

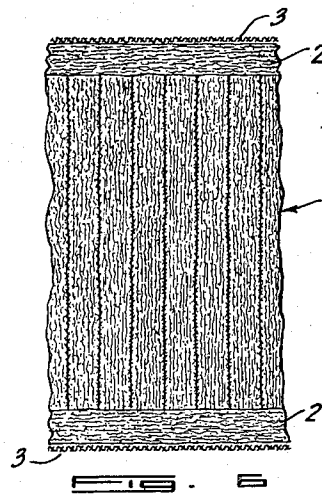
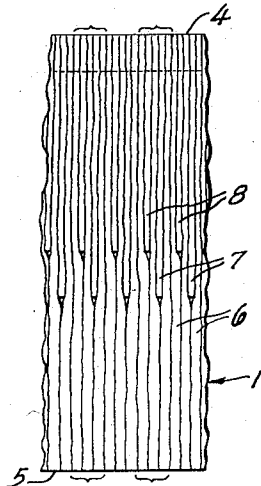
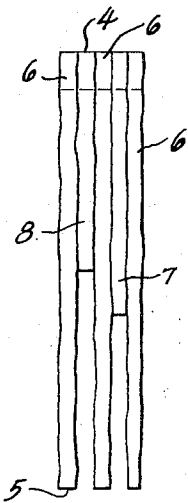
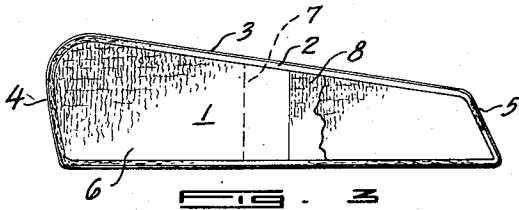
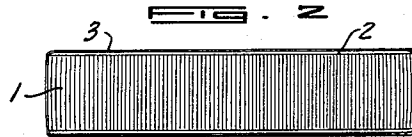
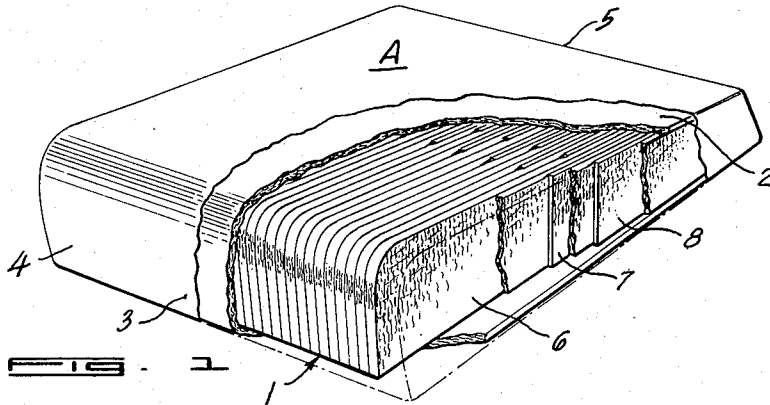
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CUSHION AND METHOD OF MANUFACTURING THE SAME

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CUSHION AND METHOD OF MANUFACTURING THE SAME

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The present invention relates to the construction of an improved seat cushion especially adapted for vehicle seats, and its method of manufacture.

In the design of seats, comfort and the elimination of fatigue on the part of the occupant is of obvious importance, especially in connection with vehicle seats used in aircraft, busses, and railroad cars where passengers are apt to be confined to their assigned seats for considerable lengths of time. In addition to these considerations, it is desirable that the construction be as light as possible and at the same time sufficiently durable to withstand the repeated use to which it is subjected without failure or excessive maintenance. All of these requirements are present in the seat cushion as well as in the structure of the seat itself.

