



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



Publication number: **0 528 351 A1**

**EUROPEAN PATENT APPLICATION**

Application number: **92113762.6**

Int. Cl.<sup>5</sup>: **B65B 69/00, B26D 7/27,  
B26D 1/04**

Date of filing: **12.08.92**

Priority: **13.08.91 US 744292**

Inventor: **Dornblaser, Norman W.**  
**275-33 South Union Road**  
**Elma, Washington 98541(US)**

Date of publication of application:  
**24.02.93 Bulletin 93/08**

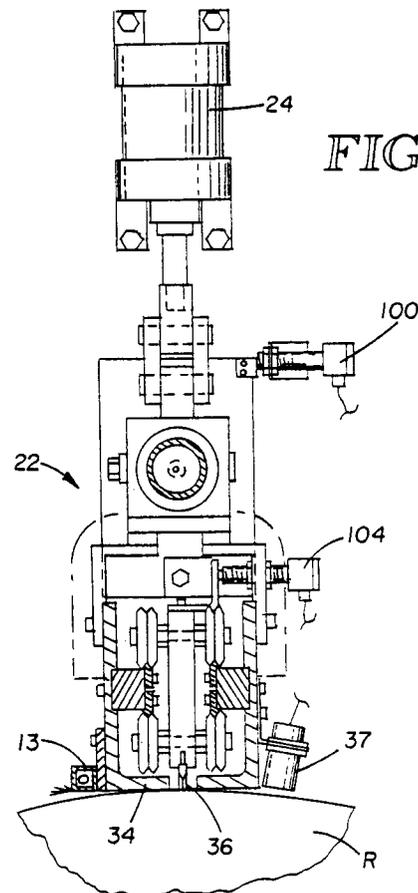
Designated Contracting States:  
**DE FR GB SE**

Representative: **Patentanwälte Grünecker,**  
**Kinkeldey, Stockmair & Partner**  
**Maximilianstrasse 58**  
**W-8000 München 22 (DE)**

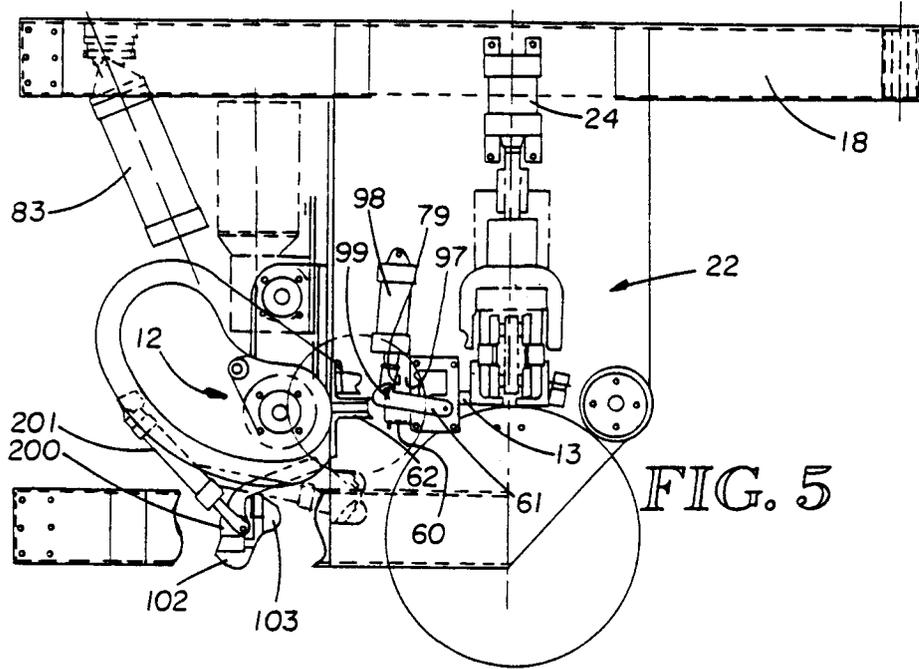
Applicant: **LAMB-GRAYS HARBOR CO., Inc.**  
**Blaine and Firman Streets,**  
**Hoquiam, Washington 98550-0359(US)**

**Automatic roll wrapper removing apparatus and method.**

Method and apparatus for cutting a wrapper on a cylindrical roll (R) in which a blade (36) has a pointed tip joined to an inclined edge extending outwardly and an opposite smooth surface, the blade being moved under the outer wrap of the wrapper but outward of the material of the roll and continuing to be moved along a predetermined path along the length of the roll, with the inclined edge cutting the outer wrapper. The blade is positioned perpendicular to the roll and circumferentially from the outer end of the wrapper. A track having gauge rails (34) resting on the roll (R) spaces the tip of the blade (36) a predetermined distance outwardly from the roll. A gathering device is provided for removing and flattening the cut wrapper.



**EP 0 528 351 A1**



## Technical Field

This invention pertains to apparatus and method for automatically removing the wrapper from a cylindrical roll such as a roll of paper such as newsprint paper.

## Background of the Invention

Paper rolls are wrapped with one or more layers of heavy wrapping paper to protect the surface of the outer layers of paper on the roll. The wrapped roll usually (but not always) includes "heads," namely, a disk of paperboard at each end of the roll, which must be removed by another process, manually or mechanically. The remaining wrapper is referred to as the "sleeve." For the purposes of this application the paper on the roll will be described as newsprint paper although the invention pertains to any roll protected by a wrapper. Various ways have been employed to cut the wrapper from the roll. One technique is for a workman to merely take a knife, press the blade inwardly against the outer surface of the wrapper at one end of the roll and slice through the wrapper from end to end on the roll. This technique can be injurious to the workman and frequently results in some of the newsprint paper being cut also. This newsprint paper is then wasted.

