



(12) **EUROPEAN PATENT APPLICATION**

(21) Application number : **94304390.1**

(51) Int. Cl.⁵ : **A47K 10/34**

(22) Date of filing : **17.06.94**

(30) Priority : **18.06.93 US 77879**

(43) Date of publication of application :
21.12.94 Bulletin 94/51

(84) Designated Contracting States :
BE CH DE DK ES FR GB IT LI NL SE

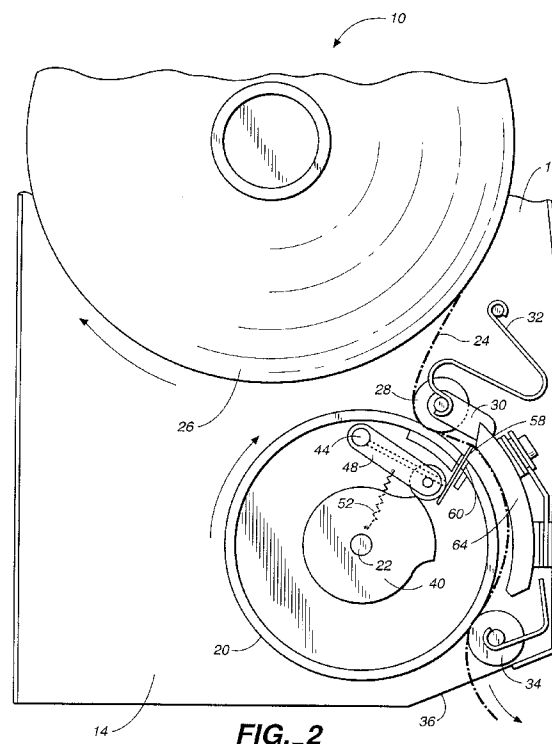
(71) Applicant : **JAMES RIVER PAPER COMPANY, INC.**
120 Tredegar Street
Richmond, Virginia 23219-4326 (US)

(72) Inventor : **Weinert, Lawrence E**
2216 Chickie Street
Antioch California 94509 (US)
Inventor : **Banas, Andrezej J**
214, Patrick Drive
Pacheco California 94553 (US)

(74) Representative : **Garratt, Peter Douglas et al**
Mathys & Squire
10 Fleet Street
London EC4Y 1AY (GB)

(54) **Shear-cutting paper towel dispenser.**

(57) Apparatus (10) for shear cutting and dispensing individual sheets of paper toweling from a web of paper toweling (24) including a feed roller (18) and two shear blades (58,64) which engage to cut the toweling (24). One of the shear blades (58) is movably mounted relative to the feed roller (18) and projects outwardly through the slot (60) during rotation of the feed roller (18) to engage the other shear blade (64) which is mounted on a dispenser housing (12). The shear blade (64) mounted on the housing (12) has a curved shear cutting surface spaced from the feed roller (18), the curvature of the curved shear cutting surface generally corresponding to the curvature of the outer surface (20) of the feed roller (18).



This invention relates to an apparatus and method for cutting and dispensing individual sheets of flexible sheet material from a web of flexible sheet material forming a roll. The invention has particular application to the dispensing of paper towels from a continuous roll of paper toweling. The cutting and dispensing operations are initiated and carried out by a user grasping and pulling a terminal end portion of the toweling. Shear blade means incorporated in the apparatus shear cut an individual paper towel from the web as the terminal end portion is pulled.

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, 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 the 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 during 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, possibly 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 number of paper towel dispensers are disclosed in the prior art in which the towel dispenser employs a toothed knife mounted internally of a feed roller. Exerting a pulling force on the toweling end causes rotation of the feed roller and a mechanism causes movement of the toothed knife outwardly through a slot formed in the feed roller to pierce the toweling disposed thereon.

For example, U.S. Patent No. 4,404,880, issued September 20, 1983, and U.S. Patent No. 4,188,844, issued February 19, 1980, disclose an approach wherein a toothed knife is pivotally mounted internally of a feed roller within the towel dispenser. The towel cut produced by the internally pivoted, toothed knife has a wavy shape due to the pivoting action of the toothed knife. The points and roots of the straight knife teeth do not emerge from the feed roller in a straight line. The paper is stretched and the web cut is unsightly.

Other apparatus for cutting and simultaneously

dispensing paper toweling which incorporates a toothed pivoted blade piercing the material to cut same is disclosed in U.S. Patent No. 4,122,738, issued October 31, 1978 and U.S. Patent No. 4,213,363, issued July 22, 1980.

U.S. Patent No. 4,712,461, issued December 15, 1987, discloses a dispenser utilizing a feed roller containing a sliding cutter. The toothed knife blade employed slides in and out of a slot formed in the feed roller along a plane corresponding to the plane of the knife teeth. Cam followers are employed to both positively project the blade cutting edge beyond the feed roll periphery to cut the web and positively retract the cutting edge after the cut is made. As is the case with the pivoting blade constructions noted above, the cutting of the toweling is caused by the teeth of the knife piercing the toweling.

U.S. Patent No. 4,846,035, issued July 11, 1989, discloses dispenser apparatus for paper toweling and the like which uses two straight, toothed blades which pivot out of a web carrier roll or drum to pierce and sever toweling on the outer drum surface. The blades are moved independently and are located side-by-side at an angle. The blades sequentially cut the toweling.

All of the arrangements employing blades which pierce toweling on a drum or roll suffer from the same deficiency. Some stretching of the toweling by the force of the knife is an inevitable byproduct of the operation. Furthermore, use of blades with teeth as taught by these 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.

