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(54) Title: PANEL MOUNT WITH PITCH, ROLL AND YAW ADJUSTMENT

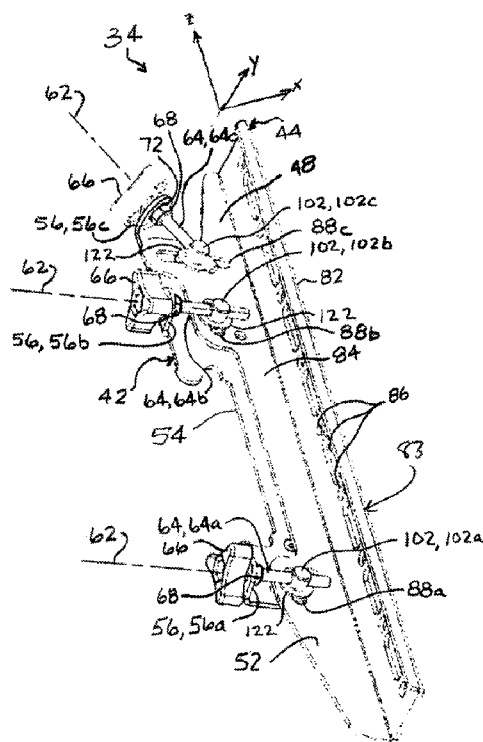


FIG. 3

(57) Abstract: A mounting system for adjusting the pitch, yaw and roll orientation of a panel display. The mounting system includes bracket assemblies comprising a mounting member and a floating member, the members having elongate slots that overlap each other in a non-parallel arrangement. Adjustment screws are coupled to interface adjustment pins that can move within the overlapping slots. The non-parallel arrangement between the slots passively secures the floating member relative to the mounting member without need for a set screw or clamp mechanism. The floating stems can be biased to provide a clamping force between the mounting and floating members. Washers and spacers comprised of dry, self-lubricating materials enable translation between the mounting and floating members and between the adjustment screws and the bracket assemblies.



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PANEL MOUNT WITH PITCH, ROLL AND YAW ADJUSTMENT

RELATED APPLICATIONS

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This application claims the benefit of U.S. Provisional Patent Application No. 61/663,284, entitled PANEL MOUNT WITH PITCH, ROLL AND YAW ADJUSTMENT, and filed June 22, 2012, said application being fully incorporated herein by reference.

10

FIELD OF THE INVENTION

The invention relates generally to mounting systems for display monitors, and more specifically to panel display mounting systems having an adjustable orientation.

BACKGROUND OF THE INVENTION

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Display arrays including multiple individual flat panel electronic displays have become common. Such arrays are especially common in commercial settings such as airports, malls, convention centers, and other such public venues.

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A drawback of prior display arrays is that it can be difficult to adjust the position of the individual displays so as to be precisely aligned with each other. Misalignment of the individual displays can detract from the aesthetic appearance of the array. Further, precise alignment of the individual displays can require extensive installer time, thereby causing delay and increasing installation expense.

What is needed in the industry is a panel display mount apparatus that can be used in an array, and that enables rapid and precise positional adjustment of the individual displays.

25

SUMMARY OF THE INVENTION

Embodiments of the invention meet the need of the industry for a panel display mount apparatus that can be used in an array, and that enables rapid and precise positional adjustment of individual displays. According to embodiments of the invention, a panel mounting system for
5 adjusting the pitch, yaw and roll orientation of a panel display. The mounting system includes bracket assemblies comprising a mounting member and a floating member, the members having elongate slots that overlap each other in a non-parallel arrangement. Adjustment screws are coupled to interface adjustment pins that can move within the overlapping slots. The non-parallel arrangement between the slots passively secures the floating member relative to the
10 mounting member without need for a set screw or clamp mechanism. The floating stems can be biased to provide a clamping force between the mounting and floating members. Washers and spacers comprised of dry, self-lubricating materials enable translation between the mounting and floating members and between the adjustment screws and the bracket assemblies.

