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(54) **Enhanced backrest particularly for a sofa bed**

(57) There is described an enhanced backrest (20; 20a; 20b), particularly for a sofa-bed, comprising a movable upper terminal portion (22) and moving means (30; 30a; 30b) for said movable upper terminal portion (22) with respect to the backrest (20; 20a; 20b), able to bring

it from a first position, in which it is substantially aligned with the backrest (20; 20a; 20b), to a second position, in which it is substantially tilted backwards with respect to the backrest, and vice versa. There is further described a sofa-bed (10) provided with such a backrest (20; 20a; 20b),

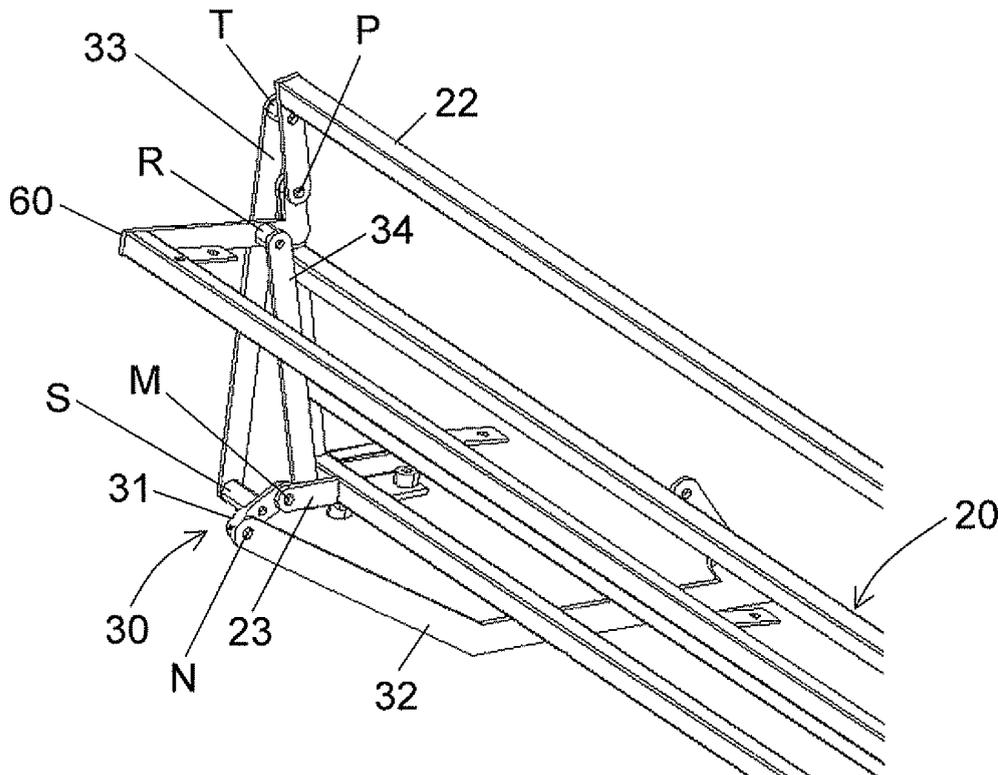


FIG. 4

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Description

[0001] The present invention refers to an enhanced backrest, particularly for a sofa-bed, and a sofa-bed equipped with such an enhanced backrest.

[0002] Sofa-beds that can be moved between a "sofa" configuration and a "bed" configuration by means of a suitable opening and closing mechanism are known to the art and widely available on the market.

[0003] A sofa-bed of the prior art generally comprises a substantially parallelepiped-shaped fixed structure, a backrest able to support a backrest cushion and a plurality of frames hinged to one another and connected to the fixed structure by means of an opening and closing mechanism, typically consisting of one or more levers.

[0004] Thanks to the presence of the opening and closing mechanism, the backrest and the frames are movable with respect to the fixed structure, preferably according to synchronized roto-translational movements, between a closed position, or "sofa" configuration of the sofa-bed and an open position or "bed" configuration of the sofa-bed.

[0005] In particular, in the "sofa" configuration, the frames are folded in an orderly manner one on top of the other on the fixed structure and a space to accommodate a mattress, also folded into a plurality of parts, is defined between the folded frames and the fixed structure. In the "bed" configuration, on the other hand, the frames are aligned consecutively with respect to one another, outside of the mattress accommodating space, so as to define a resting surface, whereas the backrest is preferably disposed beneath the resting surface.

[0006] WO 03/049579 A discloses a simplified mechanism sofa bed comprising a fixed structure that bears multiple frames hinged together, an extraction mechanism, a flip-back mechanism, and at least one synchronising mechanism between the extraction and flip-back mechanism movements. These mechanisms are connected therebetween such that the opening or closing action for forming the bed or sofa can be performed with a single operation by the user and, during the opening action, the cushions are positioned automatically under the sofa bed surface in close contact and pressed against each other.

[0007] Figures 1 and 2 show an example of a sofa-bed of the prior art, designated generally with reference numeral 1, in the "sofa" configuration and in the "bed" configuration, respectively.

[0008] As shown better in Figure 1, the backrest 2 supports a backrest cushion 3 and the frames include a seat 4 able to support a seat cushion 5. The backrest 2 is preferably mounted on an opening and closing mechanism of the sofa-bed and is equipped with a rear bracket 6, rigidly fixed thereto and serving as a cover for the opening and closing mechanism 7. The opening and closing mechanism 7 is able to move the backrest and the movable frames so as to allow the sofa-bed 1 to pass from a "sofa" configuration to a "bed" configuration, and vice

versa.

[0009] More in particular, when the sofa-bed 1 passes from the "sofa" configuration shown in Figure 1, to the "bed" configuration shown in Figure 2, the backrest 2 and the backrest cushions 3 and seat cushions 5 are set in rotation by the opening and closing mechanism 7 in the direction of the arrows F' and F" (Figure 1) and the sofa-bed 1 is brought into the "bed" configuration. In this configuration, the backrest cushions 3 and the seat cushions 5 are blocked between the backrest 2 and the seat 4, beneath the mattress 9.

[0010] However, the above-described sofa-bed of the prior art has the following drawbacks.

[0011] When the sofa-bed is in the "bed" configuration, the upper terminal portion of the backrest 2 exerts an excessive pressure against the backrest cushion 3, which is squashed between the backrest 2 and the seat cushion 5, with a consequent permanent deformation (Figure 2, circled area A).

[0012] Furthermore, again in the "bed" configuration, the compression exerted on the backrest cushion 3 by the seat cushion 5 could create slight sagging of the backrest 2, so that the rear bracket 6, which in the "bed" configuration skims the floor PA, could go as far as to touch said floor (Figure 2, circled area B).

[0013] Lastly, if the sofa-bed is left in the "bed" configuration for long periods, the compression between the backrest cushion 3 and the seat cushion 5 will leave marks on the material (fabric, leather etc.) of both and, in the worst cases, the cushions 3 and 5 could be permanently deformed (Figure 2, circled area C).

[0014] Object of the present invention is to overcome the above reported drawbacks, by providing an enhanced backrest, particularly for sofa-beds, provided with moving means able to prevent the upper terminal portion thereof from exerting excessive pressure against the seat cushion, damaging the fabric thereof and/or deforming it permanently.

[0015] Another object of the present invention is that of providing an enhanced backrest provided with moving means able to prevent the rear bracket from coming too near to the floor.

[0016] Not the last object of the present invention is to provide an enhanced backrest that can be produced and assembled at a competitive cost.

[0017] According to a first aspect, there is provided an enhanced backrest, particularly for sofa-bed, comprising a movable upper terminal portion and means for moving the movable upper terminal portion with respect to the backrest, able to bring it from a first position, in which it is substantially aligned with the backrest, to a second position in which it is substantially tilted backwards with respect to the backrest, and vice versa.

[0018] The backrest advantageously further comprises a movable rear bracket and means for moving the rear bracket with respect to the backrest, able to bring it from a first position, in which it acts as a cover for the opening and closing mechanism of the sofa-bed, and a second

position in which it is substantially parallel to the movable upper terminal portion of the backrest, and vice versa.

[0019] According to a further aspect of the invention, a sofa-bed is provided comprising a fixed structure, a plurality of frames hinged to one other, an opening and closing mechanism able to connect the frames to the fixed structure and a backrest, comprising a movable upper terminal portion and means for moving the movable upper portion with respect to the backrest, able to bring it from a first position, in which it is substantially aligned with the backrest, to a second position, in which it is tilted backwards with respect to the backrest, and vice versa.

[0020] Advantageous features of the invention are apparent from the dependent claims.

