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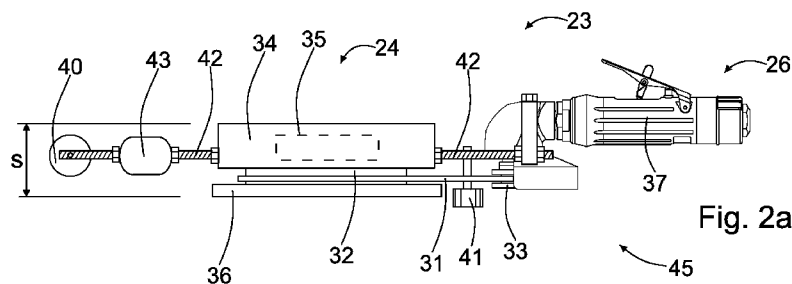
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(54) Title: DEVICE AND METHOD FOR CONDITIONING THE FLOW SURFACE OF THE HEADBOX OF A FIBER WEB MACHINE



(57) Abstract: The invention relates to a device for the conditioning of the flow surface in the headbox of a fiber web machine. The device comprises a frame structure (23) and a conditioning element (24) arranged in the frame structure (23) for the conditioning of the flow surface (25) of the slice channel (11) of a headbox. The height dimension *s* of the conditioning element (24) is equal to or less than 60 mm. An actuator (26) is also arranged in the frame structure (23) for operating the conditioning element (24). The conditioning element (24) is a grinding disc (36). The invention also relates to a method for the conditioning of the flow surface in the headbox of a fiber web machine.

DEVICE AND METHOD FOR CONDITIONING THE FLOW SURFACE OF THE HEADBOX OF A FIBER WEB MACHINE

The invention relates to a device for the conditioning of the
5 flow surface in the headbox of a fiber web machine, where the
device comprises:

- a frame structure,
- a conditioning element arranged in the frame structure
for the conditioning of the flow surface of the slice
10 channel of a headbox, where the height dimension s of the
conditioning element is equal to or less than 60 mm, and
- an actuator arranged in the frame structure for operating
the conditioning element.

The invention also relates to a method for the conditioning of
15 the flow surface in the headbox of a fiber web machine.

In a fiber web machine, such as a paper machine, the headbox
has a key role in successful web formation. In the headbox, an
intense turbulence is also created in the fiber suspension by
20 means of a turbulence generator. The turbulence generator is
followed in the headbox by a slice channel, which is limited by
the apron and the top slice. The size and especially the shape
of the slice channel determine how evenly the fiber suspension
is discharged onto the forming wire. Moreover, the apron forms
25 a flow surface, which is made as planar as possible, and often
also polished. In other words, in practice the objective is
precise flatness and a small surface roughness in order to
create trouble-free discharge from the headbox. However, the
apron and the top slice wear during operation. In addition,
30 uneven thermal expansion and deformations caused by accidents
cause changes to the flatness of the apron, which disturbs web
formation.

It is common practice to conduct measurements in order to
35 determine the condition of the headbox and especially of the
apron. One prior art measuring device is presented in U.S.

patent No. 7335280. In it, the measurements are based on a measuring tool which is used for measuring a number of points at the same time, which expedites the measurement work considerably. The slice channel is opened for the duration of the measurement. In other words, the top slice is usually turned up so that the measuring tool can be placed on the flow surface. The measuring tool is used for determining the condition of the flow surface in a single measurement. The measurement is fast, and the accuracy of the results is excellent. In addition, the results can be processed and presented in a versatile manner. Based on the results, decisions can be made as to the necessary conditioning measures.

The conditioning measures include, at least as a last measure, the grinding of the flow surface, and in many cases also its polishing. Grinding is carried out by means of a manual tool, which is moved on the flow surface. The usual tool of choice is an angle grinder equipped with a grinding wheel and emery paper. However, this prior art tool and mode of operation involve some practical shortcomings. Firstly, it is burdensome to hold the manual tool, especially if the headbox is in an upright position, in which case the flow surface is at an angle. A more notable problem is that the slice channels of modern headboxes are confined. In practice, the top slice moves so little that there is no room for a sufficiently powerful manual tool to fit on the flow surface. This requires that the entire apron needs to be removed for the grinding, which prolongs the service shutdown. The power of a prior art angle grinder is approx. 1,000 W. Moreover, the apron may be damaged upon it being installed back into place. The power of prior art angle grinders is also inadequate to rotate a sufficiently large grinding wheel. A small grinding wheel cannot satisfy the flatness requirement. Belt sanders exhibit the same problem.

The purpose of the present invention is to provide a new type of device for the conditioning of the flow surface in the

headbox of a fiber web machine, where the device is more versatile and easy to use than prior art devices. Another purpose of the invention is to provide a new type of method for the conditioning of the flow surface in the headbox of a fiber web machine, where the method is also suited to confined slice channels. The characteristic feature of the device according to the present invention is that the conditioning element is a grinding disc. Similarly, the characteristic feature of the method according to the present invention is that the conditioning element is a grinding disc. The device and method according to the invention can be used for the conditioning of even the most confined headboxes without removing the apron. Moreover, the work can be performed comfortably despite the position of the flow surface, and the conditioning can be carried out by using a sufficiently large conditioning element without suffering from a lack of power. The device and method according to the invention can be used especially for the conditioning of the flow surface formed by the apron of the slice channel in a headbox. Conditioning here mainly refers to grinding, but the conditioning element can also be used for chafing or polishing. During grinding, material is removed from the flow surface so that the flow surface can be made planar again. The method can also employ an auxiliary device, which reduces the need for grinding and thus shortens the production shutdown.

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

30

Figure 1 shows a part of the headbox of a fiber web machine in cross section,

Figure 2a shows the device according to the invention as a side view,

35 Figure 2b shows the device of Figure 2a as a top view,

Figure 3a shows a variation of the device of Figure 2a as a side view,

Figure 3b shows the device of Figure 3a as a top view,

Figure 4a shows another variation of the device of Figure 2a
5 as a side view,

Figure 4b shows another application of the device according to the invention as a side view,

Figure 4c shows the device of Figure 4b as a top view,

Figure 4d shows a third application of the device according
10 to the invention as a top view,

Figure 5 shows the application of the method according to the invention,

Figure 6 shows the conditioning element according to the invention in cross section,

15 Figure 7 shows the auxiliary device used in the conditioning according to the invention as a side view,

Figure 8 shows the auxiliary device of Figure 7 as a front view.

20 Figure 1 shows a part of the headbox of a fiber web machine, with the headbox being conventional in itself. Fiber web machines comprise for example paper, cardboard and pulp machines. As is known, a fiber suspension used in the production process is fed through the turbulence generator 10 into the slice
25 channel 11. The purpose of the turbulence generator is to separate the fibers from each other and to direct them in an as indefinite manner relative to each other as possible. Here, the turbulence generator 10 is formed of several tubes 12, which are supported at both ends to sturdy plates 13 and 14. Holes
30 have been machined in the plate which restricts the slice channel 11, and the said tubes 12 have been placed in the holes 15. In Figure 1, there are tubes 12 in seven rows on top of each other, with the rows extending across the width of the entire headbox. The tubes 12 are placed at a certain angle
35 relative to each other so that the flows discharged from the tubes in the different rows come together in the slice opening

17. However, Figure 1 does not show the fiber suspension or its flows. After the turbulence generator 10, the slice channel 11 contains turbulence plates 16, which maintain a desired level of turbulence to the slice opening 17 and all the way to the wire section. From the slice opening 17, the fiber suspension is discharged here onto the forming wire 21 supported by a roll 20, and then carried forward by the forming wire.