In an embodiment of the invention, a panel display mounting bracket includes a first
15 member defining a first plurality of spaced-apart slots and having a display mounting surface for receiving a flat panel electronic display thereon, a second member defining a second plurality of spaced-apart slots and having structure for coupling to a support, and a plurality of adjustment pins, each adjustment pin extending through a separate one of the slots of the first plurality of slots and a corresponding one of the slots of the second plurality of slots so as to slidably couple
20 the first member to the second member. The bracket further includes a plurality of adjustment controls, each adjustment control operably coupled to a separate one of the adjustment pins and operable to shift the adjustment pin along at least one of the slots through which the adjustment pin extends, thereby shifting a position of the first member relative to the second member.

In further embodiments, the plurality of slots in the first member includes a first slot, a second slot, and a third slot, the first slot and the second slot being disposed substantially parallel to the display mounting surface and the third slot being disposed substantially perpendicular to the display mounting surface, and the plurality of slots in the second member includes a fourth slot, a fifth slot, and a sixth slot, the fourth slot registered with the first slot and disposed substantially perpendicular thereto, the fifth slot registered with the second slot and disposed substantially perpendicular thereto, and the sixth slot registered with the third slot and disposed at an angle relative thereto.

The adjustment controls may be operable to shift the first bracket vertically and horizontally relative to the second bracket. In embodiments, the second member can be a plate member, with the second plurality of slots being defined in the plate member, the second member further including a plurality of tab members, each of the adjustment controls being received by a separate one of the plurality of tab members. The plate member can define a hook for coupling with a mounting rail. Each adjustment control can include a rotatable knob.

In further embodiments, the first member can include a strut portion, the first plurality of spaced-apart slots being defined in the strut portion, the display mounting surface being oriented substantially perpendicular to the strut portion.

In another embodiment, a mounting system for a flat panel electronic display includes a mounting rail, and a pair of panel display mounting brackets spaced-apart on the mounting rail. Each of the panel display mounting brackets can include a first member defining a first plurality of spaced-apart slots and having a display mounting surface receiving the flat panel electronic display thereon, a second member defining a second plurality of spaced-apart slots and having

structure for coupling to the mounting rail, a plurality of adjustment pins, each adjustment pin extending through a separate one of the slots of the first plurality of slots and a corresponding one of the slots of the second plurality of slots so as to slidably couple the first member to the second member, and a plurality of adjustment controls, each adjustment control operably coupled
5 to a separate one of the adjustment pins and operable to shift the adjustment pin along at least one of the slots through which the adjustment pin extends, thereby shifting a position of the first member relative to the second member. The adjustment controls may be operable to shift the first bracket vertically and horizontally relative to the second bracket.

The second member can include a plate member, the second plurality of slots being
10 defined in the plate member, the second member further include a plurality of tab members, each of the adjustment controls being received by a separate one of the plurality of tab members. The plate member may define a hook for coupling with the mounting rail. The first member may include a strut portion, the first plurality of spaced-apart slots being defined in the strut portion, the display mounting surface being oriented substantially perpendicular to the strut portion. The
15 plurality of slots in the first member may include a first slot, a second slot, and a third slot, the first slot and the second slot being disposed substantially parallel to the display mounting surface and the third slot being disposed substantially perpendicular to the display mounting surface, and the plurality of slots in the second member may include a fourth slot, a fifth slot, and a sixth slot, the fourth slot registered with the first slot and disposed substantially perpendicular thereto, the
20 fifth slot registered with the second slot and disposed substantially perpendicular thereto, and the sixth slot registered with the third slot and disposed at an angle relative thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments of the present invention may be more completely understood in consideration of the following detailed description of various embodiments in connection with the accompanying drawings, in which:

5 FIG. 1 is a perspective view of the rear of an array of panel displays, each supported by a pair of bracket assemblies in an embodiment of the invention;

FIG. 2 is an enlarged view of a portion of the array of panel displays of FIG. 1;

FIGS. 3 and 4 are perspective views of an adjustable bracket assembly in an embodiment of the invention;

10 FIG. 5 is the perspective view of FIG. 3 with the adjustment screws and interface adjustment pins removed;

FIG. 6 is a perspective view of a mounting member of the bracket assembly of FIG. 3 in an embodiment of the invention;

15 FIG. 7 is a perspective view of a floating member of the bracket assembly of FIG. 3 in an embodiment of the invention;

FIG. 8 is an enlarged perspective view of a interface adjustment pin in assembly *sans* the mounting and floating members in an embodiment of the invention; and

FIG. 9 is an enlarged perspective view of a grooved end of a interface adjustment pin in assembly in an embodiment of the invention.

