United States Patent [19]

Bloomfield et al.

[11] **3,794,382**

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[54] **SUPPORT SYSTEMS FOR THE SEATED HUMAN BODY**

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[73] Assignee: **British Railways Board,** London, England

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[21] Appl. No.: **196,484**

Related U.S. Application Data

[63] Continuation of Ser. No. 878,849, Nov. 21, 1969, abandoned.

[30] **Foreign Application Priority Data**

Nov. 27, 1968 Great Britain 56,324/68
July 16, 1969 Great Britain 35,924/69

[52] **U.S. Cl.** **297/457,** 297/216, 297/452
[51] **Int. Cl.** **A47c 7/02,** A47c 1/08
[58] **Field of Search** ... 297/216, 217, 196, 445, 452, 297/456, 457

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Attorney, Agent, or Firm—George Vande Sande

[57] **ABSTRACT**

A support system for the seated human body comprising a two-dimensional material such as a length of netting constrained under tension to define a three-dimensional support form including in an upwardly extending length of the material a localised forwardly projecting support portion for the upper pelvic/lumbar area of the human body, the tension in the forwardly projecting support portion being preferably higher than in the remainder of the upwardly extending length of the material. In a generally horizontally extending seat portion the tension in a zone immediately forward of the ischial tuberosities supporting zone is preferably higher than the tension in the ischial tuberosities supporting zone itself.

7 Claims, 9 Drawing Figures

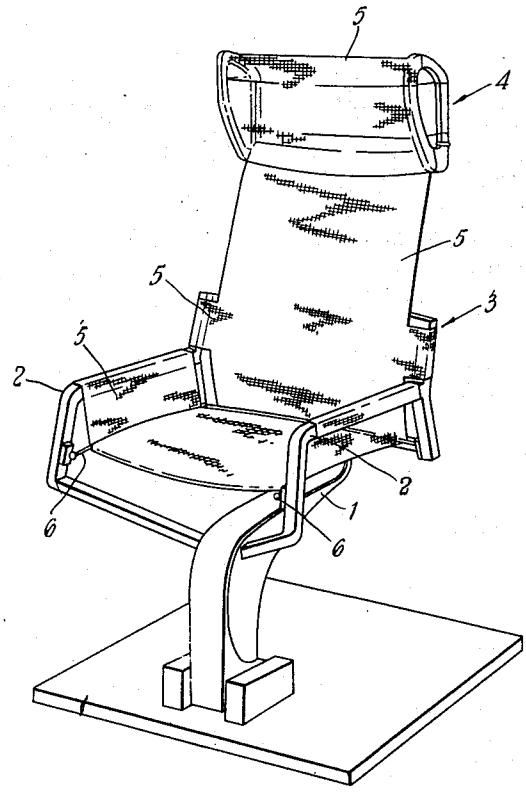
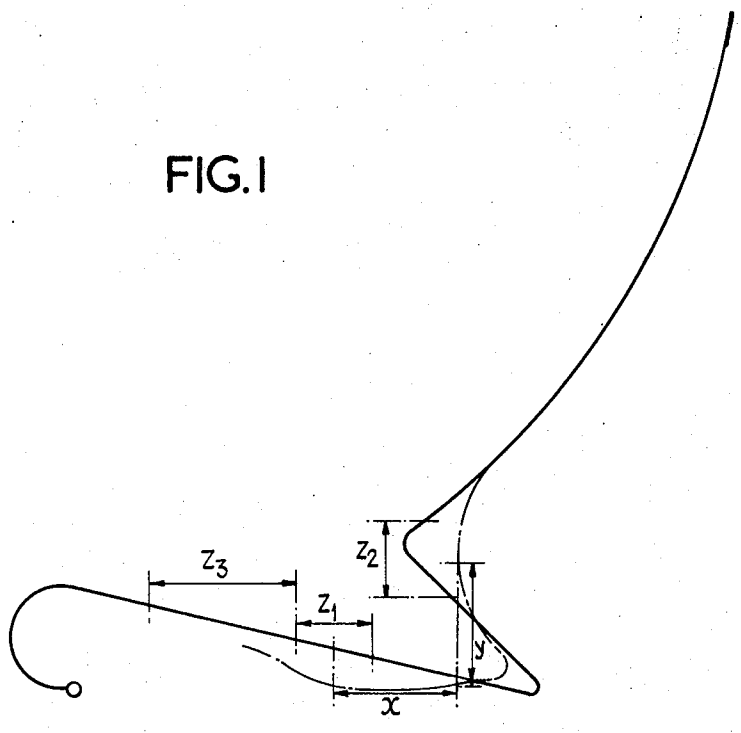