The slice channel 11 ends with a protruding apron 18, which forms the planar flow surface 25. The apron is part of the headbox, and it remains in place when the headbox is used. Instead, the top slice 19 is connected to the headbox with a joint so that the top slice can be turned up for maintenance. The joint 22 is shown in Figure 1. Moreover, the top slice has adjustor spindles at certain intervals for the adjustment of the profile of the slice opening (the adjustor spindles are not shown). When maintaining the headbox and especially when conditioning the flow surface, the structures following the headbox are dismantled and the top slice is turned to the maintenance position. In this way, the apron can be accessed across its entire width.

The invention relates to a device for the conditioning of the flow surface in the headbox of a fiber web machine. One application example of the device is shown in Figures 2a and 2b. The device comprises a frame structure 23 and a conditioning element 24 arranged in the frame structure for the conditioning of the flow surface 25 of the slice channel 11 of a headbox. Moreover, the device comprises an actuator 26 arranged in the frame structure 23 for operating the conditioning element 24. The height dimension s of the conditioning element 24 is equal to or less than 60 mm. In this way, the device can be used for conditioning even the most confined headboxes without removing the apron. Here, the height dimension refers to the greatest dimension of the conditioning element measured in the direction of the normal of the flow surface. In accordance with the

invention, the conditioning element 24 is a grinding disc 36, with which the flow surface can be made planar.

In the application example, the actuator 26 is arranged apart
5 from the conditioning element 24. In other words, the axis of rotation 27 in the actuator 26 is arranged to be aside from the axis of rotation 28 in the conditioning element 24. In this way, the actuator can be higher than the conditioning element, since the actuator remains outside the slice channel. Figure 2b
10 shows the front edge 29 of the apron with a dot-and-dash line. In the same application, the actuator 26 is connected to the conditioning element 24 by means of a transmission element 30, which provides a power transmission ratio. Here, the transmission element is a cogged V-belt 31, with the corresponding
15 pulleys 32 and 33 arranged in both the conditioning element 24 and in the actuator 26. Due to the power transmission ratio, the speed of rotation of the high-torque actuator can be raised sufficiently high. A V-belt is also lightweight, silent, and safe to use. Instead of a V-belt, some other well-known trans-
20 mission method such as gear or chain transmission can also be used.

In the application shown in Figures 2a and 2b, the conditioning element is arranged to be separate from the actuator. Here, the
25 conditioning element 24 comprises a body piece 34, to which the grinding disc 36 is supported by means of a double row bearing 35 so that the grinding disc 36 can rotate. Furthermore, the axis of rotation of the grinding disc 36 is substantially parallel with the normal of the flow surface 25. The presented
30 structure is simple but very sturdy, because a bearing with a large diameter can be used. At the same time, an ordinary actuator, where only a pulley 33 is installed, can be used. Here, the actuator 26 is a pneumatic turbine motor 37, which gives good torque. Due to the transmission ratio, the speed of
35 rotation of the quiet and high-torque turbine motor can be raised, whereby the grinding performance is improved signifi-

cantly. Preferably, the pulley 32 of the conditioning element is integrated into the grinding disc 36, whereby there are only two components in the conditioning element alongside the bearing 35 (Figure 6). The body piece can be manufactured for example from aluminum, and the grinding disc can be manufactured from stainless steel.

The presented device also has other new and unexpected properties. Firstly, the frame structure 23 comprises loading arms 38 for loading the tool 45 by taking support from the slice channel 11 (Figures 3a and 3b). The relatively long loading arms 38 are attached to the body piece 34 so that the loading arms 38 can turn. Moreover, the loading arms are equipped with rollers 39 which rotate in all directions, which rollers 39 are in contact with the top slice of the headbox while the device is operated. The loading arms extend beyond the slice opening so that the conditioning element can be loaded against the flow surface by pressing the loading arms. In this way, it is easy to press the conditioning element against the flow surface even if the flow surface is tilted, as shown in Figure 5. Loading can also be used on a horizontal flow surface, in which case it is possible to work without pushing hands into the slice channel. This improves ergonomics and at the same time occupational safety.

Secondly, the device is provided with support wheels. The frame structure 23 comprises a support wheel 40 and/or 41 to support the device against the flow surface 25 and/or against the edge 29 of the flow surface 25. The first support wheel 40 is located at the front of the device, and when supported by the support wheel, the device can be inserted into the slice opening without damaging the slice opening. In other words, the front support wheel 40 is placed gently on the apron, and the device is pushed into the slice opening by suspending the device by the actuator. The support wheel at the rear is in the cross direction so that it can be in contact with the front

edge of the flow surface. In this way, the weight of the device can be supported on the support wheel, and the operator only needs to suspend the device very little. The support wheel also facilitates the moving of the device back and forth in the lateral direction of the headbox. At the same time, the conditioning element will remain in the proper place at all times without any specific adjustment. Moreover, the support wheel prevents the actuator from hitting the front edge of the apron.

In the presented application, the various components are fastened to each other by means of threaded rods 42. In this way, the configuration of the device can be varied, and, for example, the V-belt can be adjusted to a suitable tightness. Here, there is a weight 43 near the front support wheel 40, with the weight 43 used for balancing the device. In this way, the conditioning element is loaded as evenly as possible without the operator having to suspend it. If necessary, the support wheel and weight can be removed. Such an application is shown in Figure 4a. If necessary, the rear support wheel can also be removed or turned up, whereby the device can be used for conditioning the flow surface also deeper in the slice channel if there is enough space for the actuator to get into the slice channel. The space problem can be solved by turning the actuator 26 and by fastening it to the side of the body piece 34 as shown in Figures 4b and 4c. This avoids the use of the V-belt, and the device is compact. A standard actuator can still be used, but some changes need to be made to its connection to the body piece. Figure 4c shows a support handle 44, which is arranged on the opposite side of the body piece 34. This enables the device to be moved with two hands. Moreover, two actuators can be used if necessary. In the third application, the actuator 26 is integrated into the body piece, in which case two support handles 44 are used (Figure 4d). In the applications presented, the diameter of the grinding disc is approx. 200 mm, which is generally sufficient to condition the flow surface. Generally speaking, the conditioning element 24 is a

grinding disc 36, whose diameter is at least equal to or greater than the dimension of the flow surface 25 to be conditioned in the machine direction. This avoids the unnecessary moving of the conditioning element in the machine direction, whereby the focus can be on moving the conditioning element mainly in the cross direction. Machine direction here refers to the depth direction of the headbox. At the same time, it is possible to avoid eccentricities resulting from an incorrect position, whereby the flow surface can be made precisely planar. Correspondingly, the height dimension of the conditioning element in the application example is approx. 45 mm.

Figure 5 shows the application of the method according to the invention. The method is intended for the conditioning of the flow surface in the headbox of a fiber web machine. In Figure 5, the rolls are removed, the slice opening is opened, and the side plates of the headbox are removed. This allows the flow surface to be conditioned across its entire width. In the method, the flow surface 25 is conditioned by means of a tool 45 so that the conditioning element 24 included in the tool 45 is placed in the slice channel 11 of the headbox, in the area of the flow surface 25 to be conditioned. The area is conditioned without removing the apron 18, which is part of the headbox. Moreover, the method employs the tool 45, where the height dimension s of the conditioning element 24 of the tool 45 is equal to or less than 60 mm (Figure 2a). According to the invention, the conditioning element 24 is a grinding disc 36, which is moved in the width direction of the headbox. By using the grinding disc, conditioning is effective, and the flow surface can be made precisely planar. The tool 45 is preferably supported against the edge 29 of the flow surface 25. In Figure 5, the headbox is in an upright position, in which case the flow surface is also at an angle. The support wheel makes the device remain at the right point without the operator having to suspend the device. The example in Figure 5 also shows the loading arms, with which the tool is loaded by taking support

from the slice channel. The rollers of the loading arms take support from the top slice, whereby the conditioning element can be loaded against the flow surface by pressing the loading arms down.

