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(54) **CUTTING DEVICE**

SCHNEIDVORRICHTUNG

DISPOSITIF DE DECOUPE

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## Description

**[0001]** This invention relates to a cutting device for cutting a web produced with a forming machine essentially in the cross direction of the web at the full width.

**[0002]** The above mentioned forming machine comprises especially paper and board machines, in which the web needs to be cut in the various stages of web forming and web processing. These stages include for example web coating and calendering. In particular at the final stage of web forming the web has gained such strength that some kind of blade is normally required for cutting. For using and positioning the blade in the forming machine, specific cutting devices have been developed, which allow cutting the web in one go essentially over the full width.

**[0003]** One known cutting device comprises an open C-beam assembled from a thick steel plate by welding, the beam forming the load bearing frame of the cutting device. In holes arranged in one of the flanges of the C-beam there are additionally fastened several compressed-air boxes functioning as actuators, with a blade fastened thereto. Both the frame and the blade essentially extend over the full web width. In another embodiment of this cutting device the C-beam is replaced with a robust tubular beam.

**[0004]** In both of the above-mentioned embodiments the blade and the piston rod of the compressed-air box are located outside the frame. In this case it is necessary that the cutting device also include protective sheets, which collect impurities and are sensitive to damaging. In addition, the piston rods of the compressed-air boxes are subjected to a high moment of deflection as the web to be cut pushes the blade during the cutting operation. This pushing is caused by the fact that the blade abrades the web gradually cutting it failing to cut it immediately. At the worst the piston rods bend and may even break, in which case the blade movement is prevented or the blade may even completely detach. Furthermore, the known cutting devices are laborious to manufacture. In addition, the weight of the frame for one length unit becomes high, the torsional stiffness remaining, however, insufficient. In these conditions the supporting of the cutting device is demanding, and the frame bends disadvantageously during the web cutting.

**[0005]** Document FI 108623 B discloses a cutting device, wherein the load bearing frame is essentially composed of three pieces manufactured out of extruded profiles of light metal. The three pieces are interconnected by means of bolts. Actuators for moving a blade are integrated into the three pieces of the load bearing frame, in which inter alia piston chambers for accommodating pistons of the actuators are formed.

**[0006]** A cutting device comprising the features summarized in the preamble of claim 1 is known from document US-A-4827820. The cutting device according to this document comprises a hollow load bearing frame, a blade and actuators constituted by the combination of loading hoses and springs of a spring means. In this known cutting device, the blade and the actuators are located on an outer side of the frame, so that they can easily collect impurities and are sensitive to damaging.

**[0007]** It is an object of the present invention to provide an improved cutting device. In particular, it is an object of the present invention to provide a novel cutting device which is light in weight and nevertheless rigid and in which the blade can be well supported.

**[0008]** According to the invention, this object is achieved by the cutting device defined in claim 1.

**[0009]** Advantageous developments of the cutting device according to the invention are defined in the dependent claims.

**[0010]** In the cutting device according to the invention, the novel frame construction provides unequalled lightness and rigidity. In spite of this, the manufacture is simple and economical. In addition, being located inside the frame, the actuators and the blade are better protected than heretofore, and yet the total height of the cutting device can be kept lower than before. This is possible for example due to the positioning of the actuators, enabled by the novel frame construction. Furthermore, the solution according to the invention is light in weight, which allows its easy positioning in the forming machine. Also, a low weight for one length unit allows manufacturing cutting devices that are longer than heretofore, without producing bending and supporting problems. Furthermore, the blade can be well supported in the cutting device, which prevents the harmful conveyance of the moment of deflection to the actuators.

**[0011]** The invention is described below in detail by making reference to the enclosed drawings, which illustrate one of the embodiments of the invention, in which

- Figure 1 shows an embodiment of a cutting device according to the invention adapted in connection with the web,
- Figure 2a shows a machine directional view of a part of the cutting device shown in Figure 1 in the home position,
- Figure 2b shows the part of Figure 2a in the operating position,
- Figure 2c shows a part of the blade of the cutting device according to the invention.

**[0012]** Figure 1 shows an embodiment of the cutting device according to the invention adapted in the vicinity of the web 10. Generally the cutting device is designed for cutting the web produced with a forming machine. The most common forming machines are paper or board machines. The cutting device cuts the web essentially in the cross direction of the web at the full web width. For example in the paper machines, web cutting is required in connection with coating and calendering. The length of the cutting device naturally depends on the web width. Generally, the cutting device according to the invention can be used in positions where web cutting is required.