FIG. 1



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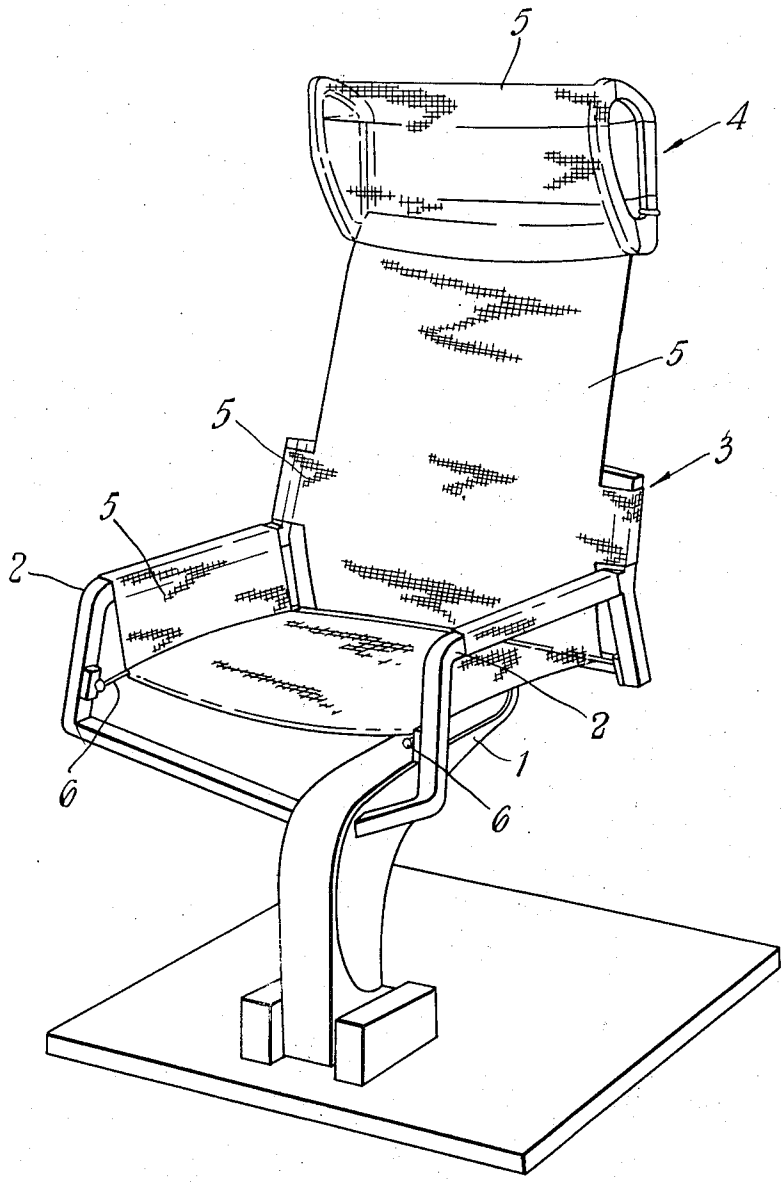

