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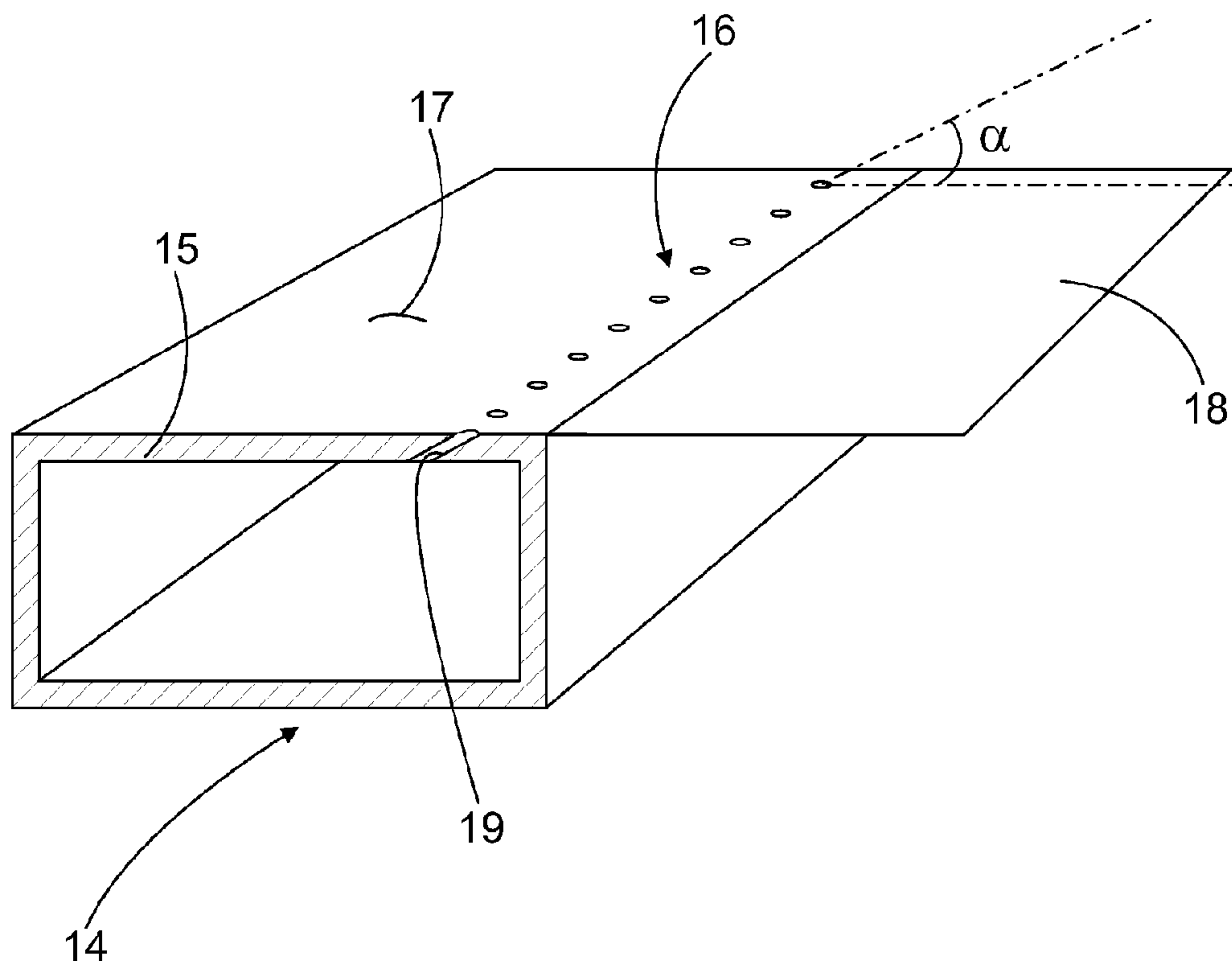
(72) **Inventeurs/Inventors:**
HAKULI, MIKKO, FI;
KOLJONEN, VELI-PEKKA, FI;
LAITINEN, KARI-MATTI, FI;
LYYTIKAINEN, VILLE, FI

(73) **Propriétaire/Owner:**
VALMET TECHNOLOGIES, INC., FI

(74) **Agent:** GOWLING WLG (CANADA) LLP

(54) **Titre : DISPOSITIF POUR TRANSFÉRER UN MATERIAU EN FORME DE BANDE CONTINUE DANS UNE MACHINE A BANDE CONTINUE FIBREUSE ET MACHINE A BANDE CONTINUE FIBREUSE**

(54) **Title: DEVICE FOR TRANSFERRING A WEB-LIKE MATERIAL IN A FIBER WEB MACHINE AND A FIBER WEB MACHINE**



(57) **Abrégé/Abstract:**

The invention relates to a device for transferring a web-like material in a fiber web machine. The device includes an air connection (14) and openings (16) arranged on a wall (15) defining the air connection for forming air blows that are parallel to the travel direction of the web-like material. The device also includes a transfer surface (17) for creating a vacuum effect with air blows and thereby transferring the web-like material. The openings (16) are formed on the transfer surface (17) and the angle α between the blow direction of the openings (16) and the transfer surface (17) is 15°-30°. The invention also relates to a fiber web machine.

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(71) Applicant (for all designated States except US): **METSO PAPER, INC.** [FI/FI]; Fabianinkatu 9 A, FI-00130 Helsinki (FI).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HAKULI, Mikko** [FI/FI]; Raennontie 20, FI-40800 Vaajakoski (FI). **KOLJONEN, Veli-Pekka** [FI/FI]; Kuhalantie 74, FI-44610 Kärnä (FI). **LAITINEN, Kari-Matti** [FI/FI]; Teljintie 3, FI-40530 Jyväskylä (FI). **LYYTIKÄINEN, Ville** [FI/FI]; Suuruspääntie 6 A 12, FI-40520 Jyväskylä (FI).

(74) Agent: **KESPAT OY**; P.O.Box 601, FI-40101 Jyväskylä (FI).

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(54) Title: DEVICE FOR TRANSFERRING A WEB-LIKE MATERIAL IN A FIBER WEB MACHINE AND A FIBER WEB MACHINE

