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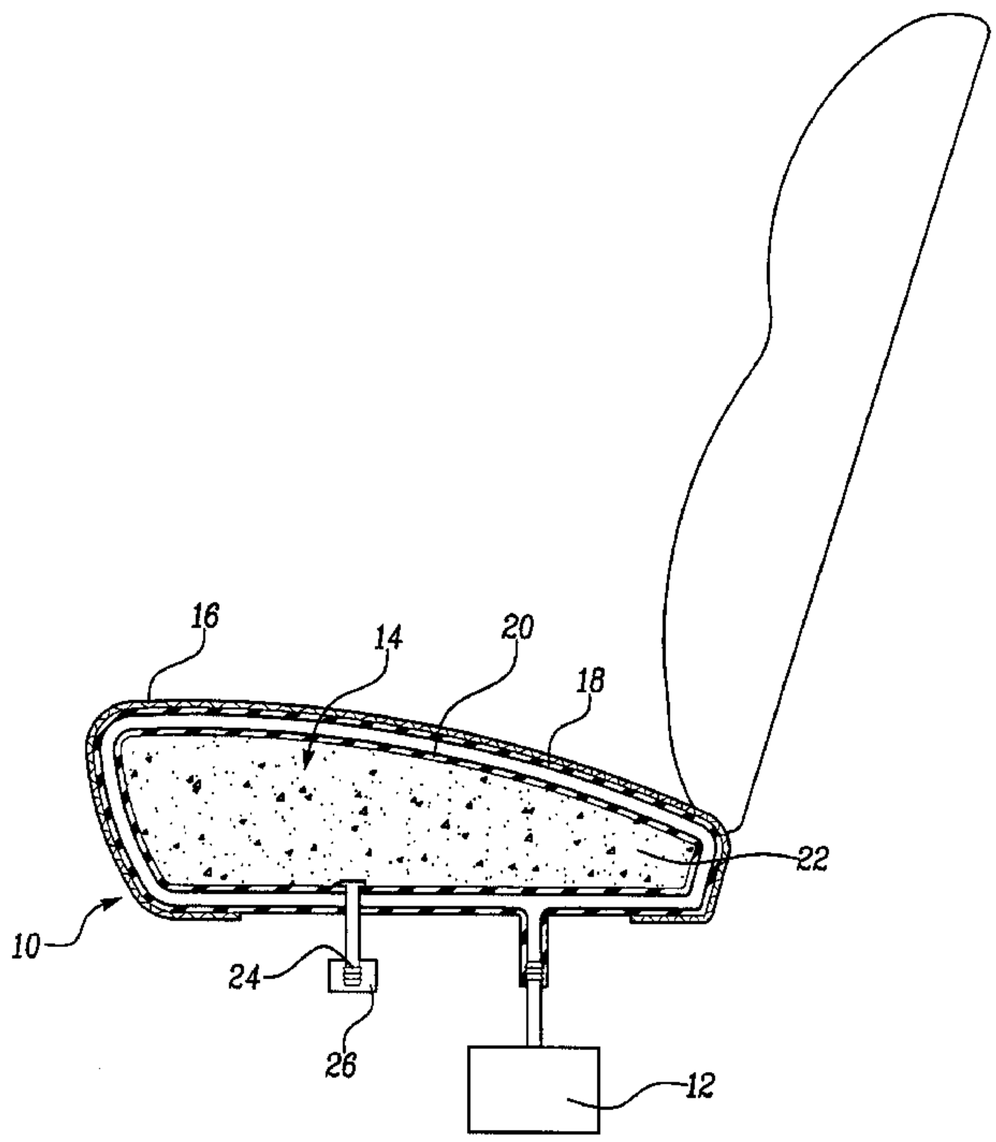
(54) **COMPOSANTS DE SIEGES EN MOUSSE DE POLYURETHANE**

(54) **POLYURETHANE FOAM SEATING COMPONENTS**



(57) The present invention provides a seating component comprising a base having an upper surface, a cushion disposed on the base and a covering disposed over the seating component to enclose the base and the cushion and defining the exterior surface of the seating component. The cushion of the seating component comprises a resilient cushioning material capable of holding a pressurizing material within the material structure, with an air impermeable bladder disposed within the cushioning material. The bladder encases and seals a void that contains the pressurizing material within the cushioning material.

