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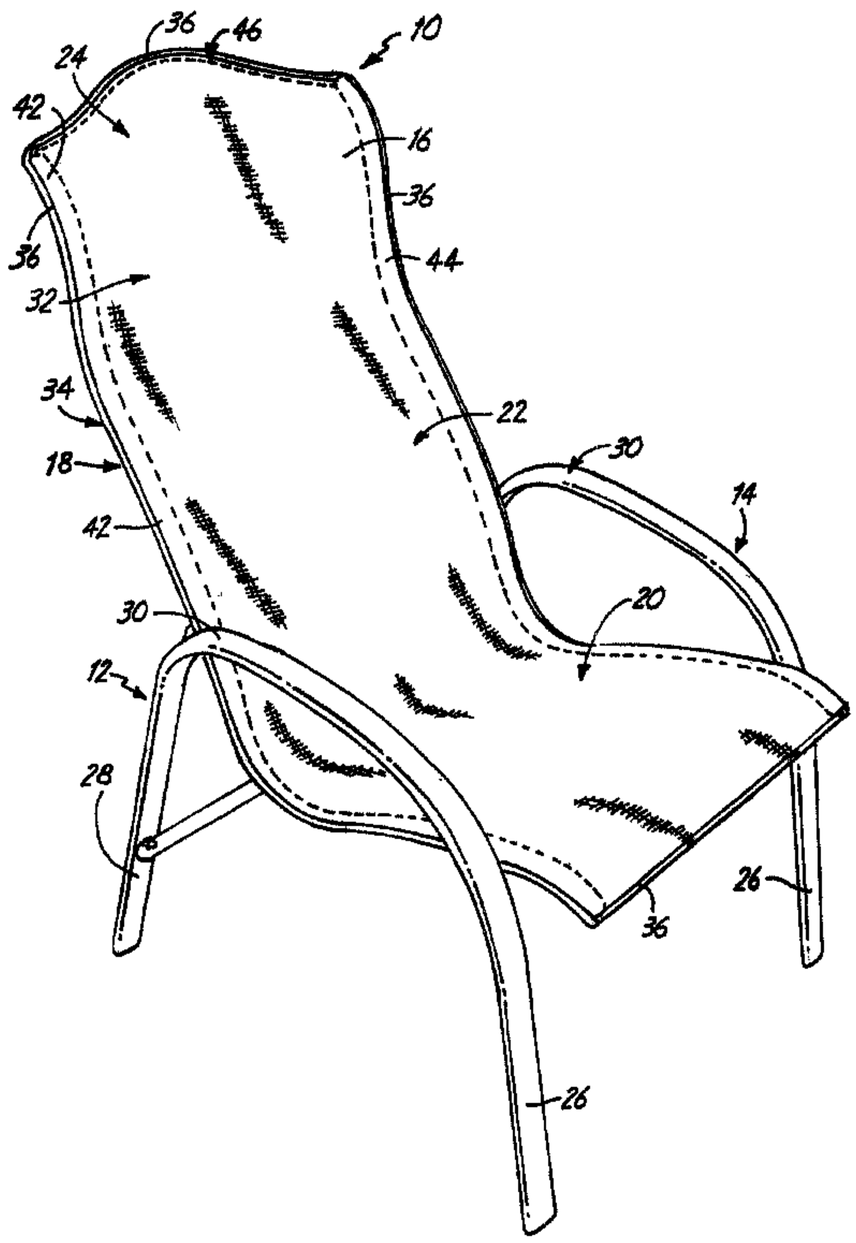
(54) Title: CHAIR SEAT WITH FIRM BUT RESILIENT FRONT EDGE



(57) Abrégé/Abstract:
A chair having a seat formed from two spaced-apart rails extending along opposing sides and unsupported along a forward portion of the seat. A flexible and elastic fabric extends between and is held in tension by the two spaced-apart rails. A flexible and relatively inelastic elastic border extends along a peripheral edge of the along a forward edge of the fabric. The border extends between and is held in tension by the two spaced-apart rails to restrict the stretch of the fabric to support a seated user's legs.

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CHAIR SEAT WITH FIRM BUT RESILIENT FRONT EDGE

ABSTRACT OF THE DISCLOSURE

A chair having a seat formed from two spaced-apart rails extending along opposing sides and unsupported along a forward portion of the seat. A flexible and elastic fabric extends between and is held in tension by the two spaced-apart rails. A flexible and relatively inelastic elastic border extends along a peripheral edge of the along a forward edge of the fabric. The border extends between and is held in tension by the two spaced-apart rails to restrict the stretch of the fabric to support a seated user's legs.

CHAIR SEAT WITH FIRM BUT RESILIENT FRONT EDGE

CROSS-REFERENCE TO RELATED APPLICATION(S)

None.

FIELD OF THE INVENTION

The present invention relates to a chair construction, and more specifically, the present invention relates to a chair construction employing two fabrics of substantially different elasticity to form a fabric envelope for stretching over a metal framework.

BACKGROUND OF THE INVENTION

Outdoor furniture having an envelope of flexible material stretched over metal framework is well known. One example of such furniture is described in U.S. Pat. No. 4,592,126 issued to Bottemiller on June 3, 1986, which is entitled "Method for Constructing Furniture Having a Flexible Sheet Portion" and which is incorporated herein by reference.

Typically, this type of furniture consists of a fabric envelope held in tension between first and second spaced-apart parallel rails, which are held apart by a number of cross-members or braces. The flexible fabric envelope is generally constructed of two sheets of fabric sown together along the entire perimeter with an opening on the back side of one of the sheets. The opening is typically located on the back side and near the bottom so as to hide or mask the opening and to allow for ease of assembly.

Generally, the furniture is assembled by attaching a wire member to the top of each rail. The bottom ends of the rails are then pushed toward one another. The opening in the fabric envelope is slid over the top end, and the top of the flexible fabric envelope is pulled over the wire member and the top of the rails, and the bottom of the flexible fabric envelope is pulled over the bottom of the rails.

The bottom end of the rails are then pulled apart and spaced from one another by cross-members, which put the fabric envelope in tension and which support the rails. A method of constructing the fabric furniture consistent with the present invention is detailed in U.S. Patent No. 6,345,446, which is incorporated herein by reference.

Traditionally, such flexible fabrics have included canvas, vinyl-coated polyester fabric, and other similar fabrics. However, over time, the traditional fabrics used for such chairs tend to deteriorate from usage. After many uses, the fabric can no longer maintain its original appearance, and no longer returns to its original form after use. There is a need within the industry for a comfortable, supportive, fabric chair that is easy to manufacture and that maintains its appearance over time.

BRIEF SUMMARY OF THE INVENTION

A chair has a seat formed by two spaced-apart rails extending along opposing sides of the seat portion and a flexible and elastic fabric extending between the two rails. The seat portion is unsupported along a forward portion of the seat between the two rails. A flexible and less-elastic border extends along a forward edge of the fabric, extending between the two rails. When a user sits on the seat portion, the elastic fabric stretches and flexes to cushion and support the user. At the same time, the border flexes to provide a comfortable forwward portion of the seat, and yet the border has sufficient strength to restrict the elasticity of the flexible and elastic fabric along the forward edge of the seat portion to provide firm and comfortable support for a user's legs.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the front of a chair constructed by the method of the present invention.

