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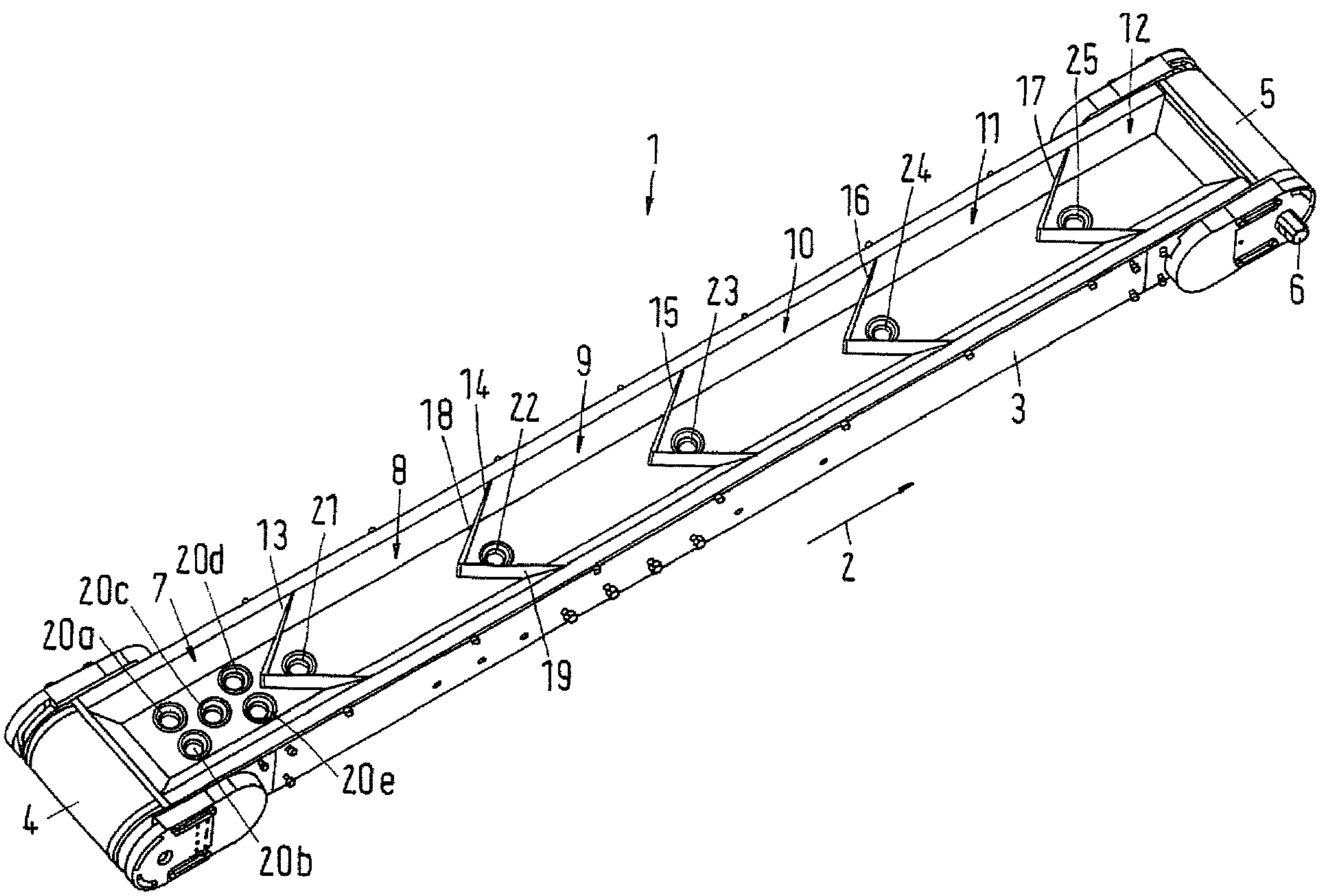

(57) Abrégé/Abstract:
An apparatus (1) for guiding a material web strip in a running direction (2) is specified having a housing (3), in which a vacuum generating device is arranged. The intention is for it to be possible to guide the material web strip reliably. To this end, there is provision for a plurality of vacuum chambers (7-12) to be arranged in the housing (3) behind one another in the running direction (2), of which each has at least one suction device (20-25).

KPF13447 WO

Abstract

An apparatus (1) for guiding a material web strip in a running direction (2) is specified having a housing (3), in which a vacuum generating device is arranged.

The intention is for it to be possible to guide the material web strip reliably.

To this end, there is provision for a plurality of vacuum chambers (7-12) to be arranged in the housing (3) behind one another in the running direction (2), of which each has at least one suction device (20-25).

Fig. 1

KPF13447 WO

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Apparatus for guiding a material web strip

The invention relates to an apparatus for guiding a material web strip in a running direction having a housing, in which a vacuum generating device is arranged.

In the following text, the invention will be described in conjunction with a paper web as an example of a material web strip. However, said invention can also be used in the case of other material webs and material web strips which are cut from them.

