

SEAT, IN PARTICULAR FOR VEHICLES

The invention relates to a seat comprising a cushion of foam plastics as described in the generic term of claim 1 .

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A seat with a foam plastics cushion, known from WO-A1 88/09731 by the present applicant, is made of a foam plastics with a supporting body made from an open-cell resilient plastics foam having a first specific gravity and a flame-retardant layer of open-cell resilient foam plastics provided with a flame retardant and having a second
10 specific gravity different from the first. A flameproof intermediate layer made of high temperature-resistant fibres or threads laid in a lattice or network is disposed between the flame-retardant layer and the supporting body, the layers being glued together in parts. The plastics foam and the flame-retardant layer are interconnected, more particularly by a foaming process, and surrounded by a low-flammable seat cover. These
15 seats in principle meet the safety regulations and test specifications, in particular as regards their application in aircraft, but this construction makes it more difficult to apply a replaceable covering layer, which for the purpose of regular cleaning has to be taken off from the seats at short intervals and installed again. Moreover, the structure of the seat shows a low resistance of the seat cushion to mechanical stresses, since the
20 joint between the individual parts of the flame-retardant layer is subjected to high stresses, often resulting in destruction.

Other known seats for public means of transport, e.g. from German utility model 85 06 816, comprise a seat cushion covered by a seat cover, the seat cover and the seat cushion
25 being made of low-flammable, low-fuming material. Often the process consists in disposing a glass fibre mat, preventing the seat cover from burning through in the direction of the cushion, between the low-flammable seat cover and the seat cushion, which is usually made of plastics foam. It has been found, however, that in many cases the flame acts from the ground and the plastics foam in the seat cushion tends to burn
30 and discharge dense fumes, so that if a fire occurs the public means of transport quickly becomes so smoke-filled that the occupants have difficulty in finding their way. In the case of this known seat, therefore, a fire-inhibiting plate is disposed in the seat supporting frame under the seat cushion. This means that a special section member must be used to hold the seat cushion, and there is the additional expense of
35 installing the fire-inhibiting plate. In this embodiment also, the seat is not adequately ventilated.

Seats with foam plastics cushions are very widely used in modern vehicle construction, particularly in rail and road vehicles and also to a predominating extent in aircraft. The specifications for rail vehicles set very strict guidelines regarding evolution of fumes or the materials used, which must be self-extinguishing, but the specifications for the aircraft industry are still more strict. For example, seats licensed for use in aircraft must undergo a test in which the cushion, in the fitting provided for installation, is directly exposed to a flame from a burner. The flame acts directly on the cushion for two minutes, after which the flame is extinguished or removed. The cushion is extinguished after five minutes, if the flame has not gone out by itself. After this burning test the weight lost by the cushion must not be higher than 10%. In order to comply with these extremely strict specifications and also to obtain low weight and a very comfortable seat during lengthy aircraft journeys, various open-cell resilient soft foam materials having different specific gravities and comprising flame retardants are stuck together.

A known vehicle seat of this kind (as per EP-A1 190 064) comprises a number of layers of needled nonwoven fabric enveloped in a flameproof cover. To reduce damage by vandals, reinforcing mats of metal or glass fibres are disposed between the seat cover and the individual layers of needled nonwoven material. This vandal-proof layer has a number of intermediate strata and the individual layers are stuck together, with the result that the known vehicle seat is even more difficult to ventilate adequately.

In the case of another known seat for aircraft, in order to simplify the complicated spatial shape given to the seat cushions, the supporting body is a part foamed in one piece in a mould and mixed with flame retardants, the surface of the parts being covered with a flame-retardant layer and then with a flameproof cover. The known seat, however, cannot meet the new severer safety regulations and test specifications for aircraft seats.

In the case of another known vehicle seat, according to DE-A 31 11 839, a hard foam shell or a supporting frame is provided with tension springs, on which a seat cushion made up of one or more foam supports is disposed. The foam layers can be of low-flammable material. The seat cushion is enveloped in a flame-retardant sheath and, on the side facing the user, has a low-flammable fabric cover. The use of low-flammable materials and a flame-retardant cover slightly improves the ignition behaviour, but this construction cannot reduce the loss in volume when an open flame acts on the various layers of foam.

The object of the invention is to provide a seat for vehicles, more particularly means of transport such as road vehicles or aircraft, which has a minimum weight, adequate permeability to air and is comfortable to sit upon and offers high resistance to ignition and evolves little smoke when exposed to a direct flame for a long time.

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Additionally or independently, the invention is based on the problem of designing a seat which enables a connecting device to be strongly secured in order to hold the seat cover on the cushion.