Considerable investigation has been undertaken in recent years to the end of producing riding comfort in vehicles and in particular, to the development of design criteria for vehicle seats and cushions which provide optimum conditions of these factors. An article entitled "Riding Comfort and Cushions," by W. E. Lay and L. L. Fisher of the University of Michigan, published on pp. 482-496 of the SAE Journal of November 1940, provides an excellent summary of this work and develops conditions of pressure distribution and deflection in cushioning the human body that are desirable in order to minimize fatigue and promote comfort. From this work it is clear that optimum conditions of comfort are obtained by varying the supporting pressure and deflection of a cushion to conform to the weight distribution of the load. For example, in a seat cushion it is desirable to provide maximum support under the buttocks where the weight of a seat occupant is concentrated, and a minimum of support under the knees at the front of the cushion.

In the conventional practice wherein springs or similar elements are employed to provide the desired resiliency in a cushion, pressure and deflection variation is accomplished by varying the individual characteristics of these resilient elements. This practice is not only costly but requires an excessive amount of padding on top of the elements in order to produce a satisfactory and uniform pressure gradient. In addition the concentrated action of the individual springs, etc. causes the upholstery to break down under repetitive loading.

The present invention contemplates a cushion construction which overcomes these objections

wherein the cushion filler is formed of a number of laminae of a suitable resilient material disposed generally in a plane parallel to the direction of the design load of the cushion and arranged "on end" or so that the load of the seat occupant is directed parallel to the plane of the laminae. The pressure and deflection characteristics of a cushion formed in this manner are readily varied to any recommended pattern by interspersing laminae of different lengths between full length laminae and by then laterally compressing the entire filler within a casing or envelope having the dimensions of the desired cushion. By this means the number of laminae in each section of the cushion is roughly proportional to the pressure characteristics of the cushion at that section and inversely proportional to its deflection. The interspersing of laminae of different lengths and the high degree of compression avoids load concentrations and provides extremely uniform pressure gradients over the cushion.

The principal object of the invention is therefore to provide a cushion construction having predetermined and variable pressure and deflection characteristics over its area wherein load concentrations are minimized and highly uniform and controlled pressure gradients are obtained.

A further object is to provide a method of manufacturing a seat cushion of the type under consideration providing the designer with a wide latitude in obtaining desirable pressure and deflection patterns and whereby assembly and maintenance is simplified and labor cost reduced.

The invention as thus described is capable of use with a wide variety of filler materials such as foam rubber, kapok, impregnated horse-hair, cotton batting and the like.

It is additionally advantageous that cushions and upholstery be light, chemically stable, fire-proof, non-absorbent, and that they do not take permanent set under repeated loads. All of these conditions are ideally met by the use of fibre glass, and it is an important object of this invention to provide a cushion construction for seats wherein this material, in particular, is utilized in such a manner that its characteristics are most efficiently employed to promote maximum comfort and durability. This object is attained by the use of fibre glass in the form of batts in which the glass fibres are generally disposed in the plane of the batt, and by fabricating the cushion filler of a plurality of laminae of this material disposed so that the plane of the

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batts is generally parallel to the plane of the design loads applied to the cushion. Additional stability and ease of manufacture is obtained by spraying the batts and the entire assembly when in laminated form with an adhesive material such as latex cement, and then laterally compressing the assembly within a cloth casing having the desired dimensions of the cushion.

A further object of the invention is therefore to provide a method of forming cushions having laminated fillers in which the laminae individually and in assembly are sprayed with a liquid adhesive such as latex cement and are held in laterally compressed form within a casing having the desired cushion dimensions.

Still another object of this invention is to provide a cushion of the type under consideration and a method of manufacturing the same in which the filler is composed of vertical laminations of fibrous batt material, particularly fibre glass batt, spraying the individual laminae and the assembly with a liquid adhesive, and compressing the filler with a casing or envelope having the ultimate form and size of the desired cushion.

A still further object of the invention is to provide an inexpensive method of fabricating cushions having fibre glass fillers.

Other advantages and objects of the invention will be apparent from the following description and the accompanying drawings in which like numerals of reference denote similar elements in the several views.