Fig. 2 is a perspective view of the bottom of a chair constructed by the method of the present invention.

Fig. 3 is a perspective view of the rear of a chair constructed by the method of the present invention.

Fig. 4 is a perspective view of the wire member being inserted into the top ends of the rails.

Fig. 5 is a perspective view of the spaced apart rails and the wire member being inserted within the flexible envelope.

Fig. 6 is a cross-sectional view of the wire member and a rail enclosed within the fabric envelope.

Fig. 7 is a graph illustrating the relative elasticity of the sheet material and the border material.

DETAILED DESCRIPTION

Conceptually, the furniture construction of the present invention involves two materials having different elastic properties: a flexible and elastic fabric and a flexible and relatively inelastic border. To form the furniture, the flexible and elastic fabric is stretched over two spaced-apart rails and is held in tension by the two rails. The two spaced-apart rails hold the fabric in tension to form a seat. The forward portion of the seat (the area behind a user's knees when seated) is unsupported by the rail or by any frame element along a forward edge. Instead, the elastic fabric is bordered by the relatively inelastic border along its forward edge. The border fabric extends between the two spaced apart rails at the forward edge of the fabric. The border fabric restricts the elasticity of the flexible and elastic fabric along the forward edge of the seat portion, such that the forward edge of the seat portion provides a firm and comfortable support for the back of a user's legs when seated on the furniture.

The furniture construction of the present invention is illustrated by chair 10 in FIGS. 1, 2 and 3. The chair 10 includes ground engaging supports 12,14, a flexible and elastic fabric envelope 16, and a support structure 18 for supporting and holding the envelope 16 in tension, defining a seat portion 20, a back portion 22, and a head rest portion 24. The support structure 18 is connected to the ground engaging supports 12,14. As used with this application, the term "construction" refers to both original construction of furniture and reconstruction of furniture to replace the envelope 16.

In the embodiment shown, each ground engaging support 12,14 is shown as a generally arcuate shape, wherein the open ends touch the ground. Each ground engaging support 12, 14 is formed from a unitary piece of material, which serves as a front leg 26, a rear leg 28 and an arm rest 30. Other ground engaging support structures, such as those shown in U.S. Patent Nos. 4,529,126 and 6,345,446 (both incorporated herein by reference), could also be employed with the construction of the present invention.

The envelope 16 is formed from two sheets of flexible, elastic material, an upper sheet 32 and a lower sheet 34, attached along their respective outside perimeters by a relatively inelastic border material 36. The lower sheet 34 also contains an opening 38 located near one end of the envelope 16, preferably near the seat portion 20. To construct the chair 10, the support structure 18 is inserted through the opening 38, as illustrated in FIG. 4. Generally, the support structure 18 is inserted through the opening 38 facing such that ultimately the opening 38 is positioned under the seat portion 20 and is substantially out of sight.

The support structure 18 includes first and second spaced apart rails 42,44, respectively. The rails 42,44 are substantially "L"-shaped, and preferably have a contour that defines the shape of the chair 10 as illustrated in FIG. 5. When inserted within the envelope 16 and spaced apart, the rails 42 and 44 simultaneously provide the structure and contour for the seat and back portions, 20 and 22, of the

chair construction. Thus, the back portion 20 and seat portion 22 are visually continuous with no defining line distinguishing the two.

The rails 42 and 44 are initially held apart at the top of the back portion 22 by a resilient wire member 46, which forms a head rest portion 24 with the envelope 16. Finally, the rails 42 and 44 are held apart by a plurality of cross-braces 50 located on the seat and back portions 20 and 22. The spaced apart rails 42,44 also include a plurality of openings 52 for engagement with the cross-braces 50 as is well known in the art. Generally, each cross-brace 50 is fastened at each end to the rails 42,44 by positioning a fastener 54 (such as a bolt and nut) through corresponding openings 52 on rails 42,44 and through an opening (not shown) on the end of the cross-brace 50. It should be understood that the number of cross braces may vary depending on the type of chair, lounge, swing chair, or other similar furniture construction that utilizes the elastic and flexible envelope with a similar support structure.

While the number of cross braces may vary, the cross braces 50 serve only to maintain the separation between the rails 42,44. The cross braces provide no direct support for a seated user. Instead, the flexible and elastic fabric envelope 16, which is held in tension by the rails 42,44, provides support for the seated user. Additionally, the border 36 restrains the elasticity along the forward edge of the seat portion 20 to provide a comfortable and firm support at the forward edge of the seat portion 20, such as behind the seated user's knees. In general, the envelope 16 stretches to conform to the user's body. The border 36 stretches less than the rest of the envelope 16, such that the seat portion 20 deforms to a mildly bowl-like shape when supporting a seated user.

In one embodiment shown, the support structure 18 is attached to the ground engaging supports 12,14 at two attachment locations corresponding to the locations of two cross-braces 50. Specifically, supports 12,14 are provided with

flanges 40, which interface with openings 52 on the rails 42,44. The flanges 40 are then attached to the rails 42,44 with the cross-brace 50 with the same fastener 54.

As shown in Fig. 4, the rails 42,44 are provided with wire openings or slots 56 on top ends 58,60 to receive the bent ends 64,66 of the resilient member 46. Additionally, the rails 42,44 are provided with cross-brace openings 52 for receiving a fastener 54 to connect cross-braces 50 to the support structure 18. Generally, each of the ends 64,66 of the resilient wire member 46 is inserted into a wire opening 56 on each of the top ends 58,60 of the rails 42,44. In the preferred method, the resilient wire member 46 is assembled to the rails 42,44 before inserting the rails 42,44 into the envelope 16.

The resilient wire member 46 is preferably made of metal and has a generally central arcuate shape extending in a generally upward direction, with each end 64 and 66 bent approximately perpendicularly downward. The wire member 46 provides flexible, spring-like action which improves head support and the overall comfort of the chair by accommodating tensions applied on the flexible envelope 16 from the movement of a sitting occupant. The arcuate shape provides an aesthetically pleasing contoured curve to the head rest portion 24 of the chair 10. While the preferred embodiment of the present invention describes the resilient wire member 46 as having an arcuate shape, it should be understood that alternative embodiments are well within the scope of the present invention. Such alternative embodiments include, but are not limited to, contours with a single or a plurality of raised or lowered portions, straight members, and ornamentally designed members.

As shown in Fig. 5, once the resilient member 46 has been inserted into the slots 56 on each rail 42,44, the rails 42,44 are held apart at a fixed distance at the top ends 58,60 of the rails 42,44. Then, the bottom ends 68 and 70 of the rails 42,44 are brought closer to one another while the top ends 50 and 52 remain a fixed distance apart from one another. The top ends 58,60 of the rails 42,44 are

then inserted into the flexible envelope 16 through the opening 38 located on the lower layer 22. It should be appreciated that since the bottom ends of the rails 68 and 70 are closer to one another than the top ends 58,60 of the rails 42,44, the envelope 16 is slack and not in tension when the rails 42,44 are being inserted. By inserting the rails 42,44 into a slack flexible envelope 16, the assembly is much easier than if the rails 42,44 were held apart and the envelope 16 was placed into tension.

