April 11, 1961 M. LIEBESKIND 2,979,240

PLEATING APPARATUS AND METHOD

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FIG. 5

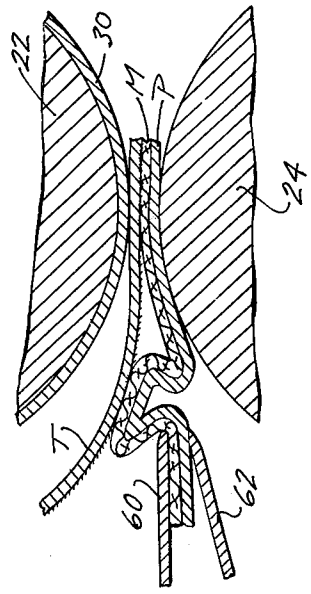


FIG. 1

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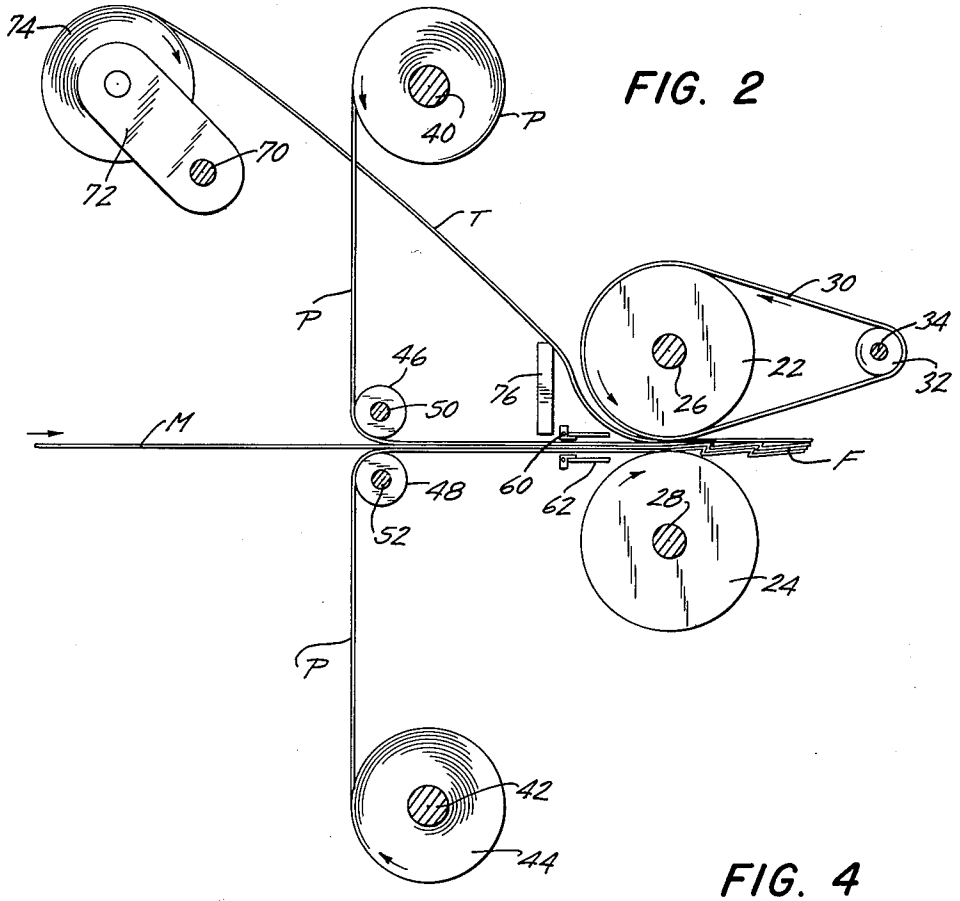


