

June 23, 1959

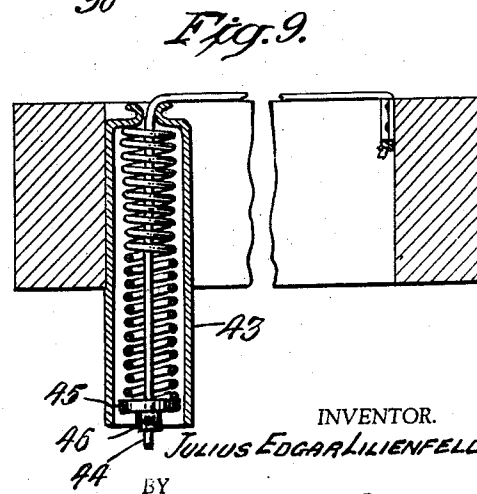
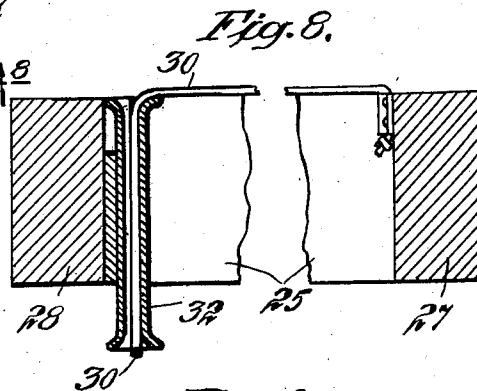
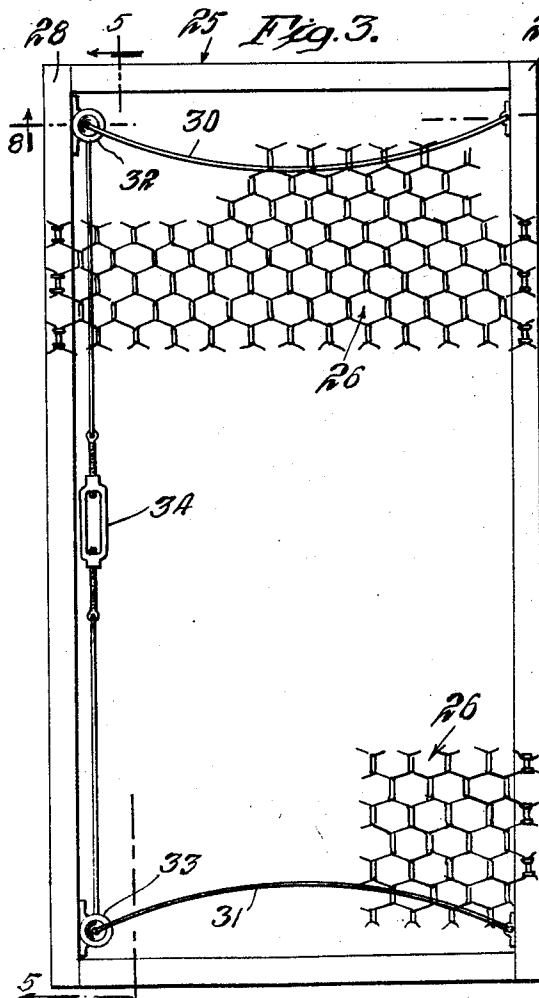
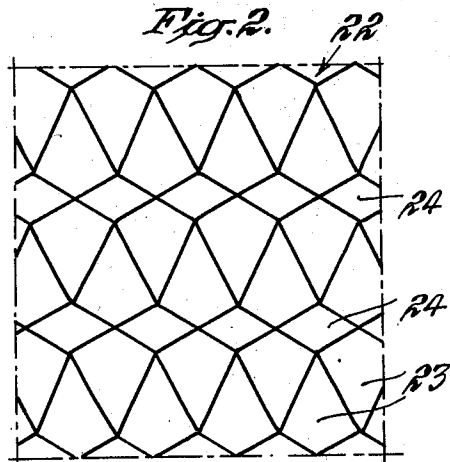
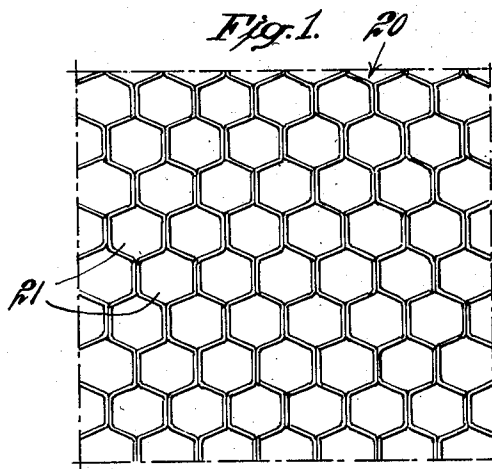
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2,891,603

