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(71) Applicant: **AGFA-GEVAERT naamloze vennootschap**
Septestraat 27
B-2640 Mortsel(BE)

(72) Inventor: **De Roeck, Jozef**
c/o Agfa-Gevaert N.V., DIE 3800,
Septestraat 27
B-2630 Mortsel(BE)
Inventor: **Lemeire, Louis**
c/o Agfa-Gevaert N.V., DIE 3800,
Septestraat 27
B-2640 Mortsel(BE)
Inventor: **Marckx, Michel**
c/o Agfa-Gevaert N.V., DIE 3800,
Septestraat 27
B-2640 Mortsel(BE)
Inventor: **Stassen, Constant**
c/o Agfa-Gevaert N.V., DIE 3800,
Septestraat 27
B-2640 Mortsel(BE)
Inventor: **Van Vaeck, Eduard**
c/o Agfa-Gevaert N.V., DIE 3800,
Septestraat 27
B-2640 Mortsel(BE)

(54) Web cutting device.

(57) A device for use in cutting a fast-moving web (10) of material, particularly of coated photographic film stock, comprises a frame (30) supporting a fixed track (40), a fixed driving bar (45) and one or more fixed motors (43) with an associated drive belt (44), all of which extend across and beyond the path of the web, and further comprises a movable carriage (50) which incorporates a drive wheel (56) rotatable by contact with the fixed driving bar (45) to drive the cutting blade. The simplified and lightweight carriage construction so provided permits a clean cut without slowing the web and thus provides for continuous web rewinding without the need for a web accumulator during the cut and accumulated web recovery thereafter.

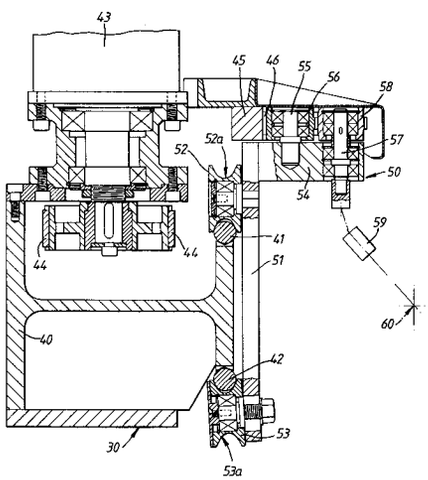

Fig.3.

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BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a device for cutting a moving web of sheet material without interrupting the material's travel along its defined path. The device is intended for use in web winding equipment in which the web is wound into rolls on successive cylindrical cores, the web being cut at the stage at which one core becomes fully laden and the web feed must be transferred to an empty core. It is particularly concerned with cutting a fast-moving web without reducing the web speed.

The invention is especially suitable for the cutting of webs of photographic film stock and is primarily described herein with reference to this duty. The main application in this field is in the rewinding of large rolls of film stock, typically after coating with photosensitive material. The web emerges from the coating line at high speed and is taken up on a driven core, creating a roll of wound material. However, the invention is not limited to this particular application, and is usable in general for the cutting of plastics material and paper webs.

Description of the prior art

A typical automated arrangement for web rewinding comprises a turret including a rotatable holder for two cores. Winding commences on a first empty core and continues until a full roll has been wound. As the winding approaches the full -roll stage the holder moves a second empty core towards and close to, but still out of contact with, the path of travel of the web upstream of the filling core. When the latter core is fully wound the web is cut close to the empty core. The new leading edge of the web is brought into contact with the empty core to be taken up thereon. Application to the new core is normally achieved with the assistance of a pre-applied adhesive strip on the core surface and a pressure roller which pushes the newly cut leading edge into contact with the adhesive strip. The holder is then rotated to turn the full core away from the machine, and the full core is then removed from the holder and replaced by a new empty core. The holder can again be rotated at the required stage to bring a new empty core close to the web.

Prior proposals for cutting the web have included, as for example in European patent specification EP-A-0385082 and US patent specifications 4422586 and 4541583, a blade extending across the full width of the web and typically including serrations on the leading edge of the blade. The use of a moving carriage to convey a cutting blade across a web of material in web winding equipment is known, for example from GB patent specification 1297812 which passes a rotary cutting blade in a transverse direction across the web. This document describes how such transverse cutting of the moving web produces a tapered leading edge of material for take-up on the mandrel (winding core). It further describes a drive means for the blade which comprises a motor, preferably an air motor, carried on a casing which is driven across the web by a pneumatic cylinder. Other prior proposals, for example Swiss patent specification 567999, have suggested the use of a carriage to pass a fixed blade across the web.

In applying such prior proposals there is however a risk of uneven cutting of the web so as to give a ragged edge to the cut, which may create problems in taking up the new leading edge on a new core, or so as to break off fragments of the web at the cut edges. The presence of broken fragments is generally undesirable and is especially to be avoided in cutting photographic film stock because of the adverse effect on film quality.

The risk of damaging the web during cutting is increased by the large scale of the webs employed in the photographic industry. A typical web is over 1.7 metres wide and may be up to 5000 metres long. Moreover, such webs are passed at very high speed, for example up to 5 m/s (300 m/min), through a treatment such as coating. In contrast, if a full-width serrated cutting blade is employed the maximum web speed that can be achieved without unacceptable damage to the severed edges may be as low as 2 m/s. Prior proposals for the use of moving carriage with a motor-driven rotary blade have permitted cutting at higher web speeds than with full width blades but have still required reduction of the web speed before making the cut in order to ensure the required quality of finish.

Thus because of the high speed of travel through the treatment line and since such lines are normally required to run continuously, it has proved necessary to employ large and elaborate accumulator means to hold back web material during the cutting operation and thereafter to increase the rewinding speed to recover the accumulated material. Moreover, the web speed during recovery must be even higher than the line speed such that for a high line speed as described above the increased recovery speed must be even higher, imposing enormous working loads on the web rewinding turret.

SUMMARY OF THE INVENTION

Objects of the invention

It is an object of the present invention to provide a web cutting device in which the bulk of the components required to drive the cutting blade are accommodated on the frame. It is also an object to allow the carriage to be of simple and lightweight construction such that it can be accelerated from rest to the desired cutting speed within a portion of the frame extending beyond the edge of the web, i.e. before the blade contacts the web. Uniform cutting speed across the web is an important factor in achieving a clean cut.

A further advantage of lightweight carriage construction is that the carriage can be accelerated in a short lateral distance to a speed sufficient to permit the cutting of a high speed web.