At least in its preferred embodiments, the present invention does not suffer from the deficiencies of the arrangements shown in the above-identified patents. 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 can produce a very clean cut in which there is no stretching or other undue distortion of the paper web which can affect performance and appearance.

Shear cutting may be accomplished by the invention over a wide range of paper quality and thickness.

In addition, in the preferred 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 on the toweling to complete the cutting operation.

The apparatus of one aspect of the present invention is for cutting and dispensing individual sheets of flexible sheet material from a web of flexible sheet material forming roll and having a terminal end por-

tion. The apparatus includes a housing defining an interior.

A feed roller is rotatably mounted in the housing interior and has an outer surface for engaging the web terminal end portion.

First shear blade means is movably mounted on the feed roller and rotatable with the feed roller. Second shear blade means is mounted within the housing and engageable by the movably mounted first shear blade means 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.

The apparatus additionally comprises biasing means for yieldably biasing at least one of the shear blade means against the other of the shear blade means during engagement therebetween.

The feed roller defines a longitudinally extending slot. The first shear blade means includes at least one shear blade movable between an operative position wherein the shear blade projects outwardly of the slot and an inoperative position. The apparatus additionally comprises means for moving the first shear blade means between the operative and inoperative positions responsive to rotation of the feed roller.

The second shear blade means in a preferred embodiment of the invention includes a fixed blade having two blade segments angularly disposed relative to one another whereby the fixed blade has a generally V-shaped configuration. The fixed blade segment has a curved shear cutting surface spaced from the feed roller, the curvature of the curved shear cutting surface generally corresponding to the curvature of the outer surface of the feed roller.

The method of the present invention includes the step of positioning the web terminal end portion on a curved surface. The roll is unwound by exerting a pulling force on the terminal end portion while maintaining the terminal end portion on the curved surface.

Through frictional engagement between the end portion and the curved surface, the curved surface is moved during the unwinding step. The web is brought between two relatively movably shear blades.

The next step comprises engaging the shear blades with the web therebetween to shear cut the web to at least partially sever the terminal end portion from the remainder of the web. While shear cutting the web, at least one of the shear blades is yieldably biased in the direction of the other of the shear blades.

Shear cutting of the web may be initiated at at least two spaced locations on the web and converging lines of cut are progressively formed during rotation of the support surface.

Other aspects of the invention are set out in the appended claims.

Other features, advantages, and objects of the present invention will become apparent with refer-

ence to the following description and accompanying drawings, which are by the way of example only.

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

Fig. 1A is a view similar to Fig. 1 but illustrating the apparatus with the front door thereof open to show selected operative components of the apparatus;

Fig. 2 is an enlarged side view showing a portion of the apparatus and selected components thereof in the respective positions assumed thereby during one stage of operation of the apparatus; Fig. 3 is a view similar to Fig. 2 but illustrating the apparatus components in the relative positions assumed thereby during a subsequent stage of operation;

Fig. 4 is a view similar to Figs. 2 and 3 but illustrating the relative positions assumed by selected components of the apparatus at yet another stage of operation;

Fig. 5 is a fragmentary, cross-sectional view taken along the line 5-5 of Fig. 4;

Fig. 6 is a fragmentary, cross-sectional view taken along the line 6-6 of Fig. 4; and

Fig. 7 is an enlarged, fragmentary, cross-sectional view taken along the line 7-7 of Fig. 6.

Referring now to the drawings, 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. Fig. 1 shows the cover closed and Fig. 1A shows the cover opened.

A feed roller 18 having a circular cross section and an outer peripheral surface 20 with a predetermined curvature is rotatably mounted in the housing interior on an axle 22 extending between the side walls of the housing body and positioned in recesses located at the housing body side walls so that the feed roller is essentially freely rotatable about its longitudinal axis.

Outer peripheral surface 20 provides a support for a web of paper toweling 24 fed from a supply roll 26 rotatably mounted within the housing interior. The toweling 24 passes under a freely rotatable rider or pressure roll 28 journaled in a bracket 30 connected to support spring 32. Support spring 32 is so sized and configured as to exert a generally downwardly directed force on the bracket and pressure roll to maintain the pressure roll in engagement with the outer peripheral surface 20 of feed roller 18.

From pressure roll 28 the toweling proceeds about a segment of the feed roller, under another pressure roll 34, and out a slot 36 formed at the bottom of the housing. Rotation of the feed roller 18 will

be effected by a consumer grasping the free or tail end of the web projecting from slot 36 and pulling it in the direction of the arrow as shown in Fig. 2.

Feed roller 18 defines a cavity 38 at at least one end thereof. The cavity accommodates therein a cam 40 affixed to a side wall of the housing body 14. The cam 40 defines one of the recesses supporting axle 22. A similar arrangement may exist at the opposed housing body side wall.

A shaft 44 is disposed parallel to axle 22 and projects through holes 46 formed at each end of the feed roller 18. An end of the shaft 44 terminates at a location in registry with cam 40. A follower arm 48 is affixed to shaft 44 and rotatably supports a contact wheel 50. A coil tension spring 52 interconnects the follower arm 48 to the cam and exerts a pulling force on the follower arm which maintains the contact wheel in engagement with the cam. It will be appreciated that the contact wheel 50 will follow the contours of the cam 40 during rotation of the feed roller relative to the cam.

A plurality of pins 56 preferably having some degree of flexibility are connected to shaft 44 and extend away therefrom. The distal ends of the pins 56 disposed away from shaft 44 are connected to a shear blade 58 and support the shear blade.