RESILIENT RETIFORM-FABRIC SUPPORT SURFACES

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4 Sheets-Sheet 1



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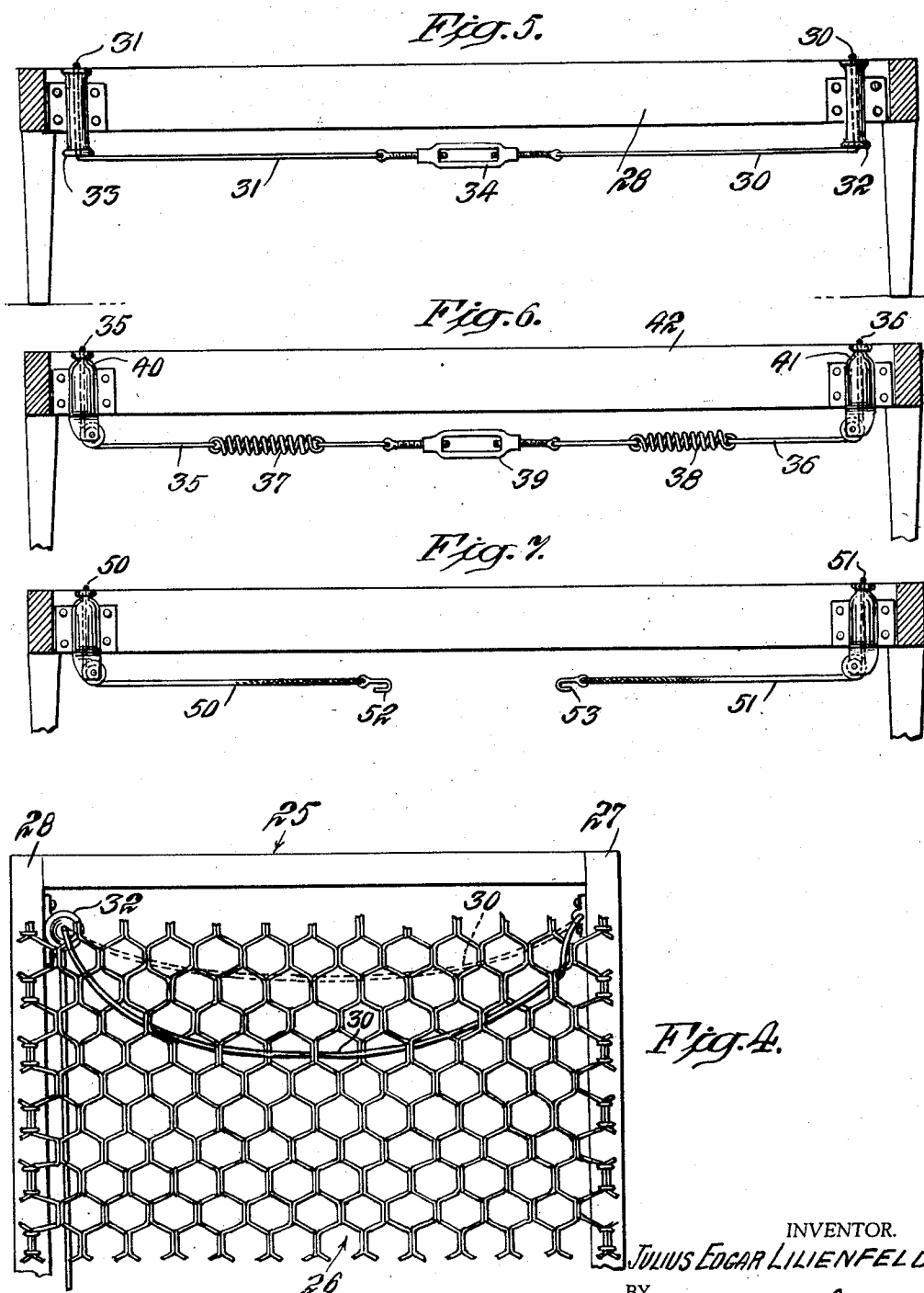
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RESILIENT RETIFORM-FABRIC SUPPORT SURFACES