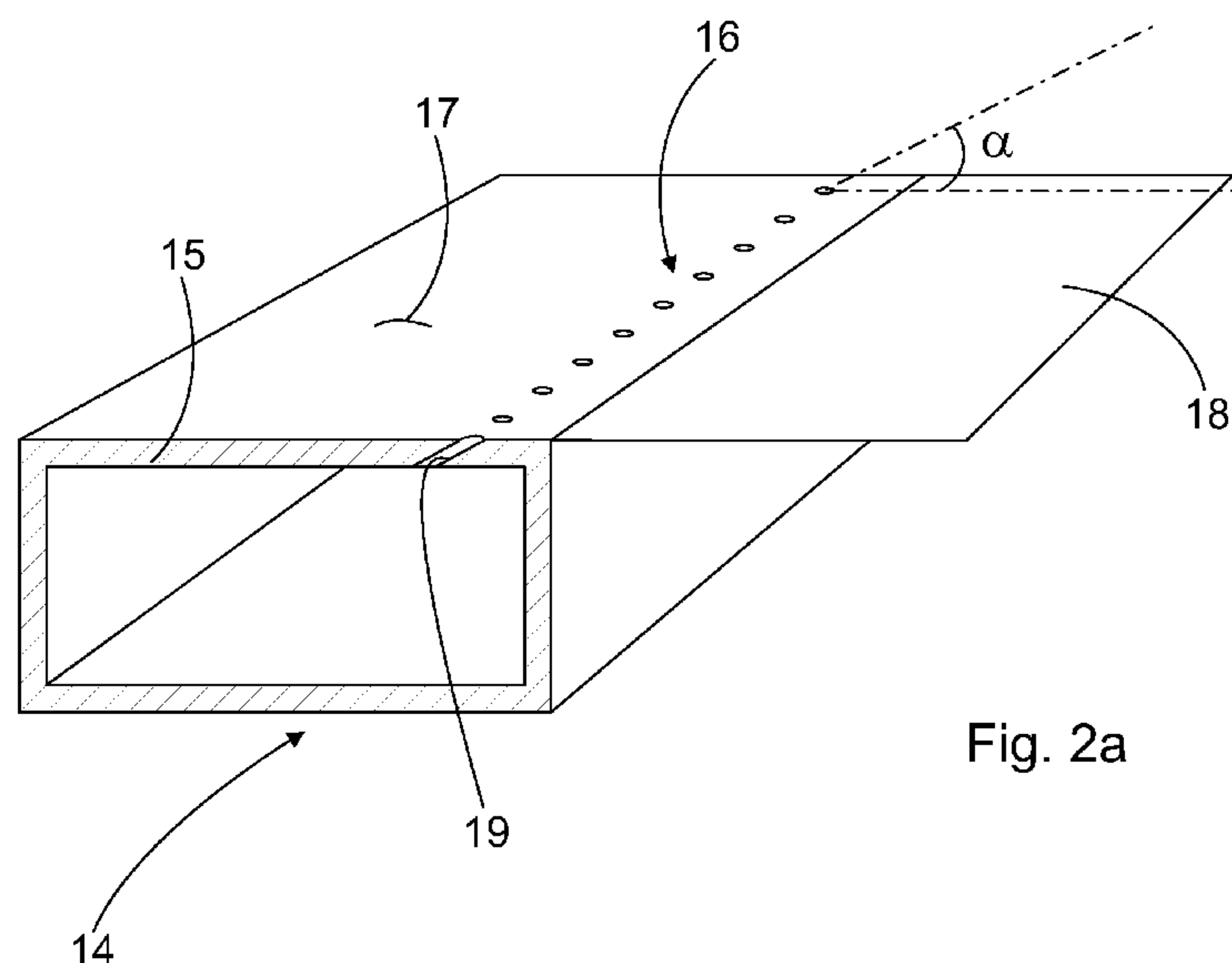


Fig. 2a

(57) Abstract: The invention relates to a device for transferring a web-like material in a fiber web machine. The device includes an air connection (14) and openings (16) arranged on a wall (15) defining the air connection for forming air blows that are parallel to the travel direction of the web-like material. The device also includes a transfer surface (17) for creating a vacuum effect with air blows and thereby transferring the web-like material. The openings (16) are formed on the transfer surface (17) and the angle α between the blow direction of the openings (16) and the transfer surface (17) is 15 -30°. The invention also relates to a fiber web machine.

DEVICE FOR TRANSFERRING A WEB-LIKE MATERIAL IN A FIBER WEB MACHINE AND A FIBER WEB MACHINE

The invention relates to a device for transferring a web-like material in a fiber web machine, which device includes:

- an air connection,
- openings arranged on a wall defining the air connection for forming air blows that are parallel to the travel direction of the web-like material, and
- 10 - a transfer surface for creating a vacuum effect with air blows and thereby transferring the web-like material.

The invention also relates to a fiber web machine.

In a fiber web machine, various devices based on air blows are used for transferring and guiding a web-like material. The web-like material can be a full-width web or a narrow tail cut from the web. At its simplest, the device is a pipe constituting an air connection with openings arranged on its wall for forming air blows. So called blow plates also exist, the operation of which is also based on air blows.

Blow pipes alone are mainly used only for guiding the web-like material approximately. Instead, a blow plate is provided with a transfer surface on which a vacuum effect is created by air blows by means of a so called Coanda effect. In other words, the web-like material tends to follow the transfer surface while the air blows parallel to the travel direction of the web-like material simultaneously transfer the material forward.

30 In a known blow plate, openings open up to a shoulder which is arranged between an air connection and a blow plate. In addition, air blows are oriented substantially parallel to the blow plate. In operation, air blows create a vacuum effect but, at the same time, significant friction is generated as the web-like material passes the shoulder. Then a major part of the transfer force of air blows is lost.

In FI patent No. 78528, the blow plate is additionally combined with a cut-off blow which first cuts the tail and thereafter the tail is moved forward with the blow plate. Initially, this system also involves the friction problem mentioned above.

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An object of the invention is to provide a novel device in a fiber web machine for transferring a web-like material, the device providing a higher transfer efficiency than before with a lower air volume and/or pressure level compared to heretofore. Another object of the invention is to provide a novel fiber web machine in which transferring a web-like material is smoother and more reliable compared to heretofore. The characteristic features of the device and fiber web machine according to this invention are that openings are formed on a transfer surface and the angle α between the blow direction of the openings and the transfer surface is $15 - 30^\circ$. As the openings open up to a transfer surface instead of a shoulder, the friction phenomenon that has caused problems earlier is avoided. Now the transfer surface remains smooth whereby, firstly, a vacuum effect more uniform than before is created. Secondly, due to the absence of a linear friction point, an air blow transfers a web-like material forward faster than heretofore. In operation, a forwarding force greater than before is achieved with the present air volume. On the other hand, the present force can be achieved with an air volume smaller than before or at a pressure level lower than before.

The invention is described below in detail by making reference to the enclosed drawings which illustrate some of the embodiments of the invention, in which

Figure 1a is a lateral view of a part of a fiber web machine position at which a device for transferring a web-like material is used,
35 Figure 1b is a cross-sectional lateral view of a device according to prior art,

Figure 2a is a cross-sectional axonometric view of a first embodiment of the device according to the invention,

Figure 2b shows a second embodiment of the device according to the invention as in Figure 2a,

Figure 3a is a cross-sectional view of a third embodiment of the invention,

Figure 3b is a cross-sectional view of a fourth embodiment of the invention,

Figure 4 is a lateral view of a fifth embodiment of the device according to the invention,

Figure 5 is a top view of the device of Figure 4 with the main components disassembled,

Figure 6a is a cross-sectional axonometric view of a sixth embodiment of the device according to the invention,

Figure 6b is a cross-sectional axonometric view of a seventh embodiment of the device according to the invention.

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Figure 1a shows the press section of a fiber web machine in a lateral view. Fiber web machines include paper and board machines, for example. At present, the tendency is to use a closed transfer in the press section in which case, in addition to the web, the tail cut therefrom is supported substantially through the entire press section. However, in the application example, the closed transfer breaks at the center roll 10 from which the tail is run down to the broke treatment. When continuing tail threading from this point, the tail must be first cut and guided to the following tail threading device. In the position shown, the tail is guided to the nip formed by a press fabric 11 and a guide roll 12. In addition to this position, the device according to the invention can be located in connection with the top roll 13 of a separate press, for example. In Figure 1a, the positions of the device are represented by a circled cross. The positions of the equipment can vary in

different press sections. The device can be used in other positions of a fiber web machine as well, such as in the dryer section. In addition to the tail, the device can be used for transferring a full-width web for tensioning the web, for example, while running it down to the pulper.