The spaced apart rails 42,44 and flexible wire member 46 are inserted within the envelope 16 until the flexible wire member 46 and top ends 58,60 of the rails 42,44 reach the top of the envelope 16. The top of the envelope 16 is formed in a shape corresponding to the contour of the wire member 46, so that the wire member 46 cooperates with the top of the envelope 16. While the bottom ends 68,70 of the rails 42,44 are still close to one another, the lower layer 34 of the envelope 16 is placed over the bottom ends 68,70 of the rails 42,44. The position of the opening 24 in the lower layer 34 of the envelope 16 after assembly is illustrated in FIG. 2.

With the spaced apart rails 42,44 fully inserted within the envelope 16, the rails 42,44 are positioned so that the envelope 16 is brought into a state of tension. It should be appreciated that the use of a special tool to place the envelope 16 in tension is not needed due to the addition of the resilient wire member 46 located at the top 58,60 of the spaced apart rails 42,44. The resilient wire member 46 acts as a fulcrum between the two spaced apart rails 42,44, which aides in the assembly of the chair 10. An assembler spaces the bottom ends 68,70 of the rails 42,44 apart to place the envelope 16 in tension. The assembler then needs only to attach the cross-braces 50 to the support structure 18, and attach the support structure 18 to the ground engaging supports 12,14 in order to complete the chair construction 10.

As shown in Fig. 6, the chair 10 is shown in cross-section taken through rail 42. The envelope 16 is in tension over the rail 42. As shown, fasteners 54 are shown inserted through rail 42, and through cross-braces 50 (and through flanges 40 where the ground engaging support 12 attaches to the rail 42, according to the embodiment shown in Figs. 1-3). As previously mentioned, the cross-braces 50 serve only to separate the rails 42,44, and do not provide actual support to a seated user. Additionally, the rails 42,44 are hollow, which contributes to the light weight of the overall chair construction 10.

Generally, the envelope 16 has a border 36 that extends along its peripheral edges. In cross-section, in FIG. 6, the relatively inelastic border 36 is shown on either end of the rail 42. As previously discussed, the border 36 along the forward edge of the seat portion 20 of the chair 10 extends between the rails across the entire forward edge of the seat portion 20. Specifically, the border 36 along the forward edge of the seat portion 20 is held in tension by the rails 42,44 and serves to restrict the elasticity of the envelope 16 along the forward edge of the seat portion 20. Since the border 36 is less elastic than the material of the envelope 16, the border 36 limits the elasticity of the envelope 16 along its entire periphery. At the forward edge of the seat portion 20, by limiting the elasticity of the envelope 16, the border 36 provides leg support for a seated user by not permitting the fabric envelope 16 to stretch as much as it does in other areas of the seat portion 20 (such as at the center of the seat portion).

As previously mentioned, the envelope 16 is constructed of two sheets of flexible, elastic fabric, an upper sheet 32 and a lower sheet 34, bound together at their respective peripheral edges with a flexible and relatively inelastic border 36. The elastic fabric material is generally elastic in the weft direction, but may have a different elasticity in the warp direction. In one embodiment, the fabric material is formed into the envelope 16 such that the weft direction of the fabric material extends laterally between the rails 42,44 when stretched, and the warp

direction corresponds with the longitudinal direction from the resilient wire member 46 to the front of the seat portion 20 of the chair 10. Thus, in one embodiment, the sheet material stretches substantially more between the rails 42,44 than longitudinally along the length of the chair 10. Generally, the elastic material can be selected according to the elastic characteristics in weft and warp directions in order to maximize the comfort of the seated user.

When stretched over the support structure 18, the upper and lower sheets 32,34 and the border 36 are in tension. As weight is applied to the seat portion 20, the back portion 22, and the head rest portion 24, the flexible fabric sheets 32,34 and the border 36 stretch. However, the flexible fabric sheets 32,34 are more elastic than the border 36. The border 36 thus restricts the stretch of the more flexible fabric sheets 32,34.

In the present invention, the flexible and elastic fabric sheets 32,34 stretch to cushion and to provide support for a sitting person, and the relatively inelastic border 36 restricts the stretch of the sheets 32,34 such that the border 36 assists the fabric sheets 32,34 in providing greater support behind the sitting person's knees. More specifically, the fabric in the seat portion 20 stretches while the border 36 positioned at the end of the seat portion 20 (i.e. behind the knees) stretches less, thereby creating a cupped (or bowl-shaped) seat area having greater comfort and stability than a fabric chair having only one type of fabric. The combination of an elastic fabric sheet 32,34 and a relatively inelastic fabric border 36 in the present invention allows for a chair construction 10 having no structural element across the front of the seat portion 20, while still providing support for the back of the legs.

Fig. 7 illustrates the elasticity of the sheet fabric 32,34 as compared with the elasticity of the relatively inelastic border 36. As shown, the elasticity of both fabrics was tested using samples that were 4 inches wide and 24 inches long. The fabric was tested in both the warp and weft directions (as the fabric is applied

to the chair structure), and the stretch aspect of the fabric is shown in the weft direction (e.g. in the direction transverse to the parallel rails 42,44 in the plane of the seat).

In one embodiment, the stretch fabric is woven from all-weather, vinyl-coated, flexible and elastic polyester yarn, such as Phifertex® fabric made by Phifer Wire Products, Inc. of Tuscaloosa, Alabama. By contrast, border fabrics can be formed from any all-weather material having a much lower elasticity than the stretch fabric. In one embodiment, the border fabric is cashmere. Other border fabrics include Holly, Sable, and other similar, relatively inelastic fabric materials.

As shown, two inches of fabric at each end of the sample was clamped and the fabric was stretched to determine the number of pounds required to stretch the fabric to a particular measurement. For test purposes, no fabric was stretched beyond four inches. All samples of the stretch fabric and the border fabric, when tested in the longitudinal direction (e.g. in the direction from the head rest to the seat), failed at a stretch of between 2 and 3 inches (e.g. between 22 and 23 inches, beginning with a 20 inch sample).

The border samples in the lateral direction were consistent with each other, (the chart below shows the average a Cashmere, a Holly and a Sable sample). All of these border samples failed between 22 and 22.5 inches.

In the lateral direction, the elastic fabric sheets 32,34 exhibited elastic qualities beyond four inches (e.g. beyond 24 inches, beginning with a 20 inch sample). As shown in the graph, both the elastic fabric 32,34 and the relatively inelastic border 36 exhibit elastic characteristics as a linear relationship between stretch in inches as a function of the weight in pounds. As shown, the slope of the graph of the elastic fabric is approximately 0.05, while the slope of the graph of the inelastic fabric is approximately 0.0075. Thus, in one embodiment the ratio of elasticity between the elastic and the relatively inelastic fabrics is 1 to 0.15,

or approximately 6.67 inches of stretch to every 1 inch of stretch for the relatively inelastic fabric.