Another manual technique for cutting the wrapper is to start a blunt sloped knife under the outer wrapper and manually push the knife from one end of the roll to the other through the wrapper. This technique tends to be more certain of not cutting the newsprint but is time-consuming and if the workman is not careful the cutting tool can also engage the newsprint damaging the outer layers of newsprint paper.

Attempts have been made to automate the wrapper cutting procedure. Generally, these automated techniques have used a motor driven rotary cutting blade which is lowered onto the wrapper and moved from one end of the roll to the other. The rotary cutting blade tends to frequently cut through the wrapper, into the newsprint paper damaging the newsprint paper.

In automated handling of rolls it is desirable to not only save labor but reduce the waste caused by manual or powered cutting tools cutting into the newsprint paper. The saving of two or three wraps of newsprint paper often adds up to savings of tens of thousands of dollars in a single years time. It is also desirable to put the heavy wrapper removed into a convenient form for handling and disposal. Disposal is typically by baling for recycling.

## Summary of the Invention

It is an object of this invention to automate the roll unwrapping process.

It is another object of this invention to automate the roll unwrapping process and at the same time minimize the waste caused when an operator or powered wrapper cutter slits through the wrapper and damages the newsprint paper.

Yet another object of this invention is to provide a means for placing the removed wrapper in condition for convenient handling and disposal.

The objects are obtained by moving a knife gauged accurately to a preferred depth along a predetermined cutting path under the wrapper and slit this wrapper from the inside out. In this way the knife can effectively slit through the outer wrapper only. In addition to cutting the wrapper, the invention also removes the cut wrapper and discharges the cut wrapper at a location remote from the paper roll.

## Brief Description of the Drawings

Figure 1 is a front elevation of an apparatus for cutting and removing the wrapper.

Figure 2 is an end elevation.

Figure 3 is an end elevation of a portion of the apparatus showing the wrapper cutting blade positioned on a roll.

Figure 4 is a side elevation of a portion of the wrapper cutting apparatus.

Figure 5 is an enlarged detail of the cutting and wrapper removal apparatus.

Figure 6 is an enlarged detail of the wrapper removal apparatus.

Figure 7 is a plan of the apparatus shown in figure 6.

Figure 8 is a plan of the apparatus for removing the wrapper from the wrapper collecting mandrel.

Figure 9 is a side elevation of the apparatus shown in Figure 8.

Figure 10 is an isometric of the cutting blade.

Figures 11A-11D are schematic illustrations showing the steps of removing the wrapper.

Figure 12 is a fragmentary view of a sensor for locating the outer edge of the wrapper.

## Detailed Description of the Invention

Figure 1 illustrates a main frame 10 having a cut wrapper collecting mandrel assembly 12, an air shower tube 13 (Figure 3) for guiding the cut wrapper into the mandrel assembly, and a wrapper removing assembly 16 for stripping the cut wrapper from off of the mandrel assembly 12.

As best shown in Figure 2 the main frame 10 also supports a cutter carriage 18 vertically and reciprocally mounted. A pair of cylinders 20 raise and lower the carriage via chains and sprockets 21. A movable cutter assembly 22 is raised and lowered on the carriage 18 by a set of hydraulic cylinders 24.

As will be described in more detail below, the roll will then be rotated at half speed until the outer edge of the wrapper is located on the roll. This is done to position the cutter at the lapped area of the wrapper in the unglued area.

The carriage 18 is provided with a rider roller 30 which, when the carriage is lowered, will move down therewith into engagement with a paper roll R located on a pair of rotatable turning rollers 32. The roll will have a wrapper of one or more wraps surrounding the paper of the roll. The rollers are capable of handling wrapped rolls of various diameters such as the second wrapped roll shown in phantom lines R2.

The cutter assembly 22 is best shown in Figures 3 and 4 and includes a set of gauge rails 34 to position a cutter blade 36. The cutter carriage 18 will stop downward movement when the rider roller engages the roll R. A photo-capacitive sensor 37 will then sense the presence of the roll R on the rollers 32 and activate the pneumatic cylinders 24 to lower the cutter assembly until the gauge rails 34 are positioned directly on the surface of the wrapper W on the roll. The gauge rails are spaced apart sufficient to allow the forward tip of the cutter blade 36 to enter beneath the outer wrap of the wrapper between .011-.016 inches below the radially outer surface of the wrapper. The cutter blade has a beveled tip 38 (Figure 10) sloping up and rearwardly to an edge 39 and sloping down on either side from the edge to a flat guide surface 40. The blade thus is intended to be slipped in from an end of the roll under the outermost wrap of the wrapper and tear the wrapper by pushing out from within. In this way, the flat guide surface 40 cannot penetrate beyond the wrap on which it lays when the blade is inserted and the continued movement of the blade from the one end of the roll to the other will have no occasion to penetrate further into the next radially inward wrap of the wrapper. In this way it is highly unlikely that any more than the top wrap or the first two wraps of the wrapper will be torn open by the blade and the newsprint paper will not be engaged by the blade. The spacing between the gauge rails 34 is such that the curvature of the roll will be slightly above the bottom surface of the guide rails in the gap between the guide rails and the blade is set to be at the precise dimension given above. This position, of course, can be adjusted if necessary for various types of wrappers.

The cutter blade 36 is propelled through the wrapper from one end of the roll to the other by an endless cable drive 42 (Figure 4) driven by a pneumatic cable cylinder 44. The cable is fixed to a trolley 46 having a plurality of guide wheels 47 that move on a guide track 48. Thus, by actuating the pneumatic cylinder 44, the blade can be moved along the guide track 48 the full length of a roll.

Once the roll wrapper has been cut all the way through, the cutter blade is retracted to its original position spaced endwise from the roll, the cutter carriage 18 is raised, and the rollers 32 are rotated to rotate the roll R in the counterclockwise direction as shown in Figures 2 and 3.