Shear blade 58 is in registry with a slot 60 formed along the length of feed roller 18. Rotation of feed roller 18 relative to the cam disposed at an end of the feed roller will cause the shear blade 58 to move relative to the feed roller between a retracted position, as shown in Fig. 4, and an extended position, as shown in Fig. 3, wherein the outer cutting end or edge of shear blade 58 projects outwardly through slot 60 to a location spaced outwardly from the outer peripheral surface 20 of feed roller 18.

Fig. 2 illustrates the shear blade 58 at the time when it just emerges from slot 60 and engages the paper web. The extended shear blade 58 is also shown just prior to engagement with a second shear blade 64. Shear blade 64 includes two blade segments 66, 68 angularly disposed relative to one another so that the blade 64 has a generally V-shaped configuration. It is to be noted that the curved shear cutting surface of blade 64 is spaced from feed roller 18, with the curvature of the curved shear cutting surface 70 generally corresponding to the curvature of the outer surface of the feed roller.

As the feed roller 18 rotates in a clockwise direction, as viewed in Fig. 2, the cutting edge or end of shear blade 58 will engage the extreme outer ends of shear blade segments 66, 68, and more particularly the curved shear cutting surface of the shear blade segments. This will initiate a cut in the paper toweling at both edges or ends of the toweling and the cuts will converge as the blade 58 reaches the lower most end of the blade 64, i.e. where shear blade segments 66 and 68 merge. This will result in severing of an indi-

vidual towel from the web.

The cam is shaped so that the follower contact wheel 50 will arrive at the lower lip of the cam protrusion or lobe at the time disengagement between the shear blades 58 and 64 occurs. This will cause continued rotation of the feed roller as well as retraction of shear blade 58 into the interior of the feed roller. Continued movement of the feed roller will, of course, result in a lead end of the web projecting from the housing for subsequent grasping by a user to reinitiate the cycle just described.

Second shear blade 64 is mounted on cover 16 of the housing. As previously stated, the curved shear cutting surface of the shear blade 58 has a curvature generally corresponding to the curvature of the outer surface of the feed roller. This allows for a relatively protracted period of contact between the shear blades during dispensing so that the cutting resistance and web pulling forces can be relatively minor at any given time. Also, the pulling force is substantially constant during the cutting operation. It is preferred that the segments of the shear blade 64 be formed of sheet steel or the like twisted along their lengths whereby the curved shear cutting surface of the shear blade 64 is essentially directed toward the feed roller outer surface over the length of the curved shear cutting surface.

In the arrangement illustrated, the shear blade segments 66 and 68 are affixed to a blade support 74 which secures the shear blade 64 to the cover 16 in relatively fixed or rigid fashion. Flexure of pins 56 during engagement between shear blades 58 and 64 will accommodate variations in blade width, placement, etc. Alternatively, the shear blade 64 may be bias or spring mounted on the 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 is included in the specification by reference.

Claims

1. Apparatus for cutting and dispensing individual sheets of flexible sheet material from a web of flexible sheet material 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 surface for engaging said web terminal end portion;

first shear blade means movably mounted on said feed roller and rotatable with said feed roller;

second shear blade means mounted within said housing and engageable by said movably mounted 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.

2. The apparatus according to Claim 1 additionally comprising biasing means for yieldably biasing at least one of said shear blade means against the other of said shear blade means during engagement therebetween. 10
3. The apparatus according to Claim 1 wherein said feed roller defines a longitudinally extending slot, said first shear blade means including at least one shear blade movable between an operative position wherein said shear blade projects outwardly of said slot and an inoperative position, said apparatus additionally comprising means for moving said first shear blade means between said operative and inoperative positions responsive to rotation of said feed roller. 15 20
4. The apparatus according to Claim 3 wherein said means for moving said first shear blade means includes a rotatable shaft rotatably mounted in said feed roller and at least one connector connecting said rotatable shaft to said first shear blade means. 25 30
5. The apparatus according to Claim 4 wherein said connector comprises a plurality of spaced pins interconnecting said rotatable shaft to said first shear blade means, said pins resiliently biasing said first shear blade means against said second blade means when said first shear blade means is in said operative position. 35
6. The apparatus according to Claim 4 wherein said means for moving said first shear blade means further includes cam means mounted in said housing interior and follower means operatively associated with said cam means and said rotatable shaft to rotate said rotatable shaft and move said first shear blade means from inoperative position to operative position responsive to rotation of said feed roller. 40 45
7. The apparatus according to Claim 6 wherein said means for moving said first shear blade means further includes spring means operatively associated with said first shear blade means to retract said shear blade means and move said shear blade means from operative position to inoperative position responsive to rotation of said feed roller. 50 55

8. The apparatus according to Claim 5 additionally comprising biasing means interconnecting said follower means and said first shear blade means for yieldably biasing said first shear blade means against said second shear blade means when said first shear blade means is in said operative position. 5
9. The apparatus according to Claim 8 wherein said follower means includes said rotatable shaft, said rotatable shaft positioned within said feed roller and extending substantially the length thereof, and wherein said follower means includes a follower arm connected to said shaft and in operative engagement with said cam means to rotate said shaft responsive to rotation of said feed roller, said biasing means comprising a plurality of biasing elements affixed to said shaft, extending from said shaft, and rotatable therewith, said biasing elements imparting movement to said first shear blade means to move said first shear blade means from inoperative to operative position during rotation of said shaft. 10
10. The apparatus according to Claim 3 additionally comprising a rider roll disposed adjacent to said feed roller, said terminal end portion passing between said rider roll and said feed roller, said rider roll being positioned closely adjacent to the slot in said feed roller. 25
11. Apparatus for cutting and dispensing individual sheets of flexible sheet material from a web of flexible sheet material 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 surface for engaging said web terminal end portion;
 - first shear blade means mounted on said feed roller and rotatable therewith; and
 - 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 the web, said second shear blade means having a curved shear cutting surface spaced from said feed roller and extending partially around said feed roller, the curvature of said curved shear cutting surface generally corresponding to the curvature of the outer surface of said feed roller. 30 35 40 45 50
12. Apparatus for cutting and dispensing individual sheets of flexible sheet material from a web of flexible sheet material forming a roll and having a terminal end portion, said apparatus compris-

ing, in combination:

a housing defining an interior;

a feed roller rotatably mounted in said housing interior and having an outer surface for engaging said web terminal end portion;

first shear blade means mounted on said feed roller and rotatable therewith;

