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(54) **Roller suspension device for a horizontally-sliding door of a piece of furniture**

(57) The roller suspension device for a horizontally-sliding door leaf of a piece of furniture comprises a stationary track-forming member having an upper and a lower running surface, and a movable leaf-supporting member provided with a leaf-supporting brace projecting from the front of the furniture piece, transversely to the direction of movement of the horizontally-sliding door leaf, and from which said horizontally-sliding door leaf is suspended. The movable leaf-supporting mem-

ber has at least a pair of first and second co-axial supporting wheels for contacting said lower and upper running surface, respectively, of the track-forming member, and the lower and upper running surfaces in combination produce a pair of non-collinear parallel and oppositely directed reaction forces which act on said first and second co-axial supporting wheels, respectively, of the leaf-supporting member for generating a balancing moment which counterbalances the moment of the gravitational force acting on the horizontally-sliding door leaf.

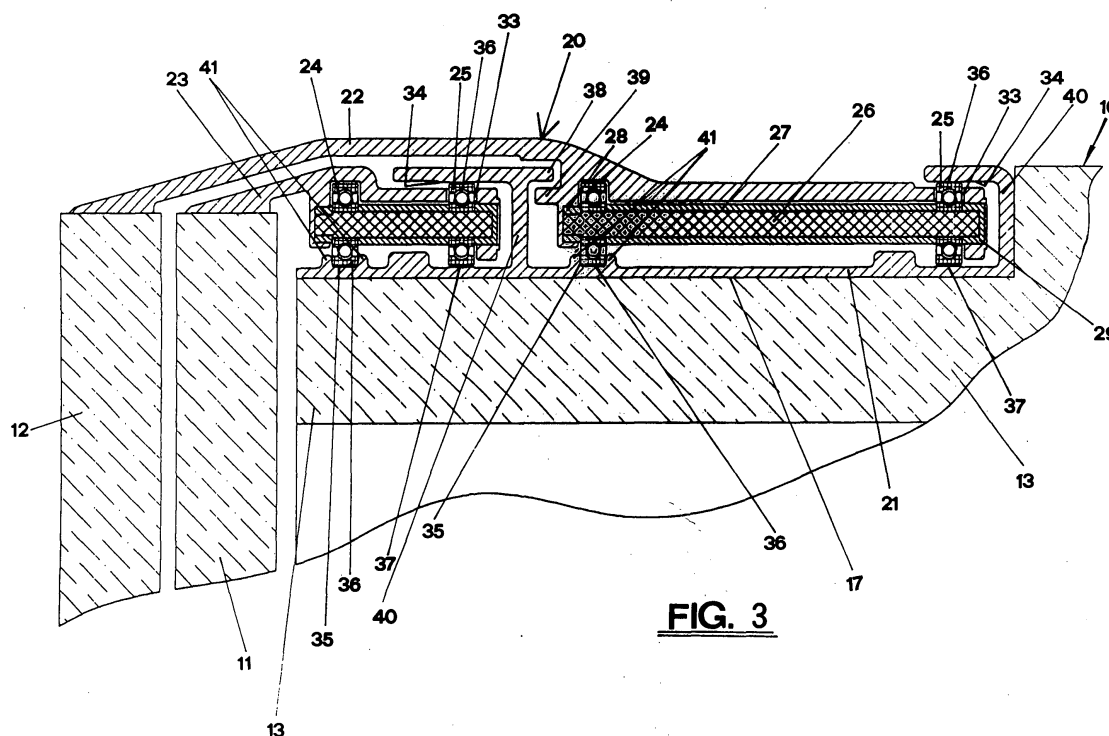


FIG. 3

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Description

[0001] The present invention generally relates to the field of suspension arrangements for horizontally-sliding doors of pieces of furniture such as cabinets, wardrobes, closets or the like. In particular, the invention relates to a roller suspension device for a horizontally-sliding door leaf which counterbalances the effects of the moments of the forces acting on the sliding door leaf and prevents an undesirable irregular rotation of the door leaf on an axis parallel or transverse to the direction of movement thereof.

[0002] Furniture pieces such as cabinets or the like having a horizontally-sliding door are well known in the art. In a conventional embodiment thereof, the piece of furniture comprises a bottom floor element, a rear wall, a pair of side walls, a top covering element and a front horizontally-sliding door having two or more door leaves each movable in its own plane into superimposing relationship. The door leaves are each suspended from a trolley or the like which is provided with supporting wheels or rollers and runs on independent parallel running tracks arranged on the top covering element and on the outer side or front of the piece of furniture. Each door leaf is connected to its own trolley by means of a connecting member, f.i. a brace, which projects from the associated trolley transversely to the direction of movement thereof, and from the front of the piece of furniture, and supports the weight of the associated door leaf.

[0003] In order to obtain a satisfactory guiding of the sliding door leaves, it is customary to place guide rails the bottom floor element and on the outer side, or front, of the piece of furniture. These guide rails secure each sliding door leaf against a possible rotation on an axis parallel to the direction of movement thereof caused by the moment of the weight of the door leaf and, more in general, by the moments of the forces acting on the door leaf when it is operated by the user's hand.

[0004] In order to stabilise the sliding door leaves against the moments of the forces acting thereon about an axis parallel to the running direction, it is also customary to provide either the trolleys or the door leaves with stabilising wheels, in addition to the aforesaid supporting wheels. These stabilising wheels generally run on an associated guide rail arranged on the top covering element or on the bottom floor element, and on the outer side, or front, of the piece of furniture. Stabilisation of the sliding door leaves is achieved in that the stabilising wheels rotate about an axis which is generally at a right angle to the axis of rotation of the supporting wheels.

[0005] It is also known in the art to stabilise the sliding door leaves against the moments of the forces acting thereon about an axis transverse to their running direction. This is achieved by providing the trolleys with at least two supporting wheels which follow one another at the same level in the running direction and are of the same diameter.

[0006] The pieces of furniture provided with horizon-

tally-sliding doors made according to this art are however constructionally complicated for they consist of a comparatively large number of interrelated parts and, moreover, they are aesthetically unsatisfactory. In fact, in the case a bottom guide rail is provided on the bottom floor element of the piece of furniture, it will generally be necessary to put into place an unconcealable mechanical member, whereas in the case a top guide rail is provided on the top covering element of the piece of furniture, it will be necessary to conceal a suspension arrangement for the door leaves which is obstructive and projects outwardly and upwardly from the top of the piece of furniture.

[0007] The object of the present invention is to obviate these technical drawbacks of the known art and to provide a roller suspension device for a horizontally-sliding door leaf which is still effective in preventing an undesirable irregular rotation of the door leaf on an axis parallel or transverse to the direction of movement thereof, but has a more simple construction than the conventional devices of the same kind, and at the same time is non-obstructive and has an aesthetically appraising appearance.