The air shower tube 13 emits a generally horizontal stream of air to the left as shown in Figure 3. As the air passes over the cut free end of the wrapper, the free end is lifted by the air stream and guided into a guide slot 62 (Figure 5). The cut free end of the wrapper is moved to the left in Figure 5 by the counterclockwise rotation of the roll R and the air stream from the air stream tube 13 and is drawn up against the surface of the guide bar 61 over the support bar 60 and then into the slot 62. After passing through the slot 62, the free end of the wrapper enters the gap between the spaced forks 72 of the cut wrapper collector mandrel assembly 12.

A web sensing photo sensor 79 signals the presence of the wrapper just before it enters the coiling mandrel 12. After a short delay the mandrel will start to rotate. The mandrel is best shown in Figures 6 and 7 and includes a motor 70 that rotates a pair of forks 72 carried on a spindle 74. Spindle 74 is driven by a drive belt 76 driven by the motor. The cut wrapper is then fed through the gap or nip 78 between the forks and as the forks rotate the wrapper becomes wrapped around the forks in a coil. The mandrel motor is designed to accelerate to its final speed and once it reaches that speed immediately begins to decelerate slowly. This is to prevent over-tightening of the wrapper coil on the forks. The deceleration curve will be in the range of 50 seconds.

When the wrapper is completely unwound from the roll R, the glue holding the inner end of the wrapper W to the roll should release and the inner end of the innermost wrap of the wrapper should pull free. As the inner end of the wrapper feeds past the web sensing photo sensor 79, the sensor will open a circuit, stopping the turning rolls 32 thus bringing the rotation of the roll R to a stop and starting a short time delay. After this delay, the mandrel motor will decelerate to a very slow indexing speed and then will shut off with the mandrel forks aligned vertically as shown in Figure 11D.

A cylinder 83 swings the motor and forks counterclockwise as shown in Figure 6 away from the

roll and raises it into alignment with the collecting roller assembly 16.

The collecting roller assembly 16 is best shown in Figures 8 and 9 and includes a set of vertical rollers 82 pivotally mounted on a pivot rod 84 and rotatably driven by belt 86. The belt is carried on sheaves 87 mounted on the pivot rod 84. The pivot rod is rotated by a motor 88. A cylinder 90 connects to linkages 92 and 94 to pivot the rollers toward one another. One roller 82 is driven so that the wrapper can be caught between the nip between the two rollers when the rollers are moved toward one another. The wrapper is thus pulled or stripped off of the mandrel forks. The coil is flattened and driven away from the machine to be received by a cart or container for disposal.

If the inner end of the wrapper glued to the newsprint paper does not pull free, the presence of the newsprint paper entering the mandrel assembly will be sensed by a light/dark photo sensor 97 (Figure 5). The sensor will then close a circuit to actuate a conventional tail cutter which will cut off the newsprint paper. The tail cutter employs a cylinder 98 (Figure 2) which is connected to the guide bar 60 that carries an elongated wire 99. The wire runs the length of the roll and is a conventional paper cutting wire. When the wire cutting cylinder piston rod is lowered, the wire is passed down past the guide slot 62 to sever the newsprint.

The operation of the apparatus is now described. A roll such as a newsprint paper roll R, enters the turning rolls 32 and is cushioned to a stop in a conventional manner.

A bracket 200 carries a light source 103 and a photo sensor 102 and is pivoted toward the roll by a cylinder 201. The light 103 is directed at the surface of the wrapper. The roll will be rotated in the unwinding direction at a reduced speed. When the outer end 108 of the wrapper passes beneath the light, it creates a shadow. The shadow is detected by the photo sensor 102. Once the photo sensor 102 finds the wrapper outer end, the turning rolls 32 stop and the cutter assembly 22 is lowered onto the roll.

The cutter carriage 18 is then lowered by the cylinders 20 until the downward motion of the cutter carriage is stopped by the rider roll 30 contacting the roll of newsprint paper. The capacitive proximity sensor 37 (Figure 3) on the cutter carriage will sense the roll of newsprint paper causing the cutter assembly 22 to be raised by the cylinders 24 relative to the carriage 18. When the cutter assembly 22 is raised to its upper position, it activates a photo sensor 100. The sensor 100 then signals to begin, slowly rotating the roll counter-clockwise to assure the desired overlap area is at the cutting path.

The cutter assembly gauge rails 34 will rest on the roll so that the tip 38 of the cutting blade 36 is positioned beneath the outermost wrap on the roll as determined by the gauge rails and beyond the glue area as was determined by the location of the outer end of the wrapper by sensor 102. The lowered presence of the cutter assembly 22 is detected by a sensor 104 which activates the cable cylinder to drive the trolley 46 and cutter blade. The cutter blade then travels along the top of the roll, slitting the wrapper. After completing the cut, the cutter assembly is raised, the air shower is emitted from tube 13. The roll is then turned in the unwind direction slowly. The air shower flows over the leading cutting edge of the wrapper, drawing it up and guiding it through the wrapper guide slot 62. The web sensing photo sensor 79 will then signal the presence of the wrapper just before it enters the forks 72 of the coiling mandrel 12. After a short delay, the mandrel will start to rotate as discussed earlier.

When the wrapper is completely unwound from the roll the glue holding the wrapper to the roll should release and the end of the wrapper should pull free. As the tail of the wrapper feeds past the web sensing photo sensor 79, the photo sensor will open a circuit stopping the turning rolls 32 and starting a short time delay. After this delay, the mandrel motor will decelerate to index speed and then shut off with the mandrel forks aligned vertically.

If the wrapper does not pull free as described earlier, the newsprint paper will be fed through the wrapper guides and sensed by the light/dark photo sensor 97. The photo sensor will actuate the newsprint paper cutter cylinder 99 which will lower the wire 99 and cut off the newsprint paper. When the newsprint paper is cut, the turning rolls 32 will be shut off and the timer will be started as described above. After the time delay, the mandrel motor will be rotated to its indexed position and then shut off. The turning rolls will be reversed to wind up the free end of the newsprint onto the roll R.