FIG. 2

FIG. 3

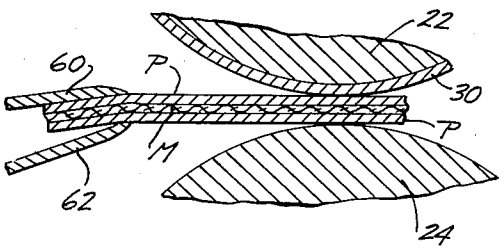
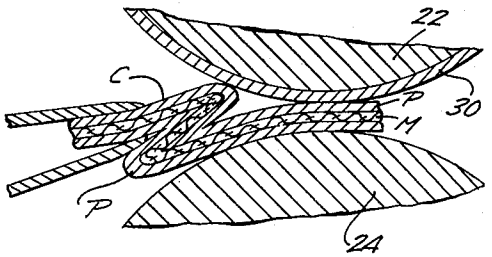


FIG. 4



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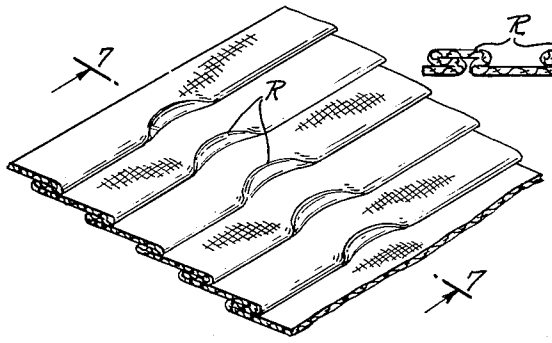


FIG. 6

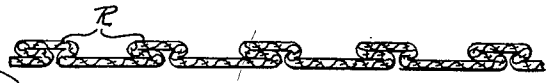


FIG. 7

FIG. 8

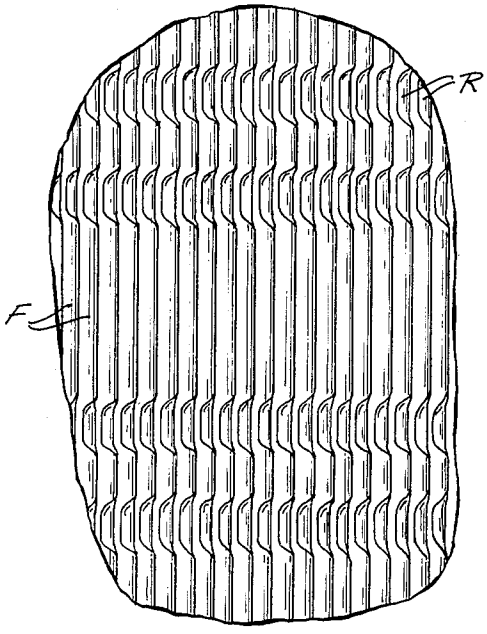
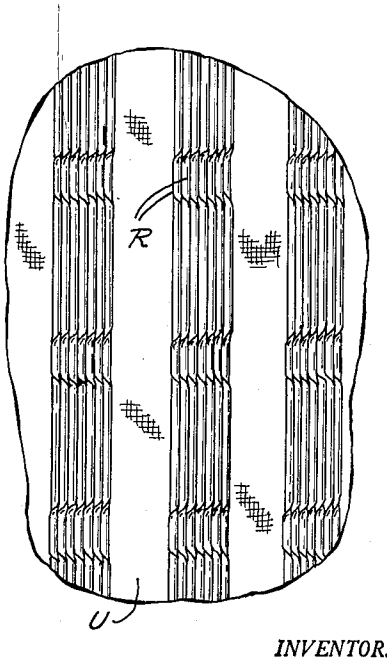


FIG. 9



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2,979,240

PLEATING APPARATUS AND METHOD

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Filed July 6, 1959, Ser. No. 825,060

7 Claims. (Cl. 223—30)

The present invention relates generally to improvements in textile manufacture, and particularly to a novel type of pleating, as well as to an apparatus and a method for the manufacture thereof.

