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⑦① Applicant: **STAMICARBON B.V., Postbus 10, NL-6160 MC Geleen (NL)**

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⑦② Inventor: **Jansen, Johann Josef, Vlonderstraat 2, NL-6118 CZ Nieuwstadt (NL)**

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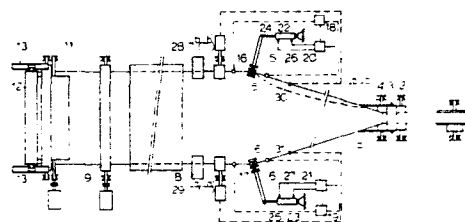
⑦④ Representative: **Philippens, Martin Hubert Johan Jacques et al, OCTROOIBUREAU DSM Postbus 9, NL-6160 MA Geleen (NL)**

⑤④ **Method and device for stretching webs of reticulate material.**

⑤⑦ Method and device for continuous lateral stretching of a web of reticulate film material with little resistance to lateral stretching to a constant width.

In the method the material is passed to pairs of clamping rollers (5, 6) mounted at either side of the web which clamp the web at the desired width and which are so controlled by a controlling mechanism that, when the desired web width is deviated from, the angle included by the clamping roller shafts and the sides of the web in the plane of the web is readjusted.

The device includes guide and/or tensioning rollers for the web of unstretched reticulate film material and photocells (16, 17) monitoring the side edges of the web and coupled to controlling mechanisms for the pair of clamping rollers. The clamping rollers have axes of rotation situated within the width of these rollers.



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METHOD AND DEVICE FOR STRETCHING WEBS OF RETICULATE MATERIAL

The invention relates to a method for continuous lateral stretching of films to a constant width. The invention relates in particular to a method for lateral stretching of reticulate film material to a constant width. By 'reticulate sheet material' is understood film material with a large number of openings, offering very little resistance to lateral stretching.

Various methods for stretching a web of film or fabric in a direction normal to the length are known in the plastics and textile industries.

Such stretching may be done, for instance, as described in the French patent specification No.1.020.595 and in the Swiss patent specification No.461.419, by means of a bent stretching bar along which the film is drawn. In this method the degree of stretching depends on the bending radius of the stretching bar, the tensile force in the film, and the coefficient of friction between the film and the stretching bar.

Another method makes use of a stretching roller, as represented in the Dutch patent application No.7015574, fig. 3. The circumference of this roller is fitted with single-threaded or multiple-headed helical ridges that extend towards the two extremities of the roller and are arranged so that their pitches are opposite. This stretching roller acts as a kind of screwing conveyor that forces the fibres towards the ends of the roller.

Still another method is that employing the so-called banana roller. This roller consists of a bent shaft to which rollers have been fitted independently of each other. A sleeve of flexible material is slipped around these rollers. If a sheet under tension is passed over the flexible outer sleeve in a direction normal to the length of the roller, the outer sleeve will rotate owing to friction. The sleeve then makes an outward movement between the point with the smallest and the point with the greatest bending radius. The film material follows this movement owing to friction.

A device that is widely used in the textile and plastics industries for lateral stretching of fabrics and films and with which very great stretching forces can be applied is the so-called stretching frame. A device like this has been described in, inter alia, the Netherlands patent application No. 6802553. This device consists of two chain tracks running in guides according to a desired pattern. Both chains are provided with clamps or needles that grip the film and carry it along in the direction of transport of the chains. The width of the stretched film depends on the distance between the chain tracks at the delivery end. A problem encountered in this method of stretching is to make allowance for the reduction in length that occurs during lateral stretching.

The proper functioning of the above equipment, which is used for lateral stretching of film and fabrics, mostly depends on the dimensional stability of the material to be stretched and/or the resistance of the film to stretching. The dimensional stability of, for instance, fibrillated film is very little and the resistance to lateral stretching is virtually negligible, so that the equipment in question is unsuitable for processing of this type of material.