In the course of its production and processing, a paper web has to be guided through various processing devices, among them a drying section, a pressing section, a calender and optionally a coating apparatus or a gluing apparatus. To this end, in many cases the procedure is such that a material web strip having a width of the order of magnitude of from 200 to 300 mm is cut at the edge of the paper web and said strip is first of all guided through the processing device. As soon as said material web strip has traveled so far that a tensile force can be exerted on it, the paper web is cut to the correct width, with the result that it can pass with its full width through the corresponding processing device.

In addition to what are known as cable guiding arrangements, apparatuses which operate with vacuum are also used for guiding the material web strip. Here, an air-permeable belt runs around a housing as a rule, on which air-permeable belt the material web lies. The belt is supported on a plate which is provided with holes or slots. A vacuum is generated on that side of the plate which faces away from the belt, with the result that the material web strip is attracted by suction on the other side of the belt.

One example of an apparatus of this type is known from EP 1 127 978 B1. Here, a plurality of turbines are arranged in the housing, which turbines suck air through the belt, in order to hold the material web strip firmly on the other side of the belt.

Another embodiment is known from EP 1 342 844 A2. Here, a plurality of "doctor blades" are arranged in the housing, which doctor blades end shortly below the inner side of the belt and, as it were, peel off the air layer which is situated there. As a result, a vacuum is also generated on the outer side of the belt, by way of which vacuum the web or at any rate its material web strip can be attracted firmly by suction.

In the case of machines which operate faster and faster, however, it is difficult in all cases to ensure that the material web strip is guided so stably that it can be transferred without problems to a following transport device, for example a cable guiding arrangement or another vacuum conveyor.

The invention is based on the object of guiding a material web strip reliably.

In an apparatus of the type which is mentioned in the introduction, this object is achieved by the fact that a plurality of vacuum chambers are arranged in the housing behind one another in the running direction, of which each has at least one suction device.

The time which is required to load the material web strip with the full vacuum is shortened by way of this embodiment. The material web strip is guided over the housing and in the process increasingly covers a vacuum chamber. However, as long as the vacuum chamber is not yet completely covered, "surrounding air" can be sucked through the remaining opening, with the result that the vacuum in the vacuum chamber is still too weak in many cases to firmly hold the material web strip reliably. However, as soon as the material web strip has covered the vacuum chamber completely, the vacuum which is made available by the suction device acts to its full extent on the material web strip. Since a plurality of vacuum chambers are arranged behind one another in the running direction, the length of each vacuum chamber is shorter than that of the overall apparatus, with the result that it is concluded earlier at the same speed. If the material web strip is held firmly at the first vacuum chamber in the running direction, it is already stabilized to a certain extent. However, the holding force which results from surface area times vacuum is still too low in many cases to firmly hold the material web strip reliably overall. However, this unstable situation lasts only for a short time because the material web strip continues to run and then covers the next chamber or chambers in the running direction, with the result that the vacuum which is situated there also acts on the material web strip. The holding force which acts on the material web strip is therefore built up in steps.

A first vacuum chamber in the running direction of the material web strip preferably has a greater number of suction devices than a vacuum chamber which is arranged behind it in the running direction of the material web strip. It is therefore possible to generate a higher vacuum in the first vacuum chamber, as long as the material web strip has not yet covered said vacuum chamber completely. More air is namely conveyed away on account of the plurality of suction devices, with the result that the material web strip is then held firmly on the fabric or another air-permeable belt with high reliability, if the first vacuum chamber is not yet completely closed. The highest vacuum occurs when the first vacuum chamber is covered completely by the material web strip. After the material web strip is stabilized in this way over the first vacuum chamber, a lower vacuum is sufficient to transport the material web strip as far as the end of the apparatus. Since the vacuum chambers are covered gradually and then act with the full vacuum on the material web strip, the holding force on the air-permeable belt at the end of the apparatus is very great. Slipping of the material web strip is reduced or even prevented.

The suction devices are preferably configured as suction nozzles. Suction nozzles can be installed simply. They are supplied with compressed air, with the result that the energy supply which is necessary for suction can also be provided in a simple way.

A boundary wall is preferably filled with suction devices in the first vacuum chamber. Such a large number of suction devices are therefore provided that this wall, for example the base of the vacuum chamber, is covered completely or at any rate virtually completely with suction devices. Here, the suction devices are not only the openings, through which the suction air is sucked out of the vacuum chamber, but also the elements which surround the suction openings. The vacuum can be generated, as it were, over the full surface area by the fact that a correspondingly large number of suction devices are provided which are distributed over the boundary wall.

The vacuum chambers preferably have a guiding side, along which the material web strip runs, and a base which lies opposite the guiding side, the suction devices acting through the base. This embodiment has the advantage that the contaminants are sucked toward the base and can then be removed through the suction devices. In the long term, practically no dirt can therefore accumulate in the vacuum chamber. This is true independently of whether the apparatus is operated in such a way that the material web strip is guided above it or below it in the direction of gravity. It is important in this context that the air flow can be sucked in, as it were, in a straight line from the side which causes dirt into the opposite side.

