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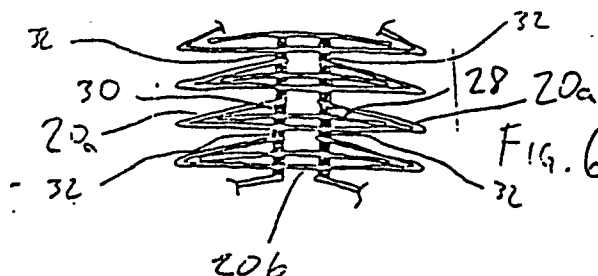
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(54) **Sheer fabric honeycomb shade production using release liner material.**

(57) A method for forming cellular shades using sheer materials. Strips of sheer material are creased to define tabs and central portions. Strips of a non-bonding material are placed over the central portions. Beads of adhesive are placed over the tabs and these assemblies are stacked, whereby the tabs are adhered to the central portions of the successive

strip, while the non-bonding material prevents adhesion of the tabs to the central portions of the corresponding strips. When the adhesive has set, the non-bonding strips can be conveniently removed, yielding a cellular shade which can be formed of substantially any fabric material.



SHEER FABRIC HONEYCOMB SHADE PRODUCTION USING RELEASE LINER MATERIAL

This invention relates to a method of manufacture of an improved cellular window shade. More particularly, the invention relates to a method of manufacture of an expandable and collapsible material for a cellular window shade, which consists of a number of horizontally-extending cells formed of fabric strips adhesively bonded to one another, according to which sheer fabrics not previously suited for manufacture of such shades may be employed.

Processes are known for manufacturing of cellular shades, in which the body of the shade consists of a number of identical fabric strips, folded and adhesively-bonded to one another so as to define cells. Typically, the cells extend transversely, but they may also be arranged vertically, or at an angle to the horizontal. When the shade is raised, the cells are collapsed; when the shade is lowered, the cells expand. Such shades contain essentially static masses of air, and thus provide useful thermal insulation.

Conventionally, such shades are manufactured by creasing strips of fabric lengthwise to define cell precursors, and using a liquid adhesive to bond tabs thus formed on each successive strip to the central body portion of the next strip, completing the cells. US-A-4450027 shows a method of and apparatus for making such shades from continuous fabric strip material. The adhesive bonding techniques employed heretofore in the manufacture of such shades have typically involved the positioning of beads of suitable adhesive on either the tabs or the central body portion of the next strip.

US-A-4677013, 4685986, 4631217, 4677012 and 4676855 show further methods of manufacture of cellular shades. For example, the strips may be creased to take a Z-shape, and tabs on either side of the strip are adhesively bonded to the prior and successive strips to form the completed shade structure. See also US-A-4732630 and EP-A-375146.

All of these patents and applications thus teach adhesive bonding of tabs formed on a strip of material to a preceding strip using a liquid adhesive, or in some cases to both preceding and successive strips, to form the cells. This technique is the most practical known, but has effectively limited the types of fabrics from which such shades can be made. Specifically, the material comprising the shade is normally stacked with the cells in the collapsed position while the liquid adhesive cures. In this position, the adhesive on the tabs of each strip is normally juxtaposed to the strip from which the tabs are formed, as well as the strips to which the tabs are to be bonded. Accordingly, the fabrics

have had to have been selected such that the adhesive does not penetrate the fabric, so that the tabs from a first strip do not adhere to the strip from which they are formed, but only to the strips to which they are to be bonded; i.e., so that the interiors of the cells are not bonded closed.

This limitation on the method of forming shades shown in the patents mentioned above has been such that certain highly desirable "sheer" fabrics have not been usable. "Sheer" as used in this specification refers to fabrics which are highly translucent or are substantially transparent to visible light. Such sheer fabrics are normally relatively open weave, and are typically woven or knit of monofilament thread. When a bead of conventional adhesive sufficient to form a good bond when employed to form cellular blinds of typical non-sheer materials is placed on these open-weave sheer fabrics, the adhesive tends to penetrate the fabric, particularly if pressure is exerted thereon to ensure a good bond. Thus, if sheer materials are used in the normal manufacturing process, the inner walls of the cells tend mutually to adhere, which ultimately prevents the blind from opening properly. This difficulty has in fact prevented manufacture of cellular shades of sheer materials, especially fabrics, permeable to liquid adhesives, which would be highly desirable to many consumers.