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4 Sheets-Sheet 2



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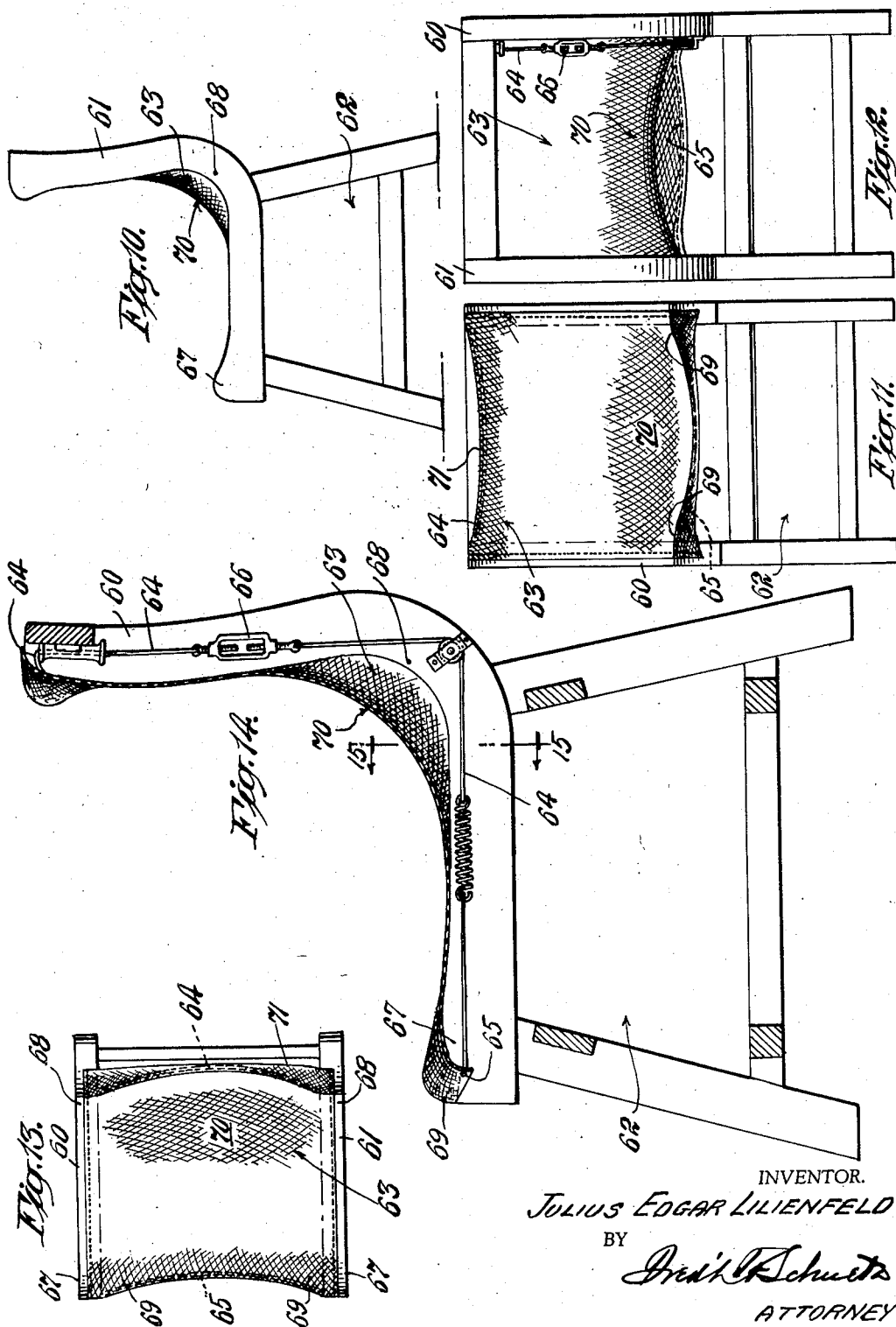
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RESILIENT RETIFORM-FABRIC SUPPORT SURFACES

