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(54) **DISPENSING APPARATUS**

(57) Aspects of the present invention relate to a dispensing apparatus (1) for cutting sheets (S) from a length of towel. The dispensing apparatus (1) includes a supply roller (33) rotatable about a central axis (X). The dispensing apparatus (1) having at least one first cutting member (45A, 45B) having a first cutting edge (51A, 51B) with a first profile. The dispensing apparatus (1) having at least one second cutting member (55A, 55B) having a second cutting edge (61A) having a second profile. The second profile of the second cutting edge (61A) includes or consists of a curved profile. The at least one first cutting member (45A, 45B) or the at least one second cutting member (55A, 55B) is mounted to the supply roller (33) for rotation with the supply roller (33). In use, the at least one first cutting member (45A, 45B) and the at least one second cutting member (55A, 55B) cooperate with each other as the supply roller (33) rotates to cut the towel.

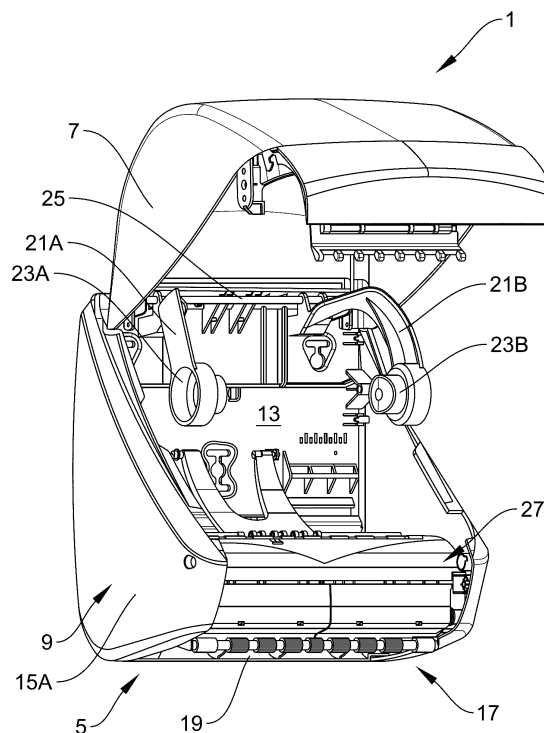


FIG. 1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a dispensing apparatus. Aspects of the invention relate to a dispensing apparatus for dispensing sheets of towel. The dispensing apparatus comprises a mechanism for cutting the sheets from a length of towel, for example stored on a roll.

BACKGROUND

[0002] It is known to provide a towel dispensing apparatus for cutting and dispensing sheets of towel. The towel dispensing apparatus typically comprises one or more blades for cutting the sheets from a length of towel, for example wound on a roll. The blades may, for example, comprise a series of triangular teeth for piercing and cutting the towel. A problem with known towel dispensing apparatus is that the blades may dull with repeated use resulting in a poorer cutting action. This may necessitate more frequent servicing and maintenance of the towel dispensing apparatus.

[0003] It is an aim of the present invention to address one or more of the disadvantages associated with the prior art.

SUMMARY OF THE INVENTION

[0004] Aspects and embodiments of the invention provide a dispensing apparatus as claimed in the appended claims.

[0005] According to an aspect of the present invention there is provided a dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and at least one first cutting member comprising a first cutting edge having a first profile; and

at least one second cutting member comprising a second cutting edge having a second profile, the second profile comprising or consisting of a curved profile;

the at least one first cutting member or the at least one second cutting member being mounted to the supply roller for rotation with the supply roller. In use, the at least one first cutting member and the at least one second cutting member may cooperate with each other as the supply roller rotates to cut the towel. The first cutting edge and the second cutting edge of respective first and second cutting members cooperate with each other to cut the towel. In use, the at least one first cutting member and the at least one second cutting member are moveable relative to each other. In use, the towel is disposed between the at least one first cutting member and the at least one second cutting member. The at least one first

cutting member being arranged to cooperate with the at least one second cutting member to cut the towel disposed therebetween as the supply roller rotates. At least in certain embodiments, the at least one first cutting member or the at least one second cutting member mounted to the supply roller is operable to move relative to the other one of the at least one first cutting member and the at least one second cutting member which is not mounted to the supply roller. The at least one first cutting member may be arranged to travel past the at least one second cutting member. Alternatively, the at least one second cutting member may be arranged to travel past the at least one first cutting member. At least in certain embodiments, the curved profile of the or each second cutting edge enables the rotation of the supply roller to impart relative movement of the first and second cutting members, thereby performing a cutting action. The curved profile enables cooperation between the at least one first cutting member and the at least one second cutting member. The at least one first cutting member and the at least one second member may be configured progressively to cut the towel as the supply roller rotates. It will be understood that either the or each first cutting member is mounted on the supply roller, or the or each second cutting member is mounted on the supply roller. The curved profile may be concave or convex. The towel may be pulp-based, for example the towel may be a paper towel.

[0006] The first profile and the second profile may be complementary. In use, the first and second cutting edges cooperate with each other to cut the towel. Each first cutting member is associated with a respective second cutting member. Thus, the dispensing apparatus comprises one or more pairs of associated first and second cutting members. The first and second cutting members in the or each pair can be arranged in opposition to each other. The associated first and second cutting member and second cutting member cooperate with each other. The dispensing apparatus may comprise a single first cutting member and a single second cutting member. The dispensing apparatus may comprise two first cutting members and two second cutting members. Each of the first cutting members may be associated with a respective one of the second cutting members. The first and second cutting members may be paired with each other.

[0007] In use, the paper towel may be disposed between the at least one first cutting member and the at least one second cutting member. The or each first cutting member and the or each second cutting member may be configured to engage each other to cut the towel.

[0008] The curved profile may comprise or consist of a part-elliptical profile.

[0009] The second cutting edge of the or each second cutting member may extend a substantially uniform radial distance from the central axis along at least a portion of

a length of the or each second cutting member. The or each second cutting member may extend a substantially uniform radial distance from the central axis along at least substantially the length of the or each second cutting member.

[0010] The second cutting edge of the or each second cutting member may be disposed outwardly of an outer surface of the supply roller. For example, a distal portion of the second cutting member may project outwardly beyond an outer surface of the supply roller.

[0011] The or each second cutting member may be fixedly mounted to the supply roller. Alternatively, the or each second cutting member may be movably mounted to the supply roller. For example, the or each second cutting member may be configured to undergo translation as the supply roller rotates. The movement of the or each second cutting member may comprise an in-plane translational movement.

[0012] The first profile may comprise or consist of a linear profile. The first cutting edge of the or each first cutting member may extend substantially parallel to the rotation axis.

[0013] A chord line of the second cutting edge (extending between opposing ends thereof) may extend at an acute angle to a reference plane extending perpendicular to the rotation axis. The or each chord line is a virtual line extending between opposing ends of the or each second cutting edge of the second cutting members. The angular orientation of each of the second cutting members may be defined as the angle between the respective chord line and the plane extending perpendicular to a rotational axis of the supply roller. If the second cutting member is planar or substantially planar, the chord line may be disposed in the plane of the second cutting member. If the second cutting member is non-planar, the chord line may be disposed outside of the second cutting member.

[0014] The dispensing apparatus may comprise a plurality of the second cutting members. The second cutting members may be disposed alongside each other. The second cutting members may be inclined relative to each other, for example in a V-shaped or W-shaped arrangement. The dispensing apparatus may comprise one or more pairs of the second cutting members disposed in a V-shaped arrangement. The dispensing apparatus may consist of two second cutting members in a V-shaped arrangement. The two second cutting members may extend at least substantially across a width of the supply roller.

[0015] The adjacent second cutting members may converge in a first direction. The first direction may correspond to a direction of travel of the towel as it is dispensed from the dispensing apparatus. Alternatively, the adjacent second cutting members may diverge in the first direction.

[0016] The first cutting edge of the or each first cutting member may cooperate with the or each second cutting edge of the or each second cutting member at a discrete location to perform a localised point cut. At least in certain

embodiments, the location where the first cutting edge and the second cutting edge cooperate with each other changes as the supply roller rotates. Thus, the towel may be cut progressively as the supply roller rotates.

[0017] The or each first cutting member may comprise a first face inclined at a first angle relative to a radius of the central axis. The or each second cutting member may comprise a second face inclined at a second angle relative to a radius of the central axis. The first angle may be different from the second angle such that a cutting angle is defined between the first and second faces. The cutting angle may be in the range 0° to 35° ; or in the range 0° to 25° ; or in the range 0° to 20° ; or in the range 0° to 10° . The cutting angle is defined in a reference plane perpendicular to the central axis. The cutting angle may be non-zero, i.e. greater than 0° . The cutting angle may be at least substantially constant along a length of the first and second cutting members. Alternatively, the cutting angle may vary along a length of the first and second cutting members.

[0018] The first angle may be an acute angle; and/or the second angle may be an acute angle.

[0019] The linear cutting edge of the at least one first cutting member and the curved cutting edge of the at least one second cutting member may be oriented in opposite directions. The linear cutting edge and the curved cutting edge may be arranged to oppose each other.

[0020] The or each first cutting member may comprise a substantially square/bluff profile, for example comprising a first cutting angle greater than or equal to 60° or 75° . The first cutting angle may be approximately 90° . The or each second cutting member may comprise a bluff profile, for example comprising a second cutting angle greater than or equal to 60° or 75° . The second cutting angle may be approximately 90° .

[0021] In certain embodiments, the second profile may comprise or consist of an ellipsoid section. The ellipsoid section may correspond to an intersection of a plane with an ellipsoid.

[0022] In certain embodiments, the second profile may comprise or consist of a hyperboloid section. The hyperboloid section may correspond to an intersection of a plane with a hyperboloid (i.e. an intersection between a plane and an hourglass shape).

[0023] In certain embodiments, the second profile may comprise or consist of a conical section. The conical section may correspond to an intersection of a plane with a cone. The cone may, for example, comprise or consist of a truncated cone.