After the mandrel motor is shut off, the cylinder 83 will swing the mandrel upward. The end of the coiled wrapper tube extending beyond the mandrel forks 72 will be fed between the discharge rollers 82. The discharge rollers will be closed on the end of the wrapper tube. The newsprint roll R will also be ejected from the turning rollers 32. After the discharge rollers 82 are closed, the discharge roller motor 88 will start. The discharge rollers will pull the wrapper tube off the mandrel forks, flattening the wrapper tube as it feeds through the rollers and will discharge the flattened wrapper tube into a bin or receptacle. As the wrapper tube is being discharged, the next roll R of newsprint enters the turning rollers and the sequence repeats.

The method of this invention is best shown schematically in Figures 11A-11D. The steps include rotating a roll wrapped with one or more wraps of a wrapper until the outer edge of the wrapper is located, automatically moving a cutting knife having a beveled tip, guided by gauge rails on the roll, along a predetermined cutting path to penetrate beneath the outer wrap at a predetermined distance circumferentially from the sensed wrapper outer edge, drawing the cutting knife through the wrapper from one end of the roll to the other, tearing the wrapper open from the inside out, and rotating the roll while guiding the cut severed end of the wrapper to a gathering location. At the gathering location, wrapping the wrapper into a coil and then stripping the coiled wrapper from the gathering location for discharge. The method includes sensing the presence of newsprint paper attached to the cut wrapper and cutting the newsprint if it is accidentally so attached to the wrapper.

While the preferred embodiments of the invention have been illustrated and described, it should be apparent that variations will be apparent to one skilled in the art without departing from the principles herein. Accordingly, the invention is not limited to the form illustrated in the drawing.

### Claims

1. Apparatus for cutting and removing a wrapper from a cylindrical roll having a wrapper with at least one overlapping wrap around the circumference of the roll, comprising:
  - roll support rollers for rotating a wrapped roll about its longitudinal axis;
  - blade means having a single stationary blade with a narrow point and an outwardly sloping cutting ramp;
  - means for positioning the blade means with the point beneath a wrap of the wrapper outside of the material of the roll;
  - means for moving the blade means along the length of the roll to cut the wrapper; and
  - means for removing the cut wrapper.
2. The apparatus of claim 1, said blade means positioning means including a guide track having spaced gauge members for engaging the wrapper on the roll and holding the blade point a predetermined distance inwardly from the gauge members to pass beneath the outer wrap of the wrapper.
3. The apparatus of claim 1, said roll being a roll of paper, including means for sensing the presence of the paper from the roll attached to the cut wrapper as the wrapper is being removed, and paper cutting means for cutting the paper from the wrapper.
4. The apparatus of claim 1, said means for removing the cut wrapper including wrapper gathering means and means for directing air along the cut wrapper for lifting and guiding the wrapper to the wrapper gathering means.
5. The apparatus of claim 1, said means for locating the outer end of the wrapper including a light source directed to strike the outer end of the wrapper and sensing means for detecting a shadow caused from the light striking the outer end of the wrapper where it joins the next inner wrap.
6. A method of cutting and removing a wrapper from a cylindrical roll having a protective wrapper around the circumference of the roll, comprising:
  - positioning a cylindrical roll with a wrapper at a wrapper removing station;
  - rotating the roll about its longitudinal axis at the removing station until the outer end of the wrapper is located with respect to said predetermined cutting path;
  - moving a blade beneath the wrapper along a predetermined cutting path at one end of the roll and passing the blade along the length of the roll along said predetermined cutting path to cut the wrapper; and
  - removing the cut wrapper.
7. The method of claim 6, said wrapper having at least one overlapping wrap, said blade having a narrow tip sloping upwardly along a cutting edge, said step of moving the blade beneath the wrapper including inserting the tip under the wrapper overlap and cutting the wrapper by moving the cutting edge through the wrapper above the tip.
8. The method of claim 6, including sensing the location of the outer end of the wrapper and inserting the blade under the wrapper at a fixed circumferentially spaced distance from the sensed outer end of the wrapper.
9. The method of claim 6, said step of removing the cut wrapper including directing air past the cut end of the wrapper to guide the wrapper to a removing location and simultaneously rotating the wrapped roll to free the wrapper from the roll while gathering the cut wrapper.
10. The method of claim 9, said step of gathering the cut wrapper including entwining the wrapper on prongs and pulling the entwined wrap-

per off the prongs when the entire wrapper has been gathered.

- 11. The method of claim 9, said step of locating the outer end of the wrapper including detecting a shadow caused by a light shining on the outer edge of the wrapper. 5