Statement of the invention

According to the invention there is provided a web cutting device which comprises a frame extending across the path of the web and a movable carriage on which is mounted a rotary cutting blade, wherein the frame includes a fixed track for the carriage, characterised in that the frame further carries a fixed driving bar parallel to the carriage track and one or more fixed motors with an associated drive belt to move the carriage, the carriage incorporates a drive wheel rotatable by contact with the fixed driving bar to drive the cutting blade and in that the fixed carriage track, the fixed driving bar and the drive belt all extend beyond the edges of the web path.

The invention offers the advantage that the bulk of the components required to drive the cutting blade are accommodated on the frame, since the fixed motor(s) provide a dual-purpose power source serving both to move the carriage and rotate the cutting blade. This dual-purpose power source allows the carriage to be of simple and lightweight construction such that it can be accelerated from rest to the desired cutting speed within a portion of the frame extending beyond the edge of the web, i.e. before the blade contacts the web. The blade thus traverses the web uniformly at the desired cutting speed and is then retarded to rest after the cut is complete, the retardation being also accomplished within a portion of the frame beyond the edge of the web. Uniform cutting speed across the web is an important factor in achieving a clean cut. The dual-purpose power source further ensures that the rotational speed of the cutting blade is proportional to the carriage traverse speed. This permits the use of predetermined and preset driving ratios between the traverse and blade speed to give optimum cutting.

A further advantage of lightweight carriage construction is that the carriage can be accelerated in a short lateral distance to a speed sufficient to permit the cutting of a high speed web. Because of the limited space available in a typical film coating line between the rest and cutting positions the acceleration, and retardation, of the carriage in the available space needs to very high. The available space may for the acceleration and retardation at the sides of the web may be as little as 300 to 400 mm, requiring acceleration and retardation forces of up to 15G. The invention permits these levels of acceleration and retardation to be achieved and withstood and thus obviates the previous need to slow down a high speed web before making the cut. As a result it is also possible to avoid the need for an accumulator in the web coating line.

The rotary cutting blade preferably has an associated mounting plate, which rotates with the blade and which provides a convenient support to hold the blade and to permit easy attachment of replacement blades. The mounting plate is preferably attached to the carriage in such a manner, for example through a universal joint, that the angle the blade presents to the web is adjustable.

In addition to the rotary cutting blade the carriage preferably also includes a cutting knife, fixed relative to the carriage, to cooperate with the rotary blade to ensure a clean cut of the web. In this configuration it is further preferred that the cutting edge of the rotary blade is polygonal rather than simply circular. The polygonal edge cooperates with the cutting knife so as to apply a slight scissor-action to the cut.

A spring member, for example a conical disc spring, is preferably interposed between the rotary blade and its mounting plate so as to ensure that the respective surfaces of the web are firmly contacted by the rotary blade and the fixed knife throughout the cutting action. In one advantageous embodiment of the invention the spring member is of a configuration which applies its greatest pressure at the point where the rotary blade bears against the knife.

The rate of rotation of the cutting blade is preferably such as to give a peripheral blade speed of about 1.5 to 2.5 times the web speed. This is found to be advantageous in ensuring a clean cut of the web, and it also increases the life-time of the cutting blade.

Furthermore, it is advantageous to connect the cutting blade with the drive shaft through a one-direction coupling in order to avoid rotation during the home run of the carriage.

As far as possible it is preferred to use plastic materials for the components of the carriage, for example engineering plastics such as reinforced nylon, but the stresses on some components, for example the supporting body structure and the main driving cogwheels, usually demand metal construction. The cutting blade and cutting knife are preferably of high quality steel.

In the preferred arrangement the carriage track is disposed at right angles to the direction of travel of the web. The web is thereby cut on the slant, which has the advantage that the leading edge of the cut web presents an angled tip which can readily be taken up on a new core. The angle of cut is selected by the relative velocities of the web and the cutting blade. Since the web speed is normally set by other factors the angle is effectively set by, and can be adjusted by, the cutting speed. The angle is normally selected according to the diameter of the core so that the angled portion of the web is taken up in a single rotation of the core (which means an angle of about 60° between the side edge and leading edge of the web at the leading point of the severed edge). This configuration assists in keeping the wound surface of the web as smooth as possible.

The preferred configuration for the track is two spaced-apart bars, each of circular cross section, extending across and beyond the web and being secured at their ends to the frame.

For use with such track the carriage preferably employs running wheels with circumferential grooves to engage the bars. The preferred number of wheels is three, two running on one of the bars and one on the other bar. This three-wheel arrangement has the advantage of combining light weight with stability. The single wheel on the other bar can conveniently incorporate adjustment means so as to ensure a proper engagement of the wheels with the bars.

The drive belt for the carriage is an endless loop extending across and beyond the full width of the web so as to power the carriage on the cutting pass from rest to the cutting speed, retard it to rest and subsequently to return the carriage to the initial rest position. The carriage should be securely attached to the belt so as to avoid the possibility of slippage relative to the belt since this could mean that the desired cutting speed might not be achieved for the whole of the cut. A preferred means of ensuring no slippage is to employ a drive belt with transverse teeth on one side, i.e. a so-called timing belt, and to provide corresponding notches on the carriage to engage the ribs. The carriage preferably further includes a clamp to hold it securely to the belt. One advantageous form of clamp for this duty is described and claimed in our copending European patent application entitled "Clamping device" filed on even date herewith. By these means it is possible to for the carriage and its drive to withstand the huge acceleration and retardation forces between rest and the cutting speed.

The transverse distance between the starting rest position of the carriage and the initial cutting point is preferably slightly greater than the distance over which the carriage acceleration occurs. This is because in practice it is found that the momentum of the carriage at the end of the acceleration causes a slight increase in carriage speed over the cutting speed ("overshoot"), which can be detected as a short peak in the carriage speed profile, before the carriage settles at the cutting speed. The transverse distance provided for the retardation to the end rest position is also preferably greater than the acceleration distance in order to foresee a free run-out path without mechanical stops.

The fixed motor or motors used to power the drive belt are preferably DC motors. Their preferred location is at the side of the frame beyond the edges of the web. The most preferred arrangement is to employ two motors, one either side of the frame. This assists in giving a positive drive to the carriage which permits the degree of acceleration necessary to bring the carriage up to the cutting speed in the available space beyond the web. Moreover the sophisticated control that is desirable to ensure a precise and uniform cutting speed across the web width can be applied to the fixed motor(s) without adding to the weight of the carriage.

