16 of the clamp 8 is correspondingly arranged in a straight line and with specific (preferably equal) intervals between the connectors. In other words, the row of connectors 16 and each of the rows of the counter-connectors 18 correspond to each other for their engagement.

Claims

1. A method of attaching a printing plate to a plate cylinder for a flexographic printing process comprising the steps of:

   a) placing the printing plate onto the plate cylinder so that the printing plate at least partly surrounds the plate cylinder and so that two opposite edges of the printing plate are positioned parallel to the plate cylinder's longitudinal axis; and

   b) clamping the two opposite edges to an outer surface of the plate cylinder by means of a clamping mechanism comprising at least one clamp, each clamp having an attachment means adapted to detachably attach the clamp to the plate cylinder.

2. A clamp for attaching at least one edge of a flexographic printing plate to a plate cylinder, the clamp comprising an attachment means adapted to detachably attach the clamp to the plate cylinder.

3. The clamp of claim 2, wherein the attachment means comprises at least two connectors detachably connectable to counter-connectors of a counter-structure of the plate cylinder.

4. The clamp of claim 2 or claim 3, wherein:

   the attachment means comprises a plurality of connectors adapted to be detachably connectable to a plurality of counter-connectors of the plate cylinder,

   the plurality of counter-connectors are provided along a line parallel to the longitudinal axis of the plate cylinder, the counter-connectors being arranged in specific, preferably equal, distances to each other,

   the plurality of connectors are provided along a line, the connectors being arranged in specific, preferably equal, distances to each other, and the distances of the connectors substantially correspond to the distances of the counter-connectors.

5. The clamp of claim 3 or 4,
   wherein the plurality of counter-connectors are provided along a plurality of lines distributed around the circumferential surface of the plate cylinder, each line being parallel to the longitudinal axis of the plate cylinder, and
   wherein the lines are arranged in specific, preferably equal, distances to each other about the longitudinal axis of the plate cylinder.

6. The clamp of any one of claims 3 to 5, wherein the connector has a form fitting configuration so that it is detachably connectable to a counter-connector of the plate cylinder.

7. The clamp of claim 6, wherein the connector comprises a post and a knob detachably connectable to

the counter-connector of the plate cylinder and the counter-connector comprises a hole configured to engage the knob, and
wherein the knob and/or the hole comprise shape(s) and/or dimension(s) for providing the detachable connectability of the knob and the hole.

8. The clamp of claim 7, wherein:

the knob has a spherical shape and a larger diameter than the hole,
the hole has a circular shape, and
the knob and/or the material comprising the hole is made of a resilient material so that the knob and the hole provide a snap-fit connection.

9. A plate cylinder comprising at least one clamp of any one of claims 2 to 8.

10. A use of the clamp of any one of claims 2 to 8 or of the plate cylinder of claim 9 in a flexographic printing method.

11. A printing system comprising a plate cylinder according to claim 9 and a flexographic printing plate, wherein two opposite edges of the flexographic printing plate are attached to the plate cylinder by at least one clamp, the clamp comprising an outer surface.

12. The printing system of claim 11, wherein the plate cylinder is configured such that an outer surface of the clamp facing radially outwards with respect to the plate cylinder is flush with the outer circumferential surface of the flexographic printing plate or arranged closer to the cylinder's longitudinal axis than the printing surface of the flexographic printing plate.

13. The printing system of claim 12, wherein the plate cylinder's outer circumferential surface comprises at least one recess extending along its longitudinal direction, said recess accommodating at least one of the two opposite edges of the flexographic printing plate

14. The printing system of any one of claims 11 to 13, wherein at least one of the two opposite edges of the flexographic printing plate has a reduced thickness for engaging the clamp.