10

15

20

25

30

35

40

45

50

55

7

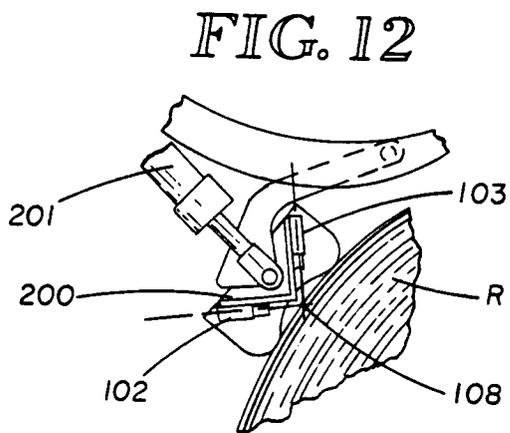
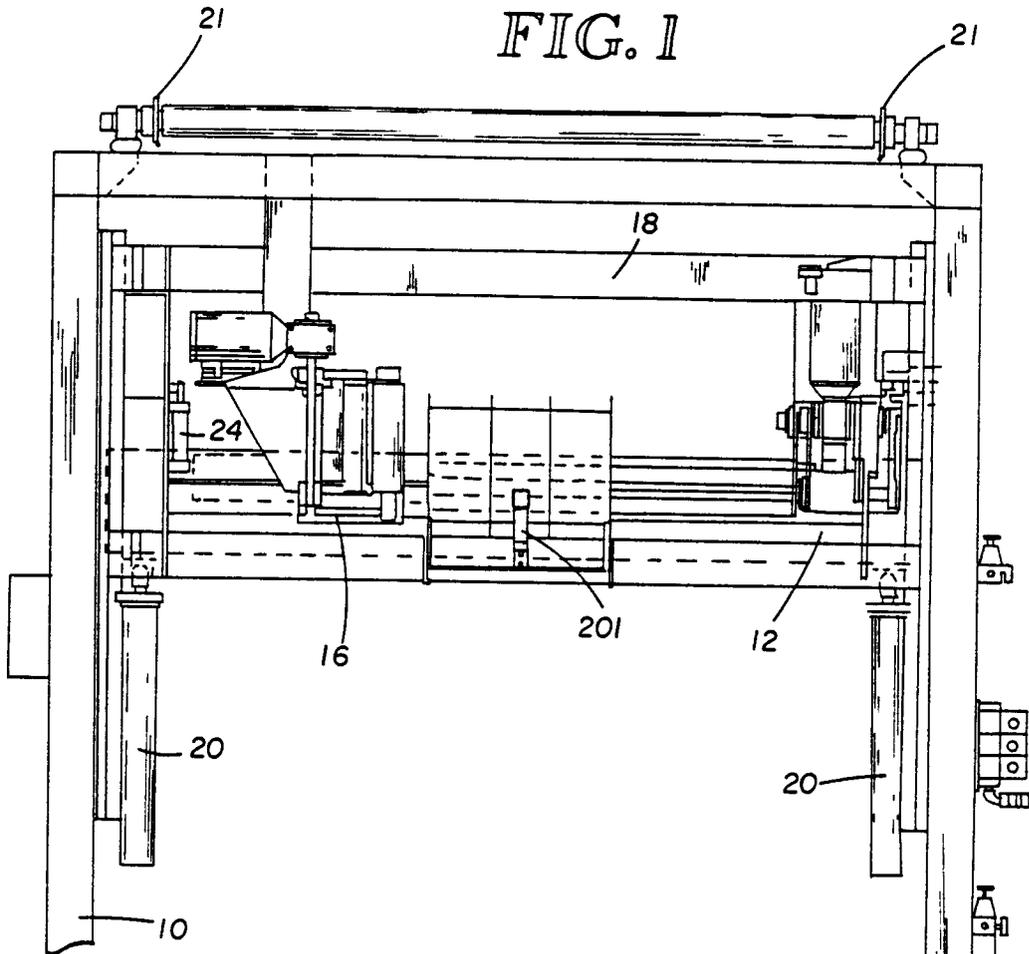


FIG. 2

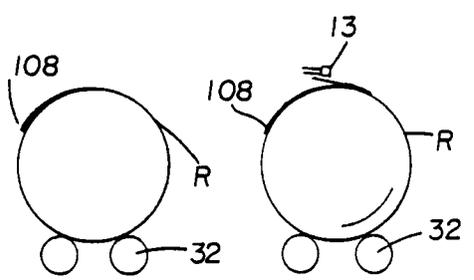
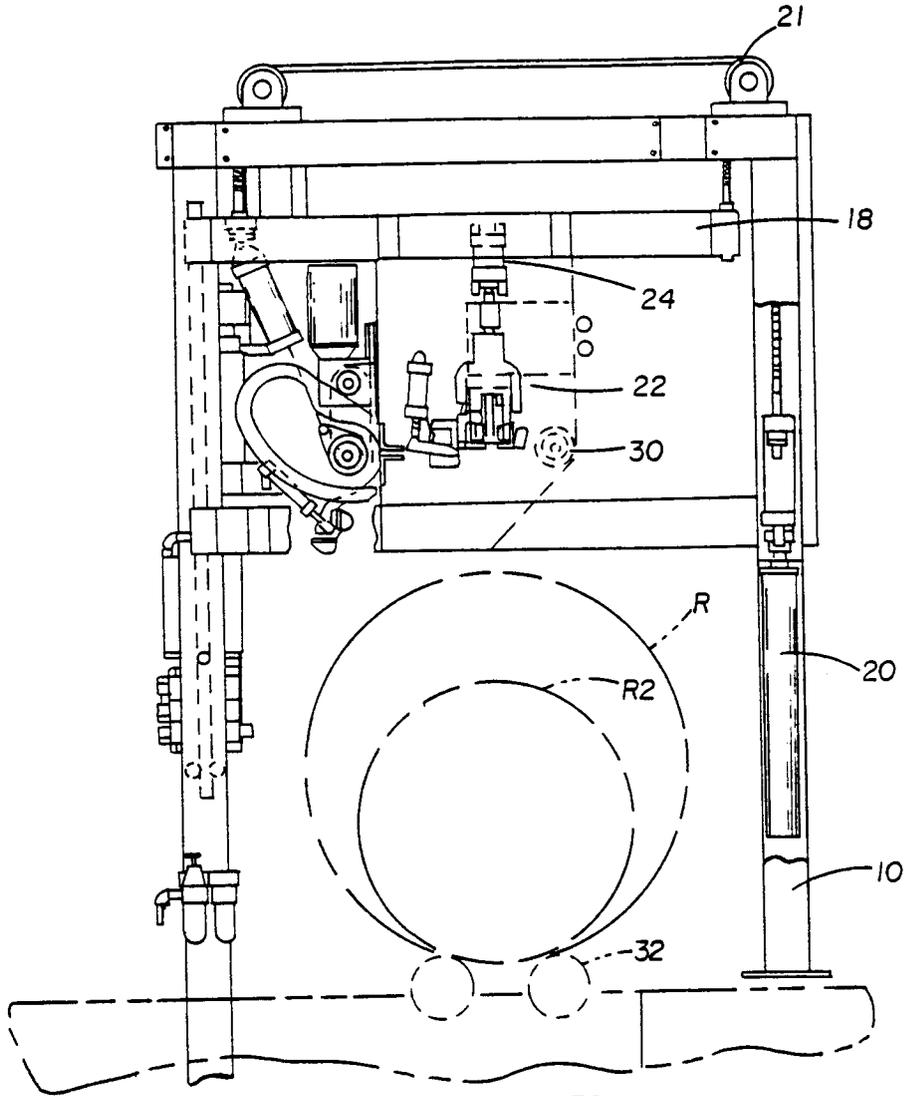


