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(54) **PLEATED PAPER AND PLANAR SHEET FOR COMPOSITE PACKAGING PRODUCT**

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(57) **ABSTRACT**

A novel packaging wrap is used in cushioning a product for shipment is formed from the combination of a layer of pleated sheet material, the pleated material being creased at the apices of each pleat have a height in the range from about 0.1 inches to about 0.05", and a planar layer of sheet material which is adhered to, to a pleated sheet of Kraft paper. The pleated sheet material has a weight in the range from about 30 to 50 pounds and the planar sheet material is preferably Kraft paper having a weight in the range of 40-70 pounds. The pleated sheet material preferably, has 80-140 pleats per foot. A void fill product is formed from the combination of a layer of pleated sheet material, where each pleat has a height in the range from about 0.1 inches to about 0.2 inches, and a planar layer of sheet material which is not adhered to a pleated sheet of Kraft paper.

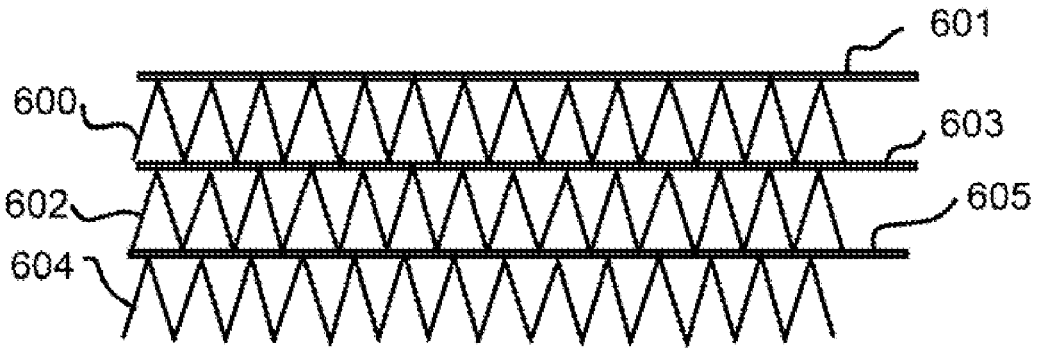


FIGURE 1

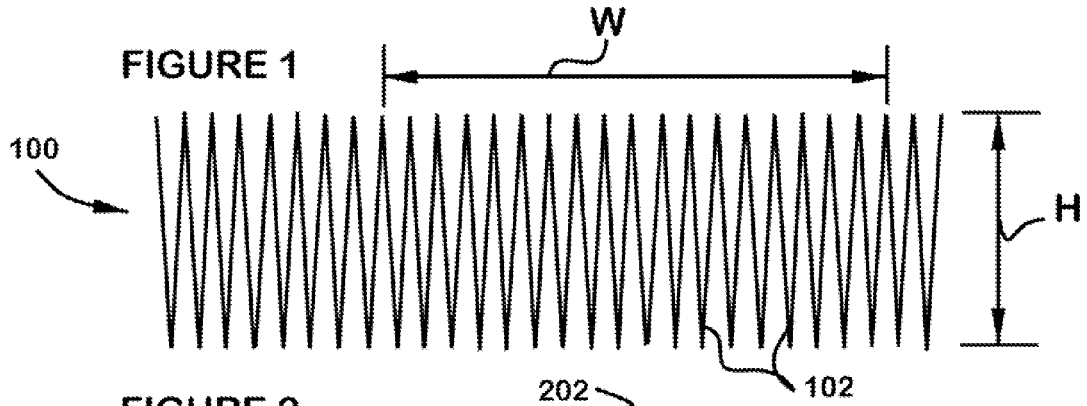


FIGURE 2

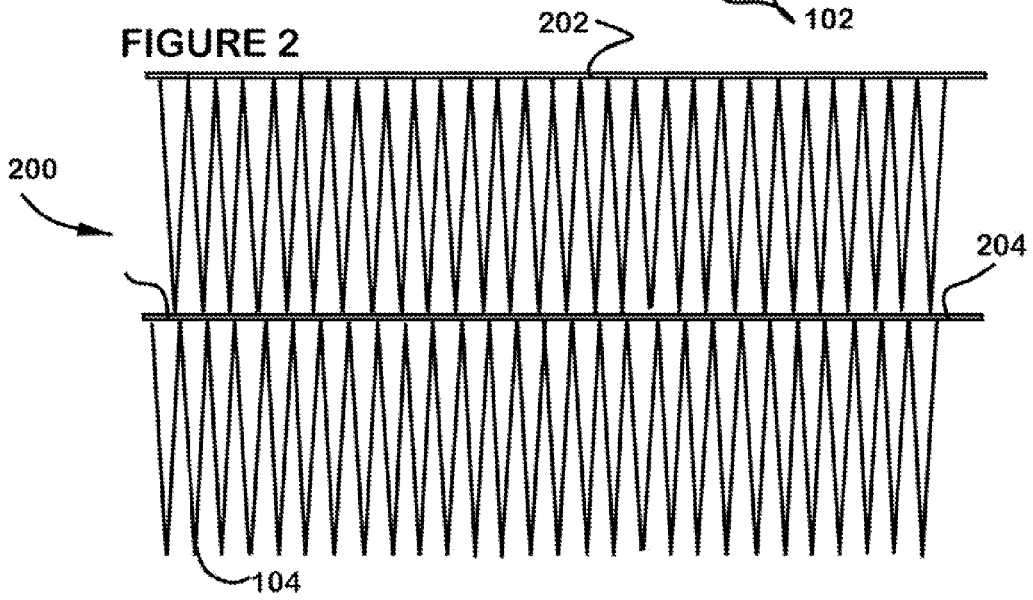


FIGURE 3

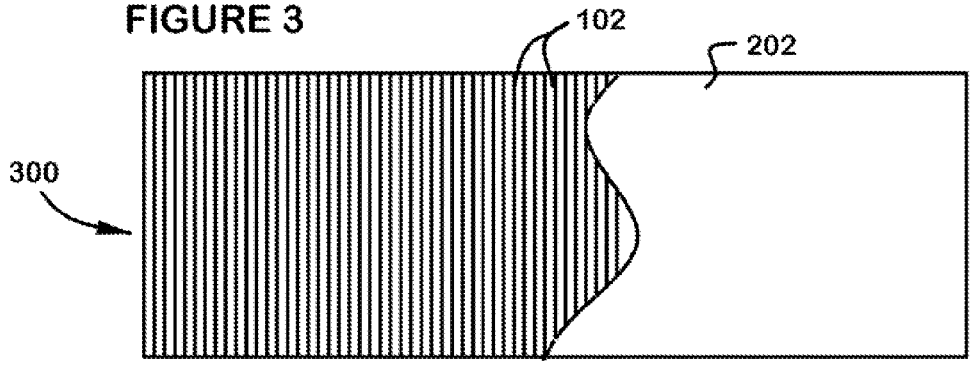
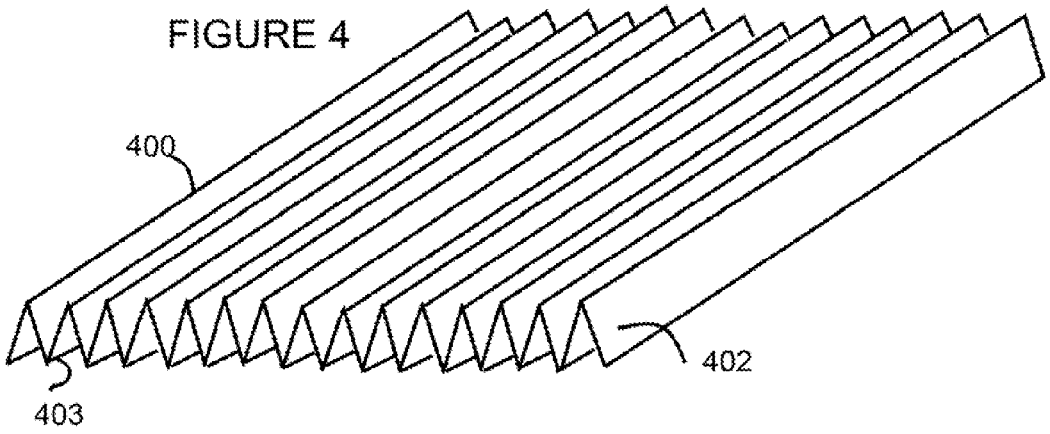


