(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 344 639 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.09.2003 Bulletin 2003/38

(51) Int Cl.[7]: **B31F 1/07**

(21) Application number: **03445032.0**

(22) Date of filing: **05.03.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(30) Priority: **12.03.2002 SE 0200757**
12.03.2002 US 363093 P

(71) Applicant: **SCA Hygiene Products GmbH**
68264 Mannheim (DE)

(72) Inventor: **Bredahl, Gunnar**
67549 Worms (DE)

(74) Representative: **Egeröd, Lisbeth et al**
Ström & Gulliksson IP AB
Sjöporten 4
417 64 Göteborg (SE)

(54) Web embossing unit

(57) Method of embossing a web (1) of of tissue paper moving at a constant basic speed by passing the web (1) through a storing and releasing unit (2), embossing the web between two substantially plane embossing elements (9, 10) as it passes through said storing and releasing unit (2), the speed of the web (1) being substantially zero during the embossing operation.

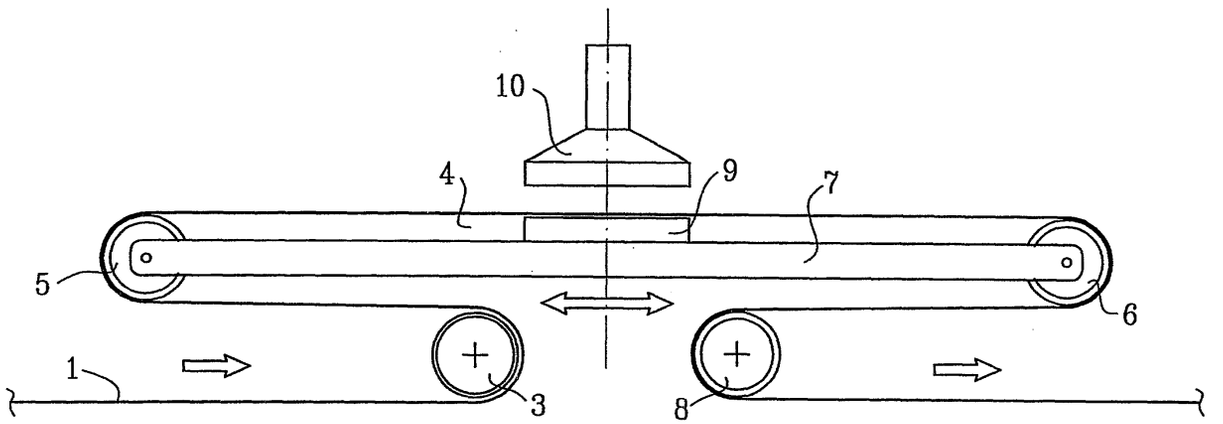

FIG. 1

EP 1 344 639 A2

Description

Technical area

[0001] The invention concerns the embossing of a web of tissue paper moving at a constant basic speed in a basic web path.
It further concerns an apparatus for performing an embossing of a web of tissue paper moving at a constant basic speed in a basic web path.

Background of the invention

[0002] One important area of paper use is as tissue for handkerchiefs and facials. These, to fulfill the demands from the customers need to be very soft and supple, with high surface softness and low bending resistance. To get these properties, the tissue sheet used must be very thin and thus have low strength, both in dry and wet condition. To get a tissue product that is strong enough it is customary to laminate two to four plies together, by dry or moist embossing or by gluing combined with embossing.
[0003] One method to emboss the web is to pass it between two rollers, one of which is a steel roller engraved with a pattern and the other a flat roller made of steel or hard rubber.
[0004] Another common method is to pass it between two patterned rollers, where the patterns are complimentary and arranged in register, so that one tip of the pattern from one roller will meet one tip of the pattern from the other roller, 'foot-to-foot' embossing.
[0005] Still another common method is to pass it between two patterned rollers, where the patterns are complimentary and arranged in register, so that one tip of the pattern from one roller will meet one depression of the pattern from the other roller, 'nested' embossing.
[0006] The embossing marks that normally are created during the embossing process have more and more been used in a decorative way, to give the laminated tissue product a pleasing appearance. Different marks have been used; dots, straight lines, curved lines, depressed areas, etc.
[0007] A problem inherent in using a patterned roller for embossing is that the pressure in the nip point between the rollers will vary, depending on the actual area of the different parts of the pattern as seen in the line of contact between the patterned roller and the anvil roller. These parts will vary as the roller rotates, causing the actual point in compression to move along the roller, and sometimes also causing the roller into a type of vibrating movement. This can result in alternating areas of good and bad embossing stripes, cross over the web.
This uneven embossing will effect the web strengths negatively.
[0008] Another prospective production problem is the need to keep the rollers very carefully in register when both are carrying patterns that are meant to cooperate.
[0009] There is a need for an embossing system that will diminish the problem with this varying pressure point. There is also a need for an embossing system that will aid in keeping cooperating patterns in register.