In the drawings:

Fig. 1 is a perspective of a seat cushion as comprehended by this invention in which portions are broken away to illustrate the construction and arrangement of its elements;

Fig. 2 is a transverse section of the cushion of Fig. 1;

Fig. 3 is a longitudinal section of the cushion of Fig. 1;

Fig. 4 is a view of one group of laminae as arranged in the course of manufacture of cushions as herein contemplated;

Fig. 5 is a partial view of the batts after assembly in the cushion;

Fig. 6 is an enlarged transverse section through a cushion when in final assembled relation.

The present invention is equally applicable to backs and arm rests of seats as well as to cushions, but its advantages are particularly evident in the latter, and for this reason it is described and illustrated in that connection. I desire it to be understood, however, that this is not to be considered as a limitation, and that the word "cushion" as herein used is to be construed as referring to any upholstered portion of a seat subjected to loads imposed by the seat's occupant.

Referring to the drawings, a typical cushion A embodying the present invention is shown comprising a filler 1, an outer wrapper 2, and a flexible casing or envelope 3. The cushion may be of any desired shape but as shown is generally rectangular in plan and is designed to be supported on a seat structure to provide a comfortable rest for those portions of the seat's occupant for which it is designed. The form shown is particularly suited for use as a cushion for the horizontal part of a seat, has a greater height at its forward edge 4 in order to cushion the under side of the occupant's knees, and is inclined downwards to the rear edge 5 to conform to standards of seat comfort that are well recognized in the art. The filler 1 comprises a

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series of laminae 6 having the fore-and-aft cross-sectional shape of the cushion disposed parallel to the direction of the design load, i. e. from front-to-back in the case of arm rests and seat cushions, and from top-to-bottom in the case of seat backs; and so that the loads are imposed against the ends or sides of the laminae, that is, parallel to their plane.

In the manufacture of a cushion of this type it is contemplated that the laminae 6 are blanked from a resilient and compressible material assembled in laminated form, compressed across their laminations; that the outer wrapper 2 is then placed around the periphery of the compressed laminae, and that the assembly is then pushed into the preformed cloth casing or envelope 3 where it is allowed to expand to the desired shape and size of the final cushion.

As thus far described, the invention exemplifies a cushion comprising a plurality of laminae of resilient material disposed with the plane of the laminae normal to the load-supporting surface of the cushion and a flexible envelope having the desired shape and dimensions of the cushion within which the laminae are supported in a laterally compressed condition.

The present invention contemplates means for uniformly varying the pressure and deflection characteristics of cushions in the plane of the applied load and this is accomplished by interspersing short laminae between the full-length laminae so that the pressure across any lateral section of the cushion is generally proportional to the number of laminae compressed therein, and the deflection is inversely proportional while the pressure and deflection gradients between sections of different characteristics are uniform and gradual.

In the drawings this feature is illustrated by the even interspersation of laminae 7 having the same cross-sectional shape as the rear edge 5 of the cushion A, but being shorter in length than the full-length laminae 6, and another group of evenly interspersed laminae 8 of even shorter length than the laminae 7. When the laminae 6, 7, and 8 are assembled so that their rear edges are aligned and the assembly is compressed and pushed into the envelope 3 as described, the resulting cushion will have a region at its rear edge having greater pressure and less deflection than at its front edge, and wherein the pressure and deflection gradients are even and uniform and present no abrupt or uncomfortable edges or projections. By this means, portions of a cushion where support is not necessary are reduced in density, contributing to a general reduction in the weight of the upholstery, a factor that is of especial importance in aircraft.