A fiber web machine thus includes one of more devices for transferring a web-like material. Based on the above, the web-like material can be a tail or a full-width web or something between these. Figure 1b shows a device according to prior art wherein the device includes an air connection 14 and openings 16 arranged on a wall 15 defining the air connection for forming air blows that are parallel to the travel direction of the web-like material. In addition, the device includes a transfer surface 17 for creating a vacuum effect with air blows and thereby transferring the web-like material. Air blows together with the transfer surface create a vacuum effect whereby the web-like material tends to follow the transfer surface. At the same time, the air blows push the web-like material forward.

Figures 2a - 3b show various embodiments of the device according to the invention. According to the invention, openings 16 are formed on a transfer surface 17 and the angle α between the blow direction of these openings 16 and the transfer surface 17 is $15 - 30^\circ$. Thus, according to the invention, the openings open up to the transfer surface in which case harmful shoulders are avoided. In other words, the transfer surface is smooth without any shoulders or other protrusions which would generate friction. On the other hand, air blows set at a suitable angle firstly create a sufficient vacuum effect and secondly efficiently forward the web-like material. In some embodiments the angle may be smaller than that mentioned above, for example $10 - 15^\circ$.

In Figures 2a and 2b the transfer surface 17 is planar. In this case the device is suitable for a linear transfer. The transfer surface can also be convex in which case it is also possible to change the travel direction of the web-like material. Specifically with the design of the air connection, new features, which are described in more detail below, can be achieved. Openings that open up to the transfer surface can be located in different points, which increases adjustment possibilities of the device features. However, the distance of the openings 16 from the front edge of the transfer surface 17 is 10 - 50 mm, more advantageously 10 - 25 mm. Then, as the web-like material arrives at the device, it is provided with a support surface before the transfer effect of the air blows. At the same time, a vacuum effect starts to generate immediately in the initial part of the device, which, for its part, minimizes friction forces and reduces the dimensions of the device. By freer positioning of the openings, even the air connection alone could function as a transfer surface. However, the transfer surface 17 is advantageously composed of an air connection 14 and a transfer plate 18 connected thereto and located in a stepless position relative to the air connection 14. Thus the design of the device remains simple and the dimensioning and shape of the transfer surface can be easily varied by changing and/or shaping the transfer plate.

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The novel design and the placement of openings enable to manufacture, on one hand, very short, and on the other hand, also very long devices. According to the invention, the dimension of the transfer surface 17 in the travel direction of the web-like material is in the range of 20 - 300 mm, more advantageously in the range of 40 - 200 mm. This dimension refers to the effective dimension obtainable with one air connection. By adapting several successive air connections in the device, the effective dimension of the device can be increased. Another alternative is to adapt several devices successively, which is advantageous particularly in the tail transfer.

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In the embodiment of Figure 2a, the openings 16 are composed of holes 19. In other words, air blows are formed without separate nozzles. The holes are easy to process using a laser, for example, particularly when the air connection is made of a drawn aluminum profile. Plastic and plastic composite materials are also possible. According to the invention, relatively small holes are used, having a diameter of 1 - 3 mm, more advantageously 1.5 - 2.5 mm. Thus the air consumption remains reasonable. In addition, separate nozzles are unnecessary. Depending on the basis weight of the web-like material to be transferred and the transfer distance, the distance between the holes is selected to suit each particular case. Generally, the distance between the holes is in the range of 10 - 50 mm, more advantageously in the range of 20 - 40 mm, such that the larger the holes, the further away they are from each other. Instead of a straight row, the holes can be arranged imbricately or slantwise, for example, for directing the vacuum effect in a desired way.

According to one embodiment, the middle openings of the transfer surface can be larger than the openings in the edge areas. In this way, a boosted blow effect can be provided in the center area which automatically centers the web-like material to be transferred. In other words, a centering force is generated which keeps the material, such as a tail, substantially at the center of the transfer surface in the longitudinal direction. At the same time, harmful effects of the openings external to the web-like material reduce as the venturi air decreases. For example, the area of boosted air blows can range from one third to two thirds of the blow width of the device, advantageously about a half of the blow width, however, less than the width of the web-like material. A device equipped with a boosted air blow area is shown in Figure 6a in which the web-like material is represented by a dot-and-dash line. A boosted air blow area can also be formed with slits while the holes are in the edge areas, or vice versa.

In the embodiment of Figure 2b, the openings 16 are composed of slits 20 which can also be processed with a laser. Slits create extremely uniform air blows and, in addition, the noise of air discharging from slits is lower compared to holes. According to 5 the invention, the width of the slits is 0.05 - 1 mm, more advantageously 0.1 - 0.5 mm. Slits can also be located in a straight line or suitably imbricately arranged whereby a comprehensive and uniform air blow is achieved (Figure 2b). The length of the slits depends mainly on case-specific require- 10 ments and the slit width. Discontinuous slits are longer than 5 mm, advantageously longer than 10 mm. A slit can also be continuous, having a width almost equal to the entire device. In this case the slit width is approximately 200 - 300 mm, even as wide as 400 mm in particularly wide applications.

15

Due to the simple design and small friction, highly variable pressures can be applied in the device. According to the invention, the device, and particularly the openings 16, are so dimensioned that a pressure of 0.25 - 7, more advantageously 20 0.5 - 2 bar, can be applied. Then significant forces transferring the web-like material can be achieved already at a low pressure. On the other hand, a high pressure can also be used, which can be utilized particularly for achieving a sufficient flow speed. In other words, the device can be used in fast 25 fiber web machines as well.

Furthermore, the efficiency of the device, more precisely the guiding vacuum effect on the web-like material, can be increased by adapting the air blows to two different directions. 30 According to the invention, the device includes second openings 21 adapted, in the travel direction of the web-like material, before the openings 16 and directed substantially to the opposite direction relative to the openings 16. This is shown in Figure 3a where the openings 16 and 21 are adapted on the 35 surface of a curved air connection 14. Another embodiment is shown in Figure 3b where the surface of the air connection 14

is mainly smooth but the openings 16 and 21 are arranged in the slanting parts. Despite the small bend, the air blows function as air cushions preventing the web-like material from chafing against the edge. Other mainly convex surface profiles can also
5 be used. The slanting parts in Figure 3a can have another profile besides straight, such as curved, convex or concave or combinations of these; in any event, the blow angle is the most critical feature. The elevation between the levels of the transfer surface 17 and the transfer plate 18 is advantageously
10 small, less than 4 mm or equal to or smaller than 3 mm. In addition, the slanting parts and the curved surfaces can be in a slight angle relative to each other.

Figure 6b shows an additional embodiment of the device. Here
15 the plane surface 17 is provided with a V-shaped incision 34 opening up to the blow direction with the openings 16 opening up to the first wall thereof. Then the individual openings are advantageously oriented and the blows discharging from the openings even out in the incision providing an efficient for-
20 warding force. The dimensioning of the incision can also vary in the width direction of the device, which can influence the centering of the tail, for example. In Figure 6a, the openings 16 are holes 19, but it is also possible to use slits. Another alternative is to leave a gently-sloping low elevation in the
25 plane surface arranging the openings in its trailing edge (not shown). In addition, it has been noted that the embodiments of Figures 2a-b and 3a-b also function crosswise. In other words, the devices of Figures 3a-b function only with transfer blows alone. Correspondingly, the devices of Figures 2a-b function
30 with parallel and counter blows (not shown).

The dimensioning principles of the second openings correspond to the dimensioning of the openings intended for forming parallel air blows. Thus the angle β between the blow directions of
35 the openings 16 and the second openings 21 is $120 - 150^\circ$. Then, due to the combined effect of the air blows, a comprehensive

vacuum effect which reliably seizes the web-like material is created on the transfer surface. This affords reliability to the device operation, which is essential particularly in the tail transfer. In Figure 4 the angle β is approximately 130° .