The fixed motor or motors serve both to provide the power to move the carriage across the web and to rotate the cutter blade. The drive to the cutter blade is provided by the combination of the driving wheel on the carriage and the fixed driving bar on the frame. Although in principle the contact between these components can be simply through friction, in which case the carriage track can act as the driving bar, it is much preferred for the fixed bar and the driving wheel to be respectively a rack and pinion. The drive preferably includes a second pinion so that the tip of the cutting blade rotates in the same direction as the direction of movement of the carriage. The drive preferably further includes an adjustable joint so that the angle of the cutting blade can be adjusted relative to the carriage. The angle is determined with reference to the web and cutting speeds and having been adjusted to a position for a particular duty is then fixed in that position.

The frame on which the carriage is mounted is preferably supported by one or more swivel arms, most conveniently powered by pistons, which can move the carriage into position for the cut and swing it away again after the cut is made. The carriage can be returned to its start position on the transverse track after the frame has been moved away from the web.

The frame also includes one or more guide rollers extending across the width of the web and which maintain the web at a small distance from the new core immediately prior to the cut. It is also required for the frame to carry one or more smaller pressure rollers, typically powered by a spring and retractable by a pneumatic piston, which, as mentioned above, are employed to press upon the newly cut leading edge of the web as it reaches the core surface and thereby assist in securing the leading edge to an adhesive on the core. The pressure rollers may be carried on a support which is movable towards and away from the winding core by a triggerable mechanism, the mechanism being triggered by a pin carried by the carriage. The mechanism preferably includes a slidably mounted inertia block which acts to reduce the tendency of the pressure rollers to bounce when applied to the web core.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described herein with reference to the accompanying drawings, in which:

Figure 1 is a general view of a web rewinding turret;

Figure 2 is a side view of the turret shown in Figure 1, as seen from A-A' on Figure 1:

Figure 3 is a sectional side view, on a larger scale than Figures 1 and 2, of a cutting carriage, carriage support and drive motor on the turret of Figures 1 and 2, as would be seen from B-B' on Figure 1 if the carriage were at its right hand rest position as indicated by R_1;

Figure 4 is a side view, on a scale twice that of Figure 3, of a cutting blade assembly for the Figure 3 carriage;

Figure 5 is an enlarged view of a pressure system for urging the cut web tip onto a winding core;

Figure 6 is a view taken in the direction VIa - VIb -VIc in Figure 5, with the pressure device removed from the frame; and

Figure 7 is a view taken in the direction VII in Figure 5, with the pressure device removed from the frame.

Detailed description of the invention

The illustrated rewinding turret comprises a support structure 2 (indicated by dotted lines) which carries a centrally pivoted holder 4 (also indicated by dotted lines) with winding cores 20 and 22 at the ends remote from its pivot point. The cores are driven by motors (not shown).

The turret receives web material 10 from a photographic coating line (not shown) which passes over guide rollers 12, 14 and 36 to reach the respective winding core.

The support 2 also carries an axle 32 on which is mounted a frame 30, powered by pneumatic pistons 34 which move it between an idle position (indicated by dotted lines 30' in Figure 2) and a web-cutting position (shown by continuous lines 30). During most of the winding operation the frame rests in the idle position. The continuous lines thus show the frame 30 in position at the point of time at which a full roll 23 has been wound on the core 20 and the web is about to be cut and secured to the empty core 22.

The frame 30 carries a guide roller 36, with an associated drive motor 37. The frame 30 also carries a spacer 19 which abuts against a sleeve 18 on the winding core and in that way determines the exact position of the guide roller 36. In the web-cutting position the guide roller 36 bears against the web 10 to hold it close to the empty core 22 across the full web width. The frame 30 also carries a transverse beam 40 which comprises cylindrical guide bars 41 and 42 for a movable carriage 50. Drive motors 43, one at each end of the beam 40, power an endless loop toothed drive belt 44 to which the carriage 50 is firmly clamped. A fixed bar 45, including a toothed rack 46 is also attached to and extends across the full width of the frame 30.

The carriage 50 has a base plate 51 to which two upper pulleys 52 and a lower pulley 53 are rotatably mounted. The pulleys, each having a reinforced nylon outer portion mounted on ball bearings, run on respectively the upper and lower guide bars 41 and 42. Each reinforced nylon outer portion carries a circumferential bar groove 52a, 53a, having a generally curved cross-section with a radius smaller than that of that curved wheel engaging surface of the guide bars 41 and 42 which is engaged by the wheel. The lower pulley 53 incorporates adjustment means to allow the carriage 50 to be held on the guide bars in a secure but free-running condition. A side arm 54 from the base plate 51 carries a nylon pinion 56 mounted on a ball-bearing-mounted axle 55 and a steel pinion 58 mounted for uni-directional rotation on ball-bearing-

mounted axle 57. Axle 57 is connected through a universal joint 59 to a drive axle 61 in a cutting head 60. The uni-directional mounting of pinion 58 serves to prolong the cutting life of the blade.

The pinion 56 engages the rack 46, rotates as the carriage 50 moves across the frame 30 and thus rotates pinion 58, thereby transmitting the drive to the cutting head 60.

The pre-cutting rest position of the carriage 50 is indicated in Figure 1 by the line R_1 and the post-cutting rest position by the line R_2. Lines R_1 and R_2 thus show the path of the carriage 50 from rest to rest and highlight the relative short lateral distances between R_1 and R_2 and the respective edges of the web 10 in which the carriage 50 must be accelerated to, and retarded from, the required cutting speed.

The cutting head 60 (Figure 4) has a mounting plate 62 in which the axle 61 is held by bearings 63 and pressure discs 64. A blade holder 65 attached to the axle 61 carries a rotary blade 66 which is resiliently held in place by disc springs 67 and backing ring 68. The blade 66 is pushed against the counter knife 71 by the disc springs 67. The amount of pressure can be set by means of the collar 72 and a differential screw 73.

The mounting plate 62 further carries a curved guide plate 70, concentric with the core, to conduct the freshly cut web tip towards the core. An adjustable security plate 69 on the blade holder 65 further ensures that the disc springs 67 stay on the blade holder 65.