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This problem according to the invention is also solved by the features in the characterising clause of claim 1. The advantages of this novel solution are that, since a covering layer made of flameproof woven or knitted or nonwoven fabric is disposed on the underside of the seat cushion, the total weight of the seat cushion can advantageously be reduced without substantially altering the ignition or smoke-inhibiting properties. At the same time the resistance of the seat cushion to mechanical stresses is increased in unpredictable manner, since the underside, which is usually given a very complex shape, can be covered with a seamless covering layer. At the same time the covering layer connected to the supporting body is more resistant to tensile stresses exerted by the devices for retaining the seat cover on the covering layer, as compared with the flame-retardant layer previously used in this region, since the loads, some of which occur at a point, are distributed over a larger area of the covering layer and are also transmitted to the joining layer, e.g. the layer of adhesive between the covering layer and the supporting body. This advantageously prevents the covering layer coming loose from the supporting body when the seat cover is taken off for cleaning. On the other hand the properties of the structure of the seat cushion in the neighbourhood of the seat surface, which have been shown to be particularly advantageous, can be retained unaltered. The main advantages are that the flame-retardant layer, which is relatively open-pore, can be very efficiently cleaned and provides a comfortable seat, since it can absorb a large quantity of body exhalations or moisture, and gives them off when the seat is unoccupied. As a result the user has a very comfortable seat. In addition, since the edge region is covered, the end-face joints between the individual strata of the flame-retardant layer and the adhesive layers there can also be covered, so that if the adhesive layer in these regions is exposed to flame, it is reliably prevented from burning through, and the stuck joints do not burst under strong stress.

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Claim 2 describes another embodiment. As a result of this embodiment, the total weight of an aforementioned seat cushion can be considerably increased and the igni-

tion properties of the seat cushion can be improved even when exposed to flame from underneath the seat.

5 Claim 3 describes another variant embodiment, by means of which the manufacturing costs can be reduced and the joint between the supporting body and the covering layer can be further improved in advantageous manner.

10 Another feature according to claim 4 enables the covering layer to be partially reinforced in weight-saving manner for adaptation to the various areas under load, more particularly in those regions in which the seat cushion rests on a supporting frame.

15 An embodiment according to claim 5 is also advantageous, since it enables the thickness of the supporting body between its underside and the underside of a spring core next to the covering layer to be kept at a minimum, while still giving the seat cushion a maximum service life.

20 A feature according to claim 6 is also advantageous, since this can advantageously increase the resistance to tearing-out of the retaining device, more particularly the burr strips.

25 The problem according to the invention is also solved by the features, independent if required, in the characterising clause of claim 7. The advantages of this solution are that the connecting device, more particularly the burr strip, can be positioned with high accuracy, using simple technical aids, on the supporting body provided with the covering layer. A surprising feature is that if the device for positioning the burr strip is suitably heated, it or a substrate tape for the connecting device melts in the regions made of heat-deformable material and is permanently joined to the covering layer, and it is technically easy to dimension the regions in accordance with the requirements on resistance to tearing out. Another advantage is mainly that it is also possible for the
30 connecting device or a substrate strip to be permanently connected directly to the foam-plastics supporting body without using the covering layer, though this usually requires larger connecting areas.

35 Another advantageous embodiment of the invention is described in claim 8. By this means it is advantageously possible to use either a burr-tape connection or a number of other connecting devices such as slide fasteners, hooks, lugs or the like.

Another embodiment is described in claim 9. By means of this embodiment, regions of the substrate strip can be used for welding to the covering layer, with application of pressure and temperature.

- 5 Another embodiment according to claim 10 is advantageous, because by means of it, the covering layer and/or the foam plastics of the supporting body are melted in the joining regions, resulting in a stronger joint.

- 10 In an alternative embodiment according to claim 11, the connecting device can be secured in self-adhesive manner to the covering layer and/or pre-positioned on the cushion.

In another possible embodiment according to claim 12, the adhesive constitutes an additional welding agent.

- 15 Another embodiment is described in claim 13. By means of this embodiment, the joining regions necessary for a permanent joint can be determined during manufacture of a substrate strip.

- 20 Another embodiment is described in claim 14. The anchoring parts, more particularly a burr strip, disposed on a connecting device can be thermally deformed, so that the permanent joint can be made without adding additional welding material.

- 25 In another possible embodiment according to claim 15, the retaining force of a connecting device can be reduced if necessary in surprisingly simple manner, by partly melting away the anchoring parts.

The invention also describes a method according to the generic term in claim 16.

- 30 The method is characterised by the measures in the characterising clause of claim 16. The surprising advantage is a technically simple device for applying the connecting device, which is in the form of a die heatable at least in certain areas. The die, supplied with energy with interposition of an automatic control device, can also be constructed so as to hold the connecting device, so that the position of the connecting
35 device on the covering layer and/or the cushion can be exactly determined. The automatic control device, disposed in front of the connecting device, determines the temperature required for the process and also the time during which pressure is applied.

Another advantageous variant of the method is described in claim 17. By this means, for example, the substrate strip of the connecting device and the covering layer permanently connected to the substrate strip are pressed into the joining regions by heating under pressure, and the overall durability of the weld is increased by the side surfaces formed in the edge region of the impressed part.

Finally, claim 18 describes yet another advantageous variant of the method, according to which the component of a substrate strip and of a covering layer are melted in the joining region and additionally the heat-activatable adhesive penetrates into the fabric structure of the substrate strip and the covering layer and, after cooling, forms a continuous joint with very high resistance to tearing out.

