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(54) SEALING BLADE

(57) The invention relates to a sealing blade, which includes opposite elongated edges (30, 31) and between them a flat (32) and which is adaptable to a blade holder (17) arranged in a coating applicator (25) of a coating device (21) and into contact with a moving surface (11'). A contact surface (33), which may be arranged against the moving surface and which is 5 - 15% of the width (W) of the sealing blade, is adapted in the sealing blade (10).

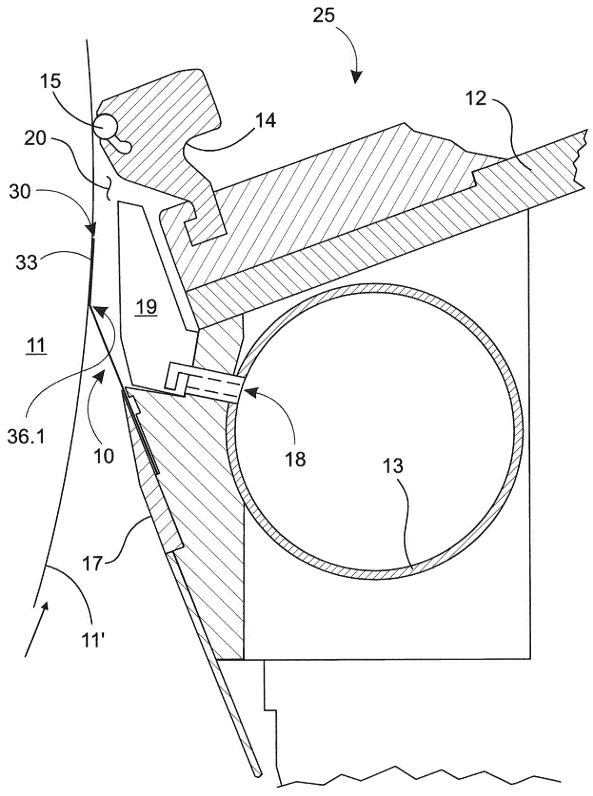

Fig. 2

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Description

[0001] The invention relates to a sealing blade, which includes opposite elongated edges and between them a flat and which is adaptable to a blade holder arranged in a coating applicator of a coating device and into contact with a moving surface.

[0002] The coating or surface sizing of paper or board may be performed for example using a film transfer coater. In it, the web to the treated runs through a nip located between two rolls. The coating mixture or sizing agent is spread using a specific coating applicator onto the surface of one roll or both rolls, from which surface it is transferred onto the surface of the web to be treated in the nip between the rolls. The thickness and profile of the sizing agent layer on the surface of the roll may be adjusted for example by means of a doctor blade or a rotating metering rod.

[0003] The coating applicator may comprise an application chamber, which is limited in the direction of rotation of the roll by the doctor element and on the other hand by the front wall. In the lateral direction, the application chamber is limited by the side seals. The coating mixture or surface sizing agent is fed into the application chamber for example through a channel located in the girder of the coating applicator. The coating mixture is fed into the application chamber at such a great speed and pressure that a return flow is created in the gap between the front wall and the application roll, in other words a coating mixture flow or sizing agent flow in a direction opposite to the direction of rotation of the application roll is created. The purpose of the return flow is to prevent the penetration of air, which is on the surface of the application roll, into the application chamber. If air can enter the application chamber, places with no coating may be created in the web.

[0004] It is well known that a sealing blade may be used as the front wall that closes the application chamber. The sealing blade may be pressed against the application roll so that no air escapes from between the blade and the application roll into the application chamber. There is no actual return flow from between the sealing blade and the application roll, but some coating mixture is led from the application chamber to the front of the blade through flow openings in the sealing blade. In this case, a pool of lubricant is formed in front of the sealing blade, which pool of lubricant prevents the friction occurring between the sealing blade and the application roll from damaging the roll or the sealing blade. If the pressure of the application chamber rises for example as a result of an excessive feeding of coating mixture, the force that presses the sealing blade against the application roll increases, whereby the sealing blade wears more rapidly and may damage the application roll or at least wear it.

[0005] However, a drawback related to the prior art sealing blade is that the edge of the blade placed against the application roll becomes sharp in connection with the use of the blade. This causes occupational safety problems in the maintenance of the coating applicator. A sharpened sealing blade is dangerous to the maintenance personnel for example when the sealing blade, metering rod or the cradle of the metering rod is replaced. For the replacement of just the metering rod and its cradle, which replacement needs to be performed in some cases more frequently than the replacement of the sealing blade, it is not often customary to remove the sealing blade from the coating applicator, because this is troublesome to perform. What makes the removal of the sealing blade difficult is that it may be firmly stuck to its blade holder and would therefore require washing to facilitate the removal. A sealing blade which has become sharpened and which is also difficult to remove may cause incised wounds to employees and also damage to the surface of the application roll.

[0006] Attempts in many different ways have been made to solve the problem related to the sealing blade becoming sharpened, but with little success. Since the holder of the sealing blade is fastened to the girder in a stationary manner, it is difficult to change the position of the holder. The sealing blade may also be lifted higher in the blade holder, but this does not always give the desired outcome, either. An attempt to enhance the lubrication that decreases the friction between the sealing blade and the application roll may be made by changing the feed pressure, but this is restricted by the seals that do not seal sufficiently well and by fouling problems. Moreover, it is not desirable to shift to a thinner sealing blade and a higher chamber pressure because of reasons such as increased leaks and splashes.