Using this or a similar ratio of about 6 to 1, various combinations of elastic and relatively inelastic fabrics could be combined to perform the present invention. Moreover, to adjust the comfort of the chair, the fabric may be selected to have a different elasticity in the warp and weft directions. Moreover, the ratio of the elastic to inelastic fabrics may be adjusted such that the ratio is larger or smaller, depending on whether more or less support behind the legs is desirable.

In the embodiment shown, using the Phifertex® fabric described above, the sheet material 32,34 was stretched approximately 6% as the rails 42,44 are spaced apart. The less elastic border 36, which is sown around the entire periphery of the elastic sheet material 32,34, including across the front of the seat portion 20. When the border 36 is stretched along with the sheet material 32,34 of the seat portion 20, the border creates an edge that provides a resilient and flexible, but firm, front to the chair 10. Thus, the chair 10 looks like other known chairs, but performs much differently in that the material conforms to the individual body shape for enhanced comfort, and recovers to a taut surface as soon as the individual stands up from the chair 10.

With the present invention, the chair 10 has no structural support along a forward edge of the seat portion 20, and yet forward edge support is provided for a seated user by a border 36 that is less elastic than the envelope 16, which provides the support for the seat, back and head of the seated user. While the chair 10 shown in the figures illustrates a contoured design that provides some leg support due to the contour of the forward edge of the seat portion 20, the border material 36 provides firmer support, without the assembly time, additional costs, and weight associated with a structural support. Thus, the border 36 provides the necessary support for a comfortable and firm seat area with less material cost, less assembly time, and less overall weight.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

CLAIMS:

1. A chair having a seat comprising:

two spaced-apart rails extending along opposing sides and unsupported along a forward portion of the seat between the two spaced-apart rails;

a flexible fabric extending between and held in tension by the two spaced-apart rails, the flexible fabric capable of stretching in at least one direction; and

a border along a forward edge of the flexible fabric, the border extending between and held in tension by the two spaced-apart rails, the border having sufficient strength to support a seated user's legs.

2. The chair of claim 1, wherein the flexible fabric is an envelope comprising:

two sheets of the flexible fabric attached along the peripheral edges with the border; and

an opening in one of the two sheets.

3. The chair of claim 1, further comprising:

cross-braces disposed along the two spaced apart rails at a spacing intervals for connecting the two spaced-apart rails and for maintaining separation between the two spaced-apart rails.

4. The chair of claim 1, wherein the border is less elastic than the flexible fabric.

5. The chair of claim 1, wherein the flexible fabric and the border each have a characteristic elasticity.

6. The chair of claim 5, wherein the flexible fabric and the border define defining an elasticity ratio of approximately 6 to 1.

7. The chair of claim 1, further comprising:
one or more ground engaging mechanisms attached to the two spaced apart rails.

8. The chair of claim 1, further comprising:
a resilient wire connecting the two spaced rails at one end to form a head rest area.

9. The chair of claim 1, wherein the rails are formed from a unitary piece of material, and are shaped in substantially an L-shape.

10. A method of assembling a chair comprising:
assembling at least one end of a chair frame having two spaced apart-rails that form a seat portion having an unsupported forward edge;
tensioning a flexible fabric having a border over the chair frame such that the border extends between the two spaced apart rails along the unsupported forward edge;
wherein the border is less elastic than the flexible fabric.

11. The method of claim 10, wherein the border is flexible.

12. The method of claim 10, wherein the step of tensioning comprises:

inserting the at least one assembled end of the chair frame into a fabric envelope having an opening;

advancing the chair frame through the opening until the at least one assembled end of the chair frame can advance no further inside the envelope; and

attaching cross-braces at predetermined locations along the spaced-apart rails in order to fixedly position the spaced-apart rails at a distance from one another.

13. A contoured chair having a seat comprising:

two rails spaced apart by cross-braces in a substantially parallel position to one another;

an elastic material extending between the two rails to form a seat portion that is unsupported structurally at a forward edge; and

a border material extending between the two rails at the forward edge, the border material being less elastic than the elastic material, the border material providing support for a user's legs.

14. The chair of claim 13, further comprising:

legs attached to the two rails.

15. The chair of claim 13, wherein the elastic material has a different modulus of elasticity in a weft direction than in a warp direction.

16. The chair of claim 13, wherein the elastic material is a woven from all-weather, vinyl-coated, flexible and elastic polyester yarn.

17. The chair of claim 13, wherein the border material restricts a stretch of the elastic material when weight is placed on the seat portion of the chair.

18. The chair according to claim 13, wherein the border material and the elastic material have a ratio of elasticity of approximately one-sixth.

