(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 004 455**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **01.12.82**

(51) Int. Cl.³: **A 47 H 23/00**

(21) Application number: **79300444.1**

(22) Date of filing: **21.03.79**

(54) **Selectively collapsible and expandable curtain and its method of manufacture.**

(30) Priority: **21.03.78 FI 780877**
21.03.78 FI 780878
13.09.78 US 942087

(43) Date of publication of application:
03.10.79 Bulletin 79/20

(45) Publication of the grant of the patent:
01.12.82 Bulletin 82/48

(84) Designated Contracting States:
BE CH DE FR IT LU NL SE

(56) References cited:
CH - A - 476 482
DE - B - 1 213 217
GB - A - 935 822
US - A - 2 234 058
US - A - 2 734 843
US - A - 2 848 132
US - A - 4 019 554

(73) Proprietor: **Suominen, Heikki Samuli**
Petsamonk 14
Tampere (FI)

(72) Inventor: **Suominen, Heikki Samuli**
Petsamonk 14
Tampere (FI)

(74) Representative: **Rushton, Ronald et al,**
89 St. Peters Street
St. Albans Hertfordshire AL1 3EN (GB)

EP 0 004 455 B1

Courier Press, Leamington Spa, England.

Selectively collapsible and expandable curtain and its method of manufacture

This invention relates to collapsible and expandable curtains of the kind having in their expanded state a pre-determined width and a pre-determined height and comprising a plurality of expandable tubes, the longitudinal axis of each of which extends in the direction of curtain width. Such curtains can be used as thermally insulating curtains over openings such as doors, windows and the like. The invention also relates to a method of producing such curtains from thin-film material.

Curtains of this kind, also with methods of making them, are known in the prior art. One such curtain is found in U.S. Patent No. 4,019,554 and a method for making that curtain is found in U.S. Patent No. 3,963,549. However, such prior art curtains require relatively narrow tubular foils of 5 to 7.5 cm (2 to 3 inches) in diameter and use a single band of adhesive between adjacent foils. As winding speed is limited by the rate at which adhesive can be applied to the foil, the prior art method is quite slow.

A beehive like wall structure with multiple cells for insulating purposes is illustrated in Finnish Patent No. 23939 dated May 31, 1950. The structure is made by gluing thin plates of paper to each other and to outside surface boards at areas of contact on alternating sides of the plates. Although the cellulated structure can be pressed together for transporting and expanded for installation, the insulating board has relatively few cells in each row and those cells could be compressed and expanded only a few times without deterioration of the wall material. According to this patent, the area of glued contact between adjacent plates must be limited to a maximum of 1/3 of the width of the air cell, presumably to minimize the severe distortion that would occur in the walls of the partial cells adjacent to each surface board. Since the width of the glued area is transverse to the direction in which insulation is desired, the air cells must be fully expanded for effective insulation.

In U.S. Patent No. 2734843 is disclosed a method for producing unexpanded blocks of expandable honeycomb. The method described includes the steps of applying longitudinally extending spaced parallel lines of adhesive to face surfaces of web material, cutting the web material into completely separated flat sheets of uniform size and thereafter adhering said sheets to one another with the obverse side of each sheet adhered to an adjacent sheet by a plurality of spaced parallel lines of adhesive and with the reverse side adhered to an adjacent sheet by lines of adhesive disposed in staggered parallel relationship to the said lines of adhesive by which its obverse side is adhered. Since the web material is cut into separated flat sheets which are thereafter stacked and then adhered to one another along said parallel lines, the method is quite slow.

Such disadvantages and limitations of the prior art are overcome by method of the present invention which permits, as will become apparent, the production of a curtain having a plurality of tubes not only in the direction of curtain height but also in the direction of curtain thickness. While the insulating properties of a curtain having a one tube thickness are significant and the method of the invention can be used to produce such a curtain, much better insulation can be provided by a plurality of tubes across the curtain thickness.

According to one aspect of invention there is provided a method of manufacturing a selectively collapsible and expandable curtain having in its expanded state a predetermined width and a predetermined height and comprising a plurality of expandable tube the longitudinal axis of each of which extends in the direction of curtain width, said method comprising the steps of:—

a. winding about a forming member a flexible thin film material so as to form on said member a plurality of super-imposed layers of said material, the forming member being chosen to have a peripheral length at least as long as said predetermined curtain width;

b. adheringly securing each said layer to one adjacent contacting layer on the forming member along at least one longitudinally extending first band and to the other adjacent contacting layer along a plurality of uniformly spaced longitudinally extending second bands disposed one on either side of the or each said first band such that a plurality of superimposed tubes are formed one atop the other on said forming member, each tube when fully expanded having a substantially rectangular cross-section with top and bottom walls whose widths are defined by an opposing pair of said bands on upper and lower adjacent layers and sidewalls whose heights are defined by upper and lower side sections comprised of the portions of said thin film material lying between said pair of opposing bands and a pair of transversely spaced bands joining said upper and lower adjacent layers on either side of said opposing bands;

c. continuing said winding step until the combined heights of said superimposed tubes in their fully expanded state are sufficient to provide substantially said predetermined curtain height;

d. transversely cutting said superimposed layers to permit removal thereof from said forming member.

The method of the invention is much simpler and faster and more economical than heretofore known.

In practicing the method of the invention,

two or more lengths of the thin film material from different sources may be wound on said forming member simultaneously in an interleaved manner, the material from each source being passed through a station at which adhesive is applied before being wound on said forming member.

In carrying out the method of the invention the number of said bands may be such that a plurality of sets of said superimposed tubes are formed adjacent one another transversely across said forming member. With such a number of bands the method of the invention may include the step of cutting at least one intermediate set of said superimposed tubes longitudinally along said opposing bands to form at least two separate curtains each having said predetermined width and said predetermined height in its expanded state. For a single column of tubes, the minimum aggregate number of said first and second bands across the width of the thin film material is 3, additional bands being provided depending upon the number of adjoining tube columns desired. The number of layers wound upon the forming member is chosen to yield the desired number of tubes in each column, which in turn determines curtain height.

As used in this specification, a column refers to tubular units aligned with curtain height and not to successive units in the direction of curtain thickness.

The curtain is extended to its full height when the tubes are fully expanded. The tubes can be collapsed in accordion fashion along fold lines formed by the side bands of contact. When flattened, the height of the tube stack approximates the total thickness of the superimposed layers of film material. To facilitate manipulation of the curtain, the top may be secured to a mounting slat and the bottom to a second slat movable relative to the top slat. Pull cords and other conventional hardware may be added to the slats to mount the curtain and selectively collapse and expand the tubular units in a manner similar to venetian blinds.

Curtains of varying height can be made depending upon the number of layers of thin film material superimposed upon the forming member. Multiple curtains of less height than originally formed can also be made by cutting the linear column or columns of tubes longitudinally in a direction transverse to curtain height.

The composition of the strip material may be selected to yield light admitting tubes (transparent or translucent), light absorbing tubes (black or other dark colors), or light reflecting tubes. A pigment material may also be added to the adhesive used so that the bands of contact have similar light controlling characteristics. With light controlling bands, the degree of light admitted, absorbed or reflected can be controlled by tilting the upper and lower-most strips by means of attached slats which will in turn produce a corresponding tilt of the longitudinally extending bands in a manner similar to the louvers or slats of a venetian blind. Similar light controlling characteristics can be obtained by applying appropriate coatings to one or more sections of each tube wall.