In the manufacture of pleating it is conventional to provide a machine which feeds a sheet of a textile material in a given direction and includes pleating knives operable to arrange the sheet into a regular but somewhat monotonous pattern of pleats. In particular, one well known type of machine of this class includes a pair of rollers which are arranged to grip the sheet between them and are driven to feed the sheet in a forward direction, and pleating knives located somewhat rearwardly of the feeding rollers and driven to feed the pleats in between the opposed gripping rollers so that the latter partially press the pleat into the material, after which the pleated material is subjected to an autoclave to give the pleat a permanent set. Attempts have been made to vary the rather monotonous row-on-row effect of conventional pleating. Some machines, for example, include a second set of pleating knives which provide a counter-pleat of some sort which relieves in some way the ordered pattern of the main pleat so as to provide a decorative fillip to the finished pleating. Such pleating machinery, however, requires an additional set of pleating knives, and this of course greatly complicates the mechanism required for imparting the decorative counter-pleat to the product.

Accordingly it is broadly an object of the present invention to avoid one or more of the foregoing disadvantages. More specifically, it is an object of this invention to provide a pleating machine which is of conventional construction in most respects and has only one set of pleating knives, but which is nevertheless capable of providing a compound pleat including a main pleat and a counter-pleat which relieves the ordered pattern of the main pleat in some decorative and interesting way. It is a further object of this invention to provide a pleating machine of extremely simple construction which is capable of producing pleating of the aforesaid type. Additional objects of this invention are the provision of a new article of manufacture consisting of a novel pleating of the kind described above, and the provision of a method for the manufacture of such a product.

In accordance with an illustrative embodiment demonstrating apparatus aspects of this invention there is provided a pleating machine which comprises means for arranging a sheet of material into pleats including cusps pointing substantially in a selected direction and extending transversely to the selected direction. In addition there are means for engaging segments of the cusps of a lesser transverse extent than the entirety thereof and cooperating with the pleating means to displace the cusp segments relative to the remainder of the cusps so as to form counter-pleats interrupting the transverse extent of the pleats. The pleats and the counter-pleats thus form a decorative pattern which consists of an interesting counter-pleat pattern pleat which is superimposed

upon the background formed by the pattern of the main pleat, the total effect being one of a uniform background relieved by an interesting decorative interruption thereof.

In accordance with method aspects of this invention there is provided a method of pleating a sheet of material which comprises the steps of intermittently advancing the sheet, moving the sheet through a pleating stroke so as to arrange the sheet into pleats including cusps pointing substantially in a selected direction, and engaging and retarding the cusps during the pleating stroke so as to displace the cusps in a direction opposite to the selected direction for forming counter-pleats.

In accordance with article aspects of this invention, there is provided as a new article of manufacture, pleating comprising a sheet of material arranged in pleats including cusps pointing substantially in a selected direction and extending transversely to the selected direction. Segments of the cusps of a lesser transverse extent than the entirety thereof are displaced relative to the remainder thereof to define a counter-pleat which interrupts the transverse extent of the cusps to provide a decorative effect.

The foregoing brief description, as well as further features and advantages inherent in this invention, may be more fully appreciated by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein;

Fig. 1 is a simplified perspective view, with parts broken away, of a pleating machine in accordance with the present invention;

Fig. 2 is a similarly simplified side elevational view of the pleating machine of Fig. 1;

Fig. 3 is an enlarged vertical section of the rollers and pleating knives of a conventional pleating machine which cooperate to arrange a sheet of material into a pleated configuration;

Fig. 4 is another enlarged vertical section of the pleating knives and rollers of the pleating machine of Fig. 3, illustrating the action of the pleating knives and rollers thereof in arranging the sheet of material into a pleated configuration;

Fig. 5 is a similar enlarged vertical section of the pleating mechanism of a pleating machine in accordance with the present invention, illustrating the manner in which such pleating mechanism arranges a sheet of material into a pleating pattern with a counter-pleating pattern superimposed thereupon;