5

The need for conditioning and the points requiring conditioning can be determined by means of the above-mentioned measuring device. In practice, the measurement takes about 15 minutes. Due to the rapid measurement, the flatness of the apron can also be re-measured after the conditioning. In practice, the grinding is started from the front edge, i.e. the face, of the apron, after which the planar flow surface is ground. In other words, the flow surface is conditioned by grinding, whereby material is removed from the flow surface, and the flow surface is hence made planar.

The device and method according to the invention can be used for easily conditioning the flow surfaces of even confined headboxes. The device and method according to the invention can be used while the headbox is attached to the structures of the fiber web machine or when the headbox is removed from the fiber web machine. Moreover, the device is suitable for both horizontal and oblique headboxes. A fiber web machine here refers to a paper, board and tissue machine and pulp drying machine.

25

Figure 7 shows a new kind of auxiliary device 46 used in conditioning. Here, the auxiliary device 46 is pushed almost entirely into the slice channel 11, and the auxiliary device 46 is in particular intended for bending the apron 18, primarily for straightening it. Straightening can be used for reducing the need for conditioning, because after straightening the apron is usually also ground using the device according to the invention. The slice lip in the top slice guides the flow of the fiber suspension intensely towards the tip of the apron, which results in the wear of the front edge of the apron in particular. Now, however, the auxiliary device can be used for

quick and accurate straightening. Local deflections can also be corrected.

The auxiliary device comprises a rigid beam 47, which is supported against the apron and top slice while placed in the slice channel. After this, while taking support from the beam, the apron can be loaded from outside the slice channel. In other words, the apron can be loaded upwards, whereby the flow surface can be straightened and further polished to become planar. Generally speaking, the apron 18 of the headbox, with the apron comprising the flow surface 25, is straightened before grinding by means of the mechanical auxiliary device 46. In this way, straightening can be done accurately without having to hit the apron with a sledge hammer. This also improves occupational safety and ergonomics.

The beam 47 is low, and its width is much greater than its height. The width and length of the beam is approx. 350 mm. In this way, it fits into the slice channel and is supported over a wide area. The supporting is therefore stable, and the flow surface of the apron remains intact. In the lower part of the beam 47, in its front and rear sections, there are also feet 48 and 49, which extend essentially across the entire width of the beam 47. However, the front foot 48 is at a distance from the front edge of the apron 18, whereby the bending of the apron 18 is possible.

The apron is bent by means of a hydraulic cylinder 50, which is supported on an L-shaped support piece 51. The support piece is preferably removable so that different support pieces can be attached to the beam and so that the auxiliary device is easy to transport. Here, the beam 47 has a projection 52, which is in contact with the support piece 51. In this way, the projection 52 bears the load so that thin bolts 53 can be used.

The beam 47 is secured into place by means of a second hydraulic cylinder 54, which is in contact with the top slice 19. Preferably, both of the hydraulic cylinders have supports of for example approx. 50 mm wide as their extensions (not shown).
5 This prevents point load, and the force provided by the hydraulic cylinders can be distributed over a wider area. Preferably, the support of the bending hydraulic cylinder is attached to the support piece by means of guideways, whereby the support will always settle in the correct position. In the presented
10 application, the hydraulic cylinder 50 bends the apron 18 upwards. By using a suitable support piece, the load of the hydraulic cylinder can also be exerted on the upper surface of the apron, whereby the apron can be bent downwards. For example, a broken forming wire may hit the apron and bend it up-
15 wards.

In Figure 7, the top slice 19 is opened in the service position, and the slice lip is removed. In this case, the height of the slice channel 11 is approx. 60 mm. During production, the
20 height of the slice opening is normally only 5 to 10 mm. Figure 7 also shows a dial indicator 55, whose measurement pin 56 is against the flow surface 25. The dial indicator can be used for determining the magnitude of the bending, and the elastic recovery of the apron can also be taken into account. The tip
25 of the apron is less than 10 millimeters thick, so even a small hydraulic cylinder can straighten the apron. Figure 7 shows in principle the oil lines 57 and the manual pump 58, which form a functional jack. The pump operates alternately both hydraulic cylinders, and for this purpose there is a distributing valve
30 59 in the oil lines. In practice, the beam is first jacked into contact with the slice channel, and then the apron is bent.

Between the bending sequences, the loading pressure of the hydraulic cylinders is removed, and the auxiliary device is
35 transferred to the next point. Rollers or other rolling elements can be attached to the feet of the beam and to the hy-

draulic cylinders. In this case, the auxiliary device can be moved in the cross direction of the headbox, and the apron can hence be bent in a way resembling mangling. The desired pressure is set in the hydraulic cylinders, and the device is
5 transferred for example by pulling by means of a tackle. The mangling can be done in stages by increasing the loading pressure at times. In this way, the device is transferred several times from one side of the headbox to the other. The auxiliary device can be transported easily, and the functional jack
10 expedites the conditioning process.

CLAIMS

1. Device for the conditioning of the flow surface in the headbox of a fiber web machine, where the device comprises:
- 5 - a frame structure (23),
- a conditioning element (24) arranged in the frame structure (23) for the conditioning of the flow surface (25) of the slice channel (11) of a headbox, where the height dimension s of the conditioning element (24) is
- 10 equal to or less than 60 mm, and
- an actuator (26) arranged in the frame structure (23) for operating the conditioning element (24),
- characterized in that the conditioning element (24) is a grinding disc (36).
- 15
2. Device according to claim 1, characterized in that the axis of rotation (27) in the actuator (26) is arranged to be aside from the axis of rotation (28) in the conditioning element (24).
- 20
3. Device according to claim 1 or 2, characterized in that the actuator (26) is connected to the conditioning element (24) by means of a transmission element (30), which provides a power transmission ratio.
- 25
4. Device according to any of claims 1 to 3, characterized in that the diameter of the grinding disc (36) is at least equal to or greater than the dimension of the flow surface (25) to be conditioned in the machine direction.
- 30
5. Device according to any of claims 1 to 4, characterized in that the conditioning element (24) comprises a body piece (24), to which the grinding disc (36) is supported by means of a bearing (35) so that the grinding disc (36) can rotate.
- 35

6. Device according to any of claims 1 to 5, characterized in that the axis of rotation of the grinding disc (36) is substantially parallel with the normal of the flow surface (25).

5

7. Device according to any of claims 1 to 6, characterized in that the actuator (26) is a pneumatic turbine motor (37).

8. Device according to any of claims 1 to 7, characterized in that the frame structure (23) comprises loading arms (38) for loading the tool (45) by taking support from the slice channel (11).

9. Device according to any of claims 1 to 8, characterized in that the frame structure (23) comprises a support wheel (40, 41) to support the device against the flow surface (25) and/or against the edge (29) of the flow surface (25).

