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(54) **Modular bed system**

(57) A patient support including a deck having a moveable head section and one or more inflatable mat-

tresses. The inflatable mattresses can position a patient in a Trendelenburg position, a reverse Trendelenburg position, or a knee gatch position.

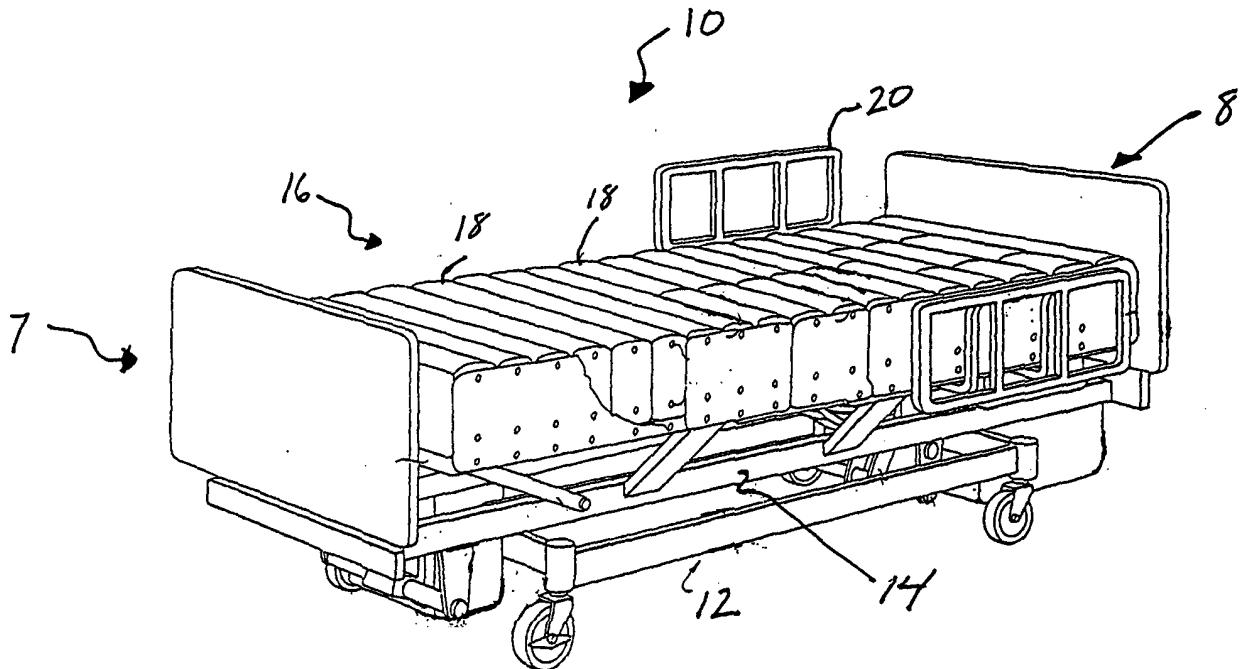


Fig. 1

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Description

[0001] The present disclosure relates to a patient support such as a hospital bed. Some hospital beds include movable deck sections that articulate to position a patient in the Trendelenburg, Reverse Trendelenburg, and knee gatch positions. The present disclosure describes an inflatable mattress that can position a patient in the Trendelenburg, Reverse Trendelenburg, and knee gatch positions.

[0002] According to one aspect of the present invention, there is provided a patient support configured to support a patient. The support includes a frame, a deck supported by the frame, and a mattress supported by the deck, the mattress including a plurality of inflatable bladders, the bladders configured to support the patient in one of a horizontal position and a Trendelenburg position.

[0003] According to another aspect of the present invention, there is provided a patient support including a frame, a deck supported by the frame, a mattress including a plurality of inflatable bladders, an inflator configured to selectively inflate at least one of the plurality of inflatable bladders, and a controller. The controller is configured to control the inflator to inflate at least one of the plurality of inflatable bladders to configure the mattress in one of a Trendelenburg position, a Reverse-Trendelenburg position, a flat position, and a knee gatch position.

[0004] A further aspect of the present invention includes an inflatable mattress configured to support a patient. The inflatable mattress includes at least one inflatable cell configured to support the patient in one of a horizontal position and a Trendelenburg position, and a controller coupled to an inflator and at least one control valve, the controller configured to receive input from a user and control the inflator and the control valve to inflate or deflate the inflatable cell to position the patient in one of the horizontal position and the Trendelenburg position.

[0005] The present invention also includes a modular patient support system configured to support a patient in various acuity environments. The system includes a frame, a deck supported by the frame, the only movable deck section being a head section moveable between a raised position and a lowered position relative to the remainder of the deck, and a plurality of mattresses. One mattress is selected for use on the deck depending on an acuity level of the patient wherein the mattress being selected is selected from a group of mattresses including a first static mattress and a second mattress including a plurality of inflatable bladders, the bladders being configured to provide selective elevation of the patient's thigh.

[0006] Preferably, the group includes a third mattress including a plurality of inflatable bladders, the bladders being configured to provide selective elevation of the patient's thigh and to selectively position the patient in a Trendelenburg position, and a fourth mattress including a plurality of inflatable bladders, the bladders configured

to provide selective elevation of the patient's thigh, and to selectively position the patient in a Trendelenburg position and a reverse Trendelenburg position.

[0007] The various aspects of the invention may be used independently or in combination.

[0008] The invention will now be described by way of example with reference to the accompanying drawings in which:

10 Fig. 1 is an elevated perspective view of one embodiment of a patient support;

Fig. 2 is a side view of the patient support of Fig. 1;

Fig. 3 is a diagrammatical view of another embodiment of a patient support with an inflatable mattress;

15 Fig. 4 is a diagrammatical side view of another embodiment of a patient support with an inflatable mattress;

Fig. 5 is a diagrammatical side view of yet another embodiment of a patient support with an inflatable mattress;

20 Fig. 6 is a cross-sectional view taken along the longitudinal axis of one embodiment of an inflatable mattress;

Fig. 7 is a cross-sectional view taken along the longitudinal axis of another embodiment of an inflatable mattress; and

Fig. 8 is a schematic of a control system for one embodiment of an inflatable mattress.

