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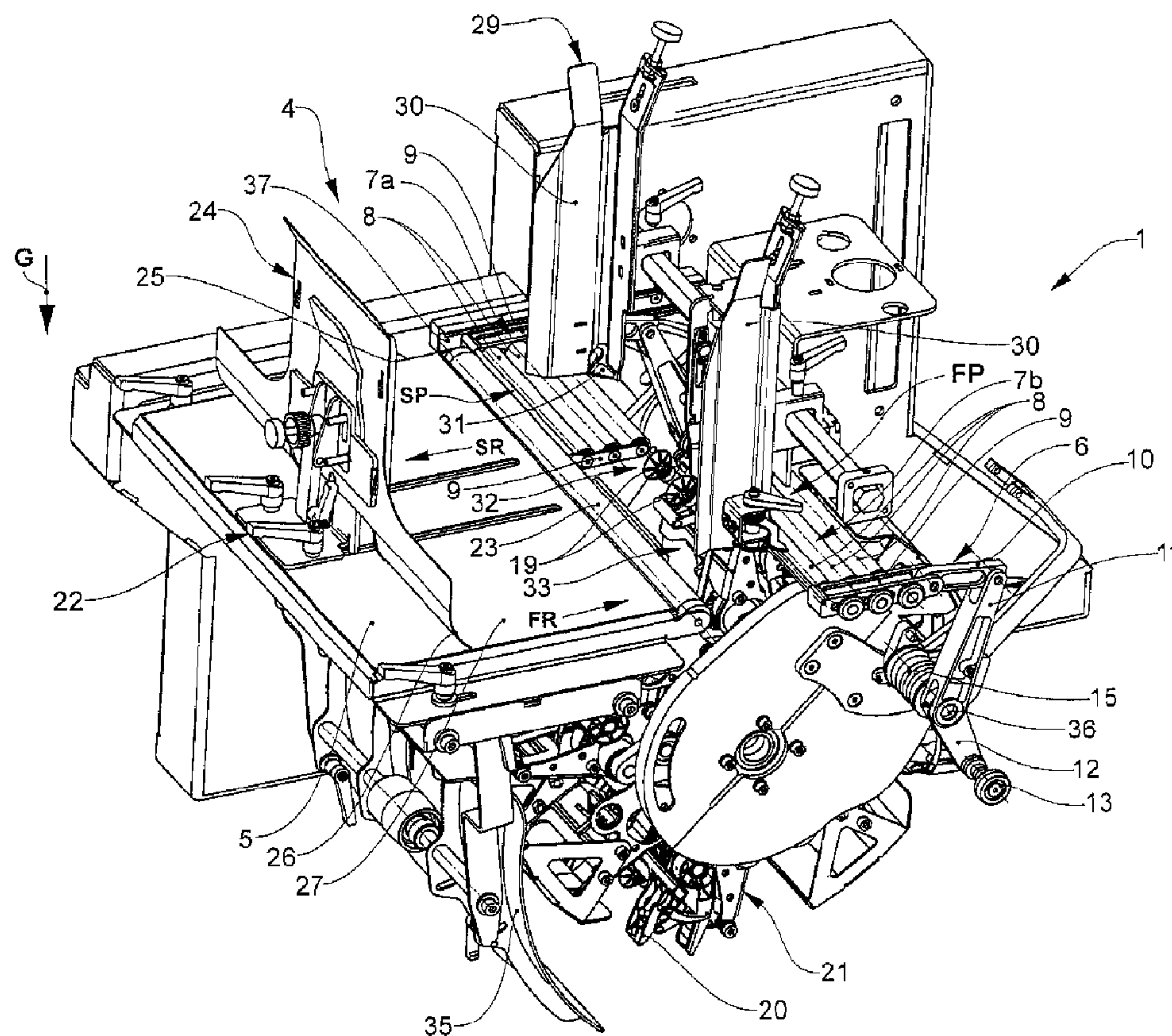
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(54) Titre : DISPOSITIF POUR SEPARER DES OBJETS FLEXIBLES BIDIMENSIONNELS INDIVIDUELS A PARTIR DE LA PARTIE INFERIEURE D'UNE PILE  
(54) Title: DEVICE FOR SEPARATING INDIVIDUAL, TWO-DIMENSIONAL, FLEXIBLE OBJECTS FROM THE LOWER SIDE OF A STACK



(57) Abrégé/Abstract:

The invention relates to a device for separating individual, two-dimensional, flexible objects from the lower side of a stack of such objects and for conveying the separated objects away from the stack. The device comprises a stack area with a support region,



(57) **Abrégé(suite)/Abstract(continued):**

and support means which support the stack from below in the support region, wherein the support means comprise a support roller arrangement of a plurality of support rollers. The device further comprises at least one separating member for separating the objects from the lower side of the stack in the support region. The support roller arrangement is part of a roller guidance device and is translatorily movable to and from between a support position (SP) and a release position (FP).

**ABSTRACT**

The invention relates to a device for separating individual, two-dimensional, flexible  
5 objects from the lower side of a stack of such objects and for conveying the separated objects  
away from the stack. The device comprises a stack area with a support region, and support  
means which support the stack from below in the support region, wherein the support means  
comprise a support roller arrangement of a plurality of support rollers. The device further  
comprises at least one separating member for separating the objects from the lower side of the  
10 stack in the support region. The support roller arrangement is part of a roller guidance device and  
is translatorily movable to and from between a support position (SP) and a release position (FP).

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DEVICE FOR SEPARATING INDIVIDUAL, TWO-DIMENSIONAL, FLEXIBLE  
OBJECTS FROM THE LOWER SIDE OF A STACK

FIELD OF THE INVENTION

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The invention relates generally to the conveying of two-dimensional, flexible objects, in particular printed products. More particularly, the invention relates to a device and method for separating such objects from the lower side of a stack consisting of these objects and for conveying the separated objects away from the stack.

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BACKGROUND OF THE INVENTION

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Such devices are known from the state of the art. Thus for example EP 1 226 083 B1 describes different embodiments of devices for separating individually printed products from the lower side of a printed product stack.

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According to a first embodiment that is shown in Figures 1 to 5 of EP 1 226 083 B1, the stack on the one hand is supported over part of the surface on a stationary rest table and on the other hand on a movably arranged support disk pair. The rest table and the support disk pair form a horizontal rest surface. The support disks are rotatably mounted about a vertical axis. The support disk pairing forms a release recess which in a release position below the stack forms an opening for the suction members and for bending away and pulling off the printed products. The release recess is periodically led through below the stack by way of the rotation of the support disks.

25

The rotating support disks on the stack lower side however produce a surface friction, i.e. they drag along the lower side of the stack. This procedure can lead to a damaging of the lowermost product and generally to disturbances in the process procedure, such as e.g. an uncontrolled displacement of the printed products in the stack.

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According to a second embodiment that is shown in Figures 7 to 9 of EP 1 226 083 B1, the device comprises a carrier wheel which is arranged below the stack and which rotates about an essentially horizontal axis. In each case, pairs of a sucker and a gripper assigned to the sucker are arranged on the periphery of the carrier wheel. Moreover, the device comprises a support means in the form of a roller carpet which on the one hand supports the stack from below and on the other hand comprises at least one removal opening, through which the respective lowermost printed product is gripped by a sucker, and can be bent against the gripper assigned to the sucker and transferred to this gripper, for separation from the stack. The roller carpet comprises a plurality of rollers, which are mounted in a freely rotatable manner, are aligned parallel to one

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another and horizontally, and are moved along a revolving (i.e., circulatory) path in a revolving device. The rollers thereby are moved through below the stack in a manner directed essentially equally with the suckers and grippers.

5           Another device is described in WO 2008/000099 A1, which serves the same purpose. Here too, a roller carpet is present, wherein the rollers of the roller carpet are fastened on a roller wheel which for example revolves on the same axis as the as the carrier wheel. The rollers run along a non-circular revolving path, along which the distance between the rollers is varied. The rollers are moreover articulately coupled on the roller wheel by way of levers, in a manner such  
10 that the levers are pivotable parallel to the rotation plane of the roller wheel. An unambiguous revolving or revolving path of the rollers and an unambiguous and always constant movement course of the rollers along this revolving path are defined by a roller guidance, which controls the movement of the rollers along the revolving path.

15           EP 1 254 855 B1 likewise shows a roller carpet, with which the rollers are fastened on a roller wheel. In order to open the roller carpet in a certain region, the rollers are tilted away and specifically about a tilt axis which runs essentially radially or secantially to the roller wheel. A cam control is provided for pivoting the rollers. A wheel rolling on a cam moves the rollers via a lever mechanism with several levers.

20           EP 2 128 055 A2 likewise describes a device for separating printed products from a lower side of a printed product stack and for conveying away the separated printed products. The device comprises a stack space with a support region, in which the stack is supported to the bottom. Moreover, the device likewise comprises a revolving roller carpet with a plurality of  
25 rollers which are freely rotatable about their longitudinal axis and are moved through the support region and thereby support the stack to the bottom. The device moreover comprises revolving sucker and gripper pairings for separating the objects from the lower side of the stack and for the transport-away of these. The rollers in the support region are moved past below the stack in a manner directed equally with the suckers and grippers. The rollers of the roller carpet are  
30 coupled onto a roller wheel. The coupling according to this embodiment is designed such that the rollers with their longitudinal axis are pivotable relative to the roller wheel.