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4 Sheets-Sheet 3



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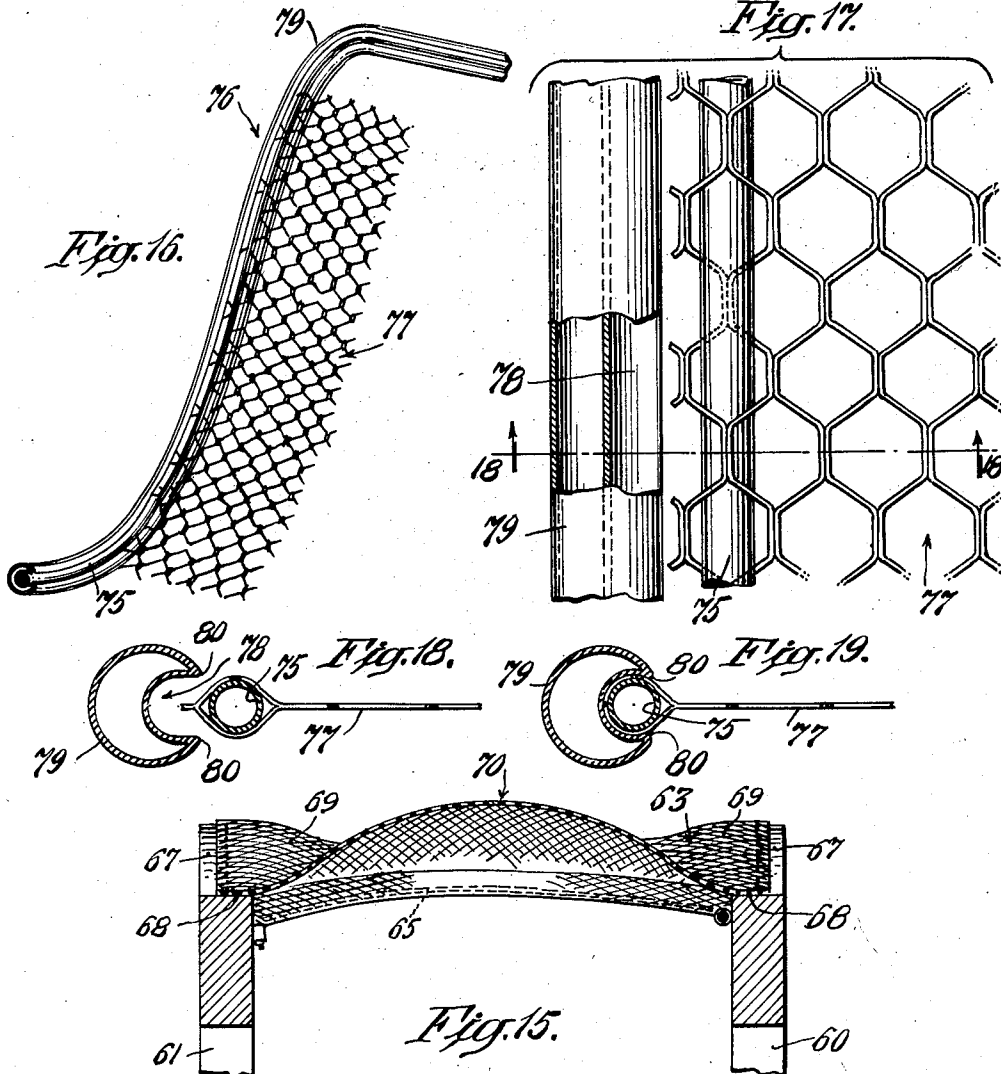
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RESILIENT RETIFORM-FABRIC SUPPORT SURFACES