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 the web; and

biasing means for yieldably biasing at least one of said shear blade means against the other of said shear blade means during engagement therebetween.

13. The apparatus according to any preceding claim wherein said second shear blade means has a generally V-shaped configuration.

14. The apparatus according to Claim 1 or Claim 12 wherein said second shear blade means has a curved shear cutting surface spaced from said feed roller, the curvature of said curved shear cutting surface generally corresponding to the curvature of the outer surface of the feed roller.

15. The apparatus according to Claim 14 wherein said second shear blade means is twisted whereby said curved shear cutting surface is directed toward said feed roller outer surface over the length of said curved shear cutting surface.

16. The apparatus according to any preceding claim wherein said housing includes a movable door for selectively closing said interior, said second shear blade means being mounted on said door and movable therewith.

17. A method for cutting and dispensing individual sheets of flexible sheet material from a web of flexible sheet material forming a roll and having a terminal end portion, said method comprising the steps of:

positioning said web terminal end portion on a curved surface;

unwinding said roll by exerting a pulling force on said terminal end portion while maintaining said terminal end portion on said curved surface;

through frictional engagement between said terminal end portion and said curved surface, moving said curved surface during said unwinding step;

during said unwinding step, bringing said web between two relatively movable shear

blades;

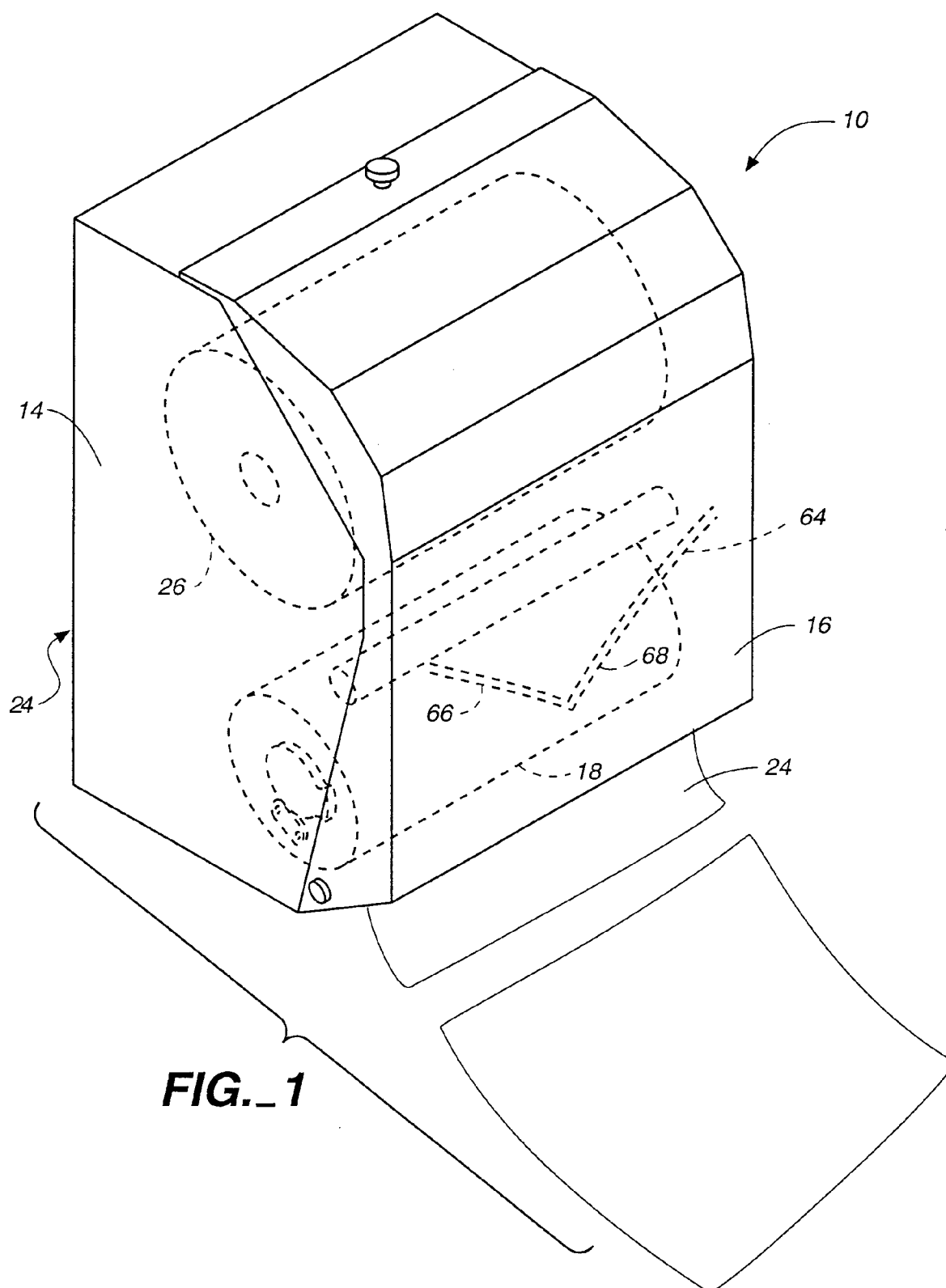
engaging said shear blades with said web therebetween to shear cut said web to at least partially sever the terminal end portion from the remainder of the web; and