ABSTRACT

The present invention provides a seating component comprising a base having an upper surface, a cushion disposed on the base and a covering disposed over the seating component to enclose the base and the cushion and defining the exterior surface of the seating component. The cushion of the seating component comprises a resilient cushioning material capable of holding a pressurizing material within the material structure, with an air impermeable bladder disposed within the cushioning material. The bladder encases and seals a void that contains the pressurizing material within the cushioning material.

POLYURETHANE FOAM SEATING COMPONENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a seating component incorporating a cushion comprised of a cushioning material surrounding a cavity disposed within the cushioning material, wherein the cavity is bounded by an air impermeable elastomeric film bonded to the cushioning material.

2. Description of the Prior Art

Original equipment manufacturers (OEMs) have steadily increased their automotive seating performance requirements with regards to comfort, e.g., wet compression set, ball rebound, hysteriesis, etc. The approach taken by many molders has been to use newly developed polyol(s) or isocyanate(s) in creating improved polyurethane foam formulations to produce more comfortable seats and seating components. Unfortunately, such efforts merely push the limits of what polyurethane foam cushions are capable of providing in terms of improved comfort performance.

Numerous objections have been raised with respect to such conventional foam-only cushions, as well as seats and seating components that use more conventional cushioning material. The polyurethane foams used in most current seats and seating components are typically encased in a covering made of vinyl, cloth or leather. While these materials provide a certain level of comfort to the rider, they are merely window dressing in terms of the overall cushioning effect of the seat. It is the polyurethane foam

itself that absorbs the weight of the load placed on the cushion. The polyurethane foam forms itself to the contours of the load (e.g., a seated passenger) by releasing air trapped in the cells of the foam upon compression. When the load is removed, air is brought back into the cells of the foam. The repetition of this process over a period of time gradually causes the cushion to become less compressible and, thus, less resilient. The results can vary from separation of the foam from the seat cover to an overall decrease in rider comfort as the rider contacts the seat or seating components less on foam and more on the rigid base to which the foam is attached. This decrease in foam resiliency and comfort is the inevitable result of such foam-only cushion configurations. Desirably, a configuration would exist that would provide a constant level of support and comfort to the rider while being freely adjustable to the contours of multiple possible riders/loads.

Numerous prior art references describe the use of bladders or air pockets to provide adjustable cushioning configurations. Many such configurations, such as U.S. Patent No. 5,711,575, provide for adjustable lumbar supports. Lumbar support is not integral to most seat designs, but comprises an additional separate device attached to the seat to provide seat comfort. It is always maintained above one (1) atmosphere (atm) pressure and is not subjected to the pressure load, which is normally exerted on a seat. In addition, most prior art lumbar supports merely provide a bladder with a covering. The lack of a cushioning material makes such supports uncomfortable over extended use periods. Desirably, a cushion/seat having both improved comfort and adjustability would be provided.

Similarly, the use of an airtight bladder in a seat configuration is not new in the design of various cushioning configurations. U.S. Patent No. 5,711,573, for example,

teaches the use of an airtight bladder as an airtight casing **around** the foam cushion. While this design overcomes the air leakage problem of many prior art designs, it sacrifices adjustability in that the casing, from fully accommodating the contours of any possible rider, constricts the foam. Further, since the casing is exposed to weathering under the porous covering, it will become brittle and less airtight over time.