**[0013]** The main components of the cutting device comprise a load bearing frame 11 arranged in the vicinity of the web 10 to be supported to the forming machine. The frame construction is described below in greater detail. In addition, the cutting device includes a blade 12 arranged movable in relation to the frame 11. For cutting the web in one go, the blade length essentially corresponds with the width of the web to be cut. The web is thus cut with the blade, for which the cutting device also comprises actuators 13 for moving the blade 12 and thus for providing the blade's operating movement. The actuators 13 are connected to both the blade 12 and the frame 11.

**[0014]** The frame 11 is composed of a box-type structure made of sheet metal material, which makes the total cutting device light in weight, yet extremely rigid. Generally the sheet metal thickness varies from 0.5 to 5 mm, more advantageously from 1 to 3 mm. Part of the sheet metal components are removed from the cutting device shown in Figure 1. The box-type structure contains two cross-directional and curved sheet metal sections 14 for forming a hollow frame 11. Each sheet metal section 14 can be made of one piece or formed of several pieces connected to each other. In Figure 1 only a part of one of the two sheet metal sections 14 is seen. The curvature of the sheet metal sections reduces the likelihood of buckling. In a finished cutting device the sheet metal sections 14 of the frame 11 are adapted against each other, and laminar intermediate supports 15 are arranged between them at an interval from each other. The intermediate supports are additionally profiled to a curved shape, and in practice, it is these supports that determine the frame profile.

**[0015]** Also other advantages are achieved by the use of the sheet metal. The sheet metal is easy to machine and profile, which facilitates producing more complicated shapes in the cutting device. An example of this is the relief 17 made for the tail threading rope 16 that forms a structural component of the forming machine. In addition, the sheet metal section and the intermediate supports are preferably laser-cut components. Laser cutting provides a good machining result and excellent dimensional and profile accuracy. The sheet metal sections and the intermediate supports are additionally connected to each other by laser welding for forming the box-type structure. This structure is extremely rigid also against torsion. Furthermore, deformations caused by laser welding are nonexistent, which allows maintaining the dimensional and profile accuracy achieved by laser welding.

**[0016]** In the cutting device, each actuator has two end positions: the operating position producing the cutting, and the home position opposite thereto. In Figures 1 and 2a the actuators 13 are in their home position, in which case the blade 12 is essentially completely inside the frame 11. This allows positioning the cutting device safely also very close to the web. In Figure 2b the actuators 13 are in their operating position, in which case the blade 12 clearly extends outside the frame 11. In Figures 2a and 2b the web is illustrated with a dot-and-dash line.

**[0017]** The space required for inserting the actuators 13 and the blade 12 allows using a lower frame structure 11 than heretofore by attaching the actuators 13 to the intermediate supports 15 described above. That is, the actuators are placed in the center part of the frame instead of the bottom part. The actuators 13 are fastened to the intermediate supports 15 either directly or by means of a bracket 18 according to the embodiment presented. The actuators are easy to fasten to the bracket and can be installed to the intermediate supports only after that. The intermediate supports preferably also comprise holes for inserting the protruding parts arranged in the brackets. This helps avoiding installation errors, and installing the actual mounting screws 19 is easy. The brackets are preferably also made of sheet metal, in which case they are ready for installation after cutting and bending. In the embodiment presented, are of the actuators 13 is fastened to each intermediate support 15. If required, the number of the intermediate supports can be higher than that of actuators.

**[0018]** At least one of the sheet metal sections 14 comprises one or more plate components 20 defining a supporting surface. In addition, the plate components 20 extend inside the frame 11 essentially in the direction of the blade 12 for supporting the blade 12 in the movement direction of the web 10. Furthermore, the plate components 20 are preferably bent from the sheet metal section 14, and this is shown especially in the detail of Figure 1, in which the blade 12 is partly cut across. When placed against each other, the plate components of the sheet metal plates form a slot-like channel for the blade. In this case, as the web presses the blade during cutting, the moment of deflection is subjected to the frame instead of the actuator. This helps avoiding deflection and other damage of the actuator piston rod.