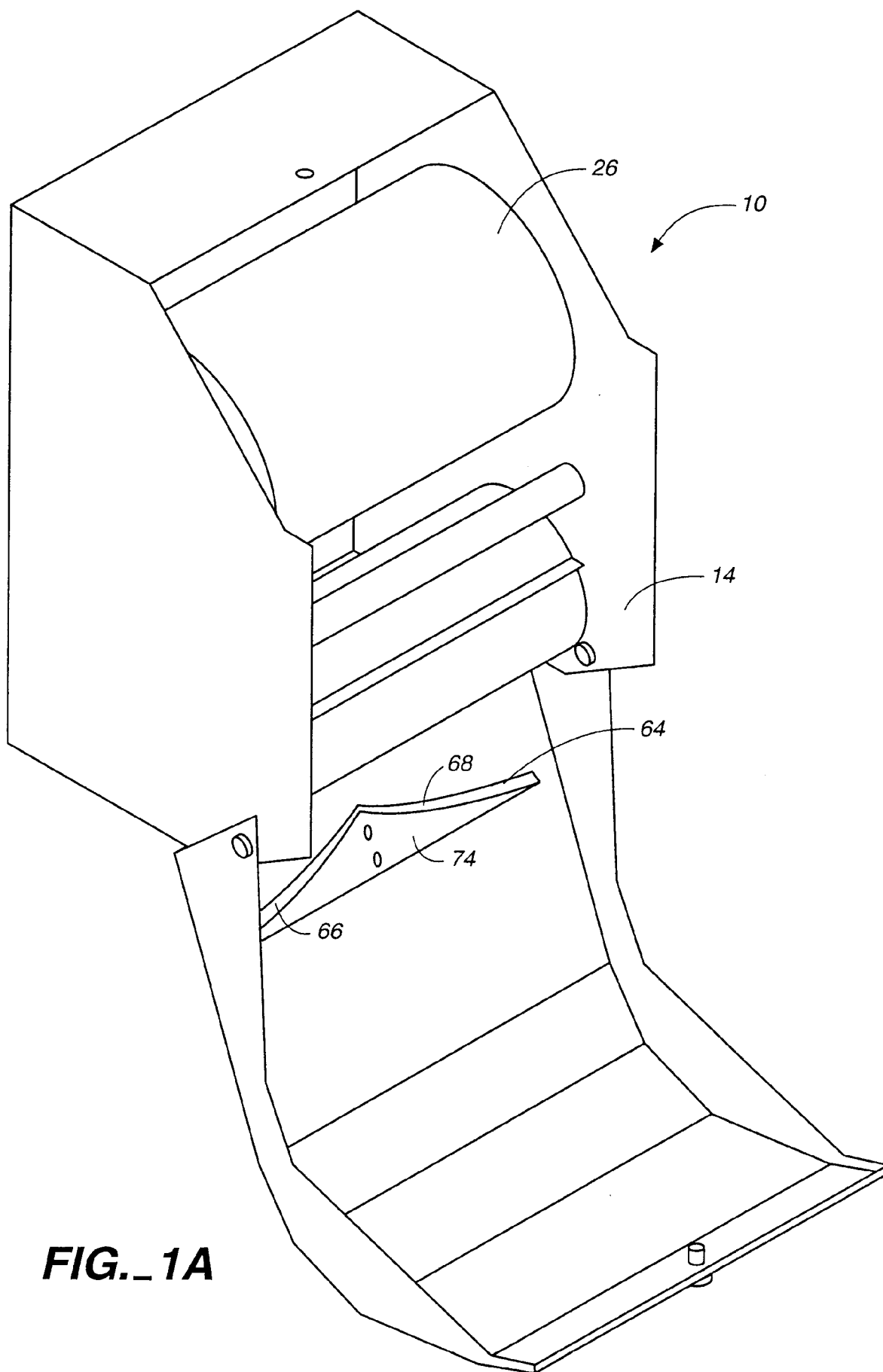
while shear cutting said web, yieldably biasing at least one of said shear blades in the direction of the other of said shear blades.