A curtain produced according to the invention has wide utility as a thermal insulating curtain and when extended vertically can serve as a substitute for storm windows, storm doors and the like. The curtain can of course be oriented in a horizontal plane rather than the normal vertical plane and pulled taut to serve as insulation beneath a floor or above a ceiling.

Numerous other objects and advantages of the invention will be apparent to those skilled in the art from this Specification and the attached drawings.

Brief Description of the Drawings

The invention, both as to its structure and method of manufacture, may be further understood by reference to the detailed description below taken in conjunction with the accompanying drawings in which:

Figure 1 is a fragmentary perspective view of a curtain made in accordance with the method of the invention having a single column of superimposed tubes.

Figure 2 is a perspective view of an embodiment of the invention wherein the curtain has a plurality of tube columns in the direction of curtain thickness.

Figure 3 is a perspective view of the curtain of Figure 2 showing a portion collapsed into a stack of superimposed tubes and illustrating means for mounting and selectively collapsing and expanding the curtain.

Figure 4 is a perspective view of an apparatus for making the tubular curtain according to the method of the invention.

Figure 5 is an end view of the tubular curtain as removed from the apparatus of Figure 4 and straightened into a linear stack of fully collapsed tubular units.

Figure 6 is an end view of the tubular curtain of Figure 1 as cut from the stack of Figure 5 along cut line Y' and partially expanded.

Figure 7 is an end view showing the curtain of Figure 6 in its fully expanded state.

Figure 8 is an end view of the tubular curtain of Figure 2 as cut from the stack of Figure 5 along cut line Y and partially expanded.

Figure 9 is an end view showing the curtain of Figure 8 in its fully expanded state.

Detailed Description of the Invention

One construction of the tubular curtain, which can be produced by the method of the present invention, is generally designated 10 in Figure 1 of the drawings. The curtain is comprised of a column of tubes C1 which are superimposed one atop the other in the direction of curtain height as best illustrated in Figures 1 and 7. Each tube has the same

structure as tube 12 which will be described in detail. The tube 12 comprises an upper strip 14 and a lower strip 15, each strip having two longitudinally extending edges. The edges of one strip abut the corresponding edges of the other strip along bands of contact 16 and 17 on opposite sides of the tubular cavity. The portions of each strip within the bands of contact 16 and 17 are adheringly secured together by appropriate means compatible with the strip material, preferably an adhesive. With reference to Figure 7, upper strip 14 has two side sections 14a and 14c and a mid section 14b, and lower strip 15 has two side sections 15a and 15c and a mid section 15b. Tube 12 is superimposed atop an underlying tube 18 and adheringly secured thereto along a band of contact coextensive with lower mid section 15b. An overlying tube 19 is superimposed atop tube 12 and adheringly secured thereto along a band of contact coextensive with upper mid section 14b.

Although curtain C1 can be hung directly by attachment of uppermost strip 21 to an overhead structure, it is preferably provided with a mounting slat 23 and a movable slat 24 of a much more rigid material, such as wood or metal. The slats may be adjusted relative to each other for collapsing and expanding the curtain by means of a drawstring or pull cord 25 which passes through a series of apertures 26 in the slats and intervening tubes of the curtain. The end of cord 25 is knotted or otherwise secured at 27 to slat 24 so that the latter can be selectively adjusted by manipulation of the cord. Upper slat 23 can be used for mounting the curtain and pull cord 25 arranged for manipulation in the manner described below for the embodiment of Figure 3.

In the preferred construction, the length of the slats corresponds substantially to the width of the curtain and the width of the slats corresponds substantially to the width of the thin-film strips from which the curtain is made. The full length and width of the strips are thereby sandwiched between the slats when the tubes are collapsed. Accordingly, when fully expanded, the transverse width of the tubes is substantially less than the width of the slat. In the construction of Figure 1, the side sections of each tube have a width of about one-half the width of mid sections such that the width of slats 23 and 24 is about twice that of the mid sections. For purposes of illustrating the effect of changing those dimensions, different relative dimensions of the corresponding parts are shown in Figure 7. Here the side sections are approximately equal to the mid sections. Corresponding slats should therefore have a width about three times the width of the mid sections (if 14a = 14c = 14b = 2.5 cm (1 in), then 14a + 14b + 14c = 7.5 cm (3 in)).

With further reference to Figure 7, the column C1 as formed has loose side sections 21a and 21c and the loose ends may be cut off or used to secure the top and bottom of the curtain to slats 23 and 24, respectively.

The tubular cavities defined by the upper and lower tube strips contain essentially still or dead air since any transverse movement of air is prevented. Accordingly, where a high degree of thermal insulation is desired, the tubes should be made of an impermeable material of low heat conductivity. The tube material should also be sufficiently flexible for the tubes to fully expand under their own weight and the weight of lower slat 24 and of a durability allowing repeated flexure without cracking or other deterioration. A good grade of thin polyethylene or equivalent plastics sheeting will satisfy these requirements.

Each sidewall of the tubular cavity is a composite of two side sections, one from the upper and the other from the lower strip. The bands joining those two sections form fold lines along each side of the tubular units making up the curtain. The double wall thickness and the adhering material at the sideband juncture provide reinforcement of the tube structure at the point of greatest stress and wall flexure.

An embodiment of curtain in accordance with the invention is illustrated in Figures 2, 3 and 9, the overall structure being generally designated 30 and the curtain portion thereof C2. Curtain C2 is comprised of a plurality of tube columns 31, 32, 33, 34 and 35, one adjoining the other in the direction of curtain thickness. Each column is comprised of a plurality of superimposed tubes having the same structure as the tubes in row C1 of Figure 1.

The bands of adhering contact between superimposed strips have been assigned a designation corresponding to the bands of adhesive applied when making the curtain as described later with reference to Figure 4. Referring now to Figures 2 and 9, the superimposed tubes of column 31 are joined together by bands of contact A1, the tubes of column 32 by bands B2, the tubes of column 33 by bands A2, the tubes of column 34 by bands B3, and the tubes of column 35 by bands A3. These bands form the mid sections of the corresponding strips. The upper and lower side sections of tubes 31 are joined together on opposite sides of each tubular cavity by bands of contact B1 and B2, the side sections of tubes 32 by bands A1 and A2, the side sections of tubes 33 by bands B2 and B3, the side sections of tubes 34 by bands A2 and A3, and the side sections of tubes 35 by bands B3 and B4. As evident from the foregoing, those bands intervening between the outer vertical walls 40 and 41 of curtain C2 serve both as a band of contact for the superimposed tubes and as a band of contact joining the side sections of the tubes in an adjacent column. Bands inside of outer columns 31 and 35 join the side sections of two adjacent columns, one at each edge of the adjoining band. For example, band B2

adheringly secures superimposed tubes 32 one atop the other in the direction of curtain height and also adheringly secures the upper and lower side sections on one side of tubes 33. As explained with reference to curtain C1, the bands adjoining the side sections of each tube define fold lines for the collapse and expansion of that tube and the curtain as a whole. The tubes therefore collapse into a symmetrical stack S when compressed together as illustrated in Figure 3. In Figure 3, there is shown a pair of pull cords 50 and 60 and corresponding pulley mechanisms 51 and 61 for manipulating the multi-column tubular curtain C2. Pull cord 50 passes over a pulley 54 and down through a series of apertures 52 in a support slat 42, a movable slat 44 and the intervening tubes of center tube column 33. The end of pull cord 50 is secured to the movable slat 44 by a knot 53 or other fastening means as seen in Figure 2. Pulley 54 is rotatably mounted upon a shaft 55 supported by a pair of brackets 56—56 which may be secured to mounting slat 42 by screws 57 or the like. In a similar manner, pull cord 60 passes over a pulley 64 and through apertures 62 and is secured to movable slat 44 by knot 63. Pulley 64 is rotatably mounted upon shaft 65 supported by a pair of brackets 66—66 which are secured to slat 42 by screws 67 or the like.