10. Method for the conditioning of the flow surface in the headbox of a fiber web machine, in which method the flow surface (25) is conditioned by means of a tool (45), where the conditioning element (24) included in the tool (45) is placed in the slice channel (11) of the headbox, in the area of the flow surface (25) to be conditioned, with this area to be conditioned without removing the apron (18) included in the headbox, and which method employs a tool (45), where the height dimension s of the conditioning element (24) of the tool (45) is equal to or less than 60 mm, and which tool (45) is moved in the width direction of the headbox, characterized in that as the conditioning element (24) a grinding disc (36) is used.

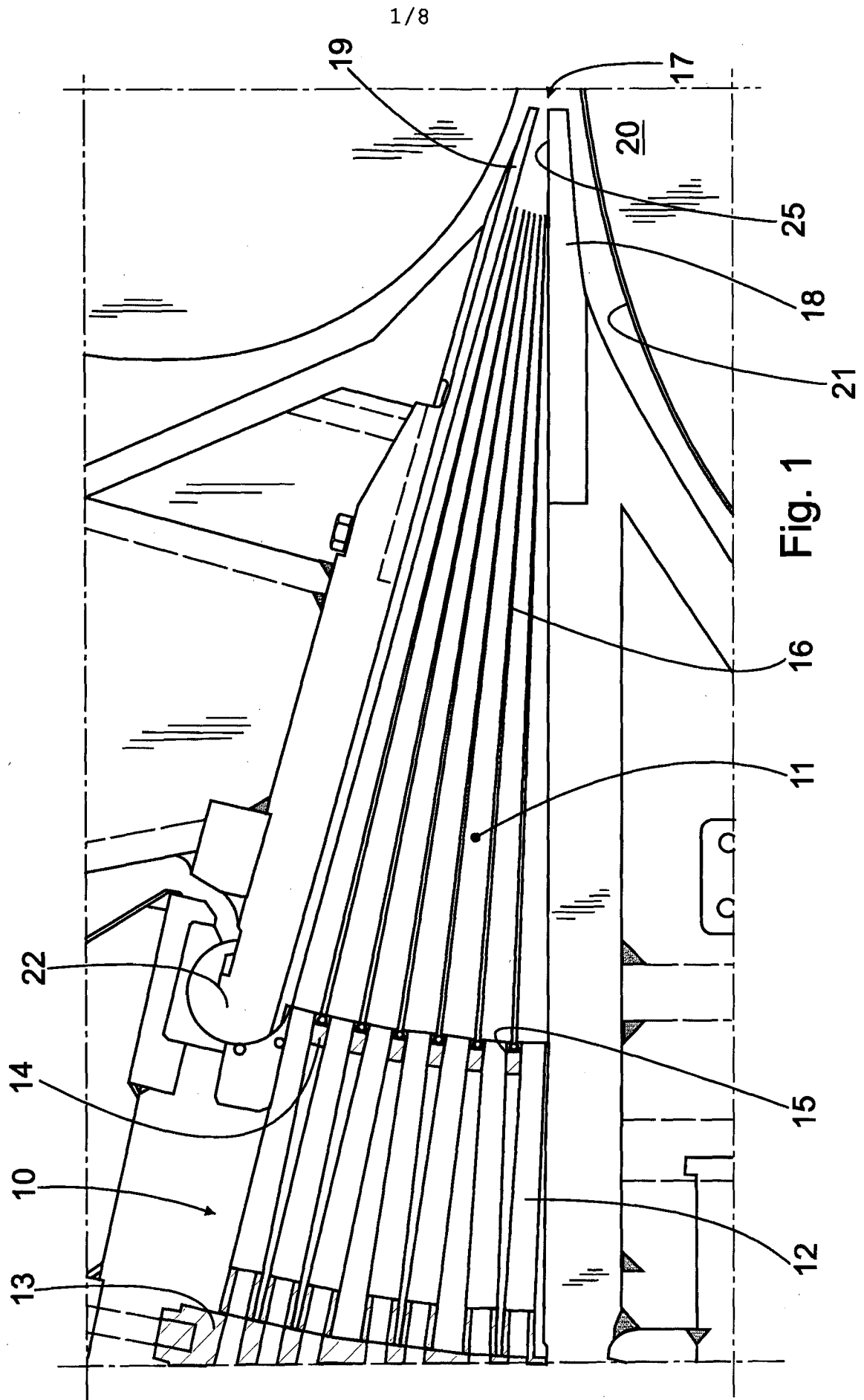
11. Method according to claim 10, characterized in that the tool (45) is supported against the edge (29) of the flow surface (25).

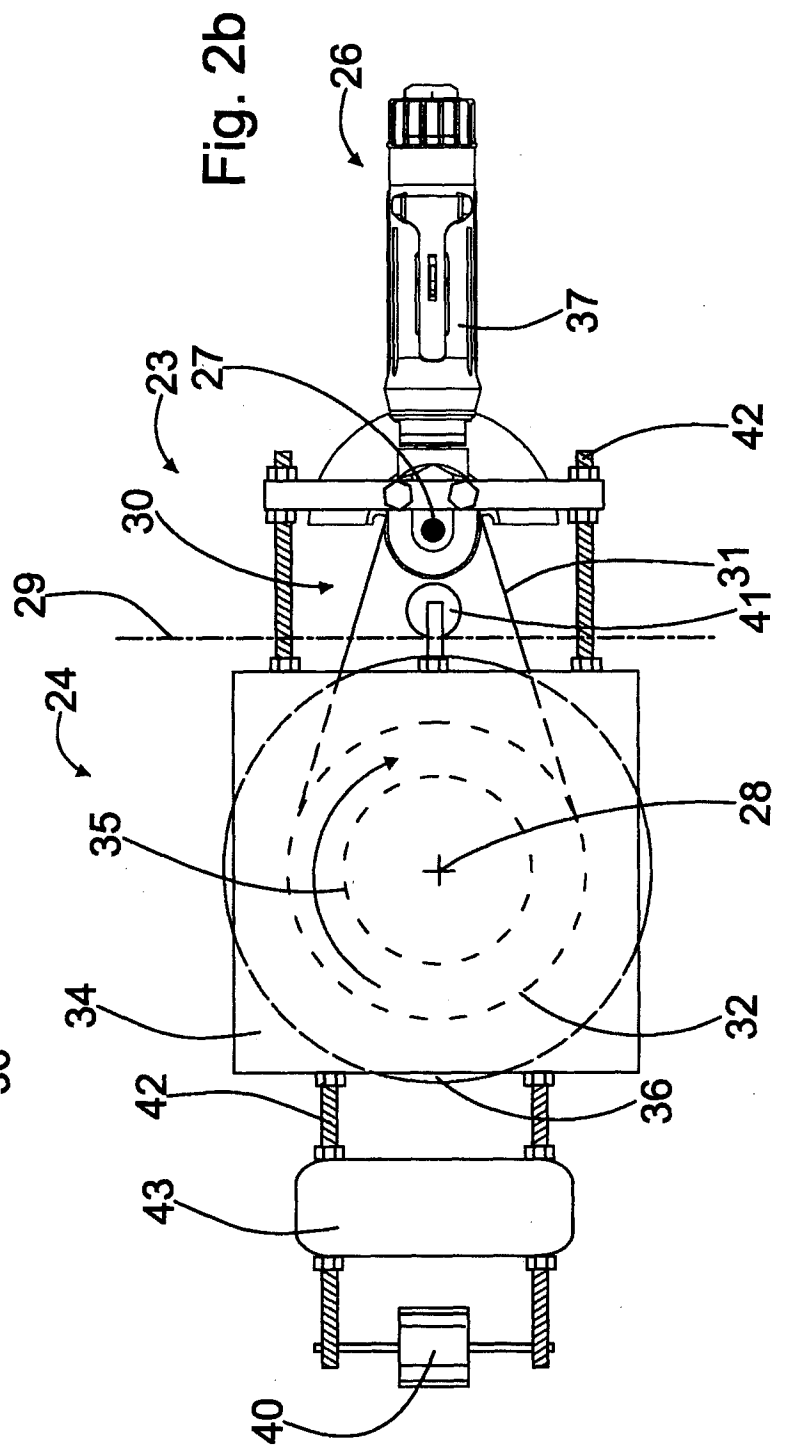
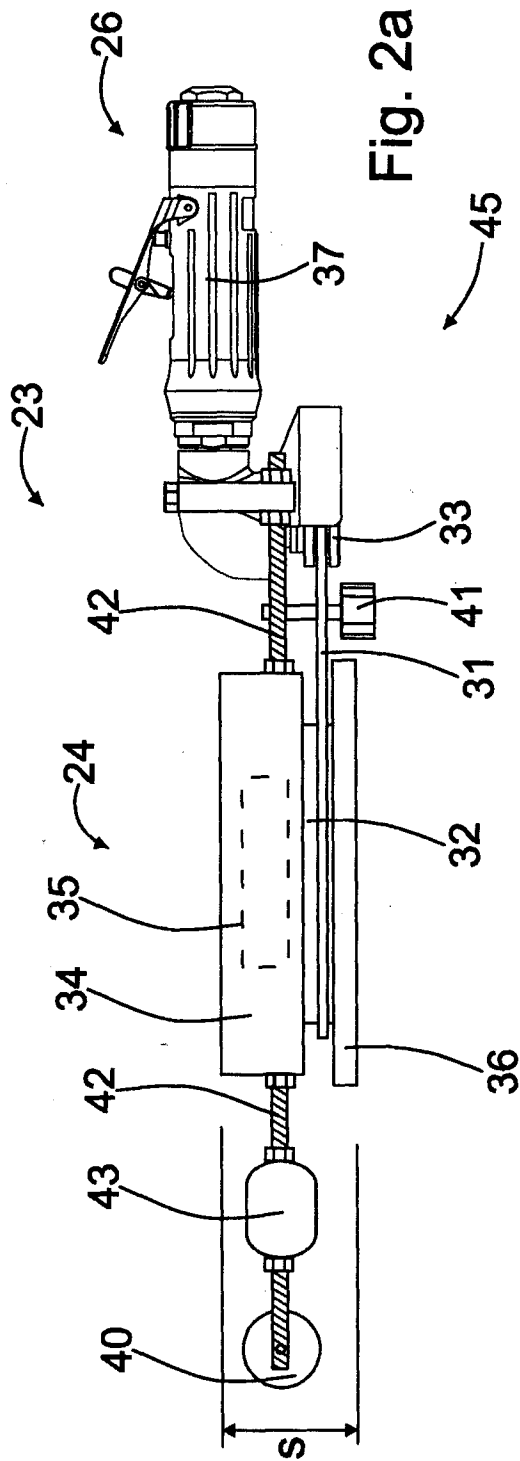
12. Method according to claim 10 or 11, characterized in that the tool (45) is loaded by taking support from the slice channel (11).