Summary of the invention

[0010] It is an object for the present invention to offer an embossing system that will diminish the problems with embossings of a web of tissue paper moving at a constant basic speed.
[0011] This object is accomplished by embossing the tissue paper web between two plane embossing elements. Preferably the embossing will create a pattern covering substantially all of the length of the web.
[0012] More specifically, the solution involves passing the web through a storing and releasing unit, embossing the web between two substantially plane embossing elements as it passes through said storing and releasing unit, the speed of the web being substantially zero during the embossing operation.
[0013] Still more specifically, the invention teaches turning the web from its basic path into said storing and releasing unit comprising a sledge means that is moved back and forth in a reciprocating movement substantially parallel to the main direction of the web path, such that at the embossing operation at the same time a length of web is stored at a first end of the sledge means and a corresponding length of web is released at a second end of the sledge means, and a turning means leading the web from the basic web path into the storing and releasing unit and back again to the basic web path,
an embossing means, comprising two plane embossing elements, one of which is moved in a reciprocating movement to emboss the web with a pattern,
where the web is led from its basic path onto the sledge means, through the embossing means, off the sledge means, and back to the basic web path,
and the web is embossed by the embossing elements at a moment of time when the combined storing/releasing action of the sledge means results in the web movement through the embossing means being zero.
[0014] Furthermore, the invention provides an apparatus comprising an embossing unit comprising two substantially plane embossing elements, one of which is movable in a reciprocating movement to emboss the web, a storing and releasing unit for temporarily storing and releasing the web in such a way that the web speed through said embossing unit varies and at a certain moment of time is zero, a control system to synchronize the storing and releasing unit and the embossing unit.
[0015] More specifically, the apparatus of the invention comprises an embossing unit comprising a sledge means that can be moved back and forth in a reciprocating movement substantially parallel to the main direction of the web movement, a sledge drive means to effect said sledge movement, an embossing means to emboss the web with a pattern, comprising two plane

embossing elements, an embossing drive means to move one of said plane embossing elements of said embossing means in a reciprocating movement, a web guiding means to lead the web from its basic path into said embossing unit, onto the sledge means, through the embossing means, off the sledge means, and back to the web basic path.

[0016] Still more specically, the apparatus is adapted for leading a web through an embossing unit comprising a first turning roller, a sledge with a first sledge roller, a second sledge roller, a sledge girder system adapted to keep the sledge rollers at a specified distance from each other, and a second turning roller, a sledge drive means adapted to move the sledge in a reciprocating action back and forth substantially parallel to the main direction of the web, an embossing pad, and an embossing die with a die drive means adapted to move the embossing die in a reciprocating action substantially perpendicular to the web for embossing, where the web is led around the first turning roller, the first sledge roller, between the embossing pad and the embossing die, and then around the second sledge roller, and the second turning roller, and where the embossing operation is controlled to take place when the movement of the sledge negates the basic movement of the web, causing the web to be at a local stand-still.

[0017] Preferably, the apparatus creates a pattern covering substantially the whole of the web.

Brief description of the drawings

[0018]

Fig 1 A schematic drawing of an embossing unit according to the invention.

Fig 2 A sequence of drawings depicting the positions of the various parts of the embossing unit at progressing points of time. The speeds of the web coming into and leaving the embossing unit is denoted by 'V', and the speeds of the sledge and the web at the embossing pad is denoted in relation to 'V'.

a) 'start' point where the sledge changes direction to reverse
b) where the sledge accelerates in the reverse direction
c) where the sledge travels at half the basic web speed (its own maximum speed), and the web on the sledge is at stand-still, and embossing takes place
d) where the sledge decelerates
e) where the sledge changes direction to forward
f) where the sledge accelerates in the forward direction
g) where the sledge travels at half the basic web speed, and the web on the sledge travels at double the basic web speed
h) where the sledge decelerates

Fig 3 A representation of the relative speeds of the basic web, the sledge, and the web upon the sledge at progressing points of time, corresponding to the points in Fig 2 a) - h).