The invention thus exemplifies a means for constructing cushions having variable pressure and deflection characteristics in different lateral sections comprising evenly interspersing laminae having the same cross-sectional shape and size as the desired final cushion, but of shorter length, between laminae of the full-length shape and size of the desired cushion and compressing the laminae laterally into an envelope having the shape and dimensions of the desired cushion. It is intended that the envelope 3 be constructed of flexible material such as linen, cheese-cloth or any other suitable material. An outer covering of trim cloth (not shown) may be employed for ornamentality and to resist wear by abrasion. The wrapper 2 is preferably but not necessarily formed of the same

material as the laminae 6, 7, and 8, and serves to promote a higher degree of comfort and better wearing qualities in the cushion by further distributing the load to the laminae and by minimizing the effect of any irregularities that may exist in the lengths thereof. It also facilitates the operation of pushing the compressed filler 2 into the envelope 3 by providing a relatively smooth surface between the two elements.

While a wide variety of materials are capable of application to the present invention, including foam rubber, or fibrous materials such as impregnated horse hair, cotton batt and the like, I have found it advantageous to form the filler 1 and wrapper 2 of fibre glass, a material that is light, chemically stable, non-absorbent, fire-proof and therefore ideal for the purpose.

Fibre glass is presently available in the form of woven cloth or as batts. In the latter form, the direction of the fibres is generally in the plane of the batt but the fibres are not otherwise controlled in relation to one another. The present invention contemplates the use of fibre glass batt material having a thickness of approximately one inch before fabrication. I have found this material to be of low cost and to possess characteristics that are superior to other materials when arranged as herein described.

When fibre glass batt is subjected to loads parallel to the plane of the batt, a higher degree of support is realized than under conditions when the load is imposed in a direction normal to the batt. Under the former conditions the load is supported resiliently and the material does not take a permanent set. Batt subjected to repetitive loading normal to its plane has less strength and resilience and tends to separate, the fibres being pushed away from the points of loading and eventually failing to provide adequate support.

I have also found it desirable to employ fibre glass batt having a specific density of .5#/cu.ft. composed of so-called "B" fibre in the construction of cushions as herein contemplated. This material utilizes fibres of approximately .00011" in diameter which are lightly bonded together with a thin coat of thermosetting resin.

While the principles of construction contemplated by the present invention obviously may be employed to produce a cushion which satisfies any desired pressure distribution and deflection pattern, I have chosen to exemplify it in connection with a seat cushion which approximates the pattern recommended in the above SAE Journal article, for obtaining maximum comfort and minimum fatigue.

I have found that these recommended conditions may be closely obtained in a cushion utilizing fibre glass of the type described and whose final dimensions are 22" in length, 18" in width, and tapering from 6" in height at the front edge to 3" at the rear, by building up the filler 1 from 54 laminae 6 having the full longitudinal cross-sectional form of the cushion, 18 center laminae 7 conforming to the rear 13" of the cross-sectional form of the cushion.

As an important feature of this invention, I have found it advantageous to spray the flat faces of all of the laminae 6, 7, and 8 with a thin coat of adhesive such as latex cement. Groups consisting of one center lamina 7 and one rear lamina 8 interspersed between three of the full length laminae 6 are then formed while the adhesive is tacky by pressing them together with their rear edges in juxtaposition with each other to form elements as shown in 75

Fig. 4. The cemented laminae in this form represents a unitary mass which is convenient to handle. In the case of the example, eighteen groups of laminae so formed are then placed in a form and compressed laterally to the desired cushion width. The exterior surface of the compressed mass is then heavily sprayed with a coat of latex cement and the wrapper 2 consisting of a sheet of 1/2" thick fibre glass batt is laid around and adhered to it. The assembly, while still in a compressed condition is then pushed into the pre-formed cover or envelope 3 through an open lateral edge, which is finally sewn together to complete the assembly.

The use of latex cement between the elements of the cushion filler as described, in addition to facilitating fabrication and assembly, contributes greatly to the stability of the cushion and prevents separation of the laminae 6, 7, and 8 from each other and relative movement of the wrapper 3 under load. The adhesion of the laminae to each other by this means produces a uniform lateral support throughout the cushion, resisting internal wear and abrasion between the elements.

