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(54) Apparatus for shear cutting and dispensing individual sheets of paper toweling

(57) Apparatus for shear cutting and dispensing individual sheets of paper toweling (22) from a web of paper toweling, including a feed roller (18) and two shear blades (32,40) which engage to cut the toweling. One of the shear blades curves about the outer peripheral surface of the feed roller with the curvature of the elongated, curved cutting distal end of the curved shear blade generally corresponding to the predetermined curvature of the feed roller outer peripheral surface.

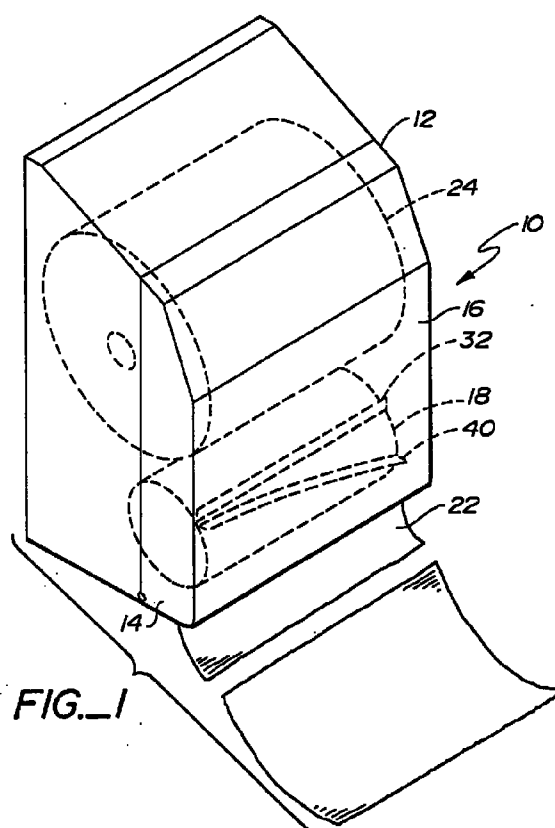


FIG. 1

EP 0 693 268 A1

Description

This invention relates to an apparatus for shear cutting and dispensing individual sheets of paper toweling from a web of paper toweling forming a roll. The shear cutting and dispensing operations are initiated and carried out by a user grasping and pulling a terminal end portion of the toweling.

The prior art includes a number of arrangements for the simultaneous dispensing and cutting of paper toweling. U.S. Patent No. 3,896,691, issued July 29, 1975, for example, discloses such a device. The free end of a roll of toweling passes over a drum having a non-circular periphery and pulling of the free end by the user causes rotation of the drum and unwinding of the roll. A blade is secured to the drum and rotates therewith. The blade secured to the drum engages a counter-blade in position within the apparatus housing. Both the blade and counter-blade are straight; however, the counter-blade is angled or obliquely mounted so that the blade and counter-blade cut the toweling passing between them in a manner of a pair of scissors.

Because the blade and counter-blade of the apparatus of U.S. Patent No. 3,896,691 are straight, cutting across the entire width of the web must be accomplished within a very short segment of the rotation of the drum and within a very short period of time. This means that considerable tension or pulling forces must be applied to the toweling free end to operate the apparatus during the short period of blade engagement, possible resulting in ripping or tearing of the toweling. Furthermore, the blade and counter-blade are prone to maladjustment and misalignment due to the mounting schemes employed.

A search of the prior art directed to the present invention also located the following U.S. Patents: 764,806, issued July 12, 1904, 3,998,120, issued December 21, 1976, 4,441,392, issued April 10, 1984, 4,846,035, issued July 11, 1989, 5,078,033, issued January 7, 1992, and 5,048,386, issued September 17, 1991.

U.S. Patent No. 764,806 discloses a toilet tissue holder and cutter wherein a serrated blade extends diagonally across a cutter roller. The blade makes a cut when it pierces through the toilet tissue and lodges in a corresponding diagonal recess formed in an adjacent roller.

Others of the noted patents disclose cooperable cutter blade arrangements, both fixed and movable, but the blades are straight and suffer from the deficiencies noted above with respect to straight blade configurations.

Furthermore, arrangements employing blades which pierce toweling on a drum or roll present a common problem. Some stretching of the toweling by the force of a knife is an inevitable byproduct of the piercing operation. Furthermore, use of blades with teeth as taught by some of the prior art devices results in unattractive and imperfect cuts. Also, such mechanisms often do not work effectively over a wide range of paper quality and thickness. This is especially true after prolonged

usage and resultant dulling of the blade or blades employed.

Preferred embodiments of the present invention do not suffer from the deficiencies of the arrangements shown in the above-identified patents. In such embodiments, a particular combination of shear blade means is employed to shear cut the web as the terminal end portion of the web is being withdrawn by the user. This action produces a very clean cut and there is no stretching or other undue distortion of the paper web which can affect performance and appearance.

Shear cutting may be accomplished readily and reliably over a wide range of paper quality and thickness. Thus, apparatus constructed in accordance with such embodiments may be employed in association with paper towelling of many types without fear that the cutting and dispensing operations will not be performed properly.

In addition, in such embodiments the shear cutting operation is carried out by shear blade means which are not prone to maladjustment and which, when engaged during shear cutting, do not require hard pulling by the operator or exceptional tensile forces being imposed on the towelling to complete the cutting operation.