The invention will be more clearly understood from the following detailed description of embodiments shown in the drawings, in which:

- Fig. 1 shows a double bench seat comprising two seats according to the invention for two persons and in perspective view;
- Fig. 2 is a side view of a seat cushion for a surface of the seat in Fig. 1 ;
- Fig. 3 is a front view of the cushion for the seat surface, in section along lines III-III in Fig. 2;
- Fig. 4 shows part of the cushion in side view and on a larger scale, in section along lines IV-IV in Fig. 3;
- Fig. 5 shows the joining regions in front view and in section along lines V-V in Fig. 4;
- Fig. 6 shows a connecting device and covering layer in plan view;
- Fig. 7 is a diagram of a connecting device comprising a heatable die;
- Fig. 8 is a simplified diagram in plan view of a connecting device disposed on a covering layer and having joining regions according to the invention;
- Fig. 9 is a side view of the connecting device in Fig. 8, shown in section and with

the associated die for the connecting devices in side view, likewise in simplified diagrammatic form;

Fig. 10 shows another embodiment of a seat cushion in side view, partly in section;

Fig. 11 shows the cushion in Fig. 10 in plan view, partly in section, and

Fig. 12 shows another variant embodiment of a seat cushion in front view, in section and in simplified diagrammatic form.

Fig. 1 shows a double bench seat 1 comprising two seats 2 and 3. Each seat 2, 3 comprises a cushion 4 for a back rest and a cushion 5 for a seat surface. The cushion 4 and the seat cushion 5 of the two seats 2 and 3 are of identical construction but in mirror arrangement. Alternatively they can be used for a single seat or a multiple bench seat. Alternatively also, a seat 2 or 3 can comprise one or more cushions.

Cushion 4 and seat cushion 5 are inserted in a supporting frame (general reference 6). The frame 6 can also have any other suitable shape.

Figs. 2 and 3 show the seat cushion 5, which forms a seat surface. The cushion 5 comprises a supporting body 7, which is preferably made of a moulded cold-curing foam and is manufactured in a mould corresponding to the desired outer dimensions of the supporting body 7. It is made of a resilient open-cell synthetic foam, and is preferably in one piece. The synthetic foam, as diagrammatically indicated by short lines in the shaded region, can be mixed with a pulverulent flame retardant 8, such as melamine resin and/or aluminium hydroxide. An intermediate layer 9 of high temperature-resistant threads 10 and 11 laid in a lattice or network is disposed on the upper surface of the supporting body 7. The intermediate layer 9 is covered by a flame-retardant layer 12, which is disposed on the side of layer 9 remote from member 7. The flame-retardant layer 12 is impregnated with a liquid flame retardant, containing e.g. chlorine, bromine or phosphorus. Advantageously the liquid flame retardant is mixed with hydrated aluminium oxide having a particle-size distribution preferably between 0.2 and 110 μm . The flame-retardant layer 12 preferably comprises a polyether, and the foam plastics forms part of a plastics foam block which is subsequently impregnated with a liquid flame retardant. The flame-retardant layer 12, the intermediate layer 9 and the supporting body 7 are interconnected by an adhesive 13 at places distributed

over the surface, so that the air flow through the seat cushion 5 is not appreciably reduced by the adhesive 13. The flame-retardant layer 12 on the seat surface 14 is covered by a low-flammable seat cover 15. The seat cover 15 is connected to the seat cushion 5 by burr strips 16, which can be disposed in the region of a recess in the flame-retardant layer 12. The intermediate layer 9 and the flame-retardant layer 12 envelop the supporting body 7 in the region of the seat surface 14 next to the person using the seat, i.e. also in the region of the side surfaces 17. The low-flammable seat cover 15 may also cover these areas of cushion 5 or the entire cushion. Alternatively, owing to the construction of the seat cushion 5 according to the invention, the low-flammable seat cover can be omitted in those regions which are invisible, e.g. underneath the sofa seat.

The intermediate layer 9, which can e.g. also be a knitted or woven or nonwoven fabric or network or lattice, preferably has a mesh width of threads laid in a lattice or network of about 0.5 to 8 mm, preferably 3 mm.

As also shown in Figs. 2 and 3, a covering layer 19 is disposed on an underside 18 of the seat cushion 5. The covering layer comprises a flameproof woven or knitted or nonwoven fabric made of non-flammable or low-flammable fibres. Low-flammable substances of this kind usually comprise a combination of cotton and polyester, e.g. 81% cotton and 19% polyester or alternatively 59% wool, 33% cotton and 8% polyester.

The covering layer 19 is connected to the supporting body 7 by an adhesive 13, e.g. a continuous layer or at individual spots, as shown in Fig. 2 in the case of the intermediate layer 9 or the flame-retardant layer 12. Alternatively of course the supporting body 7 can be foamed directly on to the covering layer 19. In that case the covering layer 19 must be placed in a suitable foaming mould before the supporting body 7 is manufactured.

