Dec. 22, 1964 H. H. TROTMAN 3,162,488

HINGED AND MARGINALLY STIFFENED UNDER-BODY VENTILATING PAD

Filed Aug. 31, 1962

FIG. 1

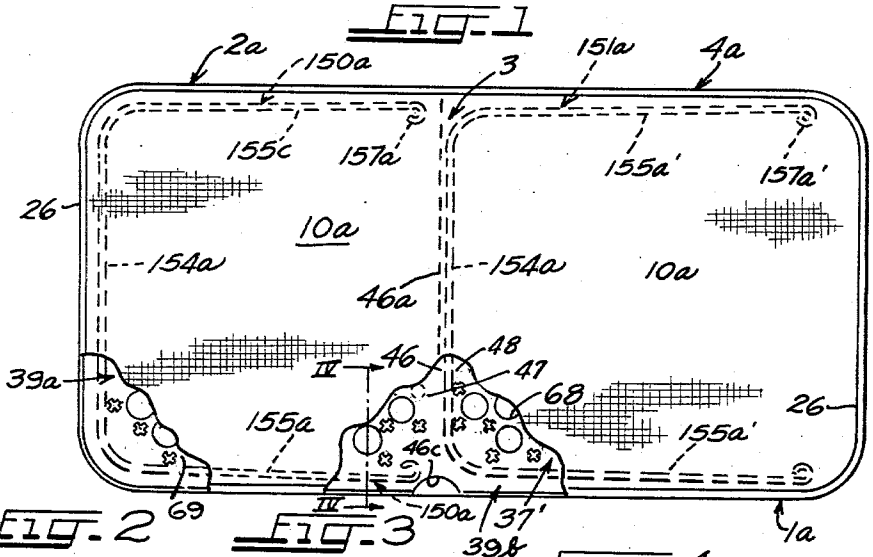

FIG. 2

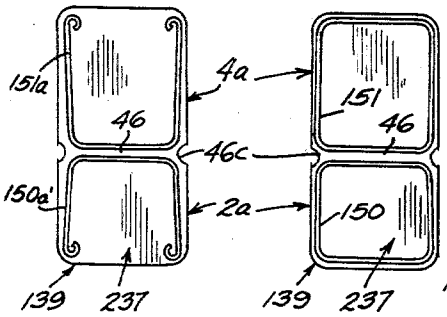

FIG. 3

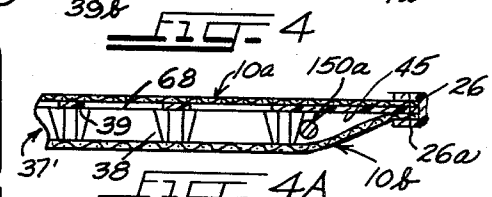

FIG. 4

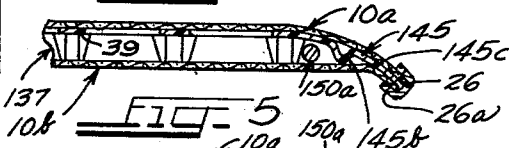

FIG. 4A

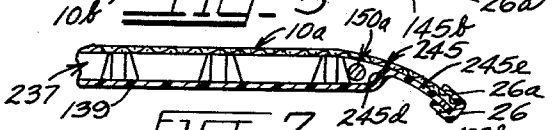

FIG. 5

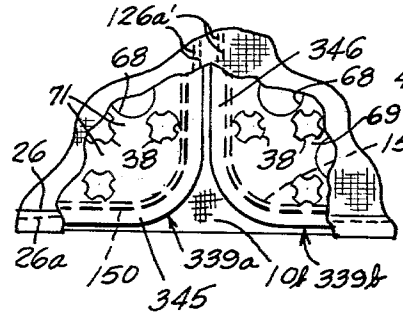

FIG. 6

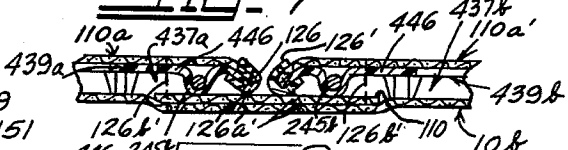

FIG. 7

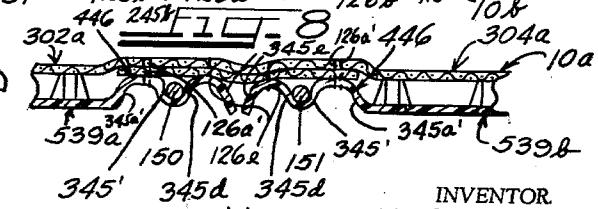

FIG. 8

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1

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HINGED AND MARGINALLY STIFFENED UNDER-BODY VENTILATING PAD

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Filed Aug. 31, 1962, Ser. No. 220,613
22 Claims. (Cl. 297—453)

This invention relates broadly to improved under-body ventilating pads for use on cushioned surfaces, and especially to improve hinge, marginal stiffening, and related means for such pads which include a thin unitary body-spacing and airflow-carrying layer of limited stiffness to hold itself generally flat locally but which is flexibly deformable or bendable in both directions under a supported person and curves down relatively freely into such cushioned surface so as to retain its comfort.

More particularly, the present invention relates to generally free or non-stretched-out types of such pads, especially those intended for use on cushioned seats of automotive vehicles and to low-cost such pads having improved comfort and longer life.

My two copending applications filed of even date herewith for "Air-Carrying Flexible Layer for Under-Body Ventilating," Serial No. 220,612, and for "Forced-Air Under-Body Ventilating Pad Devices," Serial No. 220,614, disclose and claim certain features and combinations usable with forms of this invention or disclosed herein, including, respectively (for said first application), improved forms and constructions of the air-flow-carrying, body-supporting, and flexible layer per se, and particularly such a layer formed by a plastic sheet with integral body-supporting projections spaced apart thereon for any type air flow therebetween, and (for said second application) improved forced-air-supplying and directing means and related features and combinations in pad devices of this general type. The disclosures of these two said applications are intended to be included herein by this reference, as are the disclosures of my (jointly with others) prior Patents Nos. 2,992,604 and 2,992,605.

In general, while the objects of the present invention include certain of the broader objects of my above-referred-to applications and prior patents, they here relate more to the provision of features and improvements usable in my said applications and prior patents.

The broader objects hereof also relate to the provision of improved hinge means and of improved marginal stiffening means (including their associated connections) and also to cooperating or related features in under-body-ventilating (by either natural circulation or by blower-forced air flow) generally free-type pads or devices for use by one or more people on cushioned surfaces, and more particularly in such pads having a thin unitary body-spacing and air-flow-carrying layer of inherent limited springy stiffness to hold itself locally generally flattened but adequately flexibly deformable down under a person's body into a cushioned surface to substantially retain its comfort.

The broader aspects hereof further relate to the provision of improved means to strengthen and prevent excessive tensioning of stitches holding a flexible cover to a marginally stiffened thin sheet of a limited inherent stiffness (preferably of a suitable plastic) carrying body supports to form a thin air-flow-carrying layer for use in under-body-ventilating pad devices to be supported on cushioned surfaces.

2

Additional and more specific objects of this invention are to provide:

An improved combination of marginal stiffening frame and its connecting means with hinge means and with a thin air-flow-carrying layer of spaced-apart body-supporting projections integral with a thin plastic sheet having a limited springy stiffness to hold said layer generally flattened locally but being relatively freely bendable down under a person's body into a cushioned surface.