[0024] In certain embodiments, the second profile may comprise or consist of a cylindric section. The cylindric section may correspond to an intersection of a plane with a right circular cylinder.

[0025] The second profile may comprise or consist of a plane curve. The or each second cutting member may be substantially planar.

[0026] The or each first cutting member may be substantially planar.

[0027] The or each first cutting member may be mounted to a support member. The support member may be fixedly mounted. Alternatively, the support member may be movably mounted. For example, the support member may be pivotally mounted. The or each first cutting member may be spring biased towards the supply roller.

[0028] The or each first cutting member may be fixedly mounted to the support member. Alternatively, the or each first cutting member may be movably mounted to the support member. A resilient mount or a spring mount may be provided to spring bias the or each first cutting member.

[0029] The or each second cutting member may be mounted to the supply roller for rotation with the supply roller. The supply roller may be rotatable in a first direction to supply the towel.

[0030] In use, as the supply roller rotates, the or each second cutting member may be arranged to travel past the or each first cutting member. The second cutting edge of the or each second cutting member may cooperate with the first cutting edge of the or each first cutting member to cut the paper towel. The rotation of the supply roller may draw the towel into the region between the or each first cutting member and the or each second cutting member.

[0031] The at least one first cutting member may comprise a first cutting plate. The or each first cutting member may be non-yielding. In other words, the or each first cutting member may be at least substantially inflexible. In use, the or each first cutting member may undergo limited deflection or may not bend. The or each first cutting member may have a rigid or inflexible construction. The or each first cutting member may be formed of metal.

[0032] The at least one second cutting member may comprise a second cutting plate. The or each second cutting member may be non-yielding. In other words, the or each second cutting member may be at least substantially inflexible. In use, the or each second cutting member may undergo limited deflection or may not bend. The or each second cutting member may have a rigid or inflexible construction. The or each second cutting member may be formed of metal.

[0033] The supply roller may comprise a right cylinder.

[0034] According to a further aspect of the present invention there is provided a dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and at least one first cutting member mounted to a support member; and

at least one second cutting member mounted to the supply roller for rotation with the supply roller;

the at least one first cutting member and the at least one second cutting member being configured to cooperate with each other to cut the paper towel. The or each first cutting member may comprise a first face inclined at a first angle relative to a radius of the

central axis. The or each second cutting member may comprise a second face inclined at a second angle relative to a radius of the central axis. The first angle may be different from the second angle to define a cutting angle between the first and second faces. The or each first cutting member and the or each second cutting member may engage each other or pass adjacent to each other to cut the paper towel.

[0035] The cutting angle may be in the range 0° to 35°; or in the range 0° to 25°; or in the range 0° to 20°; or in the range 0° to 10°. The cutting angle is defined in a reference plane perpendicular to the central axis. The cutting angle may be non-zero, i.e. greater than 0°. The cutting angle may be at least substantially constant along a length of the first and second cutting members. Alternatively, the cutting angle may vary along a length of the first and second cutting members.

[0036] The first angle may be an acute angle. Alternatively, or in addition, the second angle may be an acute angle.

[0037] According to a further aspect of the present invention there is provided a dispensing apparatus for cutting a sheet from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and at least one cutting member mounted to the supply roller for rotation with the supply roller. The or each cutting member comprises a cutting edge for cutting the towel.

[0038] The at least one cutting member may be configured to make a non-linear cut in the towel. The non-linear cut may be curved, for example comprising or consisting of an elliptical cut, a part-circular cut, a U-shaped cut, a semi-circular cut, etc. Alternatively, the non-linear cut may be polygonal, for example comprising or consisting of a V-shaped cut, a truncated V-shaped cut, or a W-shaped cut.

[0039] The dispensing apparatus may comprise or consist of two of the cutting members. The cutting members may be inclined at an angle relative to each other. At least in certain embodiments, the cutting members may be arranged to make two or more cuts which are inclined relative to each other. For example, the cutting members may be arranged to make a V-shaped cut in the towel. The resulting sheet comprises first and second V-shapes at respective ends thereof. The first and second V-shapes are parallel to each other.

[0040] The sheet cut by the at least one cutting member may be in the form of a chevron. As a result, the overall length of the sheet is increased compared to a rectangular sheet. The perceived size of the sheet is increased which may reduce consumption of the towel.

[0041] The or each cutting member may have a cutting edge comprising or consisting of a curved profile.

[0042] The cutting edge of the or each cutting member may extend a radial distance from the central axis. The radial distance may be substantially uniform along at least a portion of a length of the or each cutting member.

[0043] The cutting edge of the or each cutting member may comprise or consist of a plane curve.

[0044] The cutting edge of the or each cutting member may comprise or consist of an ellipsoid section. The ellipsoid section may correspond to an intersection of a plane with an ellipsoid. Alternatively, the cutting edge of the or each cutting member may comprise or consist of a hyperboloid section. The hyperboloid section may correspond to an intersection of a plane with a hyperboloid (i.e. an intersection between a plane and an hourglass shape).

[0045] The cutting edge of the or each cutting member may comprise or consist of a cylindric section. The cylindric section may be an intersection of a plane with a right circular cylinder.

[0046] The dispensing apparatus may comprise at least one fixed cutting member for cooperating with the at least one cutting member mounted to the supply roller to cut the towel.

[0047] In a variant, the at least one cutting member may be configured to make a linear cut in the towel. The linear cut may extend at an acute angle to a central longitudinal axis of the towel. The resulting sheet of towel cut by the at least one cutting member may be in the form of a parallelogram. As a result, the overall length of the sheet is increased compared to a rectangular sheet. The perceived size of the sheet is increased which may reduce consumption of the towel.

[0048] According to a further aspect of the present invention there is provided a dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and
at least one first cutting member having a first cutting edge, the first cutting edge having a first profile; and
at least one second cutting member having a second cutting edge, the second cutting edge having a second profile;
wherein the first profile and the second profile are configured to cooperate with each other to cut the towel;
wherein the at least one second cutting member is mounted to and rotatable with the supply roller, the second profile comprising or consisting of a curved profile.

[0049] The first cutting edge and the second cutting edge may have complementary profiles.

[0050] The or each first cutting member may be at least substantially planar. The first cutting edge may have a linear profile. Alternatively, the first cutting edge may have a curved profile. The first cutting edge may have a profile comprising or consisting of a planar curve. The

first cutting edge may have a convex profile. Alternatively, the first cutting edge may have a concave profile. The first cutting edge may have a profile comprising or consisting of a curved recess. The first cutting edge may have a profile comprising or consisting of a part-elliptical recess.

[0051] The or each second cutting member may be at least substantially planar. The curved profile of the second cutting edge may comprise or consist of a planar curve. The second cutting edge may comprise or consist of a cylindric section. Alternatively, the second cutting edge may comprise or consist of a conic section or an ellipsoid section.

[0052] Unless indicated to the contrary or otherwise incompatible, the references herein to the profile of the cutting edge refer to the longitudinal profile of the cutting edge. In other words, the profile of the cutting edge along the length of the cutting member.

[0053] The term curved profile is used herein to refer to a profile which is non-linear. The curved profile may, for example, be in the form of a substantially continuous curve. The substantially continuous curve may be formed without angles and/or without interruptions.

[0054] Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0055] One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of a dispensing apparatus for dispensing sheets of towel in accordance with an embodiment of the present invention; Figure 2 shows a perspective view of the dispensing mechanism of the dispensing apparatus shown in Figure 1;

Figure 3 shows an exploded view of the dispensing mechanism shown in Figure 2;

Figure 4A shows a plan elevation of the front support member and the first cutting members;

Figure 4B shows plan and end elevations of the first cutting members shown in Figure 4A;

Figure 5A shows a front elevation of the supply roller and the second cutting members;

Figure 5B shows plan and end elevations of the second cutting members shown in Figure 5A;
 Figure 6 shows a transverse sectional view of the dispensing mechanism shown in Figure 2;
 Figure 7A shows a longitudinal position of a first transverse section A1 through the dispensing mechanism;
 Figure 7B shows the first transverse section A1 through the dispensing mechanism;
 Figure 8A shows a longitudinal position of a second transverse section A2 through the dispensing mechanism;
 Figure 8B shows the second transverse section A2 through the dispensing mechanism;
 Figure 9 illustrates the towel being fed through the dispensing apparatus and cut into sheets having opposing V-shaped ends.

DETAILED DESCRIPTION

[0056] A towel dispensing apparatus 1 in accordance with an embodiment of the present invention is described herein with reference to the accompanying Figures. The towel dispensing apparatus 1 is configured to dispense sheets S of a towel. The towel dispensing apparatus 1 may, for example, be installed in a washroom or public convenience. As described herein, the towel dispensing apparatus 1 is configured to cut the sheets S from a length of towel on a roll 3 in the towel dispensing apparatus 1. The towel has a uniform width and may, for example, comprise a paper-based product.

[0057] With reference to Figure 1, the towel dispensing apparatus 1 comprises a body portion 5 and a cover 7. The cover 7 is pivotally mounted to the body portion 5 and can be raised to an open position (shown in Figure 1) for servicing or maintenance. The body portion 5 comprises a housing 9 and a compartment 11 for storing the roll 3 of towel. The roll 3 may comprise a central spindle, but in the present embodiment the roll 3 does not include a spindle (i.e. the roll 3 is spindleless). A lock (not shown) is provided for retaining the cover 7. The body portion 5 comprises a back plate 13, first and second sidewalls 15A, 15B and a lower housing section 17. The back plate 13 is configured to be fastened to a vertical wall to mount the towel dispensing apparatus 1. The lower housing section 17 comprises a dispensing aperture 19 through which the sheets S of towel are dispensed.

[0058] First and second support arms 21A, 21B are provided in the compartment 9 for supporting the roll 3. The first support arm 21A comprises a first roll engaging members 23A; and the second support arm 21B comprises a second roll engaging member 23B. The first and second roll engaging members 23A, 23B engage opposing ends of the roll 3. The first and second support arms 21A, 21B are movably mounted on a transverse rail 25. The first and second support arms 21A, 21B can translate along the transverse rail 25 to accommodate different widths of towel. In the present embodiment, the first and

second support arms 21A, 21B are resiliently deformable to facilitate mounting of the roll 3. The first and second support arms 21A, 21B may, for example, be formed from an elastomeric material which can be deformed to move the first and second roll engaging members 23A, 23B apart to facilitate insertion and/or removal of the roll 3.