20 removed for clarity.

While the present invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the present invention to

the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS 1 and 2, an array 20 of display panels 22, each display panel 22 has a pair of bracket assemblies 24. In the depicted embodiment, each pair of bracket assemblies 24 are affixed to the back side of a respective display panel 22 of the array 20, and each pair of bracket assemblies 24 is coupled to a mounting rail 26. The mounting rail 26 can be supported, for example, by a structure 28 that suspends the array 20 of display panels 22 from a ceiling (as depicted) or from below, such as by a fixed or a mobile structure (not depicted). In one embodiment, each pair of bracket assemblies 24 includes a left bracket assembly 32 and a right bracket assembly 34, the left bracket assembly 32 being a mirror image of the right bracket assembly 34. Each of the bracket assemblies 32 and 34 can also include clamping tab 36 pivotally mounted to and secured in place with a clamping screw 38, for securing the respective bracket assembly 32, 34 to the mounting rail 26.

Referring to FIGS, 3 through 9, the right bracket assembly 34 (hereinafter referred to as simply the “bracket assembly” 34) is depicted in an embodiment of the invention. The bracket assembly 34 includes a mounting member 42 operably coupled with a floating member 44. The mounting and floating members 42 and 44 are characterized as having opposing open faces 46 and 48 that face away from each other. The mounting member 42 includes a plate portion 52 having structure that defines a notch 54 for mounting to the rail 26. The mounting member 42 further includes a plurality of tab members 56 that extend substantially perpendicular to the plate

portion 52. A first tab member 56a and a second tab member 56b of the plurality of tab members 56 are located on substantially the same plane. A third tab member 56c of the plurality of tab members 56 is oriented at an acute angle θ relative to the first and second tab members 56a and 56b. An example and non-limiting magnitude of the angle θ is 60°.

5 Each tab member 56 includes a through hole 58 that defines an adjustment axis 62 passing therethrough, the adjustment axis 62 being substantially perpendicular to the corresponding tab member 56. A plurality of adjustment screws 64 (referred to individually as first, second and third adjustment screws 64a, 64b and 64c), one for each of the corresponding tab members 56, are disposed in the corresponding through holes 58 of the respective tab
10 members 56. In one embodiment, the adjustment screws 64 include a hand knob 66 on one end, and the adjustment screw 64 is retained within the respective through hole 58 using a locking nut 68. In one embodiment, a washer 72 is disposed between the locking nut 68 and the tab member 56. A plurality of mounting member slots 74 (referred to individually as first, second and third mounting member slots 74a, 74b and 74c) are formed in the plate portion 52 of the mounting
15 member 42, each being formed adjacent a corresponding one of the plurality of tab members 56 and each having a major dimension 76 along a major axis 78. The major axis 78 of each mounting member slot 74 is substantially parallel with the adjustment axis 62 of the through hole 58 of the corresponding tab member 56.

20 The floating member 44 includes a flange portion 82, presenting a display mounting surface 83, and a strut portion 84 that is substantially perpendicular to the flange portion 82 and the display mounting surface 83. The flange portion 82 can include a plurality of slots and/or apertures 86 formed thereon to facilitate the mounting of the panel display 22 thereto. The strut portion 84 includes a plurality of elongate floating member slots 88, each having a major length

92 defining a major axis 94, and each being located on the floating member 44 so as to overlap with the elongate mounting member slots 74 of the mounting member 42. A first floating member slot 88a and a second floating member slot 88b are oriented so that the major axes 94a and 94b are substantially perpendicular to the major axes 78a and 78b, respectively, of the first and second mounting member slots 74a and 74b. A third floating member slot 88c is oriented so that its major axis 94c is substantially perpendicular to the major axes 94a and 94b of the first and second floating member slots 88a and 88b.