An improved flexible-type hinge means for an under-body ventilating pad for use on a cushioned seat and associated cushioned back, and more particularly for such a pad including a plastic sheet having a marginal stiffening metal frame secured thereto and with a part thereof adjacent said hinge means.

Other and more detailed objects and advantages of this invention, including cooperating or related features or arrangements, are set forth in or will be apparent from the attached specification, drawings, and claims.

In the attached drawings:

FIGURE 1 is a plan view looking down on the top faces of an opened-out pad according to this invention, with portions broken away to show interior structure;

FIGURE 2 is a reduced scale plan view of a pad according to a modification of the stiffening frames of this invention, with the top cover removed;

FIGURE 3 is a view like FIGURE 2, showing another frame modification;

FIGURE 4 is a section taken on the line IV—IV of FIGURE 1, but to an enlarged scale;

FIGURE 4A is a view like FIGURE 4, showing a modification of its margin;

FIGURE 5 is a view like FIGURE 4, showing another modification;

FIGURE 6 is a broken-away plan view of the hinge and side portion of a modified pad, with the top cover broken away to show interior structure in which there are two separate plastic sheets;

FIGURE 7 is a sectional view taken generally as in FIGURE 4, showing a modification of the hinge and related structure; and

FIGURE 8 is a sectional view like FIGURE 7, showing another hinge modification.

In the foregoing drawings and in their descriptions, for convenience in following this disclosure the same reference numerals are used in the differing arrangements of the several modifications for parts which are or may be otherwise essentially the same. In these modified forms, certain of the differing but generally similar parts are distinguished by the use of the same reference numerals increased by 100 in the succeeding modifications.

As indicated above, the more specific and generally preferred aspects of this invention relate to free-type non-installed or non-tied-down or stretched-out types of pad devices, as contrasted to tied-down or built-in types or the like. As used herein, the terms "free-type," "substantially non-tied-down" or the like are intended to define seat or seat and back pad devices requiring no particular installation and which need their own stiffening, but which may include well-known types of partial holding or locating means (such as a member, located at the rear of the pad or in back of the pad's hinge, to be forced in between the seat and back cushions, or hooks, clips or the like to hold the back pad up), so long as such pad devices are not "built-in" or stretched out or flattened over the

seat or back cushions (as by a stretched cushion cover, full seat cover, or the like). Similarly, this invention also relates to such devices for several people as well as types for only one person.

The features of this invention may be usefully employed in various forms or types of blower-forced-air or natural air circulation under-body ventilating pads or pad devices usually intended for use on cushioned surfaces (including beds, furniture and the like) and particularly for use on cushioned seats and backs of automotive vehicles. In general, such cushioned surfaces may be yieldable by a springy, padded, or otherwise deformable means.

A two-part hinged pad showing one form of this invention, designated as a whole by **1***a*, is shown opened out flat in FIGURE 1. The pads of this invention are particularly intended for use on a cushioned automobile seat and back. Thus the more specific aspects of this invention relate particularly to the problems arising out of or connected with convenient and comfortable use of such devices on automobile seats, truck seats, or the like.

Pad device **1***a* comprises the seat portion designated as a whole by **2***a*, the hinge area or portion designated as a whole by **3**, and the back pad portion designated as a whole by **4***a*. Parts **2***a* and **4***a* may be considered either as two pads or as the two parts of one divided pad.

Pad **1***a* has thin flexible top and bottom covers **10***a* and **10***b*, respectively. At least the top cover **10***a* is foraminous for easy air flow or circulation therethrough. Usually the bottom cover is of the same type mesh as the top cover for lower cost and also for air circulation up through the bottom of the pad in certain cases. For low cost, these covers are usually of a relatively loose, coarse, or open mesh of plastic, textile or other types of threads or mono-filaments suitable for such use, of adequate wear resistance, and providing the desired comfort and appearance. Such loose mesh covers are difficult to hold firmly by economical sewing and particularly by a single line of low cost stitching.

Covers **10***a* and **10***b* are desirably in one piece, extending across the hinge area **3** and out to all of the edges of pad **1***a*, where they are secured. These outer edges of covers **10***a* and **10***b* are embraced by a suitable edge binding or piping **26** to strengthen and conceal the raw edges. Desirably, this edging **26** is a bent-over strip of either a suitable plastic-surfaced cloth or a suitable very thin plastic sheet, both selected to grip and help lock the stitches **26***a* and also to grip the edges of all material embraced by this edging. The single line of sitching **26***a* (only one line being needed in the low-cost pad of this invention) is sewed through both sides of **26**, through the edges of covers **10***a* and **10***b*, and also through the edges of the forced-air-carrying and body-supporting layer means designated as a whole by **37′** and hereinafter described in more detail.

According to the present invention, the layer **37′** has its own limited springy stiffness to hold itself generally flat locally. It is preferred that this layer **37′** be made in accordance with one of the forms or arrangements disclosed in my above-referred-to copending application for "Air-Carrying Flexible Layer for Under-Body Ventilating." It may be noted that only certain of these forms or arrangements are illustrated or mentioned here.

Such a layer **37′** is, however, relatively flexible or bendable down into a cushioned seat, back, or other supporting surface under a supported person. Thus in free-type pads it usually or normally needs some additional resilient stiffening adjacent its edges or margins to prevent undesired cupping or bowing of the pad or bending up of its edges, particularly as a permanent set remaining when the pad is unoccupied. However, due to its own limited springy stiffness, such a layer **37′** does not need as heavy or as stiff an edge or marginal stiffening means as is the case for a wholly or substantially flexible layer, such as, for example, the conventionally-used layers of steel coil springs. The several forms of the marginal stiffening means or frames according to this invention are described after a more detailed description of layer **37′**.

This air-carrying layer is designated as a whole by **37′** in FIGURES 1 to 4, by **137** in FIGURE 4A, and by **237** in FIGURES 2, 3, and 5. In like manner, other only slightly changed or generally similar parts have their reference numbers increased by 100 to indicate their similarity and yet distinguish them. However, component or detail parts which remain the same carry the same numerals.

For convenience in using the above referenced disclosures, the reference numerals here are generally the same as those in my two above-referred-to applications, especially for the detailed or component parts.

As shown in FIGURES 1 and 4, layer **37′** comprises the thin sheet **39**. This sheet **39** has a thickness in the range of from eight to twenty mils and preferably less than fifteen mils, which is relatively uniform after forming. It uses but a small amount of a suitably strong non-brittle plastic (disclosed as set forth above). The integral hollow frusto-conical (preferably polygonal) three-dimensionally-deformed and body-supporting projections **38** have generally flat outer ends of about one-half their base areas. Projections **38** are preferably rapidly mass-produced in a single sheet by vacuum-type forming on a single die, with their wall thicknesses but little reduced from the web thickness or from the original sheet thickness. Preferably, this thickness reduction is less than about one-third. Further, sheet **39** with projections **38** has little (preferably less than ten percent) orientation or locked-in stress to be released in a sun-heated automobile. It is desirable that these upright supports **38** be of less than one-half inch in height, and they may be only about one-quarter inch, to provide a very thin air-carrying layer **37′** which will not have its thickness materially reduced in normal use. They have their side walls sloped about as shown for best columnar stiffness and collapse resistance, and are corrugated to form tapering ribs **62** as shown (preferably at the polygonal corners), thus greatly increasing their body-supporting stiffness.