          CH 637 087 describes a device for separating printed products from the lower side of a printed products stack and for conveying away the separated printed products. A support means  
35 in the form of a roller grate with a plurality of rollers is arranged below the stack. The rollers of the roller grate are likewise moved in a revolving device along a revolving path, wherein the revolving path runs through the support region of the stack.

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CH 598 106 likewise describes a device for separating printed products from the lower side of a printed product stack and for conveying away the separated printed products. Here too, the support means for supporting the stack comprise rollers which are moved in a revolving manner and which are led through the support region of the stack rest.

5

Common to the publications mentioned above is the fact that the rollers of the support means are led in a revolving manner in a revolving device and in this manner are moved through the support region of the stack rest. According to particular embodiments of the publication cited above, the rollers of the roller carpet are additionally pivotable with their longitudinal axis.

10

The described devices have the disadvantage that these have comparatively large dimensions and accordingly assume much space on account of the roller carpets or roller grates, which are guided in a revolving manner. If moreover the devices comprise pivotably guided support rollers, then these have even greater dimensions.

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However, for certain applications it can be advantageous or even necessary for the device to have a compact and thus space-saving construction manner. This object however can hardly be achieved with a circulatorily (revolvingly) guided support roller arrangement.

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#### SUMMARY OF EMBODIMENTS OF THE INVENTION

It is therefore an object of at least one embodiment of the present invention to put forward a device for separating printed products from the lower side of a printed product stack and for conveying away the separated printed products, said device comprising support means for supporting the object stack and for permitting a compact and space-saving construction manner of the device. The support means however should ensure operation of the device that is as disturbance-free as possible, even at high processing speeds.

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According to an aspect of the invention, the device comprises a stack area with a support region and support means supporting the stack from below in the support region, wherein the support means comprise at least one support roller arrangement of at least one support roller. Moreover, the device comprises at least one separating member for separating the objects from the lower side of the stack.

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Moreover, the invention also relates to a method for separating individual, two-dimensional, flexible objects from the lower side of a stack of such objects and for conveying the separated objects away from the stack by way of a device according to the invention.

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According to an aspect of the invention, the device for separating individual, two-dimensional, flexible objects from the lower side of a stack of such objects and for conveying the separated objects away from the stack, as already mentioned comprises:

- 5 - a stack area with a support region;
- support means supporting the stack from below in the support region, wherein the support means comprise at least one support roller arrangement with at least one support roller; as well as
- at least one separating member for separating the objects from the lower side of the stack,  
10 in the support region,

and wherein the support roller arrangement is part of a roller guidance device, and the support roller arrangement is movable periodically between a support position and a release position.

15 The support roller arrangement is movable in particular to and fro between the support position and the release position.

According to an aspect of the invention, the support roller arrangement is movable periodically as well as, at least in sections, translatorily, in particular movable to and fro. The  
20 support roller arrangement can also be movable periodically as well as exclusively translatorily, in particular movable to and fro.

Translatorily means a straight-lined or linear movement of the support rollers of the roller  
25 arrangement.

However, it is also possible for the support roller arrangement or their support rollers to be movable periodically at least in sections along a curved movement path, in particular movable to and fro. The support roller arrangement or its support rollers can also be movable periodically,  
30 exclusively along a curved movement path, in particular movable to and fro.

In the release position, the device in the support region below the stack forms a maximal release gap, through which gap the objects can be bent away downwards. The release gap preferably extends transversely to the movement direction of the support roller arrangement. The term "downwards" relates to the direction of gravity.  
35

In the support position however, the support roller arrangement is arranged in the region of the release gap below the stack. The support roller arrangement supports the stack to the bottom at least over part of the surface, in the support position,

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The device in the support position preferably likewise comprises a release gap which e.g. is so wide that this permits the transport away of a bent-away object below the stack area. This release gap however is significantly narrower than the maximal release gap in the release position. If a stationary support arrangement or a guide roller of the subsequently described type  
5 connecting to this is provided, then the release gap in the support position is formed between the stationary support arrangement and the guide roller.

The to and fro movement describes a movement of the support rollers or of the support roller arrangement in a release direction, in which the release gap opens or is enlarged, and in a  
10 support direction which is opposite the release direction and in which the release gap reduces again due to the moved back or retracted support roller arrangement.

The two-dimensional, flexible objects are preferably printed products such as newspapers, magazines, periodicals, brochures, advertisement attachments, individual sheets,  
15 leaflets, flyers etc.

The support means can comprise one, two or more than two support roller arrangements. If the support means comprise two support roller arrangements, then these can be arranged next to one another considered in the movement direction of the support roller arrangement.  
20 Moreover, the two support roller arrangements can be formed mirror-symmetrically to one another.

According to an aspect of the invention, the support rollers are moved exclusively translatorily to and fro. In particular, the support roller arrangement as a unit can be translatorily  
25 moved to and fro at least in sections, preferably exclusively.

The support roller arrangement, considered in the movement direction of the support roller arrangement, can comprise only one support roller. The support roller arrangement however preferably comprises two, three, four or more than four support rollers which are  
30 arranged one after the other in the movement direction of the support roller arrangement. The axes or the rotation axes of the support rollers run preferably transversely to the movement direction of the support roller arrangement. The support rollers are preferably rotatably mounted in lateral holders. The lateral holders can be receiver profiles.

35 The support roller arrangement can further comprise one or more support rollers on a common rotation axis.

According to an aspect of the invention, the roller guidance device comprises two support roller arrangements of the type described above, which are arranged next to one another

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considered in the movement direction. A central gap, through which the at least one separating member can be moved towards the support region for the purpose of gripping the lowermost object of the stack, is formed between the support roller arrangements. The central gap preferably extends along the movement direction of the support roller arrangement.

5

According to an aspect of the invention the support roller arrangements or their lateral holders are linearly movably guided in a guidance device which is actively connected to the lateral holders. The holders thereby preferably have the function of a carriage and with the guidance device form a carriage guide. The guidance device can e.g. comprise guide profiles which receive the holders in a displaceably guided manner.

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According to an aspect of the invention the support roller arrangement is connected to the device via a link mechanism. The link mechanism is designed such that this converts a non-linear, e.g. rotary cam movement into a translatory movement of the support roller arrangement.

15

According to an aspect of the invention the device comprises control means, by way of which the movement of the support rollers or of the support roller arrangement can be controlled cyclically synchronously to the separating procedure. Cyclically synchronously to the separating procedure, in particular means a movement of the support roller arrangement which is cyclically synchronous to the movement of the separating members. The cyclically synchronous movement is yet explained in more detail further below in combination with the description of the method.

20

According to an aspect of the invention the control means comprise a control cam which is moved for example by a cam roller. The cam roller can be actively connected to the roller guidance device via a cam arm. The guidance of the cam roller along the control cam effects a deflection of the cam arm, wherein the deflection of the cam arm into a translatory movement of the support rollers or of the support roller arrangement is effected via a link mechanism.

25

The control cam can e.g. be coupled to the take-over device which is hereafter described in more detail and in which the separating members and, as the case may be also transport members, are revolvingly moved.

30

The movement of the support roller arrangement can however also be effected via an independent drive. This drive however is controlled preferably via the central machine control, so that a cyclically synchronous movement of the support roller arrangement with the movement of the separating elements or the transport elements is possible.

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According to an aspect of the invention the roller guidance device can comprise biasing means which are capable of being able to exert a restoring force in the direction of the support

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position or release position of the support roller arrangement. This means that the support roller arrangement, given the absence of an active control movement, by way of the restoring force of the biasing means is held in a restoring position which in particular corresponds to the support position or the release position. Basically a restoring position between the support position and  
5 the release position is also possible. The biasing means can for example comprise a rotary spring arranged on a rotation pivot of the link connection.

The support roller arrangement is moved via the pivot movement of the cam arm against the restoring force, out of the restoring position, for executing a movement in the support  
10 direction or in the release direction.

According to an aspect of the invention, the device comprises a blowing air feed device, by way of which blowing air can be blown in between a lowermost object of a stack which at least partly is bent away by way of the separating member, and the stack. The blowing air is  
15 preferably applied in the form of a thrust of compressed air. This is preferably effected simultaneously or promptly with the bending or pulling away of the object from the stack lower side. Promptly means somewhat before the pulling away or somewhat before or after the bending away of the object, with regard to time and with respect to the duration of the operating cycle.

20 Thus control means can be provided, by way of which the blowing air can be blown in, in a controlled manner. The control means in particular are capable of blowing in the blowing air cyclically synchronously to the bending-away or the pulling-away of the object from the stack.

25 Moreover, the control means in particular are also in the position of producing a pulse-like thrust of compressed air.

An air cushion which simplifies the detachment of the lowermost object from the lower side of the stack is formed by way of blowing in blowing air between the lowermost object and  
30 the stack. The mentioned air cushion specifically effects a reduction of the static friction, so that the lowermost object can be singularised from the stack without any problem. In particular, by way of this measure, one prevents several objects being simultaneously detached from the stack due to the static friction prevailing between the objects of the stack.