Finally, WO 9717001 discloses a cushioning device which incorporates a bladder composed of two films which are welded together to form a sealed compartment that is further sealed with spot welds to create multiple sub-compartments. This disclosure overcomes many of the deficiencies of the prior art, but only at the cost of creating new deficiencies. Specifically, the use of dual sheets rather than a continuous film to create the internal bladder introduces the increased incidence of leakage of the bladder. The dual sheet configuration will introduce increased wear at the welds, especially in those situations where multiple subcompartments press against the spot welds and one another. The 9717001 disclosure further introduces the feature of a loose film forming one side of the bladder. While this configuration offsets pressure problems, it drastically increases the likelihood of leakage. Finally, in terms of overall comfort, no cushioning material beyond the bladder itself is disclosed. As discussed above, this reduces the overall comfort of the rider and increases damage caused by wear. Another type of configuration uses a bladder, which is covered by a foam cushioning material. While this improves on the design exemplified by the 9717001 disclosure, it still suffers from many of the same disadvantages including friction wear between the cushioning material and the bladder or between the bladder and the seat support.

SUMMARY OF THE INVENTION

The present invention provides a seating component comprising a base, a cushion disposed on the base and a covering disposed over the seating component to enclose the cushion and defining the exterior surface of the seating component. The cushion of the seat comprises a resilient cushioning material capable of holding a pressurizing material within the material structure, with an air impermeable bladder disposed within the cushioning material. The seating component may further comprise a valve extending from the bladder and through the cushioning material and in sealed relationship with the bladder, the valve including a valve operator disposed external to the covering for opening and closing communication between the bladder and the external environment around the seat.

The encased bladder cushion design may be incorporated into an adjustable seating component where the seating component is a seat, a lumbar support, armrest, headrest, console or other seating component.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross-section view of a seat configuration of the invention.

Figure 2 is a cross-section view of a headrest configuration of the invention.

Figure 3 is a cross-section view of a lumbar configuration of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention preferably uses a continuous thermoplastic polyurethane (TPU) film as a barrier layer for the elastomeric bladder. The TPU film is preferably bonded to a surrounding polyurethane foam layer, creating a pocket within the foam. The

polyurethane foam may be formed through any of the several conventional methods well known in the art. In a preferred embodiment of the invention, an adjustable one-way valve is incorporated into the elastomeric bladder structure. In an alternative embodiment, the valve may accommodate a charge or pump to maintain air pressure within the bladder. The bladder may either be wholly contained within the cushioning material of the seat, or may extend through the cushioning material to rest flush with the seat covering. The resulting seat configuration provides improved compression set, comfort and weight reduction of the polyurethane foam setting.

The air pressure in the pocket is preferably maintained at one (1) atmosphere (atm) using a one-way valve. By using the one-way valve, the deficiencies of some prior art adjustable bladders, such as those utilized in lumbar supports, is avoided. Specifically, there is no worry about long-term pressure leak with the bladder of the instant invention. Such leaks often result in long term failure of the aforementioned lumbar supports. Preferably, the walls of the bladder will have a thickness of from about 0.01 to about 1.0 inch.

The air pressure within the impermeable elastomeric bladder is preferably maintained between 0.5 to 5.0 atmospheres (atm) by using mechanical or non-mechanical pressurizing devices such as an aerosol charge, a mechanical pump or a manual pump, wherein the pressurizing device is removably attached to the valve operator. The mechanical pump may be distinguished from the manual pump as having a sensing apparatus attached to it and in communication with the valve operator which senses decreases in pressure within the bladder and automatically compensates by pumping air or any other pressurizing material into the bladder. The manual pump will comprise a

hand pump that may be used by the rider whenever seat discomfort indicates a need for increased pressure within the bladder. The bladders of the invention are designed to retain pressure over a period of time and re-pressurizing should only be necessary on a monthly or less frequent basis, depending on use. Preferably, the bladder will contain a one-way valve to maintain the air pressure at 1 atm when under load and breathe back after the load is removed.

In an alternative embodiment, a two-way valve may be incorporated in place of the one-way valve. This configuration offers improved adjustability in situations where multiple users comprising varying loads may adjust the pressure in the bladder to individual comfort levels. The overall bladder-encased design would continue to provide increased comfort while substantially reducing leakage of any pressurizing material.

