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(54) Resilient element for mattress base with slats, and mattress bases provided with such elements.

(57) Resilient element for fixing the slats of a mattress base to the frame thereof, characterized in that the element comprises two elastically deformable tubular parts which are connected parallel to each other with an elastic part, and along the top are provided with a box for the insertion of a mattress base slat and along the bottom are provided with one or more tubes which permit a fixing at different heights through the insertion of a pin, and also a mattress base in which such resilient elements are connected to the frame sides by projecting pins, and in which the slat ends lie pushed into the boxes, so that they can spring horizontally and vertically and turn about their longitudinal axis.

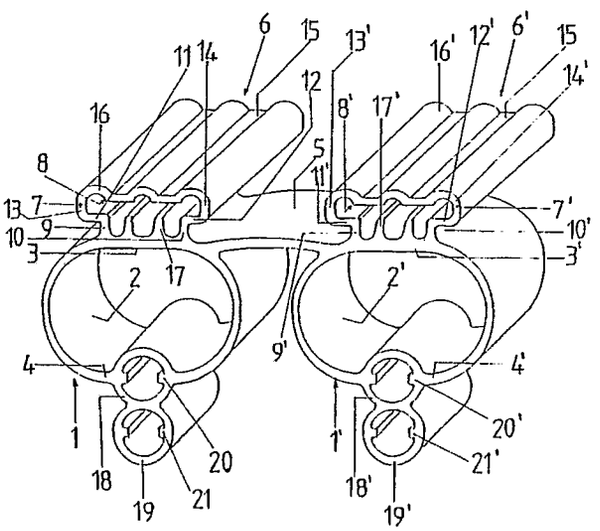

FIG. 1

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"RESILIENT ELEMENT FOR MATTRESS BASE WITH SLATS, AND MATTRESS BASES PROVIDED WITH SUCH ELEMENTS".

With regard to mattress bases, a great many devices for the purpose of increasing sleeping comfort are known.

The coil bed spring, comprising a closely woven network incorporated in a frame, is a commonly used and comfortable spring device, but mattress bases with slats are, on the other hand, often preferred because they give even greater comfort. The slats are usually fixed on a frame so that they can turn individually, by means of elements which may or may not be resilient. The possibility of each slat turning independently of the other slats means that when one lies on them the shape of the body is followed at the level of each slat, which results in greater lying comfort. A division into zones with greater or smaller spring force is also possible. These advantages, together with greater firmness, mean that many people opt for mattress bases with slats, instead of the classic coil bed springs or box springs.

Such mattress bases with slats are constructed of a rectangular frame and a number of slats which are placed crosswise with a certain distance between them, and which extend from the one longitudinal member of the frame to the other, while the slats are connected to said longitudinal members of the frame by means of elements which fix the slats to said two longitudinal members so that they turn about their longitudinal axis and which support them resiliently by their ends on either side.

The resilient elements with which the slats are supported influence the comfort of the bed to a substantial degree. A bed which is not very comfortable is obtained with a non-sprung or poorly sprung connection between the ends of the slats and the frame.

Known resilient elements for fixing mattress base slats to a frame comprise a structure pivoting about the centre point, which elements laterally bear a slat support again pivoting about its axis of symmetry. A disadvantage of this type of element is that such elements mainly provide a height and direction change of the arrangement of slats, and do less for the arrangement of their resilient properties. Another disadvantage is that it is a complex and consequently very expensive solution.

Other known resilient elements comprise rubber bearing structures, but these have major disadvantages. Their limited flexibility and compressibility, resulting in limited comfort, and also their limited service life are their main disadvantages.