In the cushion of the example, it will be seen that the rear 11" of length will be formed from 90 laminae of the fibre glass batt, the front portion of 54 laminae, and that there is a 2" intermediate zone between the front and rear portions having 72 laminae. Since the free thickness of the fibre glass batt is 1" and the assembly is compressed to 18", the width of the envelope 3, the respective compression of the filler material is 5:1 in the rear half, 3:1 in the front portion, and 4:1 in the intermediate zone between the two.

When constructed in accordance with the foregoing procedures a seat cushion closely approximating recommended pressure and deflection characteristics is obtained.

Extensive accelerated service tests have indicated and proven that cushions so constructed are capable of withstanding extraordinary repeated loads and excessively heavy service without failure or permanent set.

It is to be understood that the details set forth in the foregoing description are directed to preferred conditions in obtaining the maximum results from this invention, but that the invention is not limited or restricted thereby since these may be modified within the appended claims without departing from the spirit and scope thereof.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A cushion having variable predetermined characteristics of pressure and deflection over its load-supporting surface, comprising a filler formed of laminae of resilient material conforming substantially in size and shape to the desired cushion in a plane normal to said load-supporting surface and smaller laminae interspersed therebetween, and a flexible envelope having the dimensions of the desired cushion for supporting all of said laminae within said envelope in compression across the laminations and disposed with their planes normal to the load-supporting surface of the cushion.

2. A cushion having variable predetermined characteristics of pressure and deflection over its load-supporting surface, comprising a filler formed of laminae of fibre glass batt conforming substantially in size and shape to the desired

cushion in a plane normal to said load-supporting surface and shorter fibre glass batt laminae evenly interspersed therebetween, and a flexible envelope having the dimensions of the desired cushion for supporting all of said laminae within said envelope in compression across the laminations and disposed with their planes normal to the said load-supporting surface of the cushion.

3. A cushion having variable predetermined characteristics of pressure and deflection over its load-supporting surface, comprising a filler formed of laminae of fibre glass batt conforming substantially in size and shape to the desired cushion in a plane normal to said load-supporting surface and shorter fibre glass batt interspersed therebetween, a flexible envelope having the dimensions of the desired cushion for supporting all of said laminae within said envelope in compression across the laminations and disposed with their planes normal to the said load-supporting surface of the cushion, and a fibre glass batt wrapper surrounding said laminae within the said envelope.

4. In a cushion having variable predetermined pressure and deflection characteristics over its load-supporting surface, a plurality of resilient laminae conforming substantially in size and shape to the desired cushion in a plane normal to said load-supporting surface, a plurality of smaller resilient laminae interspersed evenly between said first laminae and bonded thereto by an adhesive, and a flexible envelope having the dimensions of the desired cushion for supporting all of said laminae within said envelope in compression across the laminations and with their planes normal to said load-supporting surface.

5. In a method of fabricating a cushion having variable predetermined characteristics of pressure and deflection over the load-supporting surfaces thereof, the steps of forming blanks of resilient material conforming substantially in size and shape to the desired cushion in a plane normal to said load-supporting surface, forming smaller blanks of resilient material, arranging the blanks in laminar form as a filler having a greater width than the desired cushion with the shorter blanks interspersed between the first blanks, compressing all of the blanks across the laminations to the width of the desired cushion, inserting and then releasing said filler within a flexible envelope having the dimensions of the desired cushion.

6. In a method of fabricating a cushion having variable predetermined characteristics of pressure and deflection over the load-supporting surface thereof, the steps of forming blanks of resilient fibrous material conforming substantially in size and shape to the desired cushion in a plane normal to said load-supporting surface, forming shorter blanks of resilient fibrous material, bonding the blanks together in laminar form as a filler having a greater width than the desired cushion with the shorter blanks distributed between the first blanks, compressing all of the blanks across the laminations to the width of the desired cushion, inserting and then releasing said filler within a flexible envelope having the dimensions of the desired cushion.