30 **[0009]** Referring to Fig. 1, a patient support 10 including a foot end 7, a head end 8, a lower frame 12, an upper frame 14, a mattress 16, and siderails 20 is shown. Mattress 16 includes a plurality of inflatable bladders 18 which can be inflated and deflated to change the shape of mattress 16 and provide optimum patient comfort. As shown in Fig. 2, patient support 10 includes supports 26 coupled between lower frame 12 and upper frame 14 that allow upper frame 14 to be raised and lowered relative to lower frame 12. A deck section 24 is supported by upper frame 14. Deck Section 24 includes a head section 22 that can be positioned substantially flat as shown in Fig. 1 or can be raised to an inclined position relative to the remainder of deck section 24 as shown in Fig. 2. A controller (not shown) including controls for raising and lowering upper frame 14 and raising and head section 22 may be included in siderails 20 or as a separate pendant controller.

40 **[0010]** One embodiment of the present disclosure is shown in Fig. 3. Patient support 10' includes a mattress 16' that includes a plurality of inflatable bladders 18'. Bladders 18' are coupled to control valves that are actuated by a controller, which are described below, to provide optimum patient comfort when the patient is lying on mattress 16'. Mattress 16' also includes a series of bladders 19' which are configured to inflate below a patient's lower leg section or knees to raise the patient's legs. Patient support 10' includes a control system that includes a knee gatch function that can be automatically

actuated when head section 22 is elevated by the patient of caregiver. When head section 22 is elevated the controller acts to inflate bladders 19'. As head section 22 is elevated to an inclined position, bladders 19' inflate to raise the patient's knees to prevent the patient from sliding toward foot end 7 of patient support 10'. Bladders 19' may also be controlled separately to be inflated or deflated when head section 22 is in the flat position. In another embodiment, only those bladders 19' located under a patient's knee are inflated to provide a knee gatch at the desired time. In this embodiment, the patient's feet are located below his knees in the knee gatch position.

[0011] It should be noted that mattress 16' may be formed of a single inflatable bladder 18' or of multiple inflatable bladders either collectively controlled or individually controlled. In another embodiment, inflatable mattress 16' and bladders 18' could also include features such as sequenced inflation/deflation to prevent decubitus ulcers, heel pressure relief, turn-assist, extendable length, low air loss therapy, rotation therapy, vibration therapy, and/or percussion therapy which are explained in U.S. Patent No. 6,584,628, which is expressly incorporated by reference herein.

[0012] As shown in Fig. 4, another embodiment of patient support 10" includes a mattress 16". Mattress 16" includes a plurality of bladders 18" which can be inflated to position the patient in the Reverse Trendelenburg position as shown in Fig. 4. Bladders 18" can be inflated to position the patient in a flat orientation or may be inflated or deflated to position the patient in the Reverse Trendelenburg position. The bladders 18" located toward head end 8 of patient support 10" may be larger than the bladders located toward foot end 7. In an alternative embodiment, several layers of bladders are present at head end 8 of patient support 10" which can be inflated to provide the incline. In another alternative embodiment, mattress 16" could also include the knee gatch function discussed above as well as the additional features described above. It should be noted that mattress 16" may include a single inflatable bladder or could include multiple inflatable bladders to perform the Reverse Trendelenburg function. If multiple bladders 18" are used, they may be selectively controlled or collectively controlled by a controller which can be actuated by the patient or a caregiver.

[0013] Another embodiment of the present disclosure is shown in Fig. 5. As shown in Fig. 5, patient support 10''' includes a mattress 16''' having a plurality of inflatable bladders 18''' which can be inflated to position the patient in the Trendelenburg position. Bladders 18''' can be inflated and/or deflated to raise the lower section of the patient and lower the head section of the patient. The bladders 18''' located toward foot end 7 of patient support 10''' may be larger or contain a larger volume than the bladders located on head end 8 of mattress 16''' may include layers of bladders which can be selectively inflated to produce the desired angle of inclination or declination. In an alternative embodiment, mattress 16''' may

also include the Reverse Trendelenburg function and/or the knee gatch function as well as the additional features described above. Bladders 18''' may be selectively controlled or collectively controlled by a controller operated by the patient or a caregiver. It should be noted that mattress 16''' may include a plurality of air bladders 18''' or could be composed of a single air bladder.

[0014] Another embodiment of mattress 16 is shown in cross-section in Fig. 6. Mattress 40 includes an outer portion 42 configured to receive a plurality of inflatable bladders 44, 46. Upper section 44 rests on top of bladders 46 and supports the patient. Outer portion 42 rests on upper deck 24 of patient support 10. Outer portion 42 may be made of a semi-rigid material such as foam or a rigid material such as plastic. Outer portion 42 may be formed from one piece of material or may include several sections such as a base section and side sections. Outer portion 42 may include only a pair of vertical side sections on the head end 45 and foot end 47 of mattress 40 or may include four vertical side sections to fully surround bladders 44, 46.

[0015] Upper section 44 is illustratively constructed of a semi-rigid material such as foam, rubber, or any other suitable material. Inflatable bladders 44 are substantially similar to inflatable bladders 18 which were discussed above. Bladders 46 are selectively inflated and deflated to position the upper section 44 in the Trendelenburg, Reverse Trendelenburg, or horizontal position. Bladders 46 can be arranged in any formation such as staggered, directly above one another, or any other suitable formation to adjust the angle of inclination or declination of upper section 44. It should be noted that mattress 40 could include a single bladder 46 or a plurality of bladders 46. Mattress 40 may include bladders of the same size or may contain bladders having different sizes or capacities. Bladders 46 can either be selectively controlled or collectively controlled by a control system. In addition to positioning the patient in the Trendelenburg, Reverse Trendelenburg, or horizontal positions, the pressure in bladders 40 can also be controlled to provide optimum patient comfort, heel pressure relief, rotation therapy, percussion therapy, and vibration therapy. An optional cover (not shown) can be placed around the components of mattress 40. In an alternative embodiment of mattress 40, a layer of inflatable bladders or foam is positioned on upper section 44 to provide support for the patient. In this embodiment, upper section 44 could be composed of a semi-rigid material or a rigid material such as plastic.