[0059] A cutting and dispensing mechanism 27 is removably mounted in a front region of the body portion 5. A perspective view of the cutting and dispensing mechanism 27 is shown in Figure 2; and an exploded view of the cutting and dispensing mechanism 27 is shown in Figure 3. The cutting and dispensing mechanism 27 comprises first and second side members 29A, 29B; a first guide roller 31, a supply roller 33, a second guide roller 35, an inner cover 37 and a front support member 39. The inner cover 37 is located over the supply roller 33. The inner cover 37 is pivotally mounted to facilitate feeding the towel from the roll 3 through the cutting and dispensing mechanism 27. The first guide roller 31, the supply roller 33, and the second guide roller 35 are rotatably mounted on the first and second side members 29A, 29B. The first guide roller 31 and the second guide roller 33 are rotatable freely. The supply roller 33 is rotatable about a central axis X. The supply roller 33 could be drivingly rotated, for example by an electric motor or by a manual actuator, such as a rotary member or a lever. In the present embodiment, the supply roller 33 is rotated by a user pulling on the towel being dispensed from the towel dispensing apparatus 1.

[0060] The supply roller 33 is mounted between the first and second guide rollers 31, 35. The first guide roller 31 is configured to guide the towel from the roll 3 onto the supply roller 33. The towel is supplied from the roll 3 around a rear portion of the first guide roller 31 and over an upper portion of the supply roller 33 towards the front of the cutting and dispensing mechanism 27. The second guide roller 35 guides the towel off the supply roller 33 and through the dispensing aperture 19. The second guide roller 35 may help maintain the towel in contact with the supply roller 33. An engaging surface 41 of the supply roller 33 cooperates with the towel such that a user pulling on the towel causes the supply roller 33 to rotate. High-grip members 43, such as an elastomeric member or a rubber member, are provided on the engaging surface 41 of the supply roller 33 to reduce or prevent the towel slipping in relation to the supply roller 33. The supply roller 33 is rotatable in only one direction (unidirectional) to maintain the towel in position.

[0061] The cutting and dispensing mechanism 27 comprises a pair of first cutting members 45A, 45B mounted to the front support member 39, as shown in Figure 4A. The first cutting members 45A, 45B extend along a first chord line CL1 of the supply roller 33 (in transverse section), as shown in Figure 6. The first cutting members 45A, 45B each comprise a plate, for example a metal plate, having a substantially planar configuration. The first cutting members 45A, 45B have a rigid (non-yielding or inflexible) composition. The first cutting members 45A,

45B could be formed from a single member. The first cutting members 45A, 45B each comprise a first end face 47A, 47B and a (upper) first engaging surface 49A, 49B. The first end faces 47A, 47B and the first engaging surfaces 49A, 49B of each first cutting member 45A, 45B define a first cutting edge 51A, 51 B having a first profile. As shown in Figures 4A and 4B, the first profile in the present embodiment comprises or consists of a linear profile. The first cutting edge 51A, 51B has a first edge angle which, in the present embodiment, is approximately 90° (i.e. the first end faces 47A, 47B and the first engaging surfaces 49A, 49B are substantially orthogonal). As shown in Figure 4B, the first cutting edges 51A, 51 B each have a substantially linear profile when viewed in planform. The first cutting members 45A, 45B are mounted to the front support member 39 such that the first cutting edges 51A, 51 B extend substantially parallel to the central axis X of the supply roller 33. The first cutting members 45A, 45B are mounted such that the first engaging surfaces 49A, 49B are inclined at a first angle α_1 to a radius R of the central axis X (in a reference plane extending perpendicular to the central axis X). The first angle α_1 in the present embodiment is approximately 65° . A gap or space is provided between the first cutting members 45A, 45B to maintain a central join between the sheet S being dispensed and the remainder of the towel. Similarly, the first cutting members 45A, 45B may not extend the full width of the towel to maintain one or more join at a side of the sheet S and the remainder of the towel. By maintaining these joins, the rotation of the supply roller 33 continues as the user extracts the sheet S. It will be understood that the join(s) can readily be torn by the user to separate the sheet S.

[0062] The first cutting members 45A, 45B are mounted such that the first cutting edges 51A, 51B extend substantially parallel to the central axis X of the supply roller 33. The first cutting members 45A, 45B in the present embodiment are fixedly mounted to the front support member 39. The first cutting members 45A, 45B are mounted to the front support member 39 using a suitable fastener (not shown), such as a mechanical fastener or an adhesive. The front support member 39 in the present embodiment is pivotally mounted on an axle 53 extending substantially parallel to the central axis X of the supply roller 33. In the present embodiment the position of the first cutting members 45A, 45B is fixed relative to the front support member 39. A spring element 54 (shown in Figure 2) is provided to act on the front support member 39 to bias the first cutting members 45A, 45B towards the supply roller 33. In a variant, the first cutting members 45A, 45B may be movably mounted on the front support member 39. For example, the first cutting members 45A, 45B may be mounted on a resilient mount for accommodating relative movement. The first cutting members 45A, 45B may be spring biased towards the supply roller 33. For example, one or more spring members may be provided to bias the first cutting members 45A, 45B towards the supply roller 33. Alternatively, or in addition, the front

support member 39 could be spring biased towards the supply roller 33. For example, the front support member 39 could be spring biased towards the supply roller 33 by one or more spring members.

[0063] The cutting and dispensing mechanism 27 comprises a pair of second cutting members 55A, 55B mounted to the supply roller 33, as shown in Figures 5A and 5B. The second cutting members 55A, 55B extend along a second chord line CL2 of the supply roller 33 (in transverse section), as shown in Figure 6. In the present embodiment the second cutting members 55A, 55B are fixedly mounted to the supply roller 33. The second cutting members 55A, 55B are configured to rotate with the supply roller 33. The second cutting members 55A, 55B each comprise a plate, for example a metal plate, having a substantially planar configuration. The second cutting members 55A, 55B have a rigid (non-yielding or inflexible) composition. The second cutting members 55A, 55B each comprise a second end face 57A, 57B and a (lower) second engaging surface 59A, 59B. The second end faces 57A, 57B and the second engaging surfaces 59A, 59B of each second cutting member 55A, 55B define a second cutting edge 61A, 61B. The second cutting edge 61A, 61B has a second edge angle which, in the present embodiment, is approximately 90° (i.e. the second end faces 57A, 57B and the second engaging surfaces 59A, 59B are substantially orthogonal). The second cutting members 55A, 55B are mounted such that the second engaging surfaces 59A, 59B are inclined at a second angle α_2 to a radius R of the central axis X (in a reference plane extending perpendicular to the central axis X). The second angle α_2 varies along the length of the second cutting members 55A, 55B. In the present embodiment, the second angle α_2 is greater than 45° and less than 90° ($45^\circ < \alpha_2 < 90^\circ$). A gap or space is provided between the second cutting members 55A, 55B to maintain a join between the sheet S being dispensed and the remainder of the towel.

[0064] As shown in Figure 3, the second cutting members 55A, 55B are inclined relative to each other in a V-shaped configuration. Each of the second cutting members 55A, 55B is inclined at an angle of approximately 75° relative to a reference plane extending perpendicular to the central axis X of the supply roller 33, as shown in Figure 5A. Thus, an included angle of approximately 160° is defined between the second cutting members 55A, 55B. The inclined arrangement of the second cutting members 55A, 55B on the supply roller 33 results in a V-shaped cut in the towel. The opposing first and second ends of the dispensed sheets S comprise V-shapes arranged parallel to each other, as shown in Figure 9. The sheets S may be described as having a chevron shape. This shape may create the impression of a larger surface area of each sheet S and may help to reduce consumption of the towel. The V-shaped configuration is oriented in opposition to a direction of travel of the towel on the supply roller 33. Thus, the apex formed by the second cutting members 55A, 55B points in the opposite direc-

tion to the rotational direction of the supply roller 33 for supplying towel. This arrangement results causes each second cutting member 55A, 55B to initiate a cut at an outer portion of the towel. The cut progress inwardly towards a centre of the towel as the supply roller 33 continues to rotate. The outer edges of the second cutting edges 61A, 61B may extend up to or beyond the edges of the towel. Alternatively, the outer edges of the second cutting edges 61A, 61B may be inset from the edges of the towel. Alternatively, or in addition, the inner edges of the second cutting edges 61A, 61B may be spaced apart from each other. This arrangement may leave sections of the towel intact after the cutting action is complete. These intact sections may maintain integrity of the towel to facilitate continued rotation of the supply roller 33. The final separation of the sheet of the towel may be performed by a tearing or ripping action to separate the intact sections. The second cutting members 55A, 55B may each be profiled to perform a perforated cut leaving a plurality of intact sections.

[0065] As shown in Figures 5A and 5B, the second cutting edges 61A, 61B each have a second profile. The second profile comprises a curved profile when viewed in planform. The second cutting edges 61A, 61B extend a substantially uniform radial distance from the central axis X along a length of the respective second cutting members 55A, 55B. In the present embodiment, the second cutting edges 61A, 61B each have a part-elliptical profile. The curved second profile of each of the second cutting edges 61A, 61B represents a cylindric section corresponding to the intersection of a cylindrical surface with a plane. The second cutting edges 61A, 61B may comprise or consist of a profile having a (circular) arc when viewed along the central axis X. In the present embodiment, the cylindric section is defined by the intersection of a virtual right cylinder having a diameter larger than the diameter of the supply roller 33 (thereby ensuring that the second cutting edges 61A, 61B extend beyond the engaging surface 41 of the supply roller 22); and a plane corresponding to the plane of the respective second cutting members 55A, 55B. As outlined above, the second cutting members 55A, 55B in the present embodiment are planar and the curved profiles of the second cutting edges 61A, 61B consist of a plane curve. In a variant, the second cutting members 55A, 55B may be non-planar, for example comprising one or more curve and/or one or more bend. The second cutting members 55A, 55B may be part-helical, for example. In these arrangements, the curved profiles of the second cutting edges 61A, 61B may comprise or consist of a non-planar curve (i.e. a curve formed in three dimensions). In a variant, the second cutting edges 61A, 61B may comprise or consist of an ellipsoid section or a conic section.