The size and shape of the bladder depends on the design of the surrounding polyurethane foam. The bladder can be either completely concealed or be partially visible on the surface by being positioned flush with the seat covering. In an alternative embodiment, the bladder can be attached to a device that will increase its air pressure either manually or mechanically. The bladder is incorporated into, preferably, a polyurethane foam cushioning material by suspending the bladder in the polyurethane mold and then pouring the foam around it.

The preferred TPU materials or elastomers should have good adhesion characteristics with polyurethane foams. Preferably, the bladder is constructed of composite TPU laminates, TPU + EVOH and similar materials.

The seating component of the invention can be used for automotive seating, wheelchair seats, household and office seats, mattresses, bicycle seats, stadium seats, saddles, and cushioning pads for hospital beds, etc.

Preferably, the bladder will be air filled. Other higher molecular weight gases or gels can be used in place of air in the sealed bladders to maintain the pressure for a longer period of time. Such compounds include inert gas, liquids, gels, oils, microspheres coated with lubricant or elastic particles in a thermoplastic bonding agent.

TPU or TPU laminated bladders can be produced from sheet laminates in a heat seal process or blow-molding processes. Preferred bladder materials include polyurethane/stretch-knit polyamide laminates, polyurethane vinyl, PVC, latex, rubber, synthetic rubber, thermoplastic elastomers or EVAs. TPU or TPU laminated bladders can also have different designs to enhance their load bearing characteristics, such as contacting half sphere bladders on either side of the seat or shape variations including squares, convex saucers, circles, triangles and the like.

Preferably, the cushioning material of the seat comprises a polyurethane foam. Alternatively, the material may include any natural or synthetic fibers, felt, animal hair and the like. Natural fibers useful as a cushioning material include cotton, jute, coconut, hemp, silk, ramie, and any natural fiber known in the art. Synthetic fibers that may be utilized as a cushioning material include polyethylene glycol terephthalates or other polyester resins, spandex, polyolefins, such as polyethylene, polypropylene and the like, as well as nitrile polymer fibers, such as vinyl cyanide or acrylonitrile, acrylic acid and acrylic ester polymers, vinyl polymers, such as vinyl chloride, vinyl acetate, and vinylidene chloride, and fibers formed from modified natural materials, such as

nitrocellulose, rayon and casein, any combination thereof, graft polymers thereof and mixtures thereof. In particular, the polyester fiber cushioning material may be an important alternative in applications where a high degree of recyclability is desirable.

The seating component of the invention may further include a liner material surrounding the cushioning material and protecting it from friction and other external sources of wear which may be exerted directly on the seat covering. Such liners may comprise any type of thermoplastic or thermoset material suitable for such application, including liners that incorporate seat heaters.

The seating component covering may comprise leather, vinyl, cloth or similar materials as are normally used for such applications. The design of the invention allows for the use of any covering material without restriction.

Finally, the base of the seating component may be either a flat plane upon which the remainder of the seating component rests, or it may incorporate one or more springs to provide additional comfort and protection from vibration. The base itself may be constructed of any material suitable for a rigid flat piece, including thermoplastics and metals.

The bladder design of the invention may be incorporated into any number of seating components, including consoles, head rests, lumbar supports and armrests. Where the bladder is used as part of a seat back lumbar support, the lumbar support will preferably be disposed or flush with the surface of a seat back. When used as part of a headrest, the bladder will preferably include a pressure-sensitive valve that will release air to absorb the weight of a contacting head, providing superior cushioning performance.

Regardless of the type of seating component chosen, the features described above with respect to the seat design may be applied to other seating components as well.

Example 1

Figure 1 shows a seat 10 comprising a base 12, a cushion 14 disposed on the base 12, and a covering 16 disposed over the seat 10 to enclose the cushion 14. The cushion 14 comprises a resilient cushioning material 18 surrounding an air impermeable bladder 20. The bladder 20 contains a pressurizing material 22. The seat further comprises a valve 24 extending from the bladder 20 and through the cushioning material 18 and in sealed relationship with the bladder 20. The valve 24 includes a valve operator 26 disposed external to the covering 16.