The US patent No. 3,838,481 relates to a device for stretching of fabrics or similar material, the side edges of the web being passed over tensioning rollers fitted alongside the web. These tensioning rollers are motor-driven and the degree of stretching is adjusted by changing the speed of rotation of the rollers and, secondly, by changing the angular position of the rollers. This results in translation of the web together with the rollers, so that the web is tensioned and also assumes a different position. By changing the angular position of the rollers, the force exerted by the web on the rollers is enlarged or diminished, so that the transversal transport of the web proportionally increases or decreases, respectively. The points of rotation of the rollers are situated relatively far from the side edges of the web, so that changing of the angular position of the rollers causes undesired deformations and displacements of the side edges. This method is therefore unsuitable for accurate width control of reticulate sheet.

It is difficult, if not impossible, with all the above-described devices to stretch films to a constant width, while the achieved widening is furthermore limited.

In further processing of the stretched material, which may be used for various purposes, i.a. for reinforcement of clothing, building material, etc., it is of importance that the film has a constant width over its entire length. If it has not, the film will
5 have to be cut to the desired length, which results in much waste, while deviations in width may furthermore cause differences in strength owing to irregular stretching.

The object of the invention is to eliminate said drawbacks and to provide a method of stretching film material to a desired constant
10 width.

According to the invention, this is achieved by passing the unstretched web of reticulate film - possibly via guide and/or tensioning rollers - to pairs of clamping rollers mounted on either side of the web which clamp the web at the desired width and which are so
15 operated by a controlling mechanism that, when the desired web width is deviated from, the angle included by the clamping roller shafts and the sides of the web in the plane of the web is readjusted.

By 'pairs of clamping rollers' is understood sets of rollers of which the treads are in contact with each other so as to clamp a web of
20 film material which is fed through. These pairs of clamping rollers have appeared to be very suitable for lateral stretching of reticulate film material to a constant width.

Readjustment of the angle included by the clamping roller shafts and the sides of the web of reticulate material is effected by turning
25 the clamping rollers around an vertical axis which is situated within the width of the clamping rollers and preferably coincides with or is near to the desired position of the side edges of the stretched material.

When the desired web width is deviated from, it is also possible to readjust the distance between the pairs of clamping rollers
30 by means of a controlling mechanism.

The controlling mechanism for readjustment of the angle included by the clamping roller shafts and the sides of the web in the plane of the web may consist of photocells that are mounted after the pairs of clamping rollers, as seen in the direction of transport of the web, and
35 which, when the desired web width is deviated from, send a signal to a transmitter coupled to a servo mechanism that operates a hydraulic cylinder whose piston is pivoted to the pairs of clamping rollers, so that the angle included by the clamping roller shafts and the sides of

the web in the plane of the web can be readjusted.

Another possibility of controlling said readjustment consists in that photocells have been mounted before the pairs of clamping rollers, as seen in the direction of transport of the web, which ensure that the side edges of the web, run, e.g. midway between the pairs of clamping rollers fitted on either side of the web. When deviations occur, readjustment is effected in the same way as indicated in the first-mentioned possibility of readjustment.

It is also possible to have the distance between the pairs of clamping rollers readjusted by photocells that, when the desired web width is deviated from, send a signal to a transmitter coupled to a hydraulic cylinder whose piston rod is so coupled, by means of a guide, to the pairs of clamping rollers that they can be moved laterally to the direction of transport of the web. This possibility of readjustment can be used in addition to the before mentioned readjustment.

After the pairs of clamping rollers, as seen in the direction of transport, there are preferably pairs of rollers at either side of the web, which pairs of rollers are driven independently of each other and between which the side edges of the web are clamped. The driving mechanisms of the pairs of rollers are controlled by photocells positioned at either side of the web, before the first-mentioned pairs of clamping rollers. When during the stretching operation one of the sides of the web sags, for instance because an excess of material is fed to one of the sides, the relevant photocell will send a signal to the driving mechanism which causes the relevant pair of rollers to run faster until the side edge has been readjusted. It is evident that when both side edges sag, the photocells at both sides will respond, speeding up the driving mechanisms of both pairs of rollers until readjustment has been effected.