Fig. 6 is a perspective view of a piece of pleating in accordance with the present invention;

Fig. 7 is a longitudinal section of the novel pleating of Fig. 6 taken along the lines 7—7 thereof and illustrating the configuration of the counter-pleat thereof;

Fig. 8 is a top plan view of another embodiment of pleating in accordance with the present invention illustrating one of the many different kinds of decorative patterns which can be achieved according to the novel teachings herein; and,

Fig. 9 is a similar top plan view of a further embodiment of pleating in accordance with this invention illustrating another of the many novel decorative patterns which may be achieved by means of this invention.

Referring now specifically to the drawings, there is provided a pleating machine, generally designated by the numeral 20, for arranging a sheet of material M into a generally pleated configuration. Many of the details of the construction of the pleating machine 20 are conventional and well known, and thus need only be referred to briefly for the purposes of illustrating their relation to the novel features thereof. As is well known, the pleating machine 20 includes a pair of closely spaced parallel gripping and driving rollers 22 and 24 mounted upon shafts 26 and 28 which in turn are suitably journaled for

rotation of the gripping and driving rollers. A transmission belt 30 passes about the upper roller 22 and also passes about a power driven roller 32 mounted upon a shaft 34 which is connected in any appropriate manner to be intermittently driven by the power train (not shown) of the pleating machine 20. The shaft 34 and power driven roller 32 intermittently drive the upper roller 22 by means of the transmission belt 30, and the gripping engagement of the material M by the opposed and closely spaced rollers 22 and 24 serves to intermittently feed the material M in the forward direction, that is, from left to right in Fig. 2, for advancing the material M in stepwise fashion along its feed path through the pleating machine 20. In the view of Fig. 1, the belt 30, roller 22 and shaft 26 are broken away for clarity of illustration.

As is also well known in the pleating art there is provided a pair of supply shafts 40 and 42 on opposite sides of the material M on which are journaled supply reels 44 containing a supply of tissue paper P. The paper P is fed from the supply reels 44 towards the material M from both sides thereof and is passed over auxiliary rollers 46 and 48 which are rotatably mounted on shafts 50 and 52 and then is drawn between the gripping and driving rollers 22 and 24 together with the material M, the layers of paper P sandwiching the layer of material M therebetween.

As is also well known in the pleating art, there is provided a pair of pleating knives 60 and 62 extending across the material M in a direction transverse to the forward direction along which the material M and the paper P are advanced. These pleating knives are located just rearwardly of the point of tangency of the gripping and driving rollers 22 and 24 with the assembly of the material M and paper P, and are driven by well known mechanisms in a forward pleating stroke. In a conventional pleating machine the two knives 60 and 62 first come together during an interval between intermittent advances to grip the assembly of the material M and paper P therebetween in the manner illustrated in Fig. 3, and subsequently are moved forwardly and somewhat upwardly, cooperating with rollers 22 and 24 as seen in Fig. 4 to form a cusp C of the material M and the paper P which defines a forwardly directed pleat F. It is seen in Fig. 4 that the cusp C points generally forwardly and also somewhat upwardly towards the rollers 22 and 24. After the cusp C is formed the next advance of the material M and paper P occurs, and as may be appreciated from Fig. 4 this results in the passing of the material M and paper P through the grip of the rollers 22 and 24 in the pleated configuration imparted thereto a moment previously by the pleating knives 60 and 62. Subsequent autoclaving makes the pleats take a permanent set. It is seen in Fig. 1 that the cusps formed in the material M and paper P extend entirely across the width of the material M in a direction transverse to the forward direction along which the material M and paper P are fed to define a regular pattern of forwardly directed pleats F.