Fig 4 A schematic drawing of an alternative way of arranging the embossing unit in spatial relationship to the basic web path.

Detailed description of the invention

[0019] The invention now will be described more in detail, referring to the drawings.

[0020] Referring to Fig 1, the web to be embossed is led into the embossing unit 2 according to the invention around a first turning roller 3, turned around a first sledge roller 5, and after being led across an embossing pad 9 is turned back around a second sledge roller 6 and a second turning roller 8. Thus the embossing unit 2 can be installed into a segment of the basic web path existing in a paper converting plant.

[0021] The web is travelling to the first turning roller 3 and from the second turning roller 8 with the basic production speed controlled by reasons of capacity and product need. This speed can vary within limits depending upon the production capabilities of the production or converting line where the embossing unit 2 is placed.

[0022] The embossing is effected by an embossing die 10 that is moved in a reciprocating action perpendicular to the web 1 and the embossing pad 9. The embossing pad 9 is a fixed plane anvil, normally unpatterned, but it can also have a pattern to fit the pattern of the embossing die 10, to make the web embossing effect two-sided. The embossing pad 9 preferably is a steel or hard rubber plate that can be fastened on a fixture, to enable easy and fast exchange of pads. The web path runs near to the embossing pad 9 and the web is embossed between the embossing die 10 and the embossing pad 9 as the die movement brings the die and pad together with a force adapted to effect an appropriate pressure. The embossing die 10 is moved by actuating means (not shown). The die is a plane patterned surface, of a material hard and strong enough to keep its pattern distinct during the embossing, like steel or ceramic. The embossing die 10 preferably is a steel plate, which can be fastened on a fixture, to enable easy and fast exchange of dies.

[0023] The first sledge roller 5 and the second sledge roller 6 are end parts of a sledge 4 that can be moved back and forth in a reciprocating movement parallel to the main direction of the web movement. The rollers are fastened and kept a defined distance apart by a sledge girder system 7. The inner space of the sledge 4 preferably is open and devoid of obstacles to make room for the embossing pad 9, but it is also possible to let the girder system occupy the lower part of the inside space,

if the embossing pad 9 has a low height demand.

[0024] The sledge girder system 7 is also equipped with driving means (not shown), that is controlled to let the sledge 4 be moved in a reciprocating movement according to a defined accelerating - decelerating sequence. The sledge movement direction is parallel to the basic web movement with a forward direction in the basic web movement direction and a backward direction contrary to the basic web movement direction. As the sledge 4 moves, it will move relatively to the embossing pad 9, so that the embossing pad 9 will progressingly occupy most of the free space inside the sledge 4.

[0025] Now turning to Fig 2 and Fig 3, the accelerating - decelerating programme will be described. The aim of this programme is to be able to emboss the web between the embossing die and embossing pad when the web is not moving relatively to the embossing pad, which is necessary to get a good embossing and an undisturbed action.

The basic production speed of the web is called V, the local web speed in the vicinity of the embossing pad is related to V, and the sledge speed is related to V, with a positive value for movement in the same forward direction as the basic production movement of the web, and a negative value for movement in the reverse direction.

[0026] Fig 2a shows the sledge at one of its direction turning points; the sledge speed is zero and the local web speed is the same as the basic web speed - the web is just travelling through the embossing unit.

Fig 2b shows the sledge accelerating in the reverse direction with speed getting higher; the local web speed is getting lower.

Fig 2c shows the sledge moving at a constant speed of one half of v in the reverse direction; the local web speed is now zero, as web is stored before and after the first sledge roller 5. At the same time web is released from before and after the second sledge roller 6, so the web will continue coming out from the embossing unit at the same basic speed. As the web is now effectively standing still in relation to the embossing pad 9, it can now be embossed.

Fig 2d shows the embossing die lifted again as the sledge is decelerating, still in reverse direction; the local web speed web is getting higher.

Fig 2e shows the sledge at the other of its direction turning points; the sledge speed is zero and the local web speed is the same as the basic web speed - the web is just travelling through the embossing unit.

Fig 2f shows the sledge accelerating in the forward direction with speed getting higher; the local web speed is also getting higher, now above the basic web speed.

[0027] Fig 2g shows the sledge moving at a speed of one half of v in the forward direction; The local web speed is now twice v.