A known alternative to the rubber bearing structures are leaf springs. Such known leaf springs, provided in order to connect the slat ends to the frame, are described in NL 8402221 and NL 8400147, and are largely composed of a resilient strip which is folded into a V-shape, and the top leaf of which is connected to a slat end, while the bottom leaf is fixed to a longitudinal member of the frame. A disadvantage of these known resilient elements and of mattress bases constructed with such elements is that the fold in the leaf spring forming an acute angle is a weak point as regards the strength and the service life of the element. Another disadvantage lies in the fact that these resilient elements permit only a resilient movement of the slats going up and down, and the slats cannot turn relative to their longitudinal axis, so that lying comfort is limited.

Another known resilient element for fixing slats of mattress bases to a frame is described in BE 905,146, and comprises a leaf spring which has a horizontal top face and is further connected to the frame with the ends folded downwards and towards each other, while one or more slats are fixed on the horizontal top face, with their end(s) connected in an enclosing chamber to the resilient element.

The disadvantage of this resilient element is that we need a leaf spring - at a relatively high cost - and must provide, on the one hand, a fixing piece for fixing the leaf spring to the frame and, on the other, a connecting piece made of plastic between slats and leaf spring, said connecting piece having to enclose the slat ends. Stop blocks are also needed in order to limit the vertical compression at certain places.

The consequent disadvantage of these resilient elements, and of the mattress bases constructed with them, lies in their cost, on the one hand, and in the necessity for providing at least three different parts for connecting a slat along one end resiliently to the frame.

The object of the invention is to provide a resilient element, without the above-mentioned disadvantages, which offers the maximum comfort, on the one hand, through allowing the slats to undergo not only the maximum vertical compression but also a certain horizontal displacement, and in the process allowing them to turn relative to their longitudinal axis, and which, on the other hand, is simple to fit and costs less than the known elements with the same above-mentioned comfort-oriented properties, but without permitting lower strength and a shorter service life of the elements.

One subject of the invention is a resilient element for fixing slats of a mattress base to their frame, so that the slats can carry out resilient

movements in the vertical and horizontal direction and can turn about their longitudinal axis.

Another subject of the invention is a mattress base with slats constructed with such resilient elements.

The resilient element according to the invention is characterized in that it comprises two tubular parts lying next to each other, made up of walls running more or less in the form of a cylindrical surface, while the axes of symmetry of the two tubular parts lie parallel next to each other.

These identical tubular parts are connected along the top by a flat part, in such a way that a certain distance is left between the walls of these adjacent parts lying closest together. Both the two tubular parts and the connecting part are preferably made of plastic, with resilient properties, and in any case of a material with similar properties.

A flat, elongated, hollow space is provided at the top on the top face of each tubular part, jutting out from said top face, with the lengthwise direction parallel to the axes of symmetry of the tubular parts. This hollow space is open at the front and back, and for the rest is enclosed by walls with rounded corners and round curves, thus producing a more or less bar-shaped internal space which along the front and along the back, in a direction parallel to the axes of symmetry of the tubular parts, allows a slat with a cross-section with dimensions equal to or slightly different from said internal space to be pushed into it, while the rounded corners and curves in the wall mean that during the insertion elastic deformation of the wall is produced, which leads to better gripping of the end of the slat. For this purpose, it is also possible to provide vertical ribs in the inside of said hollow space.

Vertically below said hollow spaces for insertion of the slat ends on each tubular part, in the lowest point of the cylindrically shaped wall of each of said two parts, provision is also made for at least two tubes of smaller diameter than the first-mentioned tubular parts, arranged vertically below one another, with their lengthwise direction parallel to the axes of symmetry of the tubular parts, and provided in order to contain a pin of corresponding diameter which at one side is driven horizontally into the inside of a longitudinal member of the frame, while at the other side one of the tubes is slid over the projecting part of said pin and fixed tightly thereon, to connect the resilient element to the frame.

A mattress base with slats is obtained with the element according to the invention by providing in a rectangular frame, along the inside of the two longitudinal members, horizontally projecting pins directed in pairs in transverse directions at right angles to the longitudinal members, distributed over the entire length of the frame, and by sliding onto each pin a tube of a resilient element fitting thereon and, finally, for every two elements lying opposite each other in a transverse direction at right angles sliding a slat by its ends into the respective flat hollow spaces.