FIGURE 4



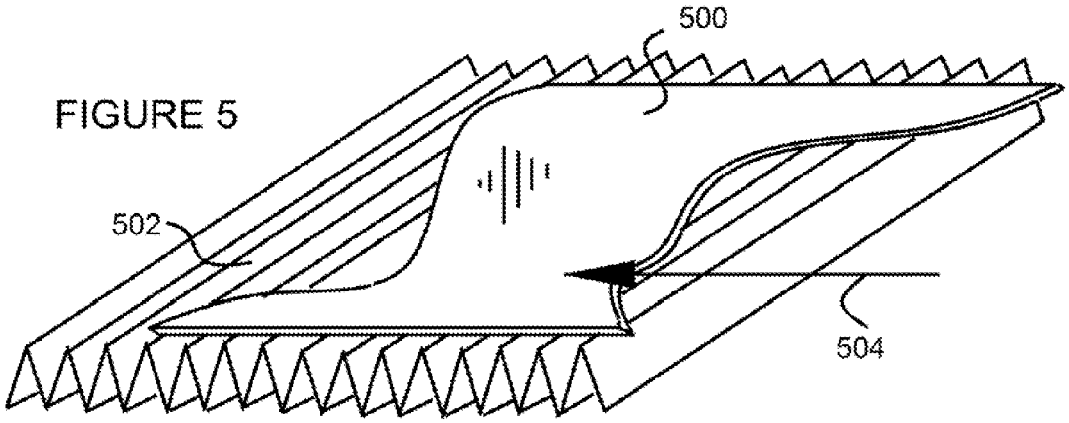


FIGURE 5

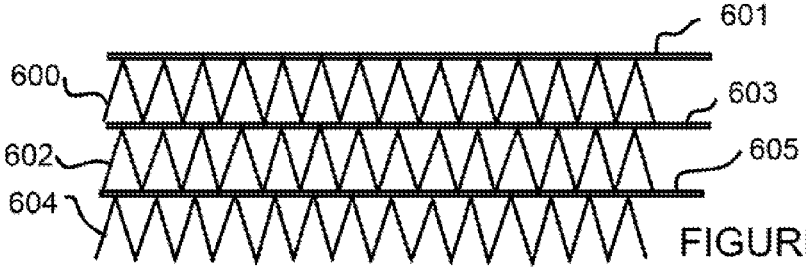


FIGURE 6

FIGURE 7

Crush Test

150 pounds of force held for 10 seconds for each duration.
11x8.4 inch surface area pressing on the same size roll of PleatFill

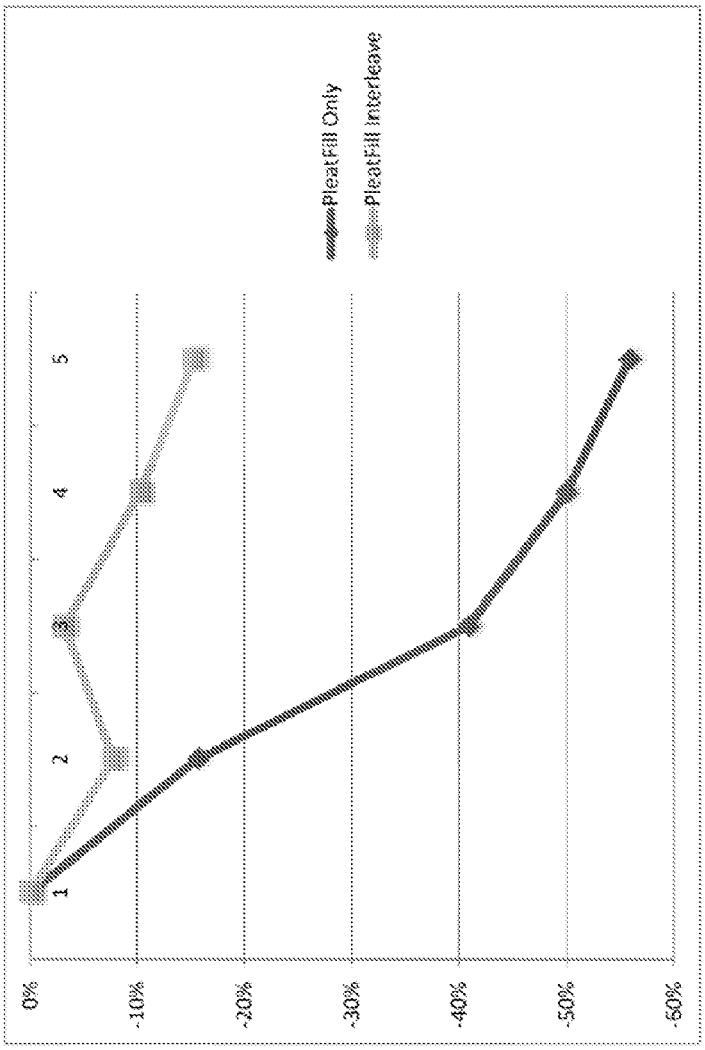
4lbs per square inch of force.