Fig 2h shows the sledge decelerating, in forward direction; the web speed is getting lower. This continues until the sledge stops at its turning point, and the sequence starts over again as in Fig 2a.

[0028] Fig 3 shows graphically, at progressing points of time, corresponding to the points in Fig 2 a) - h), the relative speeds of the basic web, which is constant at v; of the sledge, which is alternating between negative (reverse) and positive (forwards) movement with a plateau at a reverse movement of -0,5 • v; of the local web, which is alternating between zero and 2 • v. The sledge speed plateau will expand the time when the web is standing still relative to the embossing pad (the embossing window).

[0029] The accelerating - decelerating sequence preferably is a programme run by a computerized sequence control system. The sledge driving means is controlled by the programme so that the movement of the sledge is able to follow an adjustable curve as the one shown in Fig 3. As the production speed v is changed, all values of the sledge movement curve need to be multiplied with a proportional factor.

[0030] The programme also controls the actuating means for the die movement. The die must be brought into embossing contact at the correct point in time, ie when the local speed of the web is zero at the embossing plateau, and lifted again before the local web starts moving again.

[0031] An alternative way of arranging the embossing unit in spatial relationship to the basic web path can be seen in Fig 4. By including two extra turning rollers, a first distance turning roller 3a and a second distance turning roller 8a, the distance between the basic web path and the embossing unit can be varied freely. For proper functioning, ie really true zero speed over the sequence plateau, the web segments from first turning roller 3 to first sledge roller 5 and from second sledge roller 6 to second turning roller 8 should be in a straight line.

[0032] The embossing method according to the invention permits the web to be embossed with a pattern covering substantially all its length. All types of patterns, which can cover the whole or part of the width, are possible to use, both sparse and dense patterns, with dots, straight or curved short or longer line segments, or filled areas.

[0033] Areas without any embossings at all are easy to accomplish as there is no necessity for the pattern to enable a 'good rolling surface', as for an embossing roller where the effective diameter should be fairly constant around the circumference.

The pattern can be adjusted to fit individual products, eg sheets of handkerchiefs, with an edge pattern and possibly also a patterned inner area.

[0034] An alternate way of arranging the embossing pad and die is to place the pad above the web and the die below the web. This can enable the embossing to be at the correct side of the web when it later is folded into a product.

[0035] Still an alternate way to arrange the embossing is to use two embossing dies which act together to emboss the web. This will shorten the distance travelled by

an embossing die, enabling a higher embossing frequency.

[0036] The embossing method according to the invention can be used to emboss and/or laminate one or more plies of any flexible web material, as paper, tissue paper, and nonwoven.

Example

[0037] In the production of hankies 500 packages of 10 sheets each were to be produced per minute. Four sheets are processed in parallel in a web that later is split up into four packaging stations. Each sheet had a length of 0,21 m.
This results in a web speed of 500•10•0,21/4 = 262,5 m/min.
Sledge maximum speed is then 131 m/min.
Aiming at a frequency of ~200 embossings per minute, there is a need to treat 6 sheets at each embossing action. (5000 / 4 / 200 = 6,25) This will result in a frequency of 3,5 Hz.
The length of the embossing plate is 6 • 0,21 = 1,26 m.
The diameter of the sledge turning rollers is 0,2 m.
Time for embossing action is 0,5 s.
Sledge travel during embossing action is 131 • 0,5 / 60 = 1,1 m.
Deceleration and acceleration phases each uses 0,5 m.

[0038] The resulting length of the sledge unit is ~3,7 m.

Claims

1. Method of embossing a web (1) of tissue paper moving at a constant basic speed in a basic web path
   characterised in that
   the web (1) is embossed between two plane embossing elements (9, 10).

2. Method of embossing a web (1) of tissue according to claim 1
   characterised in that
   the web is embossed with a pattern covering substantially all of the length of the web.

3. Method of embossing a web (1) of tissue paper according to claim 1 or 2
   characterised in
   passing the web (1) through a storing and releasing unit (2), embossing the web between two substantially plane embossing elements (9, 10) as it passes through said storing and releasing unit (2), the speed of the web (1) being substantially zero during the embossing operation.

