April 26, 1949. J. SPALDING 2,468,310

LACE WEB SEPARATION

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Fig. 1.

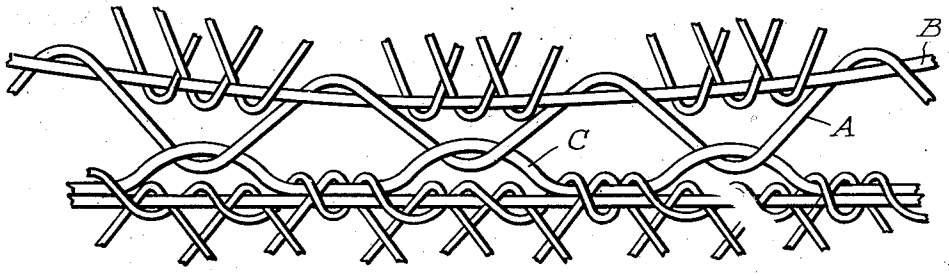


Fig. 2.

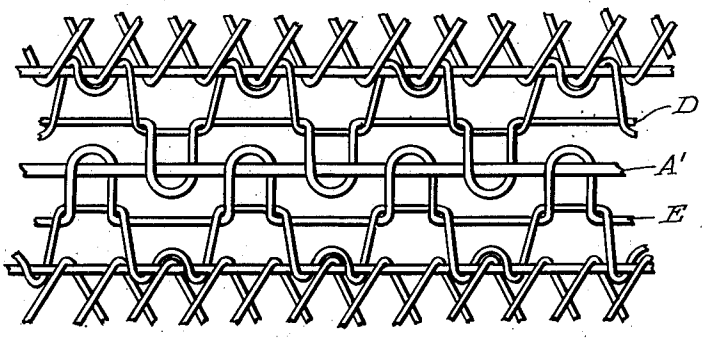
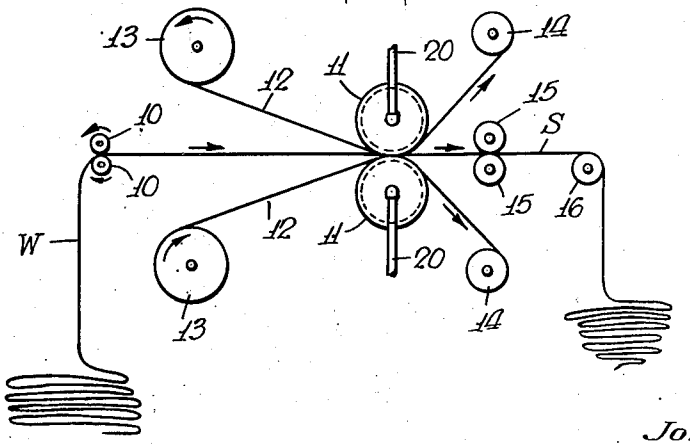


Fig. 3.



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Fig. 4.