[0066] The towel is fed over the supply roller 33 and passes between the first cutting members 45A, 45B and the second cutting members 55A, 55B. The first cutting members 45A, 45B and the second cutting members 55A, 55B are configured to cooperate with each other to

cut the towel to form the sheets S for dispensing. The rotation of the supply roller 33 causes the second cutting members 55A, 55B to rotate relative to the first cutting members 45A, 45B. The first cutting member 45A is configured to cooperate with the second cutting member 55A; and the first cutting member 45B is configured to cooperate with the second cutting members 55B. The first cutting members 45A, 45B are configured such that the first cutting edges 51A, 51B extend substantially parallel to the central axis X. The second cutting members 55A, 55B extend a substantially uniform radial distance from the central axis X along their length. Thus, a radial extent of the second cutting edges 61A, 61B is substantially uniform along at least substantially the entire length of each of the second cutting members 55A, 55B. The second cutting edges 61A, 61B may deviate slightly from this profile, for example at a first (inner) end and/or a second (outer) end of the second cutting edges 61A, 61B to provide a run-in and/or a run-out cutting feature.

[0067] As a user pulls on the towel, the supply roller 33 is rotated causing the second cutting members 55A, 55B to move relative to the first cutting members 45A, 45B. The second cutting members 55A, 55B are thereby advanced as the supply roller 33 rotates. The continued rotation of the supply roller brings the second cutting members 55A, 55B into engagement with the first cutting members 45A, 45B. Since the second cutting members 55A, 55B are angularly inclined relative to the first cutting members 45A, 45B, each first cutting member 45A, 45B engages with an associated second cutting member 55A, 55B at a discrete location. The towel is cut locally at this location (referred to herein as a point cut). In the present embodiment, the V-shaped configuration of the second cutting members 55A, 55B results in two (2) point cuts being formed in the towel at the same time. The point cuts are initiated on opposing sides of the towel and progress inwardly towards a centreline of the towel as the supply roller 33 rotates (due to orientation of the V-shaped configuration of the second cutting members 55A, 55B in relation to the direction of travel of the towel). It will be understood that different arrangements of the or each first cutting members 45A, 45B and/or the second cutting members 55A, 55B may result in a single point cut or more than two points cuts at any given time. The continued rotation of the supply roller 33 changes the location where the first cutting members 45A, 45B engages with the associated second cutting members 55A, 55B. This change in location advances the point cut such that the towel is cut progressively as the supply roller 33 rotates. The cutting action is complete when the supply roller 33 advances the second cutting members 55A, 55B past the first cutting members 45A, 45B. The sheet S is dispensed through the dispensing aperture at the bottom of the towel dispensing apparatus 1.

[0068] The cutting action performed by the first cutting members 45A, 45B and the second cutting members 55A, 55B will now be described with reference to Figures 5 and 6. The first engaging surfaces 49A, 49B of the first

cutting members 45A, 45B are inclined at a first angle α_1 to a radius of the central axis X. The second engaging surfaces 59A, 59B of the second cutting members 55A, 55B are inclined at a second angle α_2 to a radius of the central axis X. The first angle α_1 and the second angle α_2 are offset relative to each other to define a cutting angle α_3 ($\alpha_3 = \alpha_1 - \alpha_2$). The cutting angle α_3 is non-zero (i.e. greater than 0°) and preferably less than 30° . It has been determined that, at least in certain embodiments, a cutting angle α_3 in this range provides a reliable cutting action. In the present embodiment the cutting angle α_3 is less than or equal to 10° . The second angle α_2 in the present embodiment changes along the length of the second cutting members 55A, 55B.

[0069] As described herein, the second cutting members 55A, 55B are inclined relative to each other a V-shaped configuration. Since the second cutting members 55A, 55B are disposed on the supply roller 33, the resulting cut in the towel is also V-shaped. The opposing ends of the sheet S comprise V-shaped cuts (arranged parallel to each other) such that the sheet S is a chevron shape. This shape gives the impression of an increased surface area of the sheet S. A sheet S cut from the roll 3 is illustrated in Figure 6. In a variant, the second cutting member(s) 55A, 55B can be configured to make a cut at least substantially across a width of the towel. The cut may extend at an acute angle to a central longitudinal axis of the towel. For example, the cut may extend at an angle greater than or equal to 15° , 30° or 45° to a central longitudinal axis of the towel. The resulting sheet of towel cut by the at least one cutting member may be in the form of a parallelogram.

[0070] It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application. For example, the second cutting members 55A, 55B could be retractable, for example into an interior of the supply roller 33. A mechanism could be incorporated into the support roller 33 to retract the second cutting members 55A, 55B.

[0071] The second cutting members 55A, 55B in the above embodiment have been described as having second cutting edges 61A, 61B comprising a curved profile. Alternatively, or in addition, the first cutting members 45A, 45B may have first cutting edges 51A, 51B comprising a curved profile. The curved profile of each first cutting member 45A, 45B may be concave. The first cutting edges 51A, 51B may comprise a plane curve, for example comprising a cylindric section. The first cutting edges 51A, 51B may comprise or consist of a profile having a (circular) arc when viewed along the central axis X. The second cutting members 55A, 55B may comprise second cutting edges 61A, 61B comprising a linear profile. The first cutting members 45A, 45B may be inclined relative to each other, for example comprising or consisting of a V-shape. The V-shape may converge or diverge in a direction of travel of the towel as it is dispensed from the towel dispensing apparatus 1. The orientation of the

first cutting members 45A, 45B relative to the second cutting members 55A, 55B may correspond to the arrangement described herein. For example, the cutting angle defined between the faces of the first cutting members 45A, 45B and the second cutting members 55A, 55B may be the same as the ranges described herein with respect to the earlier embodiment. It will be understood that the first cutting members 45A, 45B and/or the second cutting members 55A, 55B may each comprise a substantially planar plate.

[0072] The second cutting members 55A, 55B have been described herein as comprising a cylindric section. In a variant, the second cutting members 55A, 55B may comprise an ellipsoid section. The ellipsoid section can be defined by an intersection of a plane and an ellipsoid. The first cutting members 45A, 45B can be modified such that the first cutting edges 51A, 51B are complementary. For example, the first cutting edges 51A, 51B may have a concave profile.

[0073] The first cutting members 45A, 45B have been described as comprising plates. In a variant, the first cutting members 45A, 45B may comprise an elongate member, such as a bar, a rod or a tube. The elongate member may comprise or consist of a polygonal section. For example, the elongate member may comprise or consist of a square or rectangular section. In a variant, the elongate member may comprise a circular or elliptical section. The elongate member may comprise a radiused edge which is suitable for forming the first cutting members 45A, 45B. The radiused edge may have a radius of less than or equal to 3mm, for example 1mm or 2mm.

[0074] The second profile may comprise or consist of an ellipsoid section. The ellipsoid section may correspond to an intersection of a plane with an ellipsoid. Alternatively, the second profile may comprise or consist of a hyperboloid section. The hyperboloid section may correspond to an intersection of a plane with a hyperboloid (i.e. an intersection between a plane and an hour-glass shape). Alternatively, the second profile may comprise or consist of a cylindric section. The cylindric section may correspond to an intersection of a plane with a right circular cylinder.

[0075] It will be understood that more than two of the second cutting members 55A, 55B may be provided. The second cutting members 55A, 55B could be formed from a single member, for example comprise one or more bends to form the non-linear cutting configuration.

[0076] Further aspects of the present invention are described in the following set of numbered paragraphs.

1. A dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and
at least one first cutting member comprising a first cutting edge having a first profile; and
at least one second cutting member comprising

- a second cutting edge having a second profile, the second profile comprising or consisting of a curved profile;
 the at least one first cutting member or the at least one second cutting member being mounted to the supply roller for rotation with the supply roller;
 wherein, in use, the at least one first cutting member and the at least one second cutting member cooperate with each other as the supply roller rotates to cut the towel.
2. A dispensing apparatus as described in paragraph 1, wherein the second cutting edge of the or each second cutting member extends a radial distance from the central axis, the radial distance being substantially uniform along at least a portion of a length of the or each second cutting member.
3. A dispensing apparatus as described in paragraph 1 or paragraph 2, wherein the second cutting edge of the or each second cutting member is disposed outwardly of an outer surface of the supply roller.
4. A dispensing apparatus as described in any one of paragraphs 1, 2 or 3, wherein the first profile comprises or consists of a linear profile, the first cutting edge of the or each first cutting member extending substantially parallel to the rotation axis.
5. A dispensing apparatus as described in any one of the preceding paragraphs, wherein a chord line of the second cutting edge of the or each second cutting member extends at an acute angle to a reference plane extending perpendicular to the rotation axis.
6. A dispensing apparatus as described in any one of the preceding paragraphs, wherein the first cutting edge of the or each first cutting member cooperates with the or each second cutting edge of the or each second cutting member at a discrete location to perform a point cut such that the towel is cut progressively as the supply roller rotates.
7. A dispensing apparatus as described in any one of the preceding paragraphs, wherein the or each first cutting member comprises a first face inclined at a first angle relative to a radius of the central axis; and the or each second cutting member comprises a second face inclined at a second angle relative to a radius of the central axis, the first angle being different from the second angle to define a cutting angle between the first and second faces.
8. A dispensing apparatus as described in paragraph 7, wherein the cutting angle is in the range 0° to 35° ; or in the range 0° to 25° ; or in the range 0° to 20° ;

or in the range 0° to 10° .