In accordance with the present invention there are provided two upper supply reels 44 spaced apart to provide a clearing therebetween. A support including a support rod 70 and a reel holder 72 is provided which serves to rotatably mount a supply reel 74 containing a supply of a narrow adhesive tape T which is fed through the clearing with its adhesive side facing downwardly toward the portion of material M which is exposed in the clearing between the separated upper strips of paper P. A guide bar 76 is provided just rearwardly of the pleating knives 60 and 62 which cooperates with the supply reel 74 and the gripping and driving rollers 22 and 24 to feed the adhesive tape T forwardly and downwardly along a path which passes somewhat forwardly and upwardly of the pleating knives 60 and 62 and somewhat rearwardly of the gripping and driving rollers 22 and 24. Thus, as best seen in the enlarged sectional view of Fig. 5, a short arcuate loop of the tape T hangs freely between the pleating knives 60 and 62 and the gripping and driving rollers 22 and 24 in the region to the rear of the point of tangency of the gripping and driving rollers 22 and 24 with the material M. The adhesive tape T is subsequently fed together with the material M between the gripping and driving rollers 22 and 24, so that the gripping and driving rollers also serve to pull the tape T from its supply reel as they intermittently advance the material M and the paper P.

The short arcuate loop of tape T which hangs between the pleating knives 60 and 62 and the gripping and driving rollers 22 and 24 is in position to adhere to segment the cusp C of substantially the same width as tape T as the cusps are thrust forwardly by the pleating knives 60 and 62 so that the adhesive lower surface of the tape T adheres to and retards the segments of the cusps C contacted thereby during the forward pleating stroke, resulting in a displacement of the contacted segments. Thus a segment of each succeeding cusp C substantially equal in width to the narrow adhesive tape T is displaced rearwardly relative to the remaining transverse extent of the cusps C to form rearwardly directed counter-pleats R which interrupt the transverse extent of the forwardly directed pleats F. The narrow adhesive tape T employed has a considerably lesser transverse extent than does the material M, so that while the forwardly directed pleats F extend entirely across the transverse width of the material M the rearwardly directed counter-pleats R are of considerably lesser transverse extent and merely serve as a break or interruption in the transverse extent of the forwardly directed pleat F, thus forming a decorative relief of the pattern thereof.

It will now be appreciated that in accordance with this invention a method of pleating a sheet of material comprises the steps of gripping the sheet M at a first station and intermittently advancing sheet M in a forward direction gripping sheet M at a second station located rearwardly of the first station and moving the sheet M through a forward pleating stroke during intervals between advances thereof for arranging sheet M into pleats F including cusps C pointing substantially in the forward direction and extending transversely to said forward direction, and engaging and retarding segments of the cusps C of a lesser transverse extent then the entirety thereof during the forward pleating stroke at a location forward of the second station and rearward of the first station to displace the cusp segments rearwardly relative to the remainder of the cusps C for forming rearwardly directed counter-pleats R interrupting the transverse extent of forwardly directed cusps C.

After the desired pleat and counter-pleat pattern is formed in the material M, the material and the tape T are both fed between the driving rollers 22 and 24, which thus serve not only to advance the work along but also to press the tape T more firmly into adhesion with the material M so that the tape preserves the pleats as the material issues from the machine 20. Subsequently, the assembly of the pleated and counter-pleated material M and tape T is autoclaved, as is well known in the art, to fix the pleating and counter-pleating permanently into the material M, after which the tape T can be removed, leaving the material in a form such as seen in Figs. 6–9.

Referring primarily to Figs. 6 and 7, it is seen that the material M is formed by the apparatus and method described above into a regular pattern of forwardly directed pleats F interrupted by narrower rearwardly directed counter-pleats R which interrupt the transverse extent of the forwardly directed pleats F and are arranged in a regular pattern of their own along longitudinal row. The sectional view of Fig. 7 shows the configuration of the rearwardly directed counter-pleats R, illustrating that they may have a small cusp pointing in a forward direction and a somewhat larger cusp pointing in a rearward direction, giving the whole an overall rearward orientation.