5

Figures 4 and 5 show a fifth embodiment of the device according to the invention which additionally includes a doctor blade 22. The doctor blade is used, for example, to detach a tail from a cylinder surface. Detaching is additionally aided by a
10 block-off blow which is formed by leading pressurized air from the second openings 21. Advantageously the direction of the blow-off blow is parallel to the doctor blade. After this, a parallel transfer blow is created by leading pressurized air from the openings 16. Here, in fact, two devices are combined
15 of which the latter has only a parallel transfer blow.

The device shown in Figures 4 and 5 is composed of three main parts 23, 24 and 25, which are drawn aluminum profiles. The middle main part 24 has a hollow construction for minimizing
20 the mass. However, the hollow cavities have a functional meaning in supporting the device. The circular cavity 26 has an overhanging shaft installed therein with which the device is turnably supported. The mounting flange of the overhanging shaft is screwed to one or more small cavities 27. The mass of
25 the proposed construction is so small that a spring-return actuator cylinder can be used. In other words, the doctor blade is loaded against the surface with a single-acting actuator cylinder. After successful tail threading, when the actuator cylinder is depressurized, the spring returns the device to the
30 rest position (not shown). The front main part 23 is fastened to the middle main part 24 with bolts 28. The front main part 23 is also an aluminum profile in which two adjacent cavities 29 have been formed and the cavities are provided with machined holes for forming the openings. Here the blow-off blows and the
35 transfer blows have cavities of their own forming the air connections, which allows guiding the air blows independently

of each other. In addition, the front and middle main parts are steplessly positioned relative to each other whereby friction problems are avoided. The smooth upper surface of the middle main part forms a part of the functional transfer plate.

5

In some embodiments, a device composed of the front and middle main parts would be sufficient for achieving the necessary transfer distance. However, according to the invention, the middle main part includes a counter clamp 30 to which the rear
10 main part 25 is fastened in Figure 4. Advantageously, a form-fitting connection is used and its fastening is secured with bolts 31. The rear main part 25 is also an aluminum profile having additionally an air removal slit 32 machined therein. Thus any extra air that has already lost its kinetic
15 energy can discharge from the air removal slit before the second transfer blow. The rear-most device has a transfer plate 18 for which the length can be selected to suit each particular case. Advantageously, a stainless steel plate is used, which is connected with countersunk screws 33 to form a plane with the
20 rear main part 25. The surfaces of all main parts located on the side of the tail form together a planar transfer surface to which openings according to the invention open up. Figure 5 shows the main parts disassembled from each other.

25 The design and dimensioning of the device according to the invention can vary in different applications. However, openings opening up to the transfer surface and with which earlier friction problems are avoided, are essential. Also significant are the air blows set at a certain angle by which a web-like
30 material can be both reliably seized and smoothly forwarded.

CLAIMS

1. Device for transferring a web-like material in a fiber web machine, which device includes

- an air connection (14),
- openings (16) arranged on a wall (15) defining the air connection (14) for forming air blows that are parallel to the travel direction of the web-like material, and
- a transfer surface (17) for creating a vacuum effect with air blows and thereby transferring the web-like material, wherein the openings (16) are formed on the transfer surface (17),

characterized in that the angle α between the blow direction of the openings (16) and the transfer surface (17) is $15 - 30^\circ$, and the device includes second openings (21) adapted, in the travel direction of the web-like material, before the openings (16) and directed substantially to the opposite direction relative to the openings (16), and both openings (16, 21) are formed to the same transfer surface (17).

2. Device according to claim 1, characterized in that the transfer surface (17) is planar.

3. Device according to claim 1, characterized in that the transfer surface (17) is convex.

4. Device according to any one of claims 1 - 3, characterized in that the distance of the openings (16) from the front edge of the transfer surface (17) is 10 - 50 mm.

5. Device according to claim 4, characterized in that the distance of the openings (16) from the front edge of the transfer surface (17) is 10 - 25 mm.

6. Device according to any one of claims 1 - 5, characterized in that the transfer surface (17) is composed of an air connection

(14) and a transfer plate (18) connected thereto and placed in a stepless position relative to the air connection (14).

7. Device according to any one of claims 1 - 6, characterized in that the dimension of the transfer surface (17) in the travel direction of the web-like material is 20 - 300 mm.

8. Device according to claim 7, characterized in that the dimension of the transfer surface (17) in the travel direction of the web-like material is 40 - 200 mm.

9. Device according to any one of claims 1 - 8, characterized in that the openings (16) are composed of holes (19) having a diameter of 1 - 3 mm.

10. Device according to claim 9, characterized in that the openings (16) are composed of holes (19) having a diameter of 1.5 - 2.5 mm.

11. Device according to any one of claims 1 - 10, characterized in that the openings (16) are composed of slits (20) having a width of 0.05 - 1 mm.

12. Device according to claim 11, characterized in that the openings (16) are composed of slits having a width of 0.1 - 0.5 mm.

13. Device according to any one of claims 1 - 12, characterized in that the openings (16) are dimensioned for a pressure of 0.25 - 7 mm.

14. Device according to claim 13, characterized in that the opening (16) are dimensioned for a pressure of 0.5 - 2 bar.

15. Device according to any one of claims 1 - 14, characterized in that the angle p between the blow directions of the openings (16) and the second openings (21) is $120 - 150^\circ$.

16. Device according to any one of claims 1 - 15, characterized in that the device includes a doctor blade (22).

17. Device according to any one of claims 1 - 16, characterized in that the openings (16) located in the center area of the device are larger than the openings (16) in the edge areas.

18. Device according to claim 17, characterized in that the width of the center area is $1/3 - 2/3$ of the blow width of the device.

19. Device according to claim 18, characterized in that the width of the center area is about a half of the blow width, but less than the width of the web-like material.

20. Device according to any one of claims 1 - 19, characterized in that an incision (34), to which the openings (16) are adapted to open up, is arranged in the transfer surface (17).

21. Device according to claim 11 or 12, characterized in that the length of a discontinuing slit (20) in the width direction of the device is more than 5 mm.

22. Device according to claim 21, characterized in that the length of a discontinuing slit (20) in the width direction of the device is more than 10 mm.

23. Device according to claim 11 or 12, characterized in that the length of a continuous slit (20) in the width direction of the device is 200 - 400 mm.

24. Device according to claim 23, characterized in that the length of a continuous slit (20) in the width direction of the device is 200 - 300 mm.