35 According to an embodiment, the blowing air feed device comprises a blowing air channel. This in particular runs transversely to the movement direction of the support roller arrangement. The blowing air channel can be designed as a tube which in its lateral surface comprises exit openings for blowing air. The exit openings are accordingly directed towards the lowermost object of the stack.

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According to an aspect of the invention the blowing air channel is part of the support roller arrangement. Considered in the support direction, it is preferably arranged in front of the frontmost support roller of the support roller arrangement or itself forms the frontmost support roller. The blowing air channel preferably runs parallel to the rotation axes of the support rollers.

Support rollers can be rotatably mounted on the blowing air channel itself. The blowing air channel according to this example is designed as a hollow pivot.

The term "blowing air" here is representative for any gas or gas mixture which is suitable for reducing the static friction in the described way and manner.

According to an aspect of the invention, the support means moreover comprise a stationary support arrangement which together with the support roller arrangement located in the support position, forms a common support surface. The support surface of the stationary support arrangement and/or of the support roller arrangement is preferably aligned horizontally or essentially horizontally. Essentially horizontally means that the support surface with respect to the horizontal has an inclination angle of maximal  $10^\circ$  (angle degrees). The support surface is preferably present as a support plane.

According to an aspect of the invention the stationary support arrangement forms a stationary rest surface. The support arrangement can be a closed rest surface, e.g. in the form of a rest plate or rest sheet-metal piece. The rest surface can also be broken through.

According to an aspect of the invention a stationary guide roller can be arranged on the support arrangement or the stationary rest surface at the terminating edge, which faces the support roller arrangement. The guide roller is rotatably mounted. The guide roller serves as a guide for the lowermost object of the stack that is to be separated away. The guide roller leads the objects transported away from the stack on its path downwards. This is effected by way of the object being led over the guide roller and deflected downwards. The guide roller thereby is set into a rotation by the object being moved past.

As such, the release gap is now arranged between the support arrangement or the guide roller, and the support roller arrangement located in the release position.

According to an aspect of the invention the device comprises a plurality of separating members. The separating members are preferably arranged on a take-over device arranged below the support region. The separating members are preferably arranged over the perimeter on the

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take-over device. The take-over device can for example be a revolving carrier wheel, on whose radial peripheral region the separating members are arranged.

5 According to an aspect of the invention, the device comprises a plurality of transport members for transporting the separated objects away from the stack. The transport members are preferably arranged on a take-over device arranged below the support region. The transport members are preferably arranged over the perimeter on the take-over device. The take-over device can for example be a revolving carrier wheel, on whose peripheral region the transport members are arranged.

10

The separating members and transport members can be arranged on the same take-over device or on the same carrier wheel. The separating members and transport members from a functional viewpoint in each case preferably form pairings.

15

The functional interaction of the separating member and transport member is hereinafter described in more detail with regard to the method.

20

According to an aspect of the invention, the device comprises deactivation means, by way of which the movement of the support roller arrangement can be reduced with a continued revolving movement of the at least one separating member. The deactivation means are preferably designed such that the pivot movement of the cam arm does not act on the link mechanism of the roller guidance device, given a deactivation of the movement of the support roller arrangement. The deactivation means can e.g. be locking means or coupling means.

25

According to an aspect of the invention, the device comprises rear stack area limitation means. The rear stack area limitation means are arranged at that end of the stack area, which is away from the support roller arrangement. The rear stack area limitation means are preferably designed in the form of a stack area limitation wall. The stack area limitation wall can form a continuous or broken-through limitation surface or a limitation surface formed from part surfaces.

30

The stack area limitation wall in particular can comprise a vertical or essentially vertically aligned limitation surface. Essentially vertically aligned means that the limitation surface has an inclination angle of maximal 10° (angle degrees) with respect to the vertical. The vertical or essentially vertical limitation surface is preferably designed in a plane manner.

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According to an aspect of the invention a terminating limitation surface, which is angled or bent towards the support roller arrangement, can connect to the vertical or essentially vertical limitation surface towards the support region. This terminating limitation surface is preferably

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likewise present as a wall section. The terminating limitation surface of the above-mentioned design has the effect that the lowermost object with its end section directed to the rear stack area limitation means is lifted from the support surface, in particular from the stationary support arrangement or is at least relieved. The static friction between the lowermost object and the support surface can be reduced by way of this.

The invention further also relates to method for separating individual, two-dimensional, flexible objects from the lower side of a stack of such objects and for conveying the separated objects away from the stack by way of a previously mentioned device.

The description of the method is effected beginning with a support roller arrangement which is located in a support position for supporting the stack. If the support means comprise a stationary support means arrangement, as the case may be with a guide roller, then the support roller arrangement in the support position is preferably arranged directly next to the support means arrangement or the guide roller and with this forms a continuous support surface.

Starting with the support position mentioned above, the method according to the invention is characterised by the following steps:

- moving the support roller arrangement along a release direction out of the support position resulting in the enlargement of a release gap

The support roller arrangement with this procedure in particular is moved into a release position. The support roller arrangement in particular is moved away from the stationary support arrangement or from the guide roller. The release gap opens or widens thereby between the stationary support arrangement or the guide roller, and the support roller arrangement. The movement of the support roller arrangement is preferably translatory at least in sections and runs in particular parallel to the support surface.

- gripping the lowermost object of the stack by the separating member

If the separating member is designed as a suction member, then the suction member moved from below into the support region sucks firmly on the lower side of the lowermost object. This is particularly the case in an end section supported by the support roller arrangement. The separating member preferably grips the object whilst the moving support roller arrangement enlarges the release gap.

- separating the lowermost object from the stack by way of bending the object away from the stack lower side into the release gap.

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The separating member which firmly holds the lowermost object preferably bends this downwards away from the stack by way of a pivot movement. The separating member is pivotably designed via suitable pivot means. The object is preferably bent away from the stack lower side whilst the support roller arrangement moves in the support direction.

The bending-away is comparable to a peeling procedure. In this manner, the static friction acting in a surfaced manner between the lowermost object and the stack is avoided, at least on initiating the separating procedure. The object at least partly can be bent away from the stack over the width of the release gap.

- moving the support roller arrangement in a support direction opposite to the release direction, resulting in the reduction of the release gap.

The support roller arrangement with this procedure in particular is moved into the support position. The support roller arrangement is moved in the support direction back into its support position after or during the bending of the object away from the stack. The movement of the support roller arrangement is effected via suitable control means, useful in a cyclically synchronous manner to the movement of the separation members and as the case may be the transport members.

According to an aspect of the method, the support roller arrangement already during the bending of the lowermost object away from the stack lower side is moved back from the release position in the direction of the support position. The support roller arrangement with this procedure is moved into the gap between the lowermost object and the stack in the direction of the support position.

With the presence of a stationary support arrangement, the lowermost object at this point in time, with a section of the object, is still arranged between the support arrangement and the stack. The mentioned object section forms an object part surface, with which the object lies on the stationary support arrangement.

- transporting the object away through the release gap

In a further step, the complete transport of the lowermost object away from the stack is effected. The transport-away through the release gap in particular is effected from below. For this, the lowermost object is completely pulled from the stack and transported away below the stack, before, on or after reaching the support position of the support roller arrangement.

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5 If this procedure is not effected until on or after reaching the support position of the support roller arrangement, then a release gap is formed between the support roller arrangement and the stationary support arrangement or the guide roller. This however is significantly narrower than the maximal release gap in the release position, since space must be provided for the latter for bending away the lowermost object downwards out of the stack area.

10 One can also envisage a clamping release gap being formed in the support position and being designed so large that the guide roller and the frontmost roller of the support roller arrangement which is arranged towards the guide roller lead the object on both sides through the release gap in a clamping manner.

15 With this procedure, the separating member now moves the lowermost object as a result of its continued movement along its revolving path preferably further away from the stack. The object is subsequently transported away downwards through the mentioned release gap.

20 If the device moreover comprises transport members which are co-moved along a revolving path likewise running below the support region, then the separating element transfers the object to a transport member cooperating with the separating member, during or subsequently to the bending-away.

25 If the support means form a stationary support means arrangement of the type described above, then the partly bent-away object with its remaining object section must still be pulled out between the stack and the stationary support means arrangement.

30 The transport member pulls the lowermost object completely from the stack as a result of its continued movement along its revolving path and transports this away downwards. The transport member can yet additionally execute a pivot movement via suitable pivot means, for assisting the transport-away and for treating the object in a gentle manner.

35 The device can comprise a conveying-away device, such as e.g. a belt conveyor, to which the objects singularised from the stack are transferred by the transport member. The objects which are singularised from the stack and transported away can be transferred e.g. individually or as an imbricate stream to a belt conveyor. The conveying-away device can however also contain a gripper conveyor.

On pulling the object section remaining between the stack and the stationary support means arrangement away from the stack, one must take the problem of the static friction into account.

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For this, the device according to a further development of the invention preferably comprises a blowing air feed device. Blowing air is blown with this between the at least partly bend-away, lowermost object and the stack, during the bending of the lowermost object away from the stack. An air cushion reducing the static friction is formed between the lowermost  
 5 object and the stack by way of the feed of blowing air. This permits a reliable pulling of the object away from the stack. The blowing air is preferably blown in via at least a part of the total width of the object transverse to the movement direction of the support roller arrangement.