The bracket assembly 34 can also include a plurality of interface adjustment pins 102 (referred to individually as first, second and third interface adjustment pins 102a, 102b and 102c). In one embodiment, each of the interface adjustment pins 102 includes a head portion 104 with a threaded port 106 passing laterally therethrough, and a grooved end 108 opposite the head portion with a tangential groove 112 formed thereon. The interface adjustment pins 102 are disposed within and pass through each of the overlapping elongate slots 74 and 88. That is, the first interface adjustment pin 102a passes through the first mounting member slot 74a and the first floating member slot 88a where these slots overlap, the second interface adjustment pin 102b passes through the second mounting member slot 74b and the second floating member slot 88b where these slots overlap, and the third interface adjustment pin 102c passes through the third mounting member slot 74c and the third floating member slot 88c where these slots overlap. Each adjustment screw 64 is engaged with the threaded port 106 of a corresponding interface adjustment pin 102. The tangential groove 112 formed on the grooved end 108 of each interface adjustment pin 102 is adapted to accommodate an e-clip washer 114.

In assembly, the floating member 42 is placed over the mounting member so that the elongate floating member slots 88 cross the elongate mounting member slots 74. Washers 122

can be positioned on the open faces 46, 48 of the mounting and floating members 42, 44, with the through holes of the washers 122 aligned at the locations of each of the crossings of the elongate slots 74 and 88. In one embodiment, spacers 124 are also disposed between the mounting and floating members 42 and 44 at the respective crossings of the mounting member slots 74 and floating member slots 88. Each interface adjustment pin 102 is then inserted through the mounting member 42, floating member 44 and the washers 122 and spacers 124 at the respective crossings of the elongate mounting member and floating slots 74 and 88, such that the head 104 of the interface adjustment pin 102 extends outward from the open face 48 of the floating member 44 and the grooved end 108 of the interface adjustment pin 102 extends outward from the open face 46 of the mounting member 42. The e-clip washer 114 is inserted into the tangential groove 112 of the grooved end 108 of the interface adjustment pin 102 to capture the mounting member 42 and the floating member 44 and attendant washers 122 and spacer 124 between the head 104 and the grooved end 108 of the interface adjustment pin 102. In one embodiment, a biasing element 126 such as a wave washer (as depicted, FIG. 8) to apply a clamping force between the mounting member 42 and the floating member 44.

Each of the locking nuts 68 is then aligned with the adjustment axis 62 of the through hole 58 of a respective tab member 56, and the head 104 of the interface adjustment pin 102 oriented so that the threaded port 106 is also aligned with the adjustment axis 62. In one embodiment, the washer 72 is disposed between each locking nut 68 and the respective tab member 56. The adjustment screw 64 is then inserted through the through hole 58 of the tab member 56 and threaded through the locking nut 68 and the threaded port of the interface adjustment pin. The locking nut can be drawn up close to the tab member or washer for light contact therewith.

The various washers 72, 122 and spacers 124 of the assembly can be made of a low friction material, such as polytetrafluoroethylene (TEFLON) or a thermoplastic such as polyoxymethylene (DELTRIN). Such materials enable the assembly to be lightly clamped together, while still enabling the surfaces in contact with the washers and spacers to rotate and
5 translate.

In operation, adjustment of the first adjustment screw 64a causes the first interface adjustment pin 102a to translate with in the first mounting member slot 74a and to rotate the floating member 44 about the second interface adjustment pin 102b, the second interface adjustment pin 102b remaining fixed. Similarly, adjustment of the second adjustment screw 64b
10 causes the second interface adjustment pin 102b to translate with in the second mounting member slot 74b and to rotate the floating member 44 about the first interface adjustment pin 102a, the first interface adjustment pin 102a remaining fixed. During these adjustments, the third interface adjustment pin 102c rotates in an arc about the respective fixed rotating stem 102a or 102b. The arc is accommodated by simultaneous translation of the third interface adjustment pin
15 102c within the third mounting member slot 74c and the third floating member slot 88c. Accordingly, adjustment of one of the first and second adjustment screws 102a or 102b changes the pitch (i.e., rotational position about the y-axis) of the flange portion 82 of the floating member 44, and any panel display 22 affixed thereto.