[0008] The aforesaid object is achieved with a roller suspension device that requires additional guide rail means neither on the bottom floor element nor on the top covering element and on the outer side, or front, of the piece of furniture.

[0009] Accordingly, the roller suspension device for a horizontally-sliding door leaf of a piece of furniture comprises a stationary track-forming member having an upper and a lower running surface, and a movable leaf-supporting member provided with a leaf-supporting brace projecting from the front of the furniture piece, transversely to the direction of movement of the horizontally-sliding door leaf, and from which said horizontally-sliding door leaf is suspended. The movable leaf-supporting member has at least a pair of first and second co-axial supporting wheels for contacting said lower and upper running surface, respectively, of the track-forming member, and the lower and upper running surfaces in combination produce a pair of non-collinear parallel and oppositely directed reaction forces which act on said first and second co-axial supporting wheels, respectively, of the leaf-supporting member for generating a balancing moment which counterbalances the moment of the gravitational force acting on the horizontally-sliding door leaf.

[0010] The present invention will be now described in more detail in relation to some preferred embodiments thereof, illustrated only by way of example and not limited thereto, with reference to the accompanying drawings, in which:

Figure 1 is an isometric projection view of a horizontally-sliding door-type furniture piece provided with the roller suspension device according to the present invention and illustrated with the sliding

door in the closed condition;

Figure 2 is an isometric projection view of the furniture piece of Figure 1 illustrated with its sliding door in the open condition;

Figure 3 is a cross section view of a first embodiment of the roller suspension device according to the present invention taken along line II-II of Figure 2, perpendicularly to the direction of movement of the horizontally-sliding door;

Figure 4 is an isometric projection view of the roller suspension device of Figure 3 illustrated with its movable members disassembled from the stationary member;

Figure 5 is a top isometric projection view of a movable member of the roller suspension device of Figure 4;

Figure 6 is a bottom isometric projection view of the movable member of Figure 5;

Figure 7 is a bottom isometric projection view of the movable member of Figure 6 illustrated with its wheel carrying shaft in the disassembled condition;

Figure 8 is a cross section view of a second embodiment of the roller suspension device according to the present invention taken along line II-II of Figure 2, perpendicularly to the direction of movement of the horizontally-sliding door;

Figure 9 is a bottom isometric view of a movable member of the roller suspension device of Figure 8;

Figure 10 is an enlarged bottom isometric projection view of the movable member of Figure 9;

Figure 11 is a cross section view of a third embodiment of the roller suspension device according to the present invention taken along line II-II of Figure 2, perpendicularly to the direction of movement of the horizontally-sliding door;

Figure 12 is a bottom isometric projection view of a movable member of the roller suspension device of Figure 11; and

Figure 13 is an enlarged view of the movable member of Figure 12.

[0011] Referring to Figures 1 and 2 of the drawings, there is shown a sliding door-type piece of furniture, e. g. an office filing cabinet, generally designated by 10, which comprises the roller suspension device according to the present invention, generally designated by 20. The sliding door-type piece of furniture 10 is provided with a horizontally-sliding door consisting of two superimposable door leaves 11 and 12, a top covering element 13, a bottom floor element 14, a pair of side walls 15 and a rear wall 16. The roller suspension device 20 is arranged on the top covering element 13 and on the outer side, or front, of the piece of furniture 10.

[0012] The roller suspension device 20 is shown in greater detail in Figures 3 to 7 of drawings which pertain to a first preferred embodiment thereof. According to this first embodiment, the roller suspension device 20 comprises a stationary track-forming member having the

form of a profiled section 21 which is arranged in a depressed substantially flat front portion 17 of the top covering element 13 of the piece of furniture 10. The profiled section 21 forms two independent parallel running tracks for first and second movable door-leaf supporting members each configured as a trolley 22 and 23, respectively. The trolleys 22,23 each comprise, as an integral part thereof, a door leaf supporting brace which projects from the front of the piece of furniture 10, transversely to the direction of movement of the sliding door leaves, and from which the sliding door leaves 11 and 12 are suspended. Both the profiled section 21 and the trolleys 22,23 are preferably extruded profiled members.

[0013] Each trolley 22,23 is provided with a plurality of pairs of co-axial supporting wheels 24,25 which are arranged spaced apart in the direction of movement of the sliding door leaves 11,12. Without prejudice of the generality of the embodiment, the supporting wheels 24,25 consist of ball-bearings which can be made according to an ordinary construction in order to reduce the cost of the roller suspension device.

[0014] Each pair of coaxial supporting wheels 24,25 is freely mounted on a wheel carrying cross-shaft 26 and the supporting the wheels 24,25 are kept spaced apart by a tubular spacer 27 in which the cross-shaft 26 is accommodated and from which its free end portions protrude. These end portions of the cross-shaft 26 are contained in bushings 28,29 each of which forms a bearing surface for the relevant end portion of the cross-shaft 26 and is fitted into suitable receiving seats 30,31 made in the body of the trolleys 22,23.

[0015] As illustrated more clearly in Figures 3 and 5 of the drawings, a portion of the outer race of each of the ball-bearing trolley supporting wheels 25 protrudes upwardly from the body of the associated trolley 22,23 through an adapted rectangular-shaped slot 33 cut therein for the purpose that will become apparent from the following.

[0016] The independent parallel running tracks for the trolleys 22,23 are formed within the profiled section 21. Each running track consists of an upper running surface 34 on which the supporting wheels 25 of the trolleys 22,23 run and a lower running surface 35 on which the supporting wheels 24 of the trolleys 22,23 run. The upper running surface 34 is formed on a horizontal downwardly facing surface of an upwardly projecting inverted L-shaped member 40 which is integral with the profiled section 21. This upper running surface 34 is contacted by the outer race of the ball-bearing trolley supporting wheels 25 which protrude through the slots 33 in the associated trolley 22,23. In fact, the outer race of the ball-bearing trolley supporting wheels 25 is substantially detached from the horizontal upwardly facing surface of the profiled section 21. The lower running surface 35 is located in a channel defined between a pair of parallel running ridges 41 which are formed on an upwardly facing horizontal surface of the profiled section 21. This lower

running surface 35 is contacted by the outer race of the ball-bearing trolley supporting wheels 24. These supporting wheels 24 also act as trolley guiding wheels since their rolling is confined within the ridges 41 of the channel-shaped lower running surface 35. The upper and lower running surfaces 34,35 are conveniently covered with a layer made from a synthetic padding material 36 in order to obtain a smooth and quiet running of the trolley wheels 24,25.

[0017] The roller suspension device 20 realises an effective guiding of the sliding door leaves 11,12 without the need of further guide rail means, such as a guide rail arranged on the bottom floor element 14 for preventing a possible rotation of the door leaves 11,12 on an axis parallel to the direction of movement.