For low resistance to the flow of forced or naturally circulating air in layer **37′**, supports **38** are spaced apart in all directions, as shown, and are proportioned so that their horizontal cross-sectional areas are in the range of from only one-tenth to a maximum of one-third, and preferably about one-eighth, of the body-supporting areas.

These projections **38** are integrally connected and prevented from tilting excessively by web or flat portions **69** which have a limited springy stiffness to locally hold sheet **39** and layer **37′** generally flat and yet provide sufficient springy flexibility for the unstiffened areas of pads **2** and **4** to permit relatively free or flexible curving down into the under cushion to provide comfort. This also prevents materially obstructing or changing the effective thickness of air flow by abrupt bends in layer **37′**. Preferably layer **37′** or the whole pad has only one plastic sheet materially stressed by this bending, to avoid uncomfortable beam-type stiffness in the air-carrying structure.

In certain cases, holes **68** may be provided between projections **38** and spaced apart for relatively uniform distribution of forced air to a supported body. They are die-cut or punched through webs **69** between the supports **38**, as shown. As shown, holes **68** are preferably materially larger than the bases of the projections, for economy in the punching operation. They provide a total air-carrying area in a range of from one-quarter to one-half, and preferably about one-third, of the body-supporting areas, to provide an adequate low resistance to natural air circulation or forced-air flow therethrough. These holes also define or form strip-like or elongated members **71** extending between and connecting projections **38**. Strips **71** are more flexible because they can deform by

simple bending across their relatively narrow widths. They extend from side to side and from front to rear for bending under a person in these two directions. Strips 71 retain an adequate limited stiffness to hold sheet 39 and layer 37' generally flat locally, thus preventing abrupt bends or high air-flow-resistance portions in the air-carrying passage of thin layer 37'.

Supports 38 are arranged in a suitable two-way pattern in body-supporting area 47 of the seat pad portion 39*a* of one-piece sheet 39. As shown, this area is rectangular, with corners cut away to clear or prevent interference with the hereinafter-noted stiffening frames and their two-way lost-motion connections.

Similar area 48 of the pad part 39*b* of sheet 39 is spaced from area 47 to provide the flat and hinge-forming integral or common margin 46. Relatively narrow margin 46 bends in flexure for the hinge action. That is, sheet 39 has an integral flexure hinge whose bending is limited to a narrow area by the stiffening of sheet 39 on each side of the hinge, as by the omission of a row of holes on each side, as shown.

Areas 47 and 48 are also spaced in from the side and end edges of sheet 39 to provide peripheral margin 45 of about the same or slightly less width than hinge margin 46. Margin 45 provides a sufficiently smooth or unobstructed region or flat sheet face alongside of the straight sides of outermost projections of areas 47 and 48 to provide for the relative outward lost-motion travel of the frame sides in those areas or cases where such lost-motion is needed. This lost-motion is discussed below.

It is to be noted that while the layer 37' or the like in this application is intended to be in accordance with the disclosures of my first above-referred-to application, yet to avoid undue lengthening of this disclosure only certain of the forms and arrangements of this plastic air-carrying layer are specifically illustrated or mentioned here.

FIGURES 1 and 4 show a first form and arrangement of the plastic sheet 39 in layer 37'. Here the projections 38 extend down and the pad includes top and bottom covers.

FIGURE 4A shows a plastic sheet 139 with a modification of the margin portion of FIGURE 4.

FIGURES 2, 3, and 5 show plastic sheet 239, which is like sheet 39 inverted, or with its projections extending up, and with the holes omitted. Here the bottom cover is omitted.

FIGURES 2 and 3 show two different forms of stiffening frames with the top covers and edge bindings omitted.

FIGURE 6 shows the flexible layer arrangement (here 337*a* and 337*b*) like 37' of FIGURE 4, with the stiffening frames of FIGURE 2 (or FIGURE 3), but with the plastic sheet in two pieces 339*a* and 339*b* for the seat and back portions, respectively.

FIGURE 7 shows the separate air-carrying layer portion 437*a* and 437*b* formed by the two separate plastic sheets 439*a* and 439*b* which have projections and holes like sheet 37' of FIGURE 4.

FIGURE 8 shows another modification, with the air-carrying layer portions 537*a* and 537*b* formed by the two separate plastic sheets 539*a* and 539*b* for the seat and back portions, respectively. These two plastic sheets are here shown as like sheet 139 of FIGURE 5.

The hinge and margin features of these FIGURES 6 to 8 are described below.

The several different forms or arrangements of the stiffening frames shown are discussed below. It is to be noted that any of the above-noted forms of the flexible layer 37' (as well as other of one or more sheets of plastic, all as disclosed in my above-referred-to application for "Air-Carrying Flexible Layer for Under-Body Ventilating") are intended to be used with any of the stiffening frames discussed below.

Due to its desirable and comfort-giving flexibility, and when used in free-type pads, layer 37' needs additional stiffening means adjacent its edges, as noted above. Its limited springy stiffness is not sufficient to hold the whole pad generally flat on a seat and to prevent undesirable bending up of its sides or cupping, particularly as a permanent deformation. Other and related problems involve the hinge portion, which is apt to be permanently deformed, particularly if the plastic sheet 39 is in one piece for the seat and back portions. This one-piece construction is desirable in many cases. Further, the sewing of the marginal stiffening frames presents problems as noted below. In addition, it is desirable to provide low-cost pad construction.

These problems are solved by the marginal stiffening and hinge means described below, which provide for the use of low-cost marginal stiffening frames of springy steel wire and their securing in the pad.

It is to be noted that the springy steel, as referred to herein for the stiffening frames, is intended to refer to usual lowcost and non-tempered steel types now conventionally used in the closed rectangular frames which are common in the coil spring types of automobile seat pads now in wide use.

One preferred form of such marginal stiffening frames is shown in FIGURE 1. Here (instead of both frames being in closed rectangular form like the seat pad frame 150 and the back pad frame 151 of FIGURE 3), the seat pad rectangular frame 150*a* has three sides, with its open side along the hinge, while the similar back frame 151*a* has a closed side along the hinge portion 3 and its open side at the top of the back pad 4*a*.

These frames are of steel wire of about ⅛" diameter or less (for a pad for only one person), as discussed above. This wire has a limited springy stiffness to bend under a person's body.

The seat frame 150*a* has its closed end 154*a* stiffening the pad along its front edge or marginal portion and its two integral sides 155*a* connected by the rounded corners 156*a*. In order to avoid a relatively sharp or plain end which might stick through one of the pad covers, the sides 155*a* end in the bend-around or curved portions, as shown at 157*a*.

If desired, the back frame 151*a* may be of smaller diameter wire, in view of the normally materially lower body pressures against the back pad. However, for lower cost, it is usually desirable to make these frames of the same wire. As shown, back frame 151*a* is of the same form as the seat frame 150*a* except that its sides 155*a*' are longer to fit the normally longer back pad 4*a*. Its closed end 154*a*' is here positioned along and close to the hinge portion 3 and helps to define this hinge. Its open top side is the top of the seat pad 4*a*, which normally is not subjected to high body pressures tending to cause permanent bending. Its upright sides 155*a*' help hold the back pad 4*a* up in its desired position against a cushioned back and are connected and supported by the closed end 154*a*', which rests on the cushioned seat. Thus, sides 155*a*' and the closed side 154*a*' move up and down with the seat back pad 4*a* for vertical bouncing of the automobile.