Example 2

Figure 2 shows a headrest 30 comprising a base 32, a cushion 34 disposed on the base 32, and a covering 36 disposed over the headrest 30 to enclose the cushion 34. The cushion 34 comprises a resilient cushioning material 38 surrounding an air impermeable bladder 40. The bladder 40 contains a pressurizing material 32. The headrest further comprises a valve 44 extending from the bladder 40 and through the cushioning material 38 and in sealed relationship with the bladder 40. The valve 44 includes a valve operator 46 disposed external to the covering 36.

Example 3

Figure 3 shows a lumbar support 50 comprising a base 52, a cushion 54 disposed on the base 52, and a covering 56 disposed over the lumbar support 50 to enclose the cushion 54. The cushion 54 comprises a resilient cushioning material 58 surrounding an air impermeable bladder 60. The bladder 60 contains a pressurizing material 52. The

lumbar support further comprises a valve 64 extending from the bladder 60 and through the cushioning material 58 and in sealed relationship with the bladder 60. The valve 64 includes a valve operator 66 disposed external to the covering 56.

WE CLAIM:

1. A seating component including a base having an upper surface, a cushion disposed on the base and a covering disposed over the seat to enclose the base and the cushion and defining the exterior surface of the seating component, said cushion comprising:

a resilient cushioning material capable of holding a pressurizing material within the material structure,

an air impermeable bladder disposed within the cushioning material encasing and sealing a void within the cushioning material,

a pressurizing material disposed within the bladder.

2. A seating component as claimed in claim 1, wherein said cushioning material is selected from the group consisting of polyurethane foam, felt, animal hair, cotton, jute, coconut, hemp, silk, ramie, polyethylene glycol terephthalates or other polyester resins, spandex, polyolefins, nitrile polymer fibers, acrylic acid and acrylic ester polymers, vinyl polymers, nitrocellulose, rayon, casein, combinations thereof, graft polymers thereof and mixtures thereof.

3. A seating component as claimed in claim 1, wherein said bladder comprises an elastomeric material selected from the group consisting of polyurethane, polyurethane/stretch-knit polyamide laminates, polyurethane vinyl, PVC, latex, rubber, synthetic rubber, thermoplastic elastomers and EVAs.

4. A seating component as claimed in claim 3, wherein said bladder comprises a polyurethane.

5. A seating component as claimed in claim 1, wherein the pressurizing material is selected from the group consisting of air, inert gases, liquids, gels, oils, microspheres coated with lubricant and elastic particles in a thermoplastic bonding agent.

6. A seating component as claimed in claim 1, wherein the seating component is selected from the group consisting of automotive seats, wheelchair seats, household and office seats, mattresses, bicycle seats, stadium seats, saddles and cushioning pads for hospital beds.

7. A seating component as claimed in claim 1, wherein the bladder is positioned within the cushioning material such that its orientation is wholly contained within the cushioning material.

8. A seating component as claimed in claim 1, wherein the bladder is positioned within the cushioning material such that its orientation extends out from the cushioning material to be flush with the seat covering.

9. A seating component as claimed in claim 1, further comprising valve extending from the bladder and through the cushioning material and in sealed relationship with the bladder, the valve including an operator disposed external to the covering for opening and closing communication between the bladder and the external environment around the seat.

10. A seating component as claimed in claim 9, further comprising an external pressurizing device removably attached to the valve operator.

11. A seating component as claimed in claim 9, wherein the external pressurizing device is selected from the group consisting of an aerosol charge, a mechanical pump and a manual pump.

12. A seating component as claimed in claim 10. wherein the external pressurizing device is a mechanical pump having a sensing apparatus attached to it and in communication with the valve operator which senses decreases in pressure within the bladder and automatically compensates by pumping pressurizing material into the bladder.