**[0019]** Due to the frame design, the blade 12 can be supported to the frame 11 also in the operating position of the actuator 13. There are one or more extensions 21 at the edge of the blade 12 on the side of the actuators 13. The extension 21 is adapted in such a manner that it extends in the direction of the blade 12 from the fastening point 28 of the actuator 13 towards the frame 11. In this case at least the extension rests against the channel arranged in the frame for the blade. In the blade 12, stepped extensions 21 are preferably used, which allows maintaining the weight of the blade 12 appropriately low. In addition, in the area between the extensions 21, the above mentioned plate components 20 are connected to each other at their top edges by means of the intermediate supports 15. This allows keeping the channel always at a correct width without interfering with the blade movement.

**[0020]** Compressed air for the actuators 13, which are preferably compressed-air boxes, is supplied via a distribution channel 23. Here the distribution channel 23 is additionally connected to a compressed-air line 24, extending between the two ends of the cutting device, by

means of an intermediate pipe 25. This ensures that compressed air is uniformly distributed to the actuators and it can be supplied from either end of the cutting device. In addition to the compressed-air line, there are connections 26 arranged inside the frame 11 for providing a heating effect. By heating the frame sweating of the cutting device is prevented, which could lead to web breaks or at least to local marks in the web. In the embodiment presented the distribution channel 23, compressed-air line 24, and the connections 26 are supported to recesses arranged in the intermediate supports 15. In this case separate fasteners are not needed. In practice, the connections are supplied with steam, or heating cables are passed through them.

**[0021]** The blade is preferably also a component made of sheet metal material by laser cutting. In addition, the blade 12 has a laser cut indentation 27 at the web 10 side edge. Regardless of the thin sheet metal material, laser cutting allows keeping the blade straight and the indentation sharp. Therefore, after laser cutting the blade is ready to be installed in the cutting device without grinding or other type of machining. During laser cutting, holes 28 serving as the fastening points are also made in the blade 12 for fastening it to the actuators 13 (Figure 2c). The cutting device is fastened to the forming machine simply at the ends. For this the end portions of the frame 11 are provided with fastening detents, which here are formed of a profiled opening 29 and threaded holes 30. A support arm 31, to be attached to the forming machine, is adapted to the fastening detents. The frame is arranged longer than the width of the web. This is possible due to the light weight and rigidity of the cutting device as well as the above mentioned reliefs.

**[0022]** In one example of the cutting device according to the invention, the intermediate supports are arranged at an interval of 800 mm, and the height of the cutting device is approximately 450 mm. With this design the weight of the cutting device is 35 kg/m. The height of a similar cutting device manufactured according to the prior art technique is approximately 600 mm and the weight is 150 kg/m. Hence, the cutting device according to the invention is notably smaller and lighter than heretofore. Similarly, the blade thickness is 2 mm and the width is 200 mm, for which the extensions make more than the half. Thus also the blade is lighter than heretofore. The sheet metal material used in the cutting device is either stainless steel or acid-resistant steel. At least at the actuator 13, the frame 11 additionally includes an installation and service port 32, covered with a suitable cover 33.

**[0023]** Due to its small size and light weight, the cutting device according to the invention is easy to adapt to a forming machine. Regardless of the use of the sheet metal material the cutting device is extremely rigid. In addition, the actuators and the blade are protected inside the frame. Due to the channel formed in the frame and the unique blade, the stress subjected to the actuators is slight. This increases the reliability of the cutting device and reduces the risk of damage.

## Claims

1. A cutting device for cutting a web (10) produced with a forming machine essentially in the cross direction of the web at the full width, which cutting device comprises
a hollow load bearing frame (11) to be arranged in the vicinity of the web (10) and to be supported to the forming machine, wherein the frame is constituted by a box-type structure made of a sheet material,
a blade (12) arranged movable in relation to the frame (11), the length of which essentially corresponds with the width of the web (10) to be cut, and actuators (13) connected to the blade (12) and the frame (11) for moving the blade (12) and thus cutting the web (10) with the blade (12), wherein the actuators (13) have two end positions, the one being the operating position that provides the cutting and the other the home position opposite thereto,
**characterized**
**in that** the box-type structure is made of a sheet metal material,
**in that** the actuators (13) are located inside the frame (11), and
**in that** the blade (12) is located essentially completely in the frame (11) when the actuators (13) are in their home position.