25. Fiber web machine including the one or more than one device of any one of claims 1-24.

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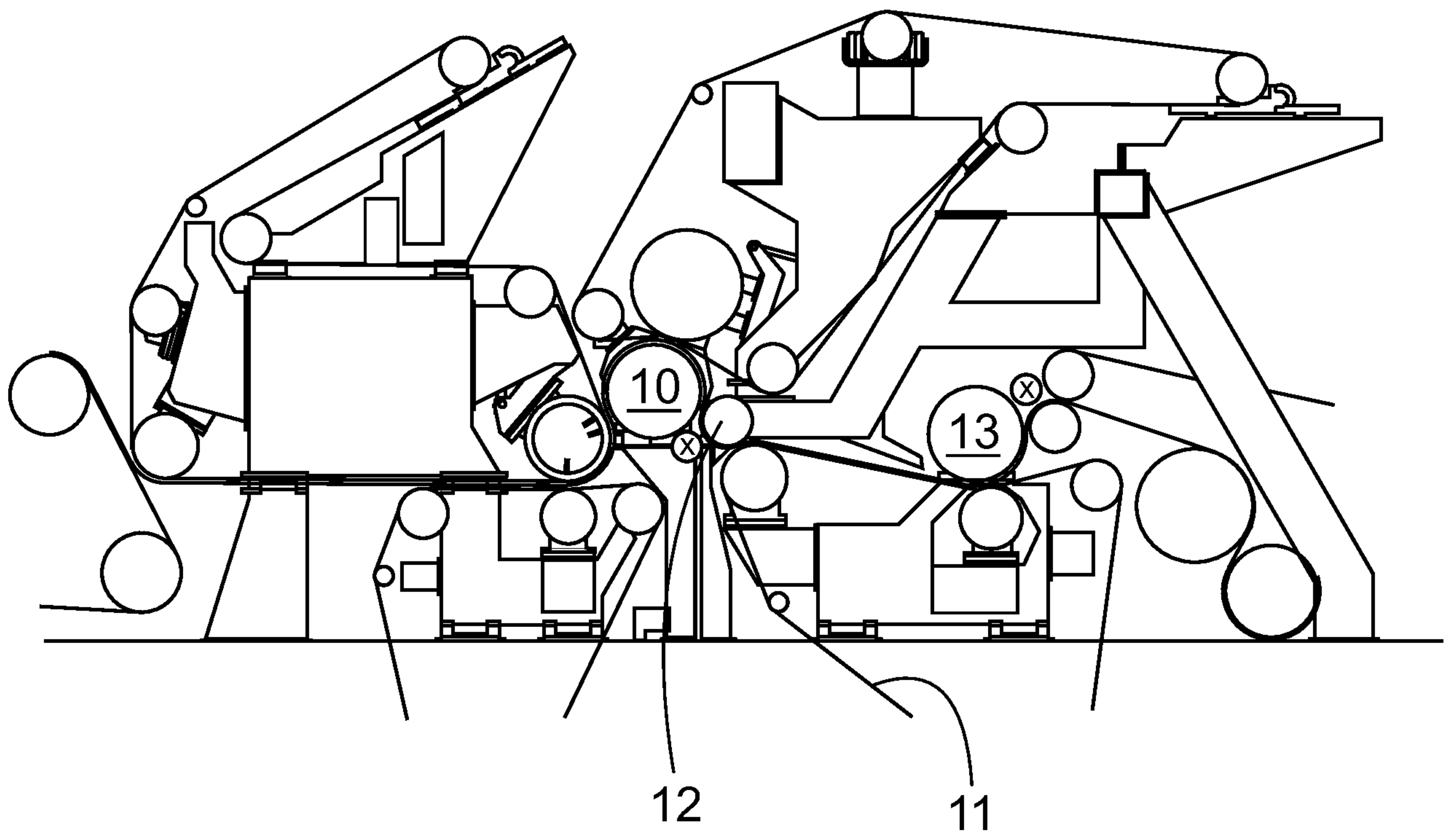
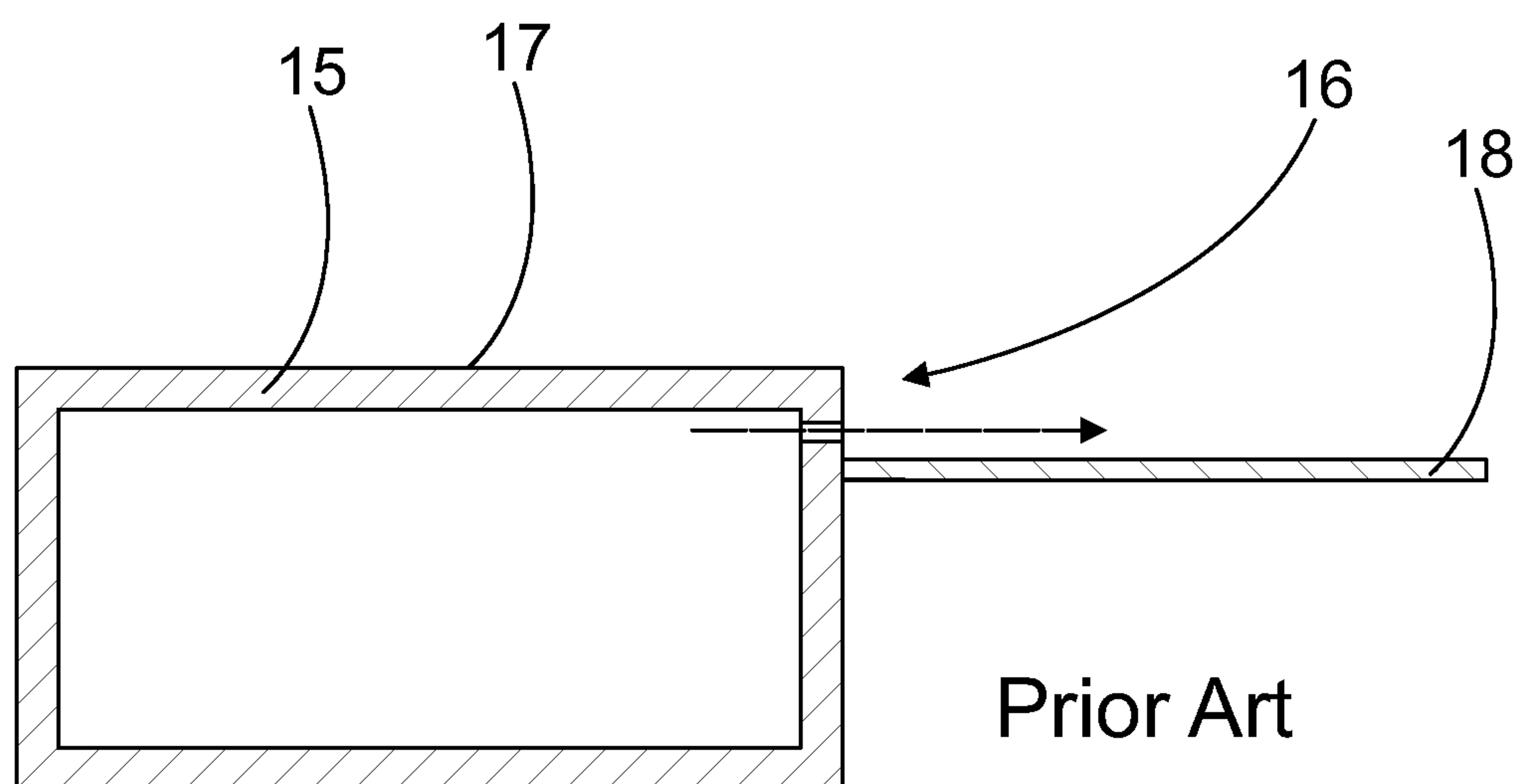