As the core 20 approaches its fully wound dimension 23, rotation of the core 22 is started and brought to the rate at which it will be required to take up the web 10. The frame 30 is then moved from its idle position 30' towards the web 10. As it approaches the web 10 its guide roller 36 pushes the web 10 close to, but just out of contact with, the empty core 22. At the moment the fully wound condition of core 20 is reached, typically detected by means of a flag or the like attached to a web splice, or by means of a counter which records the length of unwound web, the carriage 50 is triggered to make its web-cutting pass. It accelerates from position R_1 to its cutting speed, carries the cutting head 60 across the web uniformly at the said speed and then is retarded to rest at R_2. The speed profile of the carriage 50 from rest to rest is controlled by the motors 43 and relayed to the carriage 50 through the drive belt 44.

As the carriage 50 moves along the beam 40 the engaging rack and pinion 46 and 56 transmit the drive to the rotary cutting blade 66. The cutting is thus also achieved at a uniform peripheral speed of the blade 66 which is proportional the carriage speed.

When the carriage reaches the point at which it is shown in Figure 1 it triggers a pressure roller to push the newly severed leading edge of the web 10 into contact with a pre-located adhesive strip (not illustrated) on the surface of the core 22. The leading edge is thus immediately taken up on the new core 22 and is followed by the rest of the leading edge.

With the cut complete the frame 30 is swung away from the cutting position and returned to the idle position 30'. The carriage is then returned to its start position R_1 ready for the next cutting pass. The fully wound roll 23 can now be removed from the core holder 4 and replaced by a new empty core which will in turn be used to replace the core 22 when it is fully wound.

Because of the use of the system of the invention the cutting is achieved without slowing the web. This achievement is of immense practical importance in high speed web cutting since it dispenses with the need for accumulators and accumulated web recovery and thus permits a considerable increase in the web throughput. It is attained by using controlled fixed motors to drive both the carriage and the cutting blade, which allows for a simple lightweight carriage which can be accelerated from rest to a fast but uniform and controlled speed within the limited available space within a web winding turret. Various preferred features of the invention further ensure the clean cut required for high speed operations and further ensure that no harmful crumbs or fragments break away from the web edge. These features include the additional fixed knife, non-circular shape for the rotary blade, spring-loaded mounting for the rotary blade, adjustable cutting angle, the stable cutting base provided by the twin-guide bar/three mounting wheels of the carriage and the rack and pinion drive to the rotary blade.

As shown in Figures 5, 6 and 7, a pressure system for urging a cut web tip onto adhesive tape applied to an empty winding core 22, comprises a pair of pressure rollers 82, 84 carried on a hinged roller support 86, which is movable towards and away from the winding core 22 by a pressure roller system 88, mounted on the machine frame 20. The pressure roller system 88 includes a support 90 secured to the machine frame and carrying a double acting pneumatic cylinder 92. The double acting cylinder includes a piston rod carrying a nut 94. A compression spring 96 urges a boss 98 against an arm 100. An inertia block 102, integral with the arm 100, includes a guide slot 104 through which a key 106 passes.

The double acting cylinder 92 is activated so that the piston rod with nut 94 comes free from the top of the arm 100. The pressure roller system 88 is mounted on the machine frame and is triggered by a pin 108 of the carriage 50 as the carriage reaches the trigger lever 110. Pivoting of the lever 110, as seen in Figure 7 causes the upper part thereof no longer to be held by the roller 112 so that the pressure mechanism is

released and springs upwardly (in the orientation of Figure 6), urging the tip of the cut material 10 onto the web core 22. Pivoting of the arm 110 by the pin 108 triggers the complete mechanism which is pushed upwardly by the spring 96. The freely movable inertia block 102 remains behind. At the moment the rollers 82, 84 press the web on the core, and would otherwise rebound therefrom, the block 102 continues to move until the end of the slot 104 abuts the key 106 so that the kinetic energy of the rebounding rollers is absorbed and as a result the web tip is firmly applied to the core.

The cylinder 92 is then operated to retract, whereby nut 94 engages the arm 100 and lowers the mechanism until the arm 110 can pivot under the roller 112 to arm the mechanism for the next operation.

The following example illustrates the present invention.

EXAMPLE

The apparatus described above was successfully used to cut a polyethylene terephthalate web under the following conditions.

Speed of web	500 m min^{-1}
Web thickness	0.275 mm
Web width	1.73m
Length of cutting carriage path	3m
Length of acceleration and deceleration zones	0.25m
Cutting speed of carriage	600m min^{-1}
Acceleration and deceleration rate	130 m sec^{-2}
Angular cutting speed of rotary knife	800 m min^{-1}
Cutting angle of web	40°

Claims

1. A web cutting device which comprises a frame (30) extending across the path of the web and a movable carriage (50) on which is mounted a rotary cutting blade (66), wherein the frame (30) includes a fixed track (40) for the carriage, characterised in that the frame (30) further carries a fixed driving bar (45) parallel to the carriage track (40) and one or more fixed motors (43) with an associated drive belt (44) to move the carriage (50), the carriage (50) incorporates a driving wheel (56) rotatable by contact with the fixed driving bar (45) to drive the cutting blade (66) and in that the fixed carriage track (40), the fixed driving bar (45) and the drive belt (44) all extend beyond the edges of the web path.

2. A web cutting device according to claim 1, wherein the fixed driving bar (45) has the form of a toothed rack and the driving wheel is a pinion (56) cooperating with said rack.

3. A web cutting device according to claim 2, wherein the carriage (50) incorporates a second pinion (58) so that the tip of the cutting blade (66) rotates in the same direction as the direction of movement of the carriage (50).

4. A web cutting device according to claim 3, wherein the second pinion (58) is mounted for uni-directional rotation.

5. A web cutting device according to claim 1, further including an adjustable joint (59) enabling the angle of the cutting blade (66) to be adjustable relative to the carriage (50).

6. A web cutting device according to claim 1, wherein the frame includes means (21) for supporting and rotating at least one core onto which the web is to be wound, the frame carrying one or more pressure rollers (82, 84), which are employed to press upon the newly cut leading edge of the web (10) as it reaches the surface of the core and thereby assist in securing the leading edge thereto.

7. A web cutting device as claimed in claim 1, wherein the carriage (50) includes a fixed cutting knife (71) which cooperates with the rotary blade (66).

8. A web cutting device as claimed in any preceding claim, wherein the rotary blade (66) is supported on an adjustable mounting plate (62).

9. A web cutting device as claimed in claim 8, wherein a spring member (67) is interposed between the rotary blade (66) and its mounting plate (62).

