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⑤④ **Cushioning articles.**

⑤⑦ A cushioning article comprises a closed flexible envelope containing

(a) a plurality of discrete, relatively-movable gas-filled enclosures bounded by respective permanent flexible walls; and

(b) a lubricant to facilitate the relative movement of the gas-filled enclosures within the envelope. Articles of this type follow body contours of a user, thus distributing pressure evenly and providing greater comfort, as well as reducing the likelihood of pressure sores.

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1.

CUSHIONING ARTICLES

This invention relates to cushioning articles.

Until now, cushioning has been made of springs, foam rubbers, polyurethane foam, rubber straps, horse-
5 hair, artificial fibres, wadding, felt, air inflated bags, silicone fluid/rubber filled bags etc. or combinations of these. There are also waterbeds. Cushions are available, made from plastics containers filled with a high viscosity liquid/gel, which may contain mineral cenospheres,
10 or foamed polystyrene beads, but these cushions are heavy, not always low in flammability, and relatively expensive.

According to the present invention, light-weight cushioning can be made from gas-filled plastics or mineral enclosures, or mixtures of both, dispersed in a lubricant
15 so that movement of gas-filled enclosures within the lubricant is possible. This dispersion of gas-filled enclosures is contained within a covering which is impermeable to the lubricant, and which in turn may be covered by conventional upholstery materials.

20 Thus, the present invention provides a cushioning article comprising a totally sealed gas-impermeable flexible envelope containing

(a) a plurality of discrete, relatively movable gas-filled enclosures bounded by respective permanent
25 flexible walls; and

(b) a lubricant to facilitate the relative movement of the gas-filled enclosures within the envelope.

The cushioning so produced will follow the body contours of a user, thus distributing pressure evenly
30 and providing greater comfort. The possibility of the development of ischaemia (local deficiency of blood supply due to spasm or obstruction of an artery), and decubitus ulcers (pressure sores or ulcers relating from pressure on parts of the body in persons confined to bed for a
35 long time, or needing to sit, for example in wheelchairs, for long periods), is reduced.

The gas-filled enclosures (which may, for example, consist essentially of discrete undivided bubbles or

discrete spheres of a cellular material) may contain a non-flammable gas such as nitrogen, carbon dioxide or helium. Alternatively, they may contain air.

5 The gas-filled enclosures may be made of any one or more of the following films, foils or coatings:-

polyethylene, polypropylene, polyurethane,
polyvinylidene chloride, plasticised polyvinyl
chloride, butyl rubber, polyester, polyamide,
10 aluminium, chlorinated rubber or fluorinated
polymers.

It is preferred that it should be rubber-like/flexible. The gas-filled enclosures may consist wholly of any one of the aforementioned materials. Alternatively, the gas-filled enclosures may comprise a laminate of two or more
15 of the materials or a coating of one on another.

The diameter of the gas-filled enclosures is preferably between 5 microns and 50 mm. The enclosures may be spherical, but can be other shapes, e.g. ellipsoidal. It has been found that a mixture of various sizes of gas-filled enclosures will minimise the mass of lubricant
20 needed, and save weight in the cushion. For example, if spherical enclosures of 30 mm diameter are used, they will only occupy about 50% of the total envelope volume, and proportions of smaller-diameter spherical enclosures can be incorporated in the spaces, thus reducing the
25 volume of lubricant needed (see Furnas, Ind. Eng. Chem. 1931, 23(9), 1052-8).

The lubricant in which the gas-filled enclosures are dispersed must have a low coefficient of friction and
30 must flow. The lubricant may be a liquid, e.g. water, aqueous salt solution, polyhydric alcohols, natural or synthetic mineral or silicone oils or greases, the liquid optionally being thickened to give a pseudoplastic gel. Alternatively, the lubricant can be a finely-divided
35 solid, (e.g. natural silicates of plate-like structure such as talc), graphite, molybdenum disulphide or derivatives of long-chain organic materials having a plate-like structure (e.g. stearic acid and calcium

stearate), soft waxes, fluorinated polymers (e.g. polytetrafluoroethylene) or mixtures of these materials. Regard should be had to the fact that some of the above-mentioned lubricants are less desirable than others because of inherent flammability and/or the possibility of the evolution of toxic gases when burning.

5 The rheology of the liquid lubricant may be altered by using thickeners or thixotropic agents known to those skilled in the art, e.g. clays, gaseous-produced silicas, cellulose ethers, alkali-soluble acrylics, gelatine, alginates, polyacrylamide, finely divided 'fillers', glass cenospheres or mineral cenospheres.

10 A preferred lubricant for use in this invention is a 20% by weight aqueous sodium chloride solution, thickened by means of clays, gaseous-produced silicas or cellulose ethers. At -20°C a 25% by weight saline solution is still fluid, but a 20% by weight saline solution forms a slush at this temperature. Any lower proportion of salt in the solution produces a solid at this temperature. We have found that this lubricant gives good low-temperature properties, low flammability, low order of toxicity and low cost.

20 The impermeable covering constituting the envelope may be made of any one or more of the materials mentioned hereinbefore. It is preferred that the envelope should be rubber-like/flexible, without being so brittle as to be noisy in use.

25 The envelope may be sealed by means of radio-frequency, heat-sealing or thermoforming in the configuration most suitable for the intended use of the cushioning article and/or to reduce volume and weight. Alternatively, the envelope can, in appropriate cases, be formed by rotational casting or blow-moulding.