It has also been found advantageous if the covering layer 9 covers or extends over edges 20 - 23 between the side surfaces 17 and/or the underside 18. As a result of these parts 24 of the covering layer 19, which project over the side surfaces 17 and/or the seat surface 14, the layers of adhesive 13 can be covered between the supporting body 7 or covering layer 19 and the flame-retardant layer 12 or between the supporting body 7 and, if required, the intermediate layer 9. On exposure to flame, this prevents the flames igniting the adhesive and penetrating into the seat cushion 5. Also, this

overlapping arrangement of parts 24 of the covering layer 19 reliably prevents the flame-retardant layer 12 or the intermediate layer 9 coming loose from the supporting body 7. This considerably increases the loading capacity of the seat cushion 5, more particularly when the flameproof seat cover 15 is replaced, and also improves the safety of passengers in the event of a fire in the means of transport, since even after prolonged use, the seat cushions 5 still have the service lives prescribed by the various test authorities.

As also shown, the burr strips 16 of a device for retaining the flameproof seat cover 15 are disposed on the side of the covering layer 19 remote from the supporting body 7. The burr strips can be connected to the covering layer 19, preferably by a layer of adhesive 13. The advantage of this method is that the covering layer 19, which is connected to the supporting body 7 over a large area, reliably prevents the cover layer 19 being loosened by the tensile forces which occur in the region of the burr strip 16 when the flameproof seat cover 15 is loosened, and which are partly restricted to points on small areas.

As an alternative means of protecting the covering layer 19, reinforcing supports 25 can be provided, likewise on the side remote from the supporting body 7, so as to prevent the covering layer 19 becoming frayed or damaged or torn at the place where the seat cushion 5 rests on the supporting frame 6.

Fig. 4 is a larger-scale view of the front corner region of the seat cushion 5. As shown even better in Fig. 4, the seat cover 15 is moved out over the parts 24 of the covering layer 19 overlapping the side surface 17. As also shown, a flameproof seat cover 15 can be disposed on the underside 18 of cushion 5 in addition to the covering layer 19. As already described with reference to Fig. 3, it may be advantageous to dispose reinforcing supports 25 on the covering layer 19, so as to rest layer 19 on a spar 26 of the supporting frame 6.

As also shown very clearly by Fig. 4, the parts 24 of the covering layer 19 projecting beyond the side surfaces 17 can also protect the end face of the layer of adhesive disposed between the supporting body 7 and the flame-retardant layer 12.

In this embodiment also, the flame retardant 8 in the supporting body 7 is indicated by broken lines.

As also shown in this embodiment, the supporting body 7 can have recesses 27, e.g. caverns.

5 Alternatively the seat cushion 5 can be pierced with needles, e.g. after manufacture, so as to form continuous openings (shown with disproportionately large diameter in the present embodiment) for dissipating heat and moisture from the region of the seat surface 14.

10 Fig. 5 shows a connecting device 28 and burr strip 16. The foam plastics supporting body 7 is connected to the covering layer 19 by adhesive 13. The burr strip 16 has a substrate strip 29 made of heat-deformable material, e.g. polyamide. Anchoring parts 31, e.g. a hooked pile of plastics or nylon fibres, are disposed on the substrate strip 29 on a surface 30 remote from the covering layer 19. An e.g. heat-activatable adhesive 33 is disposed on a joint surface 32 on the substrate strip 29 towards the covering layer 19. In the joining regions 34 the substrate strip 29 is heat-deformed in the direction of the covering layer 19, the depth 35 and the thickness 36 of the substrate strip 29 in the joining region being greater than the thickness 37 of the substrate strip 29 when not pressed in, the result being that the substrate strip 29 and the covering layer 19 engage like teeth in the joining regions 34 and side surfaces 38.

20 If the temperature for the reshaping process is suitably adjusted in accordance with the materials used for the substrate strip 29, the heat-activatable adhesive 33 and the covering layer 19, they are converted into a viscous melt or plasticised in the joining regions 34, so that the materials flow into one another and produce a strong joint after solidifying. In addition the heat-activatable adhesive 33, which is adhesive at room temperature, can be liquid at the higher reshaping temperature, and can thus penetrate both into the substrate strip 29 and into the covering layer 19.

30 As also shown from Fig. 5, the anchoring parts 31 in the joining regions 34 can be reshaped by the heat of a heatable punch 39, or can be melted away. In the latter case the melt penetrates into the fabric-like base material of the covering layer 19 and produces a firm welded joint after solidification. During thermal reshaping also, the adhesive strength of the burr strip can be altered by altering the total area.

35 Fig. 6 shows the connecting device 28 with a burr strip 16 on the supporting body 7 comprising the covering layer 19. The burr strip 16 comprises the substrate strip 29, made e.g. of heat-deformable plastics, and with anchoring parts 31 on top. In the join-

ing regions 34, the anchoring parts 31 are melted off under pressure and temperature, and the melt enters the base material of the substrate strip 29 and the covering layer 19.