Further features and characteristics of the resilient element according to the invention, and of the mattress base made with such elements, are illustrated in the description which follows of a possible embodiment of the resilient element and a mattress base, but without the invention being restricted to these possible embodiments.

This description is illustrated with reference to the appended figures.

Figure 1 shows a perspective drawing of a resilient element according to the invention, in a preferred embodiment.

Figure 2 shows a front view of this resilient element according to the invention.

Figure 3 shows a righthand side view of the resilient element according to the invention.

As shown in Figures 1, 2 and 3, the resilient element according to the invention is characterized in that it comprises two resilient tubular parts (1) and (1') which are identical in shape and are composed of resilient walls (2) and (2') enclosing a more or less cylindrical space. These tubular parts (1) and (1') are situated next to each other with their axes of symmetry parallel to each other in the lengthwise direction, in such a way that the front and rear edges of these resilient walls (2) and (2') respectively lie in two parallel planes. The spaces enclosed by the above-mentioned walls (2) and (2') are not shut off by transverse walls, at right angles to the axes of symmetry in the lengthwise direction, along either of the two sides, so that the resilient parts (1) and (1') can be described as two open tubular shapes of more or less cylindrical shape lying parallel to each other.

The resilient element according to the invention is further characterized in that each of the two walls (2) and (2') of the tubular parts (1) and (1') has two flattened sides situated diametrically opposite each other - (3) and (4) for the wall (2) and (3') and (4') for the wall (2') - the flattened sides (3) and (3') at one side and the flattened sides (4) and (4') at the other side being situated in two parallel planes.

The resilient element according to the invention is further characterized in that both resilient tubular parts (1) and (1'), lying next to each other as described above, are connected to each other by a flat, resilient connecting part (5) which is situated in the plane in which the flattened sides (3) and (3') lie and is connected to the edges of said flattened sides (3) and (3) lying closest to each other and opposite each other, the dimensions of said connecting part (5) being such that, on the one hand,

the walls (2) and (2') are connected over their entire width and, on the other, the sides of the walls (2) and (2') lying closest to each other do not come to lie against each other, and lie far enough from each other for this not to be the case as the result of shape changes in the two walls (2) and (2') when they are compressed to the maximum.

The resilient element according to the invention is further characterized in that a projecting flat box (6) and (6') is provided on each of the resilient parts (1) and (1'), on the respective flattened sides (3) and (3') of the resilient walls (2) and (2'), the two boxes standing on the flat sides (3) and (3') and extending with their lengthwise direction parallel to the axes of symmetry in the lengthwise direction of the tubular parts (1) and (1'), and having a width - at right angles to the direction of said axes of symmetry - which is only slightly smaller than the width of the flattened sides (3) and (3') on which they stand.

The boxes (6) and (6') extend - parallel to the above-mentioned axes of symmetry - from the front edge of the resilient wall (2) or (2'), with such length that they project over a substantial distance past the rear edge of the same wall (2) or (2') running parallel to said front edge, while these projecting parts are shut off along the bottom by base areas in the form of extensions of the flattened sides (3) and (3'), situated in the same plane.

The walls (7) and (7') of the two boxes (6) and (6') are made of material with resilient properties, preferably plastic, and are of such a shape that they enclose a flat, elongated hollow space (8) and (8'), while the transverse-lying front sides and rear sides are not shut off, so that the flat hollow spaces (8) and (8') are accessible in the lengthwise direction of the boxes (6) and (6') along both sides.