2. A cutting device as set forth in claim 1, **characterized in that** the blade (12) is a component made of sheet metal material by laser cutting, with a laser cut indentation (27) at the web side edge.

3. A cutting device as set forth in claim 1 or 2, **characterized in that** the box-type structure comprises two cross-directional and curved sheet metal sections (14) adapted against each other, and laminar intermediate supports (15) arranged at an interval from each other between the sheet metal sections (14).

4. A cutting device as set forth in claim 3, **characterized in that** each sheet metal section (14) and intermediate support (15) are laser cut components, which in the cutting device are fastened to each other by means of laser welding.

5. A cutting device as set forth in claim 3 or 4, **characterized in that** the actuators (13) are fastened to the intermediate supports (15) either directly or by means of a bracket (18).

6. A cutting device as set forth in one of claims 3 to 5, **characterized in that** at least one of the sheet metal sections (14) comprises at least one plate component (20) which extends inside the frame (11) in the lengthwise direction of the blade (12) for defining a supporting surface for supporting the blade (12).

**7.** A cutting device as set forth in claim 6, **characterized in that** the two sheet metal sections (14) each comprise at least one plate component (20) which extends inside the frame (11) in the lengthwise direction of the blade (12) for defining a supporting surface for supporting the blade (12), wherein the plate components (20) of the one and the other sheet metal section (14) are placed against each other so as to form a slot-like channel for the blade (12).

**8.** A cutting device as set forth in claim 7, **characterized in that** at the side opposite to the web side edge, the blade (12) comprises at least one extension (21) which is adapted to rest against the channel arranged in the frame (11) for the blade (12).

**9.** A cutting device as set forth in one of claims 3 to 8, **characterized in that** within the frame (11) there are arranged connections (26) for providing a heating effect, the connections (26) being supported by recesses formed in the intermediate supports (15).

**10.** A cutting device as set forth in one of claims 1 to 9, **characterized in that** the length of the frame (11) is arranged longer than the width of the web (10), and at the end portions of the frame (11) there are fastening detents (29, 30) for supporting the cutting device at its ends as well as at least one relief (17) for a structural component (16) of the forming machine.

**Patentansprüche**

**1.** Schneidvorrichtung zum Schneiden einer Faserstoffbahn (10), die mit einer Umformmaschine hergestellt ist, im Wesentlichen in der Querrichtung der Faserstoffbahn über die volle Breite, wobei die Schneidvorrichtung Folgendes aufweist
einen hohlen Lasttragrahmen (11), der in der Nähe der Faserstoffbahn (10) anzuordnen ist und an der Umformmaschine zu stützen ist, wobei der Rahmen durch einen schachtelartigen Aufbau gebildet ist, der aus einem flachen Material gemacht ist,
eine Klinge (12), die beweglich in Beziehung zu dem Rahmen (11) angeordnet ist, wobei ihre Länge im Wesentlichen mit der zu schneidenden Faserstoffbahn (10) übereinstimmt, und
Stellantriebe (13), die mit der Klinge (12) und dem Rahmen (11) zum Bewegen der Klinge (12) und somit zum Schneiden der Faserstoffbahn (10) mit der Klinge (12) verbunden sind, wobei die Stellantriebe (13) zwei Endpositionen haben, wobei die eine die Betriebsposition ist, die für das Schneiden sorgt, und die andere die zu dieser gegenüberliegende Ausgangsposition ist,
**dadurch gekennzeichnet, dass**
der schachtelartige Aufbau aus einem Blechmaterial gemacht ist,
die Stellantriebe (13) sich im Inneren des Rahmens (11) befinden, und
die Klinge (12) sich im Wesentlichen vollständig in dem Rahmen (11) befindet, wenn die Stellantriebe (13) in ihrer Ausgangsposition sind.

**2.** Schneidvorrichtung gemäß Anspruch 1,
**dadurch gekennzeichnet, dass**
die Klinge (12) ein Bauteil, das aus Blechmaterial durch Laserschneiden gemacht ist, mit einer Laserschneidkerbung (27) an der Faserstoffseitenkante ist.

**3.** Schneidvorrichtung gemäß Anspruch 1 oder 2,
**dadurch gekennzeichnet, dass**
der schachtelartige Aufbau zwei gebogene Blechabschnitte (14) in Querschnittsrichtung, die aneinander angepasst sind, und flächige Zwischenstützen (15) hat, die in einem Abstand voneinander zwischen den Blechabschnitten (14) angeordnet sind.