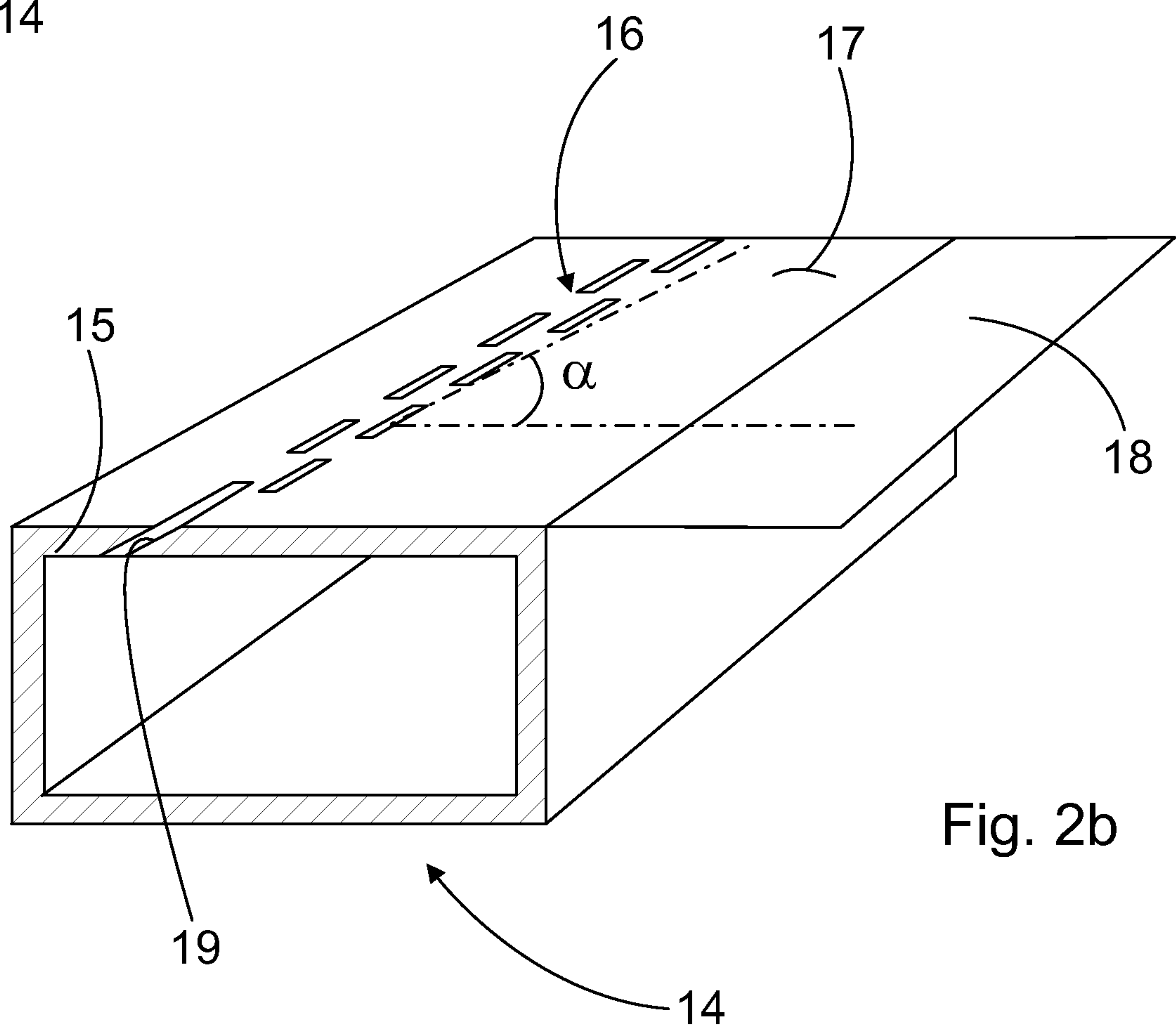
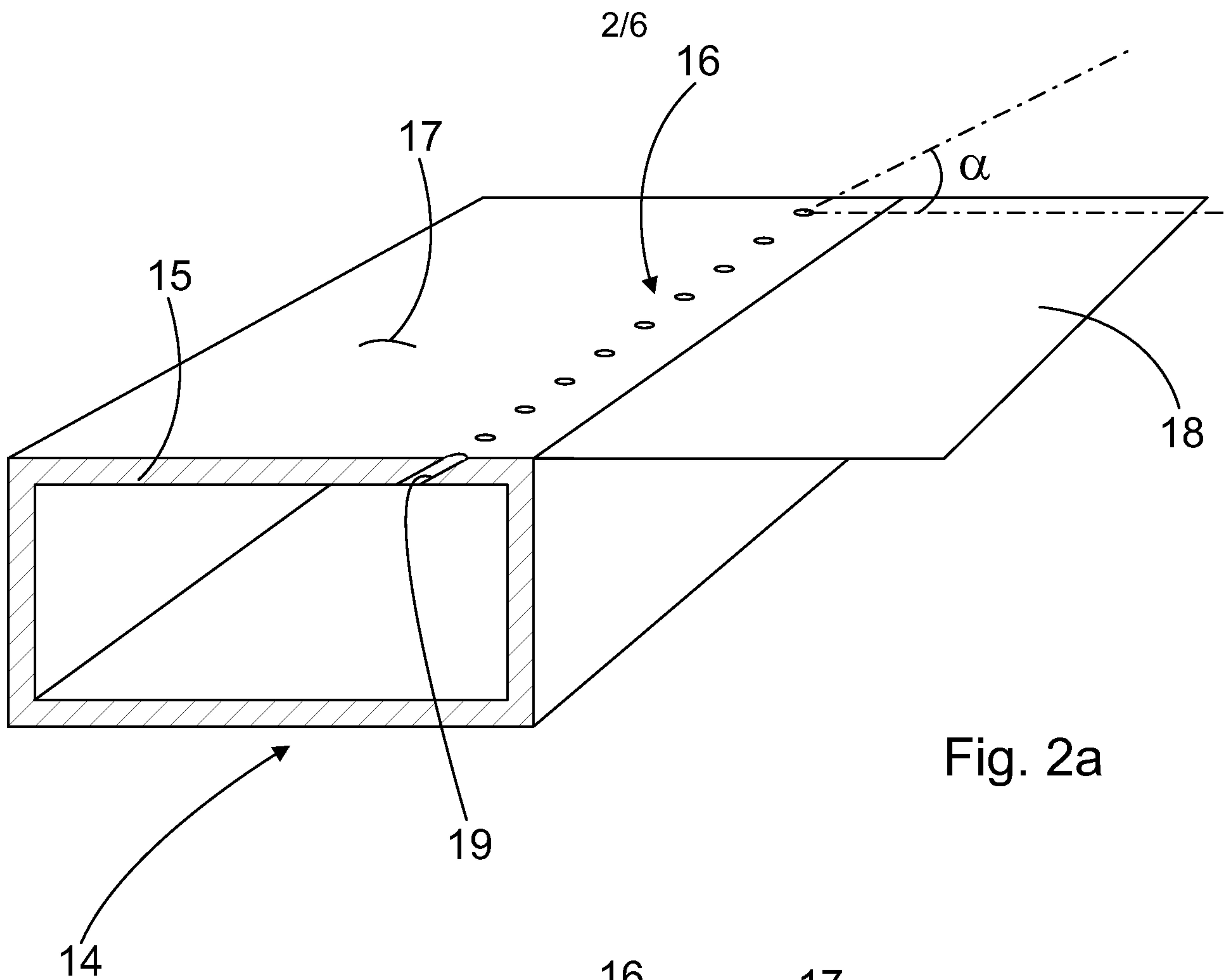
Fig. 1a