[0007] One prior art sealing blade that can be mentioned is in FI patent number 103058. The sealing blade known from it is a planar item. Both flat surfaces of the blade are hence essentially similar planar surfaces, in other words the front edge and the back edge of the blade are in the same plane.

[0008] The purpose of the present invention is to accomplish a sealing blade where the edge becomes less sharpened. The characteristics of the sealing blade according to the invention are presented in claim 1.

[0009] In the invention, a contact surface, which may be arranged against a moving surface and which is 5 - 15% of the width of the sealing blade, is adapted in the sealing blade. As a result of the contact surface already adapted in the sealing blade in advance, the angle between the sealing blade and the moving surface decreases, the area of contact of the sealing blade with the moving surface increases, and the wear of the sealing blade decreases. In this way, also the flat surface of the sealing blade can be brought reliably into contact with the moving surface, the sharpening of the elongated edge of the sealing blade is reduced, and occupational safety related to the maintenance of the coating device is enhanced.

[0010] According to one embodiment, flow openings may be included in the flat of the sealing blade. In this case, most of the contact surface is adapted between the elongated edge and the flow openings. This ensures

the optimum functioning of the flow openings in all circumstances, and they do not settle against the moving surface.

[0011] It is possible that the flat of the sealing blade is divided into two or more areas, and the contact surface is formed in at least one area. The division may be accomplished in different ways. Examples include folds or roundings to be made in the flat of the sealing blade. Several other advantages are also accomplished with the invention, such as longer service life of sealing blades, longer replacement interval of rolls, smaller quality variation of paper and board and higher production volume of paper and board, when sealing blades do not need to be replaced prematurely. The other additional advantages to be achieved with the invention are disclosed in the description of the invention, and the characteristics are disclosed in the claims.

[0012] The invention, which is not restricted to the embodiments presented below, is described in more detail by making reference to the enclosed drawings, in which:

Figure 1	shows an example in principle of a coating device viewed from the side,
Figure 2	shows one example of a coating applicator seen from the side,
Figure 3	shows one example of a sealing blade viewed axially from the top, from one end of the sealing blade, and
Figures 4a - 4c	show on a rough level of principle various embodiments of the sealing blade and of how it settles against the application roll, viewed from the side.

[0013] Figure 1 shows an example in principle of a coating device 21 viewed from the side. In this case, the device 21 comprises two rotating application rolls 22, 11, which are adapted in a nip contact and between which the paper or board web 24 to be treated, in other words to be surface sized or coated, is adapted to travel. The direction of travel of the web 24 is indicated by an arrow, and the direction of travel of the rolls 22, 11 is also indicated by an arrow. A web 24 treatment substance, such as a coating mixture or surface sizing agent, is spread onto the surfaces 22', 11' of the application rolls 22, 11 by means of coating applicators 25. The treatment substance layer is levelled and its thickness is adjusted by means of a doctor element such as a doctor blade or a rotating metering rod (reference number 15 in Figure 2). The doctored treatment substance layer is transferred from the application rolls 22, 11 onto both sides of the web 24 to be treated in a nip between the rolls 22, 11. If only one side of the web 24 is treated, the treatment substance is only spread onto one application roll 11.

[0014] Figure 2 shows one example of a coating applicator 25 seen from the side. In this case, the coating applicator 25 is constructed to rest on the girder 12, and the application chamber 20 that is against the application roll 11 is formed by a space in the girder 12, which space is limited in the direction of rotation of the application roll 11 by a sealing blade 10 which comes first, i.e. on the inlet side, and by a metering rod 15 which is on the outlet side, i.e. latter in the direction of rotation. The sealing blade 10 is fastened to the girder 12 by means of a blade holder 17, and the metering rod 15 is fastened by means of a rod holder 14.

[0015] The sealing blade 10 presses against the surface 11' of the application roll 11 and prevents the coating from flowing in an uncontrolled manner against the direction of rotation of the roll 11 and the access of air, which is carried with the rotating roll 11, into the application chamber 20. A metering rod 15 is placed at a distance from the sealing blade 10, which metering rod 15 is pressed against the application roll 11, but which metering rod 15 is suspended hydrodynamically at a distance from the surface 11' of the roll 11 by a film transferred onto the rotating roll 11. The thickness of the film transferred onto the surface 11' of the roll 11 is adjusted by changing the loading of the metering rod 15. The distance between the sealing blade 10 and the metering rod 15 forms an application distance, and the application chamber 20 is hence limited by the girder 12, sealing blade 10, metering rod 15 and application roll 11. The ends of the application chamber 20 are sealed in the case according to the embodiment by means of flexible seals 19, which limit the width of the area to be coated. The coating is fed into the application chamber 20 through nozzles 18 from a main tube 13 located inside the girder 12 and extending over the entire width of the coating applicator 25.

[0016] Figure 3 presents one example of a sealing blade 10 viewed axially from the top, from its one end, which sealing blade 10 may be corresponding to the one installed in the coating applicator 25 in Figure 2. The sealing blade 10 includes opposite elongated edges 30, 31 and a flat 32 between them. The flat 32 has two opposite sides, forming the flat surfaces 32a and 32b. The flat surface 32a of the flat 32 on the side of the roll 11 and the flat surface 32b on the side of the application chamber 20. Of these flat surfaces, Figure 3 shows the flat surface 32b on the side of the application chamber 20.