The preferred forms of the present invention are further characterised by relative simplicity and low cost, as compared with many prior art towelling cutter dispensers.

In one aspect the invention provides apparatus for shear cutting and dispensing individual sheets of paper toweling from a roll thereof, comprising:

a housing for containing the roll and permitting rotation thereof to dispense towelling;

a first shear blade and a second shear blade, one of said blades being rotatably mounted so that cutting edges of the blades periodically oppose each other to effect shear cutting;

means for feeding towelling to the blades so that it passes between the cutting edges thereof and is sheared at intervals into sheets;

and characterised in that said cutting edges lie on adjacent projected cylindrical surfaces having a common axis, said one shear blade being rotatable about said axis, the shear blades being at different angles to the said axis and the sense of rotation being such that the cutting edges oppose each other at an acute angle and define a cutting point which travels along the length of the cutting edges.

In another aspect the invention provides apparatus for shear cutting and dispensing individual sheets of paper toweling from a web of paper towelling forming a roll and having a terminal end portion. The apparatus includes a housing defining an interior.

A feed roller is rotatably mounted in the housing interior and has an outer peripheral surface for engaging the web terminal end portion, the outer peripheral surface of the feed roller having a circular cross-section of predetermined curvature.

A first shear blade having a shear cutting distal end is mounted on the feed roller and rotatable with the feed roller.

A second shear blade having a shear cutting distal end is mounted within the housing and engageable by the first shear blade upon rotation of the feed roller to shear cut the web and at least partially sever the terminal end portion from the remainder of the web.

At least one of the shear blades extends along a predetermined length of the feed roller and curves about a portion of the outer peripheral surface of the feed roller. The shear cutting distal end of said at least one shear blade comprises an elongated, curved, cutting distal end spaced from the outer peripheral surface of the feed roller, the curvature of the elongated, curved cutting distal end generally corresponding to the predetermined curvature of the feed roller outer peripheral surface.

The first shear blade may be mounted on the feed roller at a predetermined location thereon and may be slanted relative to the feed roller whereby the first shear blade is cantilevered relative to the feed roller. The shear cutting distal end of the first shear blade may define an open space with the feed roller outer peripheral surface whereby the first shear blade is free to flex at the elongated, curved cutting distal end relative to the feed roller outer peripheral surface when external force is applied to the first shear blade.

The curved shear blade, as disclosed herein, may be formed from a length of sheet metal twisted along at least a portion of the length thereof to curve about the feed roller outer peripheral surface portion.

Other features, advantages, and objects of the present invention will become apparent with reference to the following description and accompanying drawings.

Fig. 1 is a schematic perspective view of apparatus constructed in accordance with the teachings of the present invention;

Fig. 2 is a schematic side view of the apparatus;

Figs. 3 through 6 are schematic, partial, side views of the apparatus illustrating the relative positions assumed by structural components of the apparatus during sequential stages of operation of the apparatus; and

Fig. 7 is a view similar to Fig. 1 but illustrating an alternative embodiment of the invention.

Referring now to Figs. 1-6, apparatus constructed in accordance with the teachings of the present invention is generally designated by reference numeral 10. Apparatus 10 includes a housing 12 defining an interior, said housing including a housing body 14 and a cover 16 pivotally attached thereto to selectively allow access to the housing interior by an attendant.

Feed roller 18 having a circular cross section and an outer peripheral surface 20 having a predetermined curvature is rotatably mounted in the housing interior by any known expedient. The feed roller is essentially freely rotatable about its longitudinal axis and the outer peripheral

surface 20 provides a support for a web of paper toweling 22 fed from a supply roll 24 rotatably mounted within the housing interior.

The toweling passes under a freely rotatable pressure roll 26 and remains positioned on the outer peripheral surface 20 before diverging away from the feed roller and outwardly through a slot 28 formed in the bottom of the housing or cabinet 12. The terminal end portion of the web of paper toweling 22 projecting from the slot is manually grasped and pulled by a consumer when an individual sheet of paper toweling is to be dispensed.

A shear blade 32 is mounted on feed roller 18, the blade extending the length of the feed roller. In the illustrated embodiment, shear blade 32 is straight; that is, it extends in a longitudinal direction corresponding to the longitudinal axis of the feed roller. The shear blade 32 has a shear cutting distal end 34 and the blade may be formed of any suitable material, sheet spring steel having been found to be one such suitable material.

It is to be noted that shear blade 32 is slanted relative to the feed roller 18 whereby the shear blade is disposed at an angle and cantilevered relative to the feed roller and the shear cutting distal end 34 thereof defines an open space with the feed roller outer peripheral surface. Thus, shear blade 32 is free to flex at the shear cutting distal end thereof to at least some degree relative to the feed roller outer peripheral surface when external force is applied to the shear blade.

The feed roller 18 is rotated by an individual pulling the terminal end portion of the web of paper toweling 22. It will be appreciated that rotation of the feed roller will at some point bring the shear blade 32 into engagement with the toweling. That is, the shear blade 32 will be disposed under the toweling during a period of time during rotation of the feed roller. This is depicted in Fig. 3. Mere engagement between the shear blade 32 and the toweling is insufficient to cut the web. Cutting of the web takes place when shear blade 32 is brought into engagement with a second shear blade 40 mounted on the housing, and more specifically on the housing cover 16. Shear blade 40 has a shear cutting distal end 42 of a specified character. That is, shear blade 40 curves about a portion of the outer peripheral surface of the feed roller and shear cutting distal end 42 is elongated and curved, being spaced from the outer peripheral surface of the feed roller 18. The curvature of elongated, curved cutting distal end 42 generally corresponds to the curvature of the feed roller outer peripheral surface 20.