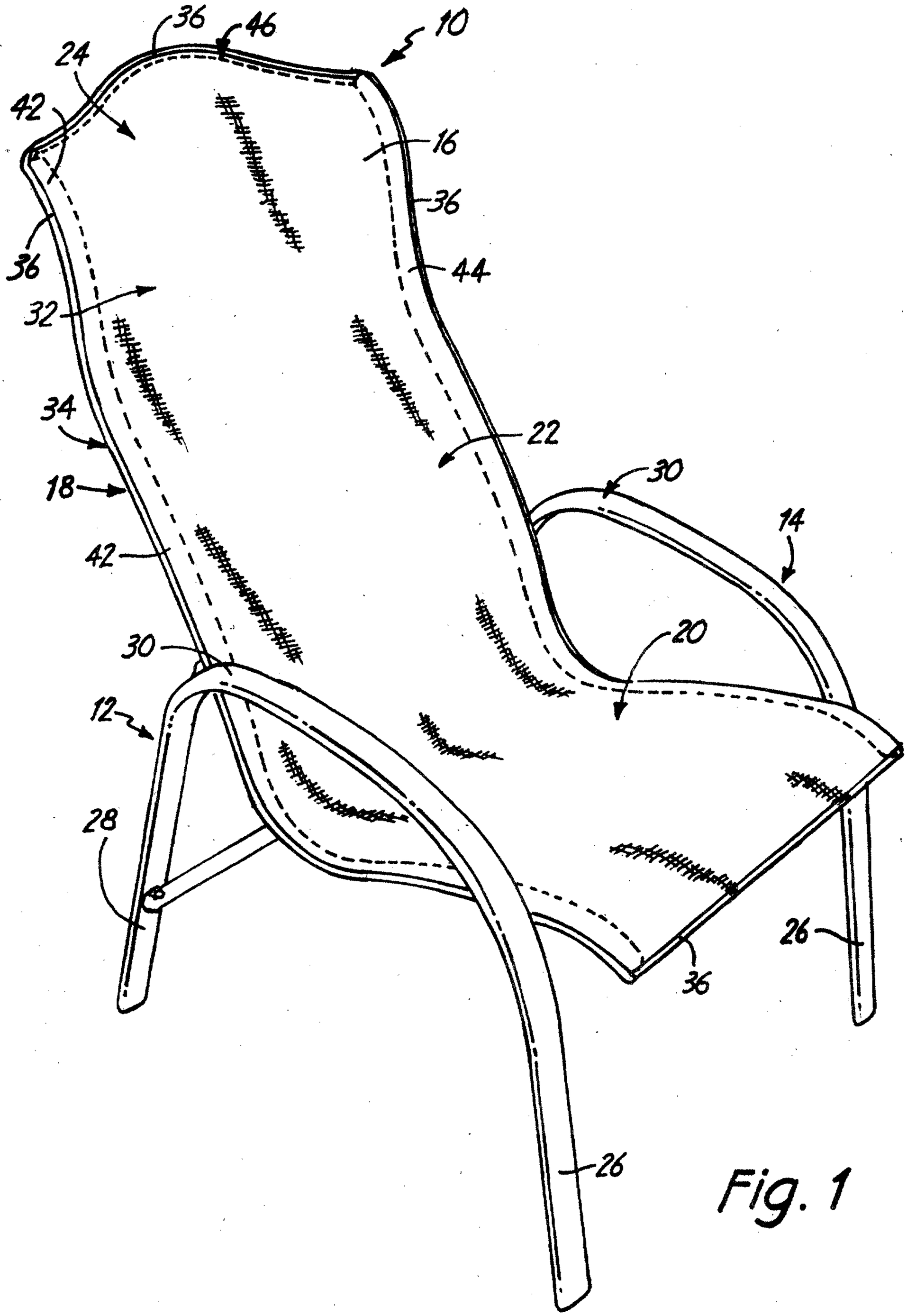

Fig. 1

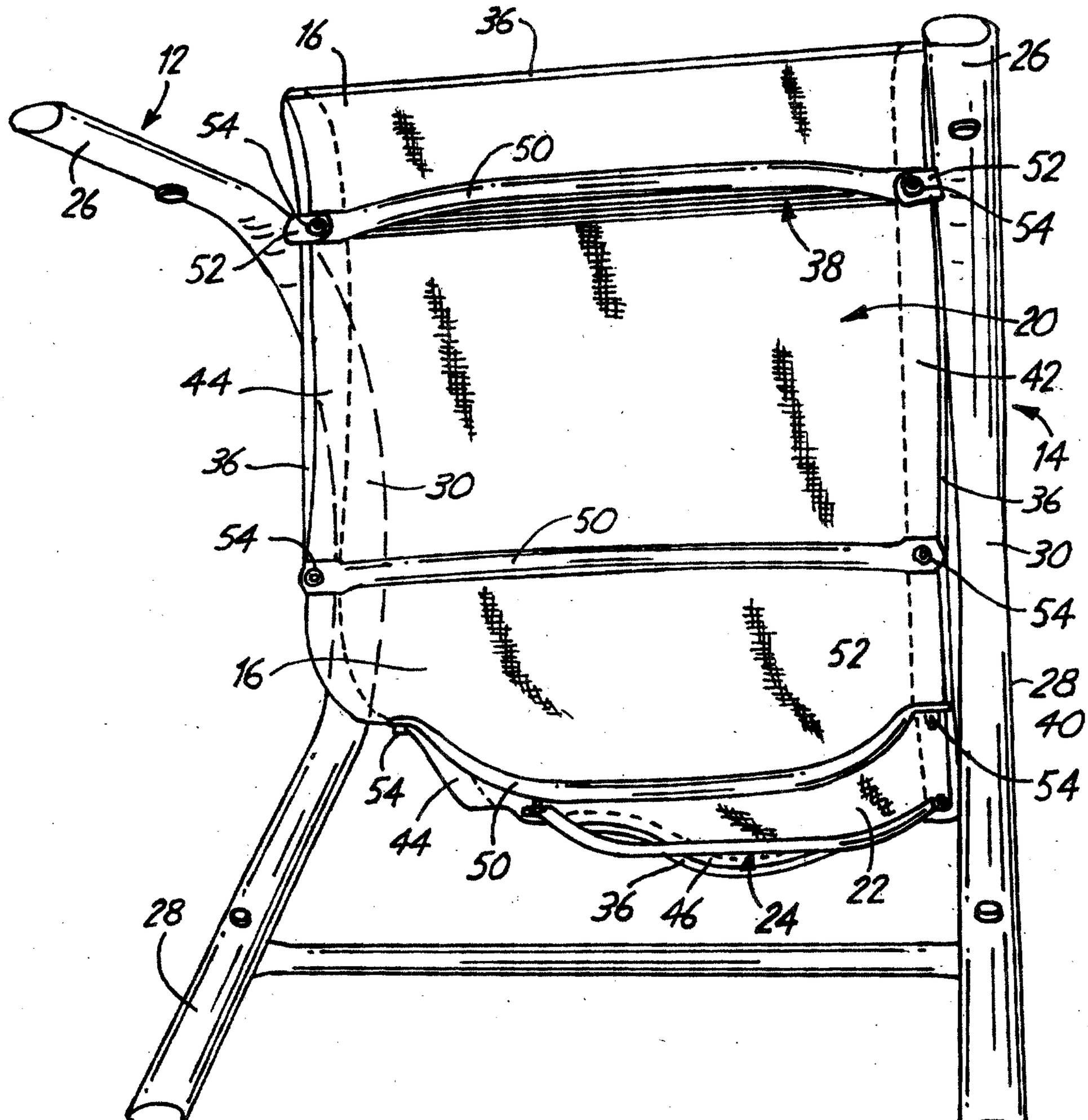
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Fig. 2