FIG. 2

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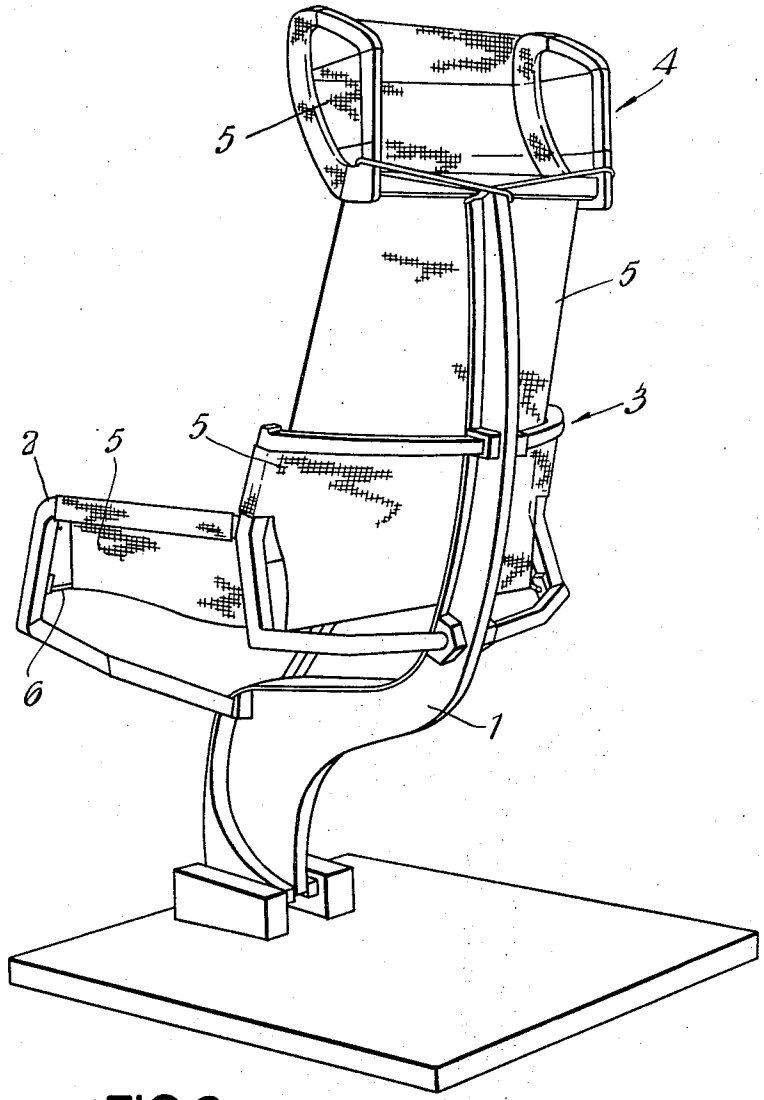