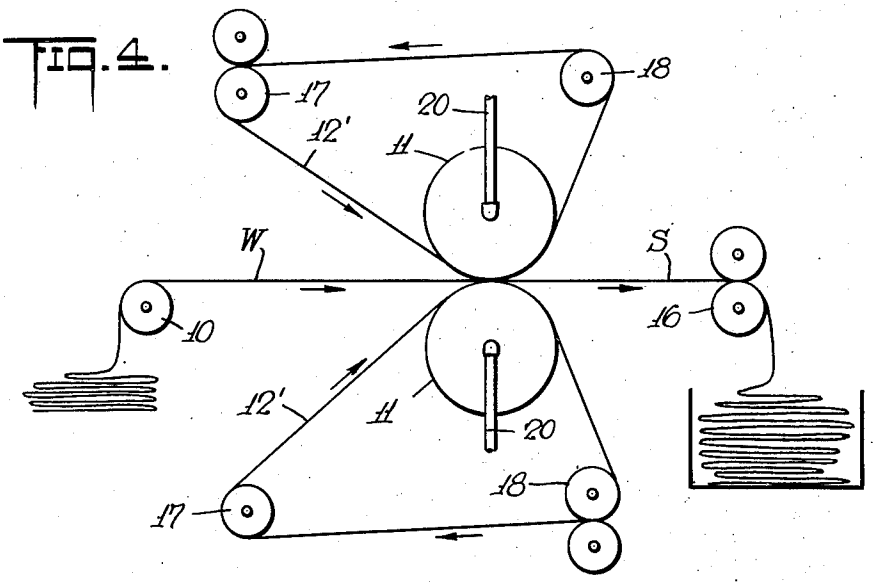
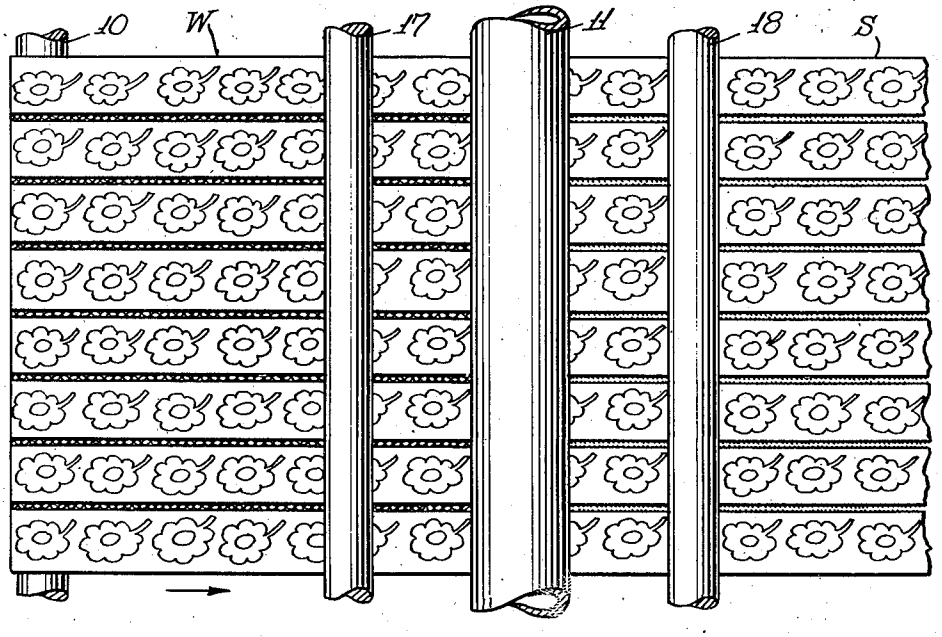


Fig. 5.



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FIG. 6.

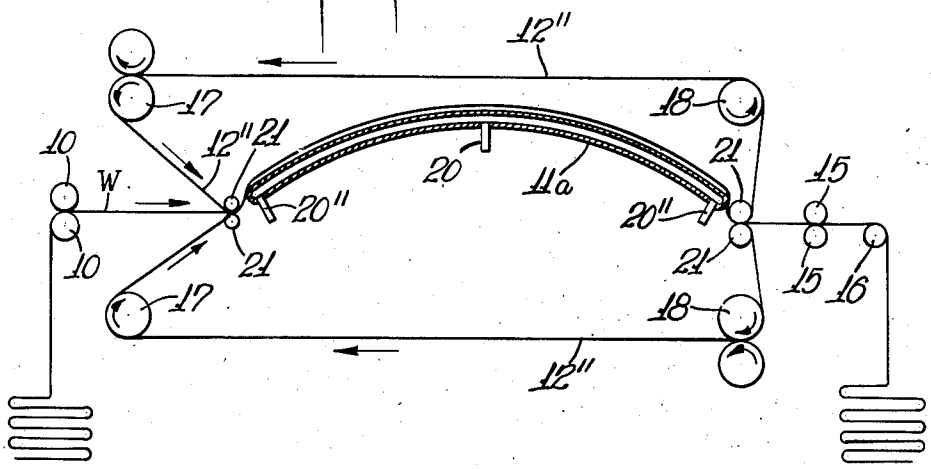
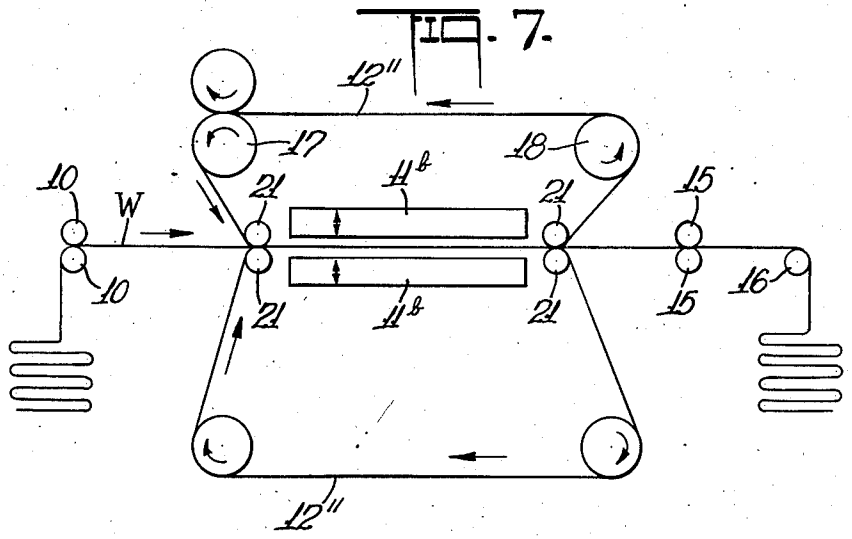