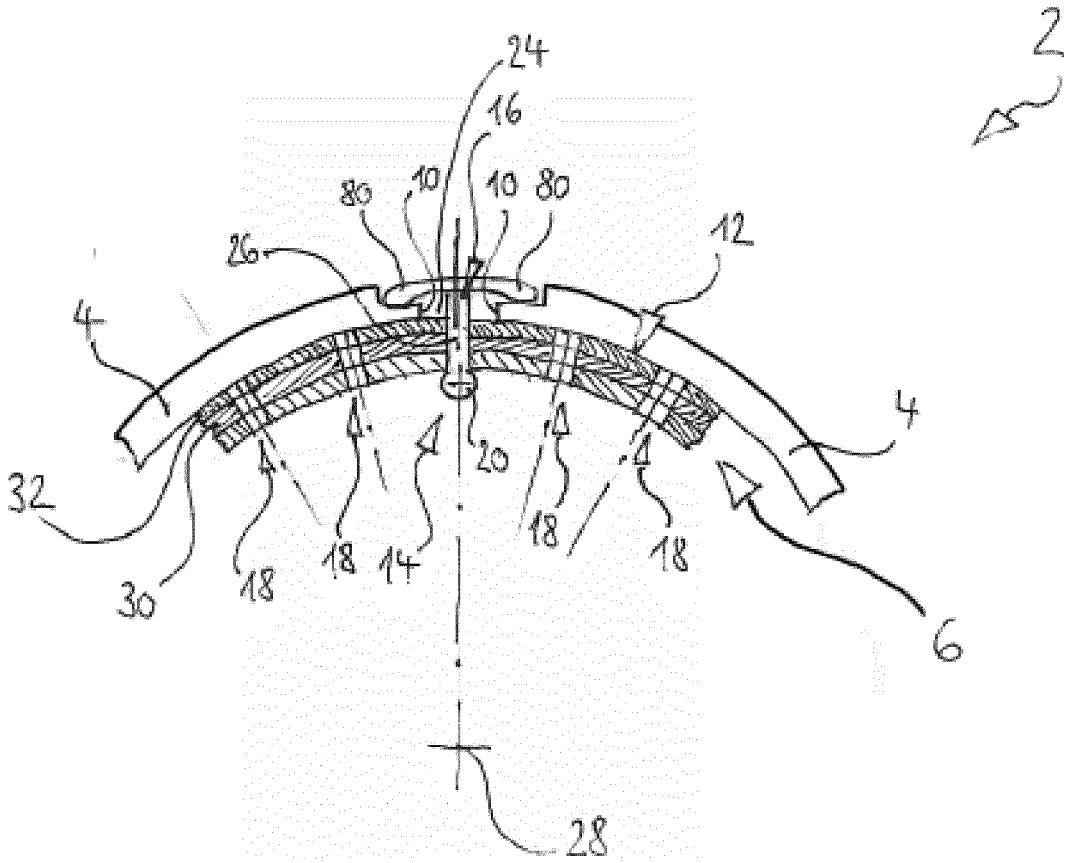

Fig. 1

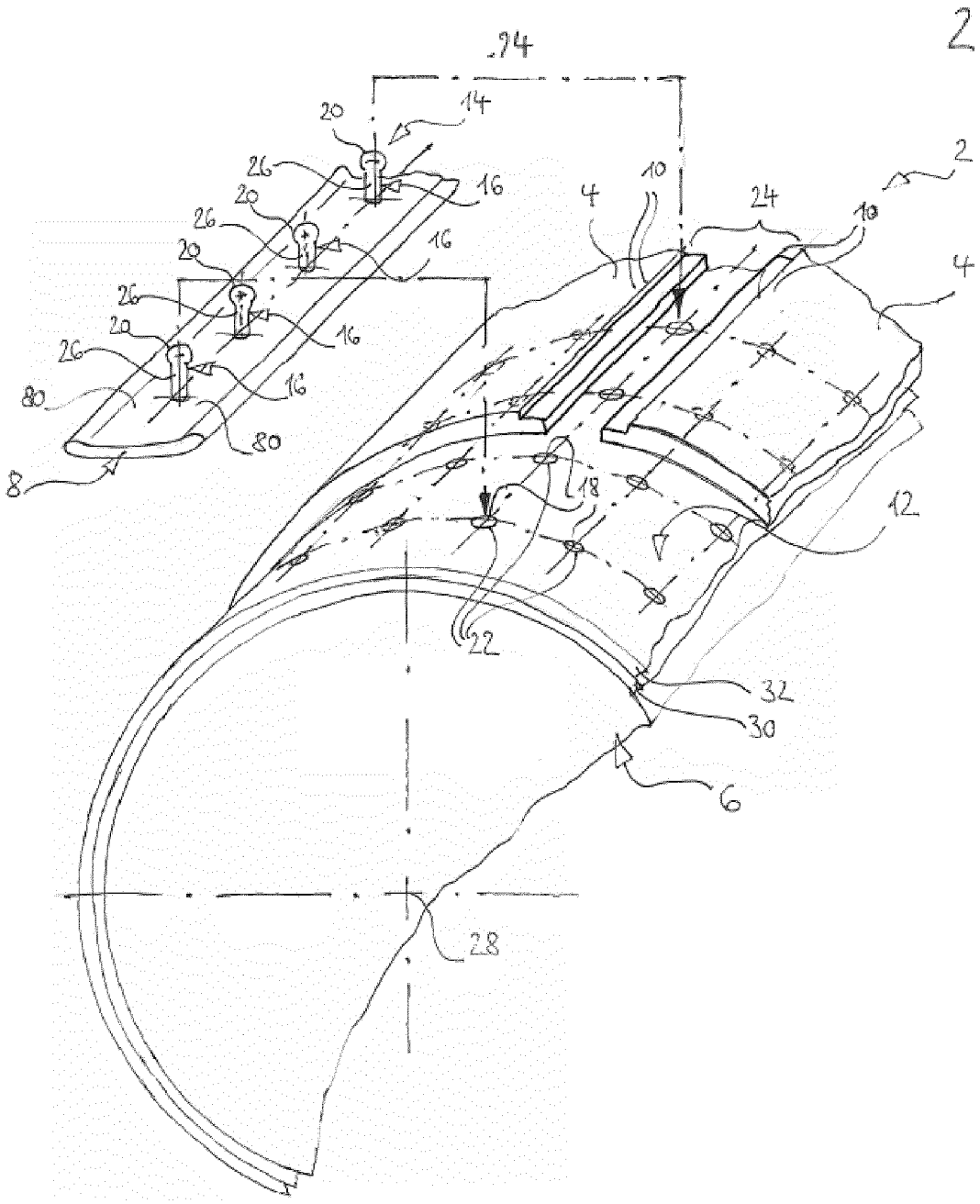

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 4638

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 198 34 068 C1 (ENDLOSSCHIFFER MICHAEL SCHIFFE [DE]) 24 February 2000 (2000-02-24) * figures 1,4-6 * * column 4, line 38 - column 6, line 36 *	1-14	INV. B41F27/12
X	EP 1 350 621 A2 (GRUPO BASGRA MAQUINARIA CERAMI [ES]) 8 October 2003 (2003-10-08) * figures 3-7 * * paragraphs [0016] - [0022] *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 February 2020	Hajji, Mohamed-Karim

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19834068 C1	24-02-2000	NONE	
EP 1350621 A2	08-10-2003	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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