In this arrangement of FIGURE 1, the two generally U-shaped frames provide at least one closed frame side along the hinge 3 and a closed frame side along the front of the seat pad 2*a*, to prevent undesired bending at these points. Both frames are here on the lower face of margins 45 and 46, alongside of the downwardly extending projections 38 of the one-piece plastic sheet 39. These two frames have their ends 154*a* and 154*a*' shown as engaging the marginal projections 38. However, since the other ends of these frames are open and the sides 155*a* and 155*a*' are generally slidable along the side margins, their ends are swingable and may be either out from the marginal projections (as shown) or else abutting the supports 38. However, the portions of sides 155*a* and 155*a*' adjacent the closed ends are preferably

positioned as shown when the pad is unoccupied and are held against relative motion in one direction by engagement with the projections 38.

The ends 154*a* and 154*a'*, as well as the sides 155*a* and 155*a'* are held against relative motion in the other direction (parallel to the general plane of sheet 39) by engagement with the stitched-down bottom cover 10*b*, which is secured to sheet 39 by the stitching 26*a* and the binding 26, as described above.

This arrangement and the space given by the width of margin 45 provides for a lost-motion travel of frame ends 154*a* and 154*a'* (as well as frame sides 155*a* and 155*a'*) between the two locating engagements of the lost-motion construction. The same lost-motion type connection also holds the frames from moving too far away from margin 45. In this case, the frames are usually held intermediate the heights of projections 38 by their lower position engagement with bottom cover 10*b*.

In each form or arrangement of the frames shown in this application, there are at least two opposite sides of each frame relatively rigidly spaced or held apart by a connecting frame end. When sheet portion 39*a* and 39*b* is curved down under a seated person, its margins are pulled in. This would highly tension sheet 39 (and its connecting stitches 26*a*) locally relative to the much more rigid portions of the frames if the edges of sheet 39 were directly connected to the stiffening means.

In FIGURE 1, this tensioning would be mainly along the lengths of the frame ends 154*a* and 154*a'* and between the adjacent portions of sides 155*a* and 155*a'*, since the free or unconnected ends of sides 155*a* and 155*a'*, can bend relatively freely. Because ends 154*a* and 154*a'* do not have their opposite ends connected to sheet 39, these ends 154*a* and 154*a'* and the adjacent connections of sheet 39 (to the covers) do not have as much need for the above-described lost motion connections or, in some cases, any need at all for such lost motion.

Thus, the outward spacing of the stitching 26*a* of sheet 39 (to at least one cover) from the frames and from the projections 38 provides a lost-motion-type connection. This lost-motion means is provided to prevent possible tearing or, in any case, undesirably high stretching of the weaker plastic sheet 39 between portions of the much stronger and stiffer steel frames. This same lost-motion means also greatly reduces the pull on the stitching 26*a* and permits the use of a low cost single line of stitches.

It will be noted that stitches 26*a* (and this lost-motion connection) hold the several portions of the complete pad 1*a* together in operative relation. It will also be noted that this arrangement holds the cover (here the bottom cover 10*b*) generally in against the marginal projections 38, so that this same cover prevents movement of the frames outwardly from sheet 39. The frames do not directly engage stitches 26*a*, but outwardly engage the cover 10*b* materially inward from the stitches 26*a*, so that all of the space between the frames (when against the projections) and the stitches 26*a* is not available as part of the lost-motion travel.

Since the amount of this lost-motion is determined in part by the width of margin 45, it is desirable that this margin (at least in regions where the lost-motion is provided) be of an adequate width. It should therefore be materially wider than the support base width or the hole diameters as defined above, and preferably greater than the projection-to-projection spacing as set forth above. For lower cost, it is preferred to have margins 45 uniform about the sides and ends of sheet 39, as shown.

Possible interference or binding at the corners of projection areas 47 and 48, which would tend to limit lost-motion travel simultaneously in two directions at 90° to each other, is more important with the closed frames of FIGURE 3. Here it is prevented by spacing the rounded corners of the frame outward from the cut-across corners of the projection areas 47 and 48, as shown.

An adequate effective amount of such lost-motion travel (preferably from at least one-eighth to one-quarter inch for a pad for one person) is provided where needed in each of the pads shown, since certain of the embodiments of this invention (and particularly those using a wholly closed or four-sided frame) require a material amount of the lost motion in two directions. That is, a material amount of lost motion is needed from front to rear as well as from side to side. Also, the margins 45 of plastic sheet 39 provide for this two-way lost motion. Accordingly, the case of this two-way lost motion is discussed here even though there is relatively little need for it in the one-side-open stiffening frames of FIGURES 1 and 2.

It is to be noted that in all of the illustrated embodiments of this invention where only one sheet of plastic is used for the seat and back pads, there are no lost-motion connections at or across the hinge. This would be undesirable, since it would interfere with the desired hinge action.

It may be noted again that the plastic sheet 39 has stiffened regions on either side of its unitary flexure-spring-forming hinge margin 46, or on either outer side of the frame sides at the hinge. This causes the bending to occur mainly in the hinge portion of the plastic sheet 39, especially between the hinge sides of the two frames or alongside of one such frame. This absence of lost-motion prevents permanent deformation of the plastic sheet in the region adjacent the hinge.

In the free-type pads of this invention, especially those with a one-piece plastic sheet 39 for use on automobile seats, and where no other means is provided to hold the back pad 4 up in place, it is desirable to have the top cover 10*a* slightly looser or less tensioned from end to end of the entire pad that the sheet 39 or the back cover 10*b* (where one is used).

Thus the slight relative tensioning of the air-carrying layer or sheet 39 or the slight tensioning of its back cover helps hold the hinged back pad part 4*a* in place or against falling forward when unoccupied. However, it is usually desirable to otherwise connect the several flexible covers slightly loosely to the edges of the plastic sheet 39, especially from side to side.

In FIGURE 1, there is a frame end on only one side of the integral flexure hinge portion 46 of sheet 39. This frame end localizes the bending in the integral margin 46, as does the absence of holes 68 adjacent the hinge. Here the central portion of sheet portion 39*a* can have a little more hinge bending outward from hinge area 46 than is true of the back portion 39*b*. However, the two open side frames are of lower cost and weight than closed frames. Also, the front of sheet portion 39 is stiffened. The use of one-side-open frames reduces the need for the above-described lost motion to a minimum or along the two frame sides only adjacent their integral ends.

In the case of the closed frames of FIGURE 3, substantially all of the lost-motion travel required for front-to-rear bending of pad 2*a* and top-to-bottom of pad 4*a* is located at the outer ends of these two pad portions, along the front margin 45 of sheet part 39*a* and along the top margin 45 of sheet part 39*b*. This arrangement also provides a better hinge structure in which the stitching 46*a* holding the cover or covers to sheet 39 at its hinge margin 46 may be quite close to the frame sides and to the marginal supports 38. The absence of a lost-motion connection here permits a narrow hinge margin 46 with a better flexure hinge action.

When a closed frame is used in either the seat pad or the back pad, it is preferred that its lost-motion connection at the end away from the hinge be at least as much as the total of the two side-to-side lost-motion travels. The slight amount of front-to-rear bending of such a closed frame under a person reduces the amount of lost-motion travel needed for the front-to-rear bending.

The top of the back pad 4*a* of FIGURES 1 and 2 is

not subjected to as high body pressures over long periods, so it is not as apt to be permanently deformed or curved. Thus it does not need marginal stiffening as much as the hinge region or the front of the seat portion.