[0021] Further characteristics of the invention will be made clearer by the detailed description that follows, referring to purely exemplifying and therefore non-limiting embodiments thereof, illustrated in the appended drawings, wherein:

Figure 1 is a side view of a sofa-bed of the prior art in the "sofa" configuration;

Figure 2 shows the sofa-bed of Figure 1 in the "bed" configuration;

Figure 3 is a side view of an enhanced backrest according to a first embodiment of the present invention;

Figure 4 is a partial perspective rear view of the backrest of Figure 3;

Figures 5 to 8 are side views which show the movement of the backrest of Figure 3 from the first position to the second position;

Figures 9 to 12 are side views, which show the movement of a backrest according to another embodiment of the invention from the first position to the second position;

Figures 13 to 15 are side views, which show the movement of a backrest according to a third embodiment of the invention from the first position to the second position;

Figure 16 is a side view of a sofa-bed according to a preferred embodiment of the invention, in the "sofa" configuration; and

Figure 17 is a side view of the sofa-bed of Figure 16, in the "bed" configuration.

[0022] In the above listed drawings like or similar parts will be identified by the same reference numerals.

[0023] Figures 1 and 2 show a sofa bed 1 according to the prior art.

[0024] As previously described, the sofa-bed 1 comprises a substantially parallelepiped-shaped fixed structure 8, a backrest 2 able to support a backrest cushion 3 and a plurality of frames, among which a seat frame 4, able to support a seat cushion 5. The backrest 2 is rigidly constrained to an opening and closing mechanism 7 of the sofa-bed 1 and the frames are hinged to each other and connected to the fixed structure 8 by means of the

opening and closing mechanism 7.

[0025] The opening and closing mechanism 7 makes the backrest 2 and the frames movable with respect to the fixed structure 8 between the above described "sofa" configuration (Figure 1) and "bed" configuration (Figure 2).

[0026] With reference now to Figures 3 and 4, illustrated in detail therein is a backrest according to a preferred embodiment of the invention, indicated as a whole with reference numeral 20.

[0027] The backrest 20 comprises an upper terminal portion 22, which has a bottom end hinged to an upper end of the backrest 20 at a first articulation point P, preferably provided at each side of the backrest 20. The upper terminal portion 22 is, therefore, movable with respect to the backrest 20 from a first position, in which is substantially aligned with the backrest 20, and a second position in which it is substantially tilted backwards with respect to the backrest 20, and vice versa.

[0028] The backrest 20 preferably has a rear bracket 60, also hinged at the first articulation point P. The rear bracket 60 is therefore movable with respect to the backrest 20 from a first position, in which it acts as a cover for the opening and closing mechanism 7 of a sofa-bed, to a second position, in which it is substantially parallel to the movable upper terminal portion 22, and vice versa.

[0029] The movable rear bracket 60 is preferably L-shaped. However, this does not rule out that it may have a linear shape or be otherwise shaped.

[0030] A plate-like element 23 extends from the end of the backrest 20 opposite that of articulation with the movable upper terminal portion 22 and with the movable rear bracket 60. The plate-like element 23 carries moving means 30 for the movable parts of the backrest 20.

[0031] The moving means 30 preferably comprise at least one lever system, including a first lever 31 articulated to the backrest 20, a second lever 32 articulated between the first lever and the sofa-bed, and a third lever 33 articulated between the first lever 31 and the movable upper terminal portion 22 of the backrest 20.

[0032] In the embodiments illustrated and described, the moving means preferably comprise a pair of lever systems, each connected between the backrest at the sides.

[0033] Each lever system of the pair of lever systems has a similar structure and operation; therefore, in the drawings and in the description that follows, reference will be made to only one of said lever systems, it being understood that what is said with reference thereto, applies likewise to the other.

[0034] Naturally, instead of a pair of lever systems, provided at the sides of the backrest, it is possible to have a single lever system mounted on the backrest at one of its sides, or in a rear centre position.

[0035] The first lever 31 is preferably shaped like an upside-down V, the second lever 32 has at least two bends and the third lever 33 is straight. In particular, the shape of the second lever 32 depends upon the specific

size requirements associated with assembly of the backrest 20 on the opening and closing mechanism 7 of the sofa-bed. This, however, does not rule out that for other applications of the backrest, the second lever 32 may be linear or otherwise shaped.

[0036] More in particular, the first lever 31 is hinged, preferably at its vertex, to the free end of the plate-like element 23 of the backrest 20 at a second articulation point M; the second lever 32 has an end hinged to a first end of the first lever 31 at a third articulation point N and the other end able to be hinged to a sofa-bed at an eighth articulation point (O, Figure 5); and the third lever 33 has an end hinged to the first lever 31 at a fourth articulation point S situated between the second articulation point M and the third articulation point N and the other end hinged to the movable upper terminal portion 22 of the backrest 20 at a fifth articulation point T, suitably spaced from the first articulation point P.

[0037] The lever system 30 preferably further comprises a fourth lever 34 articulated between the first lever 31 and the movable rear bracket 60 of the backrest 20. In particular, the fourth lever 34 has one end hinged to a second end of the first lever 31 at a sixth articulation point Q and the other end hinged to the movable rear bracket 60 at a seventh articulation point R.

[0038] Figures 5 to 8 show the backrest 20 in the position of use, for example on a sofa-bed, and the movement thereof from the first position to the second position.

[0039] The backrest 20 is preferably fixed with known fixing means, for example screws, to the opening and closing mechanism 7 of the sofa-bed and the movement means 30 of the movable parts 22 and 60 of the backrest 20 are mounted on the sofa-bed by hinging the free end of the second lever 32 to one of the frames of the sofa-bed, preferably to the seat frame 4, at the eighth articulation point O. The opening and closing mechanism 7 is preferably also hinged to the seat frame 4 at a ninth articulation point L.

[0040] In this configuration, when the sofa-bed passes from the "sofa" configuration to the "bed" configuration, both the backrest 20 and the movement means 30 of its movable parts 22 and 60 rotate synchronously with the opening and closing mechanism 7. The opening and closing mechanism 7 is of the known type, so it will not be further described in detail herein.

[0041] For reasons of clarity, in the description that follows, the backrest 20 and the lever system 30 will be broken down into a first, second and third assembly unit.

[0042] The first assembly unit, illustrated in Figure 5, preferably comprises the backrest 20 and the plate-like element 23, the first and second lever 31 and 32, respectively, of the lever system 30, and the opening and closing mechanism 7 and the seat frame 4 of the sofa-bed.

[0043] The first assembly unit clearly shows how rotation of the opening and closing mechanism 7 of the sofa-bed controls rotation of the first lever 31 of the lever system 30.

[0044] The components of the first assembly unit are

articulated with each other at the four articulation points L, M, N, O, which form a first quadrilateral LMNO, indicated with dashed lines in Figure 5.

[0045] In particular, L is the articulation point between the opening and closing mechanism 7 and the seat frame 4; M is the articulation point between the plate-like element 23 and the first lever 31; N is the articulation point between the first lever 31 and the second lever 32; and O is the articulation point between the seat frame 4 and the second lever 32.

[0046] The segments LM, MN, NO and OP connecting the articulation points L, M, N, O schematize rigid bodies, and therefore maintain their length unchanged during movement of the backrest 20.

[0047] In particular, segment LM schematizes the connection between a plurality of bodies, precisely the opening and closing mechanism 7, the backrest 20 and the plate-like element 23, rigidly constrained to each other; segment MN corresponds to part of the first lever 31; segment NO corresponds to the distance between the articulation points of the second lever 32 with the first lever 31 and the seat frame 4, respectively; and segment LO corresponds to the distance between the articulation points of the seat frame 4 with the opening and closing mechanism 7 and the second lever 32, respectively.

[0048] Movement of the first lever 31 will now be analyzed with reference to the first assembly unit defined above. For the moment the movement of the movable upper terminal portion 22 and of the movable rear bracket 60 of the backrest 20 will be left aside and will be analyzed in detail with reference to figures 6 and 7.

[0049] As shown by the arrows drawn in Figure 5, the opening and closing mechanism 7 controls counter-clockwise rotation of the backrest 20 around the ninth articulation point L (arrow F'). Associated with the counter-clockwise rotation of the backrest 20 is a counter-clockwise rotation of segments LM and NO of the first quadrilateral LMNO around the ninth articulation point L (arrows F₃, F₄), and thus a clockwise rotation of the first lever 31 around the second articulation point M (arrow F₅).

[0050] The second assembly unit, illustrated in Figure 6, preferably comprises the backrest 20, the movable upper terminal portion 22 and the plate-like element 23, the seat frame 4 of the sofa-bed and the first and third levers, 31 and 33, respectively, of the lever system 30.

[0051] The above second assembly unit clearly shows how rotation of the first lever 31 of the lever system 30 controls rotation of the movable upper terminal portion 22 of the backrest 20.

[0052] The components of the second assembly unit are articulated with each other at the four articulation points M, S, T, P, which form a second quadrilateral MSTP, indicated with dashed lines in Figure 6.

[0053] In particular, M is the point of articulation between the first lever 31 and the plate-like element 23; S is the point of articulation between the first lever 31 and the third lever 33; T is the point of articulation between

the third lever 33 and the movable upper terminal portion 22; and P is the point of articulation between the backrest 20 and its movable upper terminal portion 22.