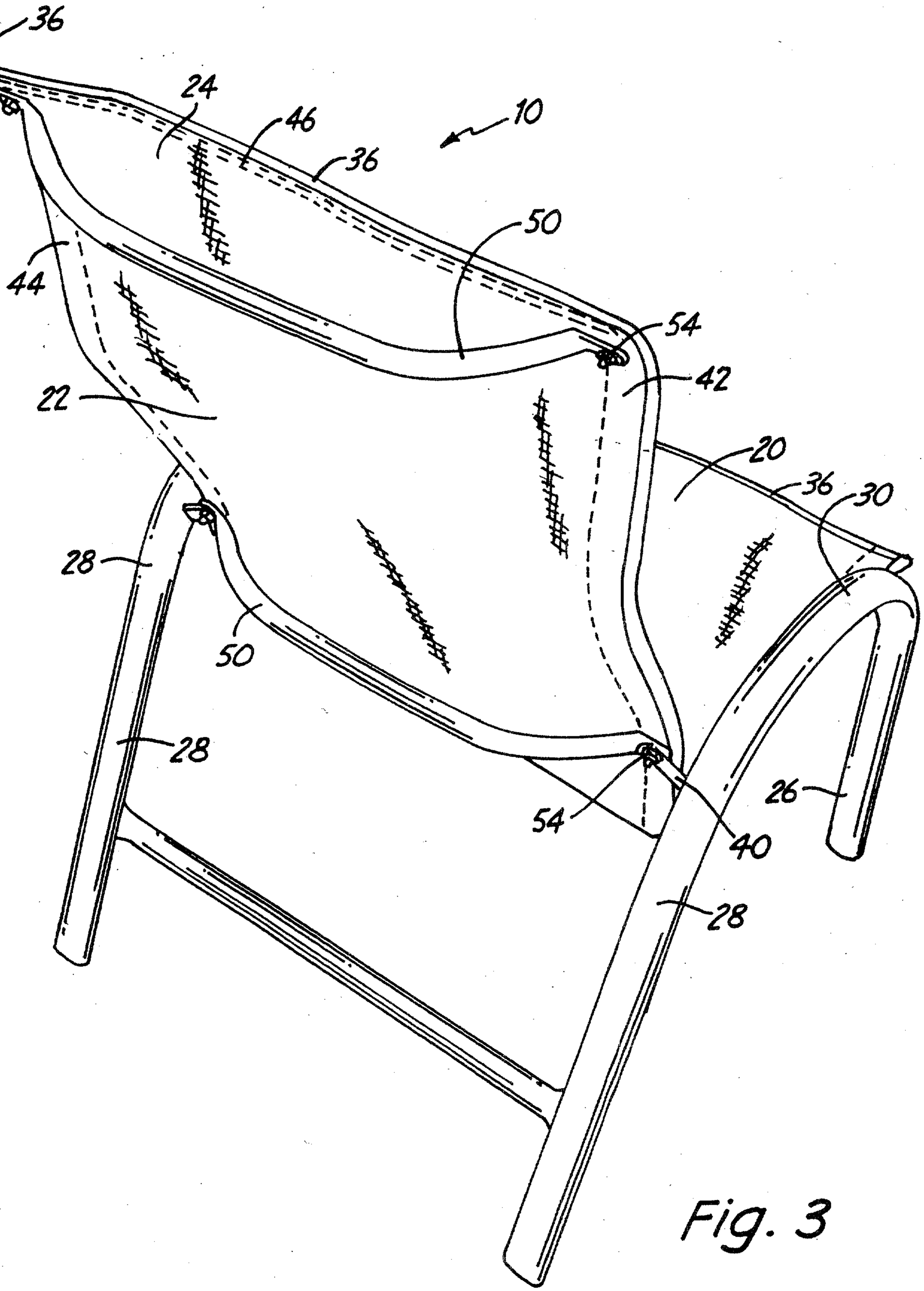


Fig. 3

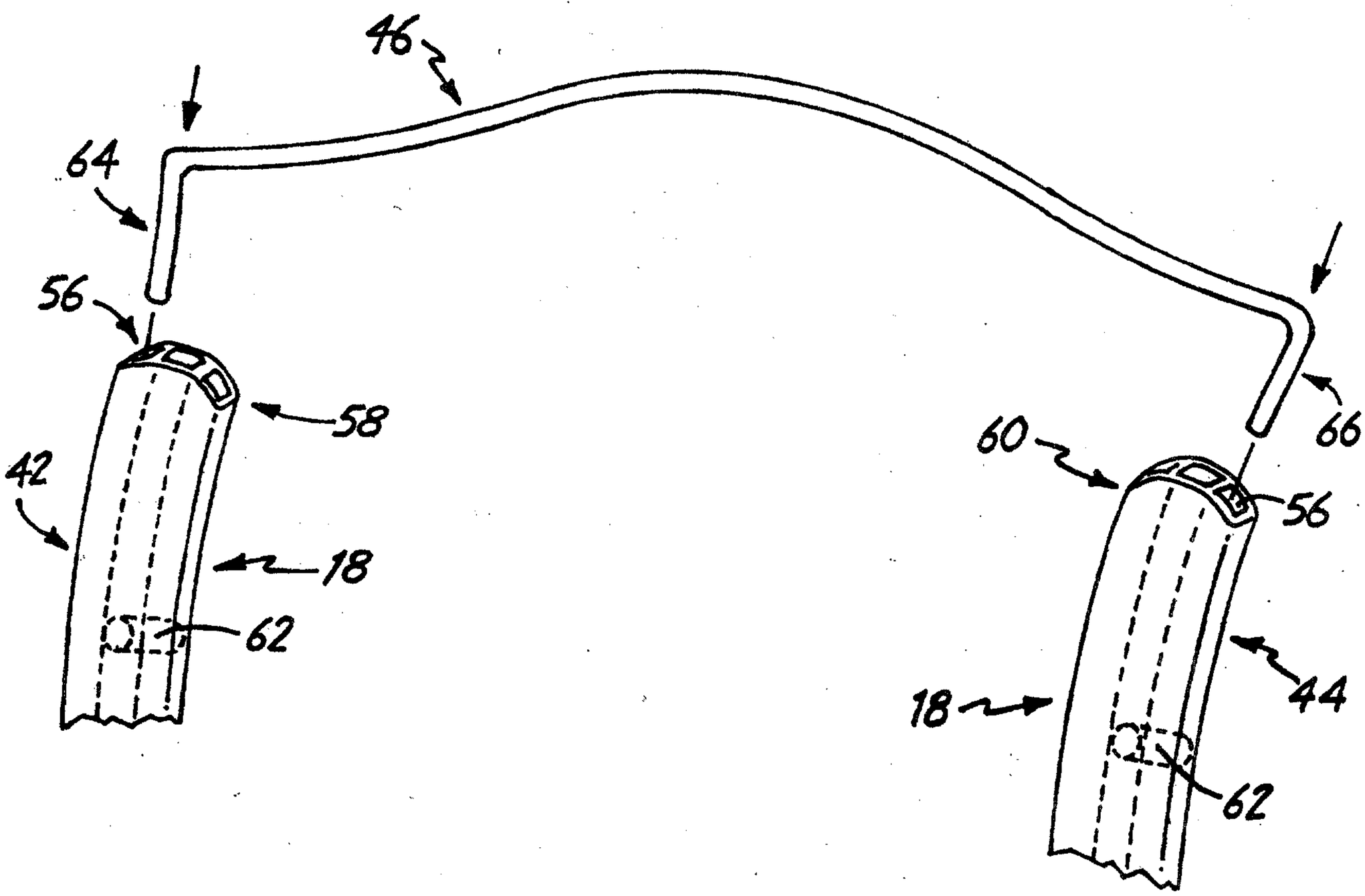


Fig. 4