FIGURE 8

All in inches

	Polyurethane foam .75" thick					
Duration	Height before test	Height after test	Height Change	% Loss/test	% loss from original	Notes
1	0.75	0.75	0	0.00%	0.00%	
2	0.75	0.75	0	0.00%	0.00%	
3	0.75	0.75	0	0.00%	0.00%	
4	0.75	0.75	0	0.00%	0.00%	
	1/2" thick bubble					
Duration	Height before test	Height after test	Height Change	% Loss/test	% loss from original	Notes
1	0.5	0	0.5	100.00%	100.00%	bubbles popped at 3.9 lb/sq"
	Patent 6871480 PleatWrap from prior art testing					
Duration	Height before test	Height after test	Height Change	% Loss/test	% loss from original	Notes
1	0.5625	0.1236	0.4389	78.03%	78.03%	3 layer
1	0.1875	0.03075	0.15675	83.60%	83.60%	1 Layer
1	0.5625	0.02955	0.53295	94.75%	94.75%	2 Layer
	Patent 5667871 Geami		60 pound paper			
Duration	Height before test	Height after test	Height Change	% Loss/test	% loss from original	Notes
1	0.77	0.65	0.12	15.58%	15.58%	
2	0.65	0.455	0.195	30.00%	40.91%	
3	0.455	0.385	0.07	15.38%	50.00%	
4	0.385	0.34	0.045	11.69%	55.84%	
	Pleatfill - 38" rolled up.					
Duration	Height before test	Height after test	Height Change	% Loss/test	% loss from original	Notes
1	0.77	0.65	0.12	15.58%	15.58%	
2	0.65	0.455	0.195	30.00%	40.91%	
3	0.455	0.385	0.07	15.38%	50.00%	
4	0.385	0.34	0.045	11.69%	55.84%	
	Pleatfill with interleaf - 38" rolled up.					
Duration	Height before test	Height after test	Height Change	% Loss/test	% loss from original	Notes
1	0.986	0.91	0.076	7.71%	7.71%	28% taller with the interleaf than without.
2	0.91	0.955	-0.045	-4.95%	3.14%	
3	0.955	0.885	0.07	7.33%	10.24%	
4	0.885	0.835	0.05	5.65%	15.31%	3.64 times smaller compression reduction

FIGURE 9



Duration	PleatFill Only	PleatFill Interleave
0	0%	0%
1	-15.58%	-7.71%
2	-40.91%	-3.14%
3	-50.00%	-10.24%
4	-55.84%	-15.31%

PLEATED PAPER AND PLANAR SHEET FOR COMPOSITE PACKAGING PRODUCT

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application claims the benefit of provisional patent applications 61/737895 and 61/585932, the disclosures of which are incorporated herein by reference, as though recited in full.

FIELD OF THE INVENTION

[0002] The invention relates to a composite packaging product for use in wrapping products and as a void fill for packaging.

BRIEF DESCRIPTION OF PRIOR ART

[0003] There is a number of moving pad products to wrap furniture and other items for the household goods and office moving industry.

[0004] Currently Pleated Paper patent U.S. Pat. No. 6,871,480 teaches using pleated paper laminated to one or more outer layers of tissue paper as a cushioning product. The pleat height, paper fiber length, and number of pleats per foot, provide a cushioning product that crushes as force is applied.