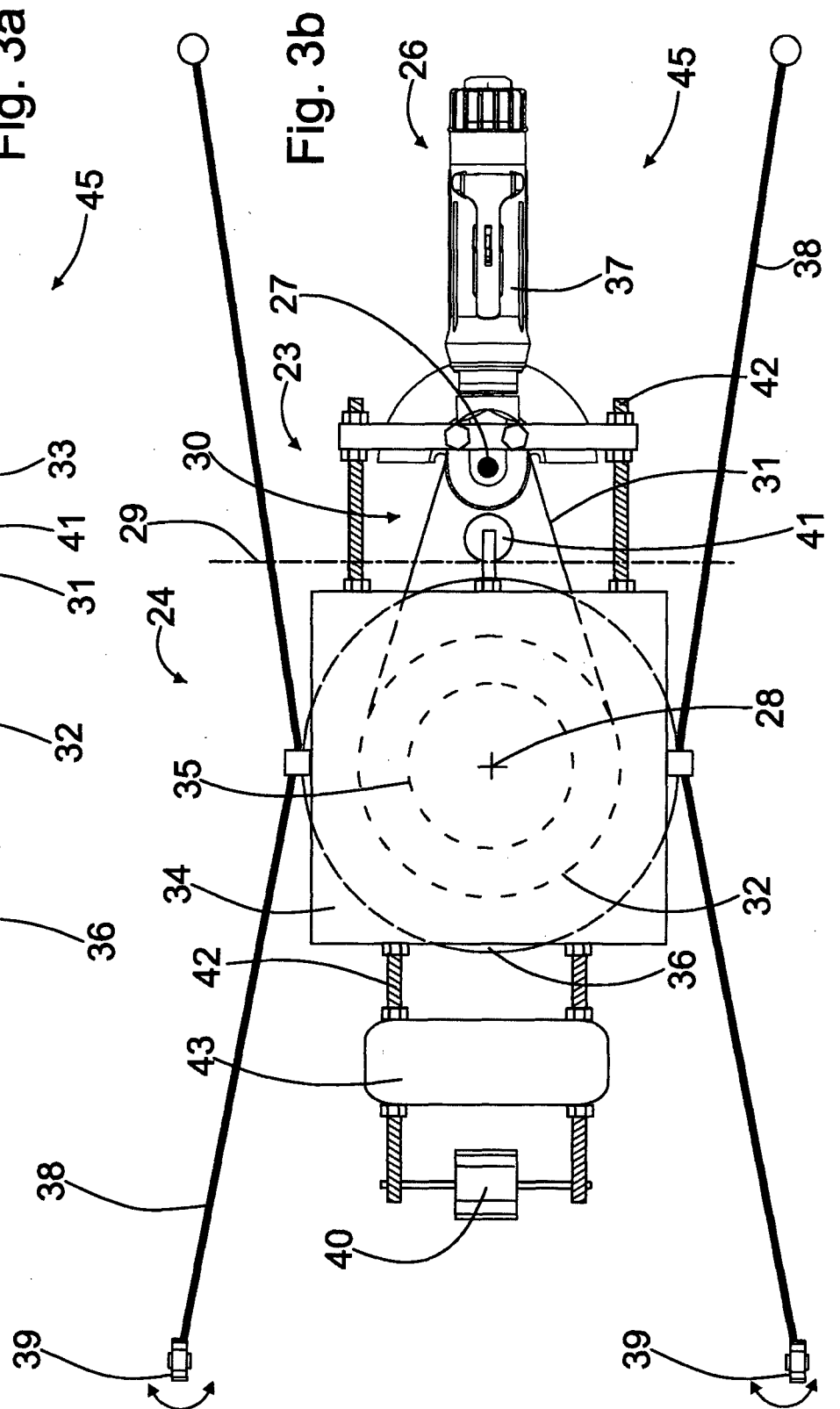
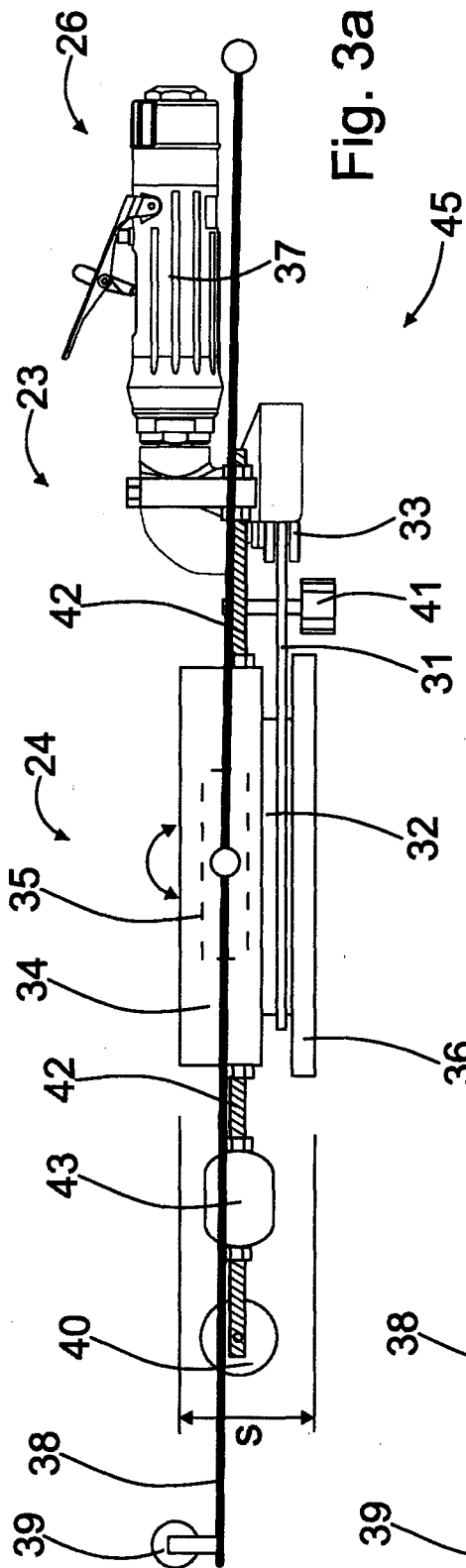
5 13. Method as claimed in any of claims 10 to 12, characterized in that the tool (45) used in the method is a device according to any of claims 2 to 9.