The slat 42 may be mounted in a window, doorway or other opening by means of eyebolts 68 or other mounting brackets which may be positioned at each corner of the mounting slat as illustrated in Figure 3. Mounting eyebolts 68 cooperate with hooks or other cooperating fasteners (not shown) as can be mounted along the top of a frame around the opening or on adjacent structure, such as a ceiling.

The manner in which curtain C2 is attached to end slats 42 and 44 will now be described. With reference to Figure 9, curtain C2 is preferably made without any adhering material on the upper surface of uppermost strip 38 or on the lowermost surface of lowermost strip 39. This leaves a series of unadhered upper sections 38a, 38b, 38c and 38d and unadhered lower sections 39a, 39b, 39c and 39d. These may be left or cut as illustrated by the cut line K through the lower sections. Although the end strips can be secured to the slats in the shape shown in Figure 9, it is preferable to attach those strips in a flattened state so that a neatly folded stack S will be produced when the curtain is collapsed. Before attachment, the side sections 38a and 38d and 39a and 39d are pulled transversely apart in the direction of curtain thickness causing the uppermost and lowermost tubes of columns 32 and 34 and some adjacent tubes to flatten as seen in areas D and D′ of Figure 2. The flattened upper and lower surfaces are then secured to the corresponding slats by an appropriate means of attachment, such as a layer of adhesive. Staples, nails and similar means of physical attachment can also be employed. When the curtain is so secured, the distortion in areas D and D′ is relatively minor and dampens out within a few tubes of the end of each column so that the major intervening portion of the curtain expands into a symmetrical undistorted shape of attractive appearance.

The width of the side sections and mid sections of each tube will again determine the width of the slats to be used with the curtain. The slat width is, of course, also a function of the number of tube columns making up the curtain. Preferably, the number of columns and the section widths are chosen so that the collapsed thickness does not exceed twice the fully expanded thickness of the curtain. When the curtain consists of five tube columns as shown, the width of each side section should be about 1/2 the mid band width. Thus if the mid band width is 2.5 cm (1 in) and the side section width is 1.25 cm (1 in), the thickness of the fully expanded curtain will be about 12.5 cm (5 in) and the slat width should be about 20 cm (8 in) (5 mid bands = 12.5 cm (5 in), 6 side sections = 7.5 cm (3 in) and 12.5 cm (5 in) + 7.5 cm (3 in) = 20 cm (8 in). These relative dimensions approximate those illustrated in Figures 2 and 3. For purposes of illustrating the effect of those dimensions, the side sections shown in Figure 9 have a width about equal to that of the mid bands. If the outermost bands B1 and B4 are to be included between the slats, the slat width should be increased by those increments.

The method of making the tubular curtain of the present invention will now be described. With reference to Figure 4, a first supply roll 80 and a second supply roll 90 provide continuous lengths 82 and 92 of thin-film material, preferably thin sheets of plastics. Length 82 passes through an upper adhesive station A comprised of a guide roller 83 for tensioning and directing the length over a series of applicator wheels M1, M2, M3 and M4 mounted for rotation upon a shaft 85. The applicator wheels M contact the underside of length 82 and underlying those wheels is a pick-up roller 86 mounted for rotation partially submerged in an adhesive contained in a trough 88.

Length 92 passes through a lower adhesive station B comprised of a guide roller 93 for tensioning and directing the length over a series of applicator wheels N1, N2, N3, N4 and N5 mounted for rotation upon a shaft 95. The applicator wheels N contact the underside of length 92 and underlying those wheels is a pick-up roller 96 mounted for rotation partially submerged in an adhesive contained in a trough 98. After passing through the adhesive stations, length 92 is interleaved beneath length 82 and the two lengths wound simultaneously upon a forming member, generally designed F. It is to be understood that the supply rolls, the rollers and wheels of the adhesive stations, and the forming member are suitably mounted for

rotation relative to each other, and that the forming member is driven by conventional machinery to wind the continuous lengths 82 and 92 thereon in interleaved fashion. Guide rollers 83 and 93 maintain sufficient tension on the lengths to produce a flat even stack of superimposed layers around the periphery of the forming member.

The forming member is shown as a cylindrical drum 100 for purposes of illustration. The forming member may take other shapes capable of providing a continuous winding surface about their periphery. For example, the member may be comprised of an endless belt supported upon two or more drums or rollers as shown in U.S. Patent No. 3,963,549.

The manufacturing process is initiated by detachably fastening the end of length 92 to the periphery of the forming member F by means of clamping devices (not shown) so that movement of the periphery in the direction of arrow Q will pull the length from the supply roll and through adhesive station B. Length 92 is attached to the forming member approximately at location T. The end of length 92 is pulled around once and then the end of length 82 is attached at approximately the same location by means of a second clamping device (not shown). Adhesive stations A and B are then placed in position for application of the adhesive to each length. As length 82 is pulled through station A, roller 86 picks up adhesive from trough 88 and supplies it to the set of applicator wheels M which in turn apply the adhesive to the underside of the length in a plurality of narrow transversely spaced bands extending longitudinally along the strip length, bands A1, A2, A3 and A4 being applied by applicator wheels M1, M2, M3 and M4, respectively.

As length 92 is pulled through station B, roller 96 picks up adhesive from trough 98 and supplies it to the set of applicator wheels N which in turn apply the adhesive to the underside of the length in a plurality of narrow transversely spaced bands extending longitudinally along the length, bands B1, B2, B3, B4 and B5 being applied by applicator wheels N1, N2, N3, N4 and N5, respectively.

After application of the adhesive bands, the lengths are wound in interleaved fashion around the periphery of the forming member to produce bands of contact adheringly securing each layer of material to the next superimposed layer. The upper set of adhesive bands A is offset transversely relative to the lower set of adhesive bands B as viewed from left to right in Figures 4 and 5. This offset between adhesive bands A relative to adhesive bands B staggers the bands of adhering contact between successive layers. Thus, the transverse distance between adjacent bands on opposite sides of the same layer substantially defines the width of the unadhered side section of each tube wall. It is this staggered relationship that produces the expanded curtain structures shown in Figures 6 through 9.

The distance around the periphery of the forming member is at least equal to the width of the curtains to be made. When the number of layers on the forming member will produce the desired height of the curtain in its expanded state, the winding operation is stopped and the wound stack of tubes cut transversely along a line X—X′ shown in Figure 4. A single cut produces a curtain width equal to the circumferential distance. Multiple cuts corresponding to the number of curtain width multiples making up the circumferential distance will produce the corresponding number of curtains. The first cut line X—X′ is preferably over the location at which adhesive was first applied to the first layer 82. The distance between that location and the point of attachment T is determined by the distance between the adhesive stations and the point of attachment, that being the distance the adhesive must travel before interlamination occurs.