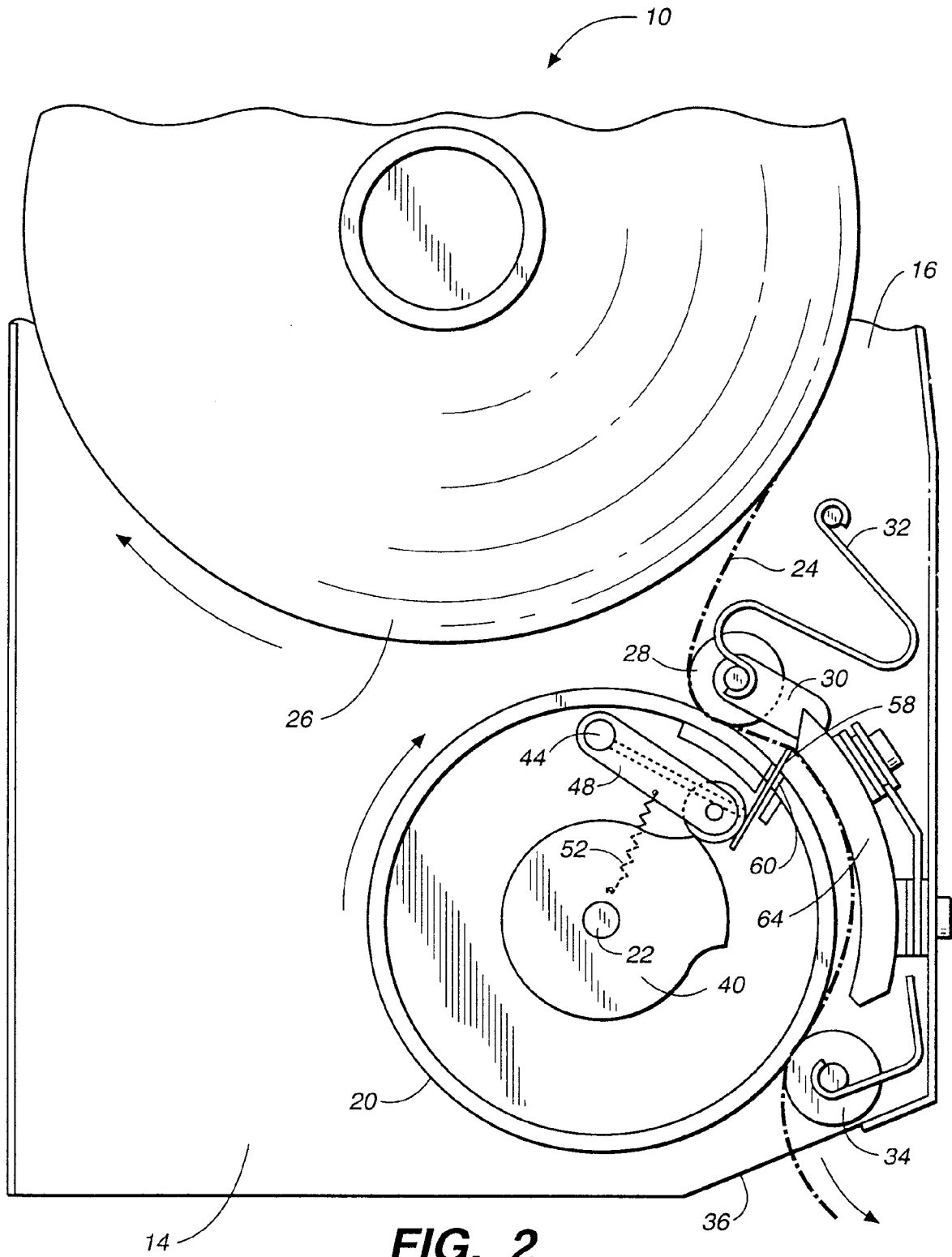
18. The method according to Claim 17 wherein said step of engaging said blades includes the simultaneous steps of moving one of said shear blades in a direction away from said curved surface and rotating said curved surface and said one shear blade toward the other of said shear blades.

19. The method according to Claim 18 wherein shear cutting of said web is initiated at at least two spaced locations on said web and converging lines of cut are progressively formed during rotation of said support surface.

20. The method according to Claim 19 wherein shear cutting of said web is substantially simultaneously initiated at said at least two spaced locations.