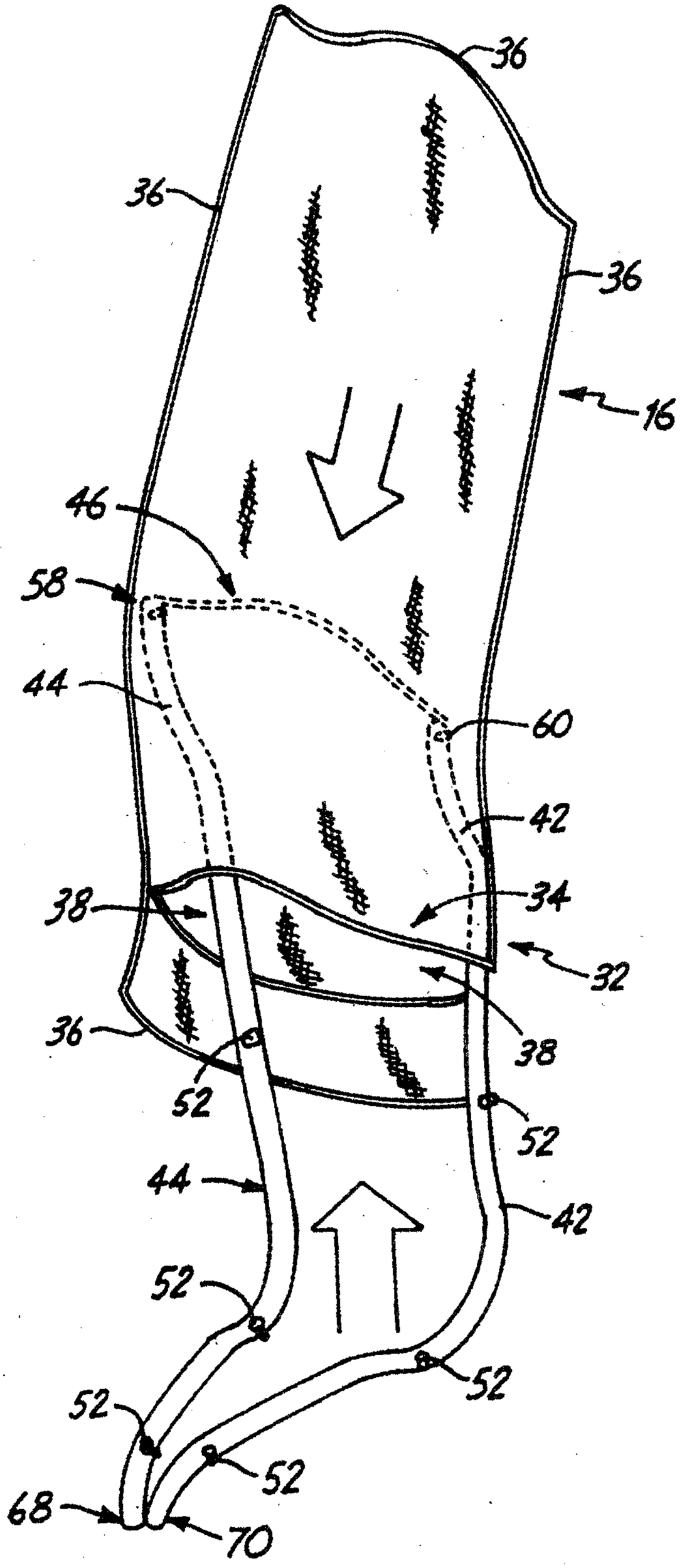


Fig. 5

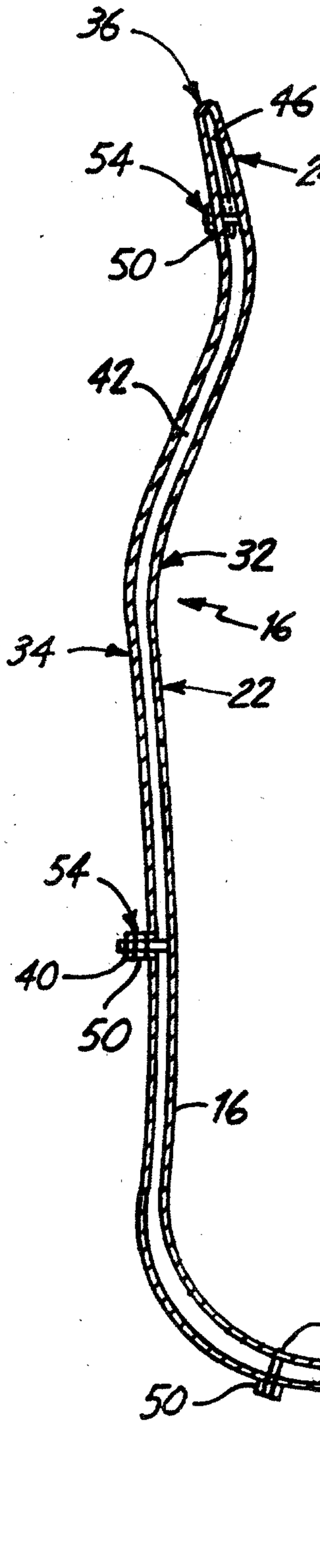
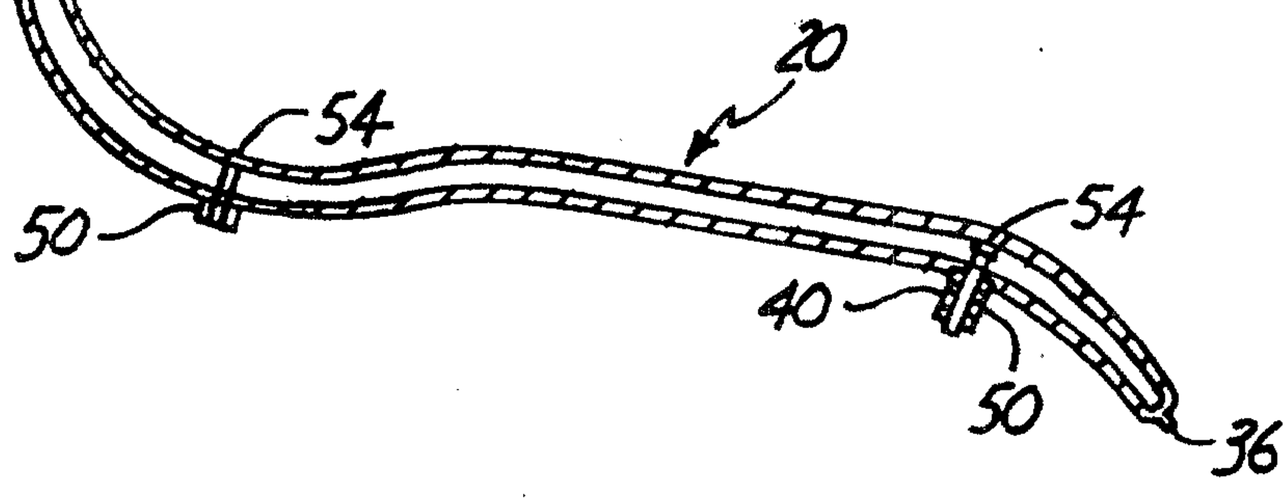