Various methods have been tried for adhesive manufacture of such cellular shades using sheer materials. Bands of heavier material have been knit into the sheer material at the locations where the adhesive is applied, to slow passage of the adhesive therethrough. In most cases this material was very difficult to handle and roughly twice as expensive as the plain sheer material. Using a more viscous adhesive which does not penetrate the fabric also has proven unsatisfactory.

It appears that successful adhesive bonds between open-weave sheer fabrics, particularly those knit or woven of monofilament materials, require impregnation and solidification of the adhesive, wherein the adhesive actually penetrates through the fabric and then solidifies into a more or less solid mass encapsulating the fibers. If the adhesive is made too viscous it cannot penetrate the fabric. This is less of a problem with tightly woven conventional fabrics, where the fibers normally have many small "hairy" sub-fibers, which provide sufficient surface area to which the adhesive adheres that a good bond can be formed without encapsulation. To a considerable extent adhesives which do not permeate the fabric have been successfully employed to form cellular shades, e.g. according to the prior art patents discussed above, of opaque,

non-sheer fabrics. Open-weave sheer fabrics do not provide sufficient surface area to allow formation of a strong non-impregnating bond. Particularly where the fabric is knit or woven of monofilament thread which is not "hairy", the impregnation mode of adhesion is required to form an effective bond. In either case, when the impregnation occurs, the tabs tend to be bonded to both their own and the preceding and/or successive strips, preventing the blind from opening properly.

US-A-4673600 addresses this problem, and discloses how sheer materials can be formed into "honeycomb" or cellular shades and adhesively bonded by allowing the adhesive to cure while the cells are in the expanded state. This method is useful if quick-setting adhesives, e.g. hot melt adhesives, are used. However, this method poses certain constraints on the design of the cellular shade thus manufactured, and on the manufacturing processes employed.

Thus, the prior methods may be considered to include the steps of:

providing the sheet material in a strip form;
folding the strip material along parallel lines in a longitudinal direction corresponding to the longitudinal direction of the cells to be formed;
applying adhesive in liquid state to one or more areas of the strips of sheet material;
stacking said strips so as to bring together the parts of the strips of sheet material to be mutually adhered in direct contact to form the cells; and
allowing the adhesive to cure.

The present invention is characterised by the steps of:

positioning a strip of non-bonding material with respect to the folded strip of sheet material so that during subsequent steps said non-bonding material will prevent any portion of a particular strip of sheet material permeated with adhesive from adhering to any other portions of the same strip of sheet material in a manner which would prevent formation of a cell; and
removing said strips of non-bonding material after the adhesive has cured.

With such a method it is possible to manufacture cellular shade material of sheets or fabrics which are permeable to liquid adhesives, particularly sheer, essentially open-weave fabric materials, which may be knit or woven of monofilamentary thread.

The method of the invention can yield a reasonably priced product.

In order that the present invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings in which:-

Figure 1 shows a perspective view of a shade according to the invention in the open posi-

tion;

Figure 2 shows a corresponding perspective view of the shade according to the invention in the closed position;

Figure 3 shows a typical problem occurring where insufficient adhesive has been used to form a suitable bond between sheer materials;

Figure 4 shows a typical problem occurring where excessive adhesive has caused adjacent layers of sheer materials to adhere to one another;

Figure 5 shows a typical prior art construction using a non-sheer material;

Figure 6 shows an intermediate stage in the process of the method of the invention;

Figure 7 shows the shade of the present invention after manufacture in the open position;

Figure 8 shows the shade of the present invention in the closed position; and

Figure 9 shows an alternative embodiment of the shade according to the invention.