[0054] The segments MS, ST, TP and PM connecting the articulation points M, S, T, P schematize rigid bodies, and therefore maintain their length unchanged during movement of the backrest.

[0055] In particular, segment MS corresponds to part of the first lever 31; segment ST corresponds to the third lever 33, which serves to transfer the rotational movement of the first lever 31 around the second articulation point M to the movable upper terminal portion 22 of the backrest 20; segment TP corresponds to the distance between the points of articulation of the movable upper terminal portion 22, with the third lever 33 and the backrest 20, respectively; and segment PM schematizes the rigid connection between the backrest 20 and the plate-like element 23.

[0056] Starting from the movement of the first lever 31, described with reference to Figure 5, the movement of the movable upper terminal portion 22 of the backrest 20 will now be described. The movement of the movable rear bracket 60 will be left aside for the moment and described in detail with reference to Figure 7.

[0057] As shown by the arrows in Figure 6, associated with the clockwise rotation of the first lever 31 around the second articulation point M (arrow F₅) is a clockwise rotation of the fourth articulation point S with respect to the second articulation point M (arrow F₆) and of the fifth articulation point T with respect to the first articulation point P (arrow F₇), with a consequent roto-translational movement of the third lever 33. Lastly, associated with the roto-translation of the third lever 33, and in particular with the rotation of the fifth articulation point T with respect to the first articulation point P, is the clockwise rotation of the movable upper terminal portion 22 of the backrest 20 around the first articulation point P (arrow F₈).

[0058] The third assembly unit, illustrated in Figure 7, preferably comprises the backrest 20, the movable rear bracket 60 and the plate-like element 23 and the first and fourth lever, 31 and 34, respectively, of the lever system 30.

[0059] The third assembly unit clearly shows how rotation of the first lever 31 of the lever system 30 controls rotation of the movable rear bracket 60 of the backrest 20.

[0060] The components of the third assembly unit are articulated to each other at the four articulation points M, Q, R, P, which form a third quadrilateral MQRP, indicated with dashed lines in Figure 7.

[0061] In particular, M is the point of articulation between the first lever 31 and the plate-like element 23; Q is the point of articulation between the first lever 31 and the fourth lever 34; R is the point of articulation between the movable rear bracket 60 and the fourth lever 34; and P is the point of articulation between the movable rear bracket 60 and the backrest 20.

[0062] In this case also, the segments MQ, QR, RP and PM schematize rigid bodies and therefore maintain

their lengths unchanged during the movement of the backrest 20. In particular, the segment MQ corresponds to part of the first lever 31; the segment QR corresponds to the fourth lever 34, which has the function of transferring the rotary movement of the first lever 31 around the second articulation point M to the movable rear bracket 60 of the backrest 20; the segment RP corresponds to the distance between the points of articulation of the movable rear bracket 60 with the fourth lever 34 and the backrest 20, respectively; and the segment PM schematizes the rigid connection between the backrest 20 and the plate-like element 23.

[0063] Starting from the movement of the first lever 31, described with reference to Figure 5, the movement of the movable rear bracket 60 of the backrest 20 will now be described.

[0064] As shown by the arrows indicated in Figure 7, associated with the clockwise rotation of the first lever 31 around the second articulation point M (arrow F₅, Figure 5) is a clockwise rotation of the sixth articulation point Q with respect to the second articulation point M (arrow F₉) and a counter-clockwise rotation of the seventh articulation point R with respect to the first articulation point P (arrow F₁₀), with a consequent roto-translation of the fourth lever 34. Lastly, associated with the roto-translational movement of the fourth lever 34, and in particular with the counter-clockwise rotation of the seventh articulation point R with respect to the first articulation point P, is a counter-clockwise rotation of the movable rear bracket 60 around the first articulation point P (arrow F₁₁).

[0065] Therefore, putting together the three assembly units described singly with reference to Figures 5 to 7, when the backrest 20 passes from the first position to the second position (arrow F', Figure 5), the first lever 31 of the lever system 30 is set in clockwise rotation with respect to the second articulation point M (arrow F₅, Figure 5). The clockwise rotation of the first lever 31 controls the roto-translation of the third lever 33 (arrows F₆ and F₇, Figure 6) and the roto-translation of the fourth lever 34 (arrows F₉ and F₁₀, Figure 7). Lastly, associated with the roto-translation of the third lever 33 is the clockwise rotation of the movable upper terminal portion 22 of the backrest 20 around the first articulation point P (arrow F₈, Figure 6), whereas associated with the roto-translation of the fourth lever 34 is the counter-clockwise rotation of the movable rear bracket 60 of the backrest 20 around the first articulation point P (arrow F₁₁, Figure 7).

[0066] Figure 8 shows the backrest 20 and its movable portions 22 and 60, in the second position. As shown, in this second position, the movable upper terminal portion 22 is substantially tilted backwards with respect to the backrest 20 and the movable rear bracket 60 is substantially parallel to the movable upper terminal portion 22.

[0067] More in particular, when the backrest 20 has made its complete rotation (about 120°) with respect to the seat frame 4, the movable upper terminal portion 22 and the movable rear bracket 60 are rotated backwards with respect to the backrest 20 by about 25°.

[0068] Figures 9 to 12 show a second embodiment of the enhanced backrest of the invention, designated generally with reference numeral 20a.

[0069] The backrest 20a has a lever system 30a, which differs from that illustrated and described with reference to Figures 3 to 8 in that the first lever, indicated with reference numeral 31a, during use has its vertex pointing downwards. This leads to a shift of the articulation points between the various components of the lever system 30a. Furthermore, the second lever, indicated with reference numeral 32a, instead of being shaped, is preferably straight.

[0070] In this case also, the backrest 20a and the lever system 30a have been broken down into three assembly units.

[0071] The first assembly unit, shown in Figure 9, substantially corresponds to the first assembly unit of Figure 5. The difference consists in having shifted the third articulation point N between the first lever 31a and the second lever 32a from the right to the left of the second articulation point M between the first lever 31a and the plate-like element 23 of the backrest 20a.

[0072] As shown by the arrows in Figure 9, associated with a counter-clockwise rotation of the backrest (arrow F'), there is again a counter-clockwise rotation of the segments LM and LO of the first quadrilateral LMNO around the ninth point of articulation L (arrows F₃, F₄). This counter-clockwise rotation this time causes a counter-clockwise rotation of the first lever 31a around the second articulation point M (arrow F₅').

[0073] It follows that, after the shift of the third articulation point N, the rotation of the first lever 31a has been transformed from clockwise to counter-clockwise.

[0074] The second assembly unit, shown in Figure 10, substantially corresponds to the second assembly unit of Figure 6. The difference consists in having moved the fourth articulation point S between the first lever 31a and the third lever 33a from the right to the left of the second articulation point M between the first lever 31a and the plate-like element 23 of the backrest 20a.

[0075] As shown by the arrows in Figure 10, associated with the counter-clockwise rotation of the first lever 31a around the second articulation point M (arrow F₅') is a counter-clockwise rotation of the fourth articulation point S with respect to the second articulation point M (arrow F₆') and a clockwise rotation of the fifth articulation point T with respect to the first articulation point P (arrow F₇), with a consequent roto-translational movement of the fourth lever 33a. Associated with the roto-translation of the third lever 33a, and in particular with the clockwise rotation of the fifth articulation point T with respect to the first articulation point P, is the clockwise rotation of the movable upper terminal portion 22 around the first articulation point P (arrow F₈).

[0076] It follows that, after the shift in the fourth articulation point S, the direction of rotation of the fourth articulation point S with respect to the second articulation point M has changed from clockwise (arrow F₆, Figure

6) to counter-clockwise (arrow F₆', Figure 10), whereas the direction of rotation of the fifth articulation point T with respect to the first articulation point P has remained unchanged, that is, clockwise (arrow F₇, Figures 6 and 10).

As a result the movable upper terminal portion 22 of the backrest 20a continues to rotate clockwise around the first articulation point P.

[0077] Lastly, the third assembly unit, shown in Figure 11, substantially corresponds to the third assembly unit of Figure 7. The difference consists in having moved the sixth articulation point Q between the first lever 31a and the fourth lever 34a from the left to the right of the second articulation point M between the first lever 31a and the plate-shaped element 23 of the backrest 20a.

As shown by the arrows in Figure 11, associated with the counter-clockwise rotation of the first lever 31a around the second articulation point M (arrow F₅', Figure 5) is a counter-clockwise rotation of the sixth articulation point Q with respect to the second articulation point M (arrow F₉') and of the seventh articulation point R with respect to the first articulation point P (arrow F₁₀), with a consequent roto-translational movement of the fourth lever 34a. Associated with the roto-translation of the fourth lever 34a, and in particular with the counter-clockwise rotation of the seventh articulation point R with respect to the first articulation point P, is the counter-clockwise rotation of the movable rear bracket 60 around the first articulation point P (arrow F₁₁).