Shear blade 40, as shown, is formed from a length of sheet metal twisted along the length thereof to curve the shear blade about the feed roller outer peripheral surface. The planar side of shear blade 40 adjacent to the feed roller forms an acute angle with the outer peripheral surface of the feed roller. The planar sides of shear blades 32 and 40 will define a substantially constant angle between each other wherever the blade distal ends engage as the feed roller rotates. Since the distal end of each blade is uniformly spaced from the feed roller surface along its length, the resistance forces imparted to

the feed roller, and thus to the toweling, will remain substantially constant through the entire cutting operation.

Shear blade 20 is attached to cover 16 of the housing by a mount 46. Thus, opening of the cover about mounting hinge 48 will withdraw the second shear blade 40 from the housing interior to a position where it cannot be engaged by shear blade 32. Closing of the cover will bring the shear cutting distal end of blade 40 into close proximity with the outer peripheral surface 20 of feed roller 18; however, the shear cutting distal end of blade 40 does not actually engage the outer peripheral surface.

Figs. 2 through 6 illustrate the relative positioning of the shear blades 32, 40 and feed roller 18 upon rotation of the feed roller due to a pull being exerted by a consumer on the projecting end of the toweling 22. The pulling force will cause the feed roller 18 to rotate clockwise, as viewed in these figures, with the toweling remaining essentially in engagement with the feed roller in the space generally defined by pressure roll 26 and the lower extremity of second shear blade 40. This will cause the shear blade 32 to move into engagement with second shear blade 40 and make a cut as the shear blade 32 remains in engagement with second shear blade 40 during continued rotation of the feed roller. The cut will be well defined and straight. The arrangement will operate effectively over a wide range of paper quality and thickness even after prolonged usage of the device. Blade flexure will accommodate blade maladjustments of any reasonable magnitude.

Because the cut of the toweling occurs gradually as the feed roll rotates a fairly considerable distance, web tension and pulling forces will occur over a greater period of time and be spread out as compared to conventional dispenser-cutter arrangements utilizing straight blades only.

It is apparent, however, that engagement between shear blades 32, 40 will impart some degree of resistance to pulling of the web and rotation of the feed roller. So that this small resistance is minimized even further, a weight 60 of lead or the like is imbedded in the feed roller to even out the pulling forces. The weight is connected to the feed roller at a predetermined location spaced from both the shear blade 32 and the axis of rotation of the feed roller. Thus, the weight changes the center of gravity of the feed roller during rotation of the feed roller to selectively alternatively impede and promote such rotation.

When the weight is to the left of the central axis of the feed roller, it will impede rotation thereof when the roller is moving in a clockwise direction as indicated by the arrow. However, once the weight crosses over center as shown in Fig. 4, it will encourage rotation of the roller. It is to be noted that the weight encourages such rotation when the shear blades 32, 40 are in engagement.

After blade disengagement, the feed roller 18 will, of course, come to a stop when a pulling force is no longer exerted on the paper toweling with the weight 60 located at its lowest point on the rotation path of travel thereof, ie. the position illustrated in Fig. 6. However, an auxiliary

stop device (not shown) of any known type may be utilized to ensure that the feed roller stops rotating more quickly and positively than would be the case when rotation is merely halted by weight location.

Fig. 7 shows an alternate arrangement wherein the curved shear blade 70 is affixed to the feed roller 18A, rather than to the apparatus housing. In this embodiment, the straight blade 72 is mounted on the housing cover.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The appended abstract as filed herewith is included in the specification by reference.

Claims

1. Apparatus for shear cutting and dispensing individual sheets of paper toweling from a web of paper toweling forming a roll and having a terminal end portion, said apparatus comprising, in combination:
 - a housing defining an interior;
 - a feed roller rotatably mounted in said housing interior and having an outer peripheral surface for engaging said web terminal end portion, said outer peripheral surface having a predetermined curvature;
 - a first shear blade having a shear cutting distal end mounted on said feed roller and rotatable with said feed roller;
 - a second shear blade having a shear cutting distal end mounted within said housing and engageable by said first shear blade upon rotation of said feed roller to shear cut said web and at least partially sever said terminal end portion from the remainder of said web, at least one of said shear blades extending along a predetermined length of said feed roller and curving about a portion of the outer peripheral surface of said feed roller, said shear cutting distal end of said at least one shear blade comprising an elongated, curved cutting distal end spaced from the outer peripheral surface of said feed roller, the curvature of said elongated, curved cutting distal end generally corresponding to the predetermined curvature of said feed roller outer peripheral surface.
2. The apparatus according to Claim 1 wherein said housing includes a housing body and a cover mounted for movement relative to said housing body between an open and a closed position, said second shear blade being mounted on said cover and moveable away from said first shear blade when said cover is moved from said closed position to said open position.
3. The apparatus according to Claim 1 wherein said first shear blade is mounted on said feed roller at a predetermined location and is slanted relative to

said feed roller whereby said first shear blade is cantilevered relative to said feed roller and the shear cutting distal end of the first shear blade defines an open space with the feed roller outer peripheral surface whereby said first shear blade is free to flex at the shear cutting distal end thereof relative to the feed roller outer peripheral surface when external force is applied to said first shear blade.