FIG. 3

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FIG. 5

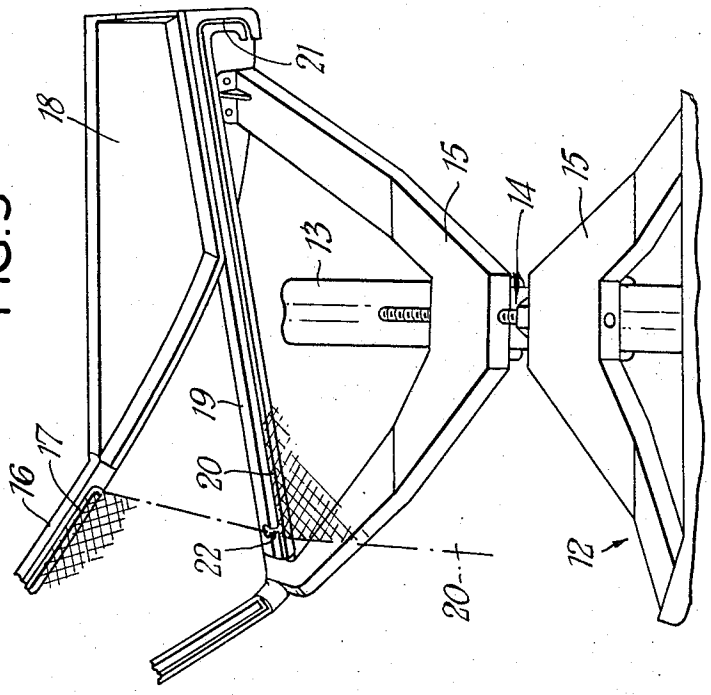

FIG. 4

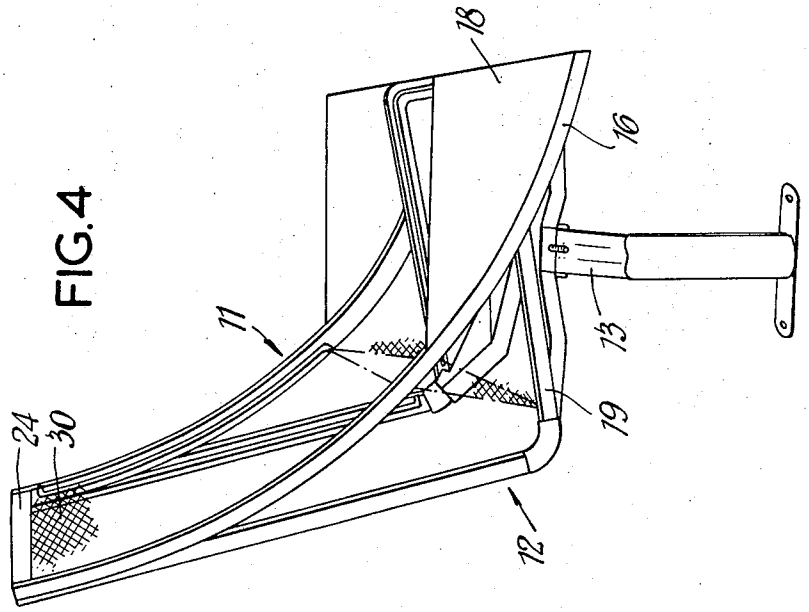

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FIG.6

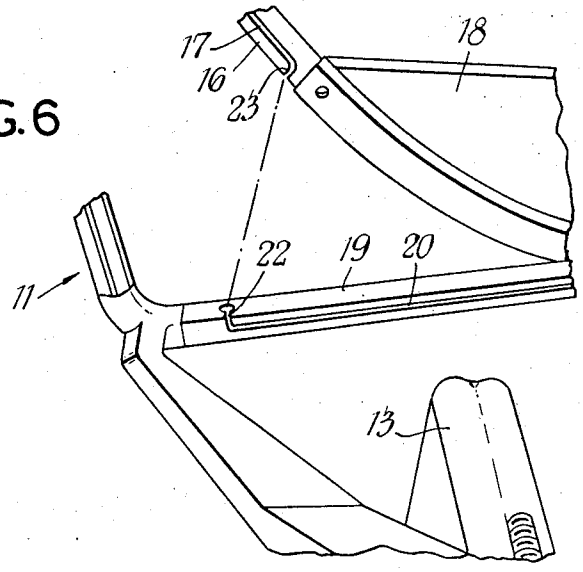


FIG.7

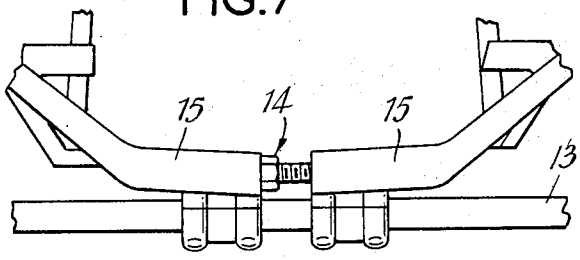
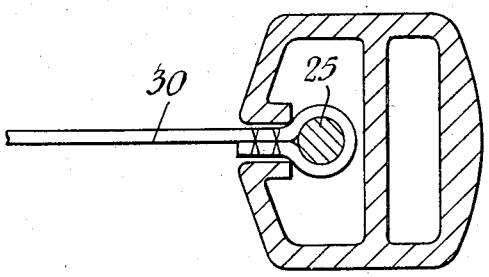


FIG.8



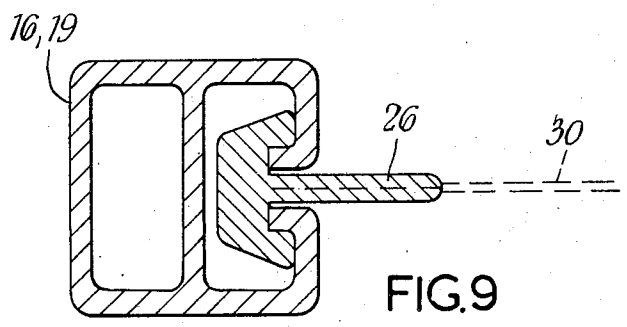


FIG.9

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SUPPORT SYSTEMS FOR THE SEATED HUMAN BODY

This is a continuation of application Ser. No. 878,849, filed Nov. 21, 1969 now abandoned.

This invention relates to support systems for the seated human body.

The object of this invention is to provide a support system for the seated human body which is of lightweight construction and which stabilises effectively certain parts of the seated human body without the use of conventional upholstery whilst providing for optimal sitting comfort.

According to this invention in its broadest aspect, a support system for the seated human body comprises a substantially two-dimensional tensionable material constrained under tension by a supporting structure to define a three dimensional support form including in an upwardly extending length of said material a localised forwardly projecting support portion for the upper pelvic/lumbar area of the human body.

Since in accordance with the present invention the human body is not supported through padding or the like but simply by the said material under tension, dissipation of heat generated at the interface between the body and the support system is facilitated and can be further improved if said material is, for example, in the form of netting.

In the ideal support system in accordance with the invention said localised forwardly projecting portion provides a sacral support region, but as will be appreciated hereafter from the description with reference to FIG. 1 of the accompanying drawings, because of the variation in size of human beings the upward extent of said localised forwardly projecting portion will extend into the lumbar area of some human beings.