5 The joining regions 34 can be disposed in any desired grid form. For example the joining regions 34 can be disposed inside the contour formed by the burr strip 16, or alternatively may overlap a side edge 40 of the burr strip 16. In this manner the durability and consequently the resistance of the connecting device 28 to tearing can be determined by the number, arrangement and size of the joining regions 34. Alternatively the number of anchoring parts 31 determining the adhesive strength of two
10 co-operating burr strips can be influenced by melting away or reshaping at certain places, in order if required to reduce the adhesive strength for easier release of the seat cover 15.

15 Fig. 7 diagrammatically shows the method of joining the burr strip 16 to a covering layer 19 covering the supporting body 7. A die 43 provided with a heating arrangement 41, e.g. heating cartridges 42, is movable by a feed device 44, e.g. a pressure-actuated cylinder 45, in the direction (arrow 46) of the burr strip 16, which has been positioned on the covering layer 19. The burr strip 16 can be held pre-
20 positioned by the adhesive 33, e.g. a heat-activatable adhesive on the covering layer 19. The heating arrangement 41 is supplied with electric energy via lines 49, 50 from a supply 48, by means of an automatic control device 47 in front of the heating cartridges 42. A temperature sensor 51 is disposed in the die 43 and connected to the automatic control device 47 by a line 52. In this manner the energy supply can be ad-
25 justed to obtain a constant temperature in die 43, which is required for the process.

An additional control element such as a timer 53 and valve 54 can control a system 55 for supplying pressure to the cylinder 45, thus controlling the holding time of the die 43 for melting and joining the burr strip 16 to the covering layer 19. An excess-
30 pressure valve 57 disposed in the pressure line 56 to the cylinder 45 can also be used to adjust the pressure (arrow 58) as required for the process, so that all the parameters influencing the process can be preselected in accordance with the materials to be joined.

35 Figs. 8 and 9 show an underside 59 of a seat cushion 5. The underside 59 is formed by a covering layer 19, e.g. of flameproof material or a network or knitted or unwoven fabric of natural or synthetic fibres, and is secured to a supporting body 7, e.g. with

interposition of an adhesive layer 60. A connecting device (a burr strip 16) is disposed on the covering layer 19 so as to join it to the seat cover 15 shown in Fig. 2. The top surface of the burr strip 16 has burr threads 61 which become hooked to a co-operating part pressed upon them and thus firmly secure or join the two parts. In order reliably to prevent accidental tearing or loosening of the connecting device or burr strip 16 from the covering layer 19, the burr strip 16 is connected to the covering layer 19 in the joining regions 62 and 63. To this end, the burr strip 16 is positioned over an adhesive layer 60 on the covering layer 19, e.g. by using brackets or similar means. Next, the joining regions 62, 63 where the burr strip 16 is provided with heat-deformable materials or consists entirely of such heat-deformable materials are heated, whereupon the burr threads are deformed, as indicated by a different representation in the diagram, so that their adhesive properties can be reduced if required. The joining regions 62 and 63 can have various shapes, or alternatively identical or identically-disposed joining regions will be adequate.

In the present embodiment the joining regions have a spacing 64 which is a multiple of a diameter 65 of a joining region 62. The rows of joining regions 62 are offset from one another by half the spacing and have a transverse spacing 66 which can be slightly greater than the diameter 65 of the joining regions 62.

The result is a grid of securing or joining places between the burr strip 16 and the covering layer 19, and as a result of the heat energy (above the plasticizing or, if required, even above the melting-point of the materials in the joining region) applied to the joining regions 62 on the burr strip, the burr strip melts or is deformed, and is thus pressed or flows into the covering layer 16 underneath, thus firmly anchoring the burr strip in the covering layer 19.

The adhesive strength of the connecting device can be altered via the ratio of the total area of the joining regions 62 to the total area of the burr strip 16, particularly when the joining regions 62, 63 make up a large proportion of the total area of the burr strip 16. This reduces the risk that the burr strip 16 will be torn off or torn loose when the seat cover 15 is removed from the covering layer 19.

It has been found advantageous if the joining region 63 at the end of the burr strip 16 extends over the entire width 67 thereof, so as reliably to prevent the burr strip 16 coming loose from the covering layer 19 even at the highly-stressed end region.

Of course, the grid spacing of the joining regions 62 can be varied as required, and fewer joining regions per unit area of burr strip 16 can be provided if the stresses are lower. Alternatively also, the joining regions can have any desired two-dimensional shape instead of the circular variant.

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Fig. 9 shows the seat cushion 5 in front view, as before showing the supporting body 7, the adhesive layer 60, the covering layer 19, the burr strip 16 and the adhesive layer 60 connecting the burr strip 16 to the covering layer 19. As also shown, the threads 61 of the burr strip 16 are not yet deformed. A ram 68 formed with projections or noses 69 is disposed above the burr strip 16. Projections 69 have a cross-section substantially corresponding to one of the joining regions 62 and 63, but their underside has the shape of a spherical cap or an elliptical cross-section. The complete ram 68 is heated by rods 70, one of which is shown, and which are connected by leads 71 to a control device 72 for regulating and monitoring the temperature. The control device 72 is connected to an energy source, e.g. a power supply network of an electricity supply undertaking.