The guiding side and the base preferably extend parallel to one another. The vacuum chambers therefore have a constant height in the running direction. This simplifies the manufacturing.

It is preferred here that the guiding side and the base are at a spacing in the range from 5 to 35 mm, in particular in the range from 10 to 20 mm. The volume of the vacuum chamber is therefore firstly kept so low that a sufficient vacuum can be generated relatively quickly with acceptable expenditure. Secondly, there is a sufficient spacing between the guiding side and the base, with the result that the flow cross section is large enough for the air which is to be extracted by suction.

The suction devices are preferably arranged symmetrically in relation to a center axis which extends parallel to the running direction. The vacuum can therefore also be generated symmetrically with regard to the center axis, which likewise contributes to a stabilization of the material web strip on the air-permeable belt. If there is only one suction device, for example one suction nozzle, in the vacuum chamber, this suction nozzle is divided by the center axis. If there are two suction nozzles in the vacuum chamber, they are arranged symmetrically on both sides of the center axis.

At least two adjacent vacuum chambers are preferably divided from one another by a dividing wall which encloses at least in sections an angle with respect to the running direction, which angle is greater than 95° or smaller than 85°. In other words, the dividing wall extends at least in sections at an angle which does not equal 90° with respect to the running direction. This has the advantage that the material web strip covers two vacuum chambers at least temporarily. Dead zones are therefore avoided which could possibly lead to an instability of the material web strip. If the material web strip runs with its start over the dividing wall, it is loaded at the same time by the vacuums in two vacuum chambers, the first vacuum chamber in the running direction acting more strongly on the material web strip.

It is preferred here that the dividing wall has two limbs which are inclined in opposite directions with respect to the running direction. Said two limbs are preferably inclined in the running direction. This results in turn in symmetrical conditions, which has a favorable effect on the stabilization of the material web strip.

The limbs preferably abut one another in a V-shape. The dividing wall therefore has two substantially straight sections, with the result that it is easy to manufacture. As soon as the material web strip passes with its start over the tip of the "V", it is also loaded with vacuum by the following vacuum chamber.

At least in the case of one vacuum chamber, the dividing wall preferably extends on both sides of the suction device in the running direction. The suction device is therefore positioned relatively closely behind the dividing wall, with the result that the vacuum can act relatively early on the material web strip, that is to say practically immediately when the material web strip has been guided over the dividing wall. This already results after a short time in conditions, by way of which the material web strip can be guided stably. If the dividing wall is of V-shaped configuration, the suction device is situated, as it were, in the knuckle of the "V".

The housing preferably has an intermediate wall which delimits the vacuum chamber. By way of this, it is possible to keep the volume of the vacuum chambers small. The smaller the volume, the quicker the air which is situated in it can be extracted by suction and the vacuum can be built up. The level of the vacuum is therefore not influenced significantly. It is therefore no longer necessary to suck the entire housing empty, in order to generate the vacuum.

The intermediate wall is preferably configured in the shape of a trough with inclined side walls. The inclined side walls firstly contribute to a reduction in the volume. Secondly, they also help to discharge dirt particles or water which penetrate into the vacuum chamber toward the suction devices.

It is preferred here that the side walls are inclined toward the suction device in the direction of gravity. This also facilitates the discharging of contaminants.

A compressed air supply line for the suction nozzles is preferably arranged between the housing and the intermediate wall. Said compressed air supply line is therefore not visible in any case within the apparatus and does not disturb further. The risk that it is damaged is also reduced.

A vacuum chamber preferably has a volume of at most 2l, in particular of at most 1 l. A volume which is this small can be sucked empty relatively quickly, with the result that even fast running material web strips which are at a speed, for example, of the order of magnitude of 1800 m/min can be held stably very quickly.

At least one vacuum chamber is preferably divided into at least two compartments parallel to the running direction. This is preferably the first vacuum chamber in the running direction. If the material web strip is cut out of the material web, it can occur that it does not come to lie precisely centrally on the vacuum chamber. In this case, there is the risk that it does not cover the vacuum chamber completely, with the result that surrounding air can still be sucked in laterally, as a result of which the holding force is reduced. If the vacuum chamber is then divided into at least two compartments parallel to the running direction, the chance is great that at least one of said compartments is covered completely by the material web strip. The material web strip is then held with the full force at least in this compartment.

It is preferred here that each compartment is delimited in the running direction by a V-shaped dividing wall. This results in the advantages which have been described generally above in conjunction with a vacuum chamber. The V-shaped dividing wall does not produce a dead zone when the material web strip moves over the dividing wall. Rather, when it moves over the dividing wall, said material web strip is then loaded by the vacuum in two adjacent compartments in the running direction.

In accordance with another aspect, there is provided an apparatus for guiding a material web strip in a running direction having a housing, in which a vacuum generating device is arranged, wherein a plurality of vacuum chambers are arranged in the housing behind one another in the running direction, of which each has at least one suction device, wherein a first vacuum chamber in the running direction of the material web strip has a greater number of suction devices than a vacuum chamber which is arranged behind it in the running direction of the material web strip.