The novel pleating which may be made by the apparatus and method of this invention may best be appreciated by reference to Figs. 8 and 9. Fig. 8 illustrates one of a great variety of decorative patterns which may be made by superimposing longitudinal rows of rearwardly directed counter-pleats R grouped by two across the transverse pattern of forwardly directed pleats F to provide an effect of a uniform background with a decorative overprint superimposed thereon. Fig. 9 illustrates another of the many decorative patterns which can be achieved by means of this invention, an additional decorative touch being imparted to the pleating because of the fact that various dwelling mechanisms such as are well known in the pleating art are employed to provide unpleated areas U extending across the width of the material of the pleating to space apart the areas upon which are formed the forwardly directed pleats F and the rearwardly directed decorative counter pleats R.

Thus it will now be appreciated that this invention provides a novel apparatus and a novel method for the production of a new article of manufacture, that is, a novel type of pleating which gives the pleasing and decorative effect of a uniform background pattern upon which is superimposed a decorative counter-pattern relieving the order of the basic pattern. The uniform background pattern consists of an ordered arrangement of forwardly directed pleats and the decorative counter-pattern superimposed thereupon consisting of a differently ordered arrangement of counter-pleats made in accordance with the methods and apparatus of this invention. It will also be appreciated that a great advantage of the apparatus of this invention is that it may be made by performing a very simple modification on any conventional pleating machine, such as the particular type including gripping and feeding rollers and pleating knives as described herein. A further advantage of this apparatus is that it is very simple and inexpensive in its operation and thus provides the novel pleating described herein at minimal expense.

The particulars of the foregoing description are provided merely for purposes of illustration and are subject to a considerable latitude of modification without departing from the novel teachings disclosed herein. For example, it is contemplated that a counter-pleat of the type described may readily be superimposed upon a box pleat including forwardly as well as rearwardly directed cusps. Accordingly, the scope of this invention is intended to be limited only as defined in the appended claims, which should be accorded a breadth of interpretation consistent with this specification.

What I claim is:

1. A machine for simultaneously pleating and counter-pleating a sheet of material comprising means including pleating knives for forming said sheet into pleats having cusps, supply means adapted to receive and feed a supply of adhesive tape past said pleating knives, and means for guiding said adhesive tape into engagement with said sheet during pleating thereof such that said tape adhesively engages a portion of said cusps to create a drag thereon and thereby form counter-pleats directed oppositely to said pleats.

2. A machine for simultaneously pleating and counter-pleating comprising opposed rollers arranged to grip a sheet of material therebetween and driven to intermittently hold and advance said sheet, pleating knives driven through a pleating stroke during intervals between advances of said sheet and cooperating with said rollers at a pleating station to arrange said sheet into pleats including cusps pointing substantially in said selcted direction and extending transversely to said selected direction, supply means adapted to receive and supply a length of flexible tape narrower than the transverse extent of said cusps, and having an adhesive surface past said pleating knives and through said opposed rollers, and means supporting a first portion of said tape out of contact with said sheet, a further portion of said tape being in position for said adhesive surface to adhere to segments of said cusps at said pleating station whereby to retard said cusp segments during said pleating stroke for displacing said cusp segments relative to the remainder of said cusps to form counter-pleats interrupting the transverse extent of said cusps.

3. A machine for simultaneously pleating and counter-pleating comprising opposed rollers arranged to grip a sheet of material therebetween and driven to intermittently hold and advance said sheet, pleating knives driven through a pleating stroke during intervals between advances of said sheet and cooperating with said rollers at a pleating station in advance of said rollers to arrange said sheet into pleats including cusps pointing substantially in a selected direction and extending transversely to said selected direction, supply means adapted to receive and supply a length of flexible tape narrower than the transverse extent of said cusps and having an adhesive surface past said pleating knives and through said opposed rollers, and means supporting a first portion of said tape out of contact with said sheet, a further portion of said tape being in position for said adhesive surface to adhere to segments of said cusps at said pleating station whereby to retard said cusp segments during said pleating stroke for displacing said cusp segments relative to the remainder of said cusps to form counter-pleats interrupting the transverse extent of said cusps, said further tape portion extending between said rollers with said sheet whereby to be pressed more firmly into adhesion therewith and thereby subsequently preserve the configuration of said counter-pleats.