**4.** Schneidvorrichtung gemäß Anspruch 3,
**dadurch gekennzeichnet, dass**
jeder Blechabschnitt (14) und jede Zwischenstütze (15) Laserschneidbauteile sind, die in der Schneidvorrichtung aneinander mit Hilfe von Laserschweißen befestigt sind.

**5.** Schneidvorrichtung gemäß Anspruch 3 oder 4,
**dadurch gekennzeichnet, dass**
die Stellantriebe (13) an den Zwischenstützen (15) entweder direkt oder mit Hilfe einer Halterung (18) befestigt sind.

**6.** Schneidvorrichtung gemäß einem der Ansprüche 3 bis 5,
**dadurch gekennzeichnet, dass**
mindestens einer der Blechabschnitte (14) mindestens ein Plattenbauteil (20) aufweist, das sich im Inneren des Rahmens (11) in der Längsrichtung der Klinge (12) zum Definieren einer Stützfläche zum Stützen der Klinge (12) erstreckt.

**7.** Schneidvorrichtung gemäß Anspruch 6,
**dadurch gekennzeichnet, dass**
die zwei Blechabschnitte (14) jeweils mindestens ein Plattenbauteil (20) aufweisen, das sich im Inneren des Rahmens (11) in der Längsrichtung der Klinge (12) zum Definieren einer Stützfläche zum Stützen der Klinge (12) erstreckt, wobei die Plattenbauteile (20) des einen und des anderen Blechabschnitts (14) gegeneinander platziert sind, um so einen schlitzartigen Kanal für die Klinge (12) zu bilden.

**8.** Schneidvorrichtung gemäß Anspruch 7,
**dadurch gekennzeichnet, dass**
an der Seite gegenüber der Faserstoffbahnseiten-

kante die Klinge (12) mindestens ein Ansatzstück (21) aufweist, das daran angepasst ist, an dem Kanal zu ruhen, der an dem Rahmen (11) für die Klinge (12) ausgebildet ist.

**9.** Schneidvorrichtung gemäß einem der Ansprüche 3 bis 8,
**dadurch gekennzeichnet, dass**
in dem Rahmen (11) Verbindungen (26) zum Vorsehen eines Heizeffekts angeordnet sind, wobei die Verbindungen (26) durch Vertiefungen geschützt sind, die in den Zwischenstützen (15) ausgebildet sind.

**10.** Schneidvorrichtung gemäß einem der Ansprüche 1 bis 9,
**dadurch gekennzeichnet, dass**
die Länge des Rahmens (11) länger als die Breite der Faserstoffbahn (10) angeordnet ist, und es an den Endabschnitten des Rahmens (11) Befestigungsrasten (29, 30) zum Stützen der Schneidvorrichtung an ihren Enden sowie mindestens eine Aussparung (17) für ein Strukturbauteil (16) der Umformmaschine gibt.

**Revendications**

**1.** Dispositif de découpage pour découper une bande (10), produite à l'aide d'une machine de formation, essentiellement dans la direction transversale de la bande à pleine largeur, lequel dispositif de découpage comprend
un bâti portant creux (11) à agencer à proximité de la bande (10) et devant être soutenu par la machine de formation, où le bâti est constitué par une structure en forme de boîte faite en un matériau en tôle, une lame (12) agencée de manie mobile en relation avec le bâti (11), dont la longueur correspond essentiellement à la largeur de la bande (10) à découper, et
des actionneurs (13) reliés à la lame (12) et au bâti (11) pour déplacer la lame (1) et découpant de ce fait la bande (10) avec la lame (12), où les actionneurs (13) possèdent deux positions extrêmes, une position extrême étant la position opérationnelle qui procure le découpage et l'autre étant la position de départ opposée à celle-ci,
**caractérisé**
**en ce que** la structure en forme de boîte est faite en un matériau en tôle,
**en ce que** les actionneurs (13) sont situés à l'intérieur du bâti (11), et
**en ce que** la lame (12) est située essentiellement en totalité dans le bâti (11) lorsque les actionneurs (13) sont dans leur position de départ.