10. A web cutting device as claimed in any preceding claim, wherein the rotary blade (66) has a polygonal cutting edge.

11. A web cutting device as claimed in any preceding claim, wherein the carriage track (40) comprises two spaced-apart bars (41, 42).

12. A web cutting device as claimed in claim 11, wherein the carriage (50) has running wheels (52, 53) each having a circumferential bar-engaging grooves (52a, 53a).

13. A web cutting device as claimed in claim 12, wherein the carriage (50) has at least two running wheels (52) engaging one of the bars (41) and at least one running wheel (53) engaging the other bar (42).

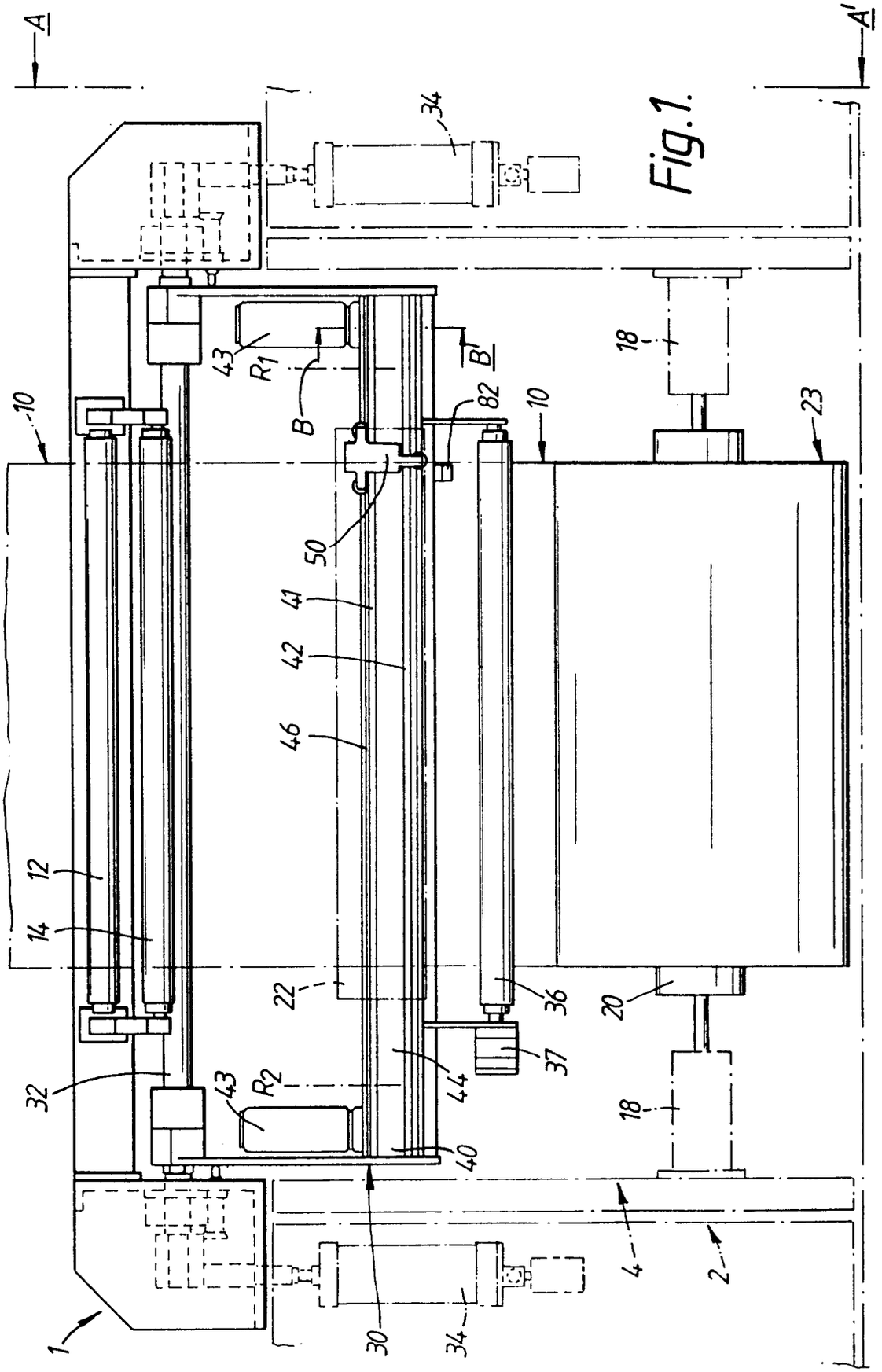
14. A web cutting device as claimed in claim 13, wherein the at least one running wheel (53) includes adjustment means to ensure engagement of the running wheels (52, 53) with the bars (41, 42).

15. A web cutting device as claimed in any of claims 12 to 14, wherein the circumferential groove (52a, 53a) on the running wheels (52, 53) has a generally curved cross-section with a radius smaller than that of a curved wheel-engaging surface of the bars (41,42).

16. A web cutting device as claimed in any preceding claim, further comprising a pressure system for urging a cut web tip onto an empty winding core (22), comprising at least one pressure roller (82, 84) carried on a support (86), which is movable towards and away from the winding core (22) by a pressure roller system (88), mounted on the frame (30).

17. A web cutting device as claimed in claim 16, wherein the pressure roller system (88) is triggered by a pin (108) carried by the carriage (50).

18. A web cutting device as claimed in claim 16 or claim 17, wherein the pressure roller system (88) includes a slidably mounted inertia block (102) to reduce the tendency of the at least one pressure roller (82, 84) to bounce when applied to the web core (22).


A
A'
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R1
R2
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50
82

Fig.1.