It follows that, after the shift of the sixth articulation point Q, the direction of rotation of the sixth articulation point Q with respect to the second articulation point M has changed from clockwise (arrow F₉, Figure 7) to counter-clockwise (arrow F₉', Figure 11), whereas the direction of rotation of the seventh articulation point R with respect to the first articulation point P is unchanged, that is, counter-clockwise (arrow F₁₀, Figures 7 and 11). As a result the movable rear bracket 60 of the backrest 20a continues to rotate counter-clockwise around the first articulation point P.

Therefore, putting together the three assembly units described individually with reference to Figures 9 to 11, it emerges that when the backrest 20a passes from the first position to the second position (arrow F', Figure 9), the first lever 31a of the lever system 30a is set in counter-clockwise rotation with respect to the second articulation point M (arrow F₅', Figure 5). The counter-clockwise rotation of the first lever 31a controls the roto-translation of the third lever 33a (arrows F₆' and F₇, Figure 10) and the roto-translation of the fourth lever 34a (arrows F₉' and F₁₀, Figure 11). Lastly, associated with the roto-translation of the third lever 33a is the clockwise rotation of the movable upper terminal portion 22 around the first articulation point P (arrow F₈, Figure 10), whereas associated with the roto-translation of the fourth lever 34a is the counter-clockwise rotation of the movable rear bracket 60 around the first articulation point P (arrow F₁₁, Figure 11).

[0081] Figure 12 shows the backrest 20a and its mov-

able portions 22 and 60, in the second position.

[0082] As can be seen, when the backrest 20a has made its complete rotation (about 120°) with respect to the seat frame 4, the movable upper terminal portion 22 and the movable rear bracket 60 are once again rotated backwards by about 25° with respect to the backrest 20a.

[0083] In the following part of the present description, and with reference to the two embodiments previously described, the relationship between the dimensions of the levers 31, 31a, 32, 32a, 33, 33a e 34, 34a of the lever systems 30 and 30a and the entity of the rotation of the movable upper terminal portion 22 and of the movable rear bracket 60 of the backrest 20, 20a will be described.

[0084] With reference to Figures 5 and 11, let us consider the first quadrilateral LMNO.

[0085] Starting from segment LO, the greater is its length, the greater the rotation of the third articulation point N with respect to the second articulation point M will be. Vice versa, as the length of the segment MN increases, its rotation around the second articulation point M will decrease. The length of the segment ML depends upon the chosen distance between the ninth articulation point L of articulation of the backrest 20, 20a with respect to the seat frame 4 of the sofa-bed and the second articulation point M of the lever system 30, 30a with respect to the backrest 20, 20a. Again, the length of the segment ON will be dictated by the lengths chosen for the segments OL and MN.

[0086] It follows that the sizing constraints to be observed for the first quadrilateral LMNO are given by the following relationship:

$$OM < MN + NO$$

[0087] Furthermore, during rotation of the backrest 20, 20a, the articulation points M, N, and O must never be aligned with each other.

[0088] With reference to Figures 6 and 12, let us consider the second quadrilateral MSTP.

[0089] The length of the segment PM depends upon the chosen distance between the first articulation point P of the movable upper terminal portion 22 with respect to the backrest 20, 20a and the second articulation point M between the backrest 20, 20a and the lever system 30, 30a.

[0090] As MS increases, the rotation of the segment PT with respect to the first articulation point P, and thus the rotation of the movable upper terminal portion 22 with respect to said point P, will increase. Vice versa, as PT increases, the rotation of the movable upper terminal portion 22 with respect to the backrest 20, 20a will decrease. After having fixed the articulation points T and S, the segment TS will be derived accordingly.

[0091] It follows that the sizing constraints to be observed for the second quadrilateral MSTP are such that, during rotation of the backrest 20, 20a, the articulation

points M, S and T and the articulation points S, T and P are never aligned with each other.

[0092] Lastly, with reference to Figures 7 and 11, let us consider the third quadrilateral MPRQ.

[0093] The length of the segment PM depends upon the distance between the first articulation point P of the movable rear bracket 60 with respect to the backrest 20, 20a and the second articulation point M between the backrest 20, 20a and the lever system 30, 30a. As MQ increases, the rotation of the segment PR with respect to the first articulation point P, and thus the rotation of the movable rear bracket 6 with respect thereto will increase. Vice versa, as PR increases the rotation of the movable rear bracket 60 with respect to the backrest 20, 20a will decrease. Once the articulation points Q and P have been fixed, the segment PQ will be derived accordingly.

[0094] Therefore, the sizing constraints to be observed for the third quadrilateral MPRQ are such that, during rotation of the backrest 20, 20a, the articulation points M, Q and R and the articulation points P, R and Q are never aligned with each other.

[0095] Figures 13 to 15 illustrate a third preferred embodiment of a backrest according to the invention, indicated generally with reference numeral 20b.

[0096] As indicated in detail in Figure 15, the moving means preferably comprise a lever system 30b, which differs from the lever systems 30 and 30a described previously in that it includes a fifth lever 35b and a sixth lever 36b and in that the third lever 33 and 33a of the lever systems 30 and 30a has been replaced by a seventh lever 37b.

[0097] The fifth lever 35b, for example V-shaped, is preferably carried by a further plate-like element 24, rigidly connected to the backrest 20b and aligned with the plate-like element 23, and suitably spaced therefrom.

[0098] More in detail, the fifth lever 35b is hinged, preferably at its vertex, to the free end of the plate-like element 24 at a tenth articulation point V; the sixth lever 36b has one end hinged to a first end of the fifth lever 35b at an eleventh articulation point U and the other end hinged to the movable rear bracket 60 of the backrest 20b at the seventh articulation point R; and the seventh lever 37b has one end articulated to a second end of the fifth lever 35b at a twelfth articulation point Z and the other end hinged to the movable upper terminal portion 22 of the backrest 20b at the fifth articulation point T. Movements of the first lever 31 and of the movable rear bracket 60 are the same as those previously described with reference to Figures 5 and 7. In particular, associated with the clockwise rotation of the first lever 31 around the second articulation point M is a roto-translation of the fourth lever 34 and a corresponding counter-clockwise rotation of the movable rear bracket 60 around the first articulation point P.

[0099] In Figures 13 e 14, respectively, the movement of the movable upper terminal portion 22 and of the backrest 20b, which in this case is controlled by the movement

of the movable rear bracket 60, will therefore be illustrated.

[0100] As shown in Figure 13, counter-clockwise rotation of the movable rear bracket 60 around the first articulation point P causes a counter-clockwise rotation of the seventh articulation point R with respect to the first articulation point P (arrow F_{12} , Figure 13) and a consequent counter-clockwise rotation of the eleventh articulation point U with respect to the tenth articulation point V (arrow F_{13} , Figure 13). It follows that the fifth lever 35b rotates counter-clockwise around the tenth articulation point V.

[0101] As shown in Figure 14, the counter-clockwise rotation of the fifth lever 35b around the tenth articulation point V causes a counter clockwise rotation of the twelfth articulation point Z with respect to the tenth articulation point V (arrow F_{14} , Figure 14) and a clockwise rotation of the fifth articulation point T with respect to the first articulation point P, with a consequent roto-translational movement of the seventh lever 37b. Once again, there corresponds to the roto-translation of the seventh lever 37b, and in particular to the rotation of the fifth articulation point T with respect to the first articulation point P, a clockwise rotation of the movable upper terminal portion 22 with respect to the first articulation point P.

[0102] In this case also, as illustrated in Figure 15, when the backrest 20b has made its entire rotation (about 120°) with respect to the seat frame 4, the movable terminal portion 22 and the movable rear bracket 60 are rotated backward by about 25° with respect to the backrest 20b.

[0103] Figures 16 and 17 show a sofa-bed according to the invention, indicated generally with reference numeral 10, in the "sofa" configuration and in the "bed" configuration, respectively.

[0104] The sofa-bed 10 has a similar structure to that of a traditional sofa-bed, described previously with reference to Figures 1 and 2, in which, however, the traditional backrest 2 has been replaced by the enhanced backrest 20 according to the invention.

[0105] As shown in Figures 16 and 17, when the backrest 20 is set in rotation counter-clockwise (arrow F') by the opening and closing mechanism 7 to bring the sofa-bed 10 from the "sofa" configuration to the "bed" configuration, the lever system 30, operation of which is controlled by the opening and closing mechanism 7, advantageously allows the movable upper terminal portion 22 of the backrest 20 to be made to rotate around its articulation point P (arrow F_8) between a first position, in which it is substantially aligned with the backrest 20, and a second position, in which it is substantially tilted backwards with respect to the backrest 20, for example by an angle of about 25° .