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4 Sheets-Sheet 4



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2,891,603

RESILIENT RETIFORM-FABRIC SUPPORT SURFACES

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4 Claims. (Cl. 155—187)

The invention relates to the combination of fabrics of the retiform type with frames and the like to form supporting surfaces of a resilient nature adapted to the shape of the load to be supported. More particularly, it is concerned with the application of such fabrics to the upholstery of furniture frames, although it is to be understood that the invention is not restricted to the art of upholstery.

The invention has for an object to adapt to the aforesaid purposes the inherent property of a retiform fabric—the mesh pattern of which is made of substantially inextensible filaments—to become distorted under stress and thus to conform to the shape of the load.

A further object of the invention is to make use of a retiform fabric of such mesh pattern as would possess the highest attainable degree of the aforesaid conformability.

Another object of the invention is to provide frames such as will, in upholstering, adapt the surface of the fabric to conform to the shape of the load and thus afford adequate resilient support for the latter.

In carrying out the invention, a retiform fabric of substantially inextensible filaments is attached firmly to a rigid frame along its lateral members and with an adequate amount of slack. If desired, this may be done by attaching the frame to a sub-frame which is then securely fixed to the aforesaid frame.

In order to take up the aforementioned initial slack of the fabric, tensing means are introduced across it and fixed to the lateral members. The area between the tensing members and the frame becomes thus the active area for resilient support.

The nature of the invention, however, will best be understood when described in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary detail view, in plan, of a suitable pattern of the fabric to be utilized; and Fig. 2 is a similar view illustrating a modification.

Fig. 3 is a plan view of a cot, as one embodiment to which the invention is applicable, and with portions of the fabric broken away—the fabric being shown in the condition before tension has been applied thereto.

Fig. 4 is an enlarged, fragmentary plan view illustrating the interlacing of a tensing means with the fabric.

Fig. 5 is a longitudinal section through the cot, taken on the line 5—5, Fig. 3, looking in the direction of the arrows—with fabric omitted; and Figs. 6 and 7 similarly illustrate modifications.

Fig. 8 is a transverse section, on an enlarged scale, taken on the line 8—8, Fig. 3, and looking in the direction of the arrows; and Fig. 9 is a similar view illustrating a modification.

Fig. 10 is a side elevation of a chair assembly embodying the invention; and Figs. 11, 12 and 13 are respectively a front elevation, a rear elevation and a plan thereof.

Fig. 14 is a longitudinal section through the chair, on

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an enlarged scale; and Fig. 15 is a transverse section taken on the line 15—15, Fig. 14.

Fig. 16 is a fragmentary elevation of the back portion of a chair and illustrates a modification in the framing construction and retention of the fabric thereby; and Fig. 17 is an enlarged fragmentary view thereof, with parts broken away and the framing members detached from each other.

Figs. 18 and 19 are transverse sections, the former taken on the line 18—18, Fig. 17, and looking in the direction of the arrows, and the latter view showing the members assembled.

The retiform fabric used in carrying out the invention is made up of insignificantly extensible filaments; and by the term "retiform" is to be understood a fabric of which the pattern is designed as repetitions of a mesh which is knitted, knotted, etc., in such a manner that the filaments thereof do not slip at their intersections. Thus, as is indicated in Figs. 1 and 2, which show two different mesh patterns, the pattern 20, Fig. 1, is shown as being composed of hexagons 21; and the pattern 22, Fig. 2, as composed of alternating rhomboids 23 and rhombuses 24. The common features of these patterns is their formation by more than two vectors. Patterns of this type are to be preferred to patterns formed by two vectors only, such as those of the conventional fish-net type.