After severing the layers along line X—X′, the winding is removed. Since no adhesive was placed on the underside of the first layer of material, there is no adhering contact between that layer and the underlying supporting surface and the winding is easily pulled away from the forming member after cutting. Upon removal, the layers are straightened into a linear stack. With reference to Figure 5, a plurality of adjoining tube columns 31, 32, 33, 34, 35, 36 and 37, each comprised of a plurality of tubes superimposed one atop the other, are thereby produced.

The number of tube columns produced is such that a plurality of curtains of the same height and width but having differing numbers of adjacent columns can be made simultaneously as illustrated by the cut lines Y and Y′ of Figure 5. Two cut lines are employed to minimize the width of resulting side bands B4 and B4′. Longitudinal cuts are preferably made through the adhering bands of contact to maintain the integrity of tube walls on both sides of the cut line. The two resulting segments form the curtain C1 of Figure 6 which has a single column of tubes and the curtain C2 of Figure 8 which has five columns of tubes, one adjoining the other in the direction of curtain thickness.

The segment of Figure 6 is shown fully expanded in Figure 7. The segment of Figure 8 is shown fully expanded in Figure 9.

The interlaminated layers are rapidly produced on the forming member through the use of lengths of material from multiple sources. Although multiple adhesive stations are shown in Figure 4, it is to be understood that a single adhesive station may apply bands to each side of a single length with the bands on one side being spaced transversely in staggered relation to the bands on the opposite side. Where adhesive bands are applied on opposite sides of the same length, a length without adhesive is

interleaved with it to produce the staggered tubular structure illustrated in the drawings. As another modification, a single length can be wound with adhesive bands applied alternately to opposite sides in the staggered relationship required, each set of bands extending for one revolution of the forming member.

The uppermost and lowermost strips of the curtain may be of a sheet material thicker than the intervening strips forming the body of the curtain. Similarly, the outer edges of each strip may be thicker than the central portion. Such increases in thickness would provide reinforcement for those parts of the curtain subject to greatest stress and the most wear and tear.

Claims

1. A method of manufacturing a selectively collapsible and expandable curtain having in its expanded state a predetermined width and a predetermined height and comprising a plurality of expandable tubes the longitudinal axis of each of which extends in the direction of curtain width, said method comprising the steps of:—

a. winding about a forming member (F) a flexible thin film material (82, 92) so as to form on said member a plurality of superimposed layers of said material, the forming member being chosen to have a peripheral length at least as long as said predetermined curtain width;

b. adheringly securing each said layer to one adjacent contacting layer on the forming member along at least one longitudinally extending first band (A) and to the other adjacent contacting layer along a plurality of uniformly spaced longitudinally extending second bands (B) disposed on either side of the or each said first band (A) such that a plurality of superimposed tubes are formed one atop the other on said forming member (F) each tube when fully expanded having a substantially rectangular cross-section with top and bottom walls whose widths are defined by an opposing pair of said bands (A or B) on upper and lower adjacent layers and sidewalls whose heights are defined by upper and lower side sections (14a, 15a and 14c, 15c) comprised of the portions of said thin film material lying between said pair of opposing bands (A or B) and a pair of transversely spaced bands (B or A) joining said upper and lower adjacent layers on either side of said opposing bands;

c. continuing said winding step until the combined heights of said superimposed tubes in their fully expanded state are sufficient to provide substantially said predetermined curtain height;

d. transversely cutting said superimposed layers to permit removal thereof from said forming member.

2. The method of claim 1 and which further includes the step of applying an adhesive composition to said flexible thin film material (82, 92) before it is wound about said forming member so as to form said first and second bands (A, B).

3. The method of claim 1 or 2 wherein the number of said bands (A, B) is such that a plurality of sets (31 to 37) of said superimposed tubes are formed adjacent one another transversely across said forming member (F).

4. The method of claim 3 and including the step of cutting at least one intermediate set (36) of said superimposed tubes longitudinally along said opposing bands (A or B) to form at least two separate curtains each having said predetermined width and said predetermined height in its expanded state.

5. The method of claim 4 in which said adhering and cutting steps are such that each of the tubes in said separate curtains has a length substantially equal to said predetermined curtain width and said tube length is greater than the thickness of at least one of said separate curtains.

6. The method of claim 4 or 5 which further includes the step of attaching to said separate curtains means for selectively adjusting the distance between the uppermost and the lowermost of said superimposed tubes so as to selectively expand and collapse said superimposed tubes in the direction of said predetermined curtain height.

7. The method of any preceding claim in which a plurality of said layers are wound onto said forming member (F) simultaneously and in an interleaved manner from a plurality of sources (80, 90) of said thin film material (82, 92).

8. The method of claim 3 in which said first bands (A) and the ones of said second bands (B) intermediate of the width of said thin film material are of equal width and equally spaced across the width of said layers to provide tubes of uniform height and uniform width.

9. A selectively collapsible and expandable curtain having thermal characteristics in its expanded state, said curtain having a predetermined width and a predetermined height in its fully expanded state and comprising a plurality of rectangular collapsible first tubes (31), the longitudinal axis of each of which extends in the direction of curtain width and which are superimposed one atop the other in the direction of curtain height, characterised in that a plurality of collapsible second tubes (32) superimposed one atop the other in the direction of curtain height lengthwise adjoin said first tubes (31) in the direction of curtain thickness and further characterised in that each of said tubes (31, 32) is formed from an upper strip (14) and a lower strip (15) secured together by bands (A, B) of adhering contact between said upper and lower strips (14, 15) on opposite sides of the tubular cavity and each of said tubes (31, 32) is secured to the next superimposed tubes (31, 32) above and below it by second bands (B, A) of adhering contact which

define the width of the tubes in their fully expanded state and still further characterised in that the upper strip (14) of one of said first tubes (31) extends laterally to form the lower strip (15) of one of said second tubes (32) and the upper strip (14) of said one of said second tubes (32) is formed by a lateral extension of the lower strip (15) of the next superimposed first tube (31) above said one first tube (31).

10. The curtain of claim 9 which includes means (42, 44, 50, 60) for mounting said curtain and for selectively expanding and collapsing said tubes.

11. The curtain of claim 10 wherein said collapsing and expanding means includes a slat (42) of relatively rigid material secured to the upper end of said curtain, a second slat (44) of relatively rigid material secured to the lower end of said curtain, and means (50, 60) extending between said slats (42, 44) for moving one relative to the other in the direction of curtain height so as to regulate the expanded state of said superimposed tubes.

12. The curtain of claim 9 in which said tubes (31, 32) are of an impermeable material.

13. The curtain of claim 12 wherein said impermeable material is plastics.

14. The curtain of claim 9 wherein said bands of adhering contact are comprised of an adhesive interlaminated between said adjoining strips.