[0106] The rotation of the movable upper terminal portion 22 with respect to the backrest 20 advantageously considerably reduces the compression it exerts on the backrest cushion 3. It follows that the backrest cushion 3, no longer being squashed between the backrest 20 and the seat cushion 5, is not permanently deformed, for

example in the event of the sofa-bed 10 being left in the "bed" configuration for long periods.

[0107] Furthermore, the lever system 30 advantageously allows the movable rear bracket 60 of the backrest 20 to be made to rotate around its articulation point P (arrow F_{11}) from a first position, in which it acts as a cover for the opening and closing mechanism of the sofa-bed, and a second position, in which it is substantially parallel to the movable upper terminal portion 22. Therefore, the movable rear bracket 60 is also tilted backwards with respect to the backrest 20 by an angle of about 25° .

[0108] The rotation of the movable rear bracket 60 advantageously prevents the bracket from touching the floor PA, for example following slight sagging of the backrest 20, caused by the compression exerted by the seat cushion 5 on the backrest cushion 3 in the "bed" configuration of the sofa-bed 10.

[0109] Numerous modifications and variations of detail within the reach of a person skilled in the art can be made to the present embodiment of the invention without thereby departing from the scope of the invention as set forth in the appended claims.

[0110] For example, although in the embodiments illustrated and described the movable upper terminal portion 22 and the movable rear bracket 60 are hinged to the backrest 20 at a common articulation point P, there is nothing to prevent the movable terminal portion 22 and the movable rear bracket 60 from being hinged to the backrest at separate articulation points. Furthermore, although reference has always been made in the present description to the movement of the backrest such as to bring said backrest from the first position to the second position, it is understood that the same continues to apply, with inverted movements, in the event of the backrest being moved from the second position to the first position, corresponding to the passage of the sofa-bed from the "bed" configuration to the "sofa" configuration.

40 Claims

1. Enhanced backrest (20; 20a; 20b), particularly for sofa-bed, **characterized in that** it comprises a movable upper terminal portion (22) and means (30; 30a; 30b) for moving said movable upper terminal portion (22) with respect to the backrest (20; 20a; 20b) from a first position, wherein it results substantially aligned with the backrest (20; 20a; 20b) to a second position, wherein it results substantially backward tilted with respect to the backrest (20; 20a; 20b), and vice versa.
2. Backrest (20; 20a; 20b) according to claim 1, **characterized in that** said movable upper terminal portion (22) is hinged to said backrest (20; 20a; 20b) in a first articulation point (P) provided at each side of the backrest (20; 20a; 20b).

3. Backrest (20; 20a; 20b) according to claim 1 or 2, **characterized in that** said means for moving said movable upper terminal portion (22) comprise at least one lever system (30; 30a; 30b).
4. Backrest (20; 20a; 20b) according to any one of the preceding claims, **characterized in that** it further comprises a rear bracket (60) hinged to the backrest (20; 20a; 20b) in the first articulation point (P) provided at each side of the backrest (20; 20a; 20b) and movable by said moving means (30; 30a; 30b) with respect to said backrest (20; 20a; 20b) from a first position, wherein it is suitable for acting as a cover for an opening and closing mechanism of the sofa-bed, to a second position, wherein it results substantially parallel to said movable upper terminal portion (22) of the backrest (20; 20a; 20b), and vice versa.
5. Backrest (20; 20a; 20b) according to claim 3 or 4, **characterized in that** said at least one lever system (30; 30a) comprises a first lever (31; 31a) articulated to said backrest (20; 20a; 20b) and a second lever (32; 32a) articulated between said first lever (31; 31a) and the sofa-bed.
6. Backrest (20; 20a; 20b) according to claim 5, **characterized in that** said first lever (31; 31a) is hinged to the backrest (20; 20a; 20b) in a second articulation point (M); and said second lever (32; 32a) has an end hinged to a first end of the first lever (31; 31a) in a third articulation point (N) and the other end suitable for being hinged to the sofa-bed in a eighth articulation point (O).
7. Backrest (20; 20a) according to claim 5 or 6, **characterized in that** said at least one lever system (30; 30a) further comprises a third lever (33; 33a) having an end hinged to the first lever (31; 31a) in a fourth articulation point (S) placed between the second articulation point (M) and the third articulation point (N) and the other end hinged to the movable upper terminal portion (22) of the backrest (20; 20a) in a fifth articulation point (T) suitably spaced from the first articulation point (P).
8. Backrest (20; 20a; 20b) according to any one of claims 3 to 7, **characterized in that** said at least one lever system (30; 30a; 30b) further comprises a fourth lever (34; 34a) articulated to said first lever (31; 31a) in a sixth articulation point (Q) and to said movable rear bracket (60) in a seventh articulation point (R).
9. Backrest (20b) according to claim 8 when depending on any one of the claims 3 to 6, **characterized in that** said at least one lever system (30b) further comprises a fifth lever (35b) articulated to said backrest (20b); a sixth lever (36b) articulated between said fifth lever (35b) and said movable rear bracket (60); and a seventh lever (37b) articulated between said fifth lever (35b) and said movable upper terminal portion (22) of the backrest (20b).
10. Backrest (20b) according to claim 9, **characterized in that** said fifth lever (35b) is hinged to the backrest (20b) in a tenth articulation point (V); said sixth lever (36b) has an end hinged to a first end of the fifth lever (35b) in an eleventh articulation point (U) and the other end hinged to the movable rear bracket (60) of the backrest (20b) in a seventh articulation point (R); and said seventh lever (37b) has an end hinged to a second end of the fifth lever (35b) in a twelfth articulation point (Z) and the other end hinged to the movable upper terminal portion (22) of the backrest (20b) in a fifth articulation point (T).
11. Backrest (20; 20a; 20b) according to any one of the preceding claims, **characterized in that**, passing from the respective first position to the second position thereof, said movable upper terminal portion (22) rotates in a clockwise direction and said movable rear bracket (60) rotates in a counter-clockwise direction, thereby resulting, in the second position, backward tilted of an angle of about 25° with respect to the backrest (20; 20a; 20b).
12. Backrest (20; 20a; 20b) according to any one of the preceding claims, **characterized in that** the distances (OM, MN, NO) between said second, third and eighth articulation points (M, N, O) are such that:
- $$OM < MN + NO$$
13. Backrest (20; 20a; 20b) according to any one of the preceding claims, **characterized in that** said second, third and eighth articulation points (M, N, O), said second, fourth and fifth articulation points (M, S, T), and said fourth, fifth and first articulation points (S, T, P) are never aligned each other.
14. Sofa-bed (10) comprising a fixed structure (8), a plurality of frames hinged each other, and an opening and closing mechanism (7) suitable for connecting said plurality of frames to said fixed structure (8), **characterized in that** it comprises a backrest (20; 20a; 20b) according to any one of the claims 1 to 13.
15. Sofa-bed (10) according to claim 14, **characterized in that** said moving means (30; 30a; 30b) and said opening and closing mechanism (7) are articulated to a seat frame (4) of said plurality of frames of the sofa-bed (10; 10a) in an eighth articulation point (O) and a ninth articulation point (L), respectively.

16. Sofa-bed (10; 10a) according to claim 14 or 15, **characterized in that** said moving means (30; 30a; 30b) are movable in synchronism with said opening and closing mechanism (7).

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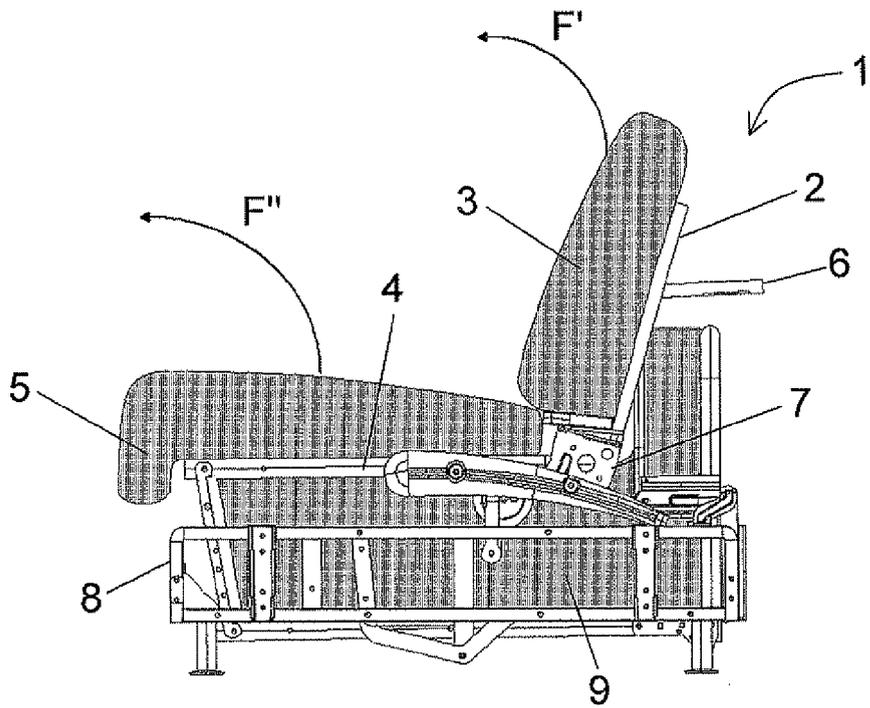