[0018] In fact, the counter-clockwise turning effect of the moment of the gravitational force acting on each door leaf 11,12 is contrasted by an opposite resulting moment produced by a pair of non-collinear parallel and oppositely directed reaction forces which act on the trolley wheels 24,25 at the contact surfaces on the running tracks 35,34.

[0019] Moreover, in order to prevent a possible clockwise turning effect of the moment of the forces acting on each door leaf 11,12 when it is operated by the user's hand, in the case the moment of these forces is greater than that produced by the weight acting on the door leaf, an opposite resulting moment is produced by a reaction force which arises when the outer race of the ball-bearing trolley supporting wheels 25 contacts the lower upwardly facing surface 37 of the tracks on which the trolleys 22,23 run.

[0020] As a safeguard against such possible clockwise turning effect of the moment acting, in particular, on the outer door leaf 12, also two horizontal superimposed and oppositely directed wing-like members 38,39 are provided which project from the facing surface portions of the inverted L-shaped member 40 of the profiled section 21 and the trolley 22, respectively. When the members 38,39 come into contact, a reaction force is produced at the contact surface existing therebetween which prevents a further clockwise rotation of the door leaf 12.

[0021] Generally, a safeguard against a possible clockwise turning effect of the moment acting on the inner door leaf 11 is not required. However, such a safeguard is also achieved in that the upper running surface 34 formed on the horizontal downwardly facing surface of the upwardly projecting inverted L-shaped member 40 of the profiled section 21 extends over the body of trolley 23 for a length which is substantially more than half the axial distance between the trolley wheels 24 and 25.

[0022] The roller suspension device 20 is also capable of preventing a possible clockwise or counter-clockwise rotation of the door leaves 11,12 on an axis which is transverse to the direction of movement thereof. This is achieved in that a plurality of pairs of co-axial wheels

24,25 are provided on the trolleys 22,23 and are arranged spaced apart in the direction of movement of the sliding door leaves 11,12. This arrangement stabilises the door leaves 11,12 against a turning effect of the moment of the forces acting thereon about an axis transverse to the direction of movement of the door leaves 11,12 when these are operated by the user's hand.

[0023] Furthermore, as illustrated in Figure 3 of the drawings, the axial distance between the co-axial wheels 24,25 of each trolley 22,23 is different. The reason of such difference is that the axial distance is suitably chosen depending on the length of the projecting brace which supports the sliding door leaf 11,12. In so doing, each set of supporting wheels 24 and 25 of the trolleys 22,23 acts on the associated running surface 35 and 34, respectively, with substantially the same load. Therefore, the force required by the user to move the door leaves 11,12 is the same irrespective of their projection from the front of the piece of furniture 10.

[0024] Referring now to Figures 8 to 10 of the drawings, there is shown a second embodiment of the roller suspension device according to the present invention. For the sake of brevity and simplicity, like reference numbers relate to identical or functionally similar elements and thus the description thereof will be omitted.

[0025] According to the second embodiment of the present invention, each trolley 22,23 of the roller suspension device 20, in addition to its supporting wheels 22,23, is also provided with front and rear separate guiding wheels 42 which rotate about an axis which is at a substantially right angle to the axis of rotation of the supporting wheels 24,25. These guiding wheels 42 preferably consist of ball-bearings according to a construction similar to that of the supporting wheels 22,23. The inner race of the ball-bearing guiding wheels 42 is fitted on to the shaft 43 of a guiding wheel supporting member 44 which is connected to the trolley body by means of an ordinary screw 45. The guiding wheel is kept in position on the associated shaft 43 of the wheel supporting member 44 by means of a Seeger ring 46. The outer race of the of each trolley guiding wheel 42 contacts a pair of parallel running ridges 47 which define therebetween a running channel 48 for the guiding wheel 42.

[0026] Referring now to Figures 11 to 13 of the drawings, there is shown a third embodiment of the roller suspension device according to the present invention. This third embodiment differs from the aforesaid second embodiment in the arrangement of the guiding wheels 42. As illustrated in the Figure 11 of the drawings, the trolley 23 is provided with front and rear guiding wheels 42 which are arranged in a staggered configuration with respect to the direction of movement of the trolley 23 and, accordingly, the width of the channel 48 is enlarged so that the outer race of the ball-bearing guiding wheels 42 contact oppositely facing running surfaces on the ridges 47 which define the running channel 48. In addition, the trolley 22 has two pairs of collinear guiding wheels 42 positioned at the front and rear thereof which run on op-

posite facing running surfaces of the ridges 47 of the channel 48.

[0027] From the foregoing, it can be understood that the roller suspension device according to the embodiments of present invention permits the aimed object to be achieved, i.e. it is capable of preventing an undesirable irregular rotation of the door leaf on an axis parallel or transverse to the direction of movement thereof. The roller suspension device has a simple construction and is not obstructive, and moreover it does not have unconcealed mechanical parts which may be prejudicial to the aesthetical appearance of the piece of furniture.