[0016] Another alternative embodiment of mattress 16 is shown in cross-section in Fig. 7. Mattress 50 is substantially similar to mattress 40 shown in Fig. 6 with the exception that upper section 44 has been replaced with additional inflatable bladders. Mattress 50 includes a plurality of inflatable bladders 56 enclosed by an outer portion 52 similar to outer portion 42. The top layer of bladders 56 directly supports the patient. Bladders 56 can be inflated or deflated to position the patient in the Trendelenburg, Reverse Trendelenburg, knee gatch, or horizon-

tal position. Bladders 56 can either be selectively controlled or collectively controlled by a control system. An optional cover (not shown) can be placed around the components of mattress 50.

[0017] Referring to Fig. 8, a control system 59 for the mattresses discussed above is shown. Controller 60 is coupled to an air supply 62 such as a blower or compressor and control valves 64. Air supply 62, is coupled to control valves 64. Valves 64 are coupled to the inflatable bladders 18' (for example) and also include an exhaust to the atmosphere 66. Controller 60 can be a pendant controller, a siderail controller, or any other suitable controller utilized by the patient or a caregiver. Controller 60 includes at least one input switch or button configured to control air supply 62 and control valves 64. Control valves 64 can be actuated to allow air to pass from air supply 62 to bladders 18' or to allow air from bladders 18' to exhaust to the atmosphere to deflate bladders 18'. Controller 60 can selectively inflate or deflate any one of the plurality of inflatable bladders to achieve the desired mattress function.

[0018] In an illustrated embodiment of the present invention, the modular bed system uses a relatively simple bed frame that has only two functions. These functions include a head section movable from a flat orientation to an elevated orientation as shown in Figs. 1-3. Also as discussed above, the bed frame includes a hi/lo mechanism for raising and lowering the frame relative to the ground. Several different mattress options are provided with this simplified bed frame. A first embodiment includes a static foam mattress. A second embodiment includes a mattress having bladders configured to achieve a thigh or knee gatch function as discussed above. A third embodiment includes a mattress having bladders that provide the Trendelenburg, and thigh (knee gatch) functions. A fourth embodiment includes a mattress having bladders configured to provide the Trendelenburg, reverse Trendelenburg and thigh (knee gatch) functions discussed above.

[0019] By providing a simplified frame with various mattress combinations, the modular bed system is easily upgradeable. This provides a cost effective frame for low acuity levels such as home care or international. The system is upgradeable to be used in different acuity environments. Therefore, the modular bed system can be used for home care with the simple bed frame and static foam mattress. For a low end long term care bed, the simple frame is used with a mattress having only the thigh function. For a high end long term care bed, the mattress may include the thigh function along with the Trendelenburg function. For a low end Med-Surg bed, the frame is used with a fully functional mattress for Trendelenburg, reverse Trendelenburg, and thigh functions.

[0020] In addition to the advantage of low cost, the simplified bed frame may be of lighter weight and have a lower centre of gravity than known bed frame. The reduction in complexity also means that it may be assembled on site.

[0021] In certain instances, other mattresses such as those disclosed in, for example, in U.S. Patent Nos. 3,667,075; 6,012,186; 3,879,772; 4,527,298; 4,839,932; 3,781,928; 3,606,623; and 4,142,263 may be used to perform certain features or for movement of portions of the the mattresses. All these listed patents are expressly incorporated by reference herein.

[0022] Although specific illustrated embodiments of the invention have been disclosed, it is understood by those skilled in the art that changes in form and details may be made.

Claims

1. A modular patient support system configured to support a patient in various acuity environments, the system comprising a frame, a deck supported by the frame, the only movable deck section being a head section moveable between a raised position and a lowered position relative to the remainder of the deck, a plurality of mattresses, one mattress being selected for use on the deck depending on an acuity level of the patient, the mattress being selected from a group of mattresses including a first static mattress and a second mattress including a plurality of inflatable bladders, the bladders being configured to provide selective elevation of part of the patient.
2. The modular patient support of claim 1, further comprising a hi/lo mechanism coupled to the frame to move the frame between a raised position and a lowered position relative to the floor.
3. The modular patient support as claimed in either claim 1 or claim 2 wherein the bladders are configured to provide selective elevation of the patient's thigh and/or the patient's knee.
4. The modular patient support system of claim 3, further comprising a third mattress including a plurality of inflatable bladders, the bladders being configured to provide selective elevation of the patient's thigh or knee and to selectively position the patient in a Trendelenburg position..
5. The modular patient support system of claim 4, further comprising a fourth mattress including a plurality of inflatable bladders, the bladders configured to provide selective elevation of the patient's thigh or knee, and to selectively position the patient in a Trendelenburg position and a reverse Trendelenburg position.
6. The modular patient support of either claim 1 or claim 2 wherein the bladders are configured to support the patient in one of a horizontal position and a Trendelenburg position.