**2.** Dispositif de découpage selon la revendication 1, **caractérisé en ce que** la lame (12) est un composant fait en un matériau en tôle par un découpage au laser, avec une échancrure de coupe au laser (27) au niveau de la bordure côté bande.

**3.** Dispositif de découpage selon la revendication 1 ou 2, **caractérisé en ce que** la structure en forme de boîte comprend deux sections en tôle transversales et incurvées (14) adaptées l'une contre l'autre, et des supports intermédiaires laminaires (15) agencés à un intervalle l'un par rapport à l'autre entre les sections en tôle (14).

**4.** Dispositif de découpage selon la revendication 3, **caractérisé en ce que** chaque section en tôle (14) et support intermédiaire (15) sont des composants coupés au laser, qui, dans le dispositif de découpage, sont fixés l'un à l'autre au moyen d'une soudure au laser.

**5.** Dispositif de découpage selon la revendication 3 ou 4, **caractérisé en ce que** les actionneurs (13) sont fixés aux supports intermédiaires (15) soit directement ou au moyen d'une console (18).

**6.** Dispositif de découpage selon l'une des revendications 3 à 5, **caractérisé en ce qu'**au moins l'une des sections en tôle (14) comprend au moins un composant de plaque (20) qui s'étend à l'intérieur du bâti (11) dans la direction de longueur de la lame (12) pour définir une surface de support pour soutenir la lame (12).

**7.** Dispositif de découpage selon la revendication 6, **caractérisé en ce que** les deux sections en tôle (14) comprennent chacune au moins un composant de plaque (20) qui s'étend à l'intérieur du bâti (11) dans la direction de longueur de la lame (12) de façon à définir une surface de support afin de soutenir la lame (12), où les composants de plaque (20) de l'une et l'autre section en tôle (14) sont placés l'un contre l'autre de manière à former un canal en forme de fente pour la lame (12).

**8.** Dispositif de découpage selon la revendication 7, **caractérisé en ce que** sur le côté opposé à la bordure côté bande, la lame (12) comprend au moins une extension (21) qui est adaptée pour se poser contre le canal agencé dans le bâti (11) pour la lame (12).

**9.** Dispositif de découpage selon l'une des revendications 3 à 8, **caractérisé en ce que** dans le bâti (11) des raccords (26) sont agencés afin de fournir un effet chauffant, les raccords (26) étant soutenus par des évidements formés dans les supports intermédiaires (15).

**10.** Dispositif de découpage selon l'une des revendications 1 à 9, **caractérisé en ce que** la longueur du bâti (11) est agencée de sorte à être supérieure à la largeur de la bande (10), et au niveau des parties extrêmes du bâti (11) il existe des cliquets de fixation (29, 30) pour soutenir le dispositif de découpage au niveau de ses extrémités aussi bien qu'au moins une dépouille (17) pour un composant de structure (16) de la machine de formation.