In the following text, the invention will be described using one preferred exemplary embodiment in conjunction with the drawing, in which:

fig. 1 shows a perspective illustration of an apparatus for guiding a material web strip in the open state,

fig. 2 shows a plan view of the apparatus according to fig. 1,

fig. 3 shows a section III-III according to fig. 2, and

fig. 4 shows a sectional view through a suction nozzle.

An apparatus 1 for guiding a material web strip (not shown in greater detail) in a running direction 2 has a housing 3 which is provided with a deflecting roller 4 at its front end and with a deflecting roller 5 at its rear end. A drive journal 6, to which a drive motor (not shown in greater detail) can be connected, is provided for the deflecting roller 5 at the rear end. An air-permeable belt which is not shown in the drawing for reasons of clarity is guided over the two deflecting rollers 4, 5. Said belt can be configured, for example, as a fabric.

The housing 3 has a covering plate (likewise not shown in greater detail) which is provided with openings, for example in the form of slots. The covering plate has been omitted, in order for it to be possible to illustrate details from the interior of the apparatus 1. During operation, the air-permeable belt rests on the covering plate. The material web strip then lies on the belt, which material web strip is loaded with vacuum through the covering plate and the air-permeable belt and is thus sucked firmly onto the outer side of the air-permeable belt.

Six vacuum chambers 7-12 are provided in the housing 3. The vacuum chambers are divided from one another by dividing walls 13-17. In plan view, each dividing wall 13-17 has a V-shape, that is to say two limbs 18, 19 which extend at an angle of approximately 45° with respect to the running direction 2.

Each vacuum chamber 7-12 is provided with at least one suction device in the form of a suction nozzle 20a-20e, 21-25. Here, the first suction chamber 7 in the running direction 2 has a greater number of suction nozzles 20a-20e than the suction chambers 8-12 which are arranged further to the rear in the running direction 2. In the present exemplary embodiment, the first vacuum chamber 7 has five suction nozzles 20a-20e. However, it is also possible to provide the first vacuum chamber 7 only with three or four suction nozzles.

The suction nozzles 20-25 are arranged in a base 26 of the vacuum chamber 7-12. The base 26 is a boundary wall which lies opposite a guiding side 27, along which the material web strip is guided. The air-permeable belt, against which the material web strip bears (not shown), is situated on the guiding side 27. The base 26 and the guiding side 27 extend parallel to one another at a spacing in the range from 5 to 35 mm, preferably at a spacing in the range from 10 to 20 mm.

As is apparent from figs 1 and 2, the suction nozzles 20a-20e are arranged in the first vacuum chamber 7 in the running direction 2 in such a way that they fill the base 26. There would therefore be no space for a further suction nozzle 20a-20e. As a result, it is possible not only to build up a vacuum relatively

quickly in the first vacuum chamber 7 when the material web strip is guided over the vacuum chamber 7, but also to allow the vacuum to already act to a sufficient extent on the material web strip when the material web strip has not yet closed the vacuum chamber 7 completely.
In contrast, the respective suction nozzle 21-25 is arranged in the remaining vacuum chambers 8-12 in such a way that it is relatively close to the dividing wall 13-17, with the result that it is still overhung by the respective dividing wall 13-17 on both sides in the running direction 2. The suction nozzle 21-25 is situated, as it were, in the "knuckle" of the "V".

As is apparent, in particular, from fig. 3, the housing 3 has an intermediate wall 28 which delimits the vacuum chambers 7-12. The intermediate wall 28 has two inclined side walls 29, 30 which are inclined in the direction of the suction nozzles 20-25. If the apparatus 1 is arranged as shown in fig. 3, that is to say the material web strip is guided above the housing 3 in the direction of gravity, dirt particles or water droplets which enter the vacuum chambers 7-12 are guided by the side walls 29, 30 in the direction of the suction nozzle 20-25, with the result that they can be removed easily. However, the same is also true in the case of "upside down" operation because even then an air flow is produced which conveys dirt particles away via the side walls 29, 30 and the base 26.

Fig. 4 diagrammatically shows a suction nozzle 23 in section. The suction nozzle 23 has a compressed air inlet 31, through which compressed air can be blown in. Furthermore, the suction nozzle 23 has a suction inlet 32. The compressed air which enters through the compressed air inlet 31 passes through a gap between the differently hatched parts of the suction nozzle 23 and then flows out through an outlet 33. Here, it drives suction air with it which has entered through the suction inlet 32. The suction nozzle 23 operates according to the venturi principle. The volume of the vacuum chambers 7-12 is kept small by the intermediate wall 28. The intermediate wall 28 can be designed in such a way that each vacuum chamber 7-12 has a volume of approximately 2 l or less, for example 1 l.

A compressed air supply line 34 is arranged in the housing 3, to be precise between the intermediate wall 28 and the actual housing wall, with the result that the compressed air supply line 34 is visible to the outside in a nondisruptive way. The compressed air supply line 34 is connected to the respective suction nozzles 20-25 in each case via a branch line 35.