7. The modular patient support of claim 6, wherein the plurality of bladders are further configured to support the patient in one of a Reverse Trendelenburg position, the Trendelenburg position, and the horizontal position. 5
8. The patient support of either claim 6 or claim 7, wherein the plurality of bladders are further configured to raise a leg section of the patient. 10
9. The modular patient support of claim 6 wherein the bladders are configured to support the patient in one of the Trendelenburg position, a Reverse-Trendelenburg position, the horizontal position, and a knee gatch position. 15
10. The modular patient support of any preceding claim, further comprising an inflator configured to selectively inflate at least one of the plurality of inflatable bladders, and a controller configured to control the inflator to control the inflation of said at least one of the plurality of inflatable bladders. 20
11. The patient support of any preceding claim, wherein the non-static mattress is further configured to provide at least one of heel pressure relief, rotation therapy, vibration therapy, percussion therapy, and turn assist. 25
12. The modular patient support of any preceding claim, wherein the non-static mattress is a modular design. 30

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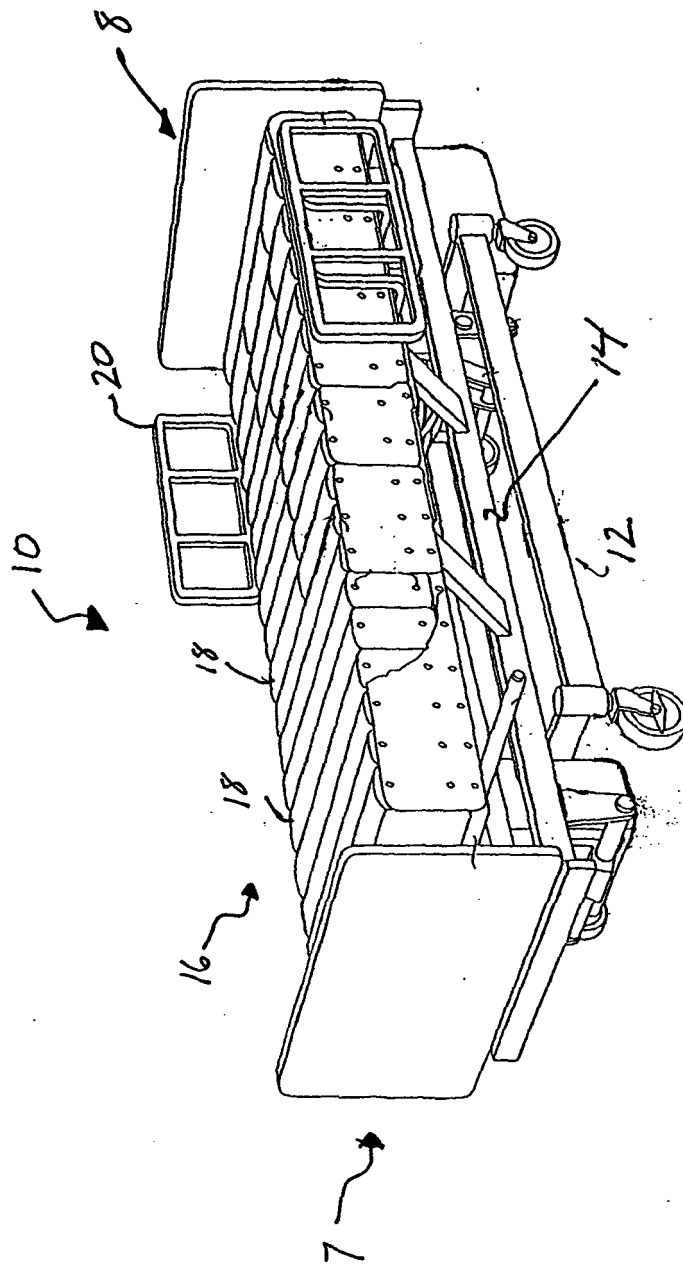
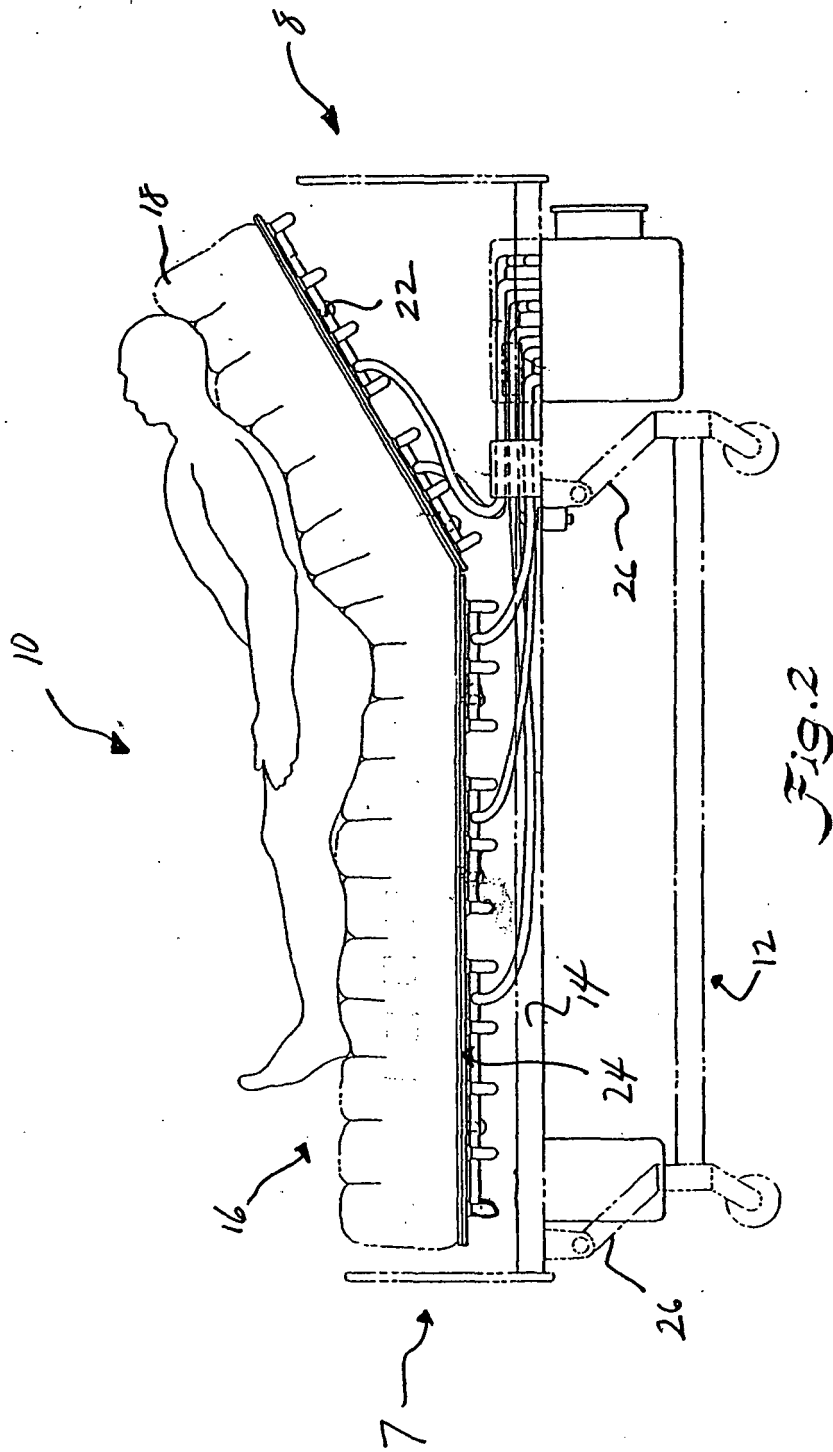