9. A dispensing apparatus as described in paragraph 7 or paragraph 8, wherein the first angle is an acute angle; and/or the second angle is an acute angle.
10. A dispensing apparatus as described in any one of the preceding paragraphs, wherein the second profile comprises or consists of a cylindric section.
11. A dispensing apparatus as described in any one of the preceding paragraphs wherein the second profile comprises or consists of a plane curve.
12. A dispensing apparatus as described in any one of the preceding paragraphs, wherein the or each first cutting member is mounted to a support member in the dispensing apparatus, the or each first cutting member being spring biased towards the supply roller.
13. A dispensing apparatus as described in any one of the preceding paragraphs, wherein the or each second cutting member is mounted to the supply roller for rotation with the supply roller.
14. A dispensing apparatus as described in paragraph 13, wherein, as the supply roller rotates, the or each second cutting member is arranged to travel past the or each first cutting member such that the second cutting edge of the or each second cutting member cooperates with the first cutting edge of the or each first cutting member to cut the paper towel.
15. A dispensing apparatus as described in any one of the preceding paragraphs, wherein the at least one first cutting member comprises a first cutting plate; and the at least one second cutting member comprises a second cutting plate.
16. A dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:
 a supply roller rotatable about a central axis; and
 at least one first cutting member mounted to a support member; and
 at least one second cutting member mounted to the supply roller for rotation with the supply roller;
 the at least one first cutting member and the at least one second cutting member being configured to cooperate with each other to cut the paper towel;
 wherein the or each first cutting member comprises a first face inclined at a first angle relative to a radius of the central axis; and the or each second cutting member comprises a second

face inclined at a second angle relative to a radius of the central axis, the first angle being different from the second angle to define a cutting angle between the first and second faces.

17. A dispensing apparatus as described in paragraph 16, wherein the cutting angle is in the range 0° to 30°; or in the range 0° to 20°; or in the range 1° to 10°.

18. A dispensing apparatus as described in paragraph 16 or paragraph 17, wherein the first angle is an acute angle; and/or the second angle is an acute angle.

19. A dispensing apparatus for cutting a sheet from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and at least one cutting member mounted to the supply roller for rotation with the supply roller, the or each cutting member comprising a cutting edge for cutting the towel;
wherein the at least one cutting member is configured to make a non-linear cut in the towel.

20. A dispensing apparatus as described in paragraph 19, wherein the cutting edge of the or each cutting member comprises or consists of a curved profile.

21. A dispensing apparatus as described in paragraph 19 or paragraph 20, wherein the cutting edge of the or each cutting member extends a radial distance from the central axis, the radial distance being substantially uniform along at least a portion of a length of the or each cutting member.

22. A dispensing apparatus as described in any one of paragraphs 19, 20 or 21, wherein the cutting edge of the or each cutting member comprises or consists of a plane curve.

23. A dispensing apparatus as described in any one of paragraphs 19 to 22, wherein the cutting edge of the or each cutting member comprises or consists of a cylindric section.

24. A dispensing apparatus as described in any one of paragraphs 19 to 23 comprising at least one fixed cutting member for cooperating with the at least one cutting member mounted to the supply roller to cut the towel.

Claims

1. A dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:

a supply roller rotatable about a central axis; and at least one first cutting member comprising a first cutting edge having a first profile; and at least one second cutting member comprising a second cutting edge having a second profile, the second profile comprising or consisting of a curved profile;
the at least one first cutting member or the at least one second cutting member being mounted to the supply roller for rotation with the supply roller;
wherein, in use, the at least one first cutting member and the at least one second cutting member cooperate with each other as the supply roller rotates to cut the towel.

2. A dispensing apparatus as claimed in claim 1, wherein the second cutting edge of the or each second cutting member extends a radial distance from the central axis, the radial distance being substantially uniform along at least a portion of a length of the or each second cutting member.

3. A dispensing apparatus as claimed in claim 1 or claim 2, wherein the second cutting edge of the or each second cutting member is disposed outwardly of an outer surface of the supply roller.

4. A dispensing apparatus as claimed in any one of the preceding claims, wherein a chord line of the second cutting edge of the or each second cutting member extends at an acute angle to a reference plane extending perpendicular to the central axis.

5. A dispensing apparatus as claimed in any one of the preceding claims, wherein the first cutting edge of the or each first cutting member cooperates with the or each second cutting edge of the or each second cutting member at a discrete location to perform a point cut such that the towel is cut progressively as the supply roller rotates.

6. A dispensing apparatus as claimed in any one of the preceding claims, wherein the or each first cutting member comprises a first face inclined at a first angle relative to a radius of the central axis; and the or each second cutting member comprises a second face inclined at a second angle relative to a radius of the central axis, the first angle being different from the second angle to define a cutting angle between the first and second faces.

7. A dispensing apparatus as claimed in claim 6, wherein the cutting angle is in the range 0° to 35° ; or in the range 0° to 25° ; or in the range 0° to 20° ; or in the range 0° to 10° .
8. A dispensing apparatus as claimed in claim 6 or claim 7, wherein the first angle is an acute angle; and/or the second angle is an acute angle.
9. A dispensing apparatus as claimed in any one of the preceding claims, wherein the second profile comprises or consists of a cylindric section.
10. A dispensing apparatus as claimed in any one of the preceding claims wherein the second profile comprises or consists of a plane curve.
11. A dispensing apparatus as claimed in any one of the preceding claims, wherein the or each first cutting member is mounted to a support member in the dispensing apparatus, the or each first cutting member being spring biased towards the supply roller.
12. A dispensing apparatus as claimed in any one of the preceding claims, wherein the or each second cutting member is mounted to the supply roller for rotation with the supply roller, wherein, as the supply roller rotates, the or each second cutting member is arranged to travel past the or each first cutting member such that the second cutting edge of the or each second cutting member cooperates with the first cutting edge of the or each first cutting member to cut the paper towel.
13. A dispensing apparatus as claimed in any one of the preceding claims, wherein the at least one first cutting member comprises a first cutting plate; and the at least one second cutting member comprises a second cutting plate.
14. A dispensing apparatus for cutting sheets from a length of towel, the dispensing apparatus comprising:
- a supply roller rotatable about a central axis; and
 - at least one first cutting member mounted to a support member; and
 - at least one second cutting member mounted to the supply roller for rotation with the supply roller;
 - the at least one first cutting member and the at least one second cutting member being configured to cooperate with each other to cut the paper towel;
 - wherein the or each first cutting member comprises a first face inclined at a first angle relative to a radius of the central axis; and the or each second cutting member comprises a second face inclined at a second angle relative to a radius of the central axis, the first angle being different from the second angle to define a cutting angle between the first and second faces.
15. A dispensing apparatus as claimed in claim 14, wherein the cutting angle is in the range 0° to 30° ; or in the range 0° to 20° ; or in the range 1° to 10° .
16. A dispensing apparatus as claimed in claim 14 or claim 15, wherein the first angle is an acute angle; and/or the second angle is an acute angle.