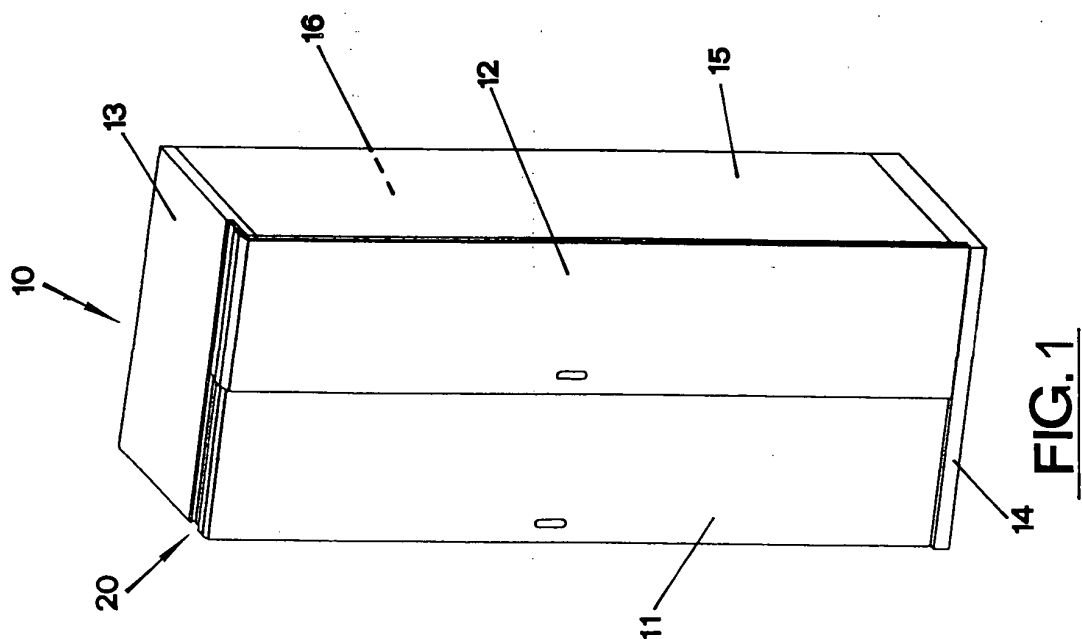
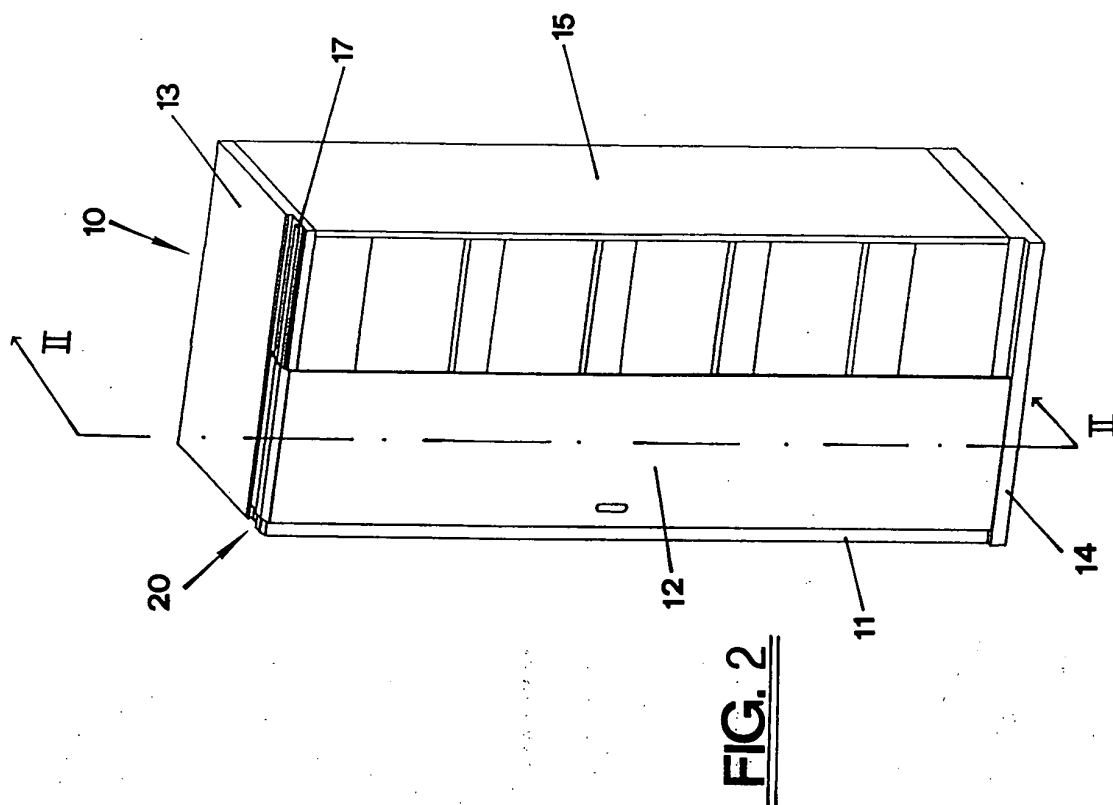
[0028] Although the above description refers to the case of a piece of furniture having a sliding door consisting of two door leaves only, the roller suspension device can be adapted also to the case of a sliding door having more than two door leaves. In a similar manner, the number and arrangement of the trolley wheels shown in the embodiments are in no way limiting and can obviously be adapted case by case to the requirements of special realisations.