15. The curtain of claim 9 which includes means for controlling the passage of light through the curtain.

Patentansprüche

1. Verfahren zur Herstellung eines wahlweise zusammenund auseinanderfahrbaren Vorhangs, der in seinem auseinandergefahrenen Zustand eine bestimmte Breite und eine bestimmte Höhe aufweist und eine Vielzahl ausdehnbarer Röhren umfasst, deren jeweilige Längsachse sich in Richtung der Vorhangbreite erstreckt, diese Verfahren umfasst die Schritte:—

a) Aufwickeln eines flexiblen, dünnen Filmmaterials (82, 92) um ein Formteil (F), so daß auf diesem Teil eine Vielzahl übereinanderliegender Schichten gebildet wird, wobei dieses Formteil so gewählt wird, daß es eine periphere Länge mindestens so lang wie die vorbestimmte Vorhangbreite hat;

b) klebendes Verbinden jeder Schicht am Formteil mit einer benachbart anliegenden Schicht längs mindestens eines in Längsrichtung sich erstreckenden ersten Bands (A) und mit der anderen benachbart anliegenden Schicht längs einer Vielzahl von in gleichförmigen Abständen angeordneten, in Längsrichtung sich erstreckenden zweiten Bändern (B), welche auf beiden Seiten jedes ersten Bands (A) angeordnet sind, derart, daß eine Vielzahl von übereinanderliegenden Röhren, jeweils eine oberhalb der anderen, auf dem Formteil (F) gebildet wird, wobei jede Röhre, wenn sie voll ausgedehnt ist, einen im wesentlichen rechteckigen Querschnitt aufweist, mit oberen und unteren Wandungen deren Breiten bestimmt sind durch eine gegenüberliegendes des Paar dieser Bänder (A oder B) an oberen und unteren benachbarten Schichten und mit Seitenwänden, deren Höhen bestimmt sind durch obere und untere Seitenabschnitte (14a, 15a und 14c, 15c), bestehend aus Teilen des dünnen Filmmaterials, welches zwischen dem Paar der gegenüberliegenden Bänder (A oder B) und einem Paar von quer im Abstand verlaufenden Bändern (B oder A) liegen, welche die oberen und unteren benachbarten Schichten an jeder Seite der gegenüberliegenden Bänder verbinden.

c) Fortsetzen des Schritts des Aufwickelns, bis die kombinierte Höhe der übereinanderliegenden Röhren in deren voll ausgedehntem Zustand ausreichend ist, um die bestimmte Vorhanghöhe zu gewährleisten;

d) Querschneiden der übereinanderliegenden Schichten, um deren Entfernung vom Formteil zu ermöglichen.

2. Verfahren nachs Anspruch 1, welches weiterhin den Schritt des Aufbringens einer Klebzusammensetzung auf das flexible dünne Filmmaterial (82, 92) umfasst, bevor es auf das Formteil aufgewickelt wird, um die ersten und zweiten Bänder (A, B) zu bilden.

3. Verfahren nach Anspruch 1 oder 2, wobei die Anzahl der Bänder (A, B) so ist, daß eine Vielzahl von Sätzen von übereinanderliegenden Röhren gebildet werden, welche quer zum Formteil (F) nebeneinanderliegend angeordnet sind.

4. Verfahren nach Anspruch 3, umfassend den Schritt des Durchschneidens mindestens eines zwischenliegenden Satzes (36) der übereinanderliegenden Röhren längs der gegenüberliegenden Bänder (A oder B) zur Bildung von mindestens zwei getrennten Vorhängen, von denen jeder die bestimmte Breite und die bestimmte Höhe im auseinandergefahrenen Zustand aufweist.

5. Verfahren nach Anspruch 4, wobei die Klebe- und Schneidschritte derart sind, daß jede der Röhren in diesen getrennten Vorhängen eine Länge im wesentlichen gleich der bestimmten Vorhangbreite aufweist und die Röhrenlänge größer ist als die Dicke von mindestens einem der getrennten Vorhänge.

6. Verfahren nach Anspruch 4 oder 5, mit dem weiteren Schritt der Befestigung von Mitteln an die getrennten Vorhänge zum wahlweisen Einstellen des Abstandes zwischen der obersten und der untersten der übereinanderliegenden Röhren, so daß die übereinanderliegenden Röhren in Richtung der bestimmten Vorhanghöhe expandiert und zusammengelegt werden können.

7. Verfahren nach einem der vorhergehenden Ansprüche, wobei eine Vielzahl dieser Schichten gleichzeitig und in durchschossener Weise von einer Vielzahl von Quellen (80, 90)

des dünnen Filmmaterials (82, 92) auf das Formteil (F) aufgewickelt werden.

8. Verfahren nach Anspruch 3, wobei die ersten Bänder (A) und eines der zweiten Bänder (B), zwischen der Breite des dünnen Filmmaterials liegend, von gleicher Breite sind und in gleichmäßigen Abständen längs der Breite der Schichten angeordnet sind, um Röhren gleichförmiger Höhe und gleichförmiger Breite zu erzeugen.

9. Wahlweise zusammen- und auseinanderfahrbarer Vorhand, der in seinem auseinandergefahrenen Zustand thermische Eigenschaften aufweist, der eine bestimmte Breite und eine bestimmte Länge in seinem voll ausgefahrenen Zustand aufweist und eine Vielzahl von rechteckigen zusammenlagbaren ersten Röhren (31) umfasst, deren jeweilige Längsachse in Richtung der Vorhangbreite sich erstreckt und welche in Richtung der Vorhanghöhe jeweils eine oberhalb der anderen angeordnet sind, dadurch gekennzeichnet, daß eine Vielzahl von zusammenlegbaren zweiten Röhren (32) jeweils eine über der anderen in Richtung der Vorhanghöhe übereinanderliegend längs der ersten Röhren (31) in Richtung der Vorhangdicke anliegend angeordnet sind und weiterhin gekennzeichnet dadurch, daß jede dieser Röhren (31, 32) gebildet wird durch einen oberen Streifen (14) und einem unteren Streifen (15), welche miteinander verbunden sind durch Bänder (A, B) in klebendem Kontakt zwischen den oberen und unteren Streifen (14, 15) an gegenüberliegenden Seiten des rohrförmigen Hohlraums und jede Röhre (31, 32) verbunden ist mit der nächsten darüberliegenden Röhre (31, 32) oberhalb und unterhalb dieser durch zweite Bänder (B, A) mit klebendem Kontakt, welche die Breite der Röhren in ihrem voll expandierten Zustand definieren und weiterhin gekennzeichnet dadurch, daß der obere Streifen (14) einer der ersten Röhren (31) sich seitlich erstreckt, um den unteren Streifen (15) einer der zweiten Röhren (32) zu bilden und der obere Streifen (14) einer der zweiten Röhren (32) gebildet wird durch eine seitliche Verlängerung des unteren Streifens (15) der unmittelbar darüberliegenden ersten Röhre (31) oberhalb dieser einen ersten Röhre (31).

10. Vorhang nach Anspruch 9, welcher Mittel (42, 44, 50, 60) zum Befestigen des Vorhangs und zum wahlweisen Auseinanderfahren und Zusammenfahren dieser Röhren umfasst.

11. Vorhang nach Anspruch 10, wobei die zusammen- und auseinanderfahrbaren Mittel umfassen eine Leiste (42) aus relativ steifem Material, welche am oberen Ende des Vorhangs befestigt ist, eine zweite Leiste (44) aus relative steifem Material, welche am unteren Ende des Vorhangs befestigt ist und Mitteln (50, 60), welche sich zwischen diesen Leisten (42, 44) erstrecken zum Bewegen einer relativ zur anderen in Richtung der Vorhanghöhe, um den expandierten Zustand der übereinanderliegenden Röhren zu regulieren.