[0005] Air filled bubble type of wrap, well known in the art, is manufactured to Kraft paper for the use as a moving pad to provide protection to furniture. In this instance the bubbles leak air and provide a barrier that is just the thickness of the paper and the plastic film combination. The lamination is also not recyclable. Other non-leaking bubble is available at a much higher cost. Nevertheless the bubble, when under pressure, will stretch to one side of the corners leaving the area exposed to damage.

[0006] Paper pads that are made from multiple layers of paper are expensive, heavy, and are only laminated on the ends to provide flexibility. If the sheets were laminated across the sheet, and not just on the ends, the sheet would be stiff and inflexible. This leaves the paper in the middle to be torn easily, one layer at a time, as there is no integral connection. The product is not crushable and provides a good barrier protection provided there is no sheering action that would progressively tear the individual sheets until the furniture is exposed. Moving companies use multiple light to medium weight paper layers, from 3 to 12 in number, based on the value of the items shipped.

[0007] There are a number of in-the-box void fill products found in the market today used to fill the open area within a box that is unused by the item shipped. Void Fill products can also help cushion the item packaged and in this fashion is placed within all six sides of a box. Void Fill products are typically limited in their cushioning quality and are not used for fragile items. Polyurethane foam is the material of choice for this type of cushioning protection.

[0008] Styrofoam peanuts are another product that provides cushioning and void fill but is not recyclable and makes a mess when unpacking. Polyurethane foam provides the best in cushioning but is expensive and not recyclable.

SUMMARY OF THE INVENTION

[0009] A novel packaging wrap is used in cushioning a product for shipment and is formed from the combination of a layer of pleated sheet material, the pleated material being creased at the apices of each pleat, and a planar layer of sheet material which is adhered to, and preferably, adhesively bonded, to a pleated sheet of Kraft paper. The pleated sheet material has a weight in the range from about 30 to 50 pounds and the planar sheet material is preferably Kraft paper having a weight in the range of 40-70 pounds. The pleated sheet material preferably, has 80-140 pleats per foot. Preferably, the pleats have a height in the range from about 0.1 inches to about 0.05", in terms of distance between top planar sheet and bottom planar sheet. With a packaging material made, using these dimensions and paper weights, cushioning benefit is replaced by new property of "barrier" quality.

[0010] Another embodiment of the present invention is directed to a novel paper product comprised of the pleated material by itself and or as a composite packaging material comprised of at least one layer of the pleated material and one layer or a separator sheet material. The composite material comprised of a pleated paper sheet being made into alternating creased apices forming transverse rows of pleats. The pleated sheet material has a weight in the range from about 30 to 50 pounds in paper basis weight. The pleated sheet material preferably, has 80-140 pleats per foot. Preferably, the pleats have a height in the range from about 0.1 inches to about 0.2", in terms of distance between top pleat apex to the bottom pleat apex.

[0011] In another embodiment, the pleated paper product, as described above, in the form of a spiral winding, thereby forming a cylinder of pleated paper.

[0012] In a further embodiment the pleated paper product comprises a layer of pleated paper is adhered to a non-pleated sheet material, and the composite is spirally wound to form a cylinder.

[0013] In a further embodiment the pleated paper product comprises a layer of pleated paper is not adhered to a non-pleated sheet material, and the composite is spirally wound to form a cylinder.

[0014] In an embodiment of the invention, the non-pleated sheet material is tissue paper.

BRIEF DESCRIPTION OF DRAWINGS

[0015] The invention will be described with the accompanying drawings, in which:

[0016] FIG. **1** is a side view (cross to the machine direction) of the barrier wrapping product.

[0017] FIG. **2** is a side view (cross to the machine direction) of two layers of pleated paper adhered to the top and middle planar layers.

[0018] FIG. **3** is a top fragmentary view of the paper pleated layer and a portion of he planar sheet.

[0019] FIG. **4** is a side perspective view of the pleat layer by itself.

[0020] FIG. **5** is a side perspective view of a pleated layer and a planar sheet.

[0021] FIG. **6** is an end view showing multiple layers as would be used to protect an item either as a wrap or voidfill.