4. Method of embossing a web (1) of tissue paper according to claim 3
   characterised in that
   the web is turned from its basic path into said storing and releasing unit (2) comprising a sledge means (4) that is moved back and forth in a reciprocating movement substantially parallel to the main direction of the web path, such that at the embossing operation at the same time a length of web is stored at a first end of the sledge means (4) and a corresponding length of web is released at a second end of the sledge means (4), and a turning means leading the web from the basic web path into the storing and releasing unit (2) and back again to the basic web path, an embossing means, comprising two plane embossing elements (9,10), one of which is moved in a reciprocating movement to emboss the web (1) with a pattern, where the web (1) is led from its basic path onto the sledge means (4), through the embossing means, off the sledge means (4), and back to the basic web path, and the web (1) is embossed by the embossing elements (9,10) at a moment of time when the combined storing/releasing action of the sledge means (4) results in the web movement through the embossing means being zero.

5. Apparatus for embossing a web (1) of tissue paper moving at a constant basic speed in a basic web path
   characterised in that
   the apparatus comprises

   • an embossing unit comprising two substantially plane embossing elements (9,10), one of which is movable in a reciprocating movement to emboss the web,
   • a storing and releasing unit (2) for temporarily storing and releasing the web (1) in such a way that the web speed through said embossing unit varies and at a certain moment of time is zero,
   • a control system to synchronize the storing and releasing unit (2) and the embossing unit.

6. Apparatus for embossing a web (1) of tissue paper according to claim 5
   characterised in that
   the apparatus comprises an embossing unit comprising

   a sledge means (4) that can be moved back and forth in a reciprocating movement substantially parallel to the main direction of the web movement,
   a sledge drive means to effect said sledge movement,
   an embossing means to emboss the web with a pattern, comprising two plane embossing elements (9,10),

an embossing drive means to move one of said plane embossing elements (9,10) of said embossing means in a reciprocating movement,
a web guiding means to lead the web from its basic path into said embossing unit, onto the sledge means (4), through the embossing means, off the sledge means (4), and back to the web basic path.

7. Apparatus for embossing a web (1) of tissue paper according to claim 5 or 6
characterised in that
the apparatus is adapted for leading a web through an embossing unit comprising

a first turning roller (3), a sledge (4) with a first sledge roller (5), a second sledge roller (6), a sledge girder system (7) adapted to keep the sledge rollers (5,6) at a specified distance from each other, and a second turning roller (8),
a sledge drive means (not shown) adapted to move the sledge (4) in a reciprocating action back and forth substantially parallel to the main direction of the web (1),
an embossing pad (9), and an embossing die (10) with a die drive means (not shown) adapted to move the embossing die (10) in a reciprocating action substantially perpendicular to the web (1) for embossing,
where the web (1) is led around the first turning roller (3), the first sledge roller (5), between the embossing pad (9) and the embossing die (10), and then around the second sledge roller (6), and the second turning roller (8),
and where the embossing operation is controlled to take place when the movement of the sledge (4) negates the basic movement of the web (1), causing the web to be at a local standstill.

8. Apparatus for embossing a web (1) of tissue paper according to any one of claims 5 to 7
characterised in that
the embossed pattern is covering substantially all of the web.