FIG. 11A FIG. 11B

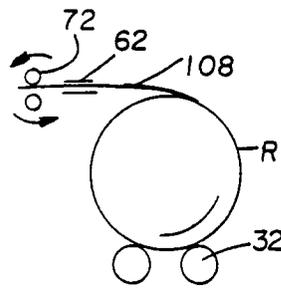


FIG. 11C

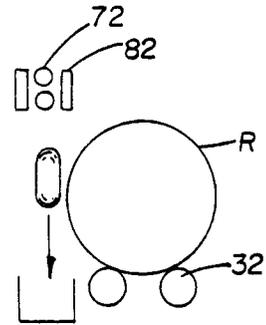


FIG. 11D

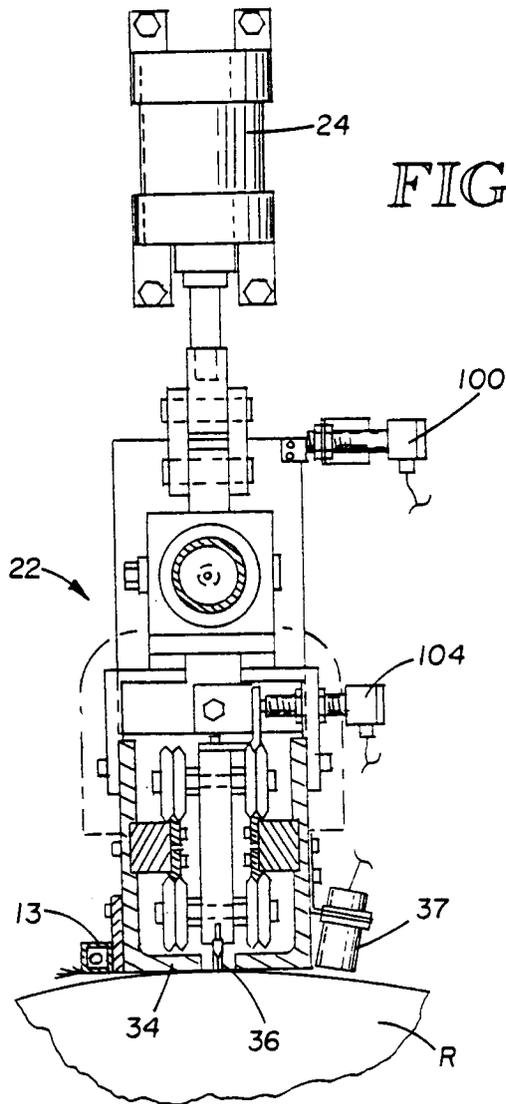


FIG. 3

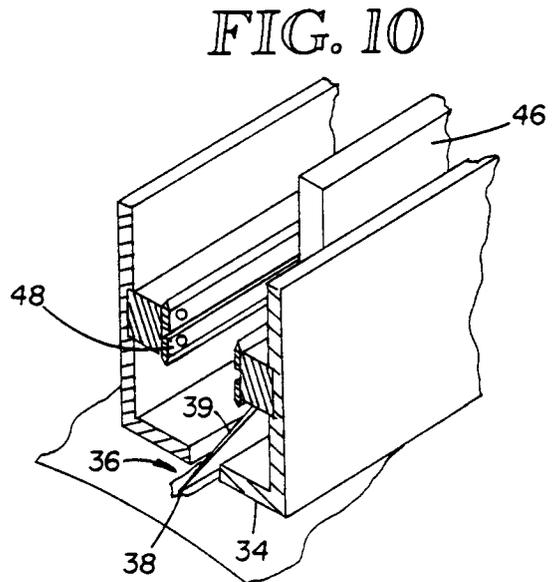


FIG. 10

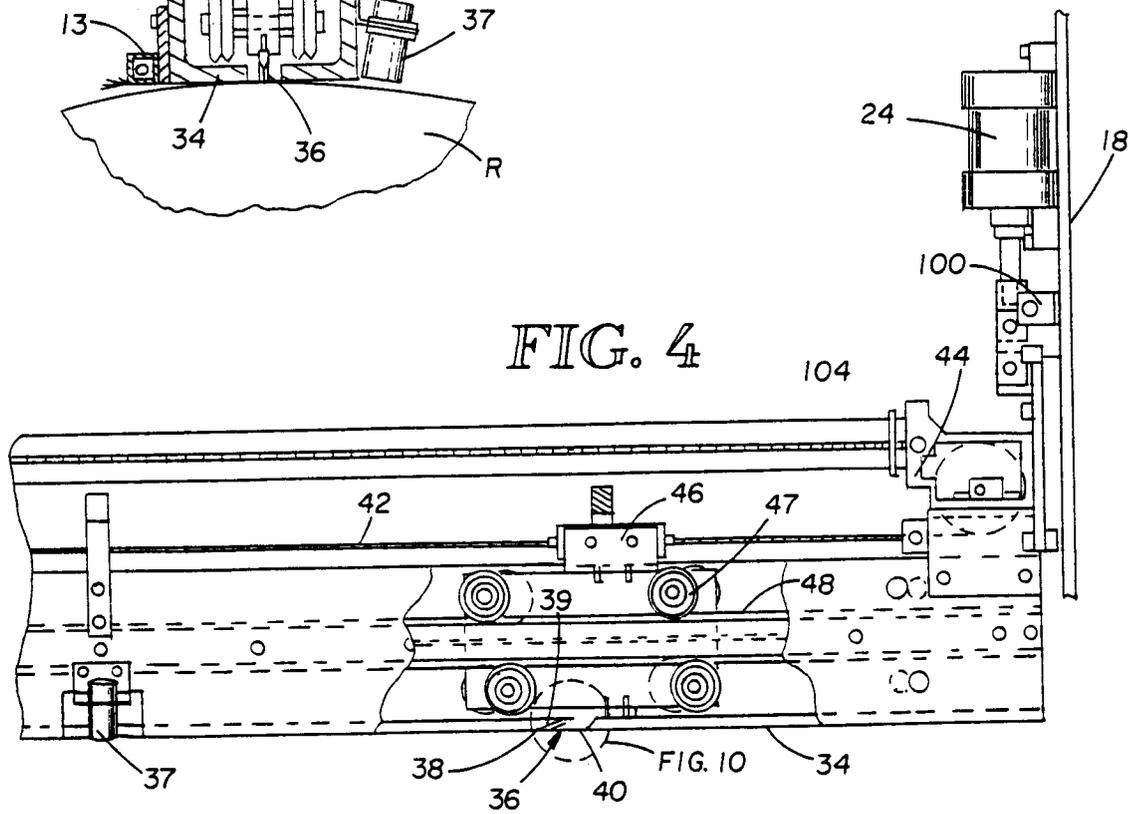


FIG. 4

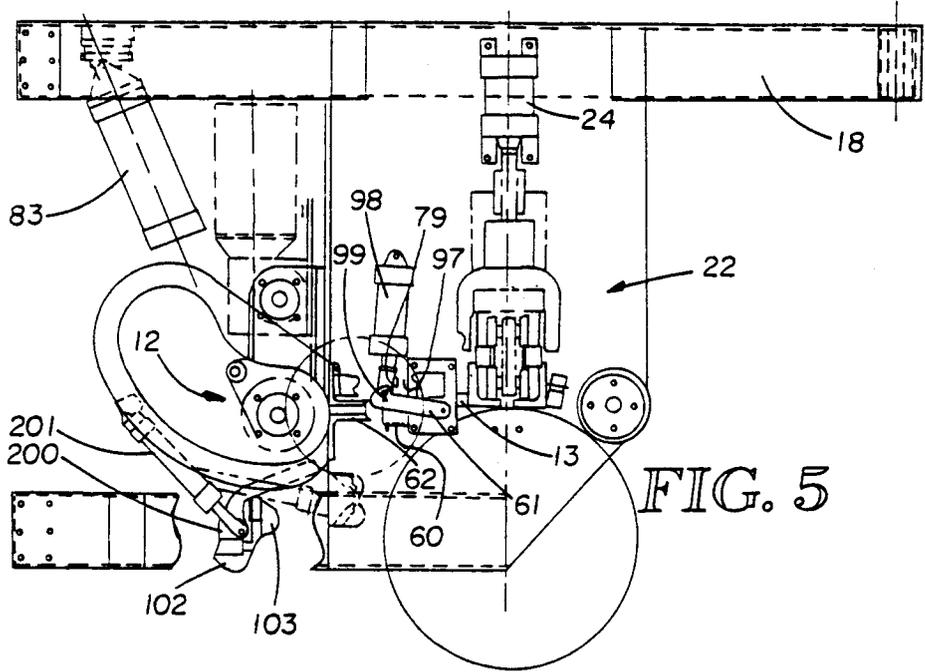


FIG. 5

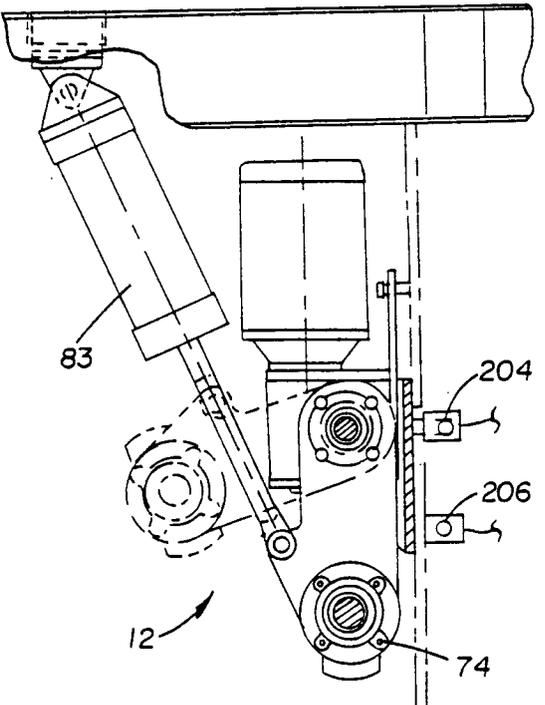


FIG. 6

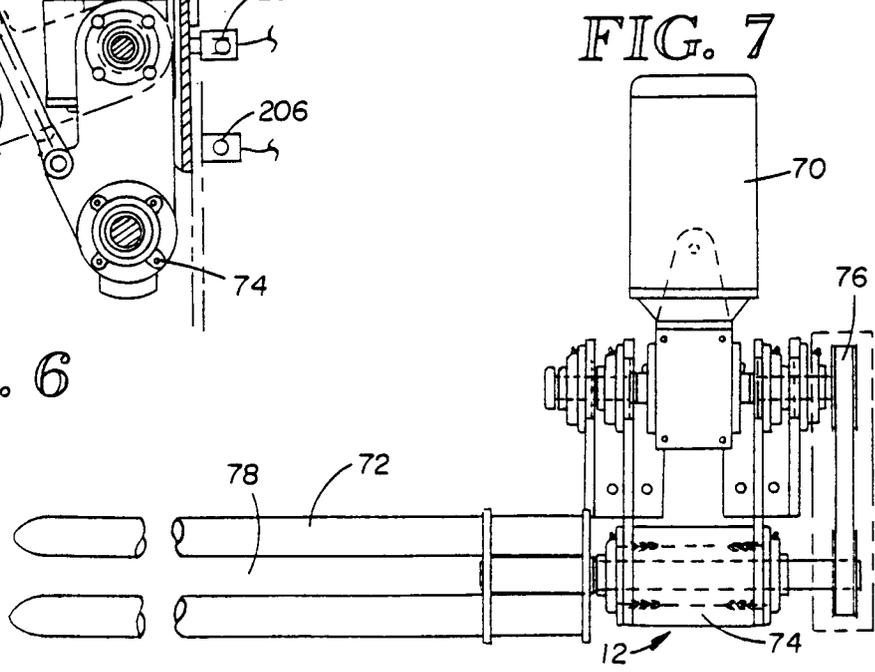