30 The impermeable covering may be reinforced e.g. by woven or non-woven fabrics of artificial, or natural materials, or of glass.

Suitable laminates/coatings for the envelope include the following:

4.

5 polypropylene to polyester to polypropylene
 polyethylene to polyester to polyethylene
 polypropylene to aluminium to polypropylene
 polyethylene to aluminium to polyethylene
 polyurethane to aluminium to polyurethane
 polyester to aluminium to polyester
 polyurethane to polyvinylidene chloride to polyurethane
 polyester to polyvinylidene chloride to polyethylene

10 The outermost covering of the envelope may be of any
 standard upholstery fabric or sheepskin, or leather or
 leathercloth and may be wholly or partly lined with
 materials such as polyester wadding or polyurethane foam.
 The outermost covering may be made to conform to the
 appropriate British Standard for flammability.

15 Amongst the applications for cushioning articles
 according to the present invention are:-

20 wheelchair cushions, orthopaedic seating, invalid
 car seats, pressure support products such as rings,
 heel and elbow pads, hospital mattresses, aircraft
 seats, helicopter seats, seats for buses, cars,
 fork-lift trucks, lorries and vans, for agricultural
 vehicles and heavy plant, in domestic and office
 furniture, kneeling pads, and in shock absorbing
 pads for equipment.

25 Preferred embodiments of the present invention will
 be illustrated by way of the following Examples:

EXAMPLE 1

Air-filled enclosures of 30 mm diameter were
 dispersed in a gel made to the following formulation:-

30	20% by mass aqueous salt solution	100 p.b.w.
	Hydrated magnesium silicate (i)	12 p.b.w.
	Fumed silica (ii)	5 p.b.w.

A suitable bactericide/fungicide was incorporated.

(i) Available under the Registered Trade Mark PANGEL S.
 35 (ii) Available under the Registered Trade Mark
 CAB-O-SIL M-5.

The viscosity of the gel, determined on a Brookfield
 viscometer model R.V.F. spindle 7 at 20°C, was:-

5.

920 poise at speed 10

360 poise at speed 20

136 poise at speed 50

114 poise at speed 100

5 This gel is strongly pseudoplastic.

The air-filled enclosures and gel were contained in a cover fabricated from a polyurethane/polyvinylidene chloride/polyurethane laminate. The whole was encased in an outer cover comprising polyester wadding and a flame-retardant fabric.

EXAMPLE 2

Air-filled enclosures of 25 mm diameter were dispersed in a gel made to the following formation:-

	Glycerol B.P.	100	p.b.w.
15	Hydrated magnesium silicate (i)	5.25	p.b.w.
	Fumed silica (ii)	3.75	p.b.w.

A suitable bactericide/fungicide was incorporated.

(i) and (ii): See EXAMPLE 1.

The viscosity of the gel, determined on a Brookfield viscometer model R V F spindle 7 at 20°C. was:-

1560 poise at speed 10

960 poise at speed 20

528 poise at speed 50

360 poise at speed 100

25 This gel is also strongly pseudoplastic.

The air-filled enclosures and gel were contained in a cover fabricated from polyvinylidene chloride/polyester/polyethylene laminate. The whole was encased in an outer cover comprising polyester wadding and a flame-retardant fabric.

EXAMPLE 3

Air-filled plastics enclosures of 30 mm diameter were dispersed in powdered graphite, and contained in a cover fabricated from a polyurethane film. The whole was encased in an outer cover comprising polyester wadding and a flame retardant fabric.

6.

CLAIMS:

1. A cushioning article comprising a totally sealed, gas-impermeable flexible envelope characterised in that the envelope contains:
- 5 (a) a plurality of discrete, relatively movable gas-filled enclosures bounded by respective permanent flexible walls; and
- (b) a lubricant to facilitate the relative movement of the said gas-filled enclosures
- 10 (a) within the envelope.
2. An article according to Claim 1, characterised in that the lubricant (b) is a liquid.
3. An article according to Claim 1 or 2, characterised in that the lubricant (b) is a liquid including one or more
- 15 thickeners.
4. An article according to Claim 1, 2 or 3, characterised in that the lubricant (b) is water containing one or more thickeners and sodium chloride.
5. An article according to Claim 1, 2 or 3, characterised
- 20 in that the lubricant (b) is a gel.
6. An article according to Claim 1, characterised in that the lubricant (b) is a powdered solid material.
7. An article according to any one of the preceding claims, characterised in that the gas-filled enclosures (a)
- 25 consist essentially of discrete undivided bubbles.
8. An article according to any one of Claims 1 to 6, characterised in that the gas-filled enclosures (a) consist essentially of discrete spheres of a cellular material.
9. An article according to any one of the preceding
- 30 claims, characterised in that the enclosures are air-filled.



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EUROPEAN SEARCH REPORT

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Application number

EP 85 30 2540

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
E	GB-A-2 150 431 (J. PARKER) * Whole document *	1-9	B 68 G 1/00
Y	--- US-A-3 407 406 (ROSEMOUNT ENGINEERING) * Column 5, line 62 - column 6, line 51 *	1,2,7-9	
Y	--- GB-A-1 465 817 (SCHAEFFER) * Page 2, lines 22-105 *	1,2,7-9	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 68 G A 47 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 03-12-1985	Examiner MARTIN A.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			