12. Vorhang nach Anspruch 9, bei welchem diese Röhren (31, 32) aus einem undurchlässigen Material bestehen.

13. Vorhang nach Anspruch 12, wobei dieses undurchlässige Material Kunststoff ist.

14. Vorhang nach Anspruch 9, wobei diese Bänder von klebenden Kontakt aus einem Klebstoff bestehen, der zwischen aneinanderliegenden Streifen zwischenlaminiert ist.

15. Vorhang nach Anspruch 9, welcher Mittel zum Kontrollieren des Lichtdurchlasses durch den Vorhang umfasst.

Revendications

1. Procédé de fabrication d'un rideau pouvant facultativement être replié ou déployé et qui, à l'état déployé, présente une largeur préalablement déterminée et une hauteur préalablement déterminée et qui comporte une série de tubes pouvant se dilater ou s'ouvrir dont l'axe longitudinal suit la direction de la largeur du rideau, caractérisé par les opérations de:

a. enroulement d'une matière en pellicule mince et souple (82, 92) sur un élément formateur (F), da façon à former sur cet élément une série de couches superposées de cette matière, l'élément formateur étant choisi de telle sorte qu'il ait une longueur périphérique au moins égale à la largeur préalablement déterminée précitée du rideau;

b. fixation par adhérence de chaque couche précitée à l'une des couches de contact voisines sur l'élément formateur suivant au moins une première bande (A), s'étendant dans le sens longitudinal, et à l'autre couche de contact voisine suivant une série de secondes bandes (B) s'étendant dans le sens longitudinal uniformément espacées, prévues de chaque côté de la première bande précitée ou de chaque première bande précitée (A), de telle façon qu'une série de tubes superposé soient formé l'un au-dessus de l'autre sur l'élément formateur précité (F), chacun des tubes présentant, à l'état pleinement dilaté ou ouvert, une section transversale en substance rectangulaire, avec des parois supérieure et inféieure dont les largeurs sont définies par une paire en opposition des bandes précitées (A ou B) á la couche supérieure et à la couche inférieure voisine et des parois latérales dont les hauteurs sont définies par des parties latérales supérieure et inférieure (14a, 15a et 14c, 15c) formées par les parties de la matière en pellicule mince précitée se trouvant entre la paire précitée de bandes en opposition (A ou B) et une paire de bandes espacées dans le sens transversal (B ou A) qui unissent les couches supérieure et inférieure voisines précitées de chaque côté des bandes en opposition précitées;

c. continuation de l'opération d'enroulement précitée jusqu'à ce que les hauteurs combinées des tubes superposés précités, à l'état pleinement dilaté ou ouvert, soient suffisantes pour donner en substance la hauteur pré-

alablement déterminée précitée du rideau;

d. Coupage dans le sens transversal des couches superposées précitées pour permettre leur retrait de l'élément formateur précité.

2. Procédé suivant la revendication 1, caractérisé en ce qu'il comporte en outre l'opération d'application d'une composition adhésive à la matière en mince pellicule souple précitée (82, 92) avant qu'elle soit enroulée sur lélément formateur précité de façon à former la première et la seconde bande précitée (A, B).

3. Procédé suivant l'une ou l'autre des revendications 1 et 2, caractérisé en ce que le nombre des bandes précitées (A, B) est tel que plusieurs séries (31 à 37) des tubes superposés précités soient formées au voisinage l'une de l'autre dans le sens transversal sur l'élément formateur précité (F).

4. Procédé suivant la revendication 3, caractérisé en ce qu'il comporte l'opération de coupage d'au moins l'une (36) des séries intermédiaires des tubes superposées précités dans le sens longitudinal, suivant la longueur des bandes en opposition précitées (A ou B), pour former au moins deux rideaux séparés présentant chacun, à l'état déployé, la largeur préalablement déterminée précitée et la hauteur préalablement déterminée précitée.

5. Procédé suivant la revendication 4, caractérisé en ce que les opérations de fixation par adhérence et de coupage précitées sont telles que chacun des tubes des rideaux séparés précités ait une longueur en substance égale à la largeur préalablement déterminée précitée du rideau et que la longueur précitées des tubes soit supérieure à l'épaisseur d'au moins l'un des rideaux séparés précités.

6. Procédé suivant l'une ou l'autre des revendications 4 et 5, caractérisé en ce qu'il comporte en outre l'opération de fixation aux rideaux séparés précité de moyens servant à régler au choix la distance comprise entre le tube supérieur extrême et le tube inférieur extrême des tubes superposés précités, de façon à dilater ou ouvrir et à resserrer facultativement les tubes superposés précités dans la sens de la hauteur préalablement déterminée précitée du rideau.

7. Procédé suivant l'une quelconque des revendications précitées caractérisé en ce qu'une série des couches précitées sont enroulées simultanément sur l'élément formateur précité (F), superposées l'une à l'autre, à partir d'une série de sources (80, 90) de la matière en mince pellicule précitée (82, 92).

8. Procédé suivant la revendication 3, caractérisé en ce que les premières bandes précitées (A) et celles des secondes bandes précitées (B) intermédiaires de la largeur de la matière en mince pellicule précitée sont de largeur égale et sont également espacées sur la largeur des couches précitées, pour donner des tubes de hauteur uniforme et de largeur uniforme.

9. Rideau pouvant facultativement être replié ou déployé, présentant des propriétés thermiques à l'état déployé, le rideau précité présentant une largeur préalablement déterminée et une hauteur préalablement déterminée à l'état pleinement déployé et comprenant une série de premiers tubes rectangulaires pouvant être resserrés (31), l'axe longitudinal de chacun des tubes suivant le sens de la largeur du rideau et les tubes étant superposés dans le sens de la hauteur du rideau, caractérisé en ce qu'une série de seconds tubes pouvant être resserrés (32), superposés l'un à l'autre dans le sens de la hauteur du rideau, rejoignent suivant leur longueur les premiers tubes précités (31) dans le sens de l'épaisseur du rideau, et caractérisé en outre en ce que chacun des tubes précités (31, 32) est formé d'une lamelle supérieure (14) et d'une lamelle inférieure (15) fixées l'une à l'autre par des bandes (A, B) de contact à adhérence entre les lamelles supérieure et inférieure précitées (14, 15) aux côtés opposés de la cavité tubulaire et en ce que chacun des tubes (31, 32) est fixé aux tubes superposés suivants (31, 32) au-dessus et en dessous de lui par de secondes bandes (B, A) de contact à adhérence qui définissent la largeur des tubes à l'état pleinement dilaté ou ouvert, et caractérisé en outre encore en ce que la lamelle supérieure (14) de l'un des premiers tubes précités (31) s'étend latéralement pour former la lamelle inférieure (15) de l'un des seconds tubes précités (32) et en ce que la lamelle supérieure (14) du tube précité des seconds tubes précités (32) est formée par un prolongement latéral de la lamelle inférieure (15) du premier tube superposé suivant (31), au-dessus du premier tube précité (31).