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The ram 68 is heated by rods 70 to a temperature between 60°C and 200°C, preferably 100°C. As a result of this temperature, the plastics in the burr strip, disposed at least in the joining regions 62 and 63, is plasticised or begins to melt and can penetrate into the fibre structure of the covering layer 19 underneath. This process is assisted by the compressive force 73 applied by ram 68 (symbolised by an arrow), so that the plasticised plastics is also pressed into the fabric underneath. At the same time the adhesive in the adhesive layer 60 is heated and its fluidity changes, so that as a result of the applied pressure and temperature, the adhesive is uniformly distributed or pressed even more deeply into the covering layer 19, resulting in intimate interlocking and joining between the adhesive and the covering layer 19 or burr strip 16.

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If the cycle time is not sufficient to wait until the adhesive in layer 60 melts, the seat cushion 5 bearing the burr strip 16, after the burr strip 16 has been joined to the covering layer 19, can be conveyed through a heating tunnel, where a temperature between 100°C and 200°C can be applied for a correspondingly longer time, so that the adhesive in layer 60 completely softens.

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In that case also, after leaving the heating tunnel, the seat cushion 5 can be briefly subjected to pressure so that the adhesive layer is uniformly distributed through the fabric, resulting in stronger adhesion between the burr strip 16 and the covering layer

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5 A particularly intimate join between the burr strip 16 and the covering layer 19 is achieved if the burr strip 19 has a substantially smooth surface in continuous or knitted form.

Fig. 10 shows another embodiment of a seat cushion 5.

10 The supporting body 7 of cushion 5 comprises a central part 74, a sheath layer 75 surrounding the central part and an intermediate layer 9, a flame-retardant layer 12 and the seat cover 15 on the top surface and side surface of the cushion 5. On the underside 18 of cushion 5, the covering layer 19 is directly applied to the supporting body 7.

15 The central part 74 of the seat cushion 5 comprises a foam core 76 having a relatively high specific gravity of 60 to 150 kg per m^3 . Preferably the specific gravity is 90 kg per m^3 . A spring core 77 is embedded by foaming in the foam core 78. The spring core 77, where it faces the cushion 4, more particularly the back cushion, has a height 78 which is less than the height 79 near the user's knees. These different heights 78, 79 of spring core 77 can be obtained by suitable manufacture of the spring core 77 or
20 by deforming the spring core 77 during manufacture of the foam core 76.

The foam core 76, which is relatively hard because of its high specific gravity, is surrounded by the sheath layer 75, which can have a thickness between 1 cm and 5 cm, preferably 3 cm. The specific gravity of the sheath layer 75 is considerably less than
25 that of the foam core 76, and is e.g. 40 kg to 45 kg per m^3 . The user of the cushion 4 therefore has a comfortable seat, since the seat cushion 5 yields softly in the first moment, whereas at an increasing depth the resistance becomes stronger, so that the seat has a pleasant feel.

30 This increase in the seat resistance is also assisted by the flame-retardant layer 12, which is made of plastics foam and is also relatively soft.

On the other hand, the foam layers are prevented from collapsing by the core layer, which is relatively heavy and therefore resistant.

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In order to prevent the user slipping and displacing the load on cushion 5, a top surface 80 of cushion 5 can be formed with a recess 81 which, in addition to the

forwardly sloping construction of cushion 5, prevents slipping in the direction of an end face 82 of cushion 5 remote from cushion 4, i.e. from the back cushion.

Optionally also, as diagrammatically shown by broken lines, the side surfaces 83 can be formed with recesses 84 which extend into the interior of the foam core 76 through the sheath layer 75, to ensure adequate dissipation of moisture or a plentiful air exchange during prolonged sitting on cushion 5.

At each movement, a corresponding volume of air is exchanged via the recesses or cavities 84, thus dissipating the resulting moisture in the form of water-vapour.

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This prevents the seat cushion 5 from becoming excessively moist, resulting in collapse of the plastics foam, more particularly polyurethane foam, particularly when the cushion 5 is used in aircraft flying into different climatic zones or if the seat is in prolonged use. With regard to the construction of the recesses, reference should be made to the parallel application by the same Applicants - WO-OS 88/09731.

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Fig. 11 is a plan view of the seat cushion 5, also showing the recesses 84 extending into the foam core 76. Fig. 11 also shows a possible shape of the recess 81 at the place where a user is sitting on the cushion 5. As can be seen, towards the front end 82 of the cushion 5 the recess 81 is adapted to the shape of the user's thigh.