A vacuum chamber 7-12 has a length in the running direction 2 of approximately 300 mm. At a web speed of 1800 m/min, it takes approximately 1/100 of a second until a vacuum chamber 7-12 is covered by the material web strip. Depending on the setting, a suction nozzle has a suction performance of, for example, 4500 l/min, with the result that approximately 0.75 l of air can be sucked out of each vacuum chamber 7-12 in 1/100 of a second. If the vacuum chamber 7-12 has a volume of from 1 to 2 l, the material web strip is reliably held firmly, as soon as it has moved over a vacuum chamber 7-12. In order to build up the vacuum which is required for this purpose, it is not necessary to remove all the air from the vacuum chamber 7-12.

Since the dividing walls 13-17 have the shown V-shape (other shapes are also possible, as long as they do not extend at right angles to the running direction 2), when being conveyed in the running direction 2, the material web strip is loaded at the same time by the vacuum in two adjacent vacuum chambers 7-12, as soon as it begins to cross a dividing wall 13-17. Dead zones are therefore avoided. It is also helpful here that the suction nozzles 21-25 are arranged relatively close behind the dividing walls 13-17, with the result that the vacuum which is generated as a result can also act relatively quickly on the material web strip.

As is apparent from fig. 3, the suction nozzles 20-25 in practice open at the level of the base 26. In every case, they are arranged in such a way that air is sucked away through the base. This has a considerable advantage for the self-cleaning effect of the apparatus. If fibers, dust or water accumulate in the vacuum chambers 7-12, these contaminants are sucked in through the suction nozzles 20-25 and blown out on the underside of the apparatus 1.

The length of the apparatus can then be used to influence the force, by way of which the material web strip is held firmly and guided. One zone, that is to say one vacuum chamber 7-12, has a length of the order of magnitude of from 250 to 400 mm. Depending on how long one wishes to guide the material web strip, more or fewer vacuum chambers 7-12 then have to be connected behind one another. For example, a vacuum of 28 mbar can be generated in the first vacuum chamber 7 in the running direction 2. A vacuum of from 5 to 20 mbar is then sufficient in the following vacuum chambers 8-12.

The suction nozzles 20-25 are arranged symmetrically in relation to a center axis 36. If therefore a vacuum chamber 8-12 has only one suction nozzle 21-25, said suction nozzle 21-25 is divided by the center axis 36. If, as in the first vacuum chamber 7, a plurality of suction nozzles 20a-20e are provided, they are arranged symmetrically with respect to the center axis 36. As a result, pressure conditions which are likewise symmetrical with respect to the center axis 36 can be realized in the vacuum chambers 7-12. A displacement of the material web strip by different pressures can be ruled out in practice.

However, it can occur that the material web strip is already displaced to the side during cutting. In this case, it can be favorable to divide the individual vacuum chambers 7-12 into two or three compartments parallel to the running direction 2. In the case of a division into two compartments, an intermediate wall would be arranged where the center axis 36 is situated. In this case, each compartment is provided with a dedicated suction nozzle 20-25, the first compartment of each row in the running direction again having more suction nozzles than the compartments which are arranged behind it in the running direction.

When the division of the vacuum chambers 7-12 into individual compartments is carried out, it will be expedient also to design the dividing walls 13-17 between the individual compartments to be V-shaped in the running direction, in order to achieve the abovementioned advantages.

What is claimed is:

1. An apparatus for guiding a material web strip in a running direction having a housing, in which a vacuum generating device is arranged, wherein a plurality of vacuum chambers are arranged in the housing behind one another in the running direction, of which each has at least one suction device, wherein a first vacuum chamber in the running direction of the material web strip has a greater number of suction devices than a vacuum chamber which is arranged behind it in the running direction of the material web strip.

2. The apparatus according to Claim 1, wherein the suction devices are configured as suction nozzles.

3. The apparatus according to Claim 2, wherein a boundary wall is filled with suction devices in the first vacuum chamber.

4. The apparatus according to any one of Claims 1 to 3, wherein the vacuum chambers have a guiding side, along which the material web strip runs, and a base which lies opposite the guiding side, the suction devices acting through the base.

5. The apparatus according to Claim 4, wherein the guiding side and the base extend parallel to one another.

6. The apparatus according to Claim 4 or 5, wherein the guiding side and the base are at a spacing in the range from 5 to 35 mm.

7. The apparatus according to Claim 6 wherein the spacing is in the range from 10 to 20 mm.

8. The apparatus according to any one of Claims 1 to 7, wherein the suction devices are arranged symmetrically in relation to a centre axis which extends parallel to the running direction.

9. The apparatus according to one of Claims 1 to 8, wherein at least two adjacent vacuum chambers are divided from one another by a dividing wall which encloses at least in sections an angle with respect to the running direction, wherein the angle is greater than 95° or smaller than 85°.

10. The apparatus according to Claim 9, wherein the dividing wall has two limbs which are inclined in opposite directions with respect to the running direction.

11. The apparatus according to Claim 10, wherein the limbs abut one another in a V-shape.

12. The apparatus according to any one of Claims 9 to 11, wherein, at least in the case of one vacuum chamber, the dividing wall extends on both sides of the suction device in the running direction.