[0022] FIG. **7** is the same perspective view as FIG. **6**, but without the planar sheet.

[0023] FIG. **8** is the testing results for the prior art and the instant art.

[0024] FIG. **9** is the test results of an unusual result for the PleatFill™ product (the product of the instant invention), with use of an interleaved, non-laminated planar sheet material.

DEFINITIONS

[0025] Where the definition of terms departs from the commonly used meaning of the term, applicant intends to utilize the definitions provided below, unless specifically indicated. For the purposes of the present invention, the term "pleat" or "pleats" refers to paper that is creased at the apices of each pleat.

[0026] For the purposes of the present invention, the term "pleat leg" refers to the two legs that make up the "V" shaped pleat.

[0027] For the purposes of the present invention, the term "barrier" refers to the type of packaging desired to create a rigid/substantially inflexible material that forms a barrier around an item to be protected.

[0028] For the purposes of the present invention, the term "pleated wrap" refers to the material created by adhering the pleats to a planar sheet to the bottom of the pleats or to the top and bottom of the pleats.

[0029] For the purposes of the present invention, the term "Kraft paper" refers to the industry name of paper that is measured in weight for every three thousand square feet of material. Thus the weight of 50# Kraft Paper would be the weight of 3000 square feet of paper.

[0030] For the purposes of the present invention, the term "basis weight" refers to the specification relating to paper that measures the weight of a certain square foot area of paper. Thus the basis weight of 3000 square feet of Kraft Paper weighing 50 pounds equals a 50# basis weight.

[0031] The basis weight of Tissue paper is based on 2,880 square feet. For the purposes of the present invention, the term "recycled paper" refers to material that is substantially made from recycled paper in the 90% range or more.

[0032] For the purposes of the present invention, the term "virgin paper" refers to paper made from substantially virgin paper fibers directly from the forest in the 90% range or more.

[0033] For the purposes of the present invention, the term "paper fibers" are the individual component of paper that makes up a paper sheet.

[0034] For the purposes of the present invention, the term "recycled paper" is paper that has been returned to the manufacturing process, having once or more made into a paper product, and remade into a paper sheet.

[0035] For the purposes of the present invention, the term "about" means a range of +/−15%.

DETAILS OF EMBODIMENTS OF THE INVENTION

[0036] The barrier pleated product is a novel product that can be used as a general wrapping product but particularly for the moving industry for wrapping furniture. The use of the material as a general wrapping product can be made with the pleated layer laminated to just one planar layer or both upper and lower planar layers. There are many applications for protecting heavy products that require a barrier to inhibit scratching rather than the need for cushioning. The moving industry requires a thick barrier wrapping material that does not crush easily but is flexible and preferably recycled. On heavier items the bubbles leak or stretch beyond the corners leaving the edges exposed and where the weight of the item presses against the bubbles it leaks rather quickly providing little protection. It is also not recyclable.

[0037] The term barrier needs to be further defined to explain the new art. A barrier made of paper is conceptually the same as a barrier made of steel or wood. Both will deform during shock or vibration and return virtually to its original shape. Paper provides additional protection and is widely used in the packaging industry due to its inherent vibration and shock dissipation within the paper itself. Paper is much less dense then wood or steel and can absorb and compress more easily.

[0038] The pleated paper barrier is even less dense then multiple layered paper yet can return to its original shape under the same loads that is found when using the multi layered sheet. The V shaped design of the pleat in combination with the paper fiber length creates this strength.

[0039] The fiber length of the paper as compared to the pleat leg length is about the same or greater making the leg much stronger. The greater number of longer fibers makes it more difficult to flex the pleat leg. As an example, a pleat leg length of 1" would be greatly more flexible than one that is 20 time mailer than the 0.05" height of the instant art.

[0040] Paper pads are marketed in a variety of layers from 3 to 12 with a variety of thicknesses for paper used. Three layer pads provide very little protection and 12 layer pads are very protective but become heavy. One difficulty encountered with paper pads is at the region around sharp edges. Regardless of the number of layers, one the first layer tears the layers underneath tear easily as they are not glued together.