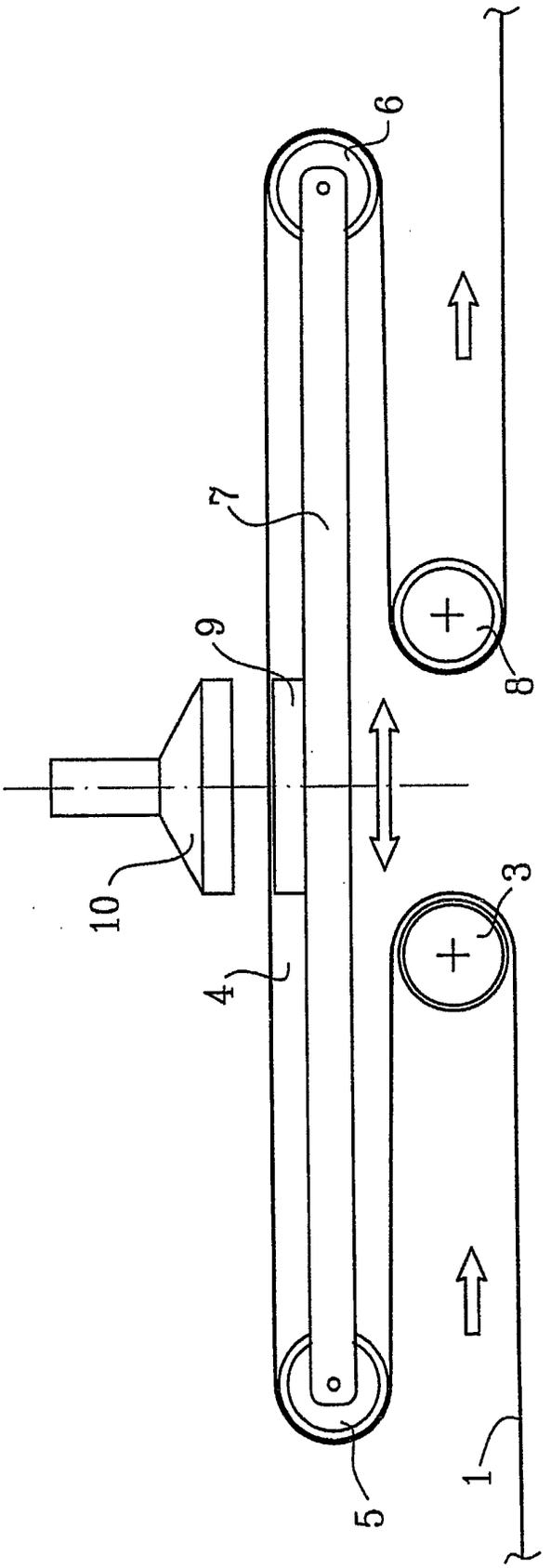

FIG.1

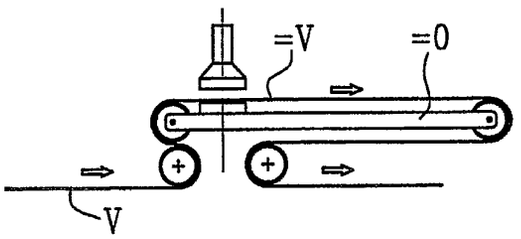

FIG.2a

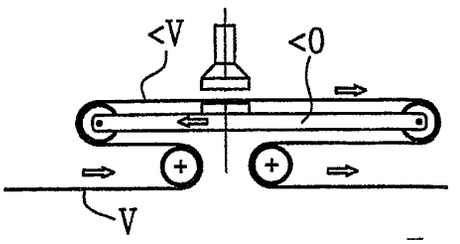

FIG.2b

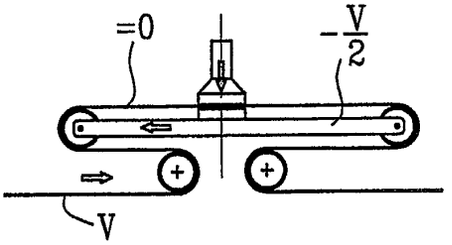

FIG.2c

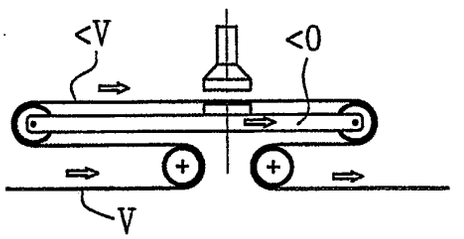

FIG.2d

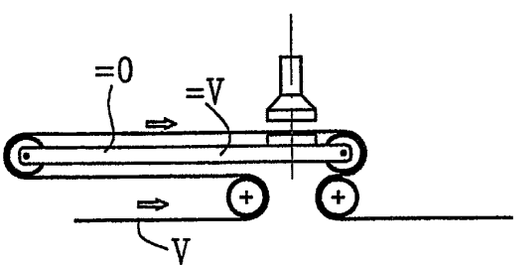