Prior Art

Fig. 1b

14



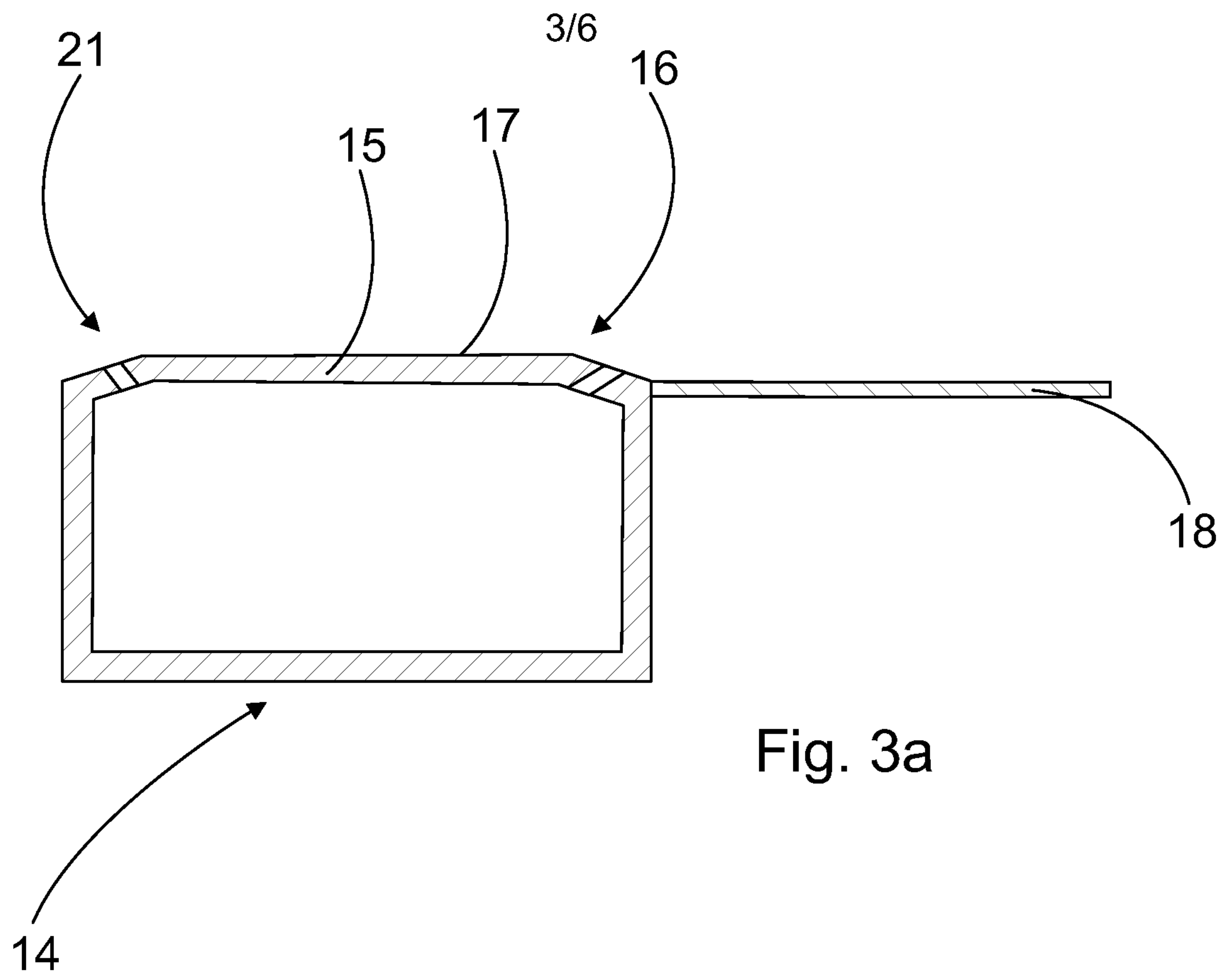


Fig. 3a

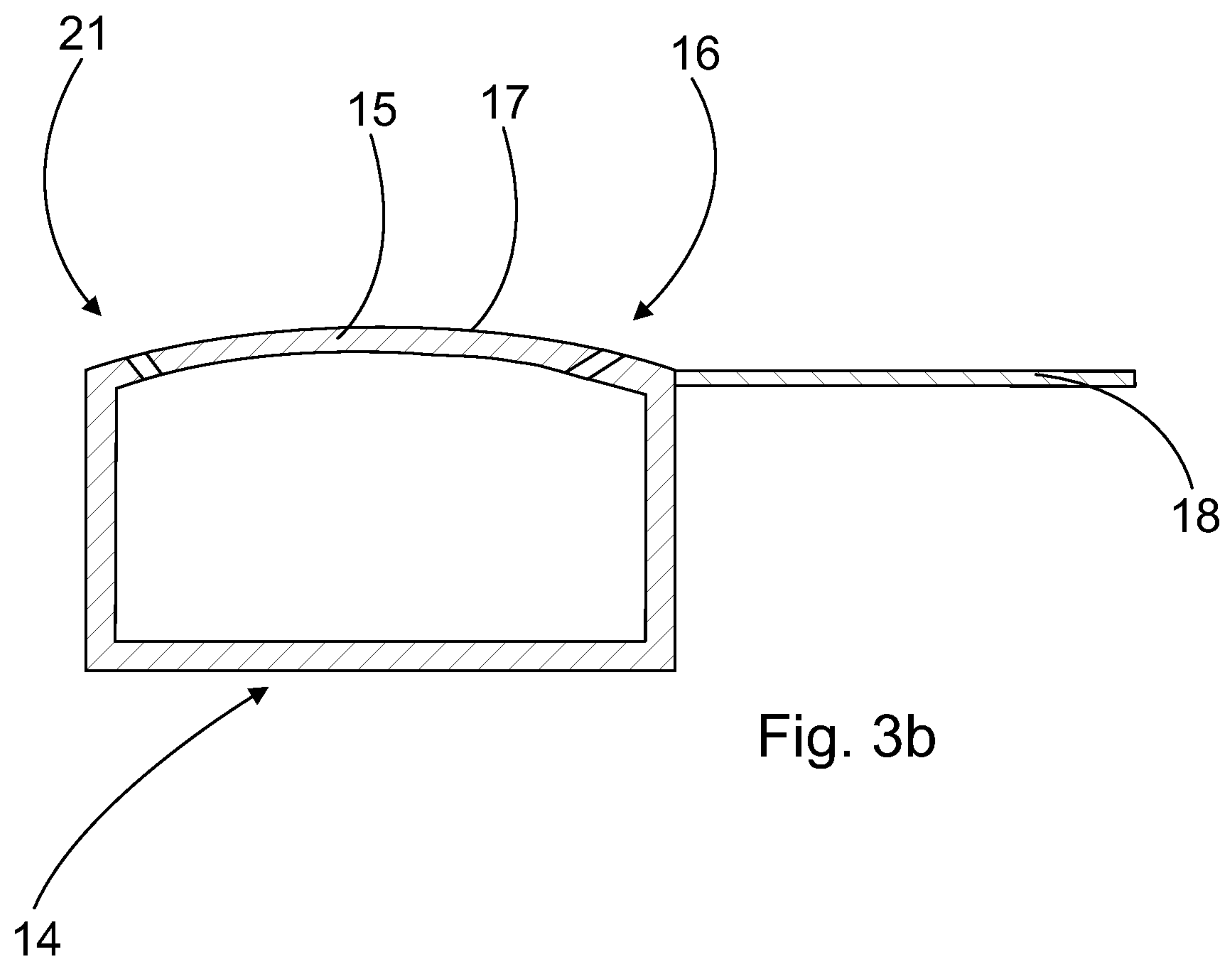
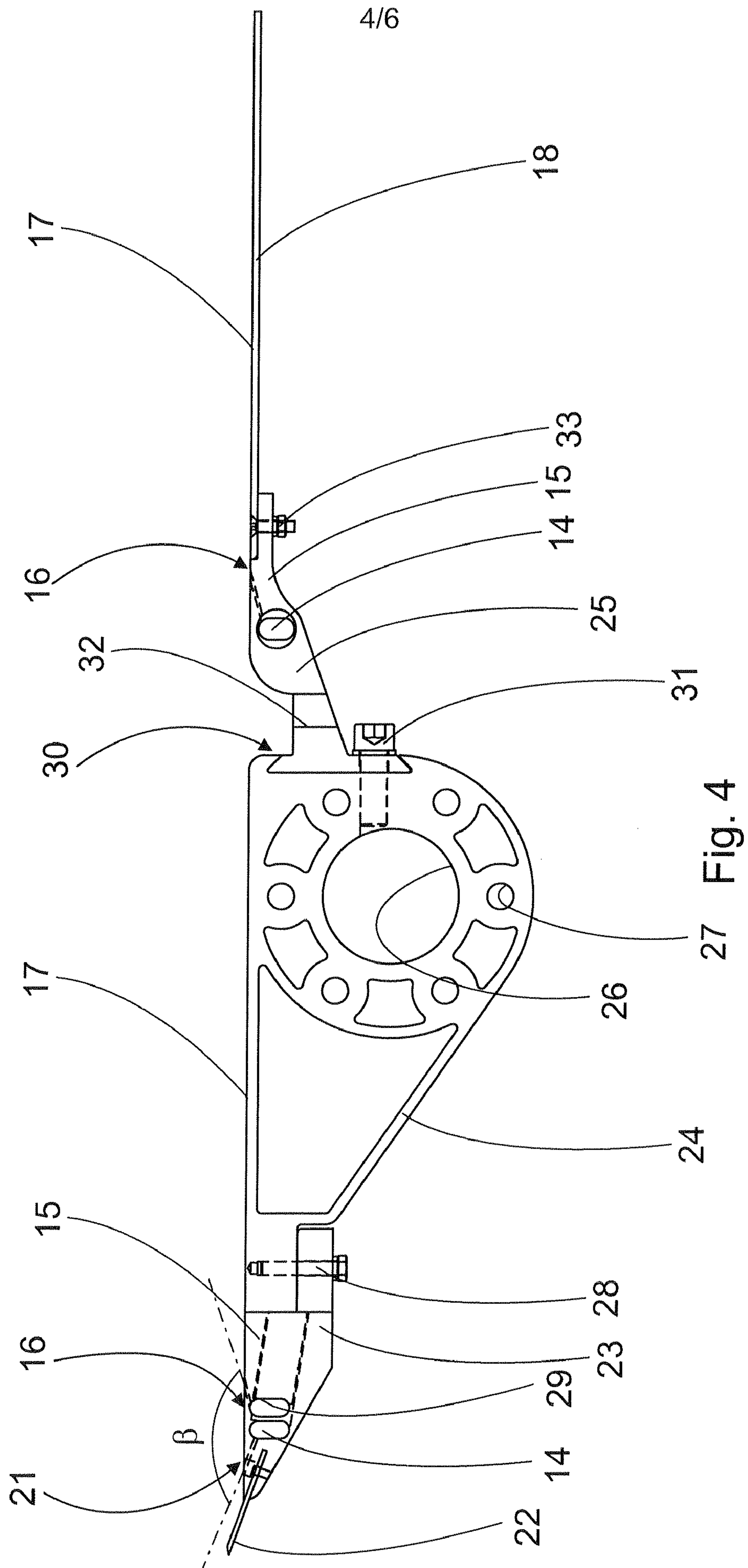