As indicated above, Figure 1 shows the shade of the invention in the shades-open position, that is, wherein the shade is drawn letting light flow unimpeded through an accompanying window (not shown), while Figure 2 shows the corresponding shades-closed position. As can be seen, the shade of the invention comprises a number of cells indicated generally at 10 which extend transversely to the window. In the Figure 2 configuration the cells are expanded, exhibiting a generally polygonal cross-section, while in the Figure 1 condition they are shown having been compressed by drawing a base member 12 upwardly. The arrangement of draw cords 14 shown controlling the motion of the base member 12 is strictly schematic and by no means a limitation on the invention. Preferably, as indicated, the cords pass through the centers of the cells and are invisible. In the expanded position of Figure 2 the cells each essentially retain static air masses, which serve as very useful window insulation. The open ends of the cells may move within U-shaped vertical end caps to assist in retention of air therein.

As can be appreciated, the requirement therefore is for a cellular structure which can be readily expanded from the compressed configuration of Figure 1 to the relatively expanded configuration of Figure 2, all without undue mechanical complexity or expense of manufacture and while retaining a pleasing appearance.

Economical manufacture of such a shade is best accomplished by adhesively joining tabs formed of the edges of strips of fabric material corresponding to the cells to corresponding portions of preceding and/or succeeding strips.

Figure 5 shows a conventional prior art construction, which may be carried out according to the teachings of US-A-4450027, in which succes-

sive strips of fabric 20 have been creased to define tabs 20a and central portions 20b. The tabs 20a are adhesively bonded to the central portions 20b by conventional adhesives as at 22. The fabric used in this prior art embodiment is not sheer and is essentially impermeable or only slightly permeable to the adhesive, such that the shade material can be manufactured simply by putting a bead of adhesive on the tabs 20a and stacking the strips such that they are aligned with the central body portions 20b of successive strips. After the adhesive has set, the material of the shade is essentially completed.

According to the present invention, as described above, it was desired to employ a sheer fabric material which is typically translucent or transparent in the structure of Figure 5. Such materials tend to be of open weave construction to let light pass through freely and are commonly knit or woven of monofilament synthetic fibers. Such monofilament fibers are very smooth-surfaced, such that they do not present small hairs or sub-fibers to which the adhesive can bond. The open weave fabrics in general comprise relatively few fibers. Therefore, in order to form a suitable bond, the adhesive must penetrate the sheer fabric, such that when it hardens into a mass, it encapsulates the fibers of the fabric.

It has been found that in doing so, using the conventional construction of Figure 5, and using the adhesives used successfully with non-sheer opaque fabrics, the adhesive tends to bond the tabs 20a of each strip not only to the central portions 20b of the successive strip, as desired, but also to the central portion of the same strip, which prevents the shade from being opened. Figure 4 shows this schematically. If an adequate amount of adhesive is provided to form a substantial bond, some of it is extruded through the open weave of the sheer material when the strips are stacked to form the bond. A string of adhesive 26 then tends to join the tabs 20a and the central portions 20b of each strip, which prevents the shade from opening properly. Figure 3 shows a typical result when a smaller amount of adhesive is used to try to avoid this problem. Essentially the adhesive bonds which are formed are very narrow, as shown at 24, and tend to break, or are nonexistent; either condition leads to immediate failure of the shade.

For similar reasons, modification of the adhesive viscosity alone is not sufficient to solve this problem. If the adhesive is made thicker, it does not penetrate and encapsulate the fabric, if too thin, it tends to diffuse through the fabric and does not form an adequate bond.

According to the invention, and as shown in cross-section in Figure 6, a strip 28 of non-bonding

material, that is, a material which does not bond to the adhesive used, is interposed between the tabs 20a and the central portions 20b of the sheer fabric used. The adhesive is then applied as indicated at 32 to the upper surfaces of the tabs, and the assembly made as previously. The adhesive will normally penetrate the tabs 20a and central portions 20b, but does not bond to the non-bonding strips 28. When the adhesive has cured, the non-bonding strips 28 can be removed.