FIG.2e

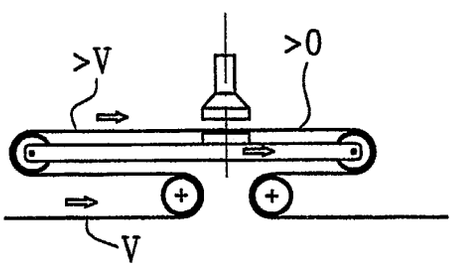

FIG.2f

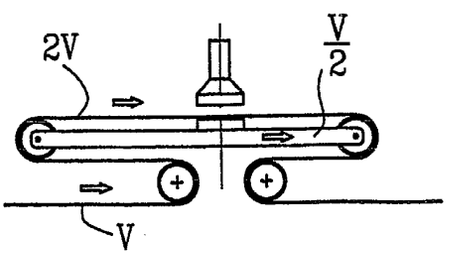

FIG.2g

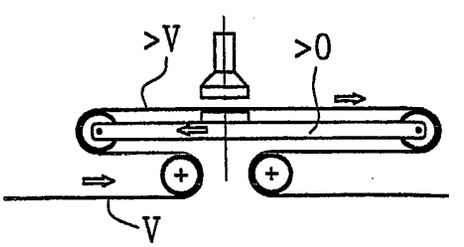

FIG.2h

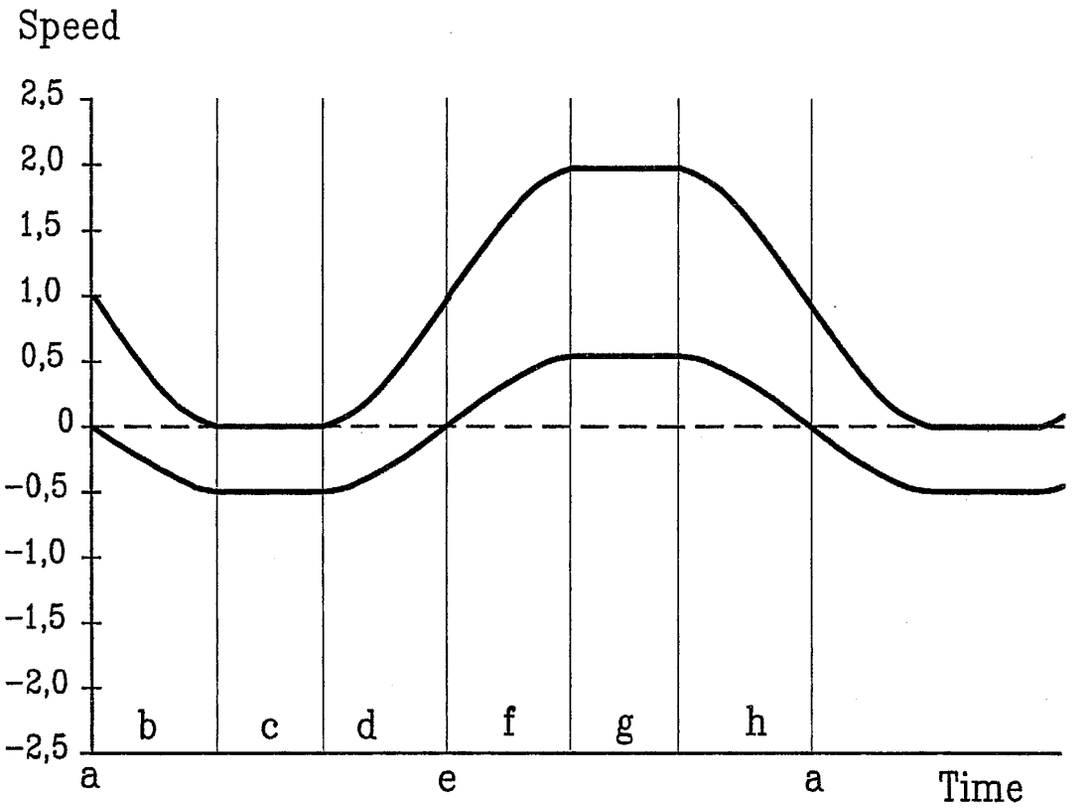

FIG.3

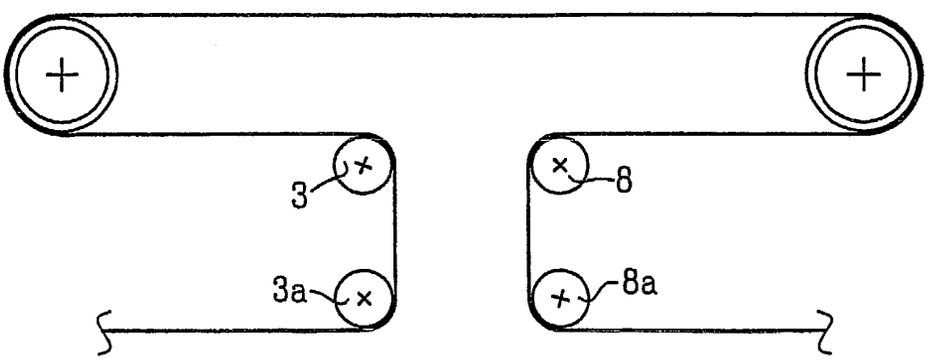

FIG.4