FIG. 7.



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2,468,310

LACE WEB SEPARATION

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Application May 15, 1947, Serial No. 748,365

14 Claims. (Cl. 28—73)

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This invention relates to processes and apparatus for separating lace webs into strips of lace. In my Patent 1,665,230 there were disclosed webs of the general type referred to, and in which a plurality of lace strips are held together by connecting threads which are of a composition different from that of the threads forming the lace, and of such a character that they can be dissolved out by the use of a suitable solvent. For instance, if such threads be of cellulose acetate they can be dissolved by the use of acetone or other suitable solvents, and the strips thus freed from each other. The dissolving of the connecting threads can be effected in an apparatus such as that disclosed in my Patent 1,865,218, but this requires saturating the roll with solvent and the later removal of the solvent.

Instead of dissolving the connecting threads they may be of such a composition that when heated they can be easily broken into short sections. For instance they may be made from vinyl chloride vinyl acetate mixtures, or the like, such as are commonly sold under the trade-name "Vinyon," or the threads may be of other synthetic composition which has low tensile strength when heated. By heating the connecting threads while they are under tension, they will contract endwise and break, thus freeing the lace strips from each other. Webs of such character, and a process and apparatus for separating them by breaking the connecting threads, are disclosed in my Patent 2,346,195. Such a process is advantageous in that no solvent is required, and a dry web may be progressively passed through a heating and thread-breaking apparatus; but in the form illustrated in said patent it is necessary to employ a plurality of thread heating and breaking units, and to provide for the adjustment of such units toward and from each other in accordance with the width of the lace strips so as to operate therebetween.

My present invention involves a new and improved process and apparatus for treating webs such as those disclosed in the last mentioned patent, to effect the heating and breaking of the connecting threads and the removal of residual portions of the broken threads, but without the need for the large number of of separate and adjustable heating and thread-breaking elements there disclosed. I have now discovered that the heating and breaking of the threads may be effected by merely passing the web through or over a heating unit while so holding the web that the lace strips cannot stretch or move laterally, or pull together during the heating step. Thus

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the breaking is effected by the mere contraction or shortening of the threads, as a result of the heating and the great reduction in tensile strength of the threads.

As an important feature of the invention the web is passed between a pair of rolls which heat the connecting threads and at the same time pinch the web and prevent edge of the lace strips from pulling toward each other. Thus the contracting or shortening of the threads causes them to break.

As a further important feature of the invention, a sheet is pressed against the web and passes with it over the heating means so as to directly contact with the connecting threads while heat is being applied.

As a further feature, at least one of the sheets is provided with a coating of a thermoplastic material which has little or no adhesion to the threads of the lace itself, under the conditions under which it is employed, but the softened and broken connecting threads will adhere thereto, so that upon separating the coated sheet from the lace, it will carry with it and remove from the lace the residual portions of the broken threads, and leave the lace strips completely freed from each other and ready for packaging.

In carrying out my invention, the steps of holding the strips against lateral movement, the heating of the connecting threads to cause them to break, and the removal of broken threads may be effected by progressively bringing the web and the coated sheet together, passing them over and pressing them against a transversely extending heating element such as a roller, and then progressively separating the sheet and the separated lace strips to leave the residual portions of the threads on the sheet.