In this embodiment of FIGURE 1, and in the other forms of this invention, the bottom cover **10***b* may be omitted in the non-forced air type of pad. Where forced air is used, the bottom cover would be impervious, but it would not be needed to hold forced air in the embodiment of FIGURE 5 wherein holes **68** are omitted.

FIGURE 2 has its back pad **4***a* and its frame **151***a* like those of FIGURE 1, but the seat pad frame **150***a'* is reversed end for end so that its open end is at the seat front, which is thus not marginally stiffened against side-to-side bending. This last is useful for lower cost and for greater comfort in certain cases where there are less long-continued body pressures at the very front of pad portion **2***a*. One such case is where the front of the seat pad normally curves down over the cushion front, as disclosed in my above-referred-to Patent No. 2,992,605. This would also be true if the front of pad portion **2***a* were held down or stretched out flat by some other means.

However, in many forms of free-type automobile pads according to this invention, the front end of the sheet portion **39** is subjected by the user's legs to relatively heavy pressures over considerable periods of time. Thus it is apt to be undesirably permanently bent. In such cases, it is desirable to have the sheet portion **39***a* stiffened across its front as in FIGURE 1, or on all four sides as shown in the seat pad portion of FIGURE 3.

In general, the problem of permanent bending or cupping of the one-piece plastic sheet **39** is worse adjacent the hinge **3**. Further, this undesirable large-radius bending adjacent the hinge tends to deform the whole pad after a time, so that its appearance when unoccupied is bad and its comfort is reduced. For these reasons, it is desirable in many cases to have two frame ends at the hinge, as shown in FIGURES 2 and 3. The use of a frame end on each side of the integral flexure hinge portion **46** substantially confines the bending to the width of portion **46** and also prevents undesirable permanent two-dimensional bending down or cupping of the seat pad, particularly in its areas adjacent the hinge.

For heavy duty applications such as free-type pads for use by cab drivers, police, and truck drivers, or other such uses, greater strength with only an acceptable increase in stiffness may be provided by the use of multiple but substantially unconnected layers of plastic sheet in layer **37'**, as disclosed in my first copending application set forth above. In such cases, it is usually desirable to provide marginal stiffening frames at all sides and ends of sheet portions **39***a* and **39***b* by the use of two closed frames **150** and **151**, as shown in FIGURE 3.

FIGURES 1, 2 and 3 are the same except as noted. In all three of these figures, the sheet portions **39***a* and **39***b* are integrally connected by the flat flexure hinge portion **46** to which the covers are sewed, as shown at **46***a*. This provides a stronger complete hinge and greater sturdiness for the pad as a whole, especially in its handling when not on the seat. This one-piece form of the plastic sheet is also desirable for lower cost.

As shown in FIGURES 6, 7, and 8, and as discussed in more detail below, the plastic sheet may be in separate pieces for its seat pad portion and its back pad portion.

FIGURES 4, 4A, and 5 show only certain of the forms or arrangements of layer **37'** that are disclosed in my above-referred-to application for Air-Carrying Flexible Layer for Under-Body Ventilating. These figures also show modifications of the outer side of the lost-motion connection for the stiffening frames. It is to be understood that the features of these FIGURES 4, 4A, and 5 may be employed with either the one-piece plastic sheets of FIGURES 1, 2, and 3, or with two-piece plastic sheet types such as those shown in FIGURES 6, 7, and 8.

As noted above, FIGURE 4 shows one arrangement of the plastic sheet **39** with its projections **38** extending down from its under face and with holes **68** between them. A bottom cover **10***b* is employed for better appearance in non-forced-air types of such pads and also to give a higher anti-slip friction for free-type pads. For this purpose, the bottom cover **10***b* may be of a high-friction material, or else be treated as by latex or the like to increase its friction. In this FIGURE 4, the margin **45** around the entire sheet **39** (or around all four sides of each of its separate seat and back portions **139***a* and **139***b* in FIGURES 6, 7, and 8) is flat as shown, and the inward travel of sheet **39** and its covers relative to the frames is limited by engagement of the frame with the sewed cover (or, indirectly, by stitches **26***a*).

The otherwise-identical FIGURE 4A shows another form of the lost-motion connection in which both ends of the lateral travel engage portions of plastic sheet **39** instead of engaging only projections **38** of sheet **39** at one end of the lost-motion travel as shown in FIGURE 4. For this purpose, the modified margin **145** has a downwardly projecting ribs **145***b* which engages the frame (**150***a* or **151***a* of FIGURE 1, **151***a'* of FIGURE 2, or **150** or **151** of FIGURE 3) when the edges of sheet **39** are pulled in by a person's weight, causing the sheet to curve down into the supporting cushioned surface. This arrangement is desirable in that it reduces or prevents stress on stitches **26***a* even when the lost motion is taken up by inward movement of the edges of sheet **39** relative to the stiffening frame.

Another desirable and independently usable feature shown in FIGURE 4A is the downwardly-bent outer lip **145***c*. This lip is at the outer portion of margin **145** and normally extends below the bottom plane of the main body of sheet **39**. This lip **145***c* helps to keep sheet **39** (and hence the whole pad) with its edges flat on the seat or seat back, and aids in preventing curling up of the edges.

FIGURE 5 shows another arrangement of sheet **39**. Here its projections **38** extend up. If desired, the holes **68** may be omitted in this arrangement. In this case, the impervious sheet **139** takes the place of an impervious bottom cover which would otherwise be needed in forced-air types of the pads. For this reason, this form of FIGURE 5 is shown without any bottom cover. It will be understood that latex or other friction material may be applied here to the bottom of sheet **139** to reduce slippage on the cushioned seats or backs. This prevention or reduction of sliding is desirable in free types of such pads, particularly in automotive use.

FIGURE 5 shows another modified margin **245**. It will be appreciated that the lost-motion connection of FIGURE 5 may be like that of FIGURE 4, with the frame (such as **150***a*) relatively laterally movable between its engagement with the outer projections **39** and its engagements with the top cover **10***a*, which latter is held down by stitches **26***a*. However, this FIGURE 5 shows another generally inverted form like FIGURE 4A, in which an outer upright wall **245***d* integrally formed in margin **245** serves as the outer lost-motion engaging means. This reduces stress on stitches **26** in the same way as **45***b* of FIGURE 4A. The top of this wall **45***d* is shown as surface **245***e* sloping relatively uniformly down to the outer edge of the sheet, which is normally well below the bottom plane of sheet **39**. This lip **245***e* is generally like the lip **145***c* of FIGURE 4A and serves to prevent curling up of the outer edges of margin **245**. It will be apparent that, if desired, wall **245***d* may be the inside of a rib like **45**, but upwardly extending. However, the form with lip **245***e*, as shown, is preferred.

The total width of the margin **145** or **245** in forms like FIGURES 4A and 5 may be made wider than the margin **45** of FIGURE 4 to provide room for the above-described ribs or the like.

While the one-piece plastic sheet **39** with its integral flexure hinge (together with the integral top and/or bottom covers) provides a low-cost hinge structure and a complete pad of high strength (particularly for rough handling when not on the automobile seat), yet the seat portion and the back portion of the plastic sheet may desirably be in two separate pieces for certain applications of this invention. In this case, a suitable separate hinge means may be provided between two otherwise unconnected seat and back pads or to supplement the hinge supplied by one or both of the outer covers. However, for simplicity and low cost, it is preferred that one or both of the outer covers be of adequate strength and adequately sewn to provide all or part of the highly flexible hinge means between the two pad portions, as shown in different forms in FIGURES 6, 7, and 8.