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Fig. 12 shows another embodiment of a seat cushion 5 which is substantially similar in structure to the previously-described embodiments, so that like reference numbers are used for like parts. Cushion 5 has a spring core 85, to prevent the supporting body 7 wearing out and delay the collapse of the foam core resulting from this overload. As before, a covering layer 19 is disposed on the underside 18 of cushion 5, whereas the flame-retardant layer 12 in the region of the seat surface 14 is covered by a flameproof seat cover 15 which also extends over the side surfaces 17 of cushion 5. As before, the covering layer 19 overlaps the edges 20, resulting in the previously described advantages. An intermediate layer 9 of non-flammable or high temperature-resistant fibres or threads is disposed between the flame-retardant layer 12 and the supporting body 7. As shown by the diagram of the spring core 85, there are joints 86 between the individual parts of the spring core. At these joints 86, when the seat is loaded in the direction of arrow 87, a relatively high stress is exerted on that layer of the supporting body between the covering layer 19 and the end of the spring core 85 facing the underside 18. Reinforcing supports 25, which can be in strip form, are provided to prevent the supporting body 7 breaking or the covering layer 19 tearing in this region.

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Of course, the reinforcing strips can be disposed between the covering layer 19 and the supporting body 7, instead of being disposed on the side of the covering layer remote from the supporting body 7.

5 In addition, even in cushions 5 provided with flame-retardant layers according to the invention, the supporting body 7 can be formed with recesses 27 to ensure ventilation and consequent removal of moisture, particularly when the seat is used for longer journeys, e.g. long-distance flights.

10 Also, as shown in the region of the underside 18 of cushion 5 in Fig. 12, an intermediate layer 9 of the previously described kind, consisting of high temperature-resistant fibres or threads, can be disposed likewise between the covering layer 19 and the supporting body 7.

15 In general, the low-flammable seat cover 15 can be made of compositions of cotton and polyester, e.g. 81% cotton and 19% polyester, or alternatively seat covers of 59% wool, 33% cotton and 8% polyester can be used.

20 The plastics foam for making the supporting body 7 can be a cold-curing moulded foam, preferably having a specific gravity of 15 to 60 kg/m³, preferably 40 kg/m³. The supporting body is also mixed with a pulverulent flame retardant 8, which can consist of melamine resin and/or aluminium hydroxide or a mixture of the two.

25 The intermediate layer 9 preferably comprises glass or carbon-fibre mats weighing between 150 and 350 g/m². This provides a favourable relation between the increase in weight through the use of the intermediate layer 9 and the flame-retarding effect thereof. However, intermediate layers 9 having a different weight can also be used.

30 Of course, the high temperature-resistant threads or fibres can be combined in any desired manner. For example use can be made of woven and knitted fabrics made of these fibres or threads or fibres consisting of similar threads, and a very wide range of materials can be used singly or mixed together, in order to offer maximum resistance for a longer time to flames acting from the exterior. Preferably, however, glass, ceramics, graphite or high temperature-resistant metals are used as base materials for the
35 threads and fibres.

The mesh width obtained in the knitted or woven fabrics or nets or lattices of high

temperature-resistant fibres or threads results in a corresponding "screen effect", which prevents the flame travelling through the small openings in the screen, thus reducing direct burning in the region of the supporting body 7 disposed behind the intermediate layer 9. On the other hand, a flame evolving inside the supporting body cannot spread from the inside to other regions of the seat cover, and consequently the air supplied to the flame in these regions of the supporting body cannot be increased, thus additionally preventing the spread of fire in the seat.

The flame-retardant layer 12 preferably comprises a foam plastics having a specific gravity of about 20 to 60 kg/m³. A polyether foam is generally used. The polyether foam is formed into blocks which, after foaming, are cut into plates or webs having the desired layer thickness. The plates are then impregnated with a liquid flame retardant, e.g. a polyurethane type 64 (Messrs Bayer), parts by weight of which are mixed with 80 parts by weight of Al (OH)₃. This hydrated aluminium oxide is stirred into the polyurethane.

Of course, the arrangement of individual components can be varied at will or differently combined according to the invention, in addition to the embodiments shown.

List of Reference Numbers

5	1	double bench seat	41	heating arrangement
	2	seat	42	heating cartridge
	3	seat	43	die
	4	cushion	44	feed device
	5	seat cushion	45	cylinder
10	6	supporting frame	46	arrow
	7	supporting body	47	automatic control device
	8	flame retardant	48	energy supply
	9	intermediate layer	49	lead
15	10	thread	50	lead
	11	thread	51	temperature sensor
	12	flame-retardant layer	52	lead
	13	adhesive	53	timer
20	14	seat surface	54	valve
	15	seat cover	55	pressure supply system
	16	burr strip	56	pressure line
	17	side surface	57	excess-pressure valve
25	18	underside	58	arrow
	19	covering layer	59	underside
	20	edge	60	adhesive layer
	21	edge	61	burr threads
30	22	edge	62	joint region
	23	edge	63	joint region
	24	part	64	spacing
	25	reinforcing support	65	diameter
35	26	spar	66	transverse spacing
	27	recess	67	width
	28	connecting device	68	ram
	29	substrate strip	69	projection
	30	upper surface	70	heating-rod
40	31	anchoring part	71	lead
	32	joining surface	72	control device
	33	adhesive	73	compressive force
	34	joint region	74	central part
45	35	depth	75	sheath layer
	36	thickness	76	foam core
	37	thickness	77	spring core
	38	side surface	78	height
50	39	punch	79	height
	40	side edge	80	top surface