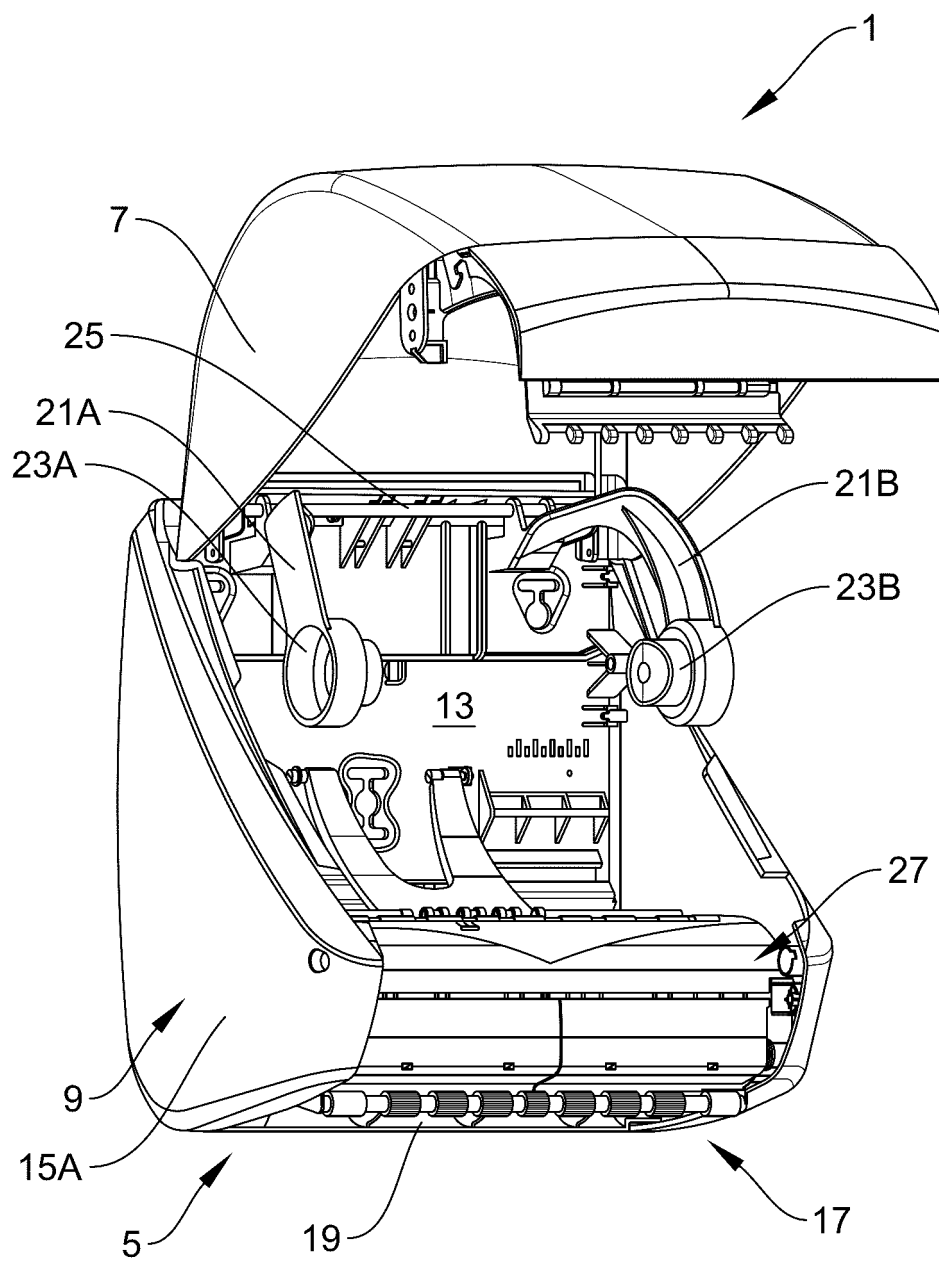


FIG. 1

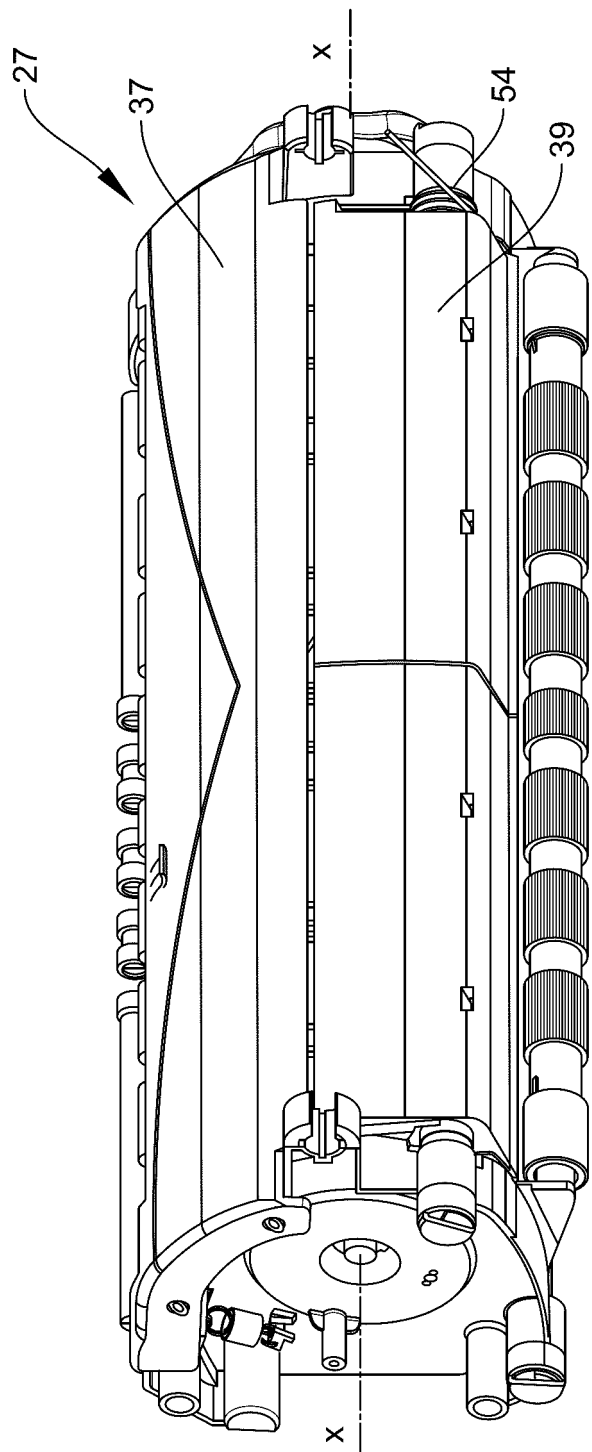


FIG. 2

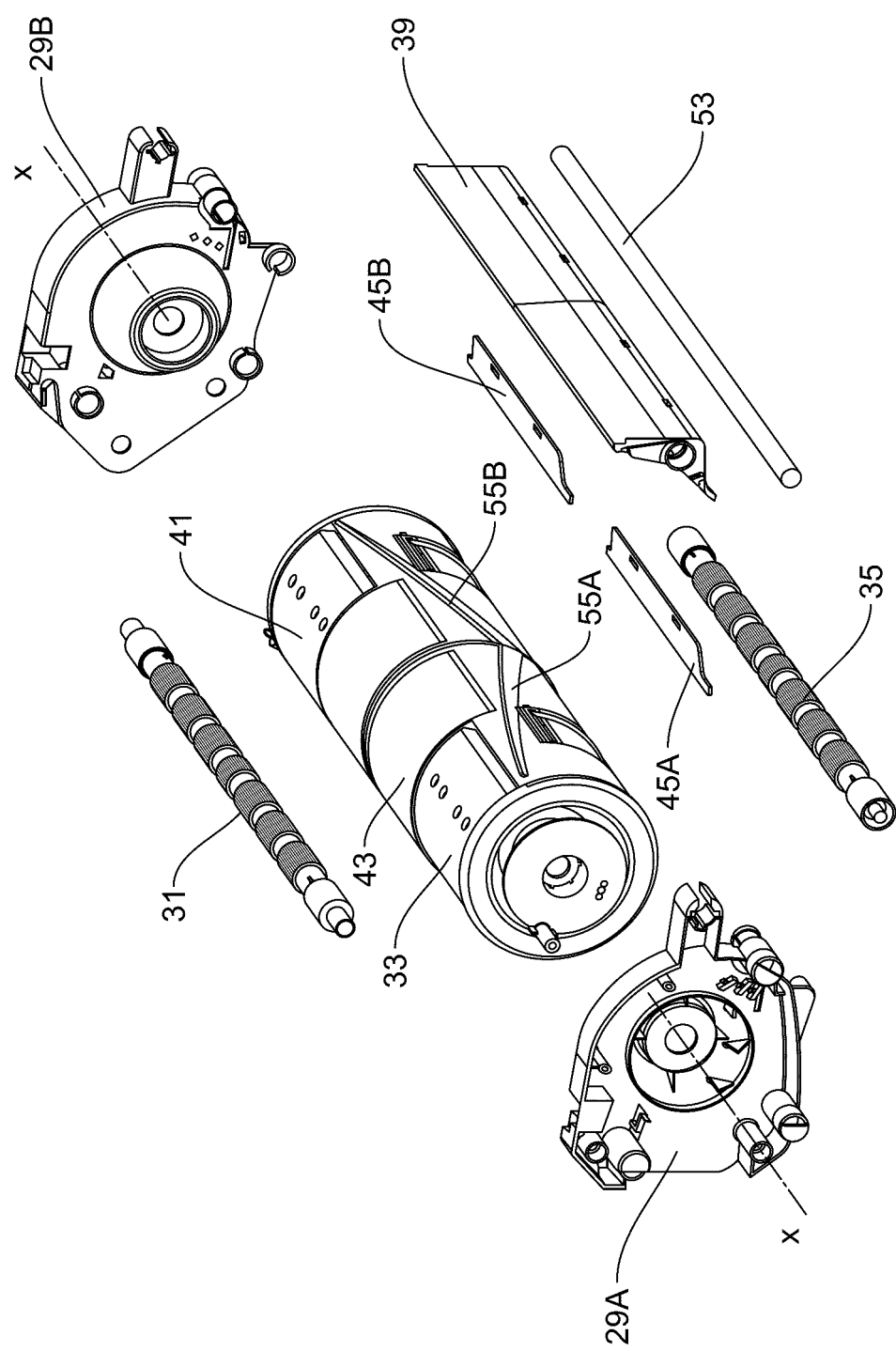


FIG. 3

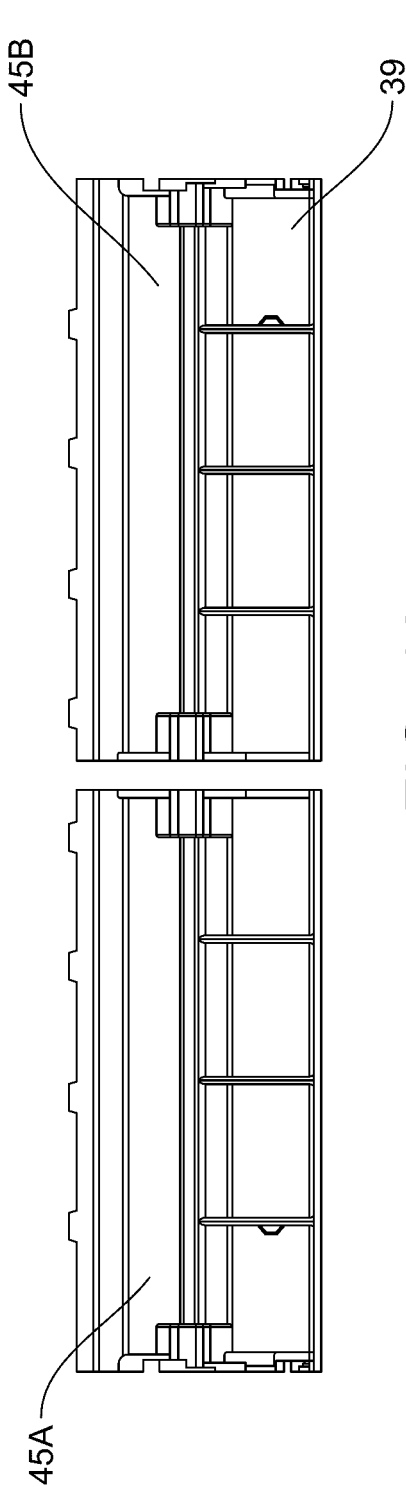


FIG. 4A