13. A seating component as claimed in claim 1, wherein the bladder has a shape selected from the group consisting of contacting half sphere bladders on either side of the seat, squares, convex saucers, circles and triangles.

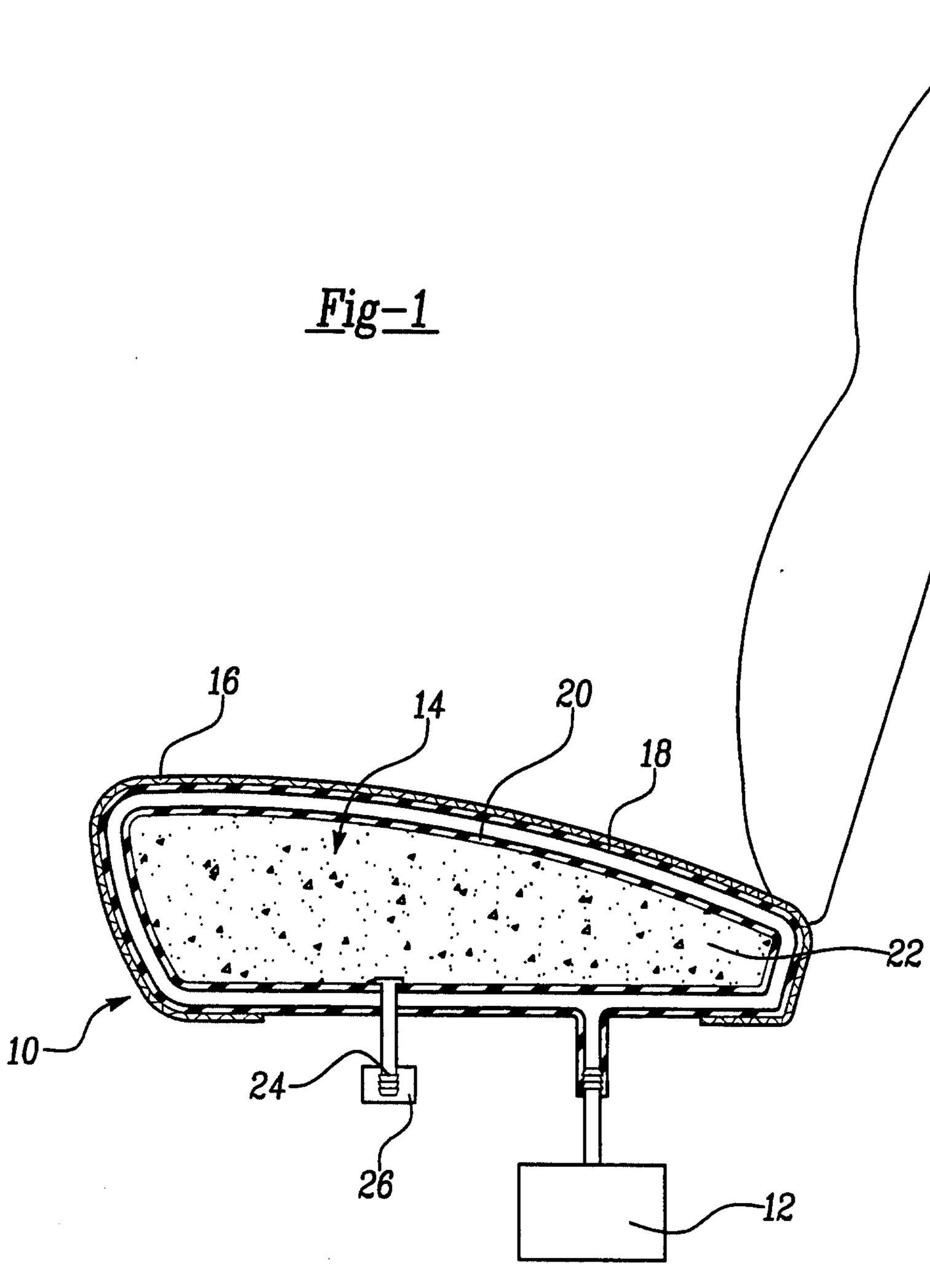
14. A seating component as claimed in claim 1, wherein the bladder wall has a thickness of from about 0.01 to about 1.0 inch.