FIG. 1 (Prior Art)

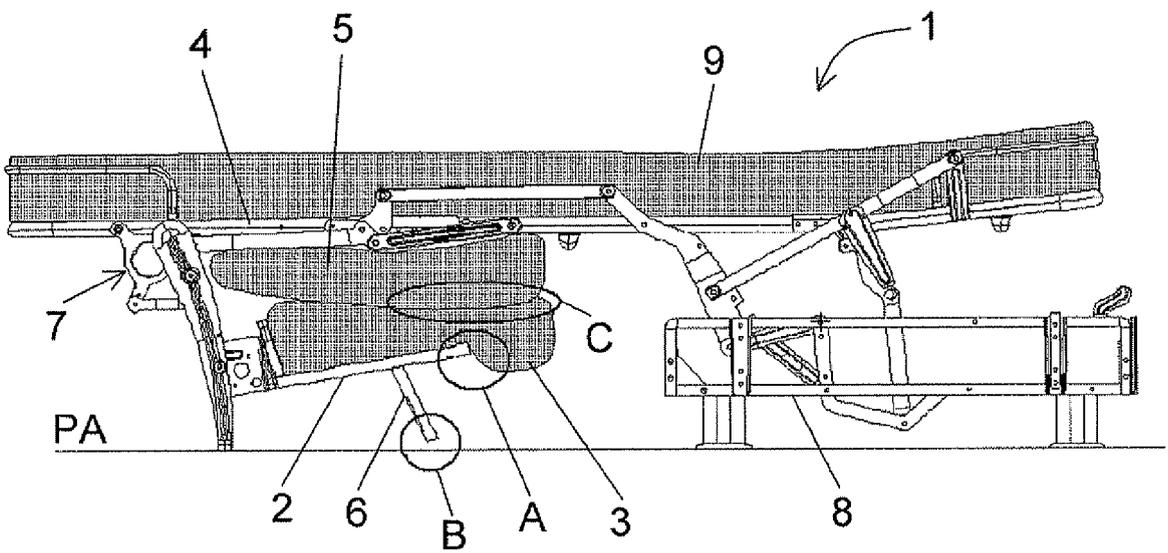
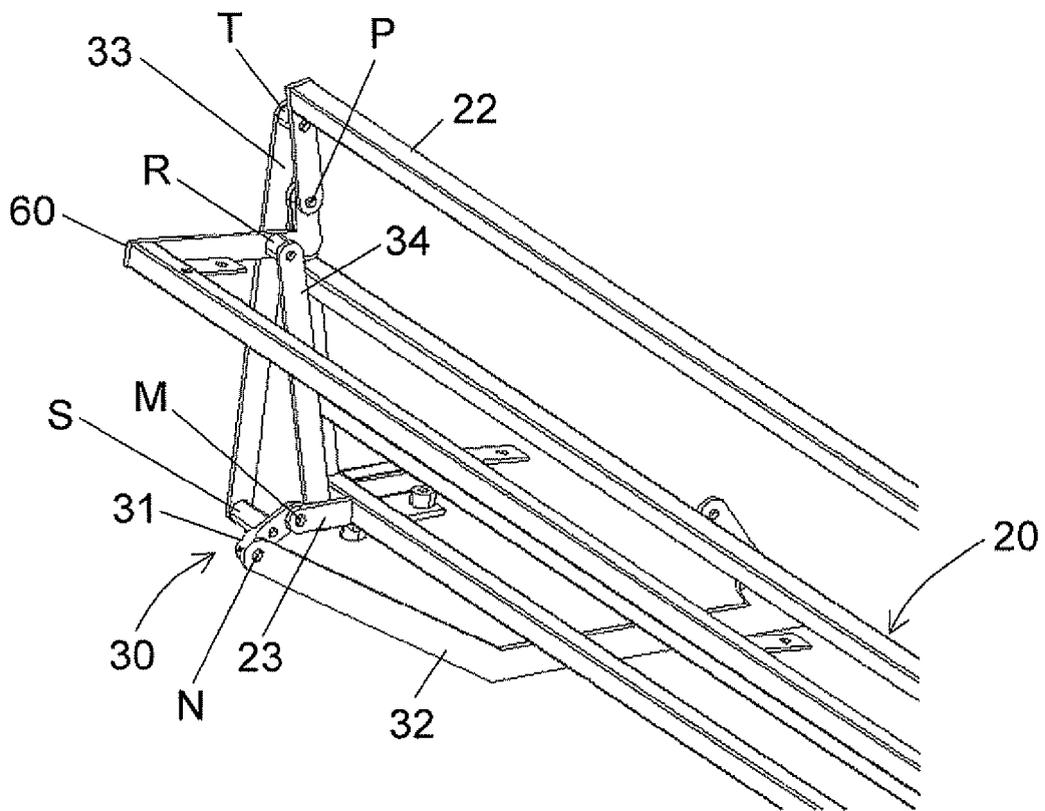
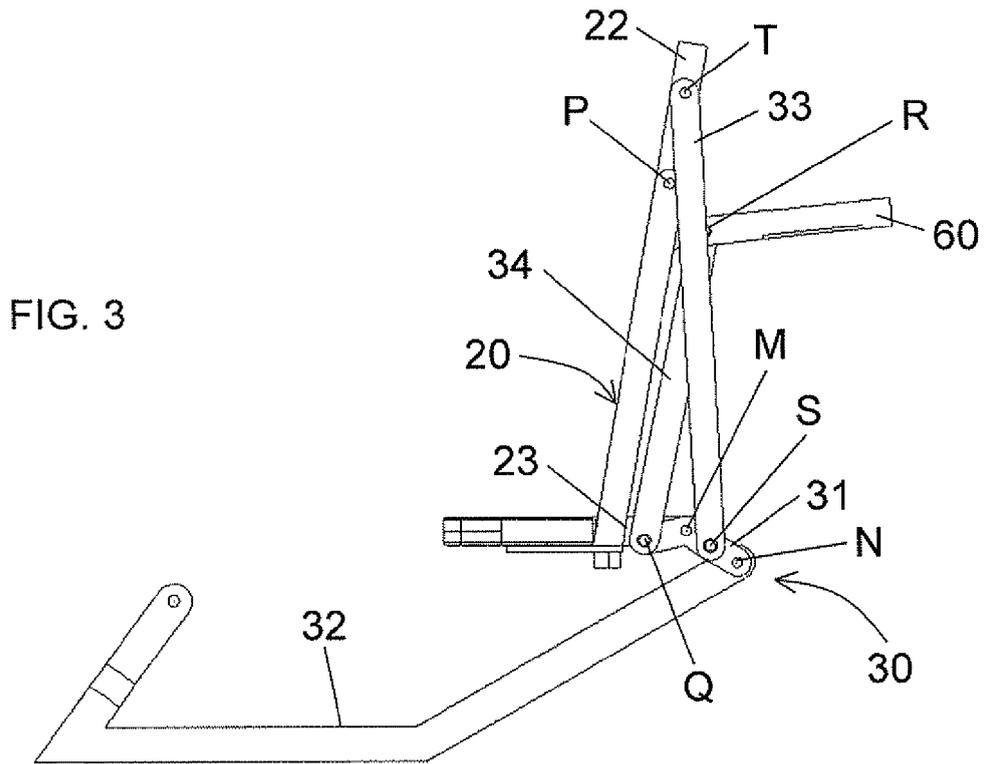


FIG. 2 (Prior Art)