After the driven pairs of rollers, as seen in the direction of transport, there can be at either side of the web so-called side stretchers for the side edges of the web, which have not been stretched yet. These stretchers consist of two small plates, one placed at a small distance above the other, between which the side of the sheet are passed. The upper or the lower plate is provided with little holes, oriented laterally as well as in the direction of transport, through which a medium, for instance air or water, can be blown in order to stretch the side edges of the sheet. By means of chain guides, the stretched

reticulate film is subsequently passed through a stabilization unit. The distance between the chains at either side of the stabilization unit can be varied, if necessary.

It has been found that in the above-described way reticulate film material can be continuously stretched laterally to a constant width without complicated and, hence, expensive equipment being required. The method according to the invention is particularly suitable for lateral stretching of a material that offers little resistance in this respect, e.g. a maximum force of 1 N on the pairs of clamping rollers at a lateral stretch of 1000%.

The invention also relates to a device for effecting the method according to the invention.

The device according to the invention consists of:

- guide and/or tensioning rollers for the unstretched web of reticulate material;
- pairs of clamping rollers fitted on either side of the web at the desired web width, and also photocells which monitor the side edges of the web and which are coupled to controlling mechanisms for the pairs of clamping rollers;
- photocells before the pairs of clamping rollers, coupled to the driving units for pairs of rollers after the pairs of clamping rollers;
- side stretchers for the unstretched side edges of the web.

Preferably, the device further comprises a device for stabilization of the stretched web at the desired width, chain guides for the web in the stabilization device, guide rollers for the stabilized web, and, finally, a winding reel and pressure roller for the stabilized web of reticulate material.

The invention will be further elucidated with reference to a non-restrictive, schematic drawing, in which:

Fig. 1 is a bottom-view of the stretching device.

Fig. 2 is a side view of the stretching device.

On the reel 1 is a web, with a width varying from a few centimetres to several metres, of polypropylene film fibrillated by, e.g., rollers with pins, which is unwound at a rate of up to about 150 m/min., say 50 m/min., and is passed to the pairs of clamping rollers 5 and 6, possibly by way of a guide roller 2, a tensioning roller 3 and another guide roller 4. It is also possible to feed more than one web of the film material, one above the other in which case

a corresponding number of pairs of tensioning rollers, one above the other, may be applied. In a preferred mode of realization of the invention, a package consisting of several webs of the film, one on top of the other and connected to each other at the side edges, is stretched by the method according to the invention. The pairs of clamping rollers 5 and 6 are mounted on either side of the web at a relative distance corresponding to the desired web width after stretching, e.g. from one to several metres. The stretched web leaving the pairs of rollers 5 and 6 is passed over the driven rollers 7a, 7a' and 7b, 7b' and the side stretchers 28 and 29 to the stabilization device 8, in which the reticulate film is clamped in between chains at the sides and passed through the device 8 in which the web is stabilized at the desired width thermally or by spraying on a stabilizing agent.

In the case of several webs above each other, the side edges of the separate webs can also be welded together after the stretching operation and the webs thus united are passed through the stabilizer as one single web. The stabilized web leaves the device 8 and is wound onto reel 11 by way of rollers 9, 9' and 10. Roller 12 acts as a pressure roller and can slide in guide 13.

The tension in the web is controlled by a tensioning roller 3, which is known in itself, coupled to the electromagnetic brake 15 via potentiometer 14.

The desired width of the stretched web is constantly checked by the photocells 16 and 17. When the web width is deviated from, these photocells 16 and 17 send a signal to the transmitter 18 and 19 and then to the servo mechanisms 20 and 21, each of which operates a hydraulic cylinder 22 or 23, whose piston rod 24 or 25 is pivoted to the pairs of clamping rollers 5 and 6, so that the angle included by these rollers and the sides of the web in the plane of the web can be readjusted, which enables the web to be stretched to the correct width. The axes of rotation 5' and 6' of the clamping rollers coincide with or are near to the desired position of the side edges of the material to be stretched. Another possibility of obtaining the correct web width consists in the installation of photocells 26 and 27 before the pairs of clamping rollers 5 and 6, as seen in the direction of transport of the web. These photocells ensure that the side edges of the web run, e.g., midway between the clamping rollers. When deviations occur, the angular

position of the pairs of clamping rollers 5 and 6 will be readjusted in the same way as in the above possibility of readjustment.