Figures 7 and 8 show the shade formed of a sheer material according to the invention after removal of the non-bonding strips 28. As can be observed, the adhesive 30 tends to penetrate the central portions 20b of the strips but has been prevented from adhering to the corresponding tabs 20a by the presence of the non-bonding material 28 as shown in Figure 6. When the shade is opened, as shown in Figure 8, the adhesive 30 then extends above the central portion of each strip, but does not interfere with the proper operation of the shade.

Figure 9 shows an alternative form of "honeycomb" or cellular shade, as described for example in US-A-4676855, which can be manufactured of adhesive-permeable sheer materials according to the method of the invention. In this case, the basic member of the cell is a strip of material 40 creased to define an overall Z-shape, with tabs 40a on either side of a central section. The tabs of each strip are joined to the central portions of the preceding and succeeding strips. If the strips 40 are formed of a glue-permeable material, adhesive is applied, and the strips stacked, the tabs 40a will tend to be adhesively bonded to the strips from which they are formed; e.g., tab 40a will tend to be bonded to the same strip 40 at a point 40b. According to the invention, strips 42 of a non-bonding material are inserted into the interior spaces of the cells before the strips are stacked, to prevent the interiors of the cells from thus being adhesively bonded closed. Strips 42 are removed when the adhesive has at least partially cured. The method of the invention is similarly applicable to other honeycomb-configuration cellular shades.

The principal steps in the practice of the invention are simply the formation of the strips by creasing them to define the tabs and central portions of cell precursors, insertion of the non-bonding material, deposition of beads or droplets of liquid adhesive along the tabs or on the corresponding mating portions of the strips, and stacking a large number of these assemblies to form the shade precursor. After exposure of the shade precursor to suitable conditions for cure of the adhesive, the strips of non-bonding material are simply removed, yielding the completed structure.

According to the invention, the preferred ma-

terial for the non-bonding strips may be a polyethylene plastic to which the adhesive does not bond. A nonstick silicone coating on the strips may be desirable in connection with certain combinations of adhesives and polyethylenes or other materials for the strip. Numerous other appropriate materials will occur to those of skill in the art. Various sorts of adhesives such as water activated catalyst adhesives, hot melt glues, moisture-curing hot melts and various silicones are all suitable. Adhesives applied dry and activated by heating after stacking of the strips, with or without application of pressure, may also prove useful in the future. It will be appreciated that the key is that the adhesive must penetrate the fibers of the fabric to fully encapsulate them, forming a suitable bond, and must be sufficiently viscous to remain in place during the various processing steps.

Removal of the non-bonding strips 28 can be feasibly accomplished simply by laborers using their fingers, but obviously more mechanized approaches may also be economically feasible in some circumstances. It has been found that certain desirable fabrics are sufficiently permeable to air that it is not satisfactory to simply blow the strips of non-bonding material out from the cells thus formed.

Claims

1. A method of manufacture of expandable and collapsible cellular shade material comprising a number of superimposed longitudinal hollow cells, said cells each being formed of sheet material, said method comprising the steps of:

providing the sheet material in a strip form;

folding the strip material along parallel lines in a longitudinal direction corresponding to the longitudinal direction of the cells to be formed;

applying adhesive in liquid state to one or more areas of the strips of sheet material;

stacking said strips so as to bring together the parts of the strips of sheet material to be mutually adhered in direct contact to form the cells; and

allowing the adhesive to cure;

characterised by the steps of:-

positioning a strip of non-bonding material with respect to the folded strip of sheet material so that during subsequent steps said non-bonding material will prevent any portion of a particular strip of sheet material permeated with adhesive from adhering to any other portions of the same strip of sheet material in a manner which would prevent formation of a cell; and

removing said strips of non-bonding material after the adhesive has cured.

2. A method according to claim 1, charac-

terised in that said folding step comprises creasing each said strip lengthwise in order to form tabs of fabric on either side of a central portion of the strip, defining a cell precursor, said cell precursors being bonded to one another to form the shade material.