FIG. 1



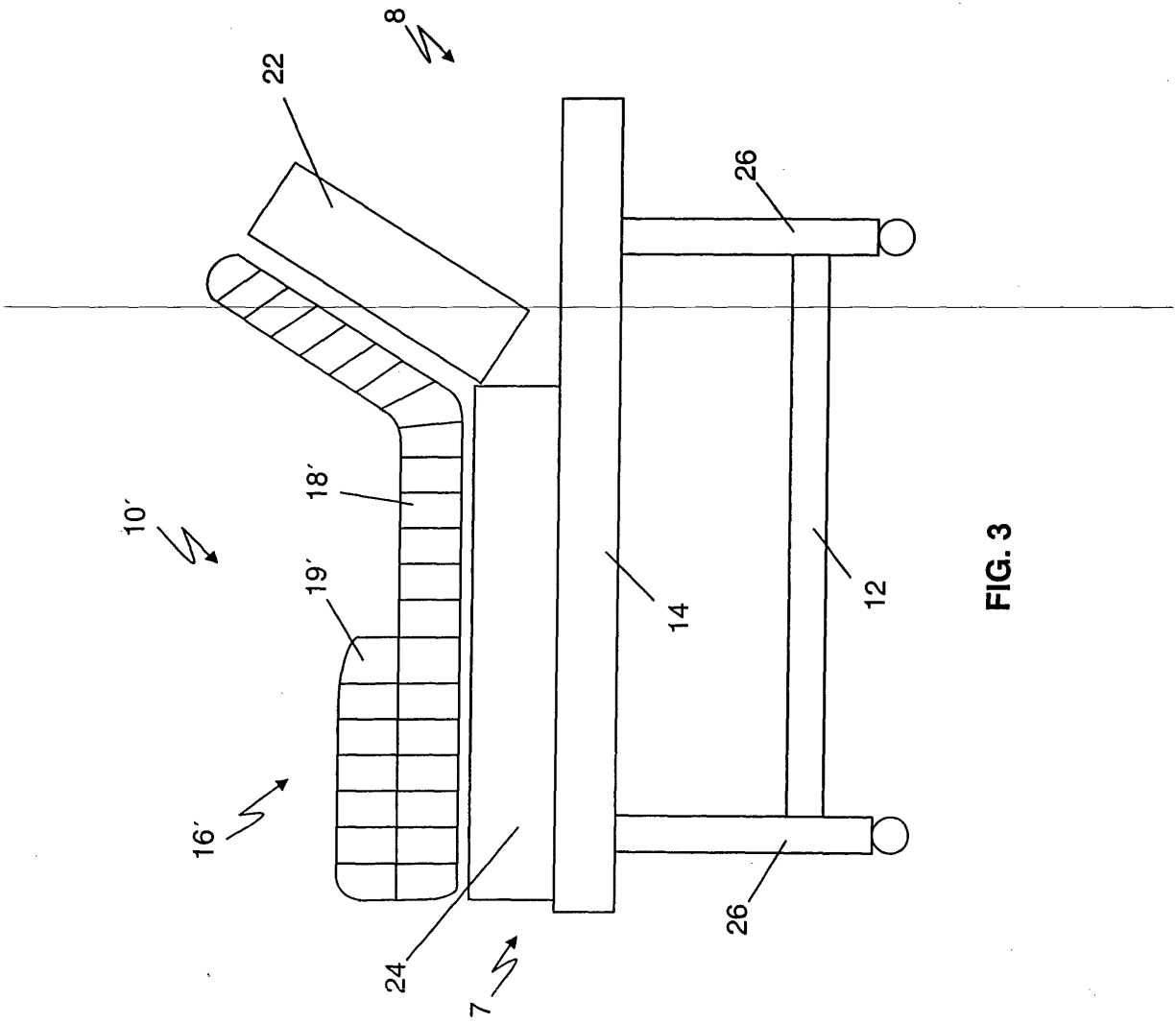


FIG. 3