15. A seating component as claimed in claim 9, wherein the valve is selected from the group consisting of one-way valves and two-way valves.

16. A seating component as claimed in claim 1, wherein the pressurizing material is maintained at a pressure of from 0.5 to 5.0 atmospheres.

17. An adjustable seating component as claimed in claim 1, wherein the seating component comprises a seat back lumbar support comprising a seat back having an upper surface, a lumbar support disposed on the seat back and a covering disposed over the lumbar support and defining the exterior surface of the seat back.

18. A seating component as claimed in claim 1, further comprising a heated liner oriented between the seat covering and the cushioning material.



Fig–1

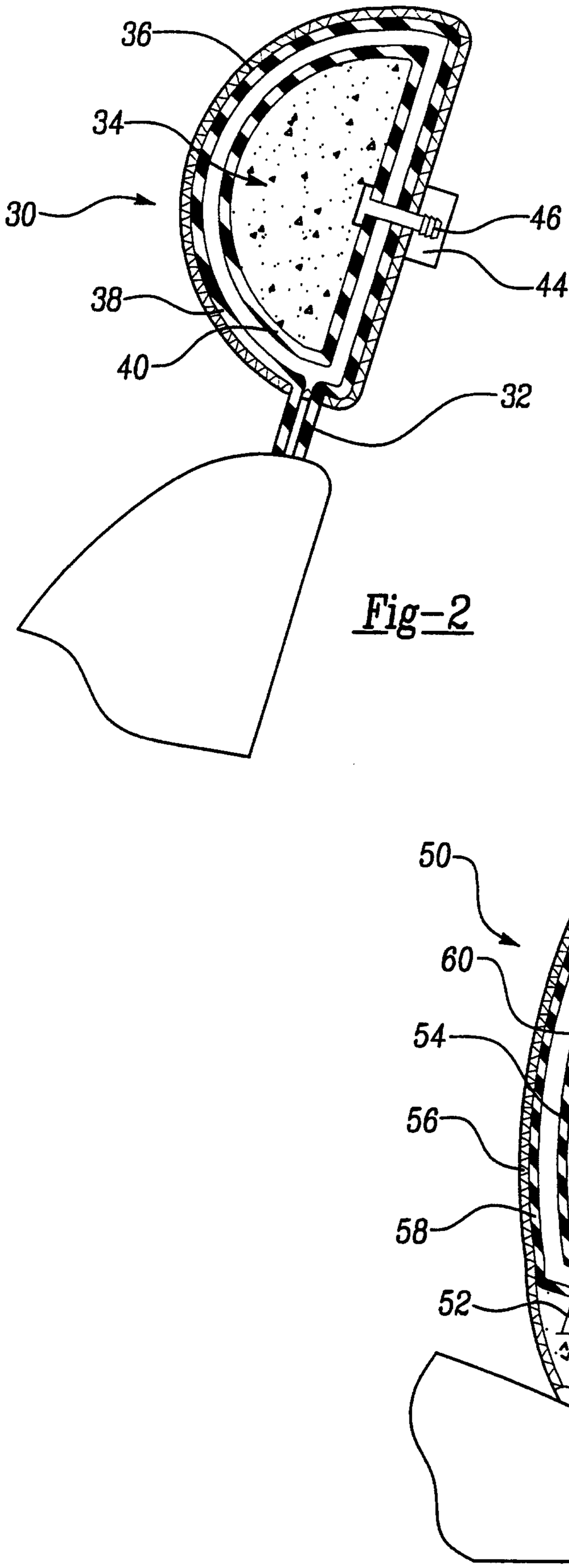


Fig-2

Fig-3