10. Rideau suivant la revendication 9, caractérisé en ce qu'il comporte des moyens (42, 44, 50, 60) pour son montage et pour la dilatation ou ouverture et le resserrement facultatif des tubes précités.

11. Rideau suivant la revendication 10, caractérisé en ce que les moyens précités de resserrement et de dilatation ou ouverture comportent une latte (42) de matière relativement rigide fixée à l'extrémité supérieure du rideau précité, une seconde latte (44) de matière relativement rigide fixée à l'extrémité inférieure du rideau précité, et des moyens (50, 60) s'étendant entre les lattes précitées (42, 44) pour déplacer l'une de celles-ci par rapport à l'autre dans le sens de la hauteur du rideau de façon à régler l'état de dilatation ou ouverture des tubes superposés précités.

12. Rideau suivant la revendication 9, caractérisé en ce que les tubes précités (31, 32) sont en une matière imperméable.

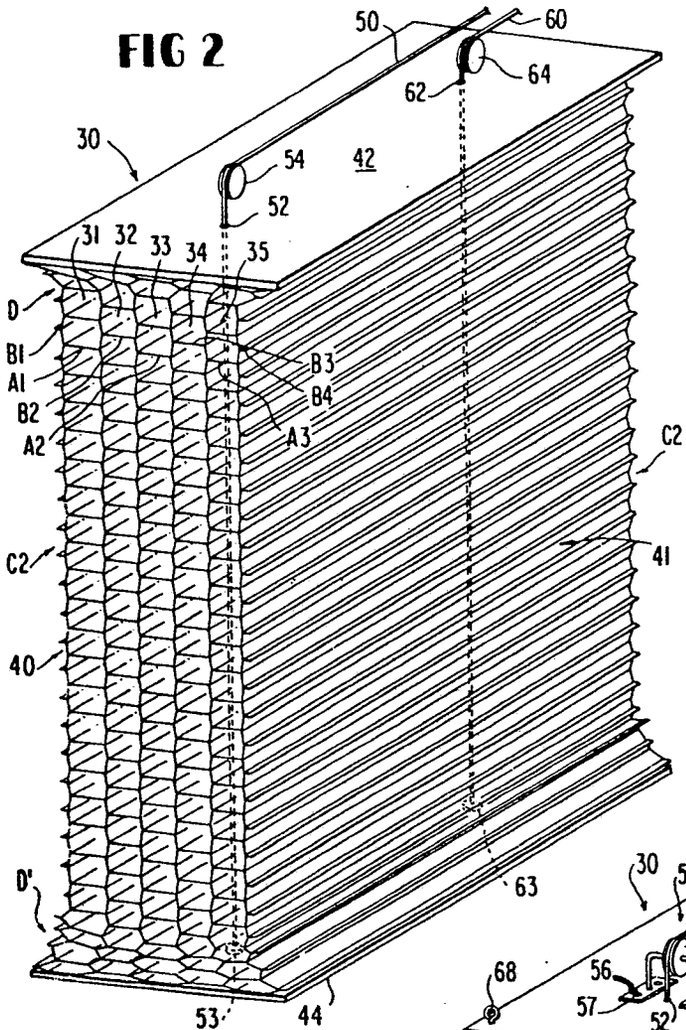
13. Rideau suivant la revendication 12, caractérisé en ce que la matière imperméable précitée est une matière plastique.

14. Rideau suivant la revendication 9, caractérisé en ce que les bandes précitées de contact à adhérence sont formées d'une matière adhésive intercallée entre les lamelles précitées

qui se rejoignent.

15. Rideau suivant la revendication 9, caractérisé en ce qu'il comporte des moyens pour régler le passage de la lumière à travers le rideau.