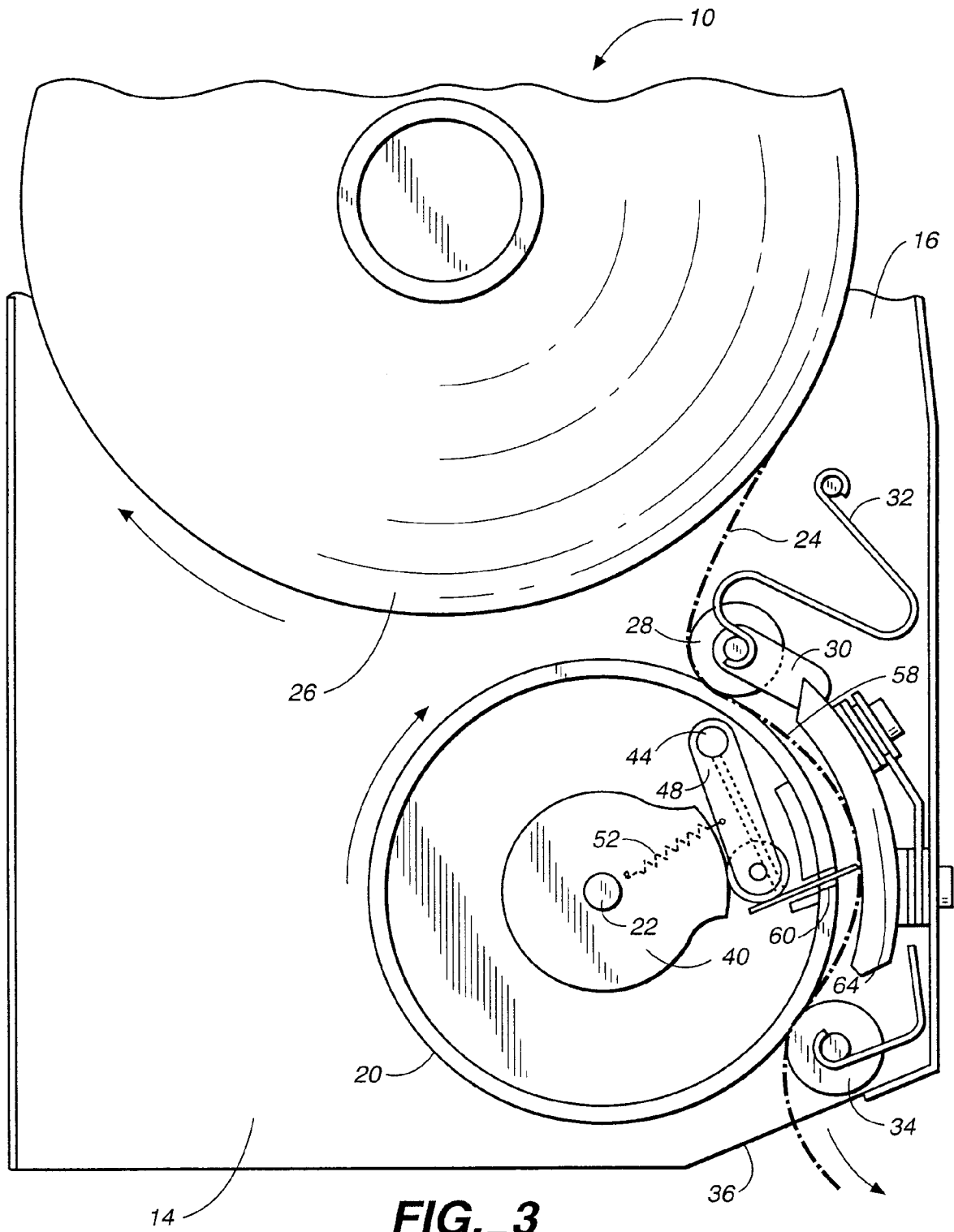
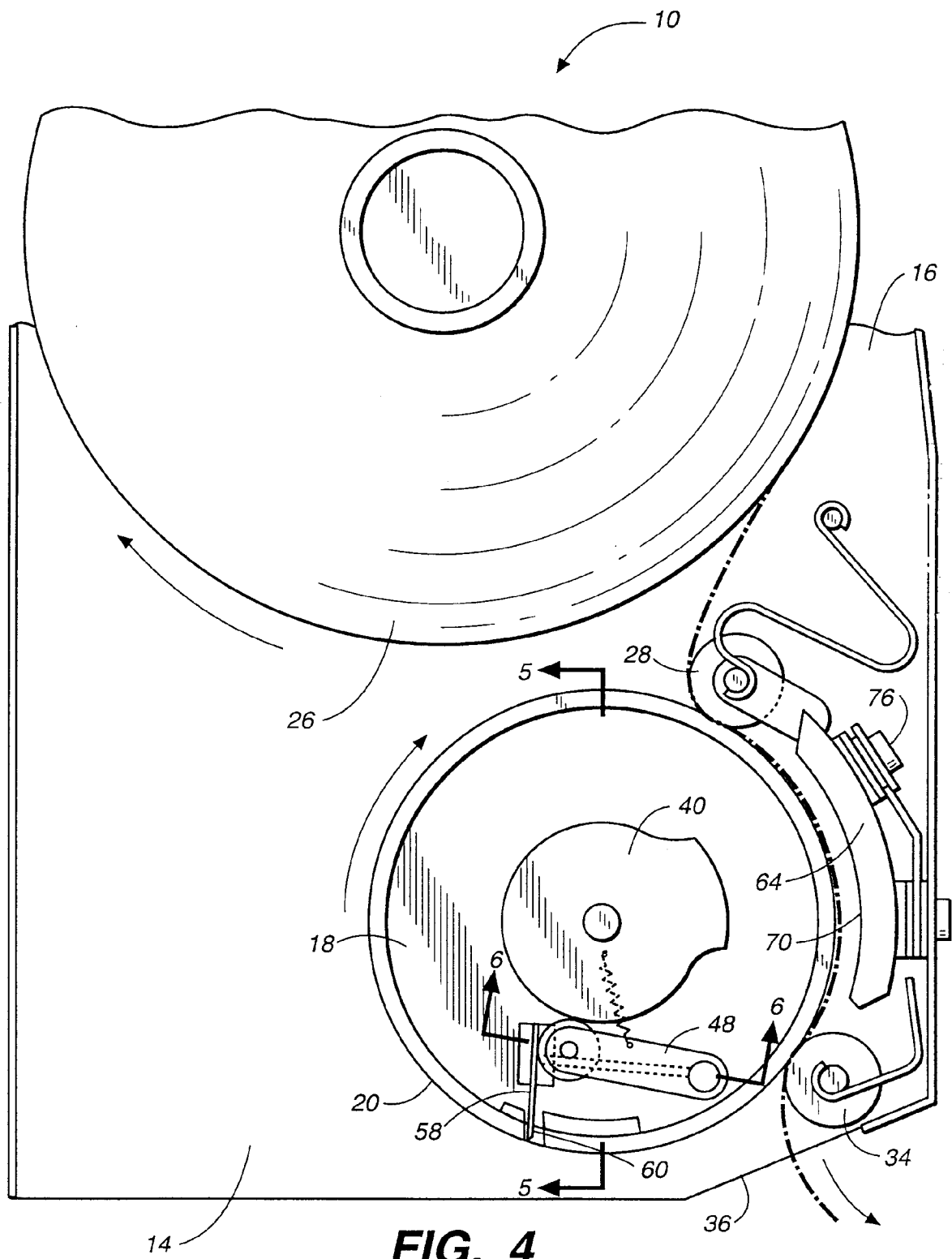