All or part of this wholly flexible or generally cloth-like hinge may be formed by only the bottom cover **10***b*, as shown in FIGURE 7, by only the top cover as shown reinforced in FIGURE 8, or by both covers as shown in FIGURE 7. In these cases, the stitches along the hinge ends of the two pad portions may be more heavily stressed in rough handling of the whole pad, especially when it is not in normal use.

For this reason, it is desirable to use either a stronger or a heavier sewing at these ends than the low-cost sewing **26***a* of FIGURES 1 to 5. The same low-cost sewing **26***a* of FIGURES 1 to 5 may be employed around the other sides and ends of these two pad portions, as shown in FIGURE 6.

The desirably stronger or heavier sewing is indicated by the two lines of stitching **126***a'*, as shown in FIGURE 6 on the side of each frame end at the hinge. This same sewing may be used in FIGURES 7 to 8. It will be understood that only one line of suitably strong sewing need be used in these cases. This sewing **126***a'* (like **26***a* as described above) is through, and gripped and locked by, the plastic sheet. This stronger sewing **126***a'* also helps retain the ends of the frames in the pad portions, as described above for stitches **26***a*.

For this same reason of heavier stressing of the cloth or the like in the wholly flexible hinge, the flexible material or fabric of the pad covers may be reinforced by an extra strip of cloth or the like extending between the two lines of stitches **126***a'*, as shown at **110** in FIGURE 7 and at **210** in FIGURE 8. It will be understood that such inner and concealed reinforcement may be used in FIGURE 6 if desired.

FIGURE 6 shows the seat portion **339***a* and the closely adjacent but separate and generally similar piece **339***b* for the seat back portion of the air-carrying layer. Each is here shown like FIGURE 4, with the holes **68**, the projections **38** extending down, the margins **345** and **346** being plain and flat, and top and bottom covers, all as described for FIGURES 1 and 4. The stiffening frames are here shown as **150** and **151**, or as with closed hinge ends, like those of FIGURE 3, but they may be like the stiffening frames of FIGURES 1 and 2, if desired.

Since the seat and back pad portions have separate plastic sheets and there is no integral flexure hinge of plastic, the special problem of deformation of the hinge area (due to cupping of the one-piece plastic sheet) is not present here in FIGURE 6. Hence, part of the front-to-rear or end-to-end lost motion for either or both the seat's plastic sheet **339***a* or the back's plastic sheet **339***b* may be provided by the lost-motion travel adjacent the hinge. This lost-motion connection is like that shown in FIGURE 4. It is particularly useful for closed frames as shown in FIGURE 3. In each of these figures, each of the two margins **346** along the hinge is of about the same width as margin **45**, as described above.

As shown in FIGURE 7, each margin **446** along the hinge may be like margin **145** of FIGURE 4A, with a similar lost motion between the projections **38** and rib **145***b*. In the arrangement as shown in FIGURE 7, the hinge **103** may be provided by only the one-piece bottom cover **10***b*. The tops are covered by a seat pad top cover **110***a* and a separate back pad top cover **110***a'*. For a better appearance and for a free hinge action, the adjacent edges of sheets **439***a* and **439***b* are enclosed, together with the edges of the two top covers **110***a* and **110***a'*, in edge bindings **126** and **126'**. If desired, these adjacent edges of sheets **439***a* and **439***b* may be spaced apart somewhat farther than shown in order to prevent interference with the hinging action.

The upper bindings **126** and **126'** are like **26**, described above, except that **126** extends around the four sides of the seat pad **102***a*, while binding **126'** extends around the four sides of the back pad **104***a*. These bindings **126** and **126'** are secured by stitches **26***a* of FIGURE 1 around the sides away from the hinge. However, as discussed above, they are here shown as secured on each side of the stiffening frames and at the hinge by the stronger two lines of stitches **126***a'* which extend down through reinforcing strip **210***c* and the one-piece bottom cover **10***b*.

In FIGURE 7, the two plastic sheet pieces **439***a* and **439***b* (for the seat pad and back pad, respectively) are each shown as like sheet **39** of FIGURES 1 and 4A. However, they may be like FIGURE 5, if desired. Similarly, the frames **150** and **151** are like those of FIGURE 3, but may be like the other frame arrangements shown. It will be noted that there is provision for the above-described lost motion along each hinge margin **446**.

In FIGURE 8, the pad portions **302***a* and **304***a* (for the seat and back, respectively) are shown as connected only by the one-piece top cover **10***a*, which may be reinforced as shown by the strip **210***c* of cloth or other strong flexible sheet material, which lies under cover **10***a* and is secured by the lines of stitching **126***a'* (as in FIGURES 6 and 7).

Since in FIGURE 8 the two plastic sheets **539***a* and **539***b* are iimpervious, like sheet **239***e* of FIGURE 5, no bottom covers are needed for non-forced air forms, and hence none are shown here. The edges of sheets **539***a* and **539***b* are underneath the top covers and are relatively concealed in normal use. Therefore, no hinge edge bindings like bindings **126** of FIGURE 7 are used. A binding like **26** of FIGURE 1 is provided about the entire pad of FIGURE 8.

FIGURE 8 also shows the hinge margins **446** for each sheet **539***a* and **539***b* as including an upright wall **345***d* which is generally like wall **245***d* of FIGURE 5, so that it forms one side of a rib portion whose top or lip **345***e* slopes down to the edge of the sheet and extends below the bottom of the plastic sheet generally, like lip **245***e* of FIGURE 5. Here, however, the width of the groove or valley between the wall **345'** of upright rib **345***a'* and wall **345***d* is just about wide enough to receive the end of the stiffening frame **150**. The construction for frame **151** is the same. Thus no lost motion is provided here adjacent the hinge for these closed frames and a double amount of lost motion is provided at the other end of each pad portion, as discussed above. If desired, rib **345***a'* may be omitted and rib wall **345***d* be positioned close to projections **38** to receive the frame therebetween and on the other face of the plastic sheets.

Accordingly, in this FIGURE 8, the lip **345***e* is shorter than in FIGURE 5. The whole margin **446** for each pad part may be narrower than the hinge margins of FIGURE 7. The two ribs of this FIGURE 8 may be used to define the two ends of travel of the above-described lost motion.

It is to be noted that the stitching **126***a'* of the covers to and through the plastic sheet at the hinge margins in FIGURE 8 is not through the sheet edges but is located on the top of rib **345***a'* close to wall **345'** where the rib comes closest to the one-piece top cover **10***a*. Only these rows of stitching **126***a'* need be used. However, it is preferred to also sew through the top of each rib **345***d*. Thus the inner lines of stitches **126***e* are located on top of these

ribs 345*d*. Here the top cover and its reinforcement is the only connecting hinge means. No covering is needed for the free ends of the normally-concealed lips 345*e*, and no bottom cover like 10*b* is necessary.

It is to be noted that the lost motion is used in forms of this invention having a one-piece plastic sheet forming an integral flexure hinge and also in forms using the plastic sheet in two separate pieces for the hinged seat and back pads. In both of these types, there is no lost motion acting to distort the hinge or forces acting across the flexure hinge, which in each case includes one or more of the flexible sheets forming the complete hinged pad.

The smoothly curved notch 46*c* at the edges of the flexure hinge portion 46 of plastic sheet 39 serves to prevent tearing or stress concentrations due to bending at the hinge ends.