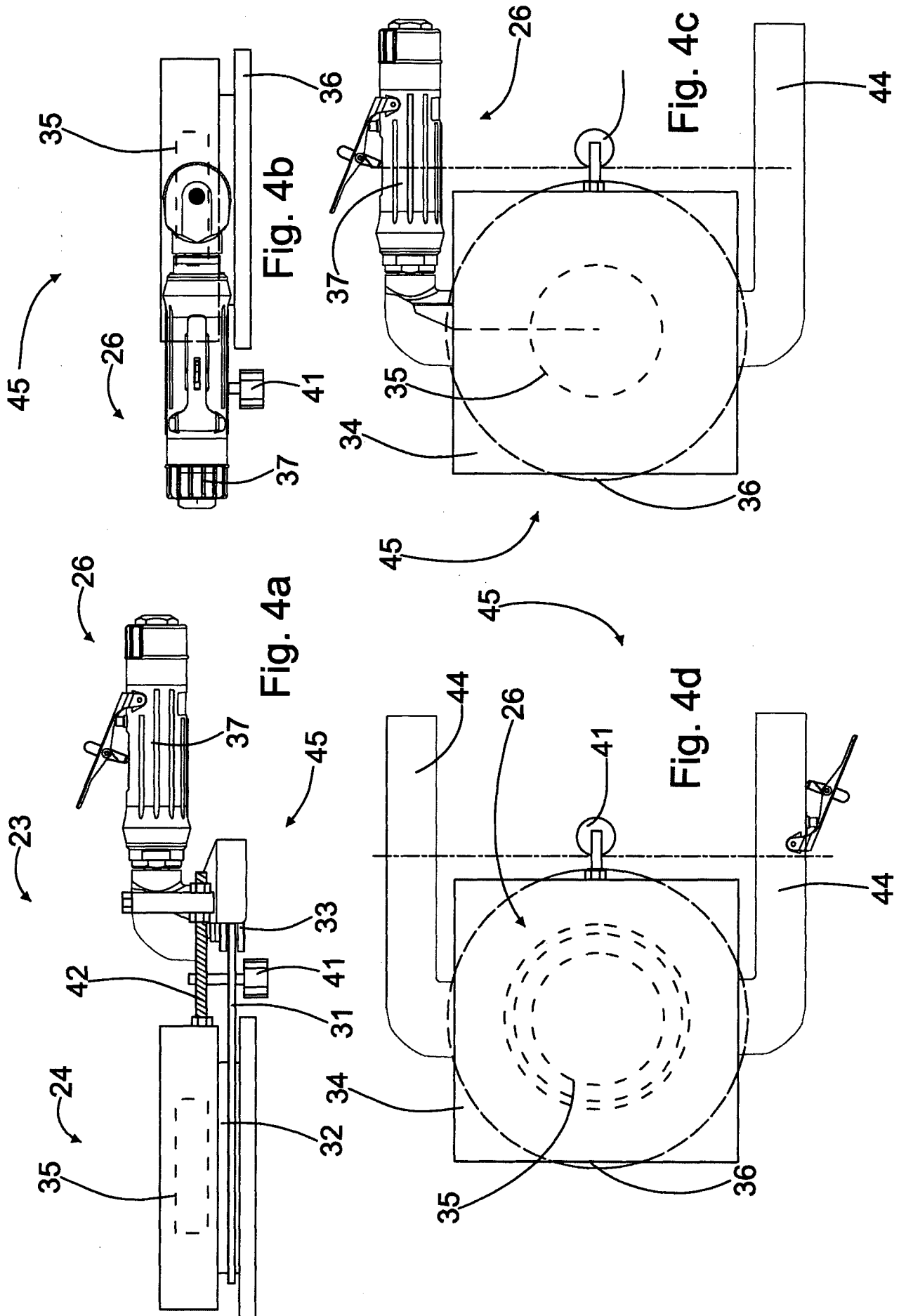
14. Method according to any of claims 10 to 13, character-
10 ized in that the flow surface (25) is conditioned by grinding.