Mechanism may be employed for slightly stretching the web laterally as it passes onto the heating unit, but ordinarily this is not necessary if the web be smoothed out before it is delivered with the sheet and pressed onto the heating element sufficiently firmly so that any substantial lateral movement or lateral stretching of the lace is prevented. By making the threads of a suitable composition, they will break with only a small reduction in length, due to the great lowering of the tensile strength as a result of the heating.

If the threads be for instance of a proper synthetic composition, sufficient contraction and decrease in tensile strength will be effected to cause breaking with very little heating, which may be to a temperature somewhat above 100° C.

I have referred to the use of a sheet, but it is preferable to use two sheets with the web pinched between them at the instant of heating.

The sheet or sheets may be made of any material of sufficient strength and flexibility, such as paper, cellophane, cloth, etc., and the coating may be of a composition which becomes somewhat tacky in the temperature range in which the threads lose their tensile strength. The temperature to which the threads are heated may be varied in accordance with the character or composition of the connecting threads, but should be sufficiently high to give a rapid heat transfer through the sheet or sheets to the threads to be broken, and while the sheet and/or web is in contact with the heater for only a very short time.

Various different coating compositions may be used on the sheet provided they are such as will, when heated, cause the broken threads to adhere thereto. A composition which has been found suitable is similar to that of the thread to be broken. If vinyl chloracetate threads be used as connecting threads in the web, the coating may be vinyl chloracetate dissolved in dichlorethylene, spread on one surface of the sheet of paper and then dried.

The sheet or sheets may be of the same length as the web and be unrolled from one roll, fed along with the web over the heating element, and rolled up on another roll; or they may be endless, and repeatedly passed over the heater with the web and then around idler rollers.

The heating and pressure applying unit may be a pair of rollers, a single roller, or a stationary member presenting a curved surface over which the web and sheet are moved.

Merely as examples of lace webs which may be separated by my improved process, and of apparatus suitable for carrying out the process, certain forms are shown in the accompanying drawings. In these drawings:

Fig. 1 is a greatly enlarged view of a portion of a web showing a thermoplastic connecting thread between adjacent edges of two lace strips.

Fig. 2 is a view similar to Fig. 1, but showing a form in which the thermoplastic thread is straight, and rover or drop out threads are employed.

Fig. 3 is a side view showing diagrammatically one form of apparatus which may be employed.

Fig. 4 is a view similar to Fig. 3, but showing an alternative arrangement,

Fig. 5 is a top plan view of apparatus showing some but not all of the parts of the apparatus diagrammatically shown in Fig. 4, and on a larger scale and

Figs. 6 and 7 are side views showing diagrammatically two other forms of apparatus which may be employed.

In the somewhat diagrammatic showing in Fig. 1, of a portion of a lace web on a very greatly enlarged scale, there is provided a thermoplastic thread A which passes around threads B and C of two lace strips so as to hold said strips together, but slightly spaced from each other. It will be noted that by destroying the thread A the lace strips will be freed from each other, and it will also be noted that the connecting thread A passes freely through holes in the edges of the lace strips, and which are sufficiently large so that there is no binding action even if the thread contracts in length so as to be of much larger diameter. If the thread A be broken at most, if not all of the transverse passes thereof, the residual portions of the thread are easily removable from the lace strips.

In the lace web shown in Fig. 2, the thermoplastic connecting thread A' is substantially straight, and passes through loops of rover threads D and E which are also looped through the lace so that they are freed from the lace by the breaking of the thread A'. Thus the rover threads will fall out or can be lifted off the lace.

In the apparatus diagrammatically illustrated in Fig. 3, the web W is taken from any suitable source, and between a pair of feed rolls **10**. Care should be taken that the web is smoothed out before entering the feed rolls, and if desired any suitable form of guiding or lateral stretching means may be employed to make sure that there is no substantial amount of slack in the connecting threads, or this may be done by hand.

The lace web passes in flat, smooth form from these rolls to a pair of rolls **11**, one or both of which may be heated. As the web passes between these rolls it is engaged on its upper and lower surfaces by sheets **12** which are of a width at least as great as that of the web. The sheets may be taken from supply rolls **13** which may have brake mechanism or frictional resistance to rotation, so that the sheets will be flat, smooth, and if desired taut, and will lie on opposite sides of the web as the latter passes between the heated rolls **11**. The sheets **12** separate from the web as the latter leaves the heated rolls, and may be wound up on rolls **14**. The web is pulled between the heated rolls by draw rolls **15**, and at the same speed as the sheets are wound on rolls **14**. The drive for the rolls **14** may have a slip friction drive so that the speed of rotation may decrease as the diameter increases.