For an understanding of the present invention it must be recognised that the human body is essentially a system of open-chain links and, particularly in the seated posture, is inherently unstable without the intervention of muscle activity. Head, trunk, arms and legs are flexibly linked and within these body parts there are yet further flexible links, notably that between the pelvic bone and the lumbar vertebrae. Scientific investigation has shown that in the sitting posture the pelvis normally rocks over the ischial tuberosities unless the uppermost backward extension of the pelvis itself is stabilised by leaning against a surface relatively rigidly connected to the surface on which the ischial tuberosities rest. Furthermore, unless the pelvis is restrained from rocking or rotating slowly, the ischial tuberosities will tend to slide forward on the seat due to the weight of trunk, head and arms, so that the lumbar spine is no longer supported by the back-rest. This is considered by most orthopaedic authorities an unhealthy posture contributing to lower back complaints.

By achieving stabilisation is not meant complete immobilisation of the pelvis in one specific posture but that a stable effect is obtained over a range of positions normally considered as sedentary. The main reasons for seeking such stability are firstly on health grounds it is undesirable that the spinal ligaments should be subjected to the strain imparted to them by the said rocking or rotation of the pelvis. Secondly, on grounds of sitting comfort stability of the pelvis saves muscle effort and hence encourages relaxation.

In further development of the present invention, said material is more highly tensioned immediately forward of its ischial tuberosities supporting portion than at the latter portion in order to assist in restraining the human body from sliding forward.

The invention will now be further explained with the aid of the accompanying drawings, in which:

FIG. 1 shows in side view the basic profile of the support system,

FIGS. 2 and 3 are front and rear perspective views of one embodiment of the invention,

FIG. 4 shows a side view of a second embodiment,

FIG. 5 shows the adjustability of two side frames of the embodiment of FIG. 4,

FIG. 6 shows a detail of the side frames,

FIG. 7 shows the adjustment arrangement for the side frames ane,

FIGS. 8 and 9 show alternative ways of trapping the netting in the side frames.

In the embodiments shown in FIGS. 2 to 9 the support system for the seated human body comprises a single length of netting material held along its lateral edges and along its upper and lower edges under tension in a supporting structure to define a generally horizontal seat portion and an upwardly extending back supporting portion. In FIG. 1 is seen in side view one example of the contour which a length of material follows in accordance with the invention, the chain-dotted lines indicating generally the way in which the material would be deformed along its centre-line (i.e. at the mid-width of the material) by a seated person in the sacral supporting zone and in the ischial tuberosities supporting zone.

On FIG. 1 have been indicated the distances x, y, z_1, z_2, and z_3. For 90–95 percent of the adult population seated in the support system, if the distance x is five inches and the distance y is six inches and the distances z_1 and z_2 are about four inches, their ischial tuberosities will rest in the zone defined by z_1 and their sacrum will rest in the zone defined by z_2. In accordance with the invention therefore it is in the zone z_2 that the forwardly projecting portion of the upwardly extending length of material is provided and advantageously the tension of the material at least in the upper part of this zone is higher than in the remainder of the upwardly extending portion. As regards the area below the zone z_2 it is essential that the material sweeps backwardly as shown so that this does not come up against a seated person and tend to push him forwardly. Also in order to assist in restraining the body from sliding forwardly the material in the zone defined by z_3 and immediately forwards of the ischial tuberosities zone z_1 will be at a higher tension than in the zone z_1. The tension of the zone forward of the zone z_3 is advantageously fairly low in order to provide comfort under the knees of the sitter. Likewise the tension in the material above zone z_2 is advantageously sufficiently low for the material to wrap to some extent around the back of the sitter to provide lateral stabilisation.

Referring now to the first embodiment shown in FIGS. 2 and 3 the support system has a supporting structure comprising a curved spine 1 from which extend various frame members which define arm rests 2, back frame 3 and head-rest frame 4.

Netting 5 is suspended from the arm rests 2 and is constrained by cords 6 or shaped by stitching. The netting continues upwards to form the back rest and has

a forwardly projecting portion which is held taut by back frame 3 in such a way that firm support is given in the upper pelvic/lumbar area. The netting 5 also forms the head rest on the head-rest frame 4.

The spine 1 extends to the floor. It may be hinged to tilt the seat backwards. It is essential in this embodiment that the tilting should not cause the leading edge of the seat to be raised. Recline may be controlled hydraulically. In an alternative construction, where the framing continues down to the floor on both sides of the seat, another method of reclining the seat would have to be adopted.