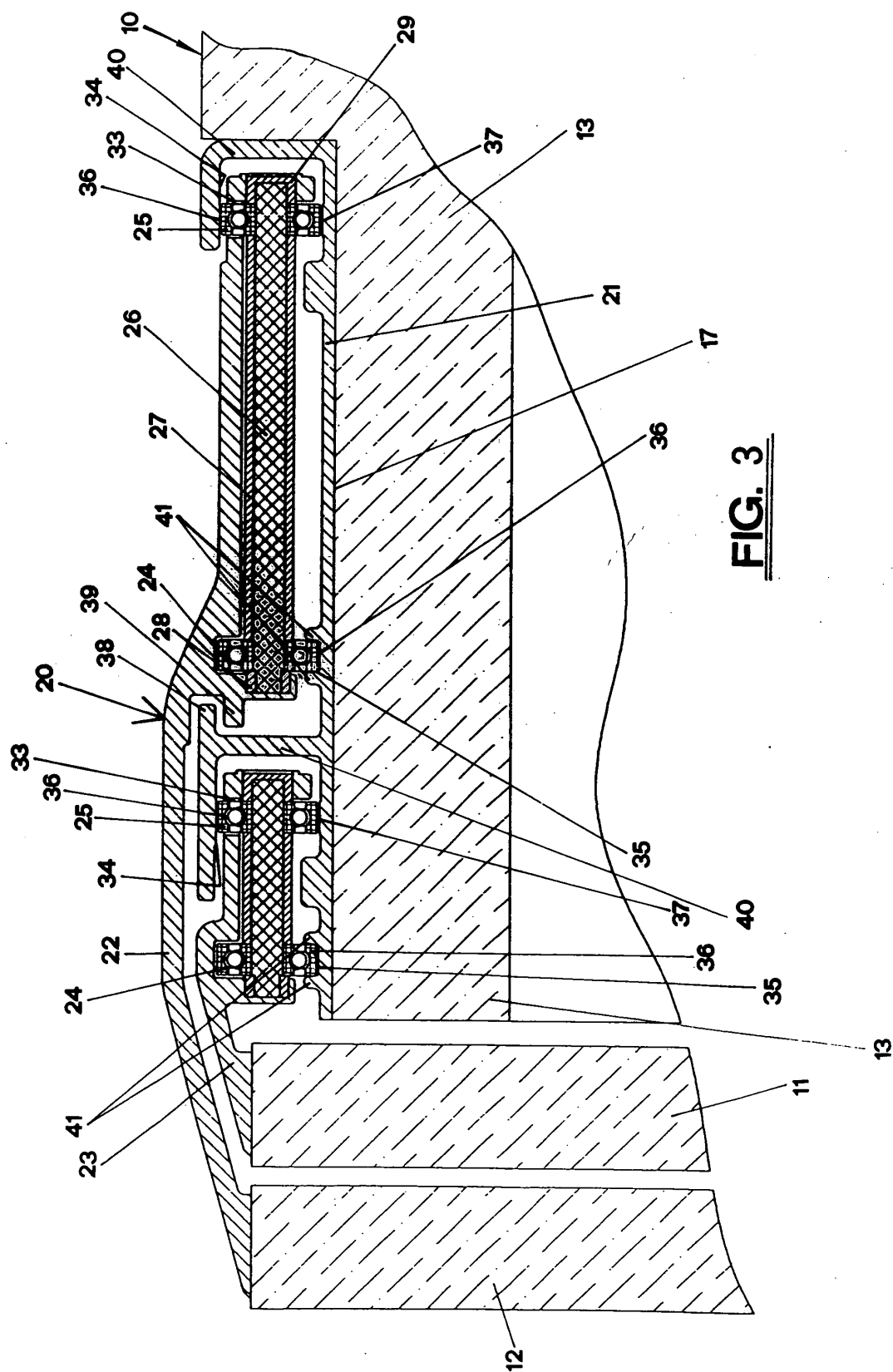
Claims

1. A roller suspension device (20) for a horizontally-sliding door leaf (11,12) of a piece of furniture (10), **characterised in that** it comprises a stationary track-forming member (21) having an upper (34) and a lower (35) running surface, and a movable leaf-supporting member (22,23) provided with a leaf-supporting brace projecting from the front of the furniture piece (10), transversely to the direction of movement of the horizontally-sliding door leaf (11,12), and from which said horizontally-sliding door leaf (11,12) is suspended, said movable leaf-supporting member (22,23) having at least a pair of first (24) and second (25) co-axial supporting wheels for contacting said lower (35) and upper (34) running surface, respectively, of the track-forming member (21), said lower (35) and upper (35) running surfaces in combination producing a pair of non-collinear parallel and oppositely directed reaction forces which act on said first (24) and second (25) co-axial supporting wheels, respectively, of the leaf-supporting member (22,23) for generating a balancing moment which counterbalances the moment of the gravitational force acting on the horizontally-sliding door leaf (11,12).
2. A roller suspension device according to claim 1, **characterised in that** the upper running surface (34) of the stationary track-forming member (21) is formed on a horizontal downwardly facing surface of an upwardly inverted L-shaped member (40) which is integral with said track-forming member (21).
3. A roller suspension device according to claim 1, **characterised in that** the lower running surface (35) of the stationary track-forming member (21) is formed on a horizontal upwardly facing surface of said track-forming member (21).
4. A roller suspension device according to claim 1, **characterised in that** the second supporting wheels (25) of the movable leaf-supporting member (22,23) are generally detached from a horizontal upwardly facing surface of the track-forming member (21) and are subject to come into contact therewith in the case the moments of the door leaf operating forces acting on the door leaf (11,12) when it is operated by a user are greater than the moment of the gravitational force acting thereon, and that upon contact with said horizontal upwardly facing surface of the track-forming member (21) a reaction force arises which acts on said second supporting wheels (25) and contrasts a possible rotation of the door leaf (11,12) on an axis parallel to the direction of movement thereof.
5. A roller suspension device according to claim 1, **characterised in that** the movable leaf-supporting member (22,23) comprises a plurality of pairs of first (24) and second (25) co-axial supporting wheels which are arranged spaced apart in the direction of movement of the horizontally-sliding door leaf (11,12) in order to prevent a possible rotation of the door leaf (11,12) on an axis transverse to the direction of movement thereof.
6. A roller suspension device according to claim 1, **characterised in that** the movable leaf-supporting member (22,23) is provided with a plurality of rectangular-shaped slots (33) through each of which a portion of the supporting wheels (25) protrudes upwardly for contacting the upper running surface (34) of the stationary track-forming member (21).
7. A roller suspension device according to claim 1, **characterised in that** the lower running surface (35) of the stationary track-forming member (21) is located in a channel defined between a pair of parallel running ridges (41) which are formed on a upwardly facing horizontal surface of said stationary track-forming member (21).
8. A roller suspension device according to claim 7, **characterised in that** at least one set of supporting wheels (24,25) of the movable leaf-supporting member (22,23) acts as guiding wheel set, the rolling of said set of supporting wheels (24,25) being confined within the pair of parallel running channel-defining ridges (41) formed on the lower running surface (35) of the stationary track-forming member (21).

9. A roller suspension device according to claim 1, **characterised in that** the movable leaf-supporting member (22,23) is provided with a separate set of guiding wheels (42) each of which rotates about an axis which is at a substantially right angle to the axis of rotation of the first (24) and second (25) co-axial supporting wheels of said movable leaf-supporting member (22,23). 5
10. A roller suspension device according to claim 9, **characterised in that** each guiding wheel (42) of the movable leaf-supporting member (22,23) runs within a pair of parallel running ridges (47) which are formed on the lower running surface (35) of the stationary track-forming member (21) and define therebetween a running channel (48) for the guiding wheel (42). 10 15
11. A roller suspension device according to claims 9 and 10, **characterised in that** the movable leaf-supporting member (22,23) is provided with a set of front and rear guiding wheels (42) which are arranged in a staggered configuration with respect to the direction of movement of said movable leaf-supporting member (22,23) and said front and rear guiding wheels (42) contact oppositely facing surfaces of the parallel running channel-defining ridges (47) on the lower running surface (35) of the stationary track-forming member (21). 20 25 30
12. A roller suspension device according to claims 9 and 10, **characterised in that** the movable leaf-supporting member (22,23) is provided with a set of front and rear pairs of collinear guiding wheels (42) which run on oppositely facing surfaces of the parallel running channel-defining ridges (47) on the lower running surface (35) of the stationary track-forming member (21). 35
13. A roller suspension device according to claim 1, **characterised in that** the stationary track-forming member (21) comprises two or more independent parallel running tracks on each of which a movable leaf-supporting member (22,23) runs, the leaf-supporting braces of the movable leaf-supporting members (22,23), together with the associated horizontally-sliding door leaf (11,12) suspended therefrom, being movable in their own plane into superimposing relationship. 40 45 50
14. A roller suspension device according to claim 1, **characterised in that** the stationary track-forming member (21) and the movable leaf-supporting member (22,23) are extruded profiled members. 55
15. A horizontally-sliding door-type piece of furniture (10) having a roller suspension device (20) according to one or more of the claims 1 to 13, **character-**

ised in that it comprises a horizontally-sliding door consisting of at least two superimposable door leaves (11,12), a top covering element (13), a bottom floor element (14), a pair of side walls (15) and a rear wall (16) and that the roller suspension device (20) is arranged on the top covering element (13) and on the outer side, or front, of the piece of furniture (10) and the stationary track-forming member (21) is arranged in a depressed substantially flat front portion (17) of the top covering element (13) of the piece of furniture (10).