3. A method according to claim 2, characterised in that said cell precursors are generally U-shaped in cross-section.

4. A method according to claim 2, characterised in that said cell precursors are generally Z-shaped in cross-section.

5. A method according to any preceding claim, characterised in that said sheet material is permeable to liquid adhesive.

6. A method according to claim 5, characterised in that said sheet material is a sheer fabric.

7. A method according to any preceding claim, characterised in that said stacked strips are subjected to pressure to ensure that said adhesive fully bonds said tabs to said adjacent central portions.

8. A method according to any preceding claim, characterised in that heat is applied to cure said adhesive.

9. A method according to any preceding claim, characterised in that in that the cells are expanded to permit removal of said strips of non-bonding material.

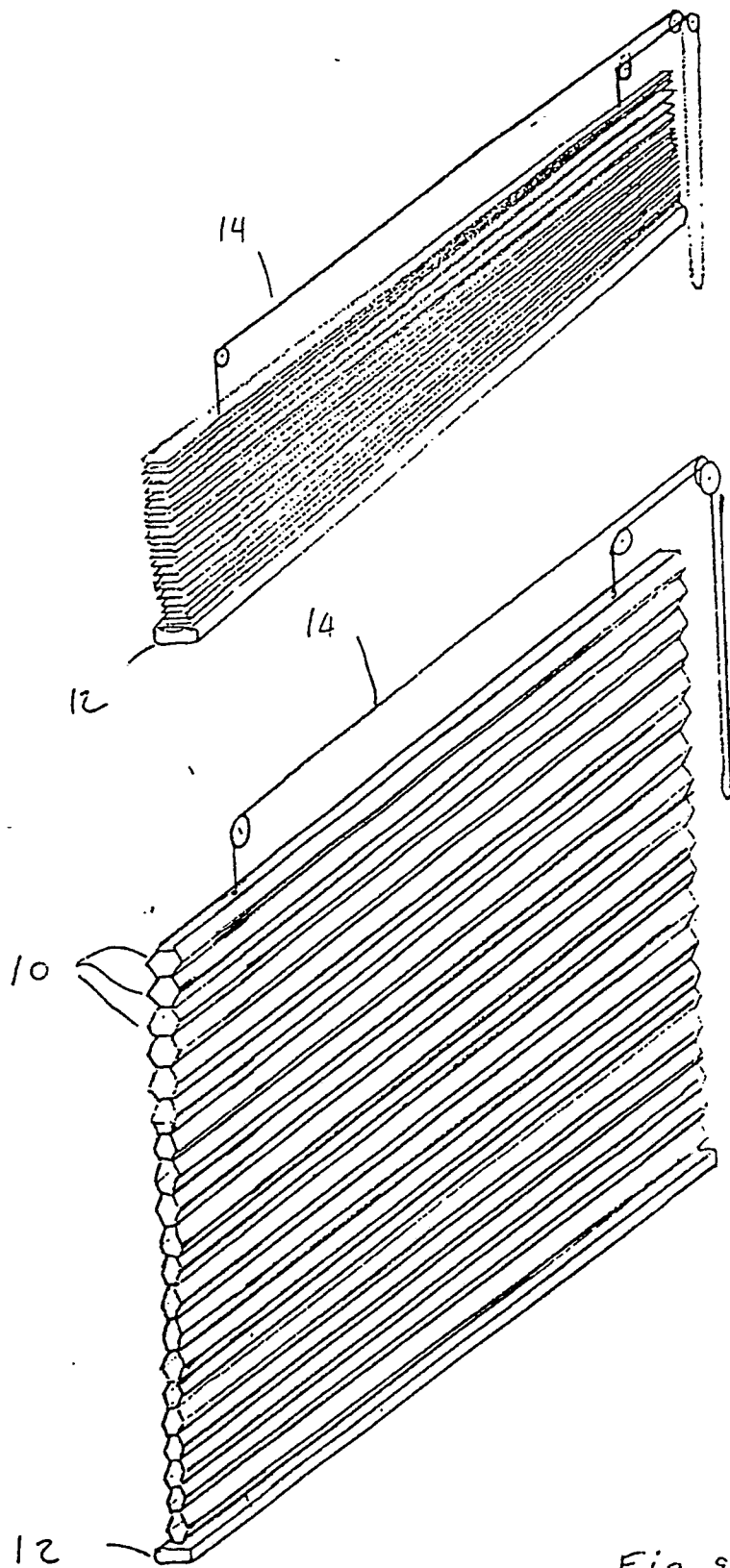
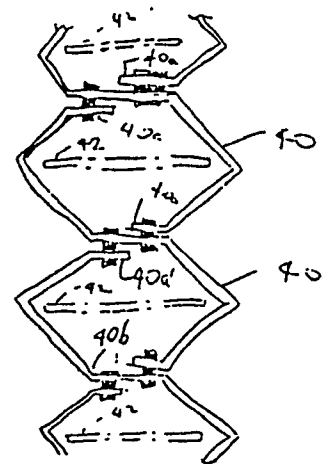