It will be appreciated that the thicknesses of sheets or like portions (such as the covers 10*a* and 10*b*, the plastic sheet 39 or the like, and the edge binding 26) are necessarily exaggerated in the drawings in order to show double lines. Thus the relative sizes or the proportions of certain parts are distorted. As will be readily understood by those skilled in this art, even though the binding 26 embraces the margin of the plastic sheet and one or more covers, yet its total thickness will actually be much less than the thickness of sheet 39 with its projections 38 (which, as shown, is about one-quarter inch).

It is to be noted that the two ribs (as shown in FIGURE 8) may be farther apart to provide for the above-noted lost motion between them and used for any of the margins of this invention. In such two-rib forms, the frames may be held on the flat or non-projection-carrying face of the plastic sheets, since the frames need not engage the projections in this arrangement.

An important feature hereof is that the plastic of thin sheet 39 or the like is of a type which shrinks inwardly upon the cold perforation of a needle in ordinary sewing. Thus the stitches are firmly gripped and locked to greatly strengthen the sewing and the securing of the frames. This also reduces costs.

While only certain of the numerous possible forms and arrangements contemplated by this invention are specifically described in the foregoing specification or by reference to my above-referred-to prior patents and copending applications, it is to be understood that this invention may include, and it is intended to cover by the appended claims, various other forms or arrangements including the use of features hereof in other relations, all within the teachings and spirit of this invention.

I claim:

1. An under-body ventilating pad portion for use on cushioned surfaces, said pad portion comprising
- a thin layer of non-metallic material,
- human body-supporting supports on and extending outwardly from at least one face of said layer and spaced apart for relatively free air flow therebetween and to the supported body,
- said layer having a limited springy stiffness to normally hold itself substantially flat but being flexible to bend relatively freely under a human body and with an under cushioned surface,
- materially stronger and more rigid marginal stiffening means having at least two connected opposite sides around at least part of the peripheral edge portions of said layer
- and lost-motion-type securing means to hold said layer and said stiffening means together in operative relation, with said layer being held untensioned and relatively loose and with relative limited movability between opposite sides of said stiffening means to substantially prevent tensioning of said layer relative to said stiffening means when said layer curves down into a cushion under a supported body.

2. The pad portion of claim 1, in which
- said supports space the human body from the cushion in the order of one-quarter inch,
- said supports are spaced apart in all directions and are arranged in a body-supporting area extending out to a margin about at least three generally rectangular sides of said layer, said margin being materially wider than the largest cross-sectional dimension of said supports,
- said layer is a sheet of non-brittle, strong plastic in the order of 15 mils thick in which said supports are hollow three-dimensionally deformed projections of said same sheet extending outwardly from only one face thereof,
- said marginal stiffening means is normally held on one face of said margin, and
- said securing means includes said projections and a stretchable textile-like top cover secured to said plastic sheet materially outwardly from said stiffening means and also includes means to hold said stiffening means on said margin about said supporting area of said supports.

3. The pad portion of claim 1 comprising a seat pad portion which is
- hingedly connected to a similar back pad portion having a separate thin layer with supports thereon.

4. The pad potion of claim 1 comprising a seat portion which is
- hingedly connected to a similar back portion by a flexure hinge integral with said thin layers of said pad portions.

5. A free-type under-body ventilating pad device for non-tied-down use on cushioned automobile seats or the like, said pad having hingedly-connected and generally rectangular seat and back pad portions, each comprising
- a thin layer of non-metallic material, human body-supporting supports on and extending outwardly from at least one face of said layer and spaced apart for relatively free air flow therebetween and to the supported body,
- said layer having a limited springy stiffness to normally hold itself substantially flat but being flexible to bend relatively freely under a human body and with an under cushioned surface,
- materially stronger and more rigid frame-like marginal stiffening means around at least three sides of said layer of each pad portion,
- lost-motion-type securing means to hold said layer and said stiffening frame means against separation and in operative relation, with said layer being held untensioned and relatively loose and with relative limited movability between opposite sides of said stiffening means to substantially prevent tensioning of said layer relative to said stiffening means when said layer curves down into a cushion under a supported body,
- and hinge means connected between said layers with no stresses due to said lost motion acting across said hinge means.

6. The pad of claim 5, in which
- each pad portion of said layer has a support-free and generally flat integral margin extending around its entire peripheral edge portions and materially wider than said supports and
- said margins are integrally connected to form a flexure hinge between said pad portions which is substantially free of said lost motion.

7. An under-body ventilating and free-type pad device for use on cushioned automobile seats or the like which is resiliently flexible under a human body but which resists undesired bending as a whole, comprising
- a main portion consisting of a sheet of thin limited-springy-stiffness plastic
- having integrally spaced-apart hollow and outwardly tapering projections to permit air flow therebetween to a human body supported thereon
  - said sheet being flexible in all directions between said spaced-apart projections to conform locally

to a human body and to deflections of a supporting cushioned surface but normally holding itself substantially flat by its own limited stiffness

and having a margin free of said projections and wider than said projections about its exposed edges,

said pad portion including elongated and relatively strong and stiff marginal stiffening means extending around at least the exposed margins of its peripheral edge portions, and

lost-motion means to operatively connect said stiffening means and said margins to limit undesired bending or folding of said pad portion as a whole but to permit relatively free inward motions of said marginal portions of said pad relative to said stiffening means when said sheet is bowed down into a cushion under a person's body.

8. A free-type under-body ventilation-providing pad, particularly for use on automobile seat cushions, comprising

a unitary main portion consisting of a thin plastic sheet of limited springy stiffness having body supports thereon spaced apart to provide open under-body air space

and interconnections of said plastic sheet which are relatively freely bendable between said supports to permit the pad to substantially conform to seat cushion deformations under the body but normally hold itself substantially flat by its own limited stiffness,

said plastic sheet having flat edge margins around said supports,

a flexible top cover of stretchable open textile-type mesh which is difficult to hold by sewing engaging over said sheet and extending out at least to its edges,

an elongated metal marginal stiffening member materially stronger and more rigid than said sheet extending about and engaging on a face of said margins inward from their edges, and

securing means to operatively connect said stiffening member to said margins of said plastic sheet, including

means to limit inward travel of opposite sides of said stiffening member by engagement against the outermost peripheral edge portions of said supports,

a flexible edge strip over the edges of said plastic sheet and over said top cover, and spaced outward from said stiffening member, and

at least one line of stitching materially outward from said stiffening means sewn through and securing together said edge strip, said plastic sheet, and said top cover mesh, with said stitches being gripped by said plastic sheet, said main top cover being locked between said plastic sheet and said edge strip to fit loosely around and to retain said stiffening member intermediate the heights of the outermost of said supports by said cover to permit said downward bending of said plastic sheet and inward motion of its edges in any direction without materially tensioning said plastic sheet between the sides of said stiffening member and to avoid pull on said stitches against said stiffening member.