FIG._3



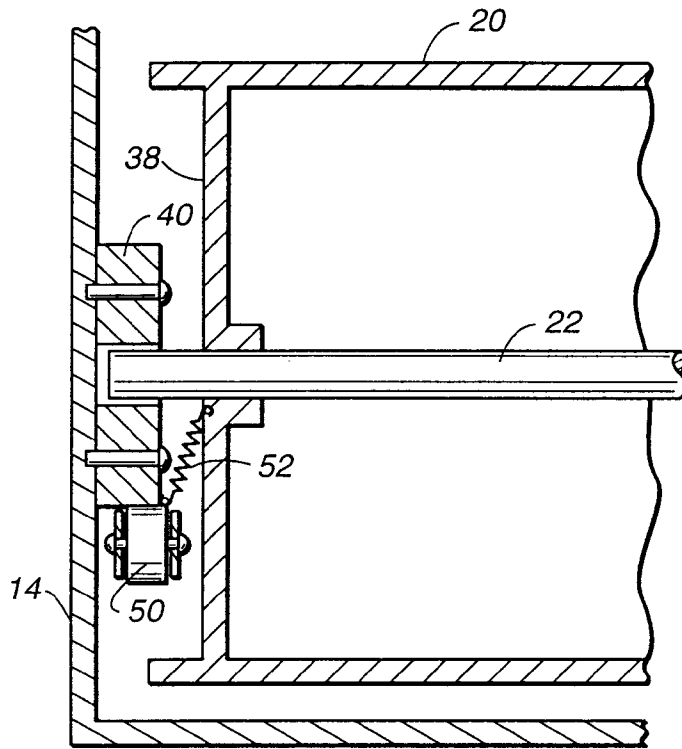


FIG._5

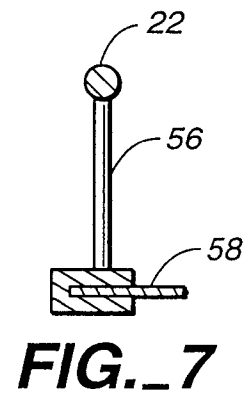


FIG._7

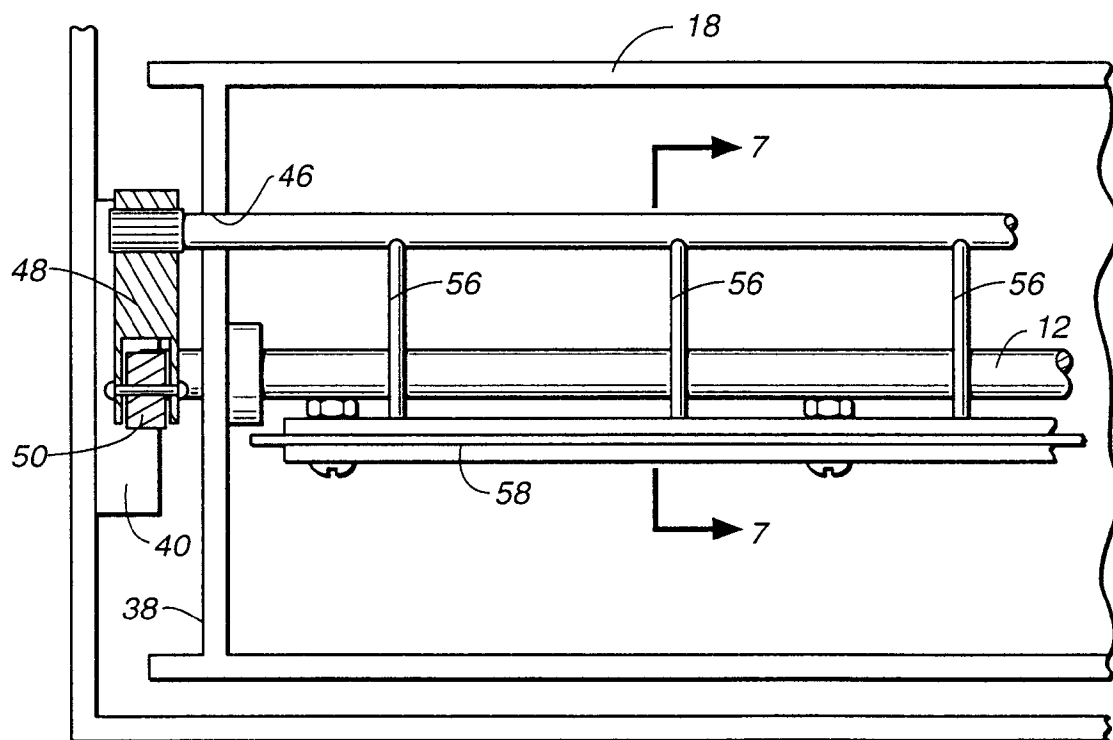


FIG._6



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 4390

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.5)
X,D	US-A-3 896 691 (M. GRANGER) * column 3, line 45 - column 6, line 3; figures 1-10 *	17	A47K10/34
Y,D	---	1-4,6,7,18	
Y,D	US-A-4 213 363 (M. GRANGER) * column 3, line 50 - column 4, line 63; figures 2,3,7-10 *	1-4,6,7,18	
A	FR-A-2 346 265 (M. GRANGER) * page 4, line 5 - line 40; figures 8-10 *	1,17	
A	EP-A-0 385 894 (M. GRANGER) * the whole document *	1,17	
A	FR-A-2 387 628 (APURA GMBH) * page 8, line 31 - page 9, line 7; figures 6A,8,12 *	1,17	
A	US-A-2 560 061 (E. AGAMATE) * the whole document *	1,17	TECHNICAL FIELDS SEARCHED (Int.Cl.5) A47K B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 September 1994	Examiner Delzor, F
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			

EPO FORM 1503 03.92 (P04C01)