13. The apparatus according to any one of Claims 1 to 12, wherein the housing has an intermediate wall which delimits at least one vacuum chamber.

14. The apparatus according to Claim 13, wherein the intermediate wall is configured in the shape of a trough with inclined side walls.

15. The apparatus according to Claim 14, wherein the side walls are inclined toward the at least one suction device of the at least one vacuum chamber in the direction of gravity.

16. The apparatus according to any one of Claims 13 to 15, wherein a compressed air supply line for the at least one suction device of the at least one vacuum chamber is arranged between the housing and the intermediate wall.

17. The apparatus according to any one of Claims 1 to 16, wherein at least one vacuum chamber has a maximum volume of 2 litres.

18. The apparatus according to any one of claims 1 to 16, wherein at least one vacuum chamber has a maximum volume of 1 litre.

19. The apparatus according to any one of Claims 1 to 18, wherein at least one vacuum chamber is divided into at least two compartments parallel to the running direction.

20. The apparatus according to Claim 19, wherein each compartment is delimited in the running direction by a V-shaped dividing wall.

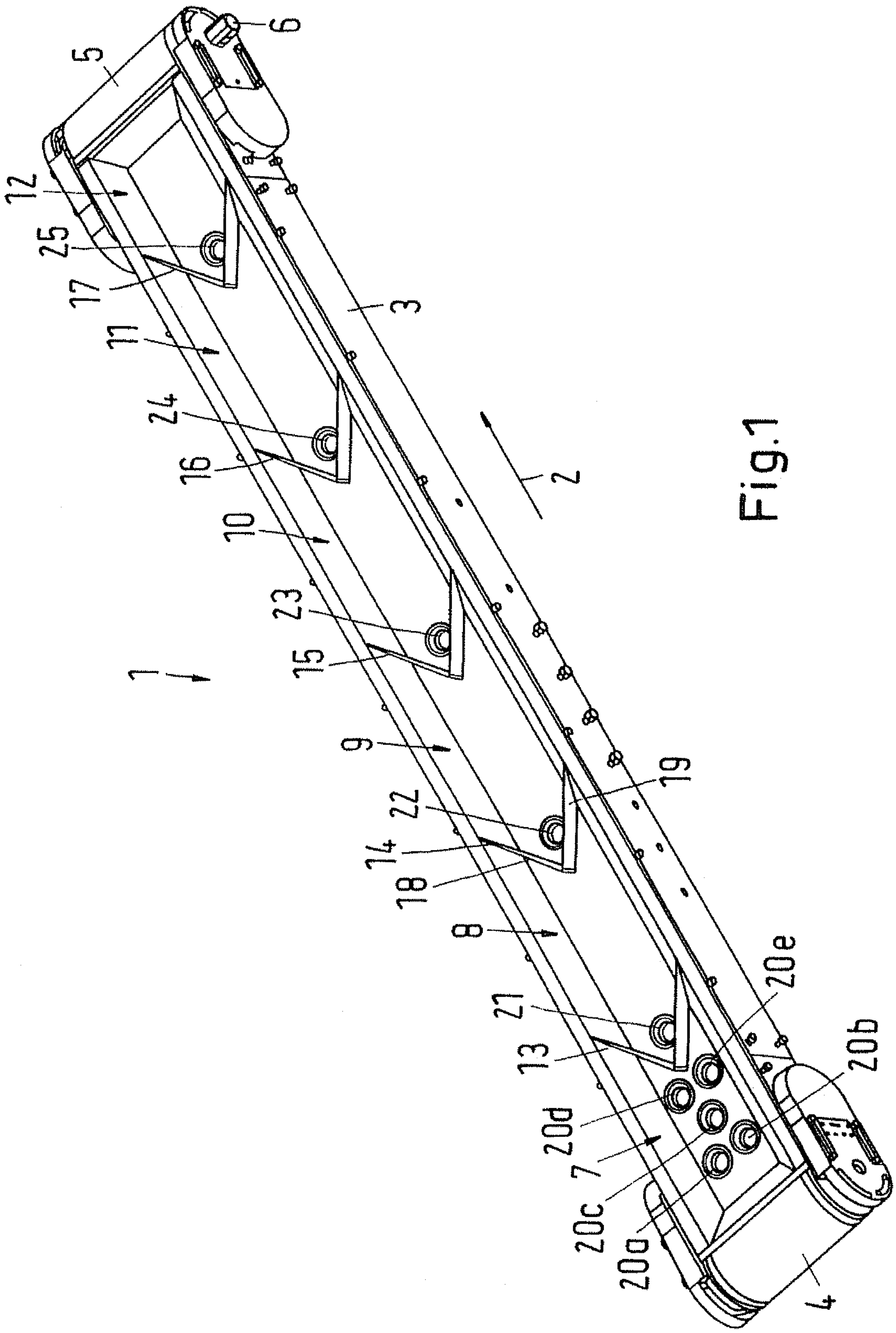

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Fig.1

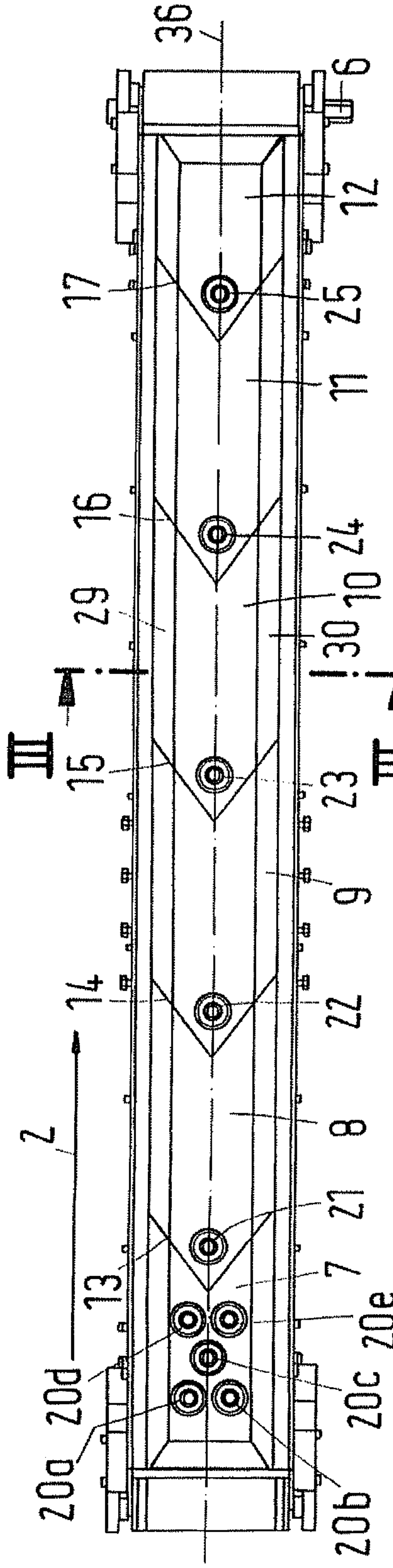

Fig.2

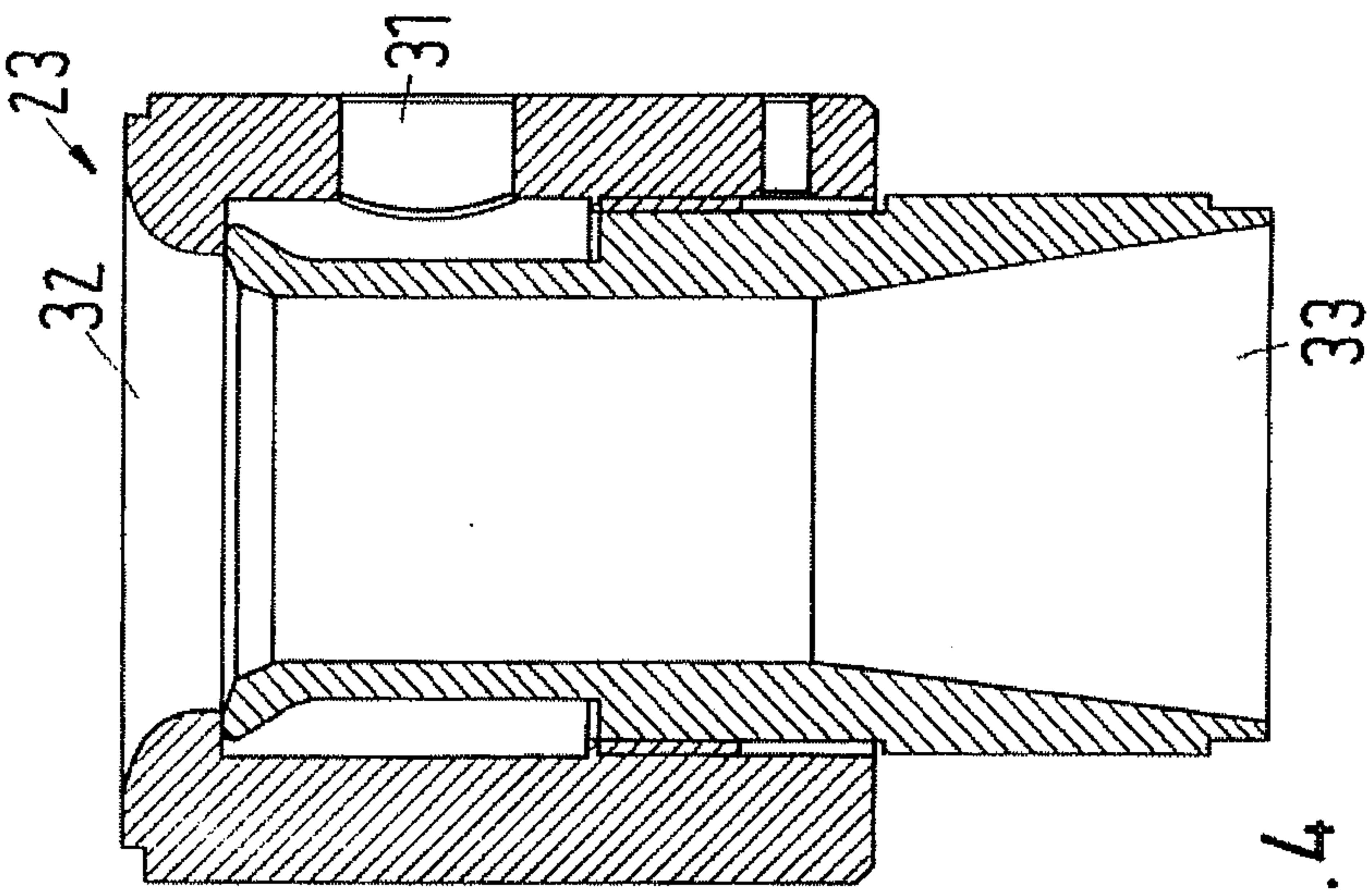

Fig.4

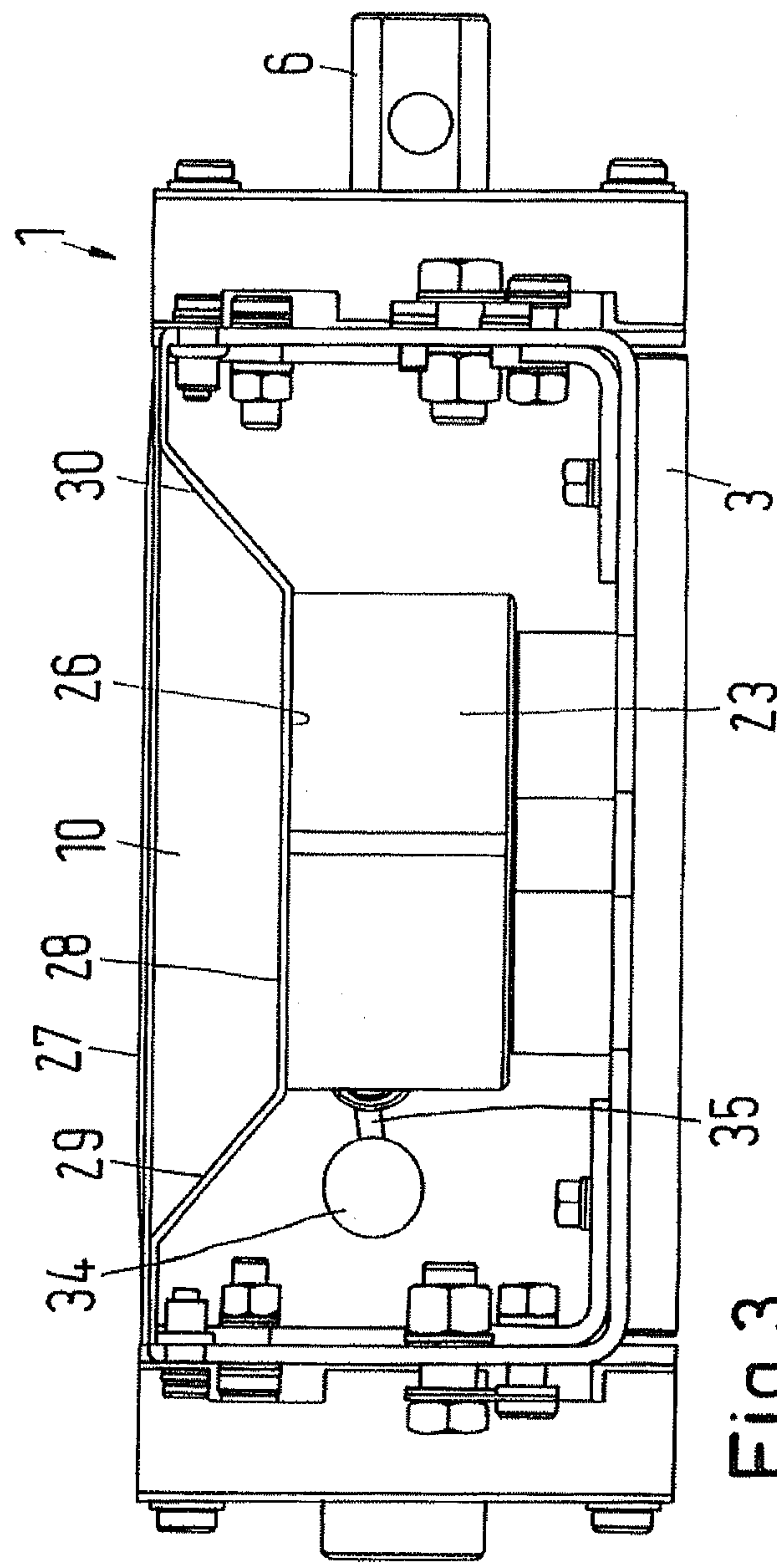

Fig.3


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Fig.1