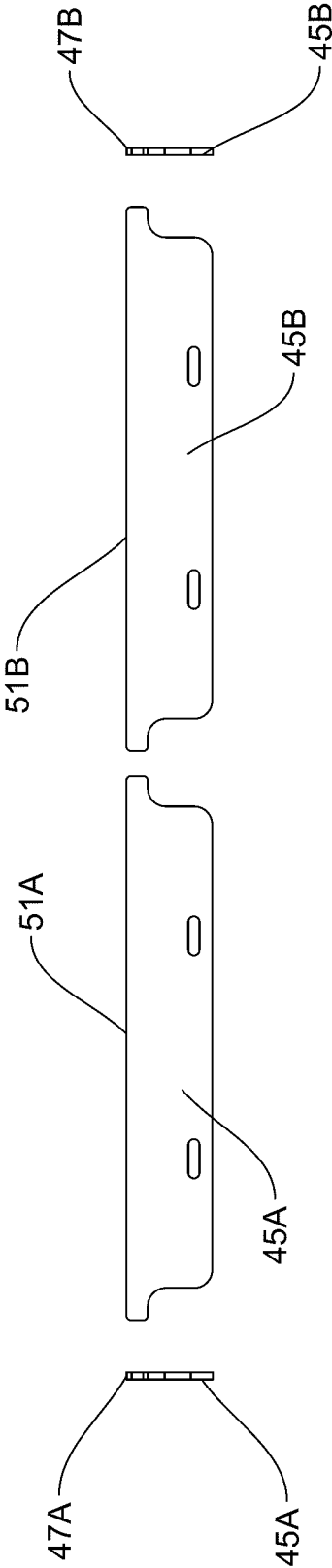


FIG. 4B

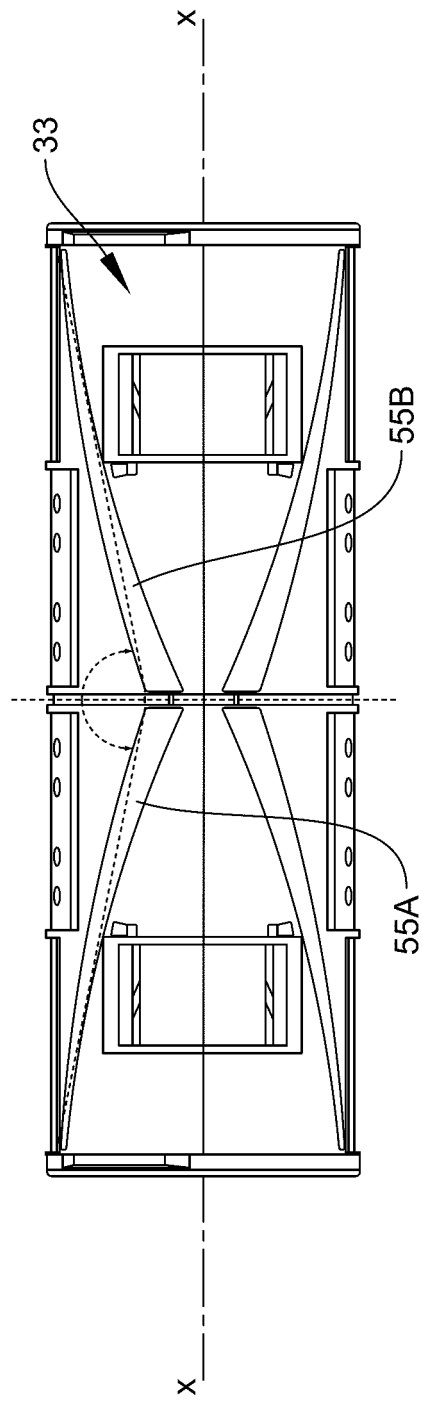


FIG. 5A

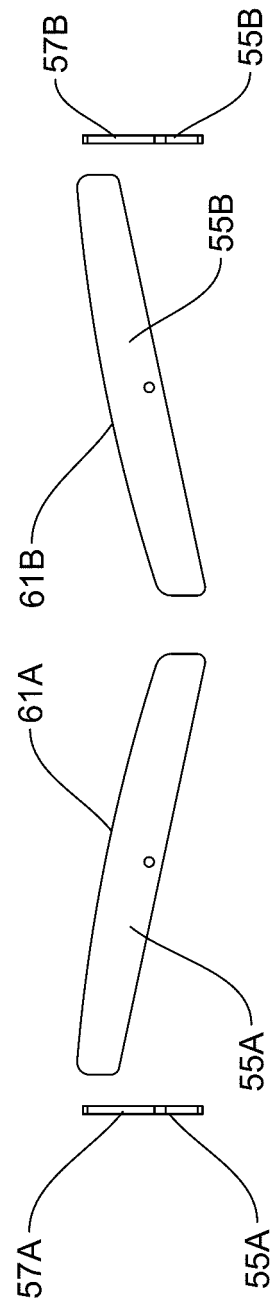


FIG. 5B

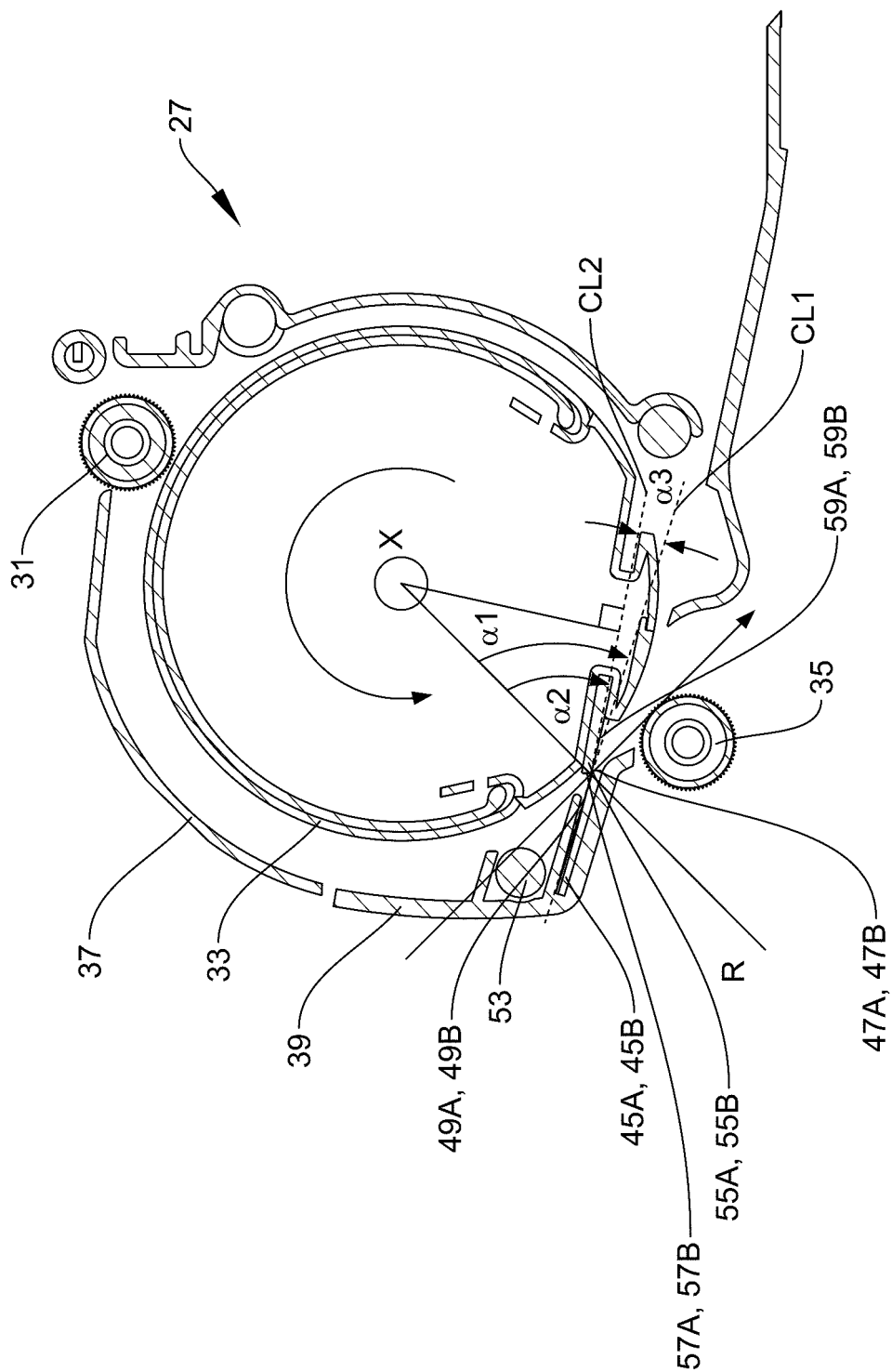


FIG. 6

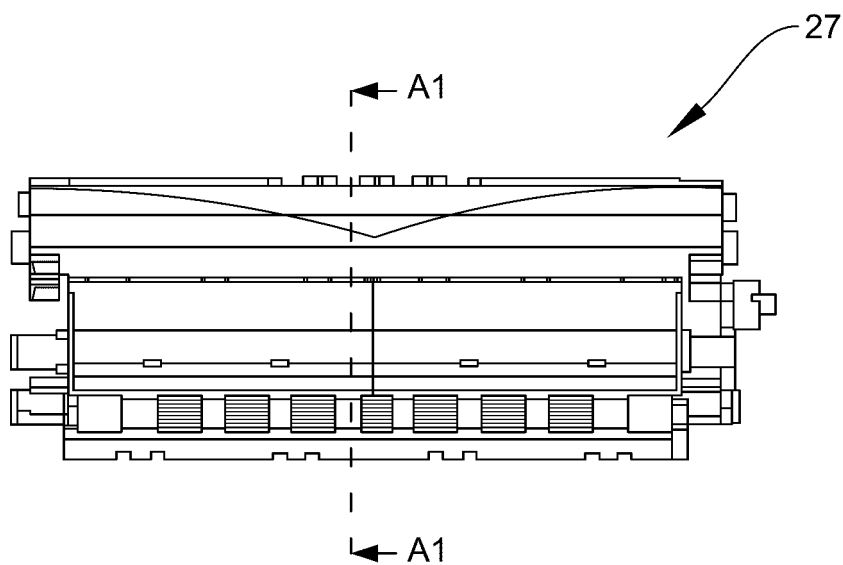