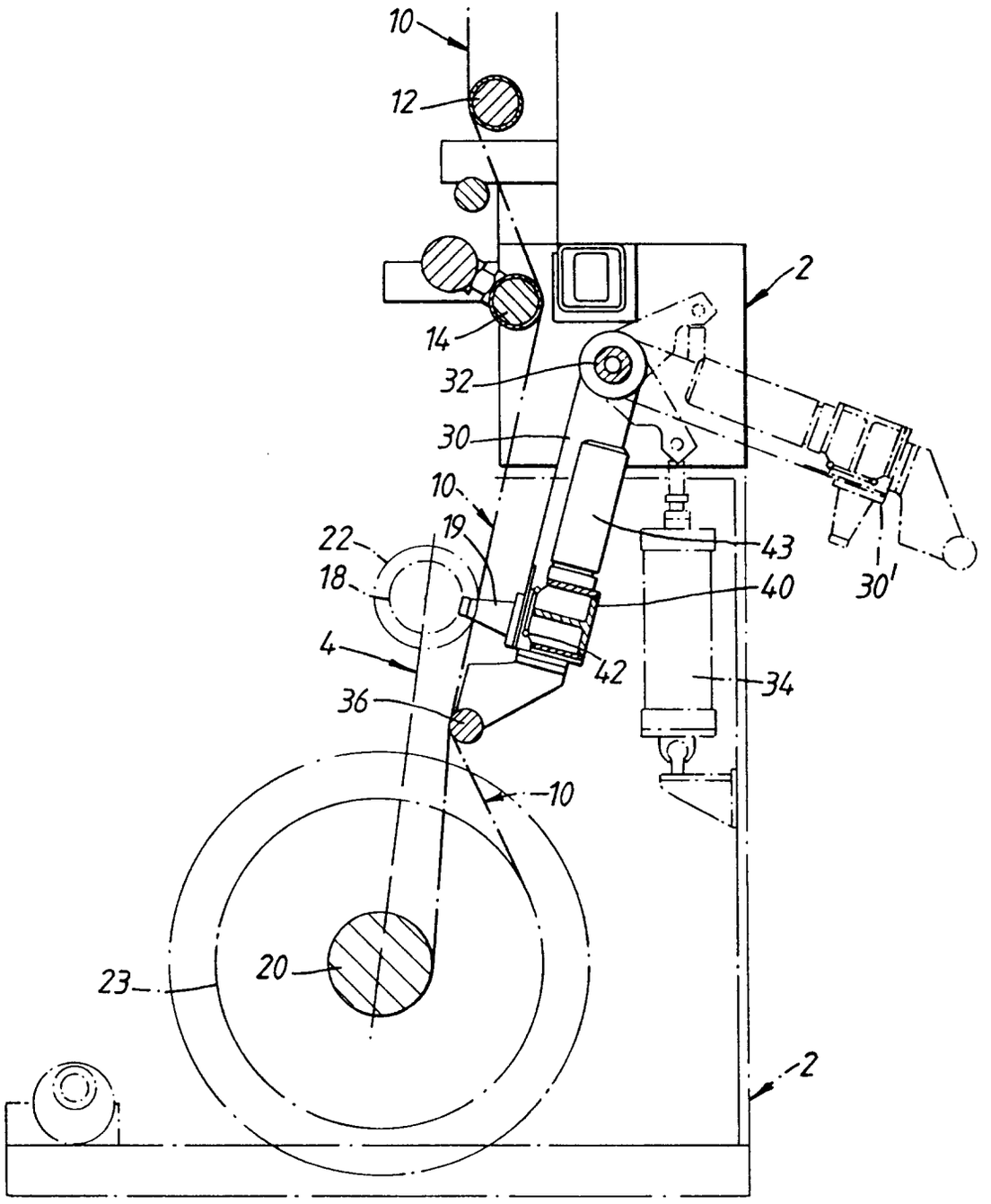

Fig.2.

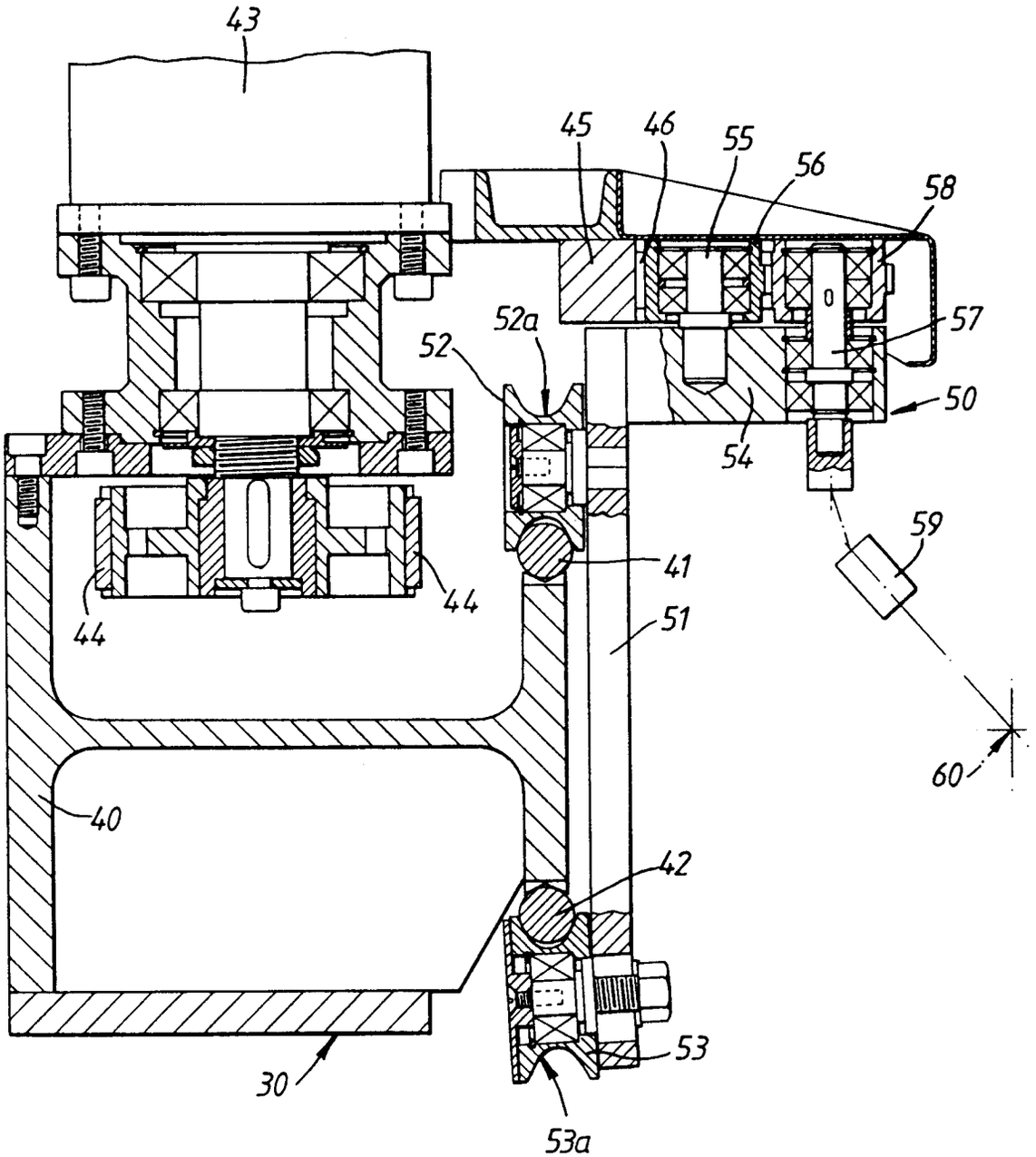

Fig.3.