The present device is simple in its construction and operation, in comparison to the  
 10 initially mentioned devices from the state of the art. The device can moreover be designed in a very compact and accordingly space-saving manner due to its particular mechanical manner of functioning. For this reason, the device according to the invention is in particular suitable for processing installations with restricted spatial conditions. Moreover, the present device is inexpensive and simple with regard to manufacture, in comparison to the devices with complex  
 15 roller revolving guides, known from the state of the art.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The subject-matter of the invention is hereinafter explained in more detail by way of  
 20 preferred embodiment examples which are represented in the accompanying drawings. There are shown in:

Figure 1: a perspective view of a device according to the invention;

Figure 2: a lateral view of the device according to the invention and according to Figure 1;

25 Figure 3a-3d: the course of the method according to the invention, by way of two lateral views of the device according to Figure 2;

Figure 4: a part view of the device according to Figures 1 to 3, from the region of the support roller arrangement;

30 Figure 5: a part view of the device according to Figure 1 to 3, from the region of the support roller arrangement, with an alternative embodiment of the support roller arrangement.

Basically, the same parts are provided with the same reference numerals in the figures.

#### 35 DETAILED DESCRIPTION OF THE DRAWINGS

Figures 1 to 4 show a specific embodiment of the present invention. Figures 3a to 3d in particular show the method course with regard to the separation and transport of objects away from a stack.

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Figure 5 shows an alternative embodiment of a support roller arrangement and of a blowing air device which however in the device according to the Figures 1 to 4 can be applied as an alternative embodiment to the support roller arrangement and blowing air device which are shown there.

5

The device 1 forms a stack area 4, which receives a stack 3 of two-dimensional, flexible objects 2. The flat sides of the objects 2 are orientated perpendicularly to the gravity direction G. The object 2a of the stack 3 which is lowermost in the gravity direction G lies with its flat side on support means supporting the stack 3 from below. The support means for this form a plan support means surface.

10

The support means comprise a stationary support arrangement 22 which forms a type of rest table for the part-surfaced support of the stack 3. Part-surfaced means that the stationary support arrangement 22 supports the stack only over a first part of the surface side of the lowermost object 2a. The rest table forms a support surface 27.

15

A stationary, rotatably mounted guide roller 23 connects to the stationary support arrangement 22 in a release direction FR which is hereinafter yet described in more detail. This guide roller is part of the stationary support arrangement 22. Moreover, considered in the release direction FR, two support roller arrangements 7a, 7b of a roller guidance device 6 which are designed in a mirror-symmetrical manner and are arranged next to one another and distanced to one another, connect to the stationary guide roller 23. The support roller arrangements 7a, 7b in each case likewise form a part of the support surface 27 for the stack 3. The support surface 27 of the support roller arrangements 7a, 7b lies in the same plane as the support surface 27 of the stationary support arrangement 22.

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A central gap 32 is formed between the two support roller arrangements 7a, 7b, through which gap separating members 19 arranged on a carrier wheel 21 can be moved into the support region. The carrier wheel 21 is arranged below the support region 5.

30

The separating members are present as suction members 19. These, as described in more detail hereinafter, are led by the rotating carrier wheel 21 along their revolving path in a cyclically controlled manner into the support region 5 and out of this again, for the purpose of gripping the objects 2a from the stack 3. The suction members 19 according to Figure 1 comprise two suction disks. The suction members however can also comprise only one or more than two suction disks.

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Transport members in the form of grippers 20 which are likewise moved by way of the rotating carrier wheel 21 along a revolving path are likewise attached onto the carrier wheel 21.

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A suction member 19 and a gripper 20 in each case form a pairing. In total four pairs with a suction member and gripper, are arranged along the periphery of the carrier wheel in a manner distanced to one another, in the present embodiment example.

5           The pairing is of a functional type and is characterised in that the suction member 19 transfers an object 2a bent away from the stack 3, to the gripper 20 of the pairing assigned to this, for the transport away.

10           The two support roller arrangements 7a, 7b are then periodically and translatorily movably guided between a support position SP and a release position FP. In the support position SP, the support roller arrangement 7a, 7b connects to the stationary support arrangement 22 or to its guide roller 23. The support arrangement 22 and the support roller arrangement 7a, 7b form a common support surface. This support surface is continuous in the broadest sense.

15           In the release position FP, the support roller arrangement 22 is maximally distanced to the stationary support arrangement 22. A release gap 33 is formed between the support arrangement or the guide roller 23, and the support roller arrangement 7a, 7b.

20           In Figure 1, the one support roller arrangement 7a, 7b of the roller guidance device 6 for illustration is in the support position SP and the support roller arrangement 7a, 7b arranged on the other side of the central gap 32 is shown in the release position FP. Of course both support roller arrangements 7a, 7b are led synchronously in regular operation of the device.

25           The support roller arrangement comprises three support rollers 8 arranged one after the other in the release direction FR. The exact number of support rollers however is not essential to the invention. The support rollers 8 are rotatably mounted in laterally arranged roller carriers 9. The roller carriers 9 are designed as longitudinal profiles which extend along the release direction FR.

30           The roller guidance device 6 moreover comprises lateral guide profiles 37 which are part of a carriage guide. The roller carriers 9 designed as carriages are thereby led in the guide profiles 37.

35           The periodic and translatory movement of the support roller arrangement 7a, 7b is controlled via mechanical cam guidance. For this, the support roller arrangement 7a, 7b is coupled via a first and second link arm 10, 11 and via a link shaft 36, to a cam arm 12. A rotatably mounted cam roller 13 is attached at the distal end of the cam arm 12. The cam roller 13 is actively connected to a control cam 14. The control cam 14 is connected to the carrier

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wheel 21 in a rotationally fixed manner and accordingly rotates with the carrier wheel 21. The cam roller 13 accordingly rolls on the cam path of the control cam 14 which moves past.

For executing a translatory movement, the control cam 14 via the rolling cam roller 13  
 5 activates a pivot movement of the cam arm 12. The rotational pivot movement 13 of the cam arm 12 is converted via the link connection of the first and second link arm 11, 12 into a periodic and translatory movement of the support roller arrangement 7a, 7b.

The cam arm 12 for this is connected to a link shaft 36 in a rotationally fixed manner.  
 10 The second link arm 11 of the link connection in contrast is rotatably mounted on the link shaft 36. The link shaft 36 is led by a biasing means in the form of a rotatory spring 15. The rotary spring 15 bears with its first limb on a first bolt 28 of a component co-rotating with the link shaft 36. Moreover, the rotary spring 15 with its second limb bears on a second bolt 28 connected to the second link arm 11.

15

The pivot movement of the cam arm 12 causes a rotation of the shaft 36 which via the first bolt and the first limb exerts a torsion movement onto the rotary spring 15. The torsion movement is transmitted from the rotary spring 15 via the second limb and the second bolt 28 onto the second link arm 11. The second joint arm 11 is set into a rotation movement by way of  
 20 this.

The rotation movement of the second link arm 11 now moves the first link arm 10 which is articulately attached on the distanced end of the second joint arm 11, along an arc-shaped movement path. The first joint arm 10 with its other end is articulately connected to the support  
 25 roller arrangement 7a, 7b, i.e. to the roller carrier 9 and transmits the movement into a translatory movement of the support roller arrangement 7a, 7b along the carriage guide.

The rotary spring 15 moreover due to its biasing can exert a restoring force in the form of a torque onto the second link arm 11. This restoring force has the effect that the support roller  
 30 arrangement 7a, 7b is guided via the link arrangement 10, 11 into the release position SP.

The device moreover comprises deactivation means in the form of blocking or locking means, which are to prevent the movement of the link arms 10, 11 and thus the movement of the support roller arrangement 7a, 7b out of the support position SP. The blocking or locking means  
 35 are necessary, if despite the separating member 19 continuing to revolve, no objects 2a are to be pulled from the stack 3.

The control cam 14 which rotates further with the carrier wheel 21, although continuing to exert a control movement of the cam arm 12, the torsion moment exerted by the pivot

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movement of the cam arm 12 onto the rotary spring 15 is however accommodated and compensated by the rotary spring 15. The rotary spring 15 is additionally tensioned by this procedure.

5           The stack area 4 in its rear end lying opposite to the release direction FR is limited by rear stack area limitation means 24. The stack area limitation means are present as a stack area limitation wall 24. The stack area limitation wall 24 forms a vertically aligned limitation surface 25. A terminating limitation surface 26, which is bent towards the support roller arrangement 7a, 7b connects onto the vertical limitation surface 25 towards the support region 5.

10

          The stack area moreover is limited in its front end lying in the release direction FR by way of front stack area limitation means 29. The front stack area limitation means 29 comprise vertically arranged angle elements 30 which define a stack area limitation in the corner regions of the rectangular objects 2 of the stack 3. The angle elements 30 at their lower termination each  
15           comprise a corner support element 31. These form a rest surface for the corner regions of the lowermost object 2a. The size of the corner support elements 31 and accordingly also the size of the rest surface are dimensioned and limited in a manner such that the objects 2a can be pulled away downwards via the corner support elements 31 without any problem.