The resilient element according to the invention is further characterized in that the wall (7) and (7') of the boxes (6) and (6') runs from the top of the flattened sides (3) and (3') with two wall parts (9) and (10) at right angles thereto on the flattened side (3), and (9') and (10') on the flattened side (3'), parallel to each other, while higher up they pass into horizontal parts (11) and (12) and (11') and (12') respectively with rounded corners, and then after a symmetrical widening of the hollow spaces (8) and (8') go back into vertically running wall parts (13) and 14) and (13') and (14') respectively, with rounded corners. These vertical wall parts (13), (13') and (14), (14') are then connected at the same height to a horizontal top wall (15), (15'), going back into it with a rounded corner. On the horizontal top walls (15) and (15'), passing into the corners which form the transition with the vertical wall parts (13), (13') and (14), (14'), and in the centre of the top walls (15) and (15'), in the lengthwise direction, provision is also made over the entire length for semi-cylindrical curves (16) and (16') projecting higher.

On the bottom side of the spaces (8) and (8') which are enclosed by the walls (7) and (7'), and which are formed by the flattened sides (3) and (3') of the walls (2) and (2') there are in each case two vertical ribs (17) and two vertical ribs (17') respectively which extend in the lengthwise direction over the length of the boxes (6) and (6'), and are disposed in such a way that the bottom side of the enclosed spaces (8) and (8') are divided symmetrically by them into more or less equal parts, while the height of said ribs corresponds to the height of the vertical wall parts (9) and (10) and (9') and (10') respectively.

The resilient element according to the invention is also characterized in that a tube (18), (18') is incorporated in the other flattened sides (4) and (4') on the walls (2) and (2'), diametrically opposite the boxes (6) and (6'). This tube (18) or (18') extends in the direction in which the axes of symmetry lie, in the lengthwise direction of the tubular parts (1) and (1'), with the same length as said parts, and incorporated parallel thereto in the flattened side (4), (4'), so that an equal part of the tube wall of this tube (18), (18') projects into the spaces enclosed by the tubular parts (1) and (1'), and an equal part of said tubular wall projects from said tube wall along the outside edge of the flattened sides (4) and (4'). The diameters of the tubes (18) and (18') are such in this case that the tubes lie fully inside the flattened sides (4) and (4').

The resilient element according to the invention is also characterized in that another identical tube (19), (19') respectively, having the same length, is fixed against each of these tubes (18) and (18'), both the tubes (18) and (19) and the tubes (18') and (19') being connected to each other other over their entire length through walls merging into each other, in such a way that they lie with their axes of symmetry in the lengthwise direction in a plane which is at right angles to the plane in which the flattened sides (3) and (3') or (4) and (4') are situated. Both the tubes (18) and (19) and (18') and (19') are provided on the inside with projecting ribs (20) and (21) and (20') and (21') respectively, standing at right angles to the wall and situated diametrically opposite each other.

A mattress base, in a preferred embodiment according to the invention, and designed making use of resilient elements according to the invention, in the embodiment described above comprises a rectangular frame, characterized in that horizontally projecting cylindrical pins are placed in the innermost side of the two frame sides running in the lengthwise direction, said pins being distributed at regular intervals along the entire length of said longitudinal members, and being placed in such a

way that each pin in one longitudinal member can be connected to a pin in the other longitudinal member along a transverse connecting line at right angles to the two transverse members. The distance between said pins of the same longitudinal members must be such that the interval between the axes of symmetry of each pair of successive pins corresponds to the vertical spacing between the axes of symmetry of the boxes (18) and (18') (or between (19) and (19')).

The mattress base according to the invention is further characterized in that a resilient element according to the invention is placed on each pair of adjacent pins on the same longitudinal member by sliding the tube (18') (or (19')) on one pin and sliding the tube (18) (or (19)) on the other pin, the dimensions of the pins and of the tubes corresponding in such a way that each resilient element is secured under tension on two pins. The resilient elements are thus fixed with the axes of symmetry in the lengthwise direction of the tubular parts (1) and (1') horizontally and at right angles to the direction of the longitudinal members of the frame, and for the elements on different longitudinal members situated in pairs in line with each other, and with the part of the boxes (6) and (6') past the rear edge of the walls (2) and (2') facing each other.