81 recess
82 end face
83 side surface
84 recess
85 spring core

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86 joint
87 arrow

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Claims

1. Seat (2, 3), in particular for vehicles, comprising a cushion (4, 5) of foam plastics having a supporting body (7) made of open-cell resilient plastics foam having a first specific gravity, on the upper side of which an intermediate layer (9) of high-temperature resistant threads (10, 11) laid in a lattice or network is arranged, which is covered by a flame-retardant layer (12) which is pre-impregnated with a liquid flameproofing agent made of an open-cell resilient plastics foam having a second specific gravity different from the first, whereby the flame-retardant layer (12), the intermediate layer (9) and the supporting body (7) are connected to one another via regions distributed over their face by means of an adhesive (13) and wherein the flame-retardant layer (12) and also the intermediate layer (9) extend at least over the seat surface (14) and, if required the side surfaces (17) of the cushion (4, 5) and moreover, whereby the cushion (4, 5) is covered with a flame-resistant upholstery material (15), characterized in that a covering layer (19) of a flameproof fabric or respectively knitted fabric or non-woven fabric is applied, in particular glued to the supporting body (7) on the underside (18) of the seat cushion opposite the seat surface (14), which overlaps the flame-retardant layer (12) at least in the region of the edges (20 to 23) between the side surfaces (17) and the underside (18) and also, if required, the seat surface (14).
2. Seat according to claim 1, characterized in that the intermediate layer (9) extends to the underside (18) between the supporting body (7) and the covering layer (19).
3. Seat according to claim 1, characterized in that the supporting body (7) is foamed on to the covering layer (19).
4. Seat according to one of claims 1 to 3, characterized in that the individual regions of the covering layer (19), in particular on the side remote from the supporting body (7) is provided with a reinforcing support (25).
5. Seat according to one of claims 1 to 4, characterized in that the reinforcing supports (25), at least in the region of the joints (86) are arranged between individual parts of a spring core (85) incorporated in the supporting body (7).



6. Seat according to one of claims 1 to 5, characterized in that on the side of the covering layer (19) facing away from the supporting body (7) burr strips (16) are arranged to fasten the upholstery material (15).
- 5 7. Seat for vehicles having a cushion (4, 5) made of foam plastics and a covering layer (19) which is made partly of synthetic fibres and a connecting device (28) connected with the covering layer (19), characterized in that the connecting device (28) comprises at least some regions made of a thermal-working material, which is welded or sealed by heat and/or fused to the covering layer (19).
- 10 8. Seat according to one or more of claims 1 to 7, characterized in that the connecting device (28) or respectively a substrate strip (29) of the connecting device (28) consists of a net, a knitted fabric, a lattice or woven fabric having at least a portion of thermal-working materials.
- 15 9. Seat according to one or more of claims 1 to 8, characterized in that the substrate strip (29) consists of polyamide, for example.
- 20 10. Seat according to one or more of claims 1 to 9, characterized in that the melting point of the thermal-working materials is between 200°C to 400°C, preferably 300°C.
- 25 11. Seat according to one or more of claims 1 to 10, characterized in that the substrate strip (29) of the connecting device (28) is at least in some regions glued to the covering layer (19).
- 30 12. Seat according to one or more of claims 1 to 11, characterized in that a heat-activatable adhesive (33) is used, which is adhesive at room temperature, becomes fluid between 60°C and 200°C, preferably 100°C, and hardens on cooling to room temperature.
- 35 13. Seat according to one or more of claims 1 to 12, characterized in that the substrate strip (29) has joint regions (34) with adhesives (33) disposed in these regions and/or the heat-deformable materials.



14. Seat according to one or more of claims 1 to 13, characterized in that anchoring parts (31) of the connecting device (28), in particular of the burr strip (16) are thermally deformed, more particular melted away.
- 5 15. Seat according to one or more of claims 1 to 14, characterized in that the joint regions (34) are disposed in a grid over the surface of the connecting device (28), in particular of the anchoring parts (31).
- 10 16. Method of manufacturing a seat (2, 3) more particularly for vehicles comprising a foam plastics cushion (4, 5) and a covering layer (19) made partly of synthetic fibres for attaching a connecting device (28), more particularly a burr strip, characterized in that in the joint regions (34) the burr strip (16) is heated above the melting point of the heat-deformable substrate strip (29) and/or of the covering layer material and is melted or welded to the covering layer (19) under pressure.
- 15 17. Method according to claim 16, characterized in that the pressure force and simultaneous heating are sufficient for the covering layer (19) to be permanently deformed in the direction of the supporting body (7) in the joint regions (34).
- 20 18. Method according to claim 16 or 17, characterized in that the connection device (28), more particularly the substrate strip (29), is secured to the covering layer (19) by an adhesive (33) and is heated in the joint regions (34) and welded to the covering layer (19) when the adhesive (33) is liquefied, during which process the adhesive (33) penetrates into the fabric of the covering layer and is cooled to
- 25 room temperature in order to achieve holding force.

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