Fig. 6



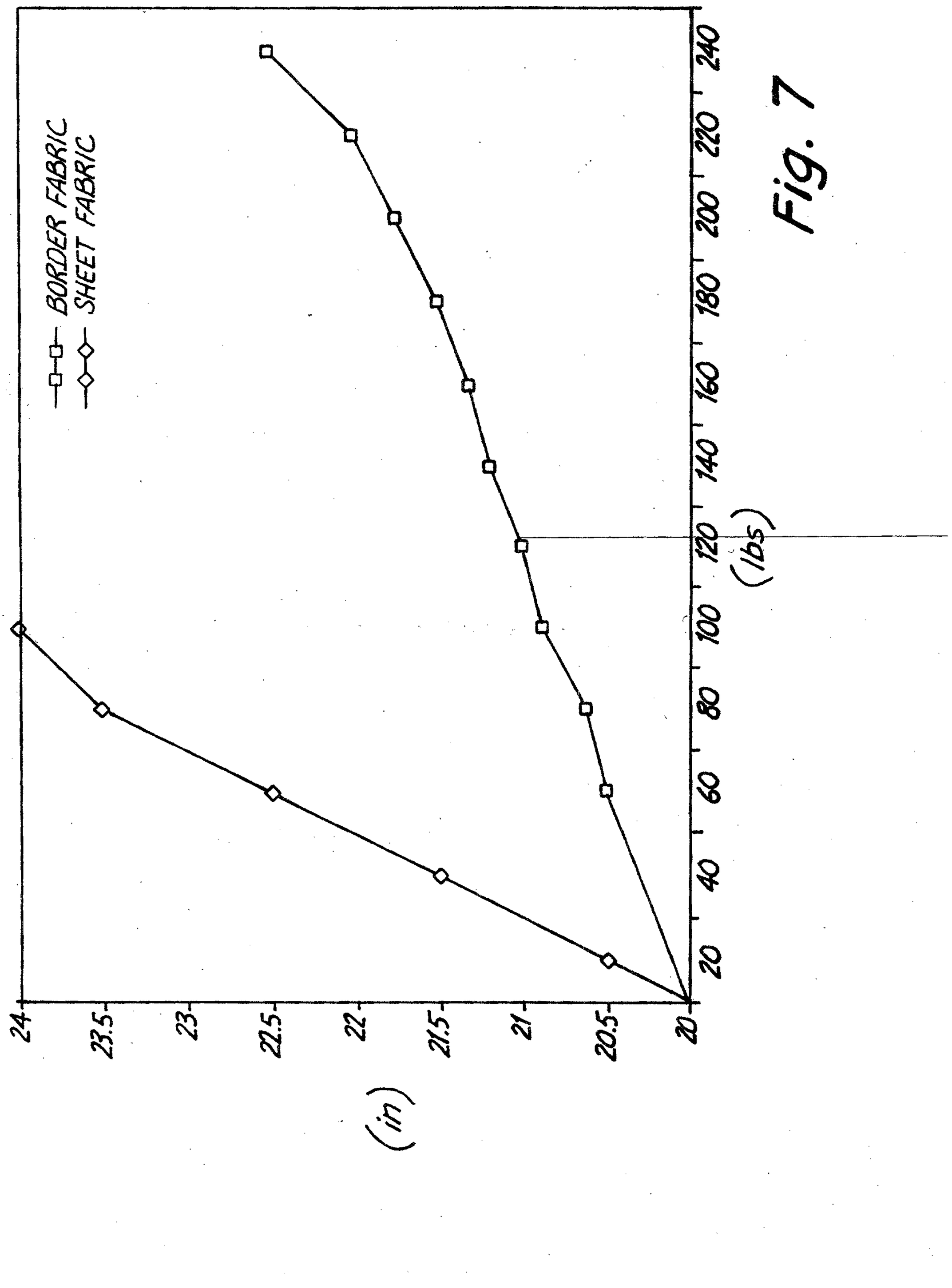

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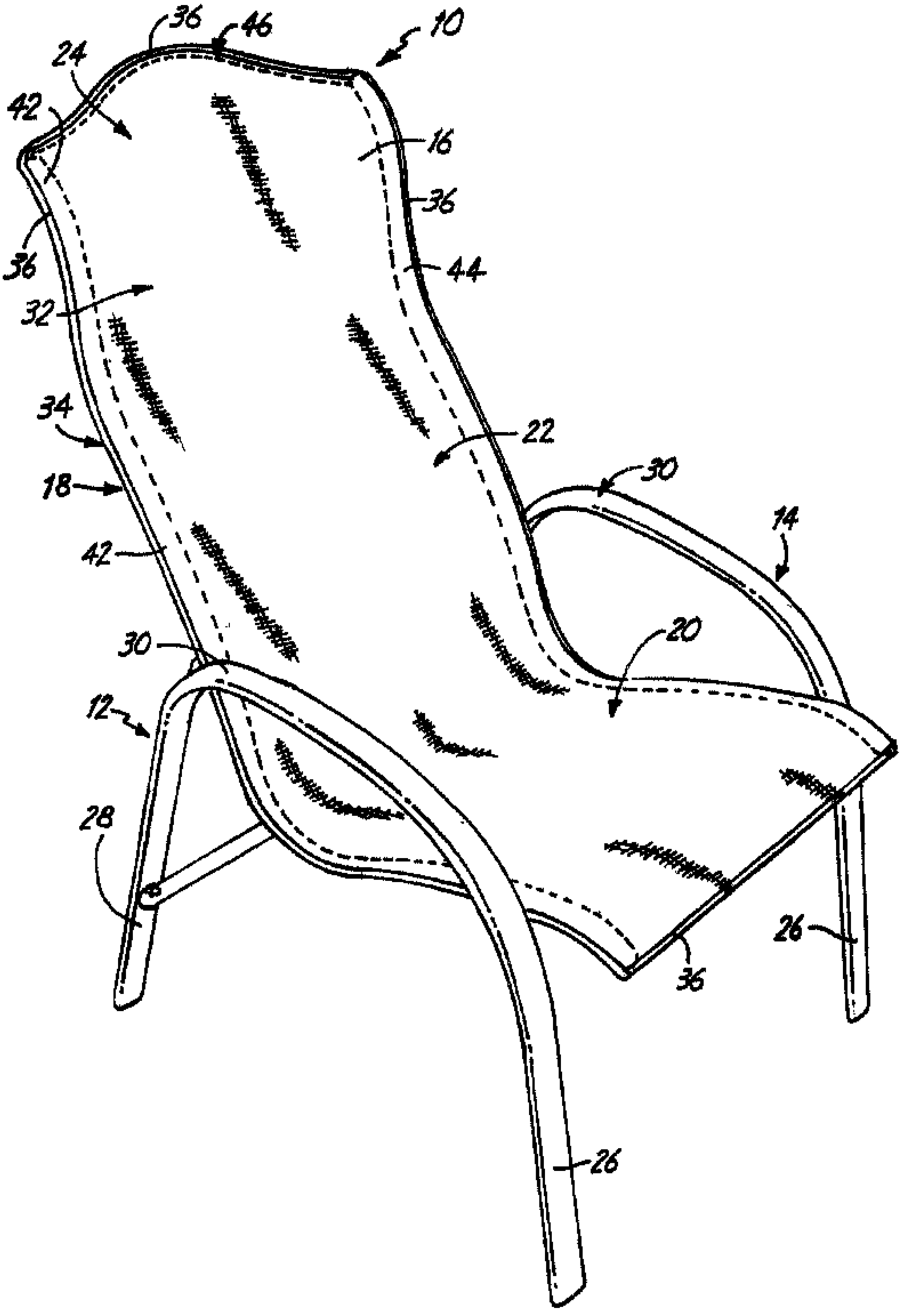
Fig. 7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