The ends of a slat are pushed into each pair of boxes (6) and (6') lying in line with each other, and belonging to two resilient elements which are fixed on a different longitudinal member. The cross-sections of the slat ends, which are more or less rectangular, and of the free spaces (8) and (8') correspond to such an extent that the slats are secured therein under tension, while the walls (7) and (7') through their elasticity, and through their curves (16) and (16') lying in the lengthwise direction, permit a slight enlargement of the free spaces (8) and (8') when the slat ends are being pushed into them, so that once they are in there the slats can be clamped even better. The ribs (17) and (17') in the hollow spaces (8), (8'), which press against the bottom surface of the slat ends in this case ensure an even greater resistance against sliding of the slat ends out of the spaces (8) and (8').

The mattress base with slats according to the invention is further characterized in that each resilient part (1) or (1') of the resilient elements can be fixed as desired at two different heights, either by sliding the tube (18), (18') or the tube (19), (19') on the pin provided.

The resilient elements according to the invention in a preferred embodiment are made in one piece, of plastic, with durable and elastic properties.

An advantage of the invention is that we have a resilient element which is simple, and thus cheap, to manufacture, without the use of leaf springs, with which a mattress base which permits a separate movement of each slat (turning of the slats about their longitudinal axis, and movable so that they spring vertically and horizontally) can be constructed, so that ideal comfort is achieved, due to the fact that the shape of the body is followed at every point through the direction of the rotatable slat lying underneath, while the compression takes place according to the local weight, both in the horizontal and in the vertical direction.

Another advantage of the invention is that, in order to increase comfort, each slat is adjustable as desired to two different heights, so that lower and higher up zones can be obtained in the mattress bases, in order to obtain a lying surface which is better adapted to the body.

Of course, the shape of the resilient elements is not limited to the preferred embodiment (with appended figures) described here, but other fixing devices, for example, could be provided for fixing the slats to the resilient elements, and/or for the resilient elements to the frame, and the shape as a whole can differ from the shape proposed here.

Claims

1. Resilient element, for fixing the slats of a mattress base to the frame thereof, said element allowing both vertical and horizontal movements of the slat(s) fixed to it, and also a rotation of each slat individually about its longitudinal axis, **characterized in that** the element comprises two identical tubular parts (1) and (1') - with elastically deformable walls (2) and (2') - which lie next to each other with their axes of symmetry in the lengthwise direction parallel to each other with sufficient space between them for one not to obstruct the deformation of the other, and connected to each other by an elastically deformable connecting part (5), while the walls (2) and (2') are each provided with a device (6) and (6') for fixing the end of a slat, which device extends parallel to the axes of symmetry in the lengthwise direction of the tubular parts (1) and (1'), with the top sides of the two slats lying in line with each other, and each element also being provided with at least one device for fixing it immovably to a frame side, in such a way that each slat connected to it lies horizontally.

2. Resilient element according to Claim 1, **characterized in that** each fixing device for fixing to a frame side is made multiple, or is adjustable in such a way that more than one fixing height is possible.

3. Resilient element according to any of the preceding claims, **characterized in that** the tubular parts (1) and (1') are in the form of a cylindrical surface, and are each flattened along two sides lying diametrically opposite each other, so that for each tubular part two parallel flat sides (3), (4) and (3'), (4') are formed, lying in pairs - (3), (3') and (4), (4') - next to each other in two parallel planes, while the connecting part (5) is in the form of a flat part of low thickness, and connects the tubular parts (1) and (1') over the full width of the walls (2) and (2'), lying in the same plane as two of the flattened sides (3) and (3').

4. Resilient element according to one or more of the preceding claims, **characterized in that** the devices for fixing the slats, running from the top of the flattened sides (3) and (3') lying in line with each other, are in the form of flat, hollow, elongated boxes (6) and (6'), extending with their lengthwise direction parallel to the axes of symmetry of the tubular parts (1) and (1'), and running through from the front edge of the walls (2) and (2') until they are past the rear edge, while the base area of these projecting parts is formed by lateral extensions of the flattened sides (3) and (3'), lying in the same plane, while these boxes enclose elongated spaces (8) and (8') which are accessible in their lengthwise direction along both sides through the open transverse sides.