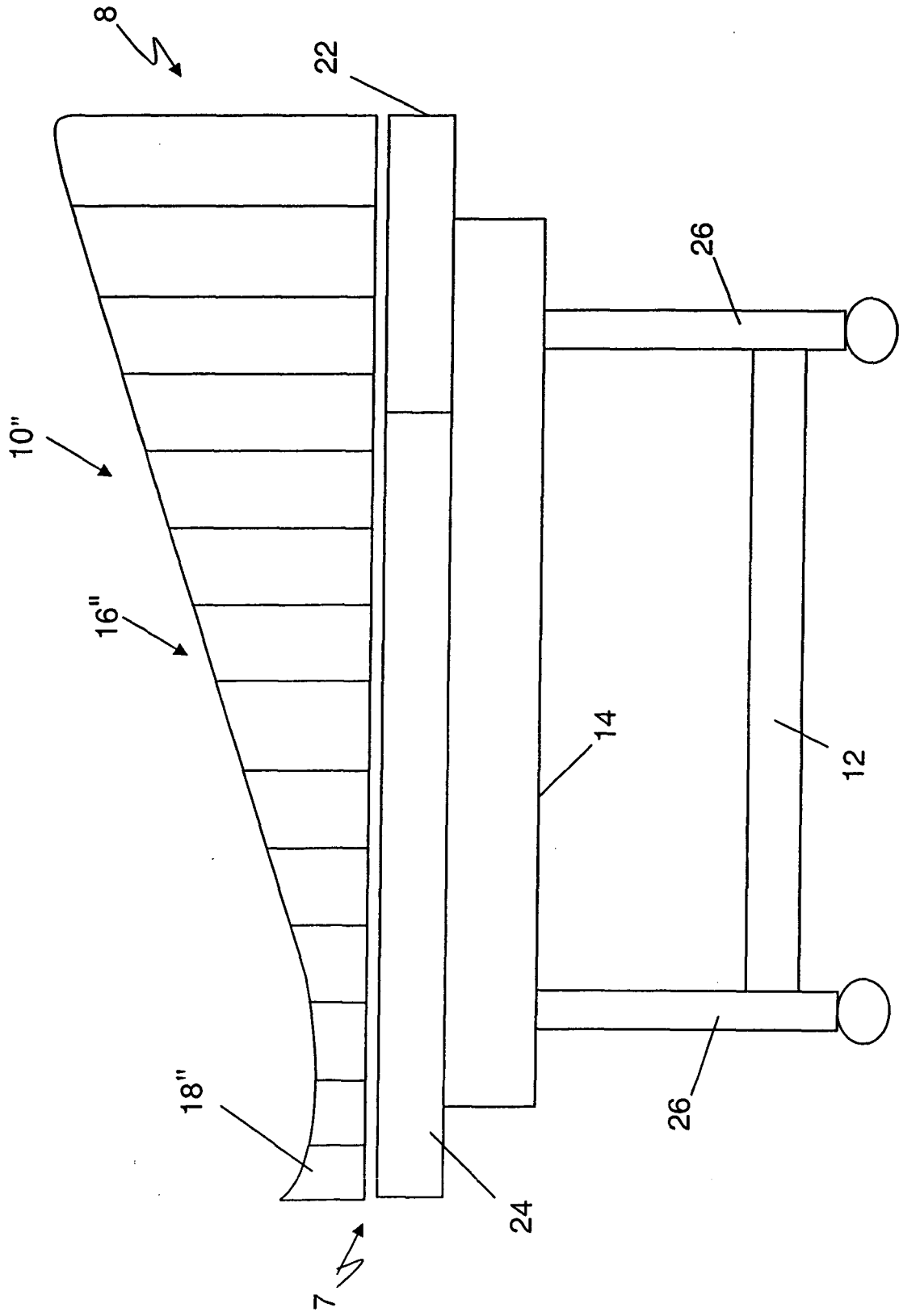


FIG. 4

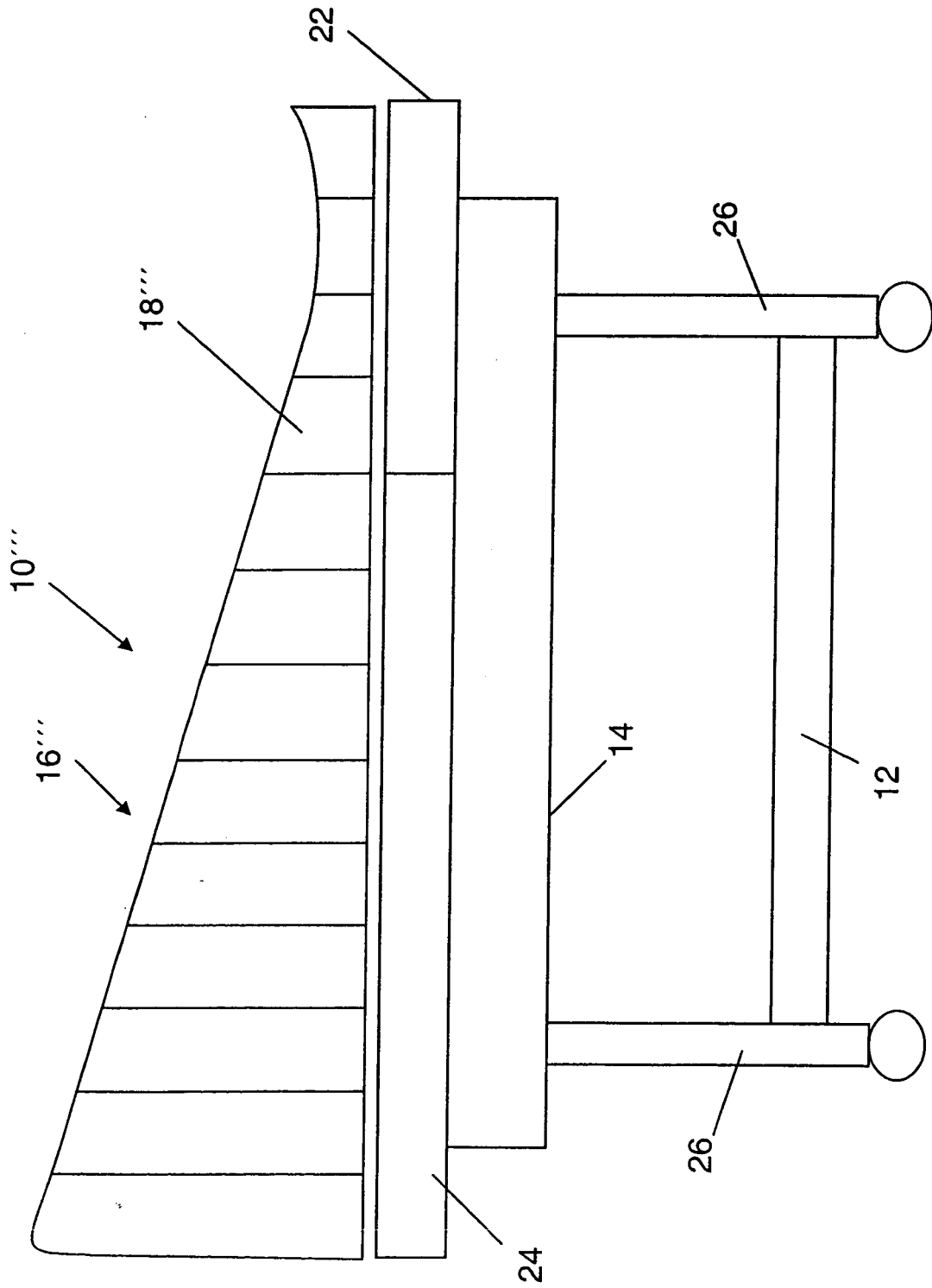