FIG. 7A

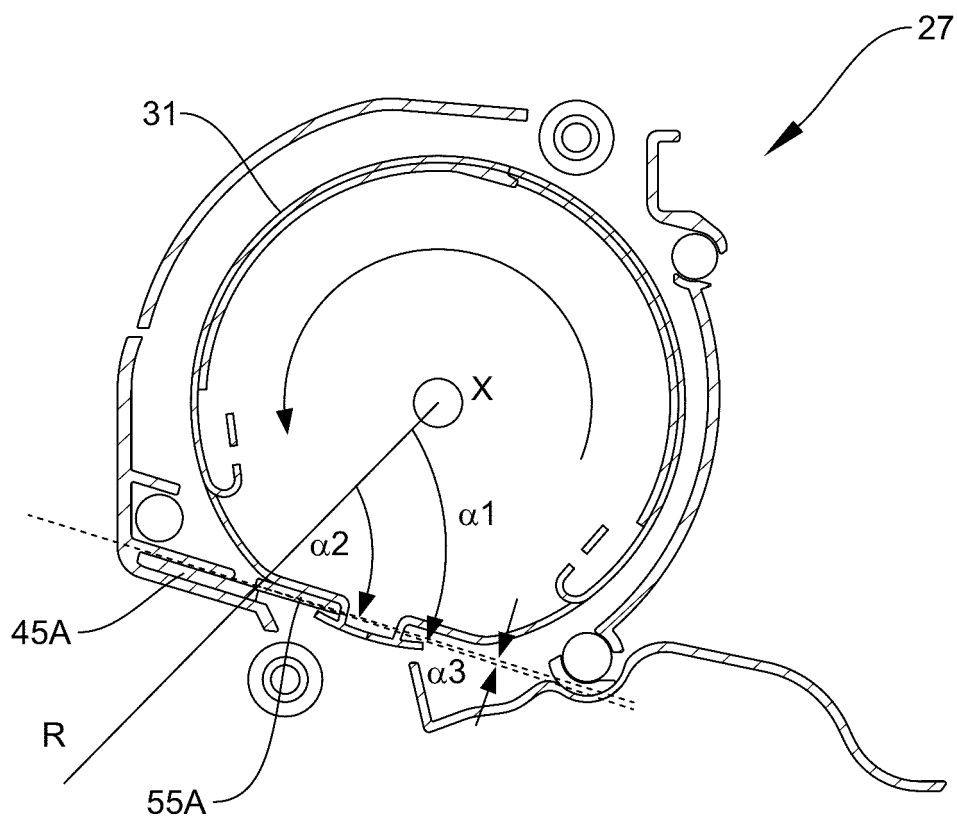


FIG. 7B

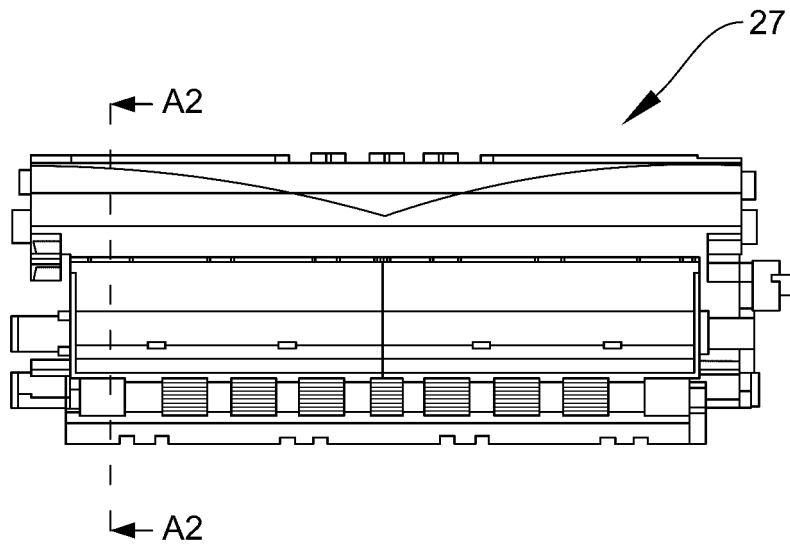


FIG. 8A

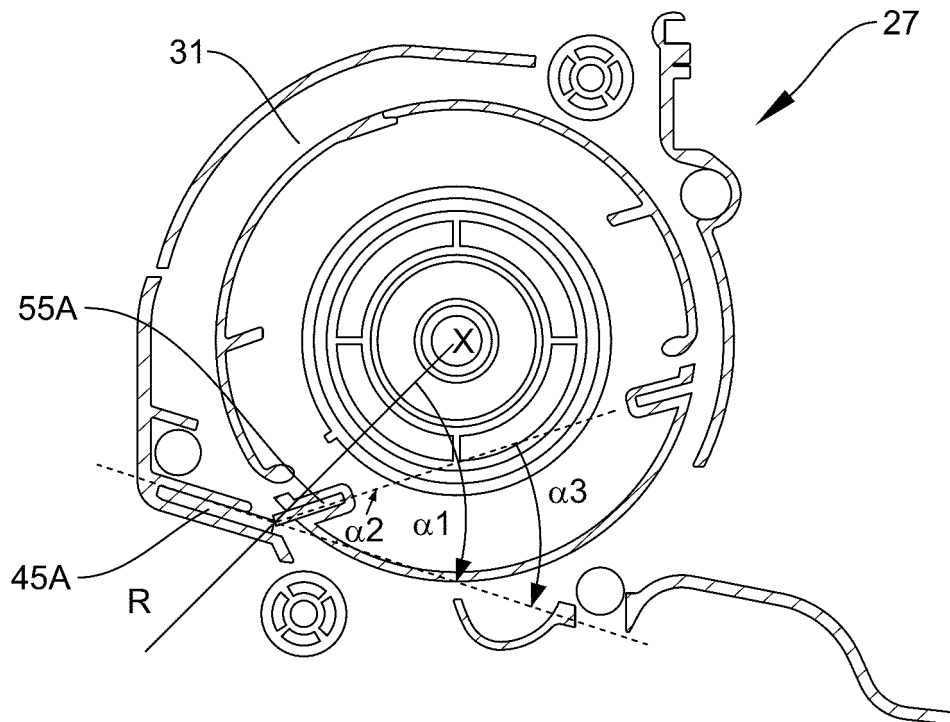


FIG. 8B

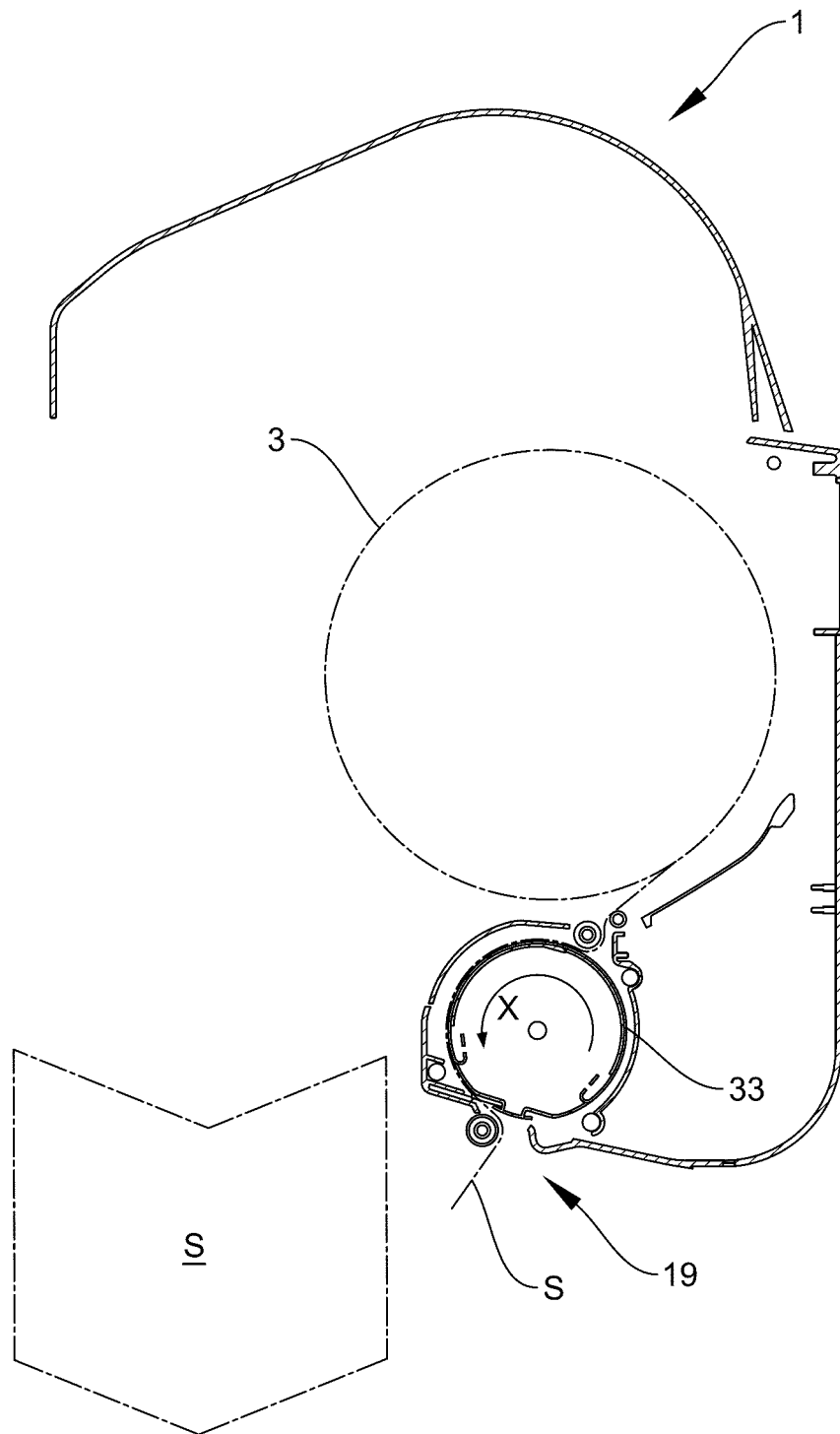


FIG. 9