When one of the side edges 1a or 1b sags, for instance as indicated by the dotted line 1b', the photocell 30 will send a signal to the driving mechanism of the rollers 7b and 7b' which speeds up the rollers until readjustment has been effected. In that case, the photocell 31 will send a signal to the driving mechanisms of the rollers 7a and 7a' so that these are speeded up until readjustment has been effected.

An additional possibility of readjustment, particularly intended to offset major irregularities in the web fed in, enables the distance between the pairs of clamping rollers in the direction normal to the web to be changed when the web width is deviated from. To this end, photocells 16' and 17' can send such a signal to a transmitter, servo mechanism and a hydraulic cylinder whose piston is coupled to the pairs of clamping rollers by way of a guide that the relative distance between the pairs of clamping rollers 5 and 6 is readjusted when the web width is deviated from. This possibility of readjustment may be combined with one of the above possibilities of readjustment.

As mentioned before, there can be side stretchers 28 and 29 after the pairs of rollers 7a, 7a' and 7b and 7b' as seen in the direction of transport. These stretchers consist of two small plates, one placed at a small distance above the other, between which the side edges of the web are passed. The upper or the lower plates are provided with little holes, oriented laterally as well as forward, through which compressed air or another medium is supplied in order to stretch the side edges of the web.

The device for effecting the method according to the invention consists of, for instance, a feed reel 1 on which unstretched sheeting has been wound, possibly guide rollers 2 and 4, a tensioning roller 3 which is coupled to the potentiometer 14 that operates the brake 15 on the reel 1, pairs of clamping rollers 5 and 6 with axes of rotation 5' and 6', mounted on either side of the web, controlling mechanism 16 through 27 for the pairs of clamping rollers 5 and 6 and the pairs rollers 7a, 7a' and 7b, 7b' with photocells 30 and 31, side stretchers 28 and 29, a device 3 with guide chains for the stretched web for stabilization of this web at the desired width, guide rollers 9, 9'

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for the stabilized web, and finally a winding reel 11 and a pressure roller 12 for the stabilized web of reticulate material, and a guide 13 for the pressure roller 12.