[0017] The sealing blade 10 is adaptable, so that it may be replaced, to a blade holder 17 arranged in a coating applicator 25 of a coating device 21 and into contact with the moving surface 11'. For these, the sealing blade 10 includes a fastening area 37 adapted on the side of the first elongated edge, the back edge 31, from which fastening area 37 the sealing blade 10 is adapted to be fastened to the blade holder 17. In the fastening area 37, there may be for example die-cut fasteners, which ensure the fastening of the blade 10 to the holder 17. The second elongated edge, the front edge 30, which is opposite to this first edge 31 coming to the elongated holder 17, includes a tip 38, which is adaptable against the moving surface 11'.

[0018] A contact surface 33, which may be arranged against the moving surface 11', is adapted in the sealing

blade 10. Some examples of the contact surface 33 are presented in Figures 2 and 4a - 4c. The contact surface 33 is on the flat surface 32a of the sealing blade 10 on the side of the roll 11, in other words on a side different from the side of the application chamber 20. The contact surface 33 may be 5 - 15% of the width W of the sealing blade 10. In this connection, the width W of the sealing blade refers to the distance between the elongated edges 30, 31 of the sealing blade 10, measured along the flat 32. Correspondingly, the length L of the sealing blade 10 refers to the length of the sealing blade 10 in the cross direction of the machine. The length L of the sealing blade 10 may be several meters, as much as ten meters. The directions W and L are perpendicular to each other. It must be noted that in the figures the proportions of the sealing blade 10 and its parts are not necessarily actual proportions. As a result of the contact surface 33 arranged in the sealing blade 10 as early as during its manufacture, the sealing blade 10 is, when installed in the blade holder 17, at a suitable angle with respect to the roll 11, and hence for example the lubrication of the tip 38 of the sealing blade 10 becomes sufficient and the tip 38 becomes less sharpened even otherwise, because part of the flat surface 32a is against the moving surface 11'.

[0019] By arranging the contact surface 33 in the sealing blade 10, it can be brought into contact with the moving surface 11' more reliably over a larger area and especially over its flat 32 than merely by a connection over its elongated edge 30. Moreover, the contact surface 33 is in the sealing blade 10 already before it is installed in the blade holder 17, and it is not formed only when loading the blade 10 against the moving surface 11'. In other words, it can be said that initial tension has been removed from the blade 10 when it is installed in its blade holder 17. This makes the contact between the flat 32 of the blade 10 and the moving surface 11' very reliable, and at the same time the sharpening of the tip 38 of the blade 10 is reduced.

[0020] According to one embodiment, flow openings 34, 34.1 - 34.3 may be adapted in the flat 32 of the sealing blade 10. Some examples of their locations have been presented in Figures 4a - 4c, where the openings are described in principle by the two-headed arrows running through the flat 32 of the blade 10. Most of the contact surface 33 may be adapted between the elongated edge 30 and the flow openings 34, 34.1 - 34.3 of the blade 10. The contact surface 33 and the flow openings 34, 34.1 - 34.3 are adapted in the sealing blade 10 so that when in contact with the moving surface 11', the flow openings 34, 34.1 - 34.3 adapted in the sealing blade 10 are at least partially separated from the moving surface 11'. In this case, the moving surface 11' does not block the flow openings 34, 34.1 - 34.3. This also ensures the functioning of the flow openings 34, 34.1 - 34.3 in all circumstances, in other words the access of air into the chamber 20 is prevented, the lubrication of the sealing blade 10 is ensured and the removal of overpressure from the chamber 20 is ensured. As a result of the invention, it is even possible to improve the impacts achieved with the flow opening 34, 34.1 - 34.3. The location of the flow openings 34, 34.1 - 34.3 on the flat 32 of the blade 10 may be optimized for example close to a standardized contact surface 33 and hence the lubrication between for example the blade 10 and the moving surface 11' may be intensified.

[0021] According to one embodiment, the contact surface 33 may be arranged in the sealing blade 10 for example so that the flat 32 of the sealing blade 10 is divided into two or more areas 35.1 - 35.3, of which the contact surface 33 is formed in at least one area 35.1, in other words on one side of the flat 32. In Figures 4a and 4b, the sealing blade 10 has been divided into two areas 35.1, 35.3, and the contact surface 33 is in the area 35.1. In Figure 4a, the contact surface 33 is in a planar area 35.1, and in Figure 4b the contact surface 33 is in a curved area 35.1. Correspondingly, in Figure 4c the sealing blade 10 has been divided into three areas 35.1 - 35.3, and the contact surface 33 is again in the area 35.1, which is a planar area here, too.

[0022] According to the embodiments presented in Figures 4a - 4c, the areas 35.1 - 35.3 may be formed in several different ways. According to a first embodiment, the flat 32 of the sealing blade 10 is divided into two or more areas 35.1 - 35.3 by means of one or more folds 36.1, 36.2. In Figures 4a and 4b, the sealing blade 10 has one fold 36.1, and in Figure 4c, the sealing blade 10 has two folds 36.1, 36.2. The fold 36.1, 36.2 may be a bevelled sharp fold or also a rounded fold. With two folds 36.1, 36.2, the angles of the folds do not need to be that great. The flat 32 of the sealing blade 10 may also be divided into two or more areas 35.1, 35.3 by means of one or more roundings 36.3. This is the case for example in Figure 4b. The folds 36.1, 36.2 and/or roundings 36.3, more generally the removal of the initial tension of the sealing blade 10, may be performed for example in the last stage of the manufacture of the sealing blade 10.