9. A free-type flexible pad device for non-tied-down use on automobile seats comprising a hinged-together seat portion and a longer back portion, each pad portion comprising

a main body-supporting portion consisting of a thin flexible layer having

upwardly-extending body-supporting yieldable flat-topped upright columnar non-metallic supports thereon of substantially uniform height,

said supports being multi-directionally and uniformly spaced apart to provide for air flow therebetween and to a human body supported thereon.

said layer having openings therethrough between said supports

and a margin free of said supports about its exposed peripheral edges,

said supports being in a generally rectangular area for each pad portion,

each said pad portion also including

elongated marginal stiffening means consisting of a closed generally rectangular frame with rounded corners slightly larger than and located around said supports,

said frames being of relatively stiff rod-like steel wire to prevent undesired bending of each pad as a whole, particularly adjacent its edges

and said pad device including

means interconnecting said two frames to form a hinge,

at least one stretchable foraminous flexible topmost cover extending over said hinge and common and integral for said seat and back portions,

at least one stretchable flexible lowermost cover extending over said hinge and common and integral for said seat and back portions,

a flexible outer binding extending around and embracing the peripheral edges of said complete pad device including its seat and back portions

and stitches sewed through said embracing binding, through said topmost cover, through said layer, through said lowermost cover, and again through said embracing binding outside of said steel frames and around the entire periphery of said pad device and also between said steel frames at said hinge, to permit said layer and said covers to bend down under a supported body while they are held in operative relation.

10. A free-type flexible pad device for non-tied-down use on cushioned automobile seats comprising

hinged-together and generally rectangular seat and back portions, each comprising

a main portion consisting of a thin non-metallic layer having upright non-metallic supports thereon,

said supports being multi-directionally spaced apart by materially more than their lateral dimensions for air flow therebetween and to a human body supported thereon,

said layer being flexibly bendable between said supports down into a cushion and under a supported person

and marginal edge-stiffening generally rectangular frame means about said supports and around the entire periphery of each of said portions,

hinge means between said seat and back portions,

said pad device including

a stretchable foraminous top cover over each of said portions and a stretchable bottom cover under each of said portions,

said top cover and said bottom cover being secured together and to said layer outside of said frame means about the periphery of said device and at said hinge means to hold said layer between the sides of each frame and in operative relation when it is bent down therebetween under a supported person.

11. A flexible under-body ventilating pad for non-tied-down use on cushioned automobile seats or the like comprising

a sheet of thin substantially-uniform-thickness plastic of limited springy stiffness to normally hold itself generally flat,

said sheet having upright supports extending out from at least one face over an area shaped to support at least one human body, and spaced apart for relatively unimpeded air flow therebetween and to a supported body by flat con-

necting sheet portions which are relatively flexibly bendable down into a csuhioned surface under a supported body,

said plastic sheet having integral flat springy support-free margins wider than said supports about said area of supports and about its free edges and a metal marginal stiffening means operatively connected to said margin to provide a lost-motion means to prevent undue stressing of said plastic sheet by said metal stiffening means and located on one face of the edge of said margin adjacent said area of supports.

12. A free-type under-body ventilating pad for use on automobile seats, comprising

a thin sheet of plastic having a limited springy stiffness to normally hold itself substantially flat and having integral hollow outwardly tapering columnar supports thereon,

said supports being multi-directionally spaced apart for air flow therebetween and to a human body supported thereon,

said sheet being flexible between said supports to bend under a person and down into a supporting cushioned surface

and an elongated frame-like marginal stiffening means operatively secured relative to said sheet adjacent its peripheral edges by lost-motion means to slightly compress said plastic sheet at least from side to side between the sides of said frame-like marginal stiffening means and to permit downward bowing of said sheet under a person, with a resulting and material inward motion of its edges before limiting engagement with said stiffening means.

13. The pad of claim 12, comprising

hinged-together seat and back portions,

said marginal stiffening means for at least one of said portions being a three-sided rectangular frame of steel wire.

14. The pad of claim 12, comprising

hinged-together seat and back portions,

said marginal stiffening means for at least said seat portion being a closed rectangular frame of steel wire.

15. The pad of claim 12, comprising

hinged-together seat and back portions,

cover sheets including at least one outer cover, and

flexure hinge means comprising an integral portion of one of said sheets.

16. The pad of claim 12, in which

said lost-motion means includes laterally spaced-apart integral portions of said sheet of plastic to engage said stiffening means.

17. The pad of claim 12, in whch

said lost-motion means includes integral rib means formed in said plastic sheet adjacent to, but inward from, its edges, and a down-turned lip along its edge.

18. A free-type under-body ventilation-providing pad, particularly for use on automobile seat cushions, having hinged-together seat and back portions each comprising

a unitary main part consisting of a thin plastic sheet having a limited springy stiffness to normally hold itself substantially flat and having

hollow body-supporting protuberances formed integrally in said plastic sheet,

spaced apart to provide intercommunicating air spaces open to under a supported person's body and interconnections of said same plastic sheet which are flexibly bendable to permit the pad to substantially conform to seat cushion deformations under a person,

said protuberances extending over substantially the entire pad area out to flat margins,

a flexible stretchable cover of generally textile-type open mesh which is difficult to secure by sewing engaging over said sheet and extending out at least to its edges,

an elongated marginal stiffening frame materially stronger and stiffer than said sheet extending about and normally engaging a face of said margins of each portion inward from the edges

and securing means for said top cover and said frame relative to said plastic sheet consisting of

a flexible binding strip folded over the adjacent edges of said plastic sheet and said cover

and a line of stitches sewed through and securing together both sides of said binding strip, through and locked by said plastic sheet, and also through said cover mesh loosely outward of said stiffening frame,

said stiffening member being located around the outer boundary of said protuberances and being held intermediate their heights by said cover, all to prevent material tensioning of said stitches or of said plastic sheet relative to said frame by downward bowing of said plastic sheet under a supported person.

19. A free-type under-body ventilating pad unit having generally rectangular seat and back portions and comprising

a sheet of thin plastic common to and integrally forming said seat and back portions and having a limited springy stiffness to normally hold itself substantially flat locally,

each of said portions having an area of integral hollow and body-supporting projections extending out from at least one face and spaced apart in all directions for air flow therebetween and to a supported body,

said areas of projections being spaced apart to form an integral hinge portion of said sheet free of said projections

and a stiffening frame-like means materially stiffer and stronger than said sheet operatively connected about the said area of supports of each portion and spaced apart at said hinge portion.

20. The pad unit of claim 19, in which

said areas of projections are generally rectangular, said sheet has ventilating air holes between and larger than said projections,

each area of projections has a margin about its three exposed sides, and

said margins and said hinge portion of said sheet are free of holes and free of projections

and which includes means to locally increase the stiffness of said sheet at either side of said stiffening means at said hinge portion comprising a width of sheet free of holes between said projections which are adjacent said stiffening means.

21. In a free-type under-body ventilating pad device for use substantially non-tied-down on cushioned automobile seats or the like, generally rectangular pad portion comprising

a peripheral open frame of relatively stiff strong elongated metal to hold said pad portion generally flat as a whole, particularly adjacent its edges,

a thin layer of non-metallic material having a limited springy stiffness to normally hold itself substantially flat locally but relatively freely bendable down into a cushion under a supported person and having human body spacing supports thereon spaced apart for air flow therebetween and to a supported body,

at least a thin flexible stretchable top cover foraminous for air flow therethrough over said layer

and inter-securing means including stitching sewn through said layer and said cover materially outwardly of said frame to provide a lost-motion means to prevent substantial tensioning of said stitching in normal use of said pad device.

22. The pad device of claim 21, including

hinge means between seat and back portions,

in which said top cover is secured untensioned and relatively loosely from side to side of said seat portion and said back portion

and in which at least said top cover is connected across said hinge means in slight normal tension from the front edge of said seat portion to the upper edge of said back portion to help hold the unoccupied back portion up against a seat back in normal use and to be folded with said top cover for packaging.

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