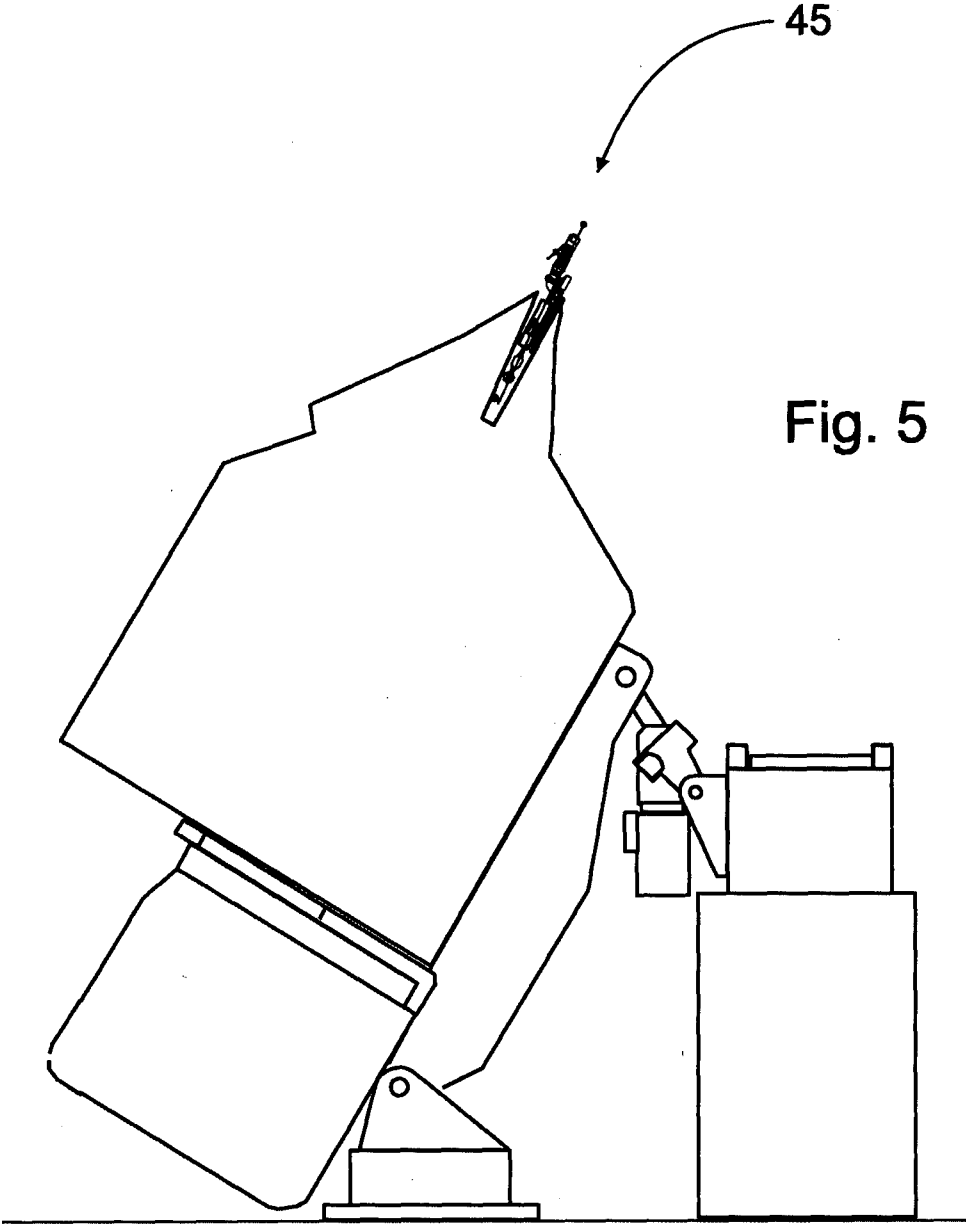
15. Method according to any of claims 10 to 14, character-
ized in that the apron (18) of the headbox, with the apron (18) comprising the flow surface (25), is straightened before grind-
15 ing by means of the mechanical auxiliary device (46).











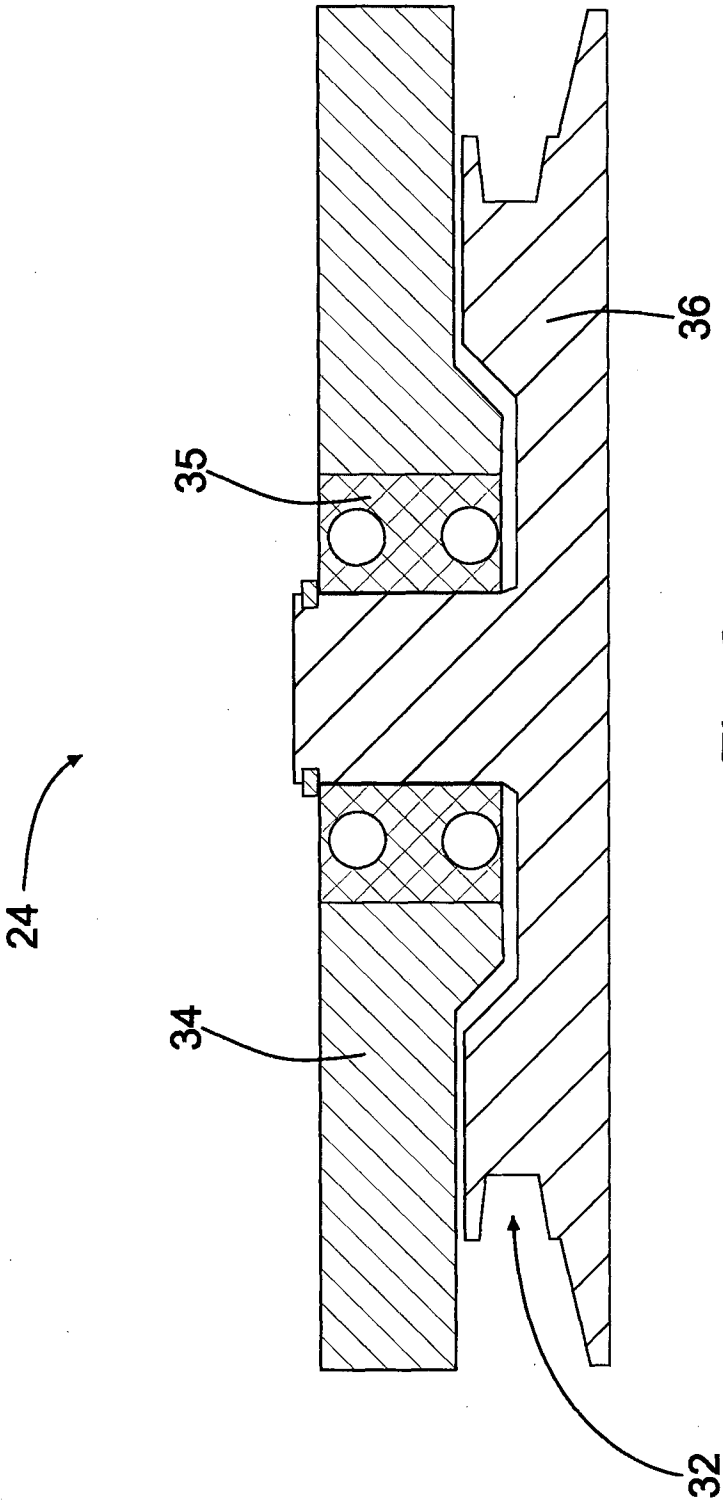
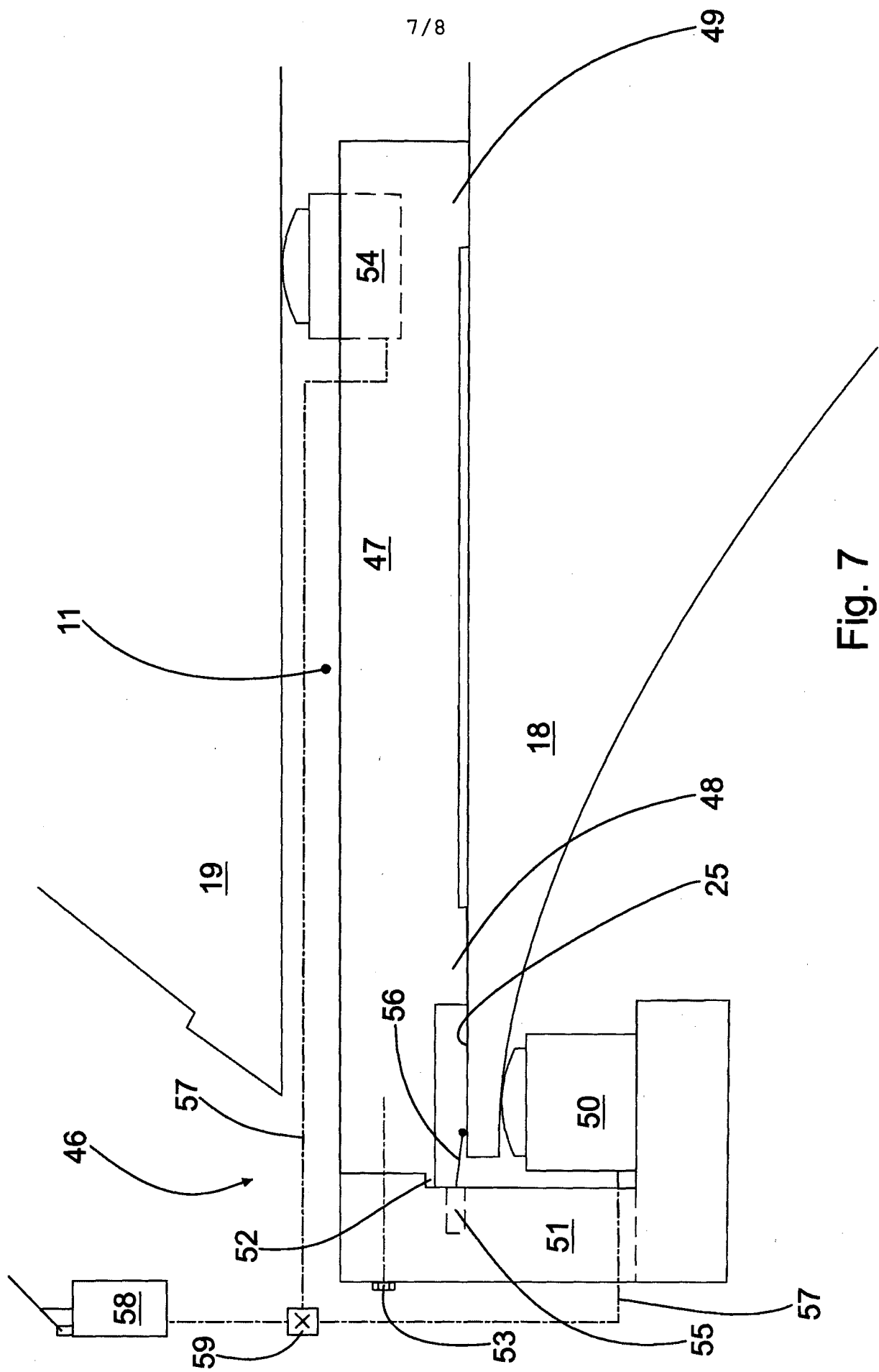