[0023] Figures 4a present three different possibilities to arrange the flow openings 34.1 - 34.3 in the sealing blade 10. They can be for example in the same area 35.1 with the contact surface 33, in which case they are between the fold 36.1 and the contact surface 33. They can also be in the same area 35.3 where the sealing blade 10 is fastened to the holder 17. Moreover, they can also be at exactly the fold 36.1. In the embodiment of Figure 4b, the flow openings 34.3 are in the area 35.3, and in Figure 4c the flow openings 34.1 are in the area 35.2.

[0024] The distance D of the top edge of the flow openings 34, in other words that of the edge closest to the tip 38 of the blade 10, from the elongated edge 30 of the sealing blade 10, which edge 30 is equipped with the tip 38, may be for example 15 - 50 mm. The sealing blade 10 may be for example of spring steel type 1,4301, and its material thickness may be for example 0.254 - 0.381 mm and total width W for example 100 - 130 mm.

[0025] As presented above, the sealing blade 10 ac-

cording to the invention is no longer a planar item known from prior art. Instead, its front edge 30 is deviated from the planar surface. The deviation may be accomplished for example by means of one or more angle folds in the longitudinal L direction of the blade 10. The folds may be located in the width W direction of the blade 10 at a distance of 5 - 15% from the tip 38 of the blade 10, which tip 38 is an edge 30 opposite to the edge 31 on the side of the blade holder 17. Another alternative presented for example in Figure 4b is to round the tip portion of the blade 10 in the area 33 in question to be curved in the same direction as the curvature of the roll surface 11'.

[0026] It is to be understood that the above description and the related figures are only intended to illustrate the present invention. The invention is hence not only restricted to the above-presented embodiments or the embodiments defined in the claims, but several different variations and adaptations of the invention will also be obvious to a professional in the field, which variations and adaptations are possible within the inventive idea defined by the enclosed claims.

Claims

1. A sealing blade, which includes opposite elongated edges (30, 31) and between them a flat (32) and which is adaptable to a blade holder (17) arranged in a coating applicator (25) of a coating device (21) and into contact with a moving surface (11'), **characterized in that** a contact surface (33), which may be arranged against the moving surface (11') and which is 5 - 15% of the width (W) of the sealing blade (10) , is adapted in the sealing blade (10) .

2. A sealing blade according to claim 1, where flow openings (34, 34.1 - 34.3) are adapted on the flat (32) of the sealing blade, **characterized in that** most of the contact surface (33) is adapted between the elongated edge (30) and the flow openings (34, 34.1 - 34.3).

3. A sealing blade according to claim 1 or 2, where flow openings (34, 34.1 - 34.3) are adapted on the flat (32) of the sealing blade, **characterized in that** the contact surface (33) is adapted in the sealing blade (10) so that when in contact with the moving surface (11'), the flow openings (34, 34.1 - 34.3) adapted in the sealing blade (10) are at least partially separated from the moving surface (11').

4. A sealing blade according to any one of claims 1 - 3, **characterized in that** the flat (32) of the sealing blade (10) is divided into two or more areas (35.1 - 35.3), from which the contact surface (33) is formed in at least one area (35.1).

5. A sealing blade according to any one of claims 1 - 4, **characterized in that** the flat (32) of the sealing blade (10) is divided into two or more areas (35.1 - 35.3) by means of one or more folds (36.1, 36.2).

6. A sealing blade according to any one of claims 1 - 5, **characterized in that** the flat (32) of the sealing blade (10) is divided into two or more areas (35.1, 35.3) by means of one or more roundings (36.3).

7. A sealing blade according to any one of claims 2 - 6, **characterized in that** the distance (D) of the top edge of the flow openings (34) from the elongated edge (30) of the sealing blade (10) is 15 - 50 mm.

8. A sealing blade according to any one of claims 1 - 7, **characterized in that** the sealing blade (10) includes:

   - a fastening area (37) adapted on the side of a first elongated edge (31), from which fastening area (37) the sealing blade (10) is adapted to be fastened to said blade holder (17),
   - a second elongated edge (30), which is opposite to the first elongated edge (31),
   - flat surfaces (32a, 32b) located on the opposite sides of the sealing blade (10) between the elongated edges (30, 31), to which flat surface said contact surface (33) is adapted on one side.

9. A sealing blade according to claim 8, **characterized in that** a tip (38), which is adaptable against the moving surface (11'), is adapted on one elongated edge (30) of the sealing blade (10).