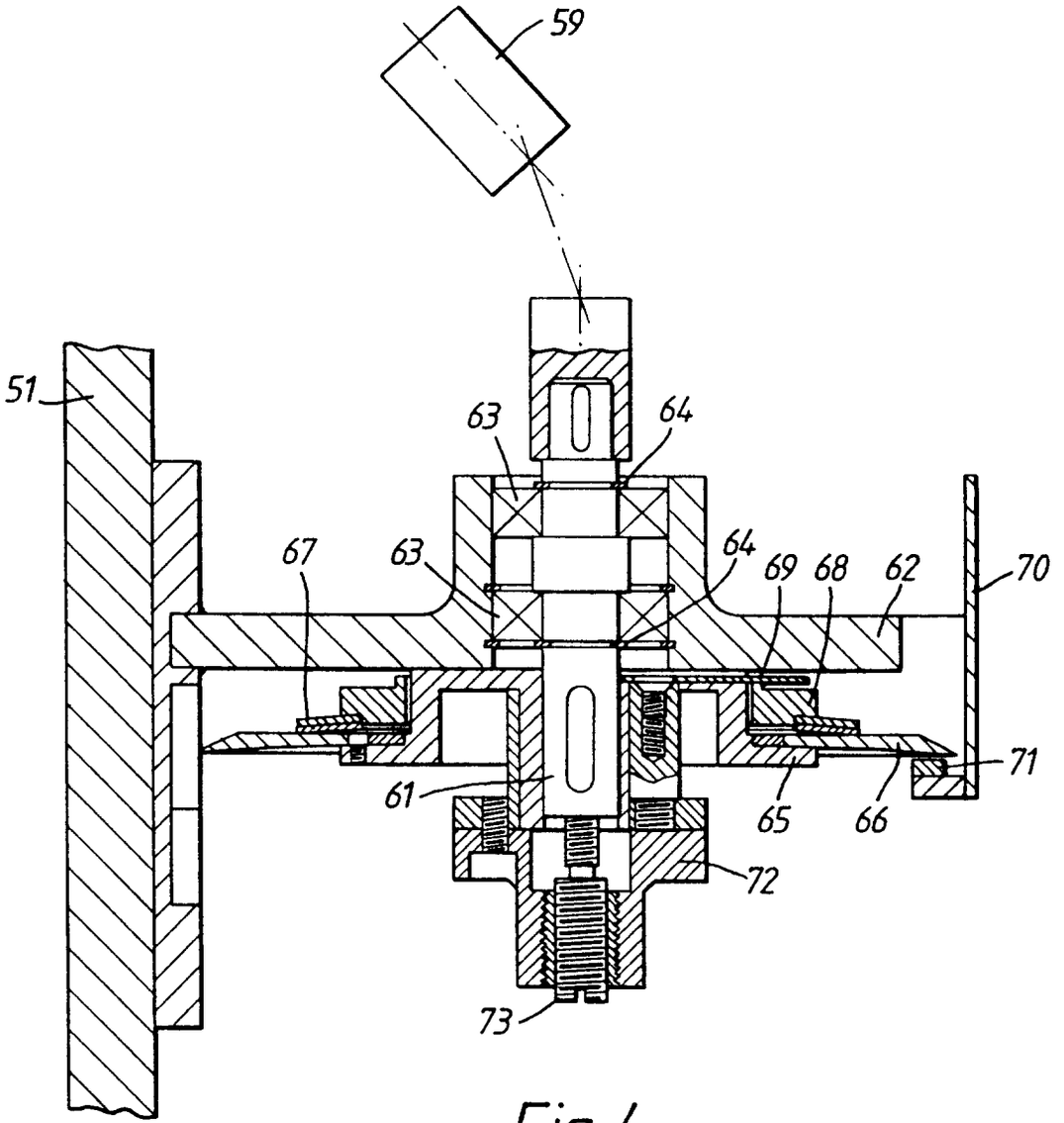

Fig.4.