4. The apparatus according to Claim 1 wherein said at least one shear blade is formed from a length of sheet metal twisted along at least a portion of the length thereof to curve said at least one shear blade about said feed roller outer peripheral surface portion.
5. The apparatus according to Claim 1 wherein said feed roller has an axis of rotation, said apparatus additionally comprising a weight connected to said feed roller at a predetermined location spaced from both said first shear blade and said axis of rotation, said weight changing the center of gravity of said feed roller during rotation of the feed roller to selectively alternatively impede and promote such rotation.
6. The apparatus according to Claim 5 wherein said predetermined location of said weight is selected to promote rotation of said feed roller when the shear cutting distal ends of said first and second shear blades are in engagement.
7. The apparatus according to Claim 1 wherein said second shear blade shear cutting distal end comprises said elongated, curved cutting distal end spaced from the outer peripheral surface of said feed roller.
8. The apparatus according to Claim 1 wherein said first shear blade shear cutting distal end comprises said elongated, curved cutting distal end spaced from the outer peripheral distal end of said feed roller.
9. Apparatus for shear cutting and dispensing individual sheets of paper toweling from a web of paper toweling forming a roll and having a terminal end portion, said apparatus comprising, in combination:
 - a housing defining an interior;
 - a feed roller rotatably mounted in said housing interior and having an outer peripheral surface for engaging said web terminal end portion, said outer peripheral surface having a predetermined curvature;
 - first shear blade means mounted on said feed roller and rotatable with said feed roller;
 - second shear blade means mounted within said housing and engageable by said first shear blade means upon rotation of said feed roller to

shear cut said web and at least partially sever said terminal end portion from the remainder of said web, at least one of said first and second shear blade means including at least one blade extending along a predetermined length of said feed roller and curving about a portion of the outer peripheral surface of said feed roller, said blade having an elongated, curved cutting distal end spaced from the outer peripheral surface of said feed roller, the curvature of said elongated, curved cutting distal end generally corresponding to the predetermined curvature of said feed roller outer peripheral surface.

10. The apparatus according to Claim 9 wherein said at least one blade is twisted as it curves about said outer peripheral surface portion.
11. Apparatus for shear cutting and dispensing individual sheets of paper towelling from a roll thereof, comprising:
 - a housing for containing the roll and permitting rotation thereof to dispense towelling;
 - a first shear blade and a second shear blade, one of said blades being rotatably mounted so that cutting edges of the blades periodically oppose each other to effect shear cutting;
 - means for feeding towelling to the blades so that it passes between the cutting edges thereof and is sheared at intervals into sheets;
 - and characterised in that said cutting edges lie on adjacent projected cylindrical surfaces having a common axis, said one shear blade being rotatable about said axis, the shear blades being at different angles to the said axis and the sense of rotation being such that the cutting edges oppose each other at an acute angle and define a cutting point which travels along the length of the cutting edges.
12. Apparatus according to Claim 11, wherein the means for feeding towelling to the blades comprises a feed roller.
13. Apparatus according to Claim 11 or 12, comprising means for reducing variations in a feeding force required to feed the towelling during shearing thereof and during the intervals between shearing thereof.
14. Apparatus according to Claim 11, 12, or 13, comprising means for assisting operation of the feeding means during shearing of the towelling.