5. Resilient element according to Claim 4, **characterized in that** the walls (7) and (7') of the boxes (6) and (6') are elastically deformable and are made up of flat parts, each enclosing a bar-shaped space (8) and (8'), with a symmetrical narrower bar-shaped part lying against the tubular parts (1) and (1') over the entire length of the boxes (6) and (6'), while provision is made in the top walls (15) and (15') for semi-cylindrical curves (16) and (16') which project upwards, and there is at least one raised rib (17) on the bottom sides of the enclosed spaces (8) and (8'), parallel to the side walls of the boxes (6) and (6'), over the entire length thereof, and not going higher than the narrower bar-shaped part.

6. Resilient element according to one or more of the preceding claims, **characterized in that** each tubular part (1) and (1') in its respective flat side (4) and (4') - diametrically opposite the fixing devices for the slats - is provided with a tube (18) and (18') which is incorporated centrally parallel to the axes of symmetry in the lengthwise direction of the tubular parts (1) and (1') over the entire length thereof in the flat sides (4) and (4'), so that the tube wall of the tubes (18) and (18') projects as much above as below the walls (2) and (2').

7. Resilient element according to Claim 6, **characterized in that** each tubular part (1) and (1') also has provided for it at least one tube (19) and (19'), which are identical to the tubes (18) and (18'), and which are connected to the tubes (18) and (18') parallel to them and over the entire length thereof by walls merging into each other, so that for each tubular part (1) and (1') at least two contacting tubes (18), (19) and (18'), (19') are provided, said tubes being situated with their axes of symmetry in the lengthwise direction in a plane which is at right angles to the flattened sides (4) and (4') of the walls (2) and (2').

8. Resilient element according to Claims 6 and 7, **characterized in that** all tubes (18), (19) and (18'), (19') which are provided on a frame side as a fixing device for the resilient element have internally projecting ribs (20), (21) and (20'), (21') which project radially from the inside of the wall, lying diametrically opposite each other.

9. Mattress base provided with resilient elements according to one or more of the preceding claims, **characterized in that** they are fixed against the inside of the two longitudinal members of a rectangular frame, at regular intervals from each other over the entire length of said longitudinal members, and are placed in such a way that they lie in pairs in a transverse direction perpendicular to the frame longitudinal members, and for each pair of resilient elements thus situated two mattress base slats are fixed on the tubular parts (1) and (1') of the respective elements lying in line with each other, and the frame is thus provided with slats which are placed transversely at regular intervals, and which are supported in their ends by the resilient elements so that they spring horizontally and vertically and turn about their longitudinal axis.

10. Mattress base according to Claim 9, provided with resilient elements according to one or more of Claims 6 to 8, **characterized in that** the resilient elements are fixed to the longitudinal members of the frame by pins which project horizontally from said longitudinal members, and each sit clamped in a tube (18), (18') and (19), (19') belonging to a different tubular part (1) and (1'), so that each resilient element

is fixed on two pins, with its boxes (6) and (6') lying horizontally, and with the side projecting past the edge of the walls (2) and (2') facing the centre of the frame, while it is possible through the choice of the tubes - (18) or (19), (18') or (19') - to have different fixing heights for each tubular part (1) and (1') of a resilient element.

11. Mattress base according to one or more of Claims 9 and 10, provided with resilient elements according to one or more of Claims 4 to 8, **characterized in that** the two ends of each mattress base slat sit fast in two boxes (6) and (6') belonging to two resilient elements which lie in line with each other in a transverse direction perpendicular to the frame.