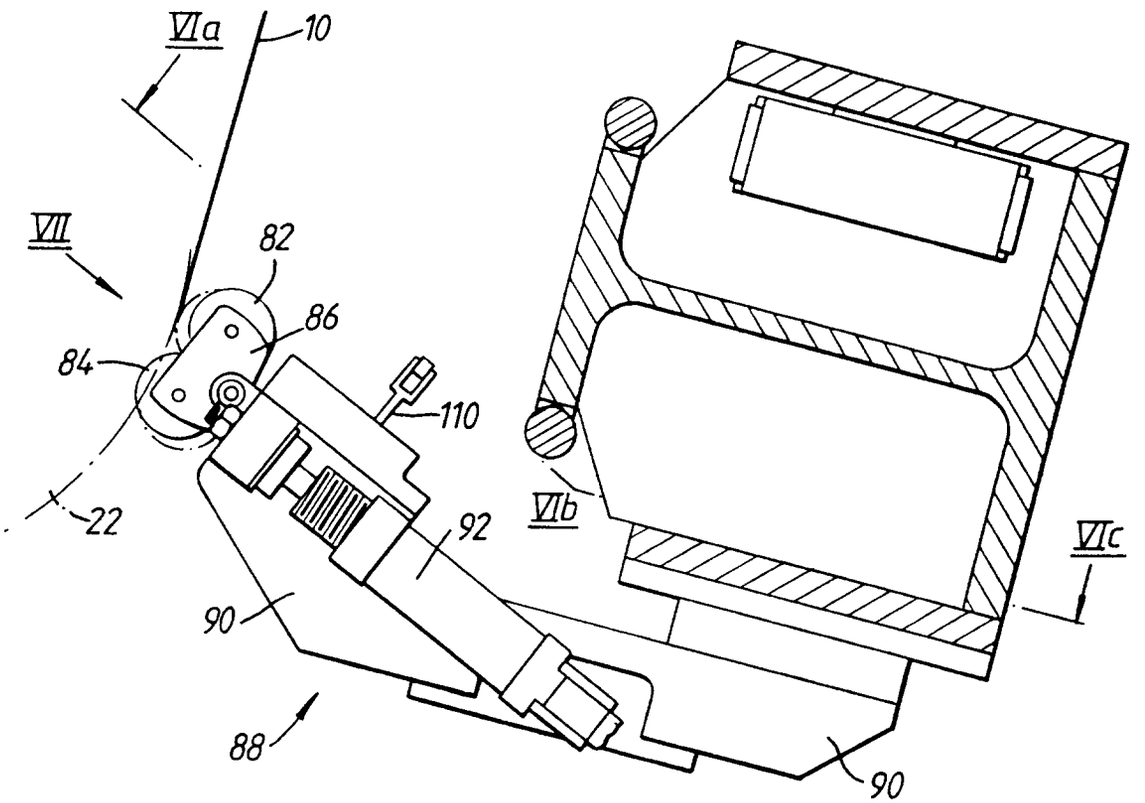

Fig.5.

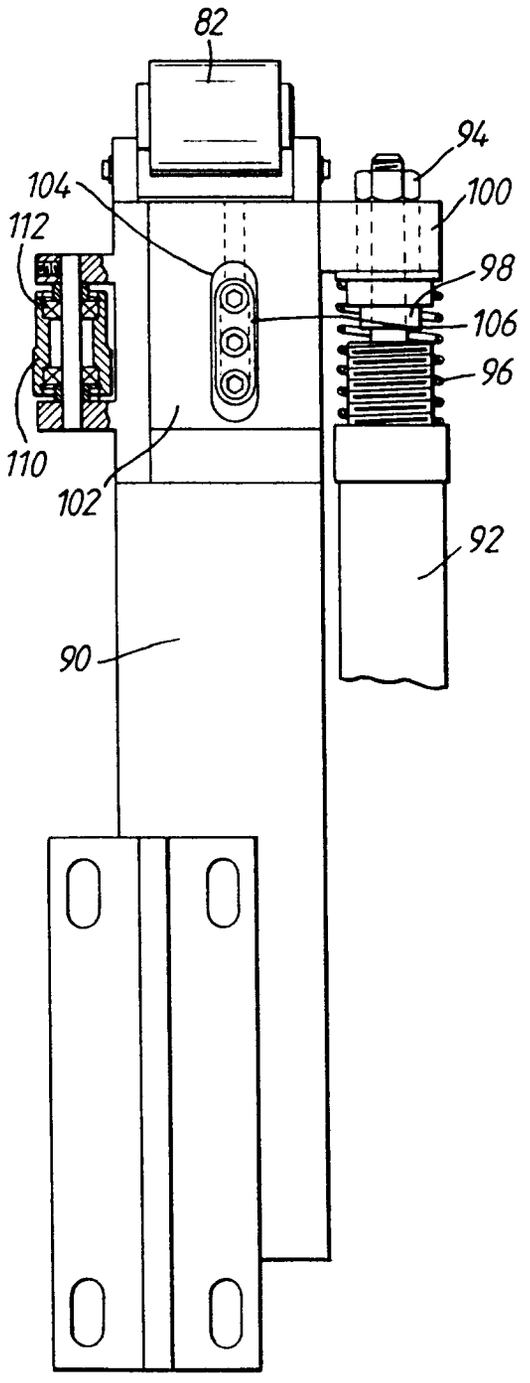

Fig.6.

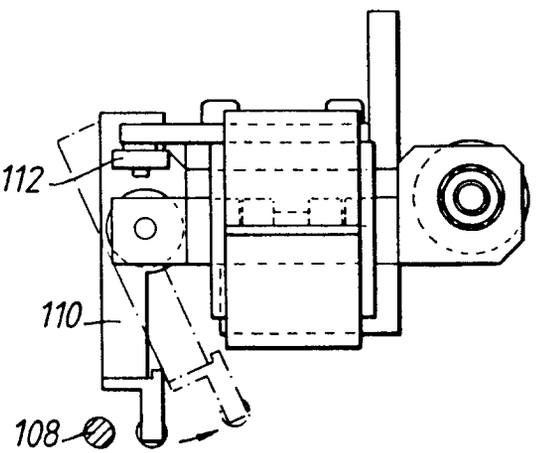

Fig.7.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0043

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 Y	US-A-3 341 144 (T. MASE) * the whole document * ---	1-3 5,7-15	B 65 H 19/26 B 26 D 1/18 B 65 H 19/28
Y A	FR-A-2 320 886 (AGFA-GEVAERT NAAMLOZE VENNOOTSCHAP) * the whole document * ---	5,7-15 1	
A	US-A-4 779 500 (L.C. BENNET ET AL.) * figures 4,11,12 * ---	1	
A	DE-B-2 650 355 (W. STROHMEYER) * figures 1,2 * ---	1,12-15	
X	BE-A- 384 769 (J. BECELAERE) * figures 1-3; page 2, line 9 - page 4, line 23 * ---	1	
A	US-A-5 044 241 (N.F. LABRECQUE) * figures 1-6 * ---	1-3	
A	US-A-3 821 915 (W.T. LARRABLE) * figures 1-4 * ---	1,2,12, 14	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B 65 H B 26 D
A	GB-A-1 297 812 (CHAMBON LIMITED) * figures 1,2; page 2, line 19 - line 38; page 3, line 19 - line 57 * --- -/-	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-09-1993	HAEUSLER F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims:

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions.

namely:

See sheet -B-

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid,

namely claims:

☒ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims.

namely claims: 1-5,7-15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0043

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)
A	DE-A-2 721 883 (ESCHER WYSS GMBH) * claim 9; figure 2 *	1,5	
A	GB-A-1 096 126 (FABRIK FUR FIRESTONE PRODUKTE A.G.) * figure 11; page 3, line 38 - line 76 *	1-3,5	
A	DE-C- 190 383 (J. KALMAN GEN. J. IMMERGLÜCK) * the whole document *	1-3	
A	FR-A-1 584 005 (L.A. DUMAS) * figure 2 *	9	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-09-1993	HAEUSLER F

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-5,7-15: Web cutting device with gear driven rotary cutting blade the gear comprising a one-way coupling

2. Claims 6,16-18 : Web cutting device comprising a pressure system with at least one pressure roller for urging the newly cut leading end of the web onto an empty winding core