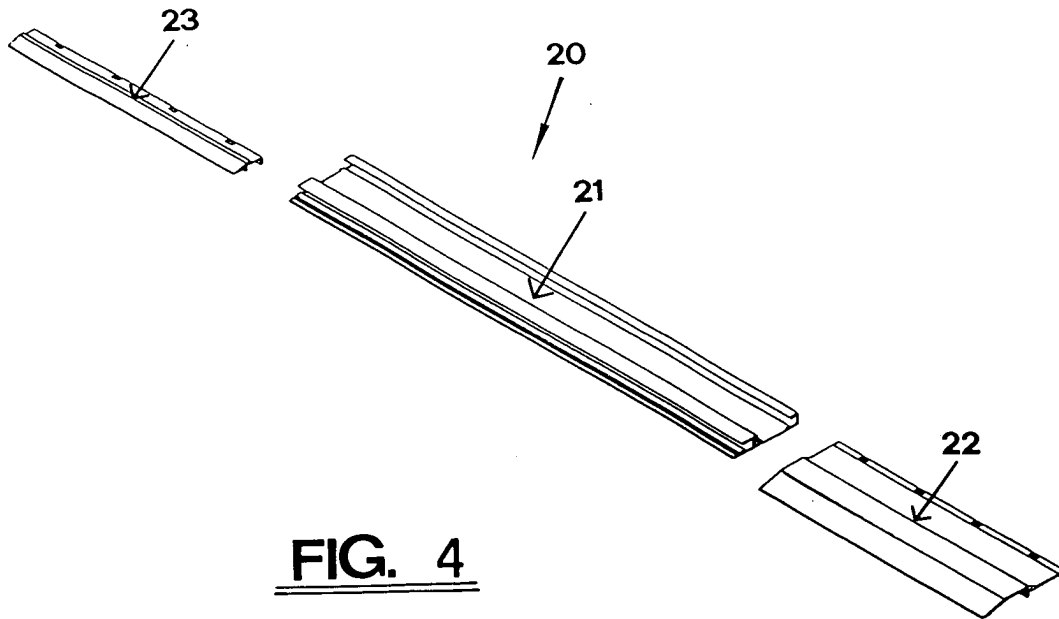


FIG. 4

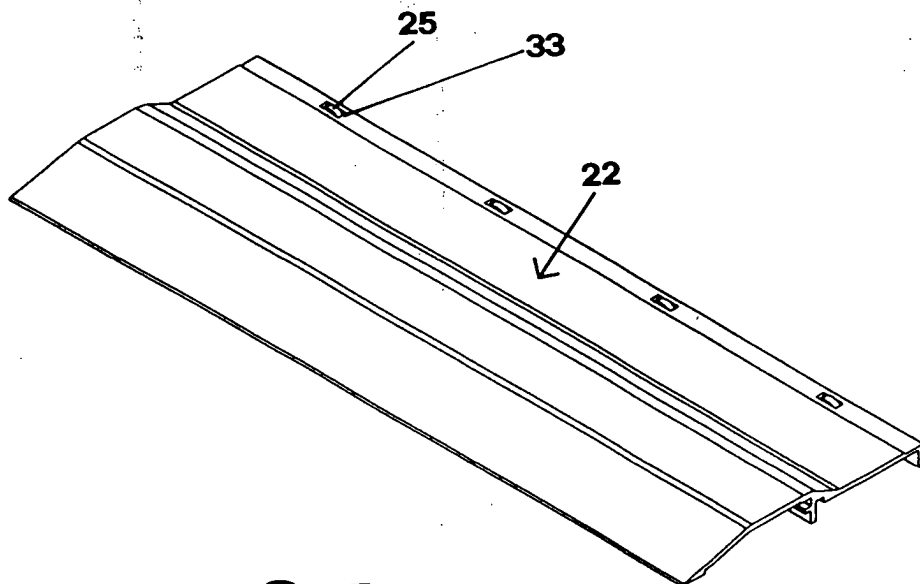


FIG. 5

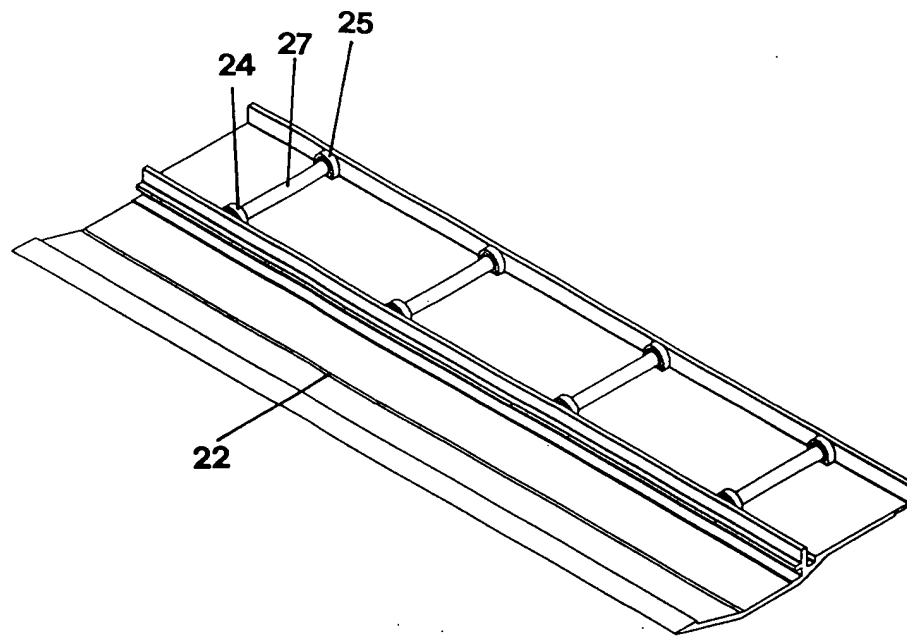