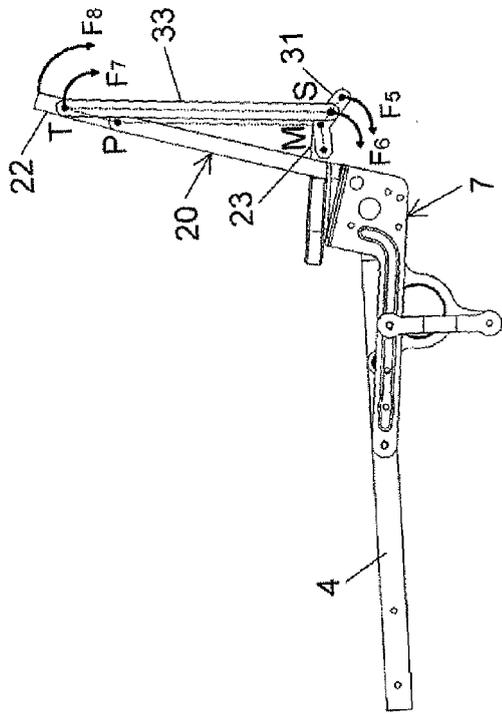


FIG. 6

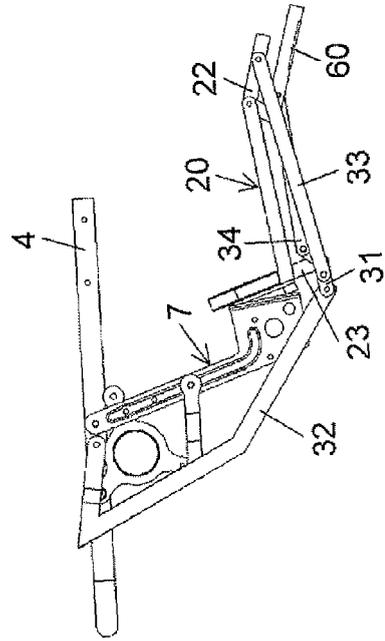


FIG. 8

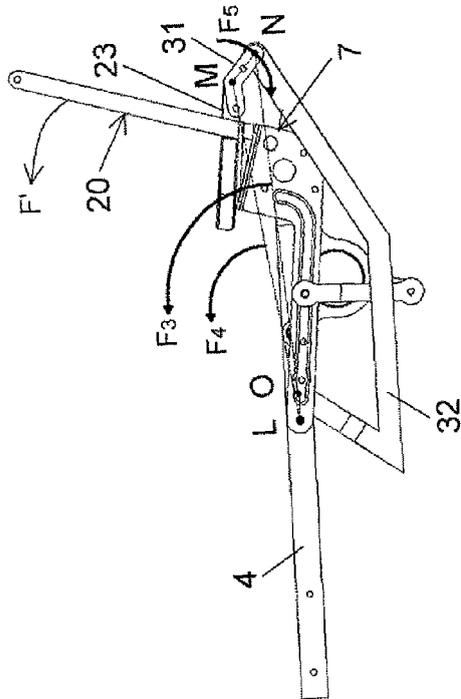


FIG. 5

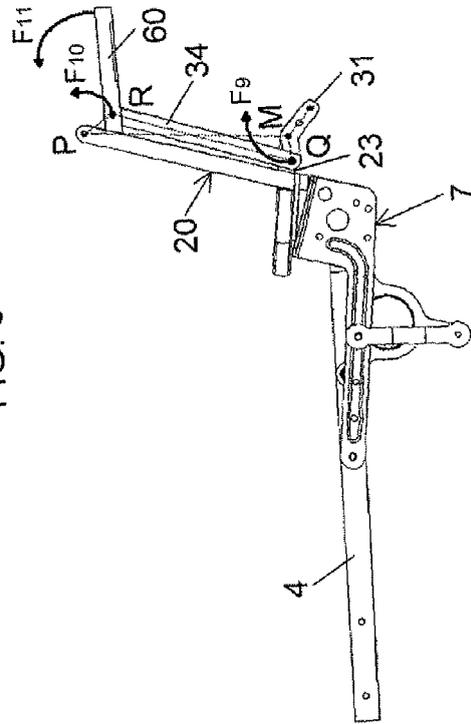


FIG. 7

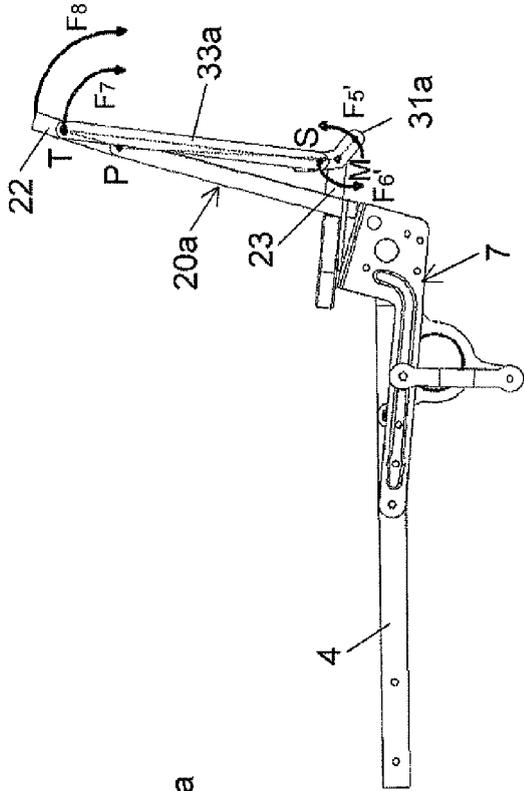


FIG. 9

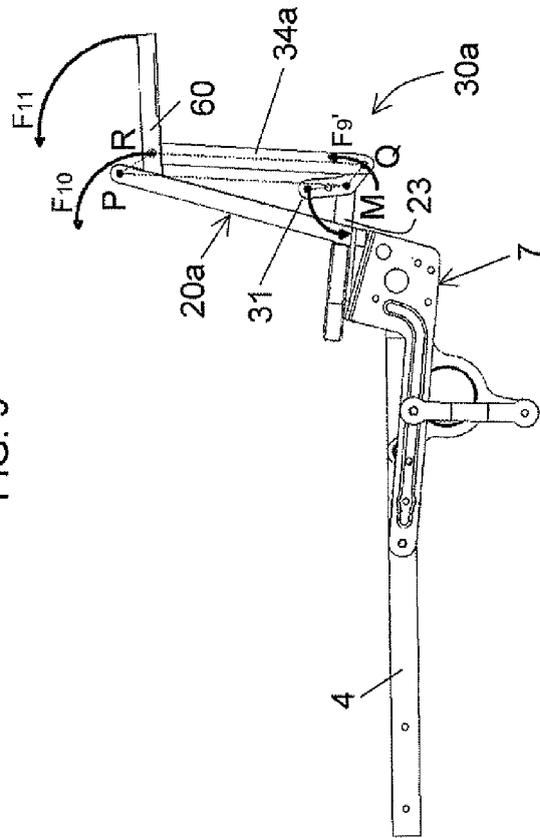


FIG. 10

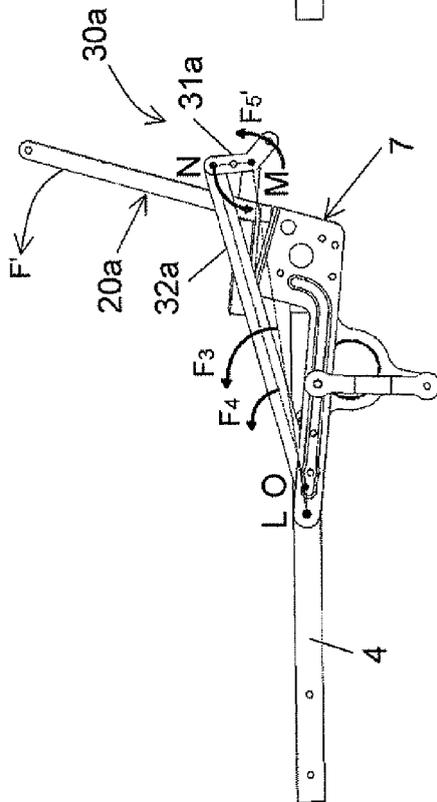


FIG. 11

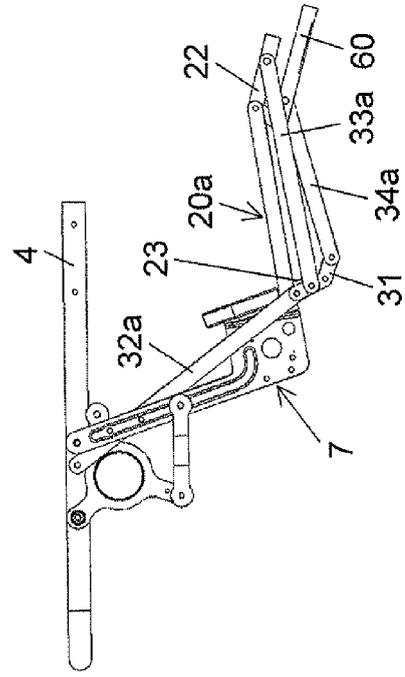


FIG. 12

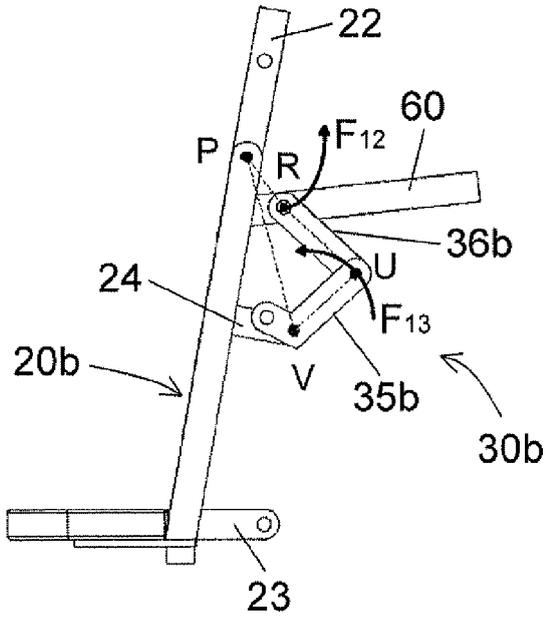


FIG. 13