C L A I M S

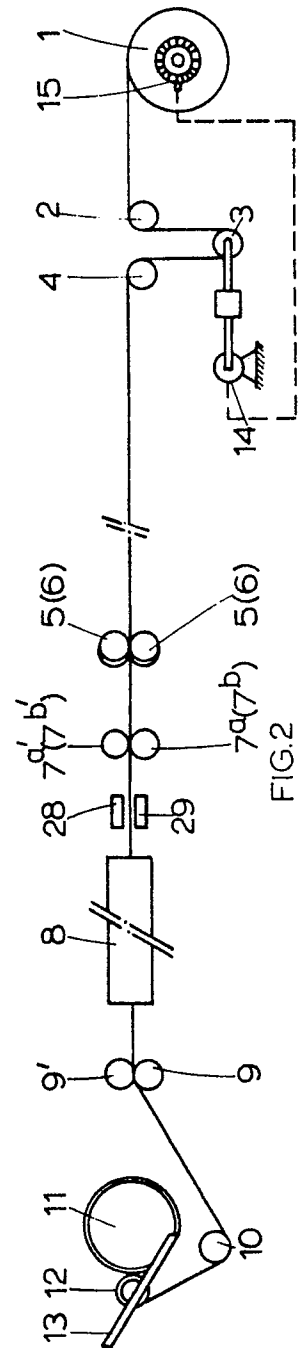
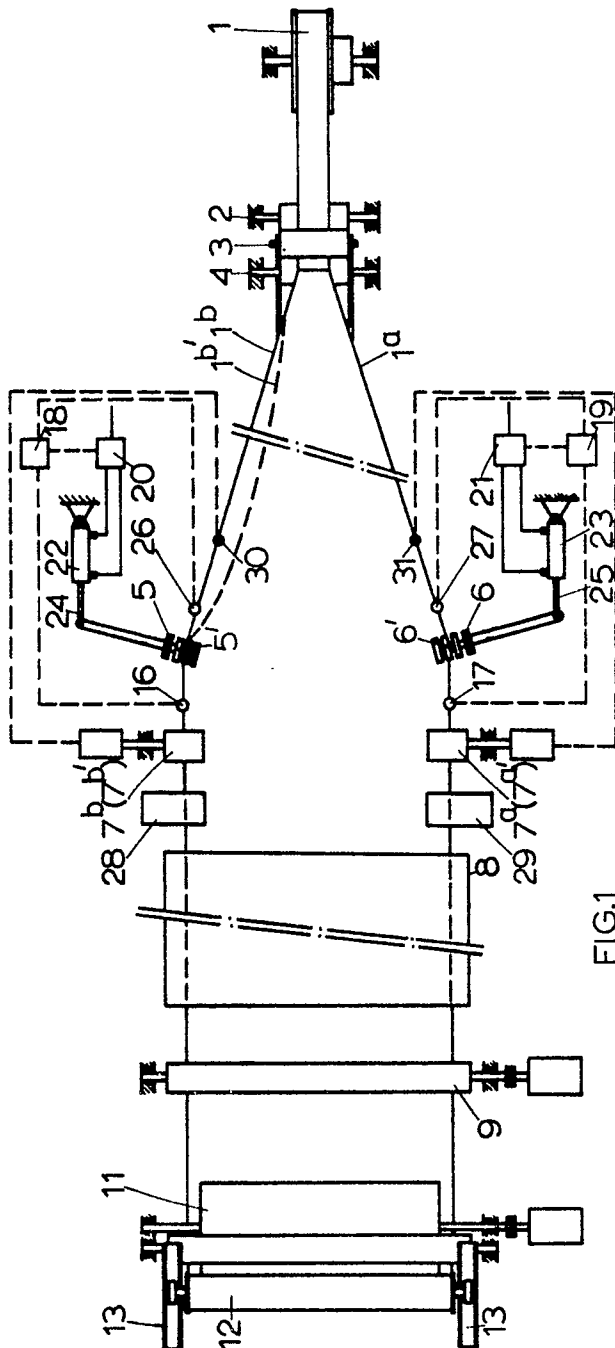
1. Method for continuous lateral stretching of films to a constant width, characterized in that an unstretched web of reticulate film material is passed to pairs of clamping rollers mounted at either side of the web which clamp the web at the desired width and which
5 are so controlled by a controlling mechanism that, when the desired web width is deviated from, the angle included by the clamping roller shafts and the sides of the web in the plane of the web is readjusted.
2. Method according to claim 1, characterized in that the web of
10 reticulate film material is passed to the pairs of clamping rollers by way of guide and/or tensioning rollers.
3. Method according to claim 1-2 characterized in that readjustment of the angle included by the clamping roller shafts and the sides of the web in the plane of the web is effected by turning clamping rollers
15 around an axis which coincides with or is near to the desired position of the side edges of the stretched material.
4. Method according to the claims 1-3, characterized in that the distance between the pairs of clamping rollers, as seen in the direction normal to the web, is also readjusted by a controlling mechanism
20 when the desired web width is deviated from.
5. Method according to claim 1-4, characterized in that the controlling mechanism for readjustment of the angle included by the clamping rollers shafts and the sides of the web in the plane of the web consists of photocells that are mounted after the pairs of
25 clamping rollers, as seen in the direction of transport of the web, and which, when the desired web width is deviated from, send a signal to a transmitter coupled to a servo mechanism that operates a hydraulic cylinder whose piston rod is pivoted to the pairs of clamping rollers.
- 30 6. Method according to claim 1-5, characterized in that the controlling mechanism for readjustment of the angle included by the clamping roller shafts and the sides of the web in the plane of the web consists of photocells that are mounted before the pairs of clamping rollers, as seen in the direction of transport of the web, and which,
35 when the desired web width is deviated from, send a signal to a transmitter coupled to a servo mechanism that operates a hydraulic cylinder whose piston is connected to the pairs of clamping rollers.