[0041] The instant art creates a lightweight, tear resistant, flexible barrier wrapping product by gluing the three layers of paper together, the top sheet, the pleated layer, and the bottom sheet across the entire area of the barrier wrap or in spaced rows of adhesive. The rows of adhesive provide an additional flexibility when required. The pleated layer by its nature flexes easily but maintains its barrier crush resistant properties while taking the shape of the item wrapped. The open area between and around the pleats versus solid paper saves at least a 50% in paper weight. This paper weight reduction provides a less costly product with equal or better qualities.

[0042] Another variation of the preferred embodiment is to use tissue on the inner planar sheet layer. This provides a softer nonabrasive wrap that goes against the furniture while providing the pleated outer layer as the barrier.

[0043] Preferred specifications: In both instances, the preferred pleat height is in the range of 0.1" to 0.05". The range of the number of pleats per 12 inches, or one foot of pleated material, ranges from 80 to 140. The basis weight of the Kraft paper is in the range of 35 pounds to 70 pounds for the upper and lower planar sheet layers. The lower or inner sheet is made of Tissue paper in the range from 11 pound to 30 pound tissue. The range of the pleated layer is 35# to 60# recycled Kraft paper.

[0044] It is preferred to use recycled Kraft paper based on the shorter fibers that are more easily manipulated into the pleat shape. Virgin fibers are much longer and can be used in lighter basis weights with equal strength to heavier weight recycled paper. Presently it is much easier to find basis weights in the market that are 30# or higher in virgin paper. The virgin paper required would be with a basis weight of 20-28 pounds. This paper weight is not readily available but would certainly provide a lighter weight alternative and is considered part of the preferred range.

[0045] One of the preferred combinations is with the use of 50# virgin Kraft paper as the upper and lower planar sheet in combination with a 40# recycled Kraft paper for the pleated layer.

[0046] Another preferred combination is with the use of 50# virgin Kraft paper as the upper layer and a 15 pound tissue paper for the lower planar sheet in combination with a 40# recycled Kraft paper for the pleated layer. It should be understood that the paper weights can be +/−15%

DESCRIPTION OF THE DRAWINGS

[0047] Referring now to FIGS. **1**, **2**, and **3** we see the side view of the pleat wrap product and its components. The wrap is made up of "V" shape pleats facing downward or inverted (**102**) and upward.

[0048] FIG. **1** is an end (side) view of the pleated wrapping product with the pleated layer shown without an upper and/or lower planar layer, for ease of understanding. The pleated layer indicated generally as **100**.

[0049] FIG. **2** is an end view of the pleated wrapping product with the pleated layer **200** laminated to upper and lower planar sheet layers **202** and **204** and a lower pleated layer indicated generally as **206**, laminated to the planar sheet **204**. Thus. the upward pleat of layer **206** is connected to inverted pleated layer **200**, by virtue of both layers being laminated to the planar sheet **204**. The lamination is preferably achieved through the use of separate rows of adhesive running in the machine direction.

[0050] FIG. **3** is a top view of the top planar sheet **202** with glue lines **302** running in the continuous direction of the manufacturing process (machine direction/the direction in which the paper flows). The glue adheres the pleats **102** to the underside of the planar sheet **202**.

[0051] FIG. **4** shows the upward apex **400** of the first pleat contiguously connected to the lower apex **403** of the second inverted pleat. The legs of the pleat **402** are created in the direction of the pleats. The ridge lines or apexes are created from the pleat making manufacturing process with paper of a predetermined transverse width of the manufacturing process.

[0052] FIG. **5** is a perspective view of the pleated product of the instant invention, with the pleated layer **502** extending beyond and under the planar sheet **500**. The manufacturing direction of the pleats is shown as **504** to demonstrate the continuous formation of pleats.

[0053] FIG. **6** is an end view showing multiple layers of pleated paper **600**, **602**, and **604**, with multiple layers of planar sheets **601**, **603**, and **605**, as they are used to protect an item either as a wrap or voidfill. For purposes of ease in reviewing the wrap, it is not necessary to attempt to wrap or extend the composite product completely around an item to protect the item, but the multiple layers as shown would formed on all six sides of the item wrapped. Some of the PleatFill material can be folded upward and around the item creating the all-sided wrapping. The pleats **600**, **602**, and **604** as well as the composite sheets **601**, **603**, and **605**, are very flexible and can easily conform around an item due to the flexibility of the composite structure.