At either cross-border of the aforesaid active area—or at both cross-borders—flexible tensing means are introduced to stress the fabric over its active area, the initial length dimension of which will then be a minimum along the axis intermediate the lateral members. Correspondingly, when tension is applied, the elongation of the active portion of the fabric becomes maximal along said axis and tends to zero value along the lateral members.

A convenient way to stress the fabric in the aforesaid manner is to interlace arcuately—the convexity of the arc being toward the active area—with the mesh a flexible member and to fix it thereupon under tension to the frame, thereby reducing its curvature.

The filament material constituting the fabric is to be so chosen as not to be affected significantly by ambient humidity conditions and/or temperature conditions, and must as well possess insignificant extensibility and also rapid recovery upon removal of the applied load. Numerous metal filaments, i.e., wires, stranded wires, etc., satisfy such requirements.

I have found that these conditions are generally not satisfied by the vegetable type of fibers, but that some synthetic fibers are acceptable, for example, those of nylon, Dacron, Orlon, etc.

The fact that resilient performance is obtained with a substantially inextensible, inelastic filament is of practical importance—not only because such filaments are by far the most stable ones in all respects—but, just as important, because in the absence of significant elongation of the filament, the response of the fabric to the stressing is strictly defined and may be so adjusted as to support the load in proper shape. It may be added that this resilient performance of a fabric made of inextensible filaments is a consequence of the indicated strict definition of its response to the size and shape of the load. If the latter changes, the configuration of the fabric changes; and the transition from configuration to configuration is accompanied by a change of the energy level of the total assembly, which fact involves a resilient performance. If so desired, the resiliency of the assembly may be arbitrarily increased by endowing the tensioning element with adequate elastic performance, e.g., by using a spring in series with it, or by making said element itself of an elastic braid or cord, etc. This will adjust the performance of the assembly to a desired degree, while not altering it in kind.

In the particular embodiment of the invention for the upholstering of a rigid frame, such as the cot frame 25 shown in Fig. 3 and over which is provided the fabric 26, the said fabric is attached to the respective sides 27, 28 of the frame with an adequate amount of slack. In order to establish the desired stress, inelastic wires 30, 31 are to be arcuately interlaced with the meshes of the fabric (as is more clearly shown in Fig. 4) at the cross-borders of the active area. The said wires are then connected under tension to the lateral members 27, 28 (by reducing the convexity of the arc as is indicated by the dotted line position, Fig. 4), first passing through direction-changing guides 32, 33 secured to the cot frame 25, as shown.

The tension to be applied to the wires may then be afforded through the operation of an intermediate turnbuckle 34, in which case the opposite ends of the turnbuckle are attached respectively to the corresponding ends of said wires. Or, the tension may be established once for all in assembly by means other than turnbuckles, in which case, however, no adjustment is available to the user. The desired degree of tension may thus be applied to the fabric through its mutual reaction with the tensing wires.

Or inelastic wires 35, 36, reference being had to Fig. 6 of the drawings, may be associated with a resilient member or members such as a spring or springs 37, 38 which are connected to a turnbuckle 39 for determining the tension, said wires being interlaced with the fabric (not shown) as in the previously described embodiment, and passing through the guides 40, 41, respectively, attached to the lateral member 42. If desired, such springs may be retained within a corresponding tubular direction-changing guide as the guide 43, Fig. 9, bearing against the inner end thereof. A tensing wire 44 then passes axially through the spring and through a plate 45 which engages the outer end of the spring, a clamp 46 being provided about the wire to connect the latter operatively to its spring and maintain the predetermined tension thereof.