FIG. 6

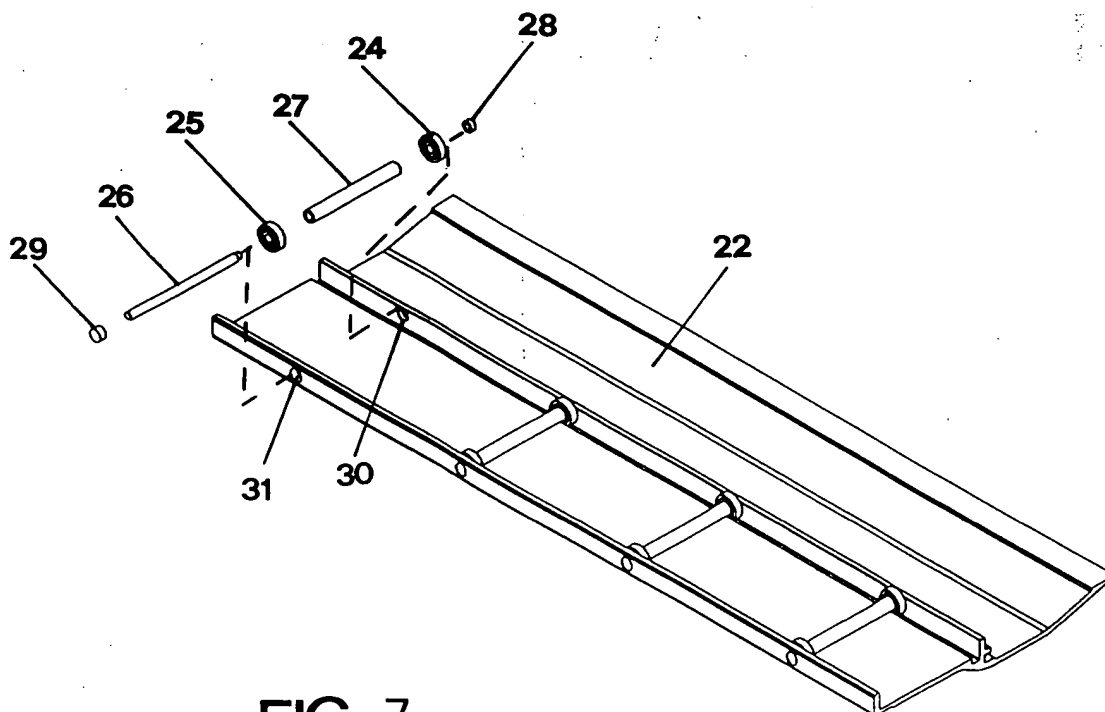


FIG. 7

FIG. 8

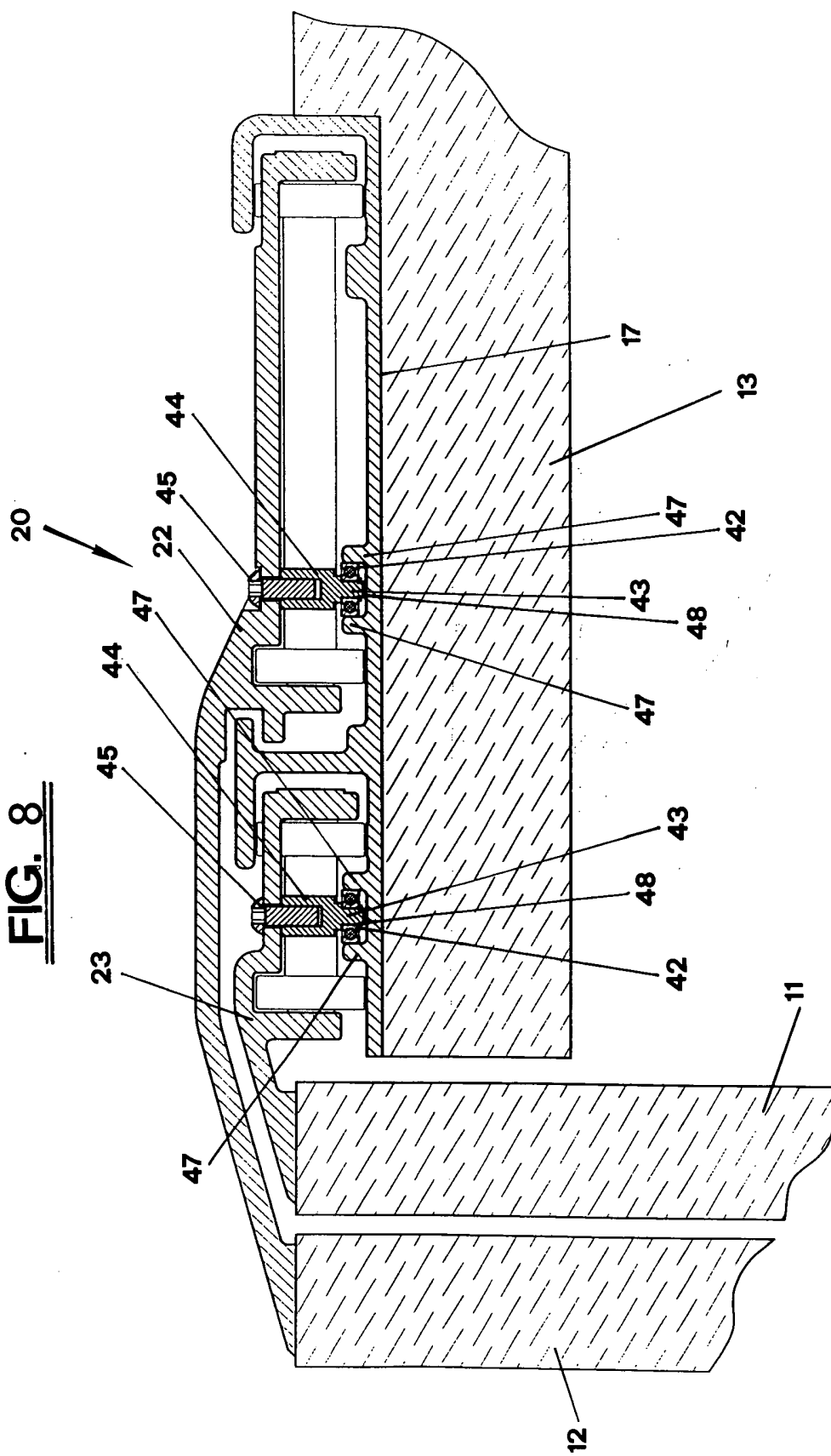
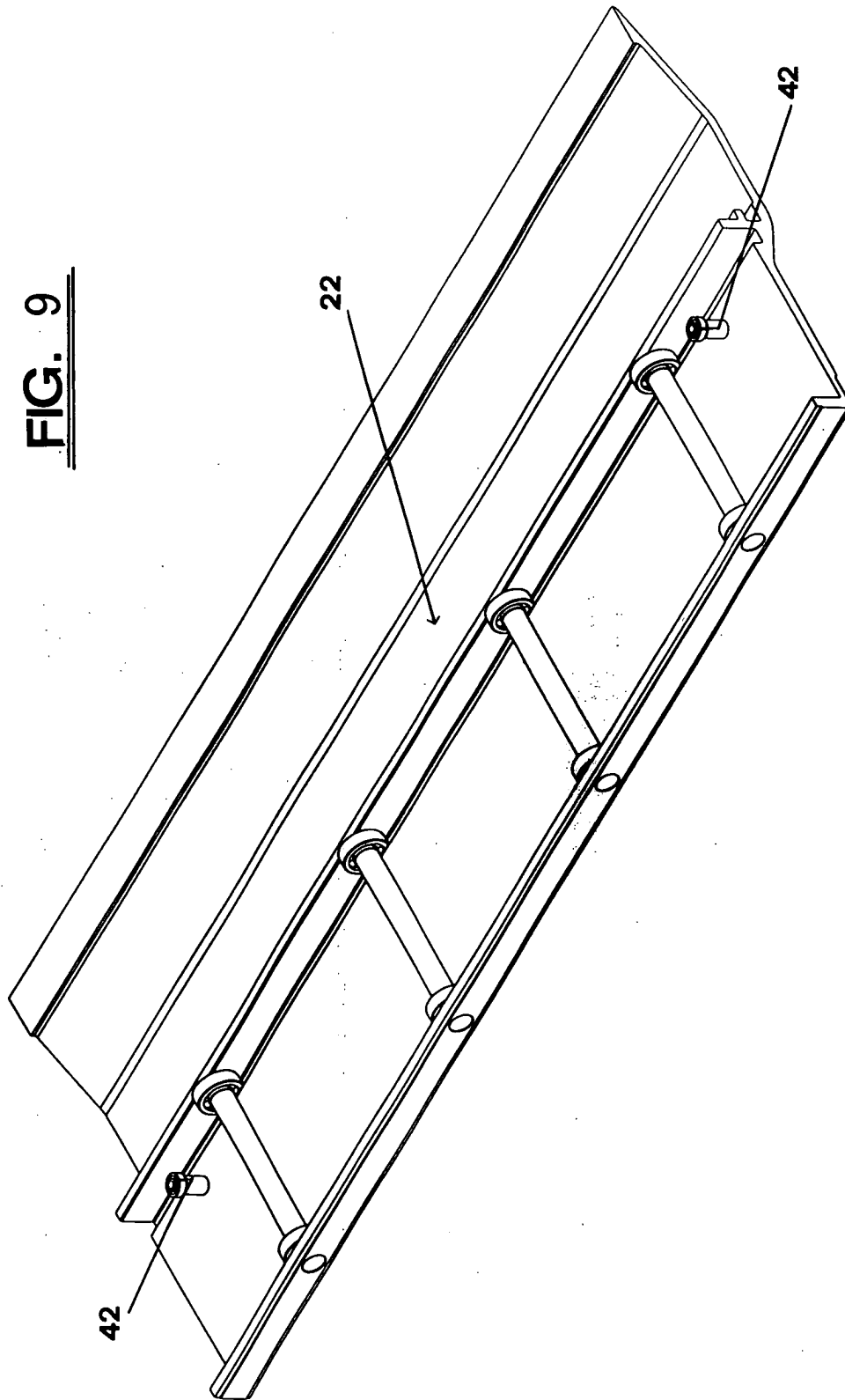