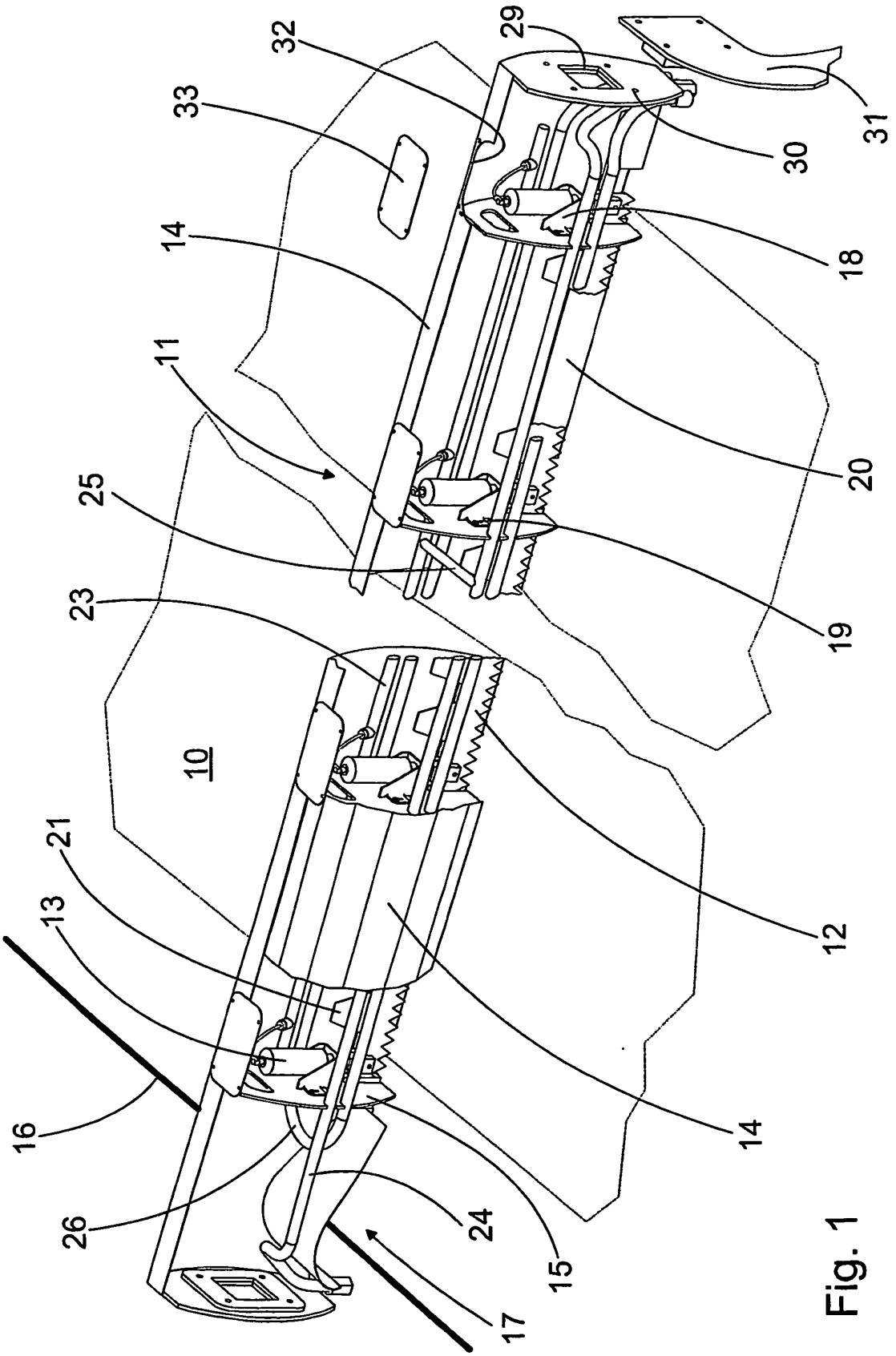


Fig. 1

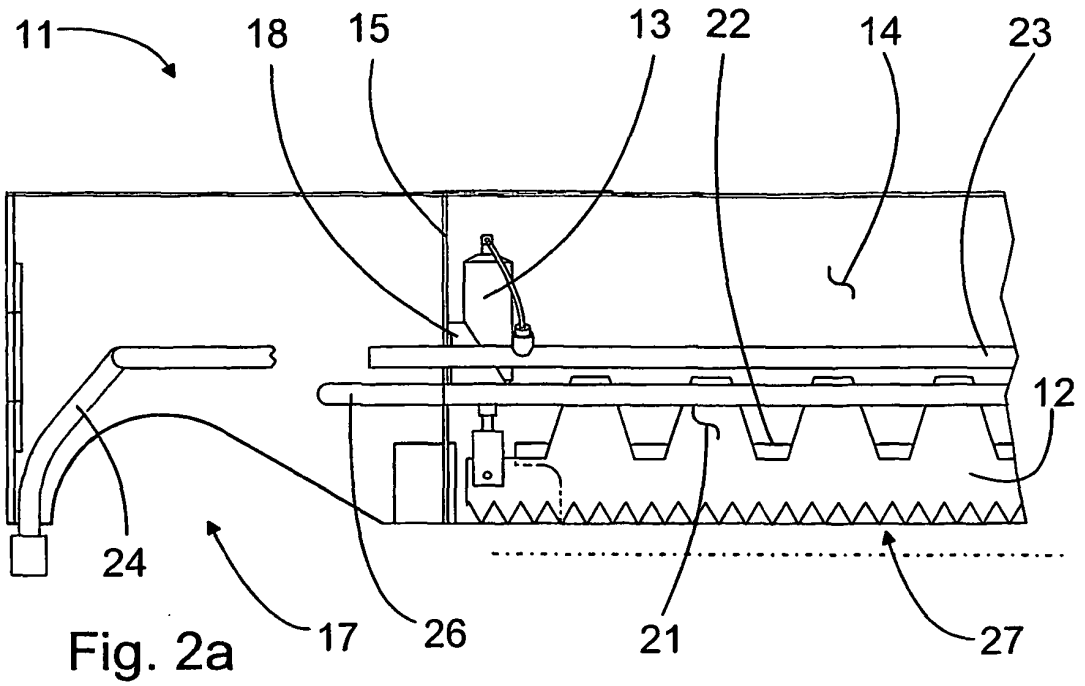


Fig. 2a

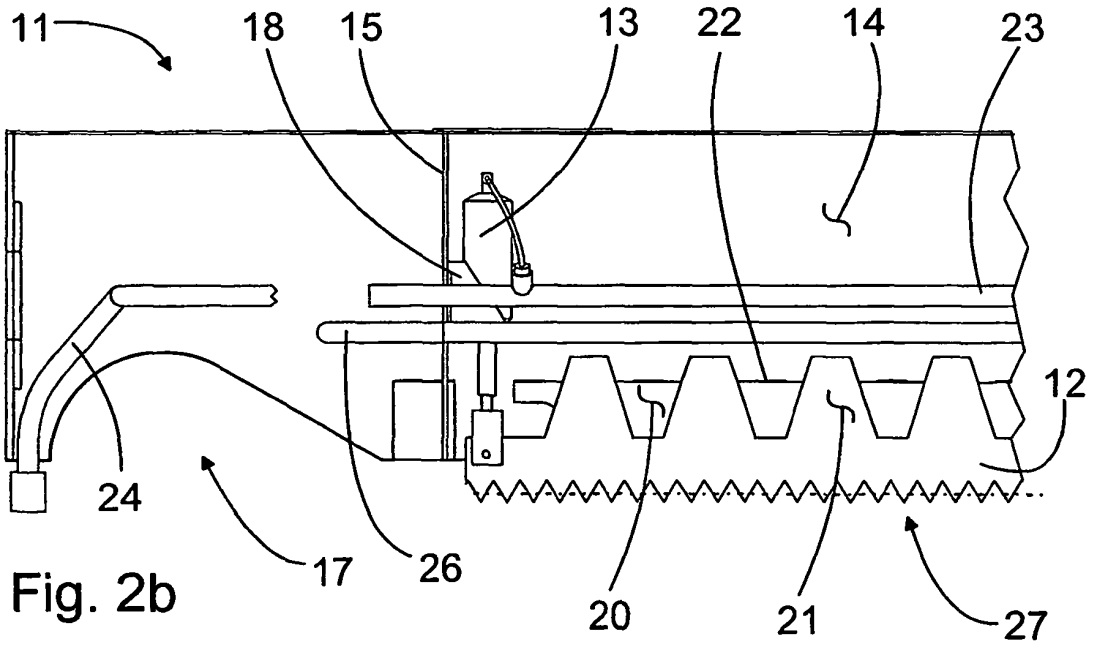


Fig. 2b

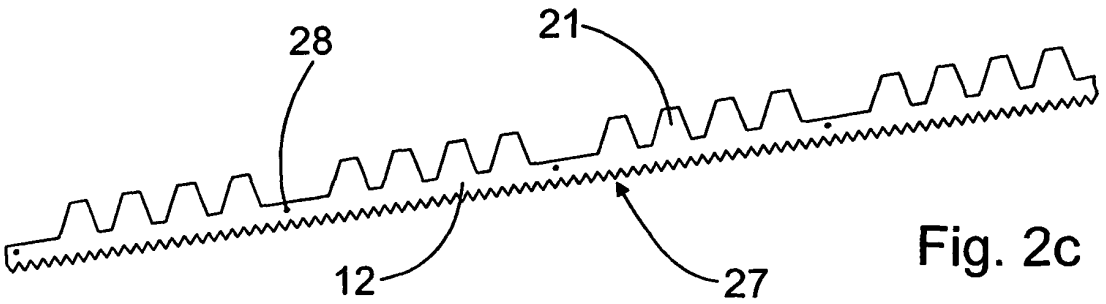


Fig. 2c

## REFERENCES CITED IN THE DESCRIPTION

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