20

          Adjustment means are moreover provided, which permit an adjustment of the front and rear stack area limitation means 24, 29. In this manner, the stack area 4 can be adapted to the different object formats by way of adjusting the stack area limitation means 24, 29. The adjustment mechanism is not dealt with in more detail at this location, since it is not essential to the invention.

25

          The method shown in Figures 3a to 3d for singularising objects from a stack and for transporting these away from takes its course as follows.

          In an initial position, the support roller arrangement 7a, 7b is arranged in its support  
30           position SP, in which this directly connects to the stationary support arrangement 22 or to its guide roller 23. I.e., in the support position SP, no or a narrow gap is formed between the support arrangement 22 or the guide roller 23, and the support roller arrangement 7a, 7b.

          For removal of the lowermost object 2a from the stack 3, a suction member 19 moved  
35           along a revolving path on the carrier wheel 21 is now led up and onto the lower side of the lowermost object 2a in its end section supported by the support roller arrangement 7a, 7b. For this, the suction member 19 is moved through the central gap 32 between the two support roller arrangements 7a, 7b.

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The support roller arrangement 7a, 7b, simultaneously or even before this, is moved in the release direction FR away from the stationary support arrangement 22. A release gap 33 opens (see Figure 3a).

5 The suction member 19 grips the lowermost object 2a on its front end section and bends this downwards away from the stack lower side. The bending-away downwards is effected via a superimposed movement, consisting of a pivot movement of the suction member 19 about a pivot axis as well as a rotation movement of the suction member 19 with the carrier wheel 21. The front end section of the object 2a is accordingly led downwards through the release gap 33  
10 (see Figure 3b).

With regard to the objects 2 pulled away from the stack 3, it is the case of multi-page printed products each with a fold and a cut edge. The objects 2a are then bent away downwards with the fold in front and transported away.

15 During the bending-away of the lowermost object 2a by way of the suction member 19, the support roller arrangement 7a, 7b is moved back in the support direction SR opposite to the release direction FR, back in the direction of the support position SP. The support roller arrangement 7a, 7b thereby moves in between the bent-away object 2a and the stack 3. In this  
20 manner, an as early as possible support of the stack 3 in the region of the release gap 33 is ensured, specifically already before the lowermost object 2a has already been pulled away (see Figure 3b).

Moreover, by way of a blowing air feed device 16, blowing air is blown in between the at  
25 least partly bent-away lowermost object 2a and the stack lower side, during the bending-away of the lowermost object 2a. By way of this, an air cushion reducing the static friction is formed between the lowermost object 2a and the stack lower side, during the bending-away of the lowermost object 2a. The reduction of the static friction permits a reliable removal of the lowermost object 2a from the stack lower side.

30 A first embodiment variant of a blowing air device 16 is shown in Figure 4, which shows an enlarged part detail from the region of the support roller arrangement 7a. This comprises a blowing air tube 17 arranged transversely to the movement direction of the support roller arrangement 7a and having air exit openings 38 which are directed to the stack lower side (not  
35 shown). The blowing air tube 17 is designed as part of the support roller arrangement 7a and is arranged running in front of the frontmost support roller 8 seen in the support direction SR as well as parallel to the rotation axes of the support rollers 8. The blowing air 18 on retracting or moving back the support roller arrangement 7a in the support direction SR is now blown through

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the air exit openings 38 towards the gap opening between the bending-away, lowermost object 2a and the stack lower side.

5 An alternative embodiment of a blowing air feed device 46 is shown in Figure 5. The blowing air feed device 46 analogously to the embodiment variant according to Figure 4 comprises a blowing air tube 47 which is arranged transversely to the movement direction of the support roller arrangement 57a and having air exit openings 38 directed towards the stack lower side (not shown). The blowing air is fed via a blowing air flexible tubing to the blowing air tube.

10 The blowing air tube 47 is likewise designed as part of the support roller arrangement 57a and, considered in the support direction SR is arranged running in front of the support rollers 8 as well as parallel to the rotation axis of the support rollers 8. Now according to this embodiment, several additional support rollers 48 which are rotatably mounted and are arranged in a manner distanced to one another along longitudinal axis of the blowing air tube 47 are  
15 arranged on the blowing air tube 47. The blowing air tube 47 forms a roller pivot designed as a hollow pivot, for the additional support rollers 48. The mounting of the additional support rollers 48 on the roller pivot can be effected via suitable ball bearings. The individual, additional support rollers 48 which are arranged next to one another transversely to the movement direction of the support roller arrangement 57a likewise serve for the support of the stack 3 in the support  
20 position SP.

The blowing air 18 with this embodiment, on retracting the support roller arrangement 57a in the support direction SR, is now blown through air exit openings 38 towards the gap opening between the bending-away lowermost object 2 and the stack lower side. The air exit  
25 openings 38 are arranged between the additional support rollers 48.

In a further development of the method, the suction member 19 now transfers the object 2a to a gripper which is likewise co-moved in a revolving manner with the carrier wheel 21. The gripper 20 now pulls the gripped object 2a downwards completely away from the stack 3. With  
30 this procedure, the object 2a is pulled away downwards around the guide roller 23 (see Figure 3c and 3d).

The support roller arrangement 7a, 7b again reaches its support position SP with the pulling of the object 2a away from the stack 3. A new operating cycle can begin.

35

The transferring suction member 19 and the taking-over gripper 20 form a pairing. The manner of operation of the suction members 19 and grippers 20, which are led in a revolving manner on a common carrier wheel 21, is already known from the state of the art mentioned in the description introduction and is therefore no longer described in all details at this location.

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The translatory movement of the support roller arrangement 7a, 7b is of course controlled in a cyclically synchronous manner with the movement of the suction members 19 and grippers 20. The movement of the suction members 19 as well as of the grippers 20 along their revolving path and, as the case may be, the pivot movement of the suction members and grippers about a pivot axis and the closure and opening movement of the grippers can likewise be effected via control cams.

The device 1 moreover also comprises a damping element 34 in the form of an elastic loop which damps the radial deflection of the trailing end section of the object 2a, said deflection being produced by way of pulling down the object 2a.

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## CLAIMS

What is claimed is:

- 5 1. A device for separating individual, two-dimensional, flexible objects from the lower side of a stack of such objects and for conveying the separated objects away from the stack, comprising:
- 10 a stack area with a support region;  
 support means which support the stack from below in the support region, wherein the support means comprise at least one support roller arrangement with at least one support roller; and  
 at least one separating member for separating the objects from the lower side of the stack, wherein  
 the at least one support roller arrangement is part of a roller guidance device, and the support roller arrangement is periodically movable between a support position (SP) and a release position (FP).
- 15 2. A device according to claim 1, wherein the support roller arrangement at least in sections is translatorily movable.
- 20 3. A device according to claim 1 or 2, wherein the support roller arrangement at least in sections is movable along an arcuate movement path.
4. A device according to any one of claims 1 to 3, comprising control means, wherein by way of said control means the movement of the support roller arrangement is controlled in a cyclically synchronous manner to the separating procedure.
- 25 5. A device according to any one of claims 1 to 4, comprising biasing means for exerting a restoring force in the direction of the support position (SP) or release position (FP) of the support roller arrangement.
- 30 6. A device according to any one of claims 1 to 5, comprising a blowing air feed device for blowing air in between a lowermost object of the stack, when the lowermost object is at least partly bent away by the separating member, and the stack.
- 35 7. A device according to any one of claims 1 to 6, wherein the support means comprises a stationary support arrangement, which together with the support roller arrangement located in the support position (SP) forms a common support surface for the stack.

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8. A device according to any one of claims 1 to 7, comprising a stationary guide roller disposed in the support region and which connects to the stationary support arrangement towards the support roller arrangement.

5 9. A device according to any one of claims 1 to 8, wherein the at least one separating member is arranged on a take-over device arranged below the support region.

10. A device according to any one of claims 1 to 8, comprising at least one transport member for transporting the separated objects away from the stack, wherein the at least one transport  
10 member is arranged on a take-over device arranged below the support region.

11. A device according to claim 9, comprising deactivation means, by way of which the movement of the support roller arrangement can be stopped given a continued revolving movement of the at least one separating member.

15

12. A device according to any one of claims 1 to 11, comprising rear stack area limitation means, wherein the rear stack area limitation means forms an essentially vertical limitation surface, and towards the support region comprises a wall section which is angled or bent in the direction of the support roller arrangement.

20

13. A method for separating individual, two-dimensional, flexible objects from the lower side of a stack of such objects and for conveying the separated objects away from the stack using the device according to any one of claims 1 to 12, wherein the support roller arrangement is located in the support position (SP) for supporting the stack, the method comprising:

25 moving the support roller arrangement along a release direction (FR) out of the support position (SP) resulting in the enlargement of a release gap;

gripping the lowermost object of the stack by way of the separating member ;

separating the lowermost object from the stack by way of bending the object away from the stack lower side into the release gap;

30 moving the support roller arrangement in a support direction (SR) opposite to the release direction (FR) resulting in the reduction of the release gap; and

transporting away the object through the release gap.

14. A method according to claim 13, wherein the support roller arrangement is moved in the  
35 support direction (SR) during the bending of the object away from the stack lower side.

15. A method according to any one of claims 13 to 14, wherein the separating member grips the object whilst the moving support roller arrangement enlarges the release gap.