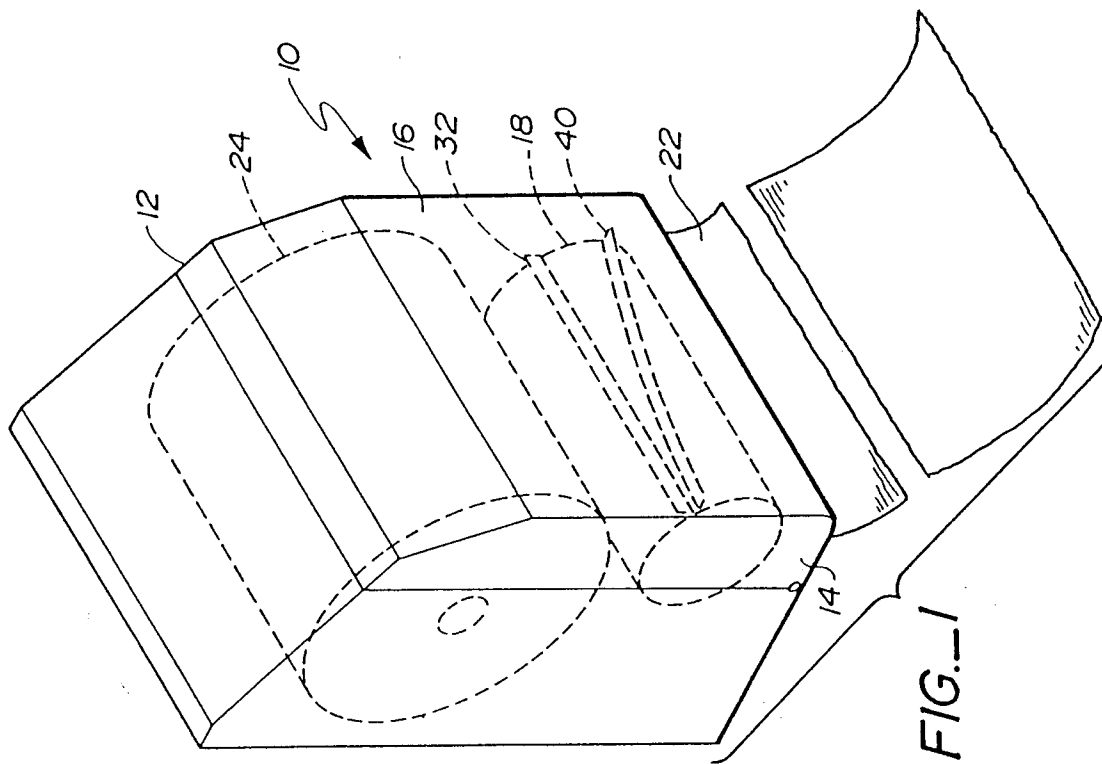
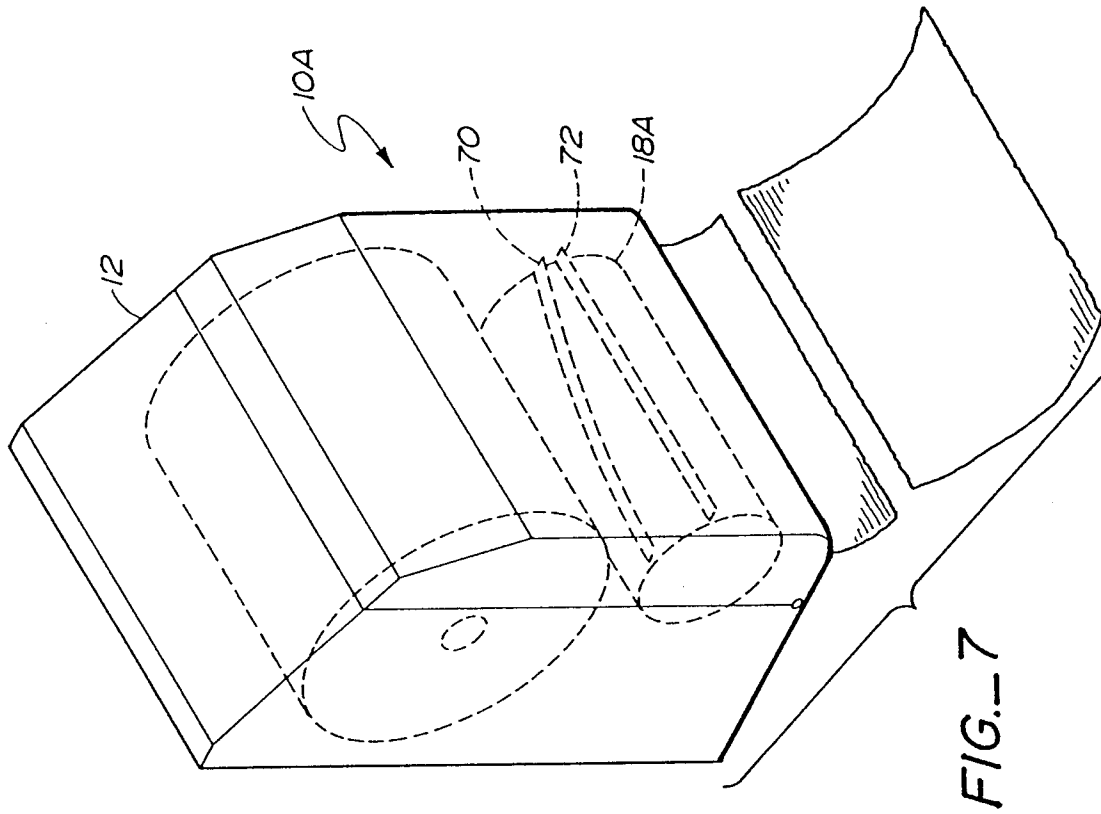
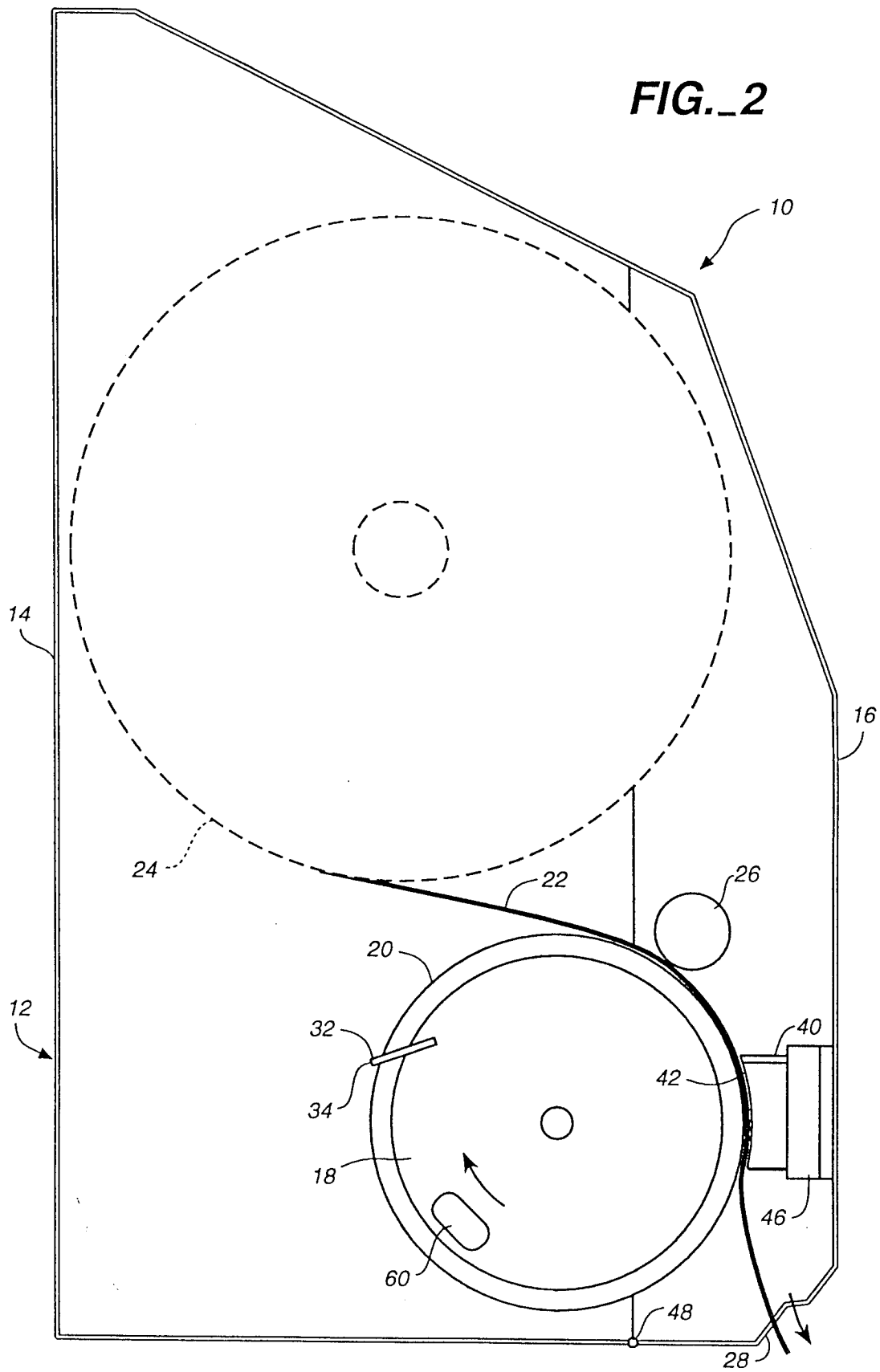
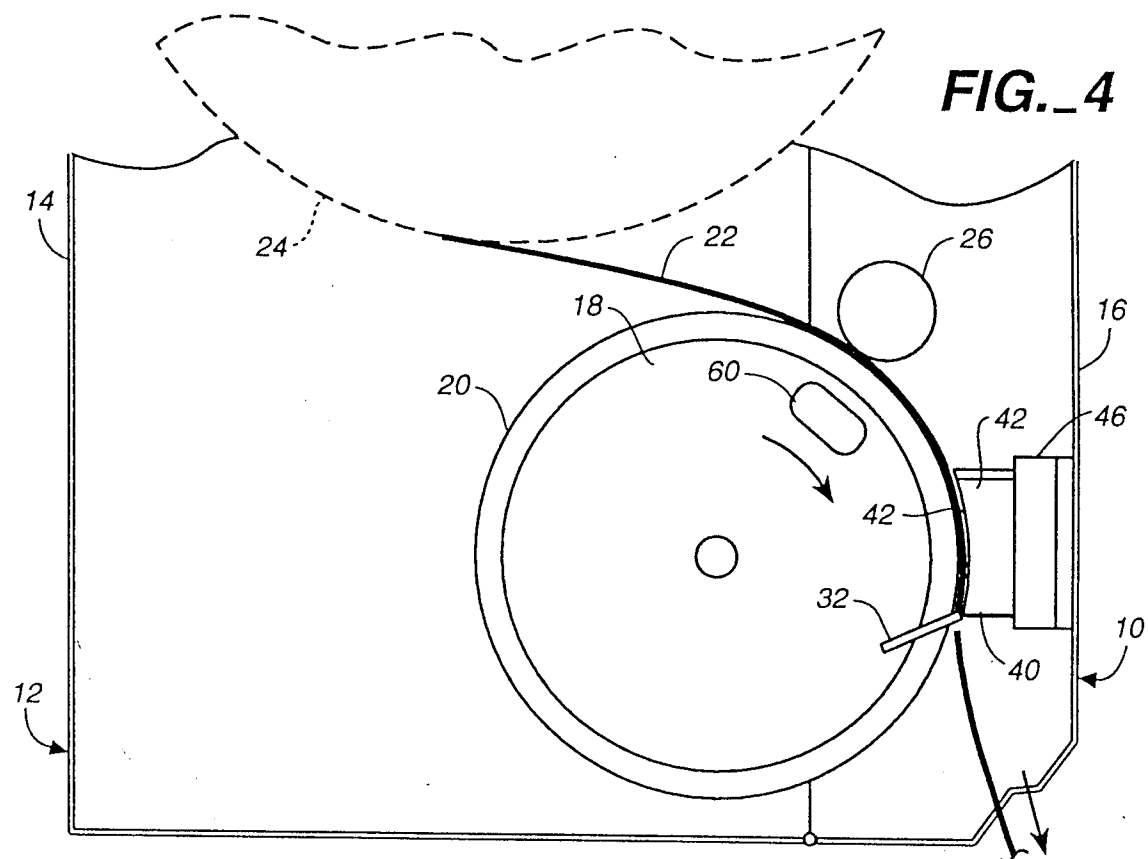
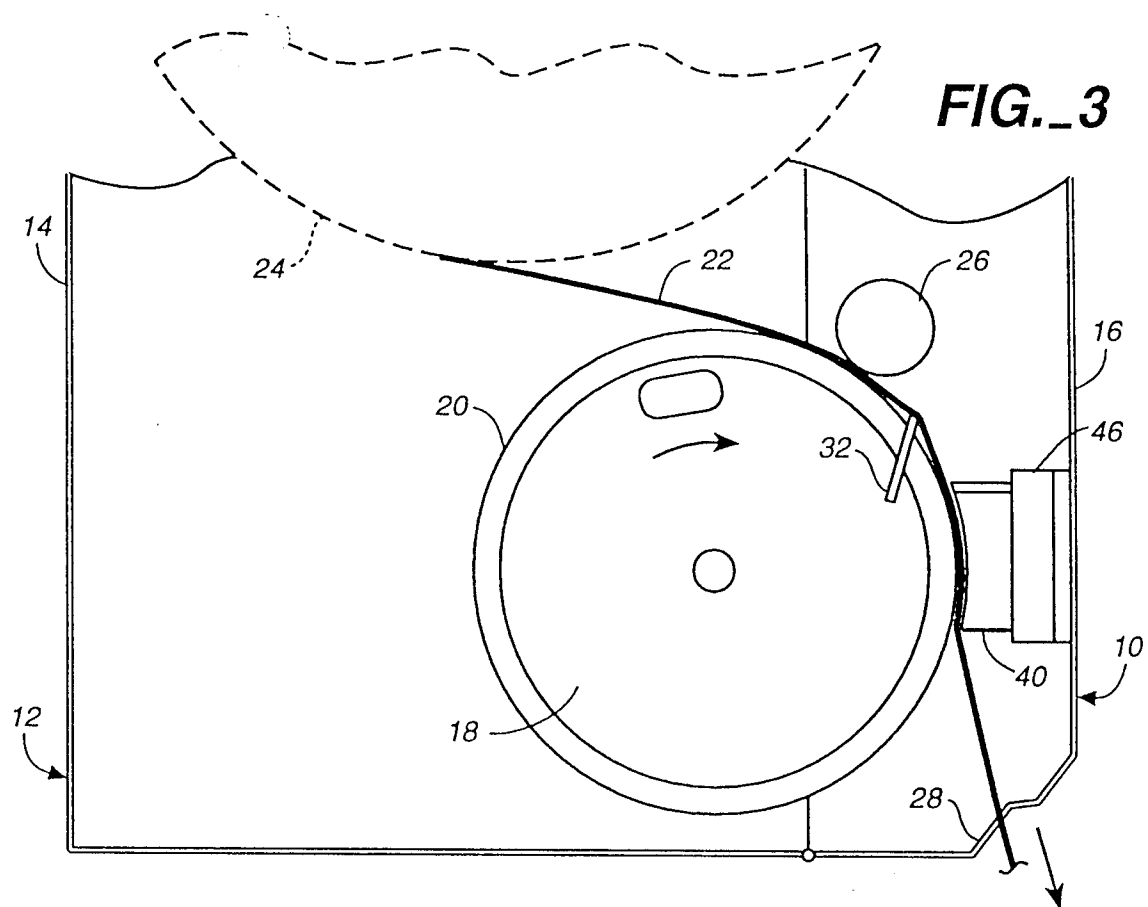
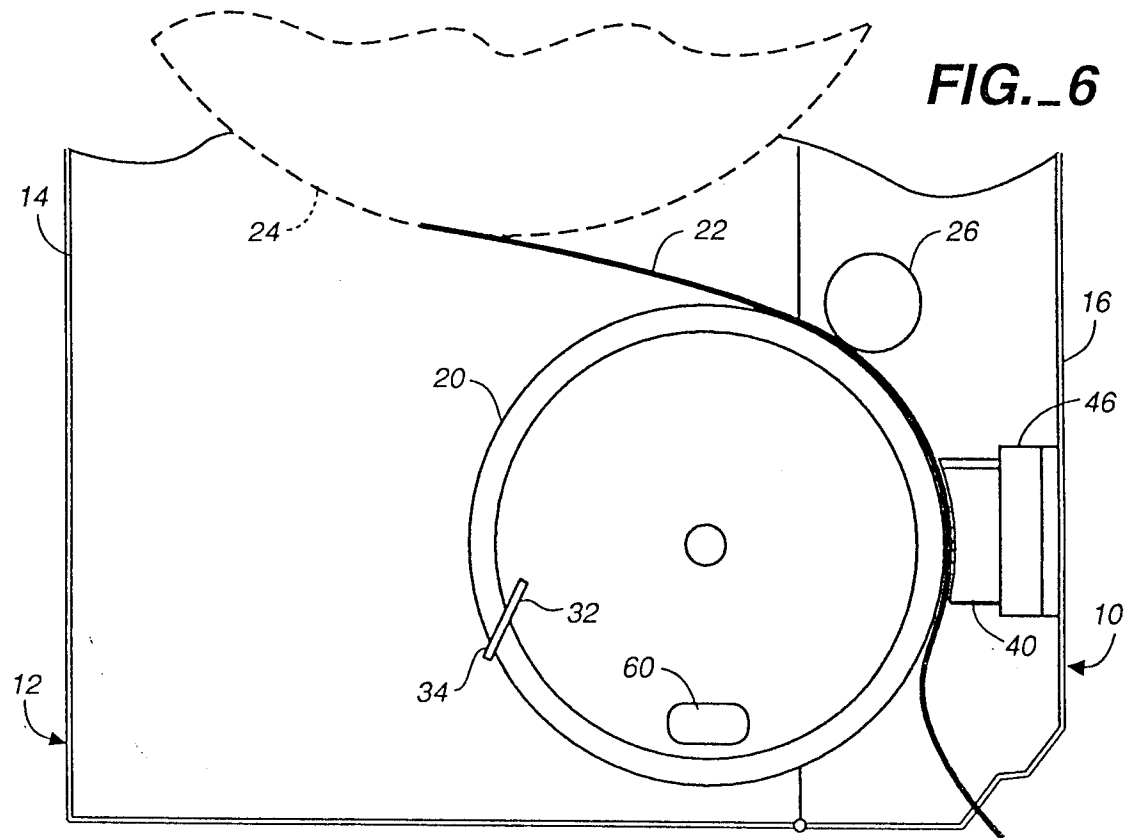