FIG. 9



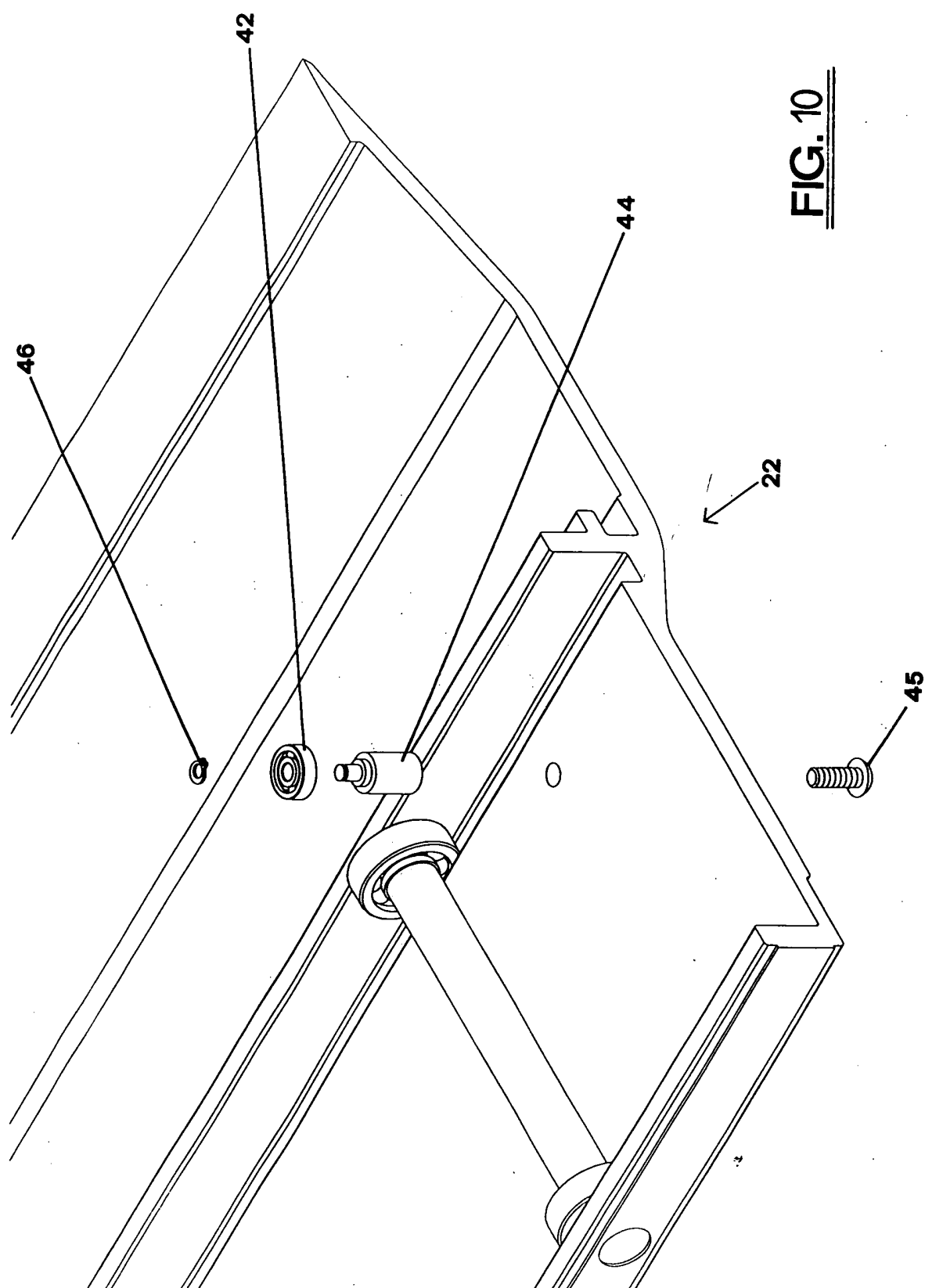


FIG. 11