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16. A method according to any one of claims 13 to 15, wherein the object is bent away from the stack lower side whilst the support roller arrangement moves in the support direction (SR).

17. A method according to any one of claims 13 to 16, wherein the device comprises control means, and wherein the movement of the support roller arrangement, via the control means, is effected in a cyclically synchronous manner with the separating procedure.

18. A method according to any one of claims 13 to 17, wherein the device comprises a blowing air feed device, and wherein air is blown in between the at least partly bent-away, lowermost object and the stack, during the bending of the lowermost object away from the stack, by way of the blowing air feed device.

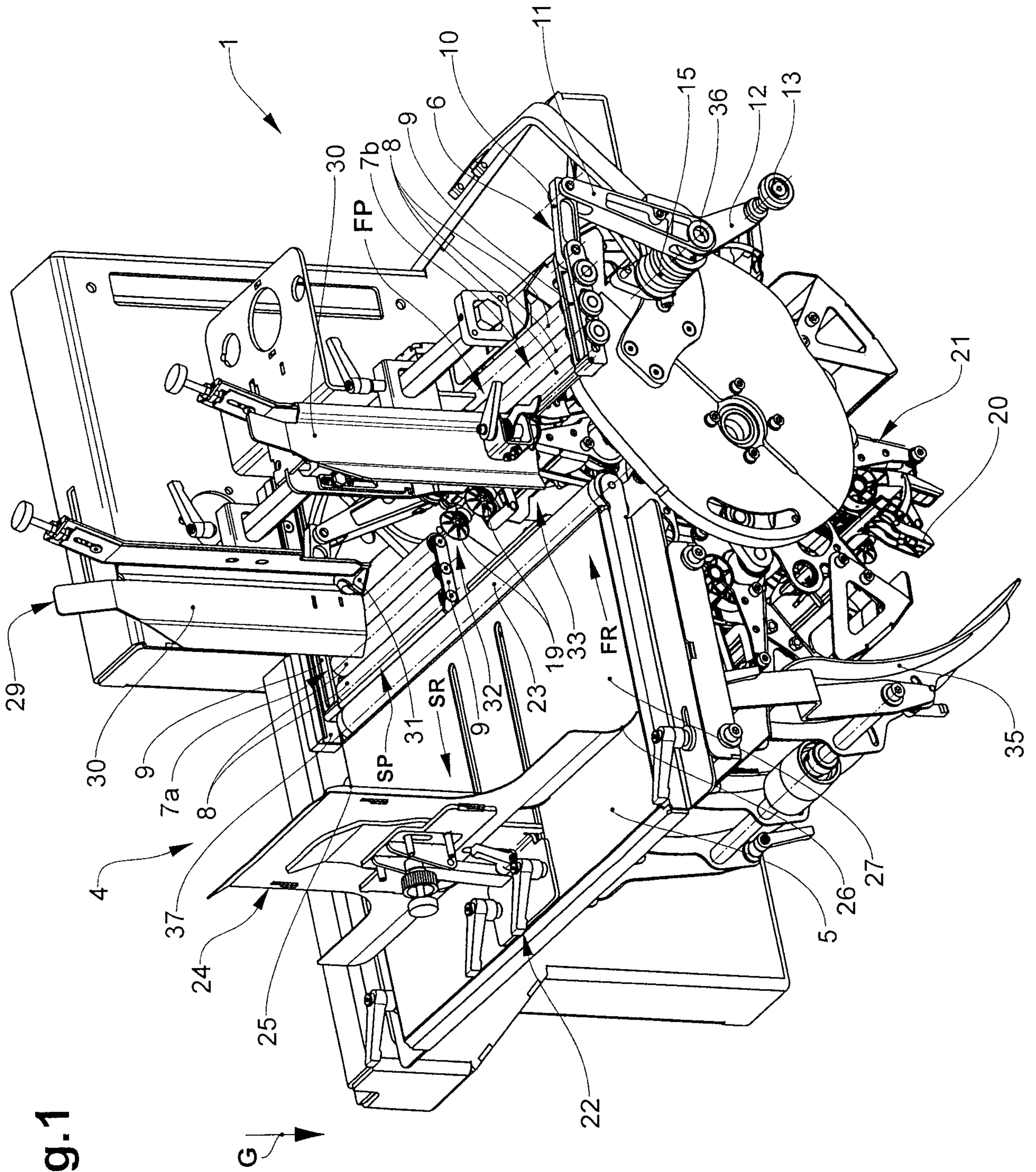


Fig.1

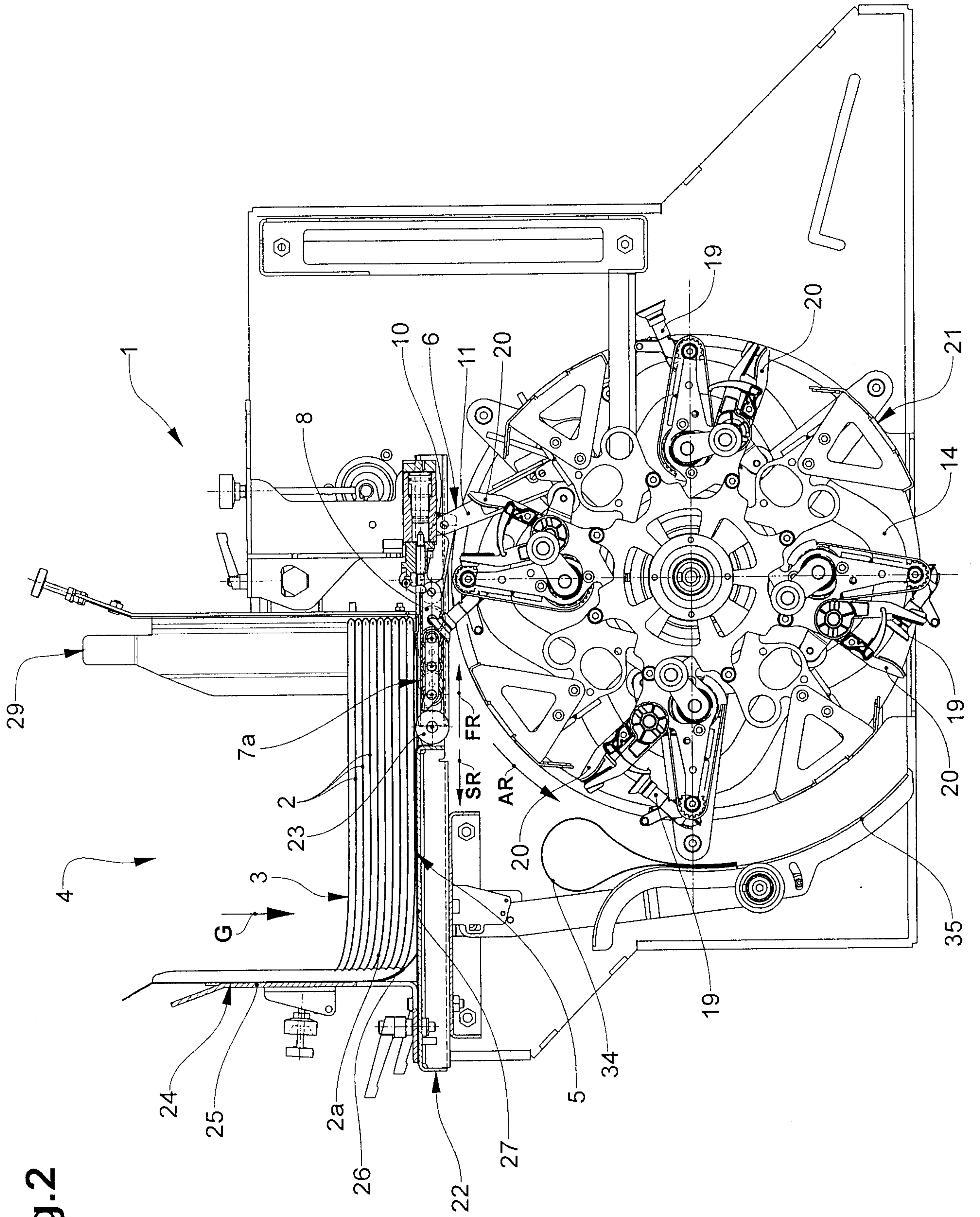


Fig. 2

Fig.3a

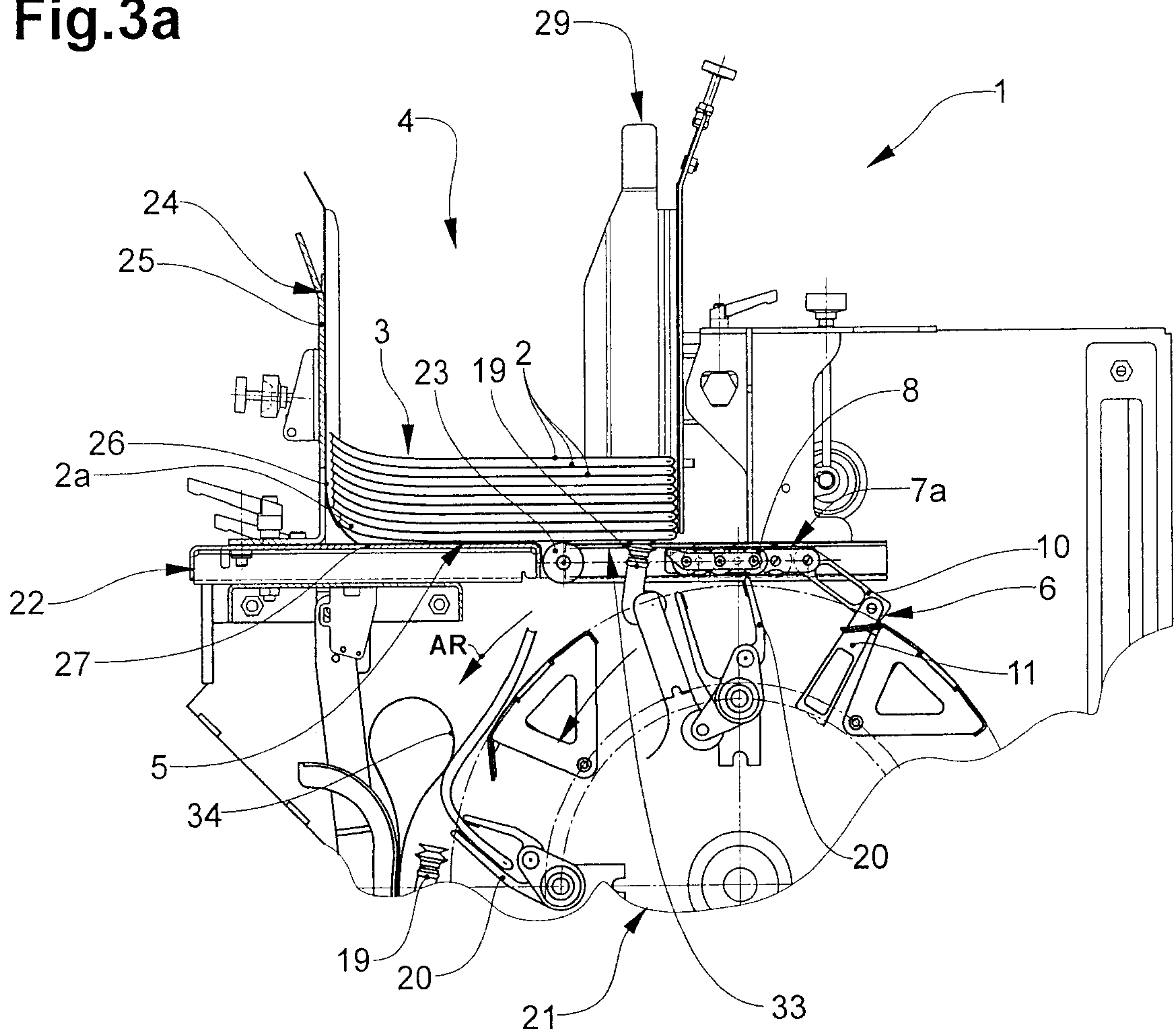


Fig.3b

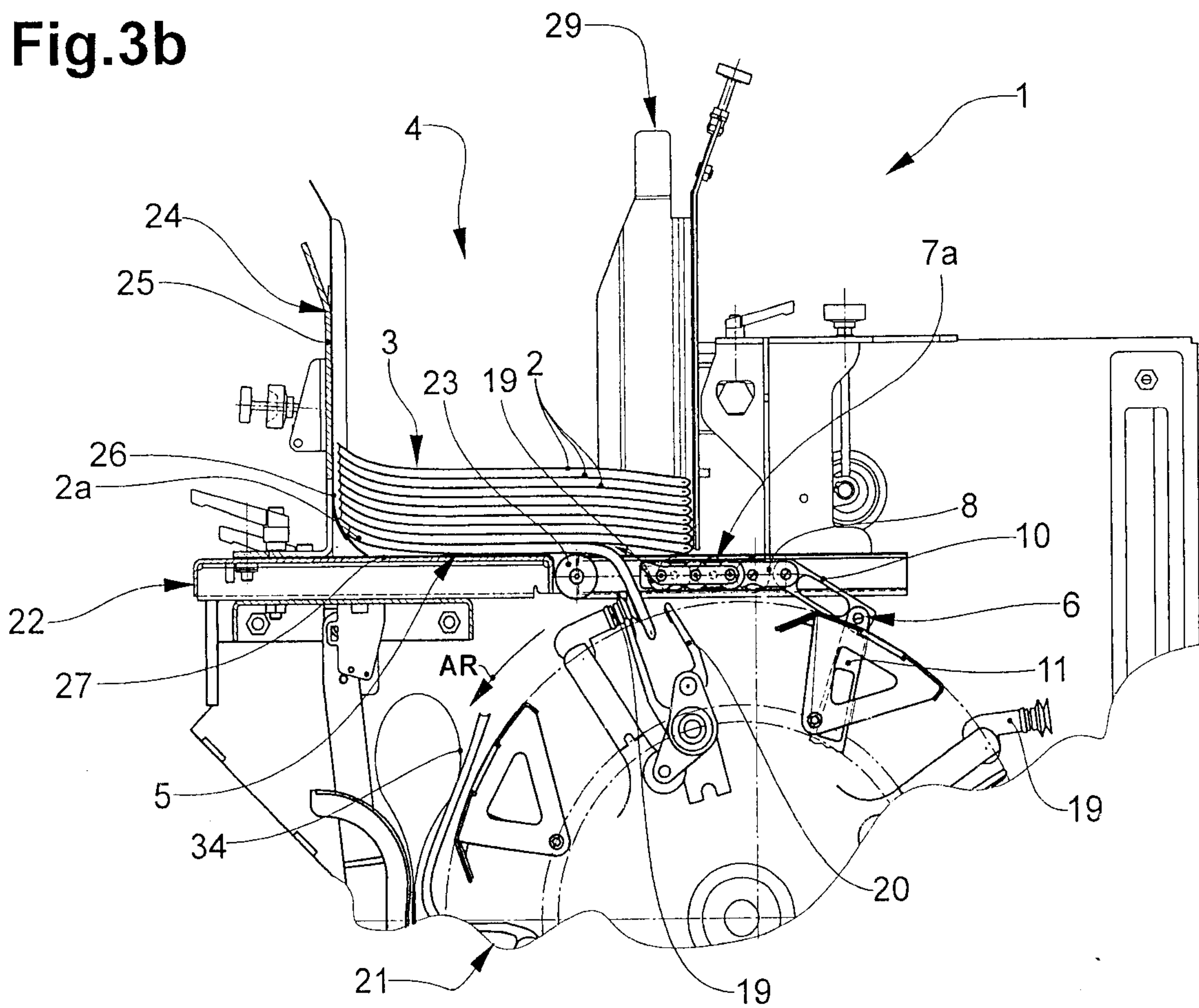


Fig.3c

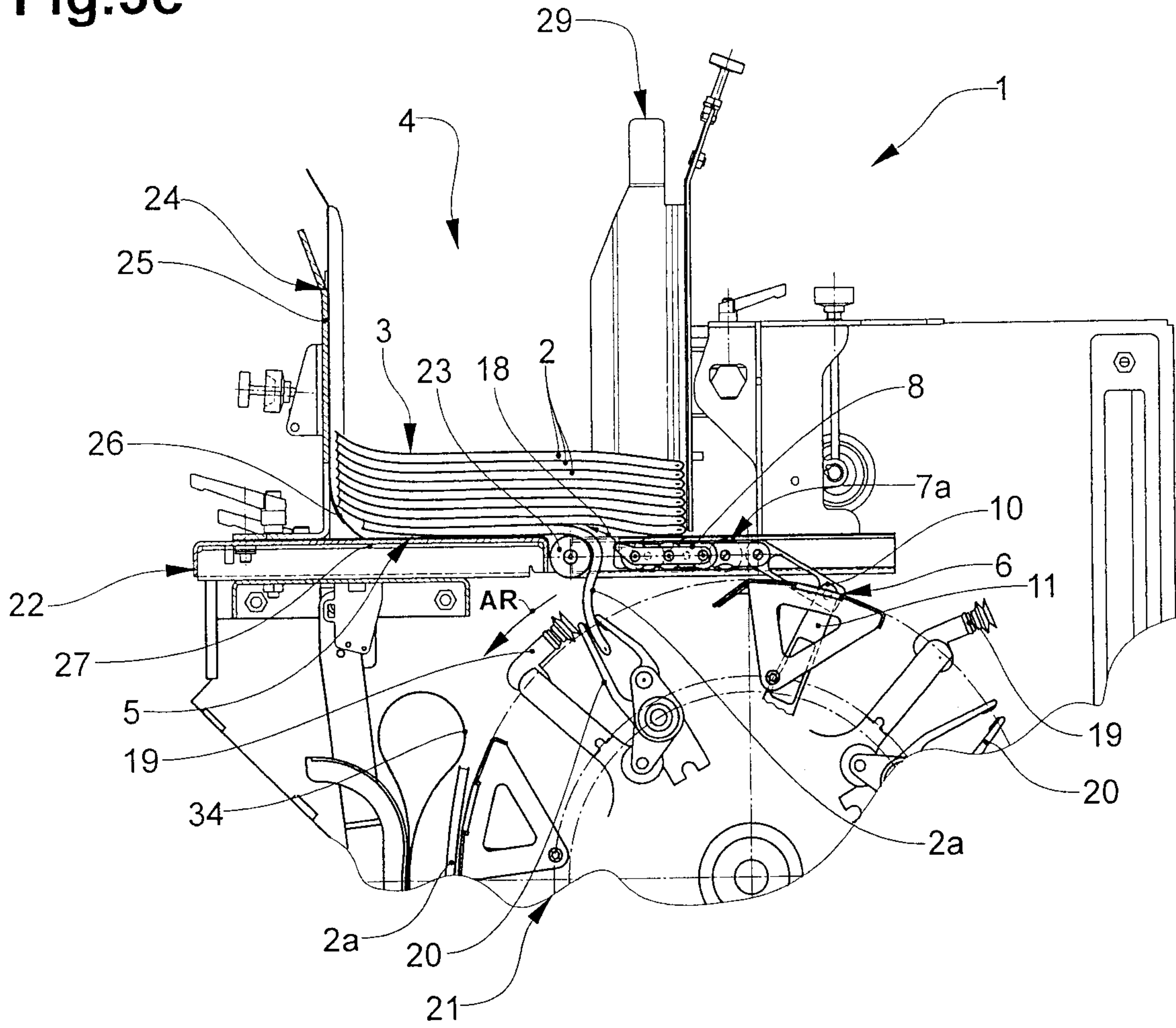


Fig.3d

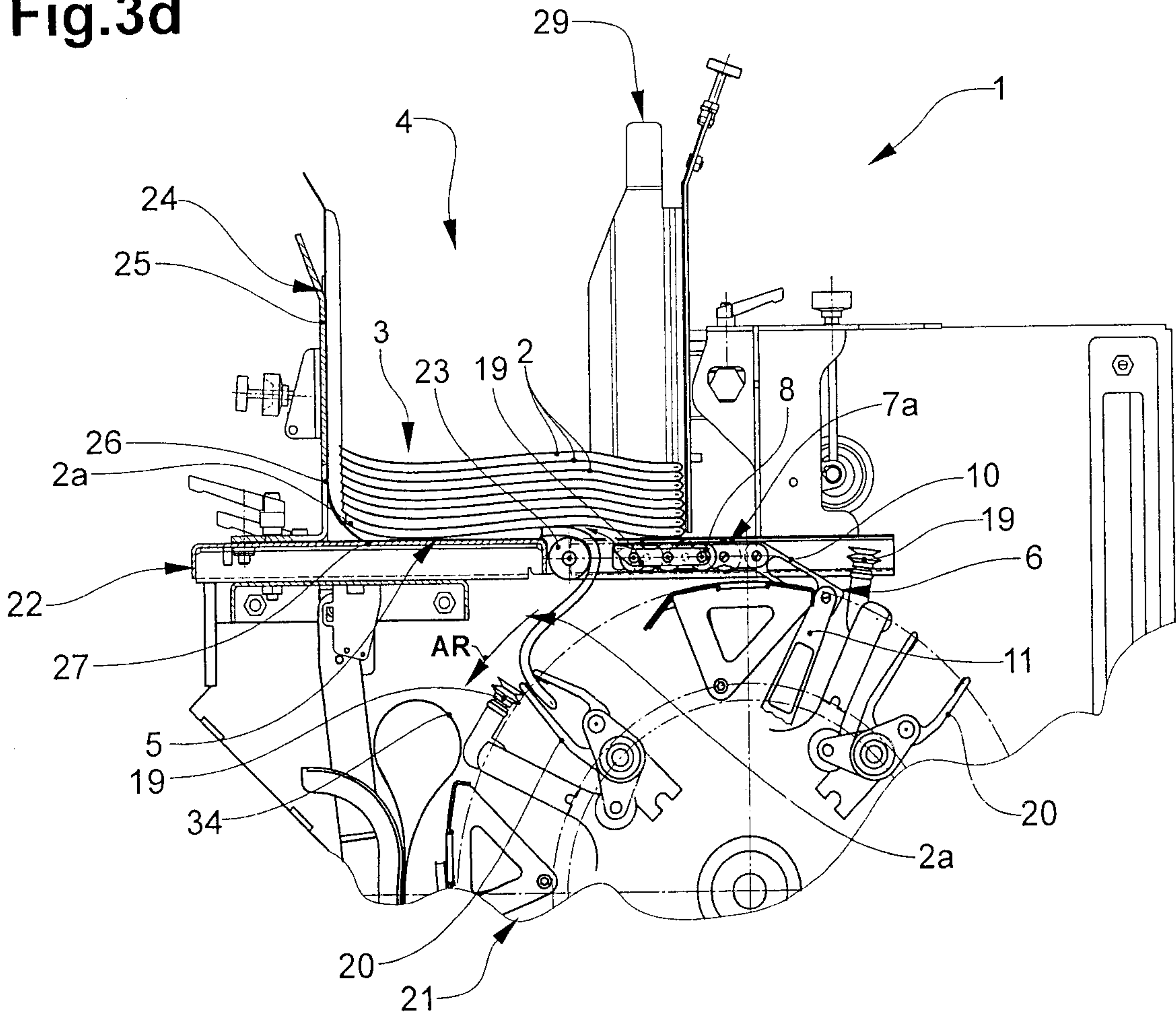


Fig.4

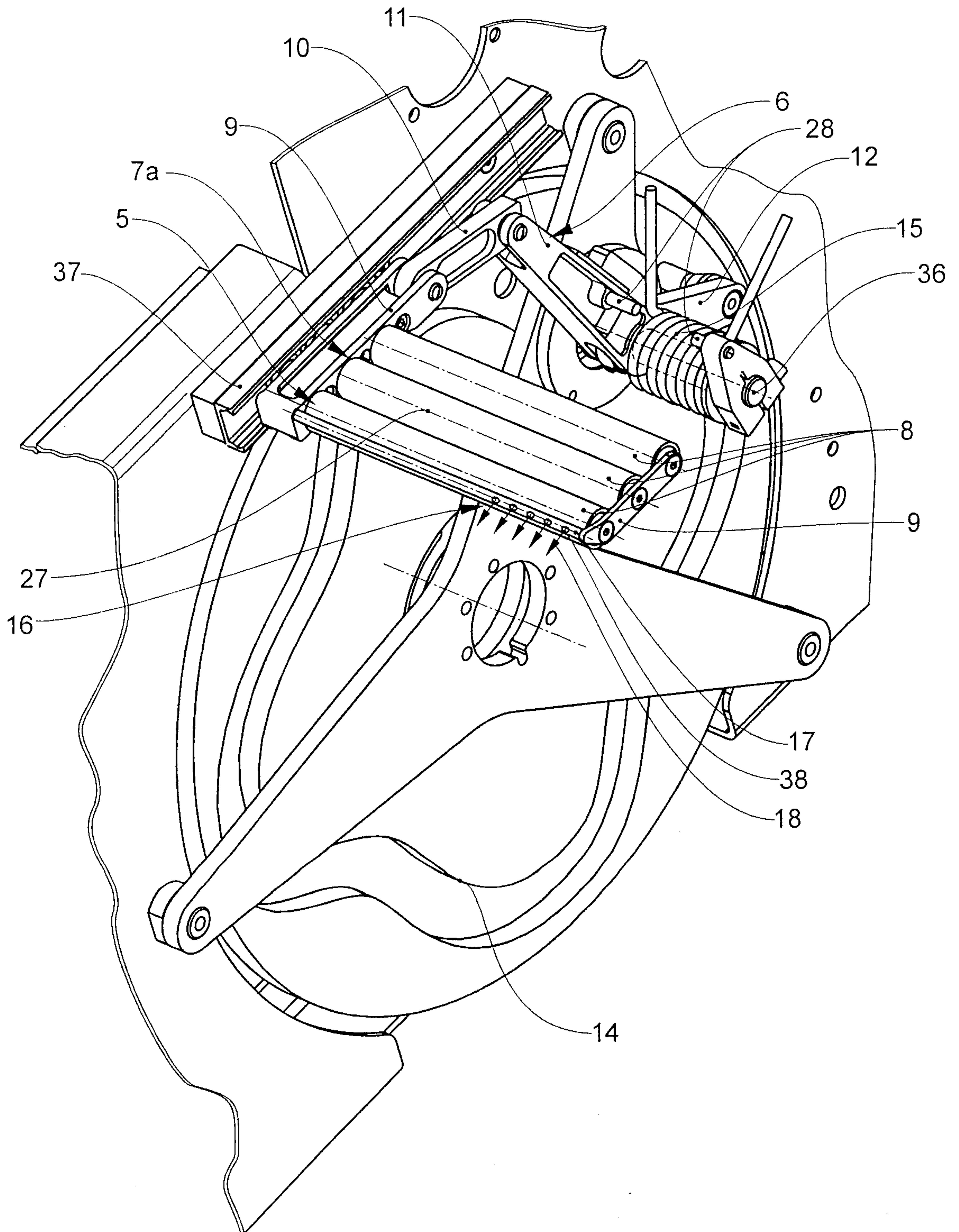


Fig.5