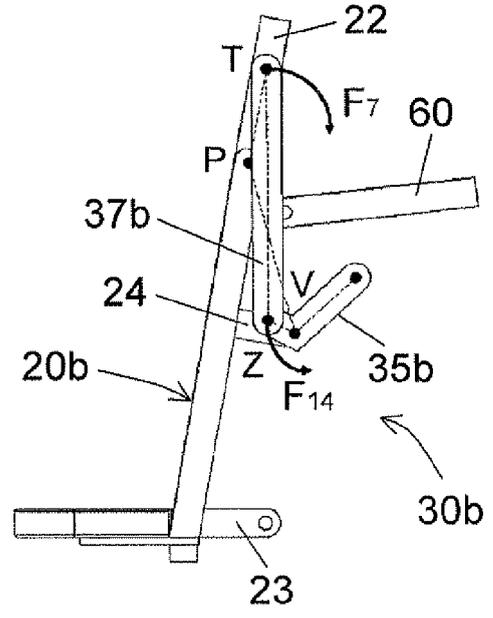


FIG. 14

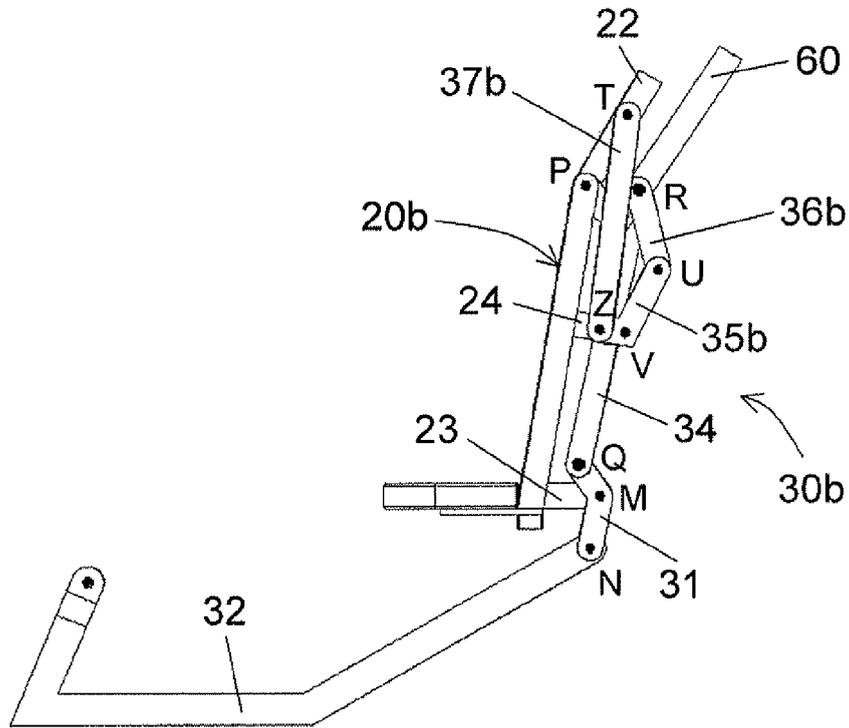


FIG. 15

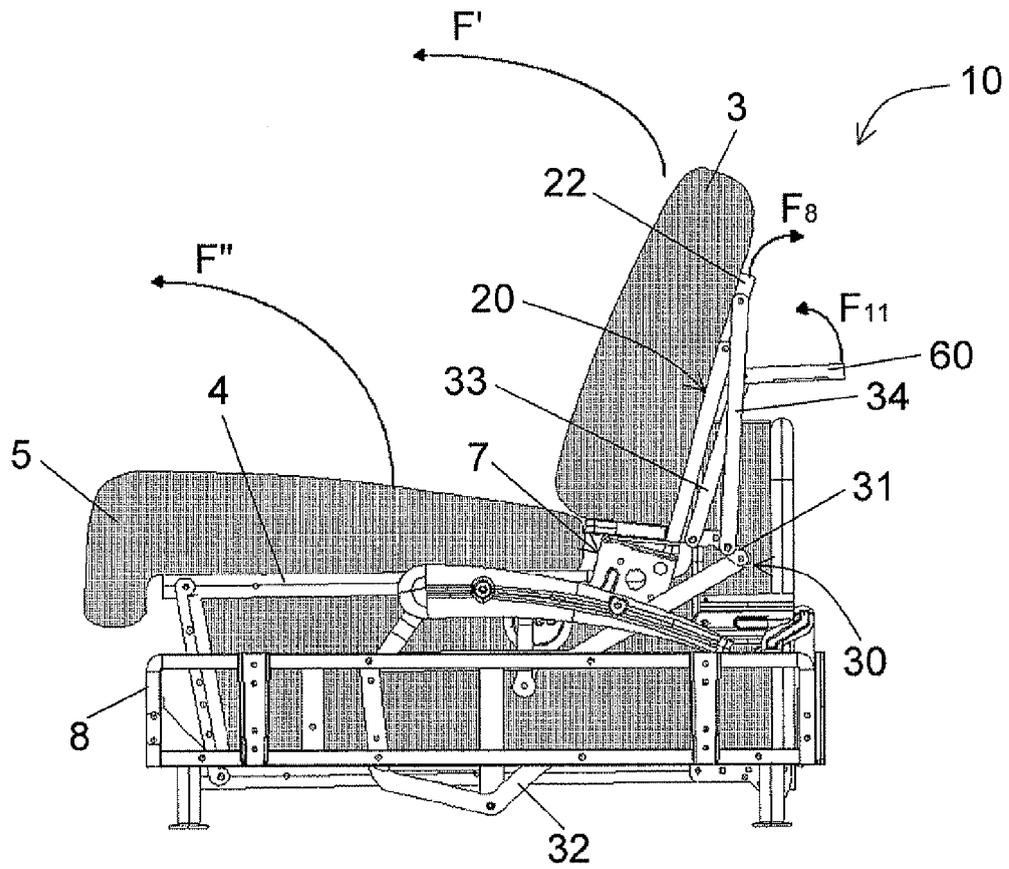


FIG. 16

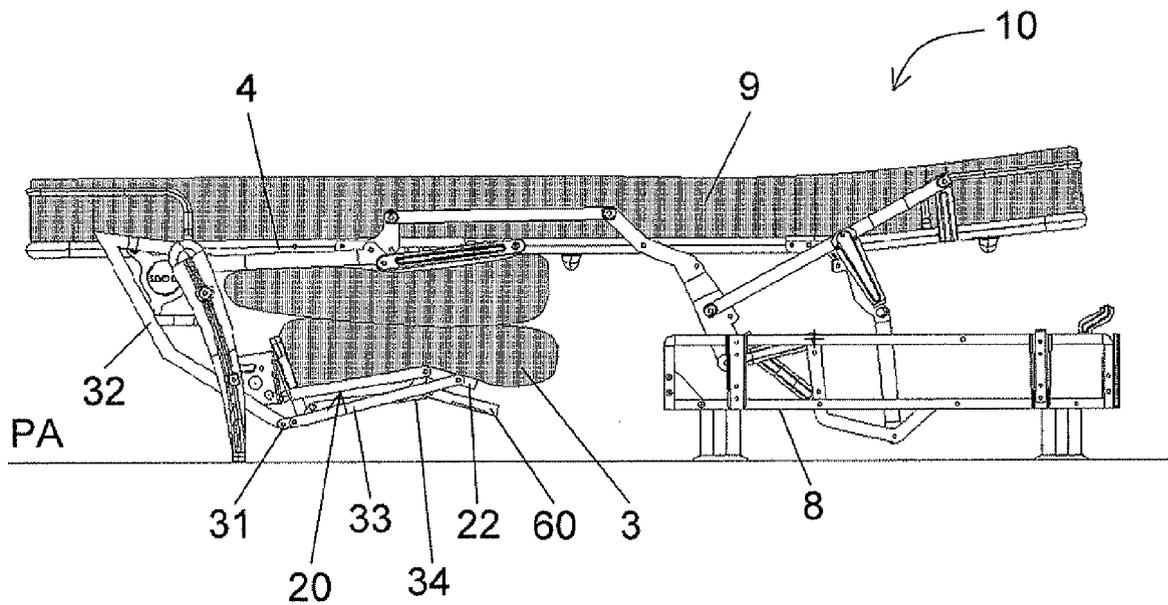


FIG. 17



EUROPEAN SEARCH REPORT

Application Number
EP 10 16 1143

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 September 2010	Examiner MacCormick, Duncan
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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