FIG. 5

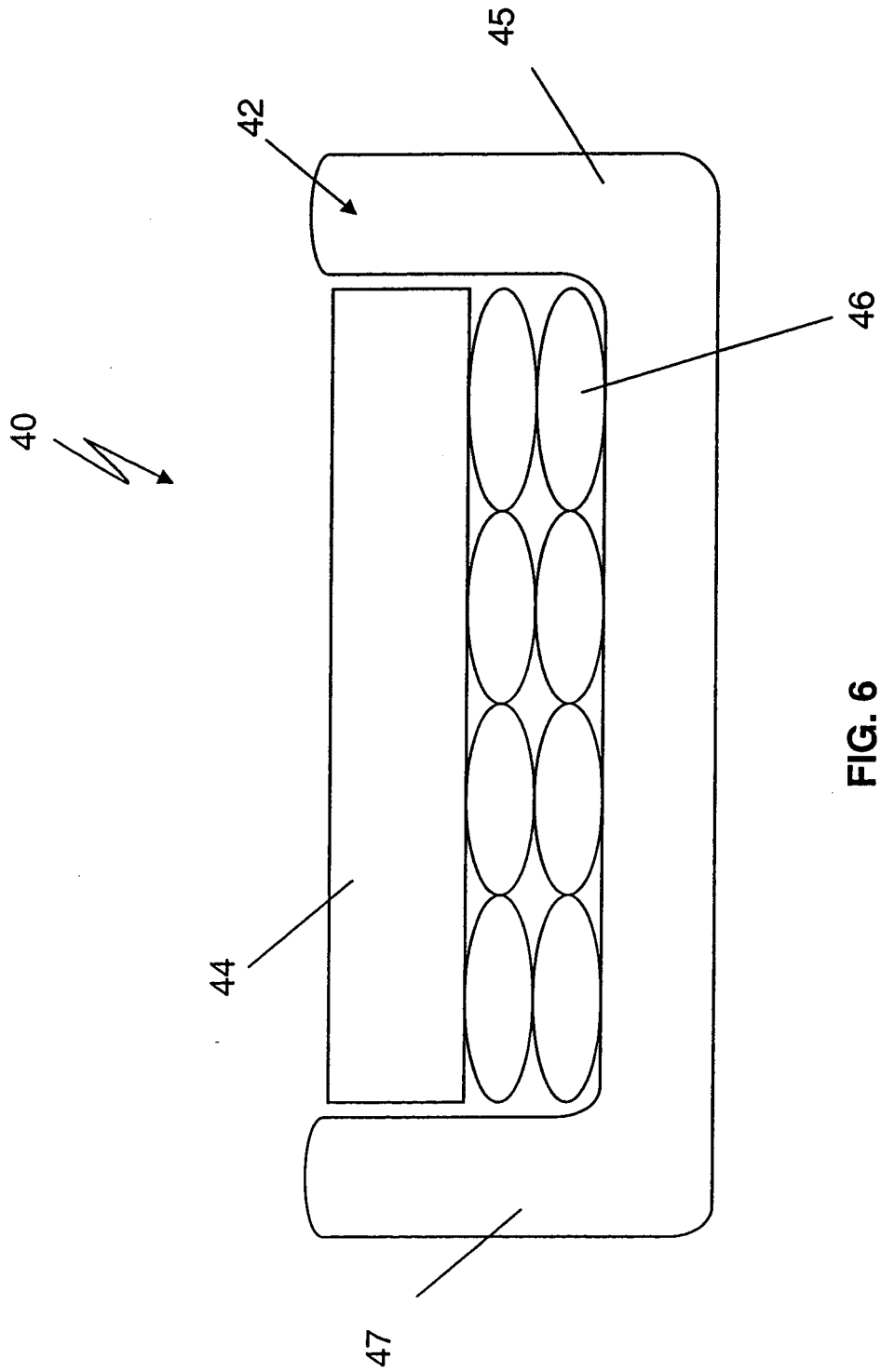


FIG. 6

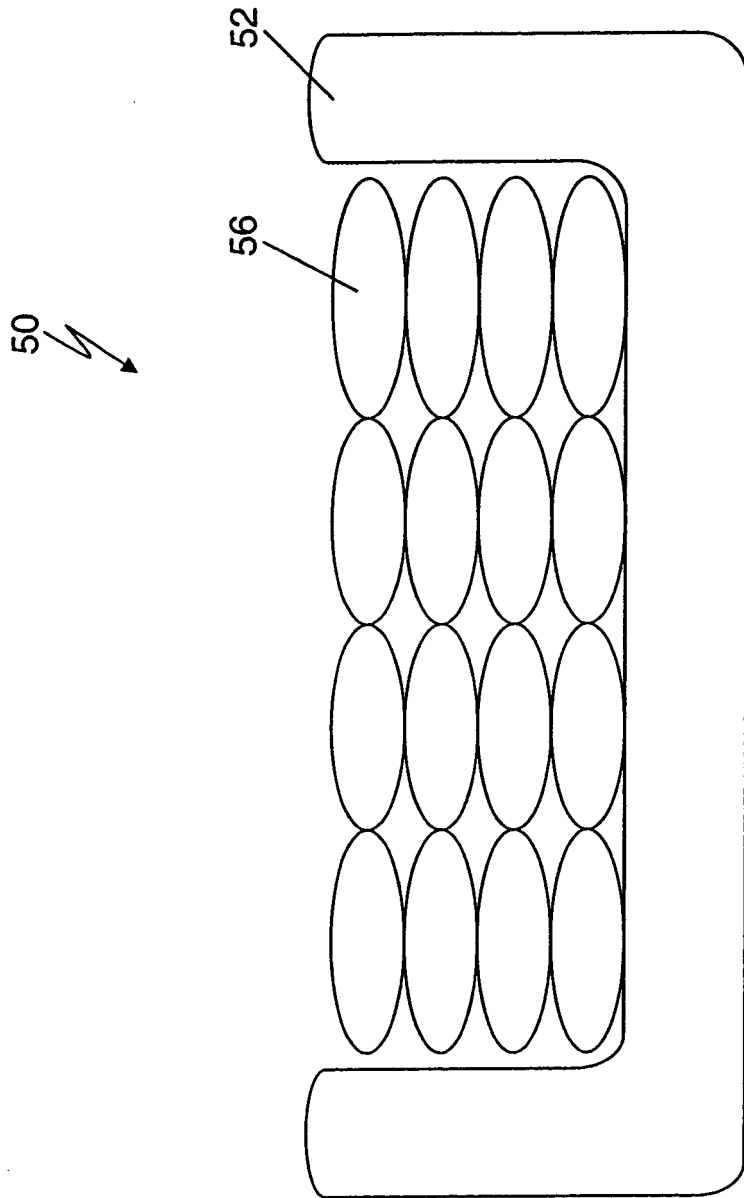