7. Method according to the claims 1-6, characterized in that pairs of rollers mounted after the pairs of clamping rollers are driven independently of each other, the driving mechanisms being controlled by photocells which are mounted at either side of the web before the pairs of clamping rollers and which, when one of the sides of the web sags, send a signal to one of the driving mechanisms so that it runs at a higher speed until the sagging has been eliminated.
8. Method according to the claims 1-7, characterized in that after the driven pairs of rollers, as seen in the direction of transport of the web, there are side stretchers, which stretch the unstretched sides of the web by means of compressed air or another medium.
9. Method according to claims 1-8, characterized in that, when the desired web width is deviated from, a signal is furthermore sent by photocells to a transmitter coupled to a servo mechanism that operates a hydraulic cylinder whose piston rod is coupled, by means of a guide, to the pairs of clamping rollers, so that the distance between the pairs of clamping rollers normal to the web is readjusted.
10. Method according to the claims 1-9, characterized in that the web of reticulate material to be stretched laterally offers very little resistance to lateral stretching.
11. Method according to claims, 1-10 characterized in that a package consisting of several webs of reticulate material, one on top of the other and connected to each other at the side edges is laterally stretched to a constant width, after which the package of reticulate webs is passed through a stabilization device.
12. Method as described, and represented in the drawing.
13. Device for continuous lateral stretching of a web of reticulate material to a constant width, characterized in that the device comprises:
- guide and/or tensioning rollers (2, 4 and 3, respectively) for the web of unstretched reticulate material;
 - pairs of clamping rollers (5 and 6) mounted at either side of the web at the desired web width, as well as photocells (16, 17) monitoring the side edge of the web and coupled to controlling mechanisms for the pairs of clamping rollers;

- axes of rotation for the pairs of clamping rollers (5 and 6),
situated within the width of the clamping rollers.

14. Device according to claim 13, characterized in that the device is
also provided with:

- 5 - photocells (30 and 31) before the pairs of clamping rollers
 (5 and 6), coupled to the driving mechanisms for the driven
 pairs of rollers (7a, 7a' and 7b, 7b') after the pairs of
 clamping rollers;
- 10 - side stretchers (28 and 29) for the unstretched side edges of
 the web.



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EUROPEAN SEARCH REPORT

Application number

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| DOCUMENTS CONSIDERED TO BE RELEVANT | | | CLASSIFICATION OF THE APPLICATION (Int. Cl. 7) |
|--|---|----------------------------------|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | |
| P | US - A - 4 140 574 (BELOIT CORPORATION) * The whole document * | 1,3,8, 10,12, 13 | D 29 D 7/30 |
| | -- | | |
| D | US - A - 3 838 481 (MITURU KURODA) * Claim 1 * | 1 | |
| | -- | | TECHNICAL FIELDS SEARCHED (Int. Cl. 7) |
| A | FR - A - 1 577 739 (JOHNSON & JOHNSON) * Claim 18 * | 1 | D 06 C B 29 D |
| | -- | | |
| A | FR - A - 1 424 541 (KODAK-PATHE) * Abstract 1a; figure 1 * | 1,2 | |
| | -- | | CATEGORY OF CITED DOCUMENTS |
| A | FR - A - 2 090 131 (HOECHST) * Figure 1; claim 1 * | 1,2 | X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons |
| | ---- | | |
| The present search report has been drawn up for all claims | | | & member of the same patent family, corresponding document |
| Place of search | | Date of completion of the search | Examiner |
| The Hague | | 01-11-1979 | PETIT |