FIG 2



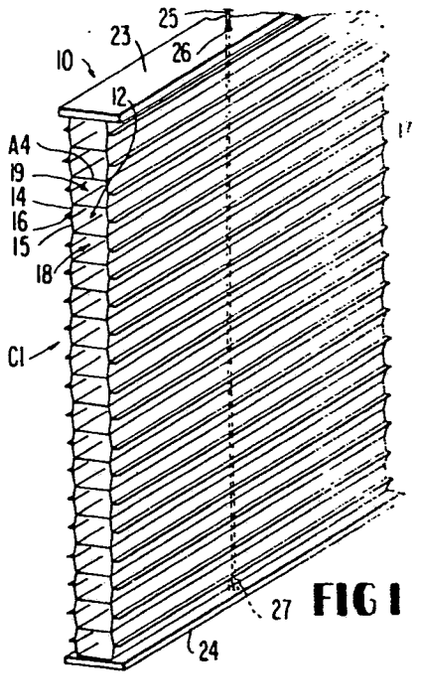


FIG 1

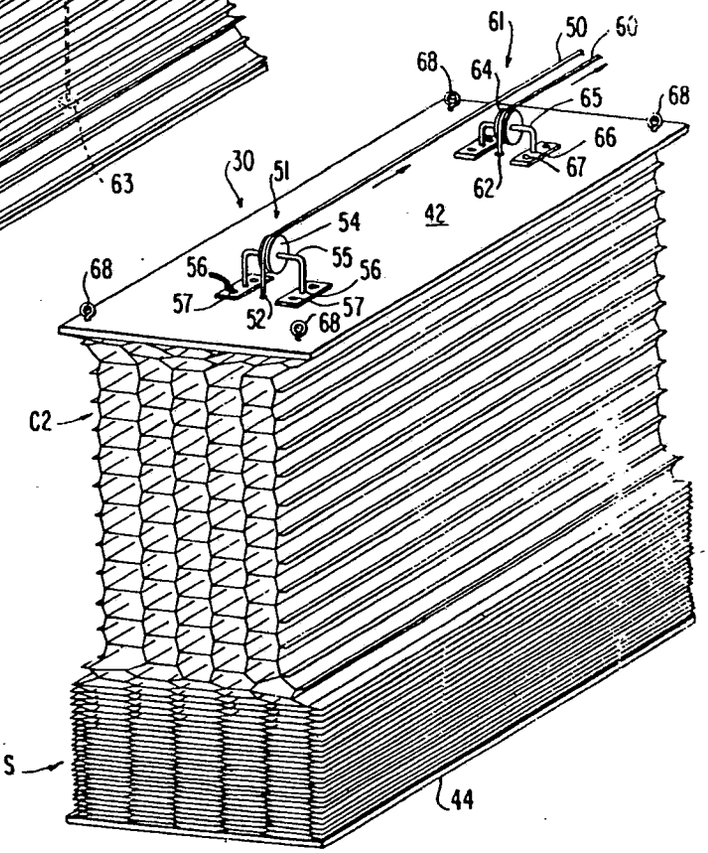


FIG 3

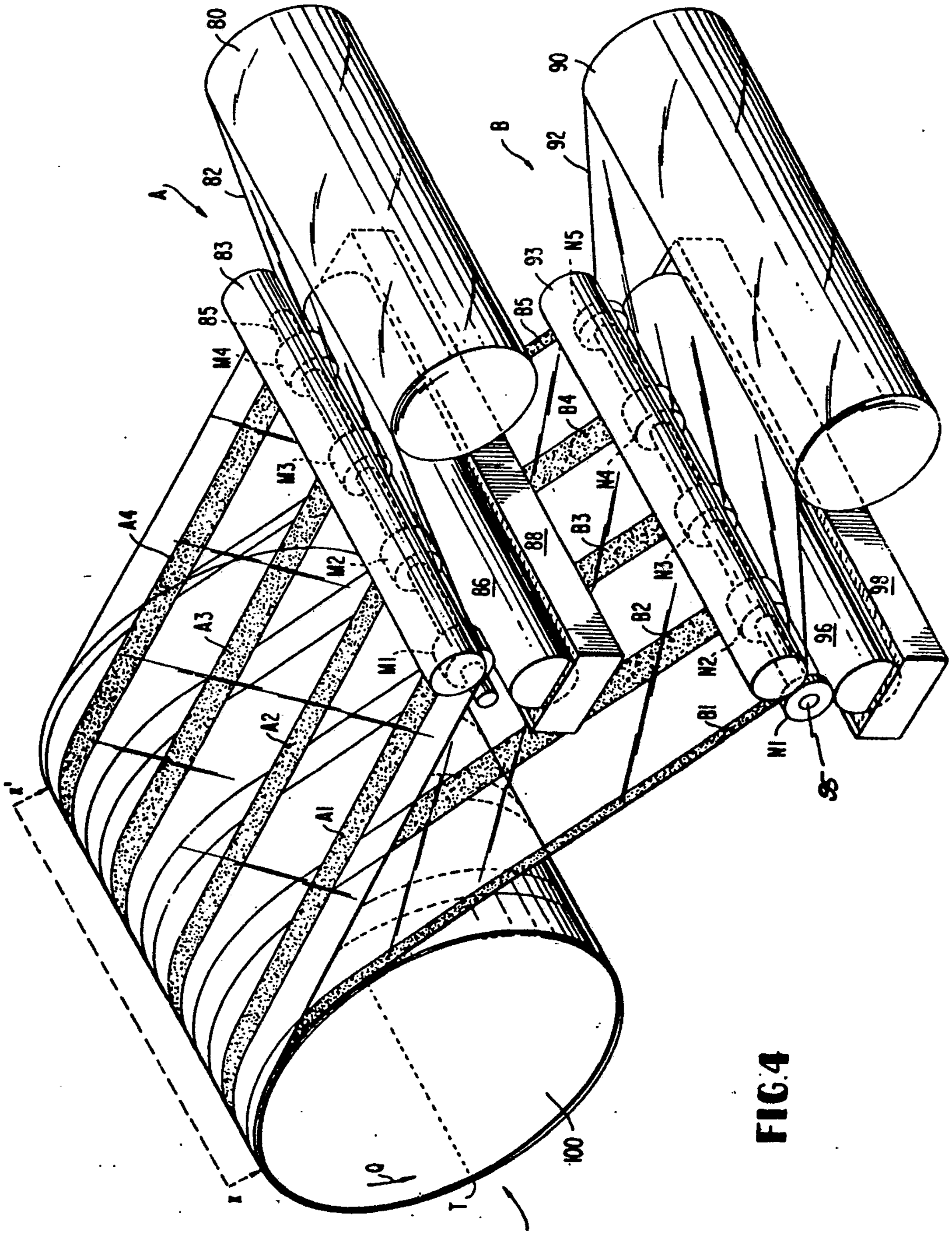
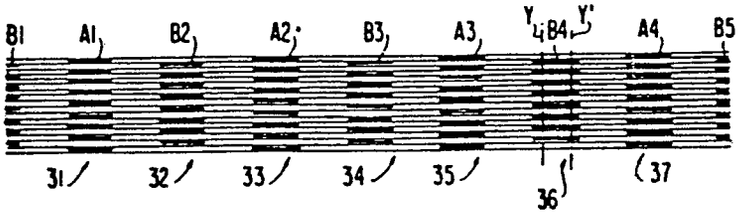

80
82
83
85
A
B
90
92
93
N5
B5
B4
M4
M3
A4
88
86
B3
N4
M2
A3
N3
B2
M1
A2
B1
N2
N1
96
98
95
A1
x'
x
T
F
100

FIG.4

FIG.5



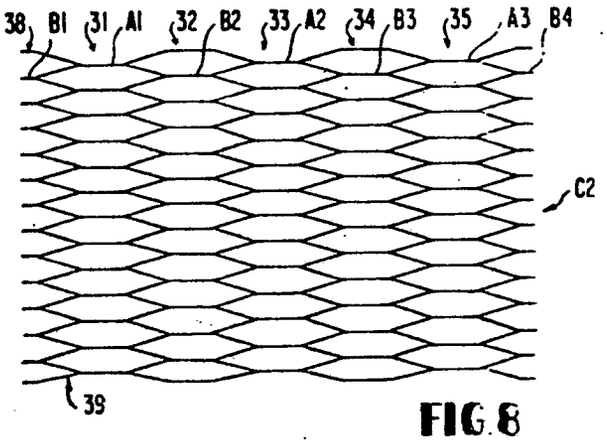


FIG.8

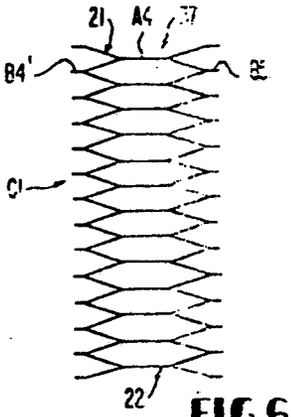


FIG.6

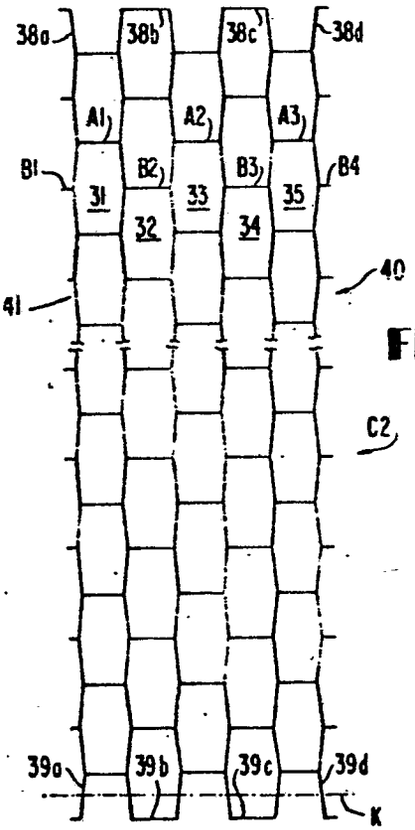


FIG.9

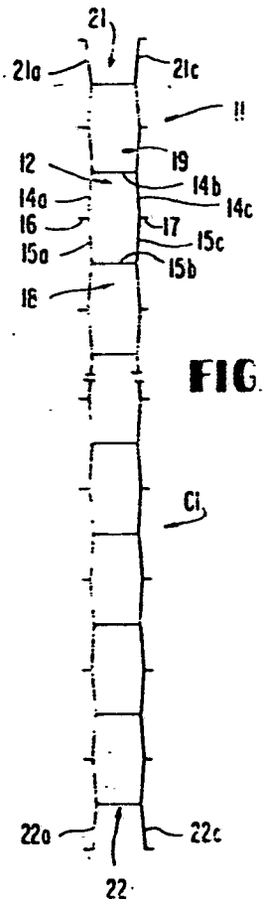


FIG.7