As previously explained, the temperature of the heated rolls **11** is such as will cause the connecting threads between adjacent lace strips to contract and break, and as the sheets **12** have a coating of thermoplastic material which will cause the residual portions of the broken threads to adhere thereto, said sheets will carry them away from the separated lace strips. The separated strips S delivered by the draw rolls **15** may be passed over a roller **16**, and accumulate in a suitable receptacle, or may be progressively and separately wound up or otherwise disposed of.

In Fig. 4 there is shown a modified form in which the coated sheets **12'** instead of being taken from one roll and wound up on another, are endless, and pass around pairs of idler rolls **17** and **18**.

I have not illustrated details of any driving mechanism for any of the rolls, but it will be understood that they may be driven by any suitable means, and at the proper relative speeds. The heated rolls may be of conventional type, that is hollow, and provided with means for the circulation of steam or hot water through them, as for instance from pipes **20**, or they may be heated in any other suitable manner. The lace web will be gripped between the rolls, and the gripping may be due to the weight of the upper roll, or conventional means may be employed for pressing them together. As a result of the gripping or pinching action of the rolls **11**, the separate strips are prevented from stretching laterally under the tension created in pulling them endwise, or the tension of the connecting threads as they are heated and contract in length before they break.

The residual portions of the connecting threads

adhere to the coating on one or both of the sheets, and are carried away from the separated strips by the sheets. They may remain permanently attached to the coatings on the sheets, particularly if such coatings are of a composition somewhat similar to that of the threads. As the threads are of small diameter and there may be only a few of such threads in a web composed of wide lace strips, the sheets may be used repeatedly, and the residual portions accumulate on the coatings. When such accumulation becomes excessive, the coatings with such residual thread portions, may be dissolved off from the sheet, and new coatings applied.

In the form shown there are two of the coated sheets, one on each side of the web. In some cases, particularly where the lace is very thin, or is of extremely open mesh, it is preferable to have only one of the sheets coated, so that the coatings cannot directly contact through openings in the lace, with the possibility of their adhering to each other. As previously noted, in some cases only one sheet need be employed.

In the constructions illustrated the heating elements are rolls. It will be obvious that where two rolls are used only one need be heated, particularly if only one coated sheet is employed. Substantially the same effect is obtained if the coated sheet or sheets and the lace web pass over and along a portion of a curved surface of a stationary or non-rotating heating element. In that case the web and sheets slide over the heating element instead of moving with the surface of the heated element.

In Fig. 6 I have shown such an apparatus, and which may be similar to those shown in Figs. 3 and 4 in all respects, except that the upper heating roll 11 is omitted and the lower heating roll 11 replaced by a heater 11*a*, which has an upwardly facing curved surface over which the web W may slide. Pairs of feed rollers 21 for the coated sheet 12'' are positioned opposite the ends of said heater and the heating fluid may be delivered at the upper part through a pipe 20' and withdrawn from the lower part through pipes 20''.

In some cases the heated elements may be flat plates, and the web and sheets advance step by step between said elements. In this case the elements are intermittently moved toward and from each other to cause alternate compressing and releasing of the web and sheet. This has the advantage of insuring uniform application of heat across the entire width of the sheet, and permits the use of a lower temperature for a longer time than is the case where the sheets merely pass between two rolls which apply the heat along only narrow areas, and only for an instant.

In Fig. 7 I have shown such an apparatus, which is similar to that shown in Fig. 6 except that two flat heaters 11*b* are used, these having parallel surfaces. At least one of these heaters may be moved toward and from the other to grip and release the web, as indicated by the arrows, and the rollers are rotated intermittently to advance the coated sheet 12'' only when the heaters are separated.

In some cases the web may be moved intermittently over a flat platen, and between successive advancing movements a roller may be caused to move over the platen and across the sheet, either or both the platen and roller being heated. In all cases the openings in the lace, and through which the connecting thread passes, should be enough larger than the diameter of the connecting thread as to avoid any liability of the thread portions being held in the lace after the diameter of the threads has increased, upon endwise contraction and breaking.