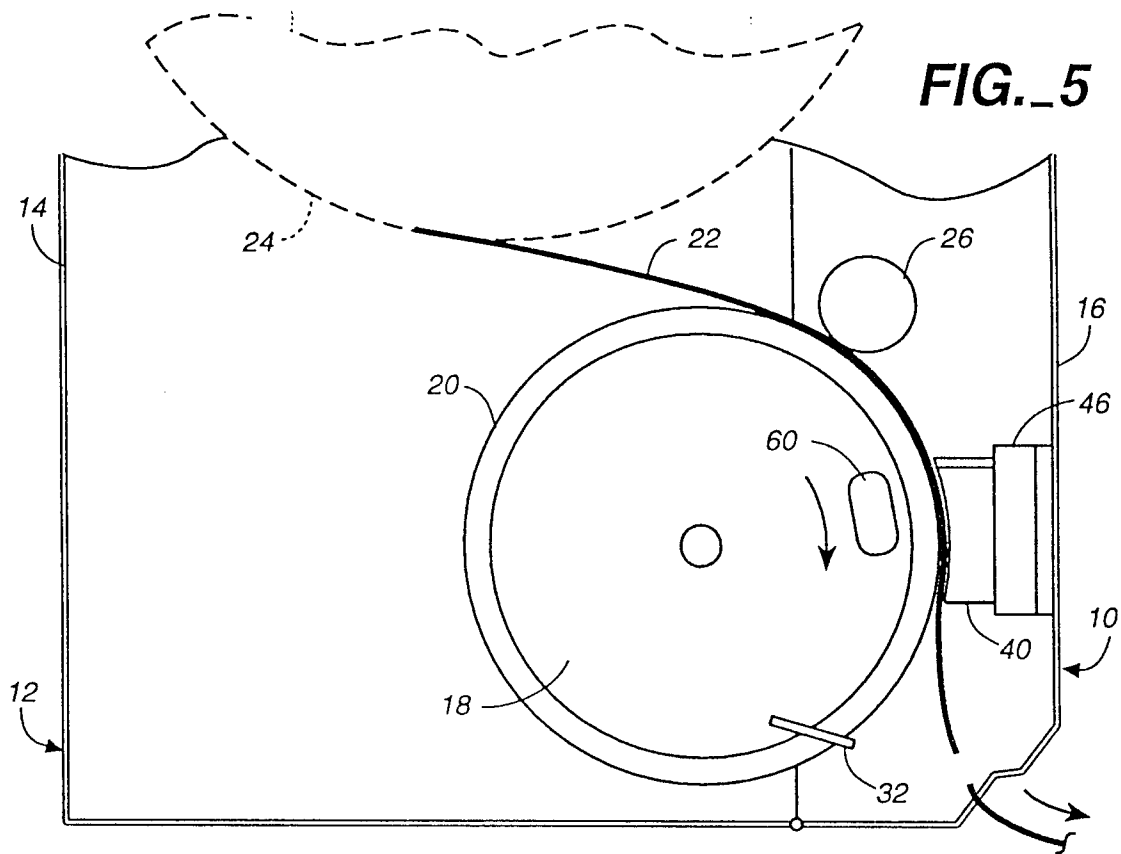


FIG. 2









European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 5272

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-2 560 061 (EDWARD AGAMAITE) 10 July 1951 * column 2, line 12 - line 21; claims; figures 2,3 *	1-14	A47K10/34
A	FR-A-2 321 443 (MAURICE GRANGER) 18 March 1977		
A	US-A-3 697 146 (BOISEN) 10 October 1972		
D,A	US-A-3 896 691 (GRANGER ET AL.) 29 July 1975		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A47K B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 December 1994	Examiner Soederberg, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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