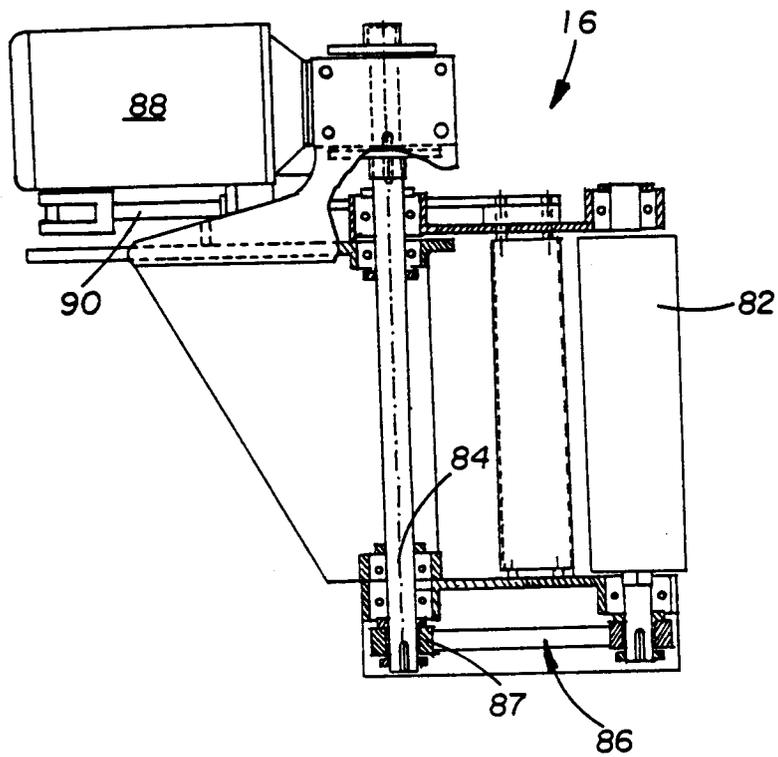
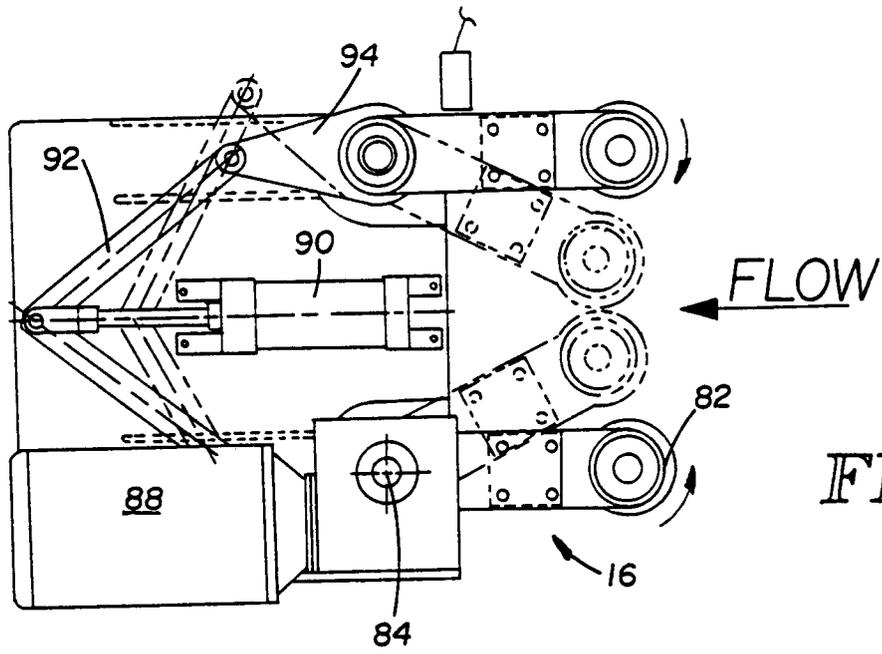


FIG. 7





European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 11 3762

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	US-A-4 821 971 (TAKEMI WATANABE) * column 5, line 9 - column 7, line 30; figures *	1,2,6,7	B65B69/00 B26D7/27 B26D1/04
A	---	3,4,8,9	
X	US-A-3 521 347 (E. BENTLEY) * column 3, line 35 - column 6, line 74; figures *	1,2,6,7	
A	---		
	US-A-4 721 263 (MASARU MIYAZAKI) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B65B B26D B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 04 DECEMBER 1992	Examiner JAGUSIAK A.H.G.
CATEGORY OF CITED DOCUMENTS		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	
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			

EPO FORM 1503 03.82 (P0401)