However, resilience may be associated with the tensing members by making them inherently elastic, for example, said members may be of the nature of the elastic cord set forth in my U.S. Letters Patent No. 2,700,317. Thus, reference being had to Fig. 7, cords 50, 51 of this nature are interlaced arcuately with the fabric (not shown), whereupon the said cords are more or less stretched to reduce the curvature to the desired degree in selecting the stress applied, and the ends 52, 53 hooked together, their respective other ends having previously been fixed to opposite lateral members of the frame (not shown).

The application of the novel upholstery arrangement to a chair is illustrated in Figs. 10 to 15 of the drawings, wherein there is disclosed, also, the manner of conforming the active surface to the shape of the load for securing maximum comfort and support of the spine in sitting or reclining. This is effected by making the active surface adjustable to the load, so that convexities and concavities appear therein wherever such are required.

Thus, by proper shaping of the lateral members in curving them concavely where a convexity in the surface (pillow effect) is required and convexly where a concave supporting surface is called for, the supporting load or active surface may be suitably accommodated. For example, the lateral members 60, 61 of the chair have a predetermined curvature, as shown, and are rigidly fixed to the supporting base portion 62 in the conventional manner. The upholstery fabric, indicated at 63, is supported by said lateral frame members; and, in accordance with the invention, the fabric—which is of the specific type hereinbefore set forth—is first fixed along its edges to said lateral members, with an adequate amount of transversal slack, to follow the predetermined curvature thereof. Then flexible stressing members 64, 65 are interlaced with the fabric 63 in the manner aforesaid and tensioned,

for example, by adjustment of an interposed turnbuckle 66 to reduce the initial curvature of the arc of said stressing members to an extent sufficient to afford the desired effects, tensing the originally slack fabric to a degree for proper support. It is to be noted that the fabric thus tensed will form itself according to a concave surface in correspondence with a convex portion of the lateral members; and conversely, said surface will be convex where the curvature of said members is concave.

By thus choosing the inversion points, as the points 67, 68 along the respective lateral members, and the radii of the curvatures for such members, the active surface of the chair presents portions 69, 70 concavely and convexly conforming to the specific features of the load.

Particularly in the case of chairs and in order to conform to the anatomy of the human body, it is important that the radius of curvature of the lateral members should not exceed seven inches at the transition area of backrest to seat of the chair.

The fabric may continue beyond the active area, specifically beyond the stressing members, as in the case of the portion 71, in which it is slack in these areas; and the manner of integrating the slack portions with the frame is merely a question of appearance.

A convenient arrangement for securing the aforesaid desirable curvatures, as well as to effect ready attachment of the fabric, is to provide a suitably shaped sub-frame unit for said fabric and within which it is tensed. As is shown in Figs. 16 and 17, the sub-frame is constructed of a rod or tube 75, of metal or other substantial material such as wood or plastic, the tube being shaped to follow the lines of the chair structure 76. To attach the fabric 77 to said sub-frame, it is necessary merely to thread a pair of such lateral members 75 through the corresponding edge meshes of the fabric 77, as is indicated in Fig. 17. The unit is then inserted into a longitudinal recess or groove 78 of the chair frame 79 which may be of tubular or solid material, in the former case having its wall rolled in, as indicated, to accommodate the sub-frame. After the sub-frame has been assembled with its chair frame, it is fixed thereto through a reduction of the recess, for example, by rolling over the edges 80 of the recess or groove, Fig. 19.

I claim:

1. In combination: a rigid frame having side and cross-members; a length of retiform fabric, of substantially inextensible filaments, fixed only along its sides to the corresponding sides of the frame; and flexible stressing means located across and secured at the respective ends of the frame to the sides thereof, said stressing means engaging transversely the corresponding ends of the fabric to establish an over-all distortion of the mesh pattern of the fabric over the area located between the said stressing means when tension is applied to said means.

2. The combination according to claim 1, wherein the mesh pattern of the fabric is formed with more than two vectors.

3. The combination according to claim 1, wherein the stressing means is interlaced with the mesh of the fabric.

4. The combination according to claim 1, wherein the stressing means comprises a flexible, axially-displaced, arcuate member, the convexity of the arc thereof being directed toward the active area of the fabric.

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