Referring now to the second embodiment shown in FIGS. 4 to 9 of the drawings, the length of netting 30 forming the body support system has the general contour shown in FIG. 1 and is supported between two side frames 11 and 12. Each side frame 11 and 12 is slidably supported on a cross beam 13 so that in constructing the seat the spacing between the side frames 11 and 12 can be adjusted. To effect this adjustment a lead screw arrangement 14 is provided between inwardly extending members 15 of the side frames 11 and 12.

Each side frame 11, 12 has a curved hollow metal or plastics extruded member 16 for example of aluminum, formed with a continuous slit 17 along it opening into the interior of the extrusion. Secured to the lower end of the member 16 is arm rest member 18.

Each side frame 11, 12 also has hollow aluminum extruded member 19 bent to angular form so that it extends from the front to the back of the seat portion and then extends upwardly to join with the curved member 16. At the front of the seat portion the member 19 is attached to the arm rest member 18. The member 19 also has a continuous slit 20 extending along it. As can be best seen from FIG. 5 at the front of the seat the slit 20 aligns with a slit 21 formed in the arm rest 8 and which curves generally downwardly.

The length of netting 30 extends between the two side frames 11 and 12 and has its side edges trapped in the various slits mentioned. Thus proceeding from the front of the seat, the side edges of netting 30 follow slits 21 and 20 to the rear of the seat portion. They then leave members 19 through slots 22 and extend to members 16, into the slits 17 of which they are entered through slots 23. Thereafter the side edges of the length of netting follow the slits 17 up the back portion of the support system. At the top of the back portion the end edge of the netting is trapped in cross member 24.

The side edges of the netting 30 may be trapped in the members 16 and 19 in the manner shown in FIG. 8. Thus a cord 35 is threaded through a hem in each side edge of the netting, the cord being wider than the slits 17 and 20. Alternatively it may be trapped in the manner shown in FIG. 6 where a side runner 26 of PVC is heat sealed to the side edges of the netting 30, the side runner 26 having a portion 27 trapped in the hollow of the extruded member 16, 19.

To fit the netting 30, the side frames 11 and 12 are initially spaced apart a distance less than their spacing in the finished seat. The netting is then fitted in the side frames 11 and 12 and to the cross member 24. Afterwards the net is transversely tensioned by the lead screw arrangement 14 which moves the side frames 11 and 12 apart.

Finally the cross member 24 is fitted. It can be arranged by careful tailoring of the length of netting 30 that when the spacing of the frames 11 and 12 corresponds to the finished dimensions of the seat, the netting 30 is correctly tensioned.

To provide zones of different tension in the length of netting 30 the latter may be cut on the bias in predetermined zones. Alternatively the netting may have a different composition in predetermined zones, or provided with reinforcement.

We claim:

1. A support system for the upright seated human body comprising,

a supporting frame including back support means,

a flexible web material constrained under tension on said back support means to define a three-dimension back support form,

said back support means including pelvic-lumbar support means at the upper pelvic-lumbar area of the human body,

said pelvic-lumbar support means supporting said flexible web material with a configuration such that said back support form defines a first support portion which extends laterally of said back support form and is positioned forwardly of the rest of the flexible web material forming the back support form,

said first support portion of said back support form being constrained in tension across its width by said pelvic-lumbar support means,

said back support means having additional means at second and third locations which are respectively above and below said first support portion which constrains said flexible web material so that the upwardly extending length of said material extends both upwardly and rearwardly and also downwardly and rearwardly from said first portion to define thereby said back support form,

said flexible web material being unsupported across the width of the back support form by said back support means between said additional means at said first and third locations.

2. A support system as claimed in claim 12, wherein the tension of said flexible web material in said first support portion is higher than in the remainder of said upwardly extending length of said web material.

3. A support system as claimed in claim 1 wherein in a generally horizontally extending seat portion the tension in a zone immediately forward of the ischial tuberosities supporting zone is higher than the tension in said ischial tuberosities supporting zone.

4. A support system as claimed in claim 3 wherein forward of said zone of higher tension up to the front edge of said seat portion the tension of said material is less than in said zone of higher tension.

5. A support system as claimed in claim 1, wherein the supporting structure includes two side frames provided with slits in which the side-edges of the material are trapped.

6. A support system as claimed in claim 5, wherein the spacing of said side frames is adjustable in order to vary the transverse tension in said material.

7. A support system as claimed in claim 6, wherein said side frames are interconnected through a lead-screw arrangement enabling the adjustment of said side frames.

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