FIG. 7

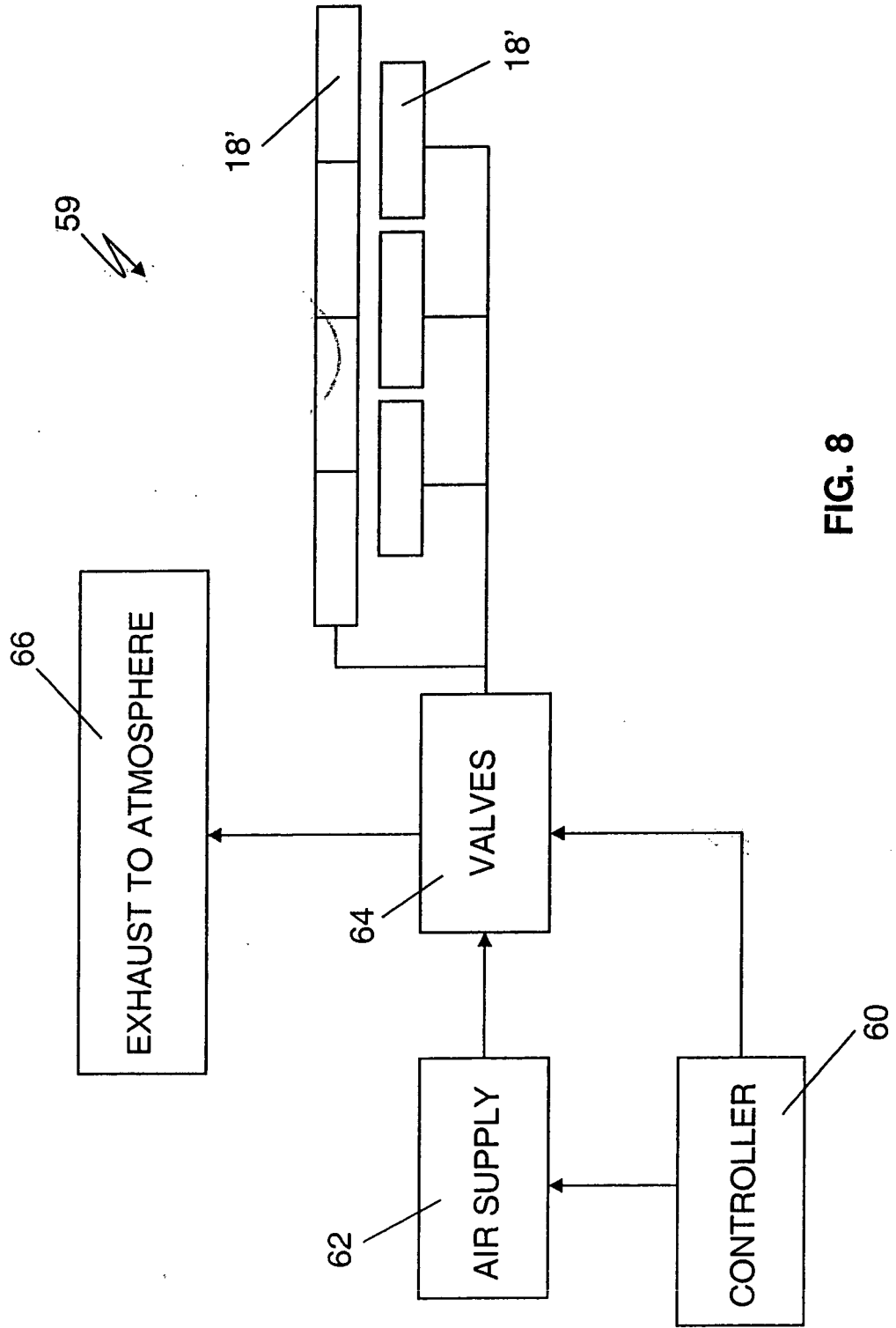


FIG. 8