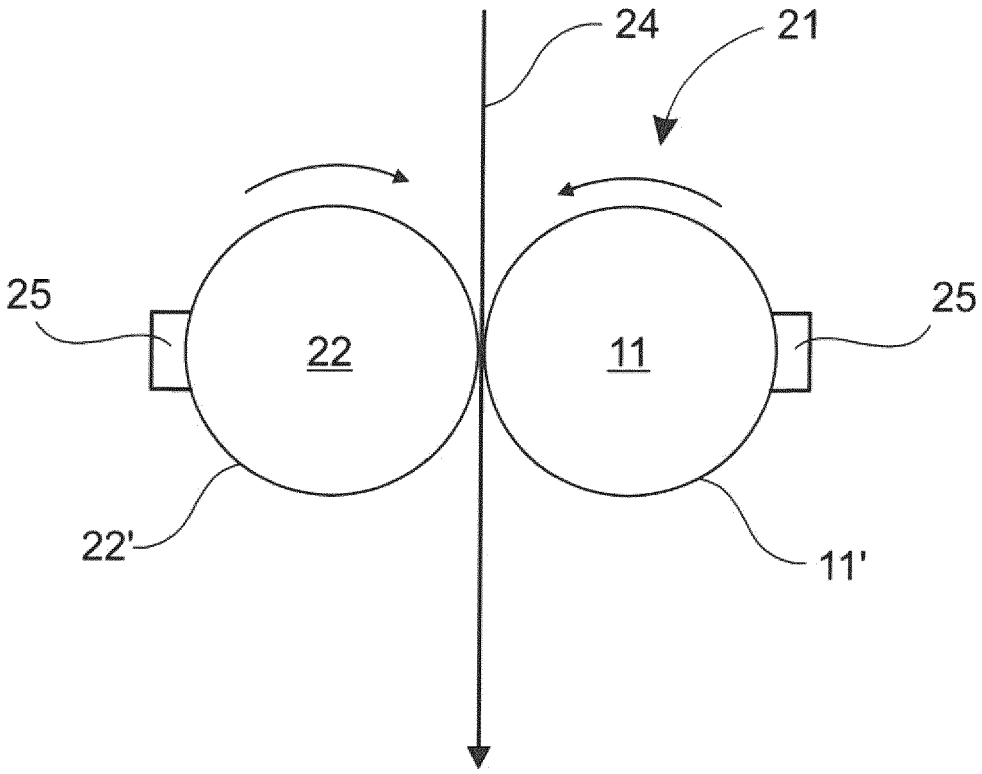

Fig. 1

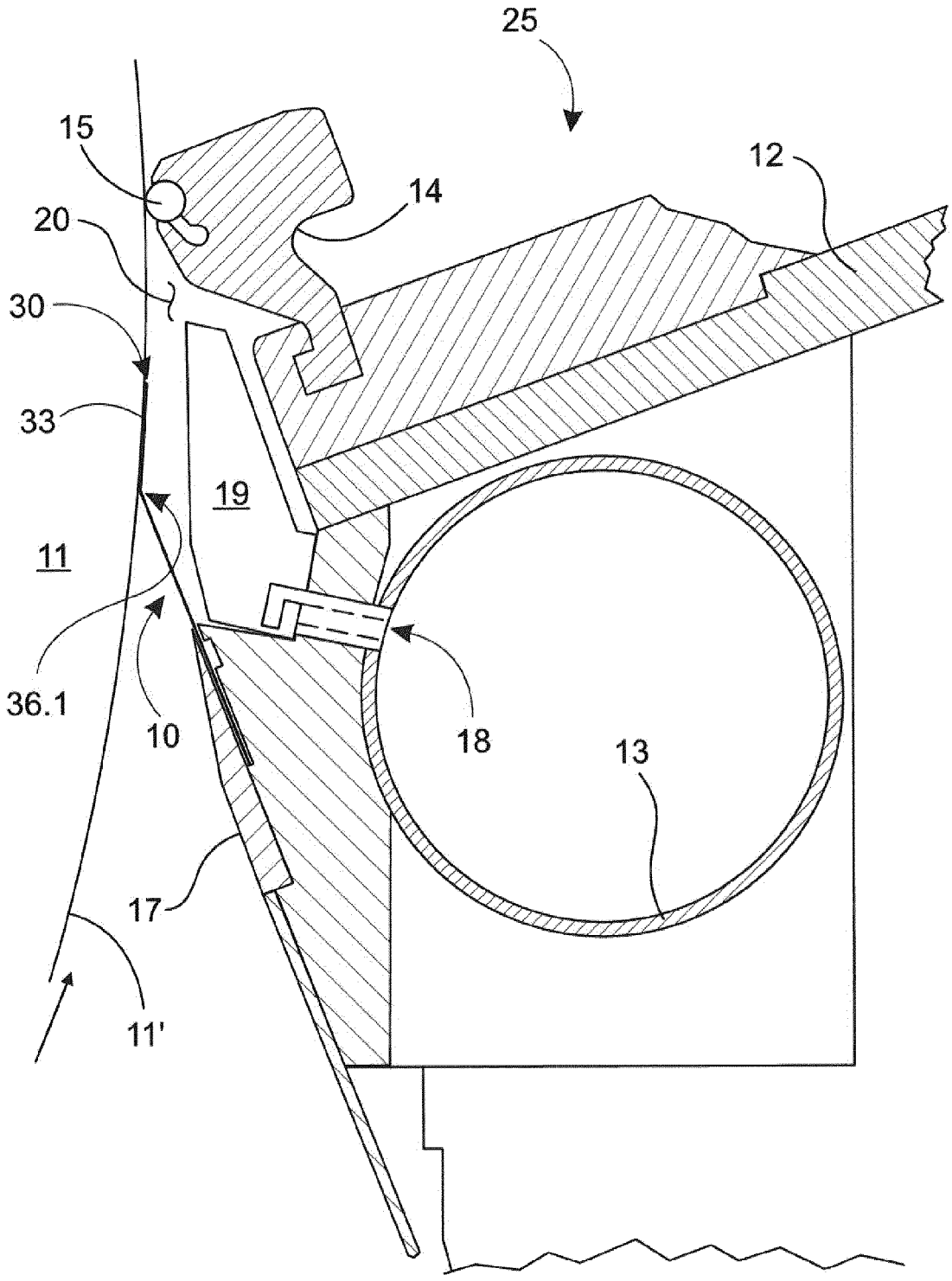

Fig. 2

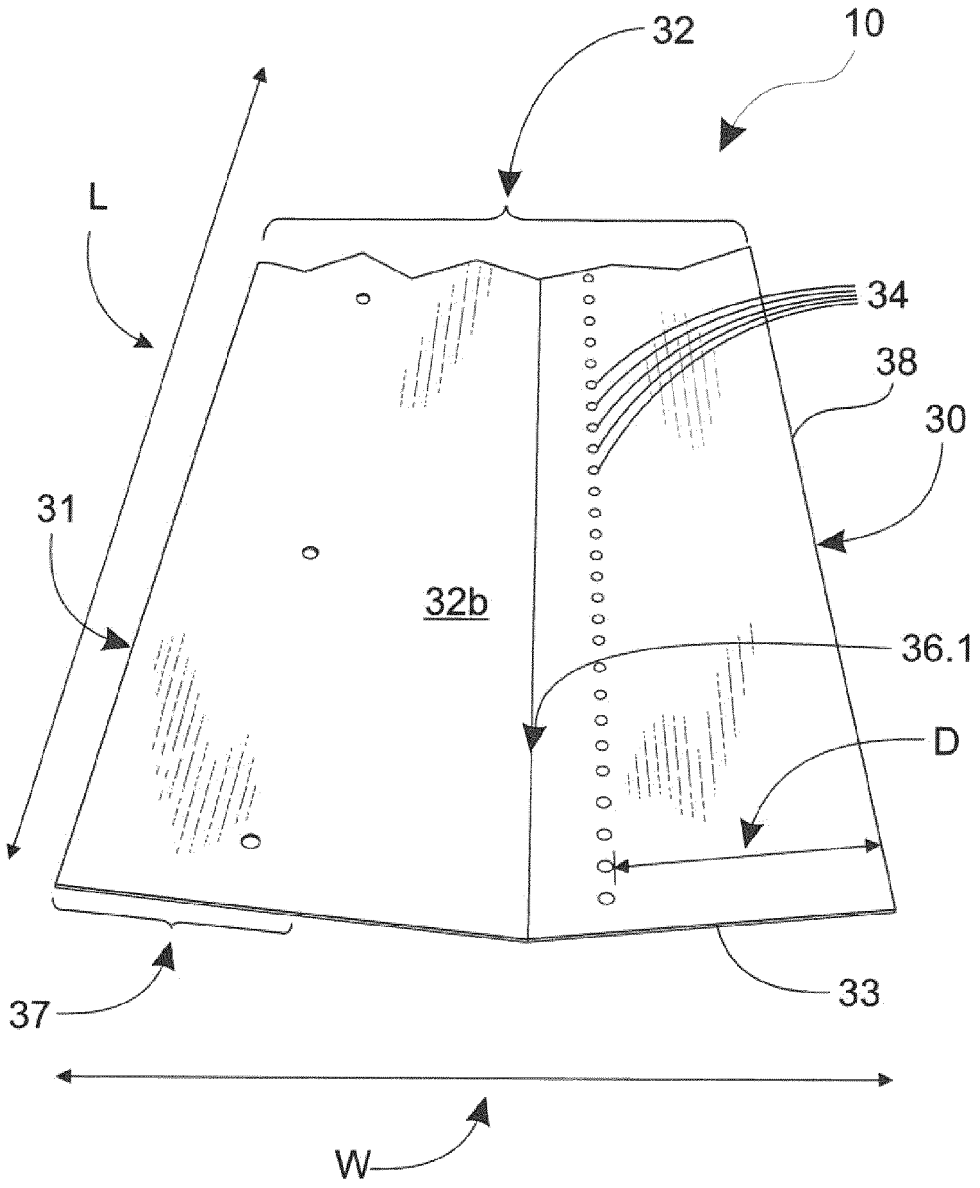