4. A machine for simultaneously pleating and counter-pleating comprising opposed rollers arranged to grip a sheet of material therebetween and driven to intermittently hold and advance said sheet in a forward direction, pleating knives located rearwardly of said rollers and driven through a forward pleating stroke during intervals between advances of said sheet and cooperating with said rollers at a pleating station in advance of said rollers to arrange said sheet into pleats including cusps pointing substantially in said forward direction and extending transversely to said forward direction, supply means adapted to receive and supply a plurality of lengths of flexible tape narrower than the transverse extent of said cusps and said rollers and having an adhesive surface past said pleating knives and through said opposed rollers, and means supporting a portion of each of said lengths of tape out of contact with said sheet, a further portion of each of said lengths of tape being in position for said adhesive surface to adhere to segments of said cusps at said pleating station whereby to retard said cusp segments during said forward pleating stroke for displacing said cusp segments rearwardly relative to the remainder of said cusps to form substantially rearwardly directed counter-pleats interrupting the transverse extent of said cusps, said further tape length portions extending between said rollers with said sheet whereby to be pressed more firmly into adhesion therewith and thereby subsequently preserve the configuration of said counter-pleats.

5. A method of simultaneously pleating and counter-pleating a sheet of material comprising the steps of advancing said sheet in a selected direction, moving said sheet through a pleating stroke for arranging said sheet into pleats including cusps pointing substantially in said selected direction and extending transversely to said selected direction, and so positioning a body narrower than the transverse extent of said cusps and having an adhesive surface that said surface adhesively engages segments of said cusps of a lesser transverse extent than the entirety thereof during said pleating stroke to retard and displace said cusp segments relative to the remainder of said cusps for forming counter-pleats interrupting the transverse extent of said cusps.

6. A method of simultaneously pleating and counter-pleating a sheet of material comprising the steps of gripping and advancing said sheet in a forward direction at a selected station, moving said sheet through a forward pleating stroke for arranging said sheet into pleats including cusps pointing substantially in said forward direction and extending transversely to said forward direction, so positioning a flexible tape narrower than the transverse extent of said cusps and having an adhesive surface that said surface thereof adhesively engages segments of said cusps of a lesser transverse extent than the entirety thereof in advance of said selected station during said forward pleating stroke to retard and displace said cusps segments rearwardly relative to the remainder of said cusps for forming substantially rearwardly directed counter-pleats interrupting the transverse extent of said forwardly directed cusps, and then advancing said tape through said selected station with said sheet and gripping said tape and sheet together thereat to press them more firmly into adhesion and thereby subsequently preserve the configuration of said counter-pleats.

7. A method of simultaneously pleating and counter-pleating a sheet of material comprising the steps of gripping said sheet advancing said sheet in a forward direction, at a selected station, moving said sheet through a forward pleating stroke for arranging said sheet into pleats including cusps pointing substantially in said forward direction and extending transversely to said forward direction, so positioning a plurality of flexible tapes, each narrower than the transverse extent of said cusps and having an adhesive surface, that said surfaces thereof adhesively engage segments of said cusps of a lesser transverse extent than the entirety thereof in advance of said selected station during said forward pleating stroke to retard and displace said cusp segments rearwardly relative to the remainder of said cusps for forming substantially rearwardly directed counter-pleats interrupting the transverse extent of said forwardly directed cusps, and then advancing said tapes through said selected station with said sheet and gripping said tapes and sheet together thereat to press them more firmly into adhesion and thereby subsequently preserve the configuration of said counter-pleats.

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