[0054] In this instance the pleat layers precluded from nesting through the use of the planar layer.

[0055] FIG. **7** is the same perspective view as FIG. **6**, but without the planar sheet. The pleated layers are seen to nesting on or within, each other in the absence of a planar sheet. As can easily be seen, the nesting layers as depicted would require many more layers to equal the height and protection of the composite product of FIG. **5**.

[0056] FIG. **8** shows the testing results for the prior art and the instant art. It is important to generally note that 2-5 psi is generally a good cushioning product for small box shipments. Products, including the instant art, fall within this range, but what is unique, is the ability of the product of the present invention to return to its original height. As seen from the chart, best performer is the Urethane product and the worst is bubble.

[0057] FIG. **9** is the test results of an unusual result for the PleatFill™ product (the product of the instant invention), with use of a non-laminated interleave planar sheet material. As can be seen in the graph the Interleave sheet provides an increased resiliency that is up to 4 times more resilient than pleated product (PleatFill) by itself.

[0058] The prior art product of patent number U.S. Pat. No. 5,667,871 uses an interleaf, but it does not help in resiliency. The product of '871 maintains its three dimensional shape with the use of its four adjacent perpendicularly attached legs that are the left and right sides to the hexagon created when rotated to the 60 degree angle. These vertically oriented legs that make up four sides of the hexagon crush easily and are not resilient even with the planar sheet present.

[0059] Conversely, the composite of the present invention does not have legs that are vertical and therefore can constantly flex at the apex of each upper and lower adjoining pleat enabling a flex and return to shape even after 40 seconds of 4 psi crushing force. Paper just does not normally perform like this. This is almost the equivalent of Urethane foam. This means that composite of the present invention can protect the most fragile items, even through repeated impacts.

1. A pleated paper product, said pleated paper being pleated sheet material having a weight in the range from about 30 to 60 pounds, in paper basis weight, 80-140 pleats per foot, have a height in the range from about 0.1 inches to about 0.05", in terms of distance between top pleat apex to the bottom pleat apex.

2. A pleated paper product, said pleated paper being pleated sheet material having a weight in the range from about 30 to 60 pounds, in paper basis weight, 80-140 pleats per foot, have a height in the range from about 0.1 inches to about 0.2 inches, in terms of distance between top pleat apex to the bottom pleat apex.

3. The pleated paper product of claim **1**, wherein said pleated paper sheet material is in the form of a spiral winding, thereby forming a cylinder of pleated paper.

4. The pleated paper product of claim **1**, wherein the pleated paper comprises a layer of pleated paper that is adhered to a non-pleated sheet material, and the composite is spirally wound to form a cylinder.

5. The pleated paper product of claim **2**, wherein the pleated paper comprises a layer of pleated paper that is not adhered to a non-pleated sheet material, and the composite is spirally wound to form a cylinder.

6. The pleated paper product of claim **1**, wherein said pleated paper is recycled paper.

7. The pleated paper product of claim **2**, wherein said pleated paper is recycled paper.

8. The pleated paper product of claim **1**, wherein said pleated paper has a height in the range from at least 0.05 inches up to 0.1 inches.

9. The pleated paper product of claim **2**, wherein said pleated paper has a height in the range from at least 0.1 inches up to 0.2 inches.

10. The pleated paper product of claim **1**, wherein the pleated paper comprises a plurality of layers of pleated paper that is adhered to a non-pleated sheet material that is inter-

leaved between the layers of pleated paper, said non-pleated sheet material being tissue paper in the range from about 11 pound to about 30 pound tissue.

11. The pleated paper product of claim **2**, wherein the pleated paper comprises a plurality of layers of pleated paper that is not adhered to a non-pleated sheet material that is interleaved between layers of the pleated paper, said non-pleated sheet material being tissue paper in the range from about 11 pound to about 30 pound tissue.

12. The pleated paper product of claim **4**, wherein said pleated paper product is wrapped around an object and the wrapped object is contained within a shipping container.

13. The pleated paper product of claim **5**, wherein said pleated paper product and an object are contained within a shipping container.

* * * * *