Fig. 3

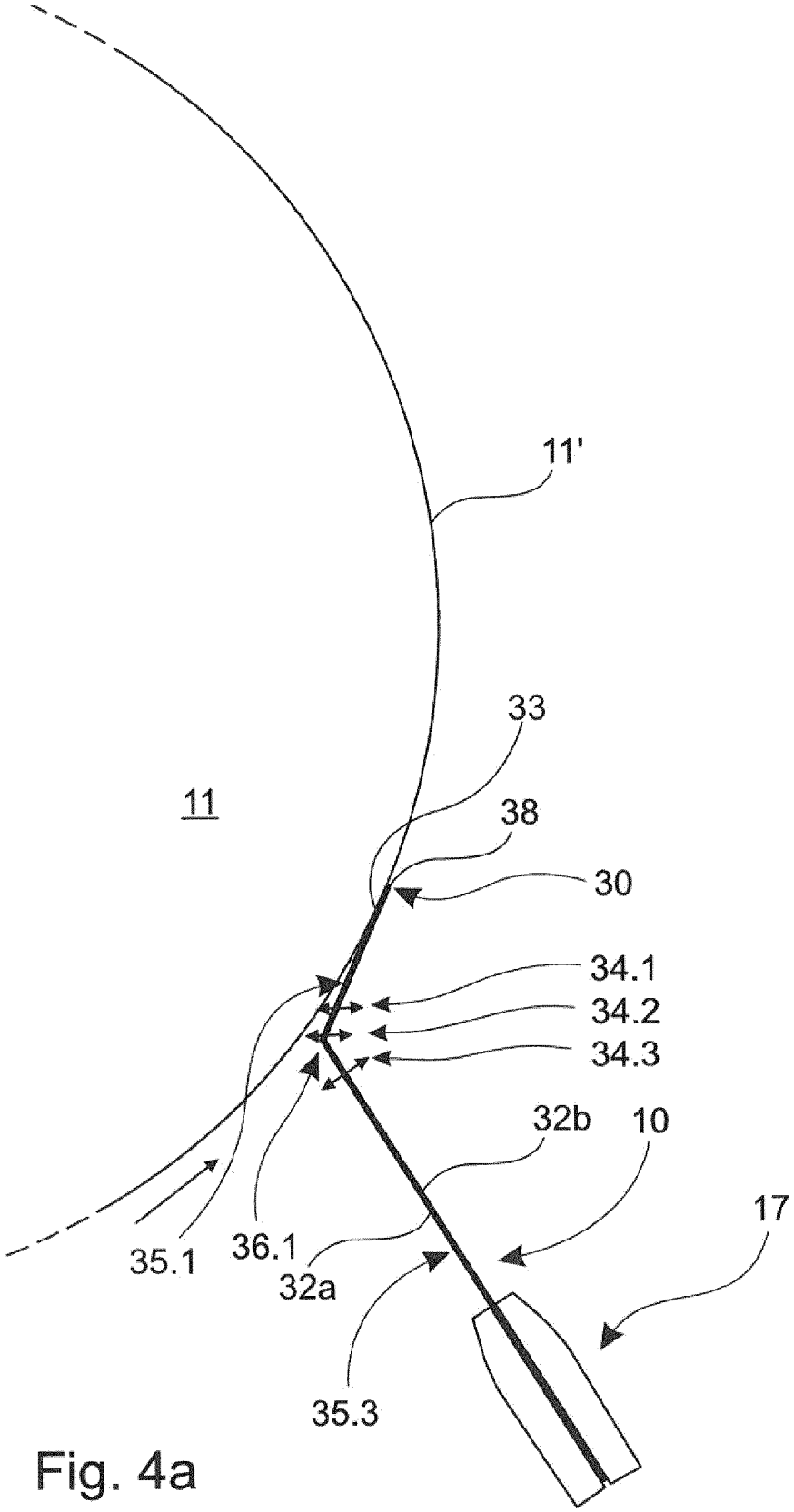

Fig. 4a

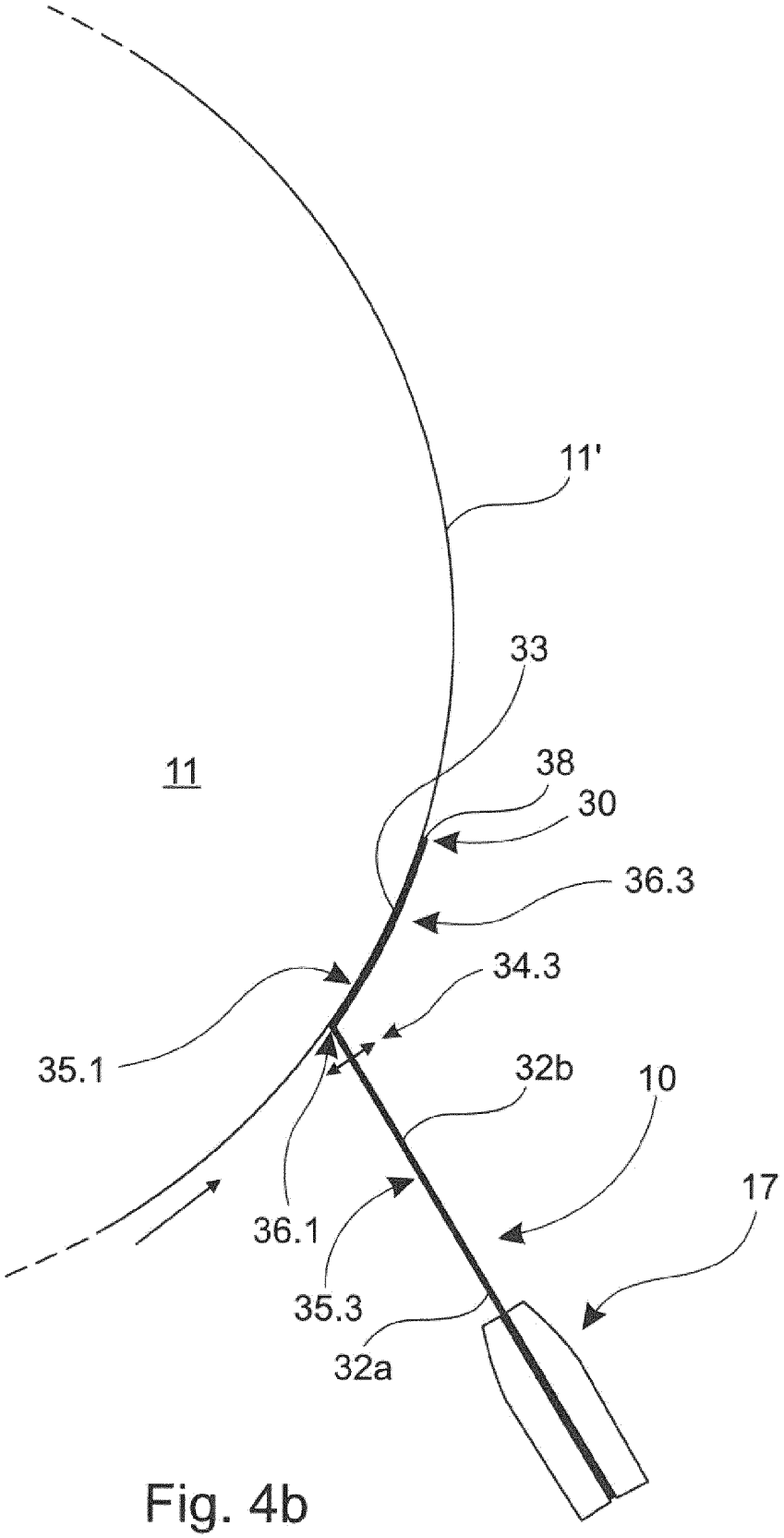

Fig. 4b