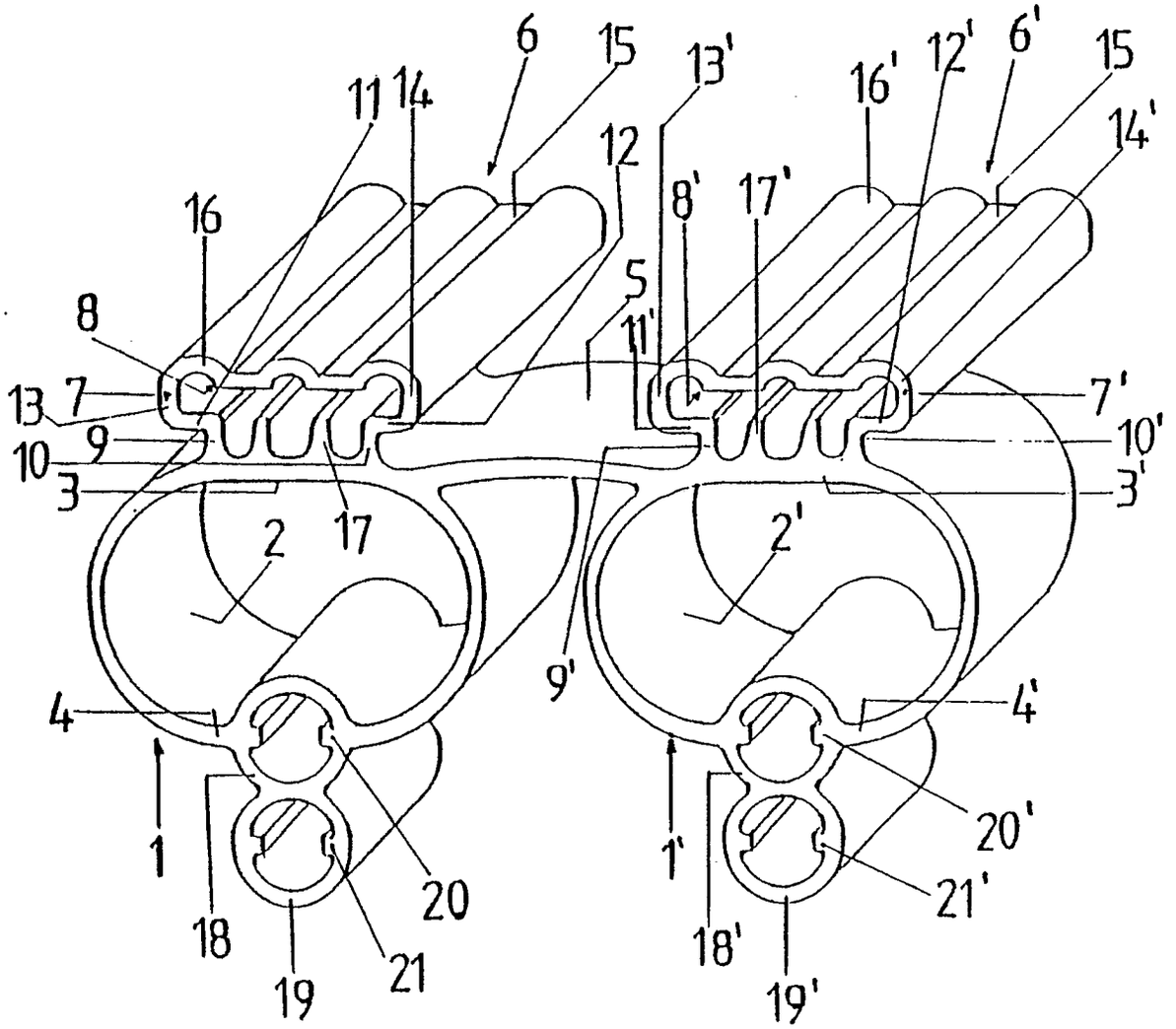
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FIG. 1