Fig. 6



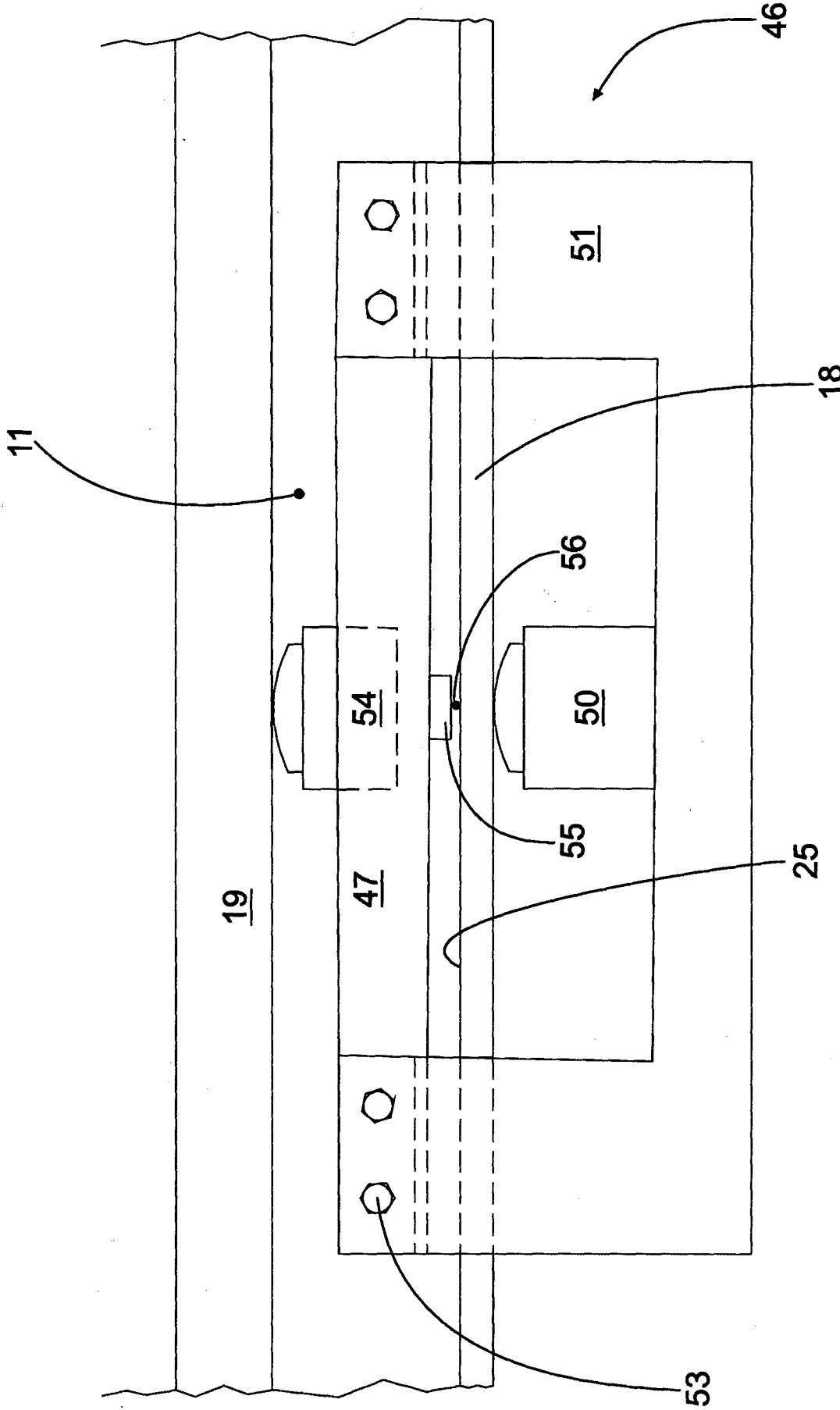


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2012/050625

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: D21F, B24B

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

FI, SE, NO, DK

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

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 102008059247 A1 (METABOWERKE GMBH) 27 May 2010 (27.05.2010)	1-6, 10, 13-15
Y	columns [0001] and [0018]-[0024]; figures 1 and 2	11
X	US 2009165610 A1 (HACHISUKA TOMOHIRO) 02 July 2009 (02.07.2009) paragraphs [0008], [0023] and [0038]; figures 1 and 2	1, 7, 10
A	US 5928067 A (HOPPER WALTER D et al.) 27 July 1999 (27.07.1999) abstract and figures 1-7	1-15
A	US 7335280 B2 (LAMPI PETRI et al.) 26 February 2008 (26.02.2008)	1-10, 12-15
Y	abstract and figures 1, 2 and 4b	11
A	FI 84087 B (VALMET PAPER MACHINERY INC) 28 June 1991 (28.06.1991) abstract and figures 1-3	1-15

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

10 September 2012 (10.09.2012)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2012/050625

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
DE 102008059247 A1	27/05/2010	None	
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US 2009165610 A1	02/07/2009	BR PI0814091 A2	27/07/2010
		RU 2008151866 A	27/06/2010
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		JP 2009154244 A	16/07/2009
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US 5928067 A	27/07/1999	None	
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FI 84087 B	28/06/1991	None	
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2012/050625

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

D21F 1/02 (2006.01)

B24B 1/00 (2006.01)