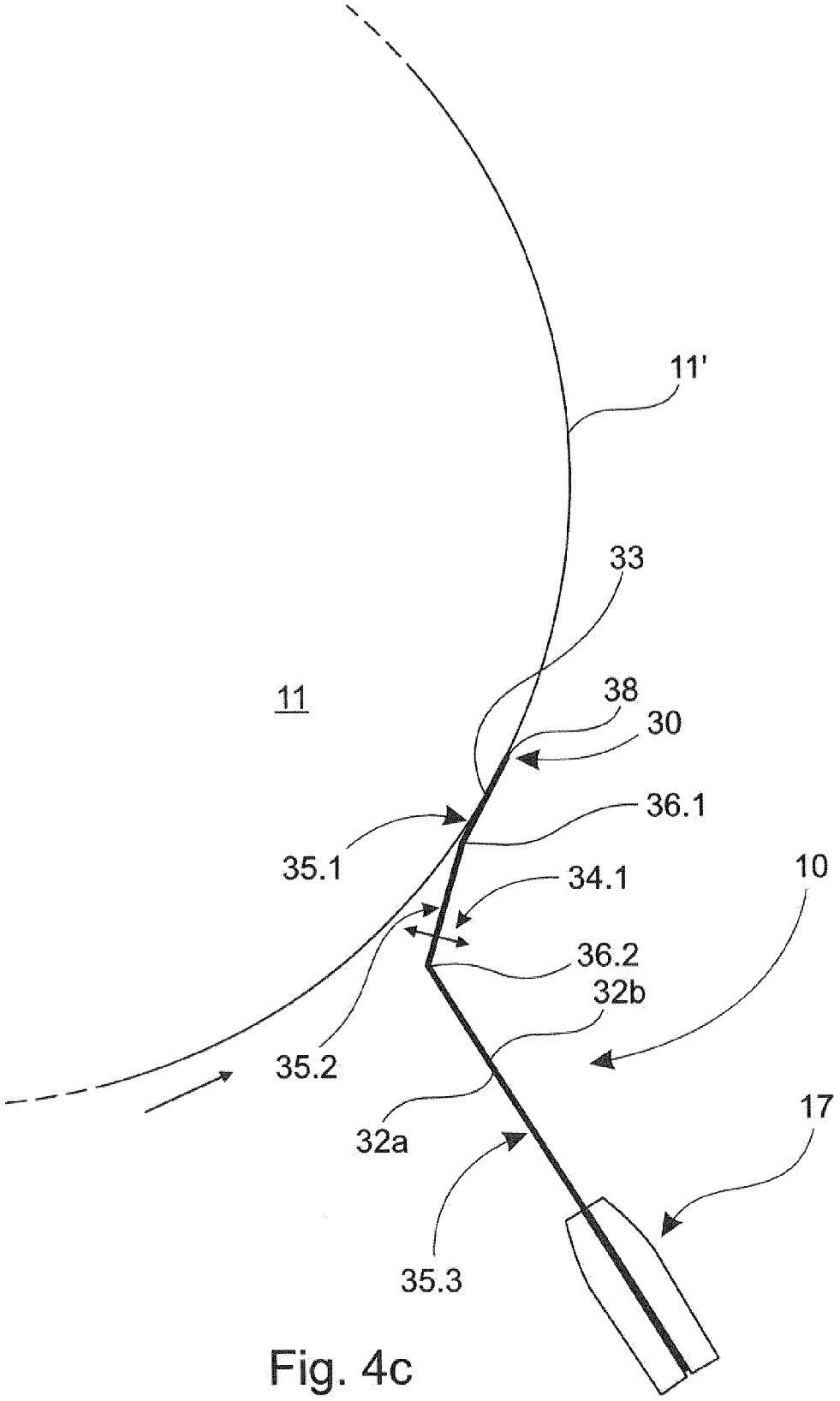

Fig. 4c

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 4249

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 April 2016	Roldán Abalos, Jaime

CATEGORY OF CITED DOCUMENTS

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