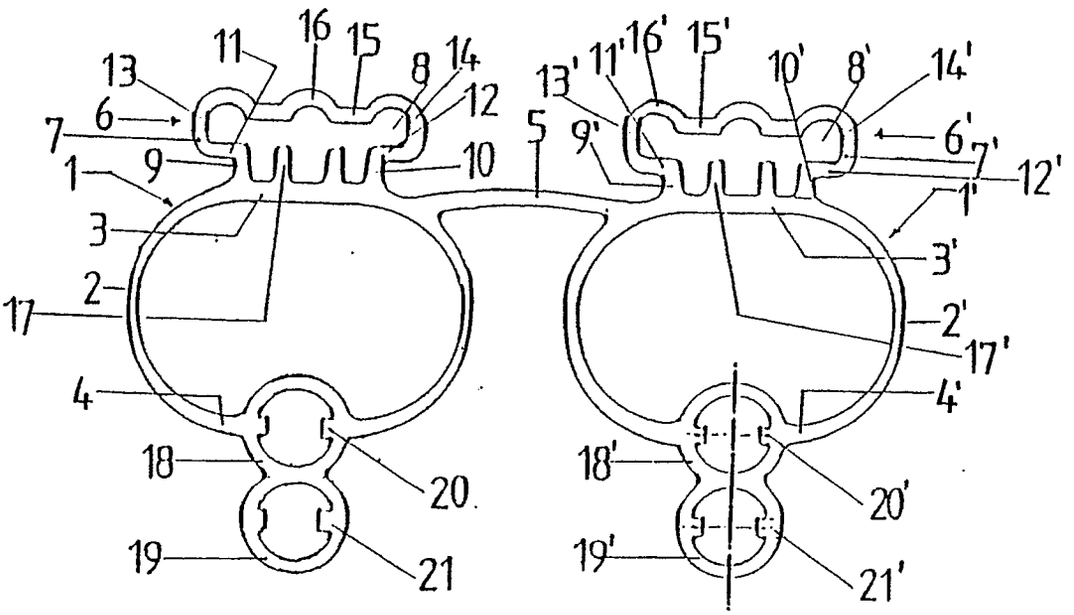
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FIG. 2

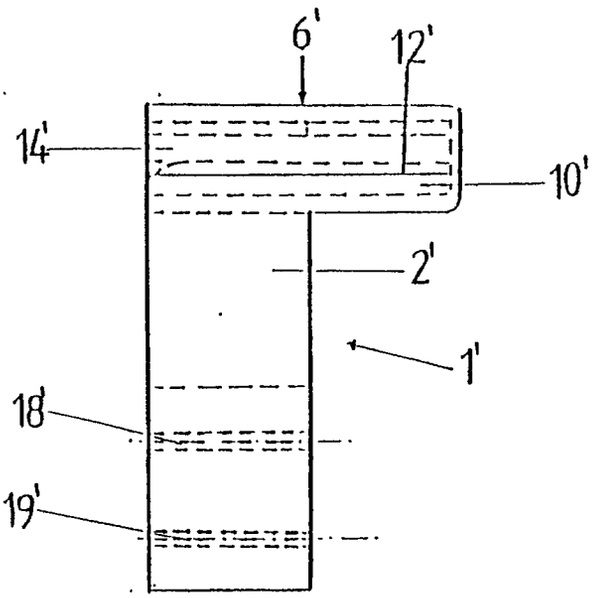
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FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 20 2998

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-U-8 804 759 (HARTMANN) * Figures 1,2; page 3, lines 8-12 *	1,3,4,9,11	A 47 C 23/06
Y		2	
A		5,10	
Y	EP-A-0 220 762 (SALENS) * Figures 1-5 *	2	
A		1	
A	DE-U-8 909 432 (MATRAFLEX) * Figures 1-3; claims *	1,3,4,5,9,11	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A 47 C

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	11 February 91	MYSLIWETZ W.P.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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A: technological background
O: non-written disclosure
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D: document cited in the application
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