Having thus described by invention, what I claim as new and desire to secure by Letters Patent is:

1. The process of separating into strips a lace web of the type in which lace strips are connected edge to edge by threads of a composition having low tensile strength when heated, said process including the steps of applying to the web a sheet having a coating of adhesive material, and heating the web to cause contracting and breaking of said connecting threads and the adhering of the residual portions of the broken threads to said sheet.

2. The process of separating into strips a lace web of the type in which lace strips are connected by threads of different composition from that of the threads of the lace, and having low tensile strength when heated, said process including pressing the web against a sheet having an adhesive coating, and heating the web to cause said threads to contract and break and adhere to said sheet.

3. The process of separating into strips a lace web of the type in which lace strips are connected by threads of a composition having low tensile strength when heated, said process including pressing the web between a pair of sheets, at least one of which has an adhesive coating, and heating said web to contract and break said connecting threads.

4. The process of separating into strips a lace web of the type in which lace strips are connected by transverse threads which shorten and have low tensile strength when heated, said process including passing the web and a sheet having an adhesive coating between a pair of rolls, at least one of which is heated, thereby to contract and break said connecting threads, and separating said sheet from said strips, and with the residual portions of said connecting threads adhering to said sheet.

5. The process of separating into strips a lace web of the type in which lace strips are connected by transverse threads of a composition having low tensile strength when heated, said process including the steps of applying to the web a sheet having a coating of adhesive material, holding the web against lateral contracting, and heating the web to cause contracting and breaking of said connecting threads and the adhering of the residual portions of the broken threads to said sheet.

6. The process of separating into strips a lace web of the type in which lace strips are connected by transverse threads of different composition from that of the threads of the lace, and having low tensile strength when heated, said process including the steps of applying a sheet having adhesive coating to hold the web against lateral contracting, and applying heat to the surface of the web to contract and break said threads.

7. The process of separating into strips a lace web of the type in which lace strips formed of cotton threads are connected by transverse threads formed of nitrogenous synthetic material having low tensile strength when heated, said process including the steps of applying a sheet having adhesive coating to hold the web against lateral contracting, and applying heat to the surface of the web to contract and break said threads.

8. The process of separating into strips a lace

web of the type in which lace strips are connected by transverse threads of a composition having low tensile strength when heated, said process including passing the web and a sheet having an adhesive coating between a pair of heated rolls to prevent lateral contraction of the web while heating the web to effect contraction and breaking of the connecting threads.

9. The process of separating into strips a lace web of the type in which lace strips are connected by transverse threads having low tensile strength when heated, said process including the steps of applying to the web a sheet having a coating of adhesive material, and passing the web and sheet between a pair of heated rolls thereby to prevent lateral contracting of the web while heating the same to cause contracting and breaking of the connecting threads.

10. The process of separating into strips a lace web of the type in which lace strips are connected by transverse threads having low tensile strength when heated, said process including the steps of pressing the web between a pair of sheets, at least one of which has an adhesive coating, to hold said sheets against lateral movement, and simultaneously heating the web and sheets to contract and break the connecting threads.

11. The process of separating into strips a lace web of the type in which lace strips are connected by transverse threads of a composition having low tensile strength when heated, said process including the steps of pressing the web between a pair of sheets, at least one of which has an adhesive coating, simultaneously heating the web and sheets to contract and break the connecting threads, and separating said sheets with the residual portions of said threads from the separated strips.

12. The process of separating into strips a lace web of the type in which lace strips are connected

by transverse threads of a composition having low tensile strength when heated, said process including the steps of pressing the web between a pair of sheets, at least one of which has a coating of a composition similar to that of said transverse threads, simultaneously heating the web and sheets to contract and break the connecting threads, and separating said sheets with the residual portions of said threads from the separated strips.

13. The process of separating into strips a lace web of the type in which lace strips are connected edge to edge by threads of a composition having low tensile strength when heated, said process including the steps of applying to the web a sheet having a coating of a composition similar to that of the connecting threads, and heating the web to cause contracting and breaking of said connecting threads and the adhering of the residual portions of the broken threads to said sheet.

14. The process of separating into strips a lace web of the type in which lace strips are connected by threads of a composition having low tensile strength when heated, said process including pressing the web between a pair of sheets to prevent contraction, at least one of which sheets has a coating of a composition similar to that of the connecting threads, and heating said web to contract and break said connecting threads.

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