FIG. 1

FIG. 2

Fig. 9



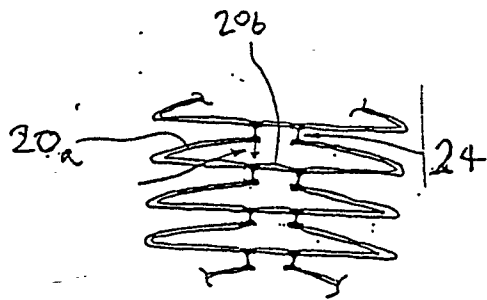


FIG. 3

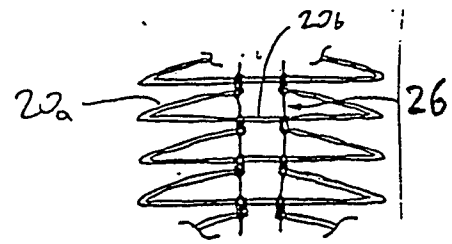


FIG. 4

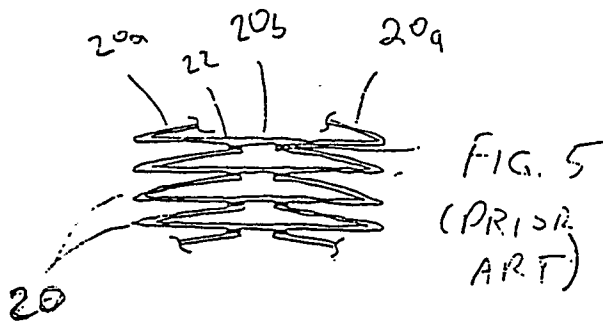


FIG. 5
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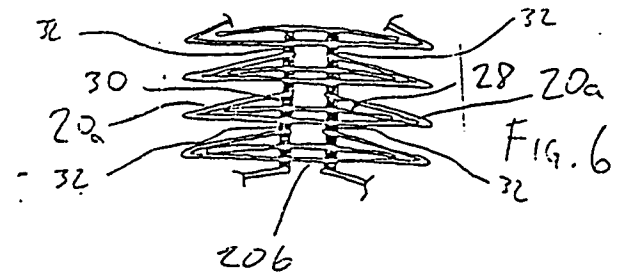


FIG. 6

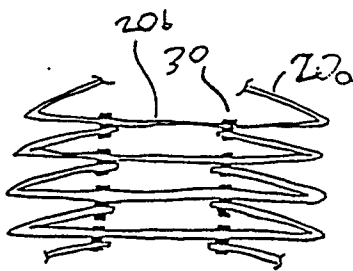


FIG. 7

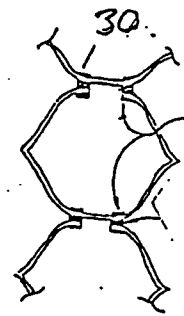


FIG. 8