7. In a method of fabricating a cushion having variable predetermined characteristics of pressure and deflection over the load-supporting surface thereof, the steps of forming blanks of fibre glass batt conforming substantially in size and shape to the desired cushion in a plane

normal to said load-supporting surface, forming shorter blanks of fibre glass batt, bonding the blanks together in laminar form as a filler having a greater width than the desired cushion with the shorter blanks distributed between the first blanks, compressing all of the blanks across the laminations to the width of the desired cushion, inserting and then releasing said filler within a flexible envelope having the dimensions of the desired cushion.

8. A seat cushion having highest pressure and lowest deflection characteristics at its rear edge and uniformly decreasing pressure characteristics and increasing deflection characteristics towards its front edge with respect to a plane normal to the load-supporting surface thereof, comprising a filler formed of laminations of resilient material having the cross-sectional shape and size of the desired cushion in a plane normal to the load-supporting surface thereof and evenly interspersed shorter laminations of resilient material, and a flexible envelope having the dimensions of the desired cushion for supporting said laminations within said envelope in compression across the laminations and disposed with their planes normal to the load-supporting surface of the cushion, said shorter laminations being interspersed between the first laminations in the portion of the filler forming the rear edge of the seat cushion.

9. A seat cushion having highest pressure and lowest deflection characteristics at its rear edge and uniformly decreasing pressure characteristics and increasing deflection characteristics towards its front edge with respect to a plane normal to the load-supporting surface thereof, comprising a filler formed of bonded laminations of resilient material having the cross-sectional shape and size of the desired cushion in a plane normal to said load-supporting surface and evenly interspersed shorter laminations of resilient material and a flexible envelope having the dimensions of the desired cushion for supporting said laminations within said envelope in compression across the laminations and disposed with their planes normal to the load-supporting surface of the cushion, said shorter laminations being interspersed between and bonded to the first laminations in the portion of the filler forming the rear edge of the seat cushion.

10. In a seat cushion having a leading edge adapted to support the knees of an occupant and a rear edge adapted to support the body thereof, a filler formed of laminations of resilient material lying in vertical planes between the leading and rear edges of the seat cushion, and a flexible envelope for supporting the laminations within the envelope in compression across the laminations, said laminations being of varying lengths and being interspersed and arranged within the filler with their edges aligned at the rear edge of the cushion to produce predetermined zones of decreasing pressure characteristics and increasing deflection characteristics from the rear to the leading edge of the cushion.

11. In a seat cushion having a leading edge adapted to support the knees of an occupant and a rear edge adapted to support the body thereof, a filler formed of bonded laminations of resilient material lying in vertical planes between the leading and rear edges of the seat cushion, and a flexible envelope for supporting the laminations within the envelope in compression across the laminations, said laminations being of varying lengths and being interspersed and arranged

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within the filler with their edges aligned at the rear edge of the cushion to produce predetermined zones of decreasing pressure characteristics and increasing deflection characteristics from the rear to the leading edge of the cushion.

12. In a seat cushion having a leading edge adapted to support the knees of an occupant and a rear edge adapted to support the body thereof, a filler formed of laminations of fibrous material bonded together with an adhesive lying in vertical planes between the leading and rear edges of the seat cushion, and a flexible envelope for supporting the laminations within the envelope in compression across the laminations, said laminations being of varying lengths and being interspersed and arranged within the filler with their edges aligned at the rear edge of the cushion to produce predetermined zones of decreasing pressure characteristics and increasing deflection characteristics from the rear to the leading edge of the cushion.

13. In a seat cushion having a leading edge adapted to support the knees of an occupant and a rear edge adapted to support the body thereof, a filler formed of laminations of fibre glass batt

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bonded together with an adhesive lying in vertical planes between the leading and rear edges of the seat cushion, within the envelope in compression across the laminations, and a flexible envelope for supporting the laminations, said laminations being of varying lengths and being interspersed and arranged within the filler with their edges aligned at the rear edge of the cushion to produce predetermined zones of decreasing pressure characteristics and increasing deflection characteristics from the rear to the front edge of the cushion.

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