Fig. 3b



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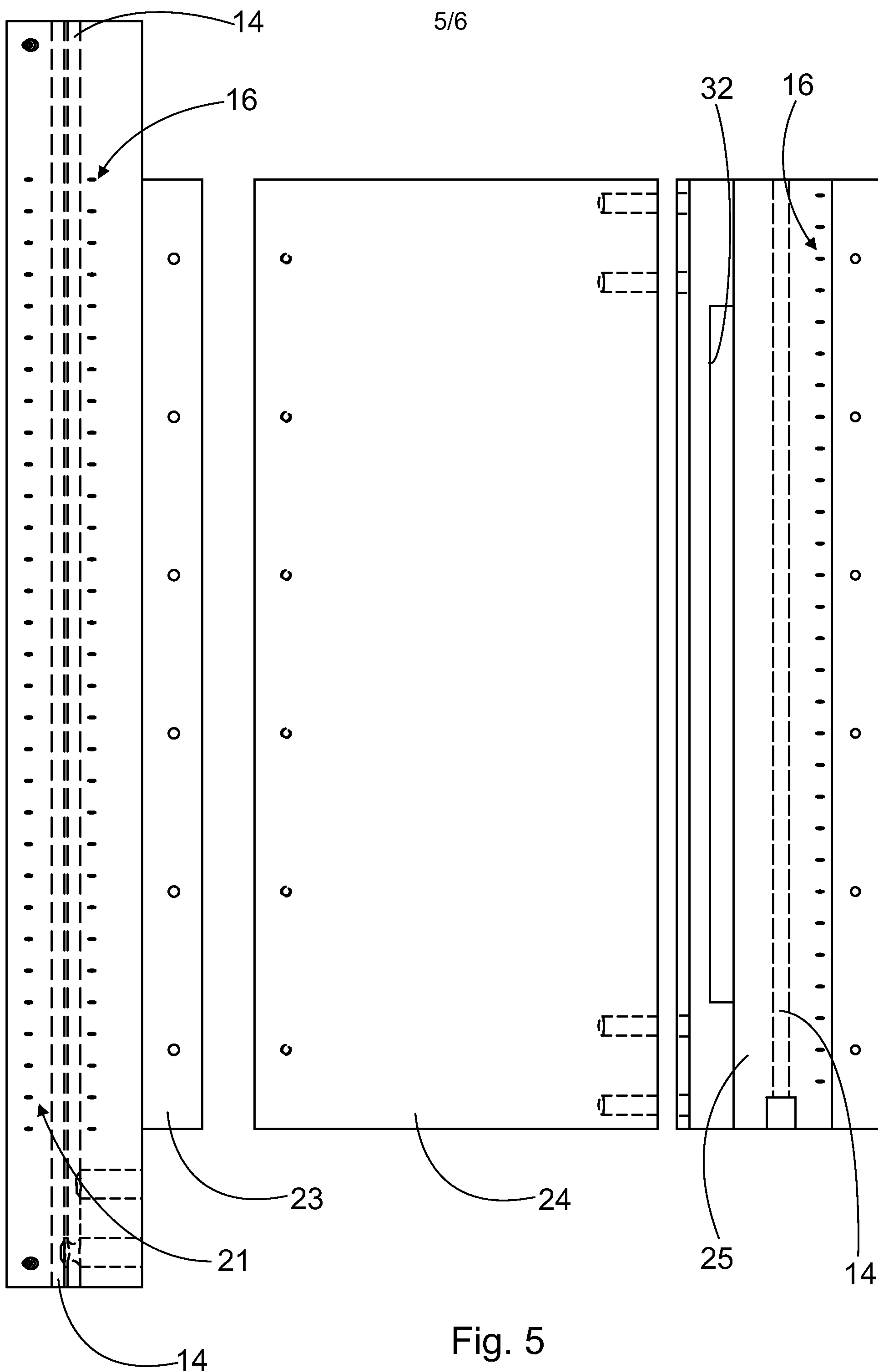


Fig. 5