It is further noted that equal adjustment of the first and second adjusting screws 64a and
20 64b in the same direction results in translation of the floating frame 44 in a direction perpendicular to the flange portion 82 of the floating member 44.

Adjustment of the third adjustment screw 64c causes the floating member 44 to translate relative to the mounting member 42 and in a direction parallel to the flange portion 84 of the

floating member 44 (i.e., to translate along the z-axis). During this action, the first and second interface adjustment pins 102a and 102b remain fixed in place, and the floating member 44 can only translate along the axes 94a and 94b of the first and second floating member slots 88a and 88b about the respective first and second interface adjustment pins 102a and 102b. Also during
5 this action, the third interface adjustment pin 102c translates within the third floating frame slot 88c and within the third mounting frame slot 74c as the third adjustment screw 64c is adjusted. Specifically, in an adjustment where the third adjustment screw 64c is rotated clockwise (assuming right hand threads), the third interface adjustment pin 102c is drawn along the major axis 78 of the third mounting member slot 74c and towards the knob 66 of the third adjustment
10 screw 64c, which also causes the third interface adjustment pin 102c to translate laterally away from the flange portion 84 along the major axis 94c of the third floating member slot 88c (i.e., in a direction parallel to the x-axis). A counterclockwise rotation will cause an opposite action—i.e., translation away from the knob 66 and along the major axis 78 of the third mounting member slot 74c and translation towards the flange portion 84 of the floating member 44 along
15 the major axis 94c of the third floating member slot 88c. By the above-described action, the floating member 44, restricted by the floating member slots 88a and 88b, undergoes a translation that is parallel to the flange portion of the floating member 44 (i.e., translation parallel to the z-axis).

Accordingly, each bracket assembly of each bracket assembly pair 24 has the capability
20 of moving its respective floating member 44 portion in translation in the x and z directions, and to pitch about the y-axis. Therefore, adjusting the pitch of each bracket 32, 34 adjusts the pitch of the panel display 22 attached thereto. Adjusting the translation of the right bracket 34 relative to the left bracket 32 in the x-direction causes the panel display to yaw (i.e., to rotate about the z-

axis). And adjusting the translation of the right bracket 34 relative to the left bracket 32 in the z-direction causes the panel display 22 to roll (i.e., to rotate about the x-axis). In this way, each panel display 22 of the array 20 can be adjusted to conform with the other panel displays 22 to define a planar assembly in a well-meshed array.

5 The foregoing descriptions present numerous specific details that provide a thorough understanding of various embodiments of the invention. It will be apparent to one skilled in the art that various embodiments, having been disclosed herein, may be practiced without some or all of these specific details. In other instances, components as are known to those of ordinary skill in the art have not been described in detail herein in order to avoid unnecessarily obscuring
10 the present invention. It is to be understood that even though numerous characteristics and advantages of various embodiments are set forth in the foregoing description, together with details of the structure and function of various embodiments, this disclosure is illustrative only. Other embodiments may be constructed that nevertheless employ the principles and spirit of the present invention. Accordingly, this application is intended to cover any adaptations or
15 variations of the invention.

For purposes of interpreting the claims for the present invention, it is expressly intended that the provisions of 35 U.S.C. § 112(f) are not to be invoked unless the specific terms “means for” or “step for” are recited in a claim.

CLAIMS

What is claimed is:

1. A panel display mounting bracket comprising:
 - a first member defining a first plurality of spaced-apart slots and having a display mounting surface for receiving a flat panel electronic display thereon;
 - a second member defining a second plurality of spaced-apart slots and having structure for coupling to a support;
 - a plurality of adjustment pins, each adjustment pin extending through a separate one of the slots of the first plurality of slots and a corresponding one of the slots of the second plurality of slots so as to slidably couple the first member to the second member;
 - a plurality of adjustment controls, each adjustment control operably coupled to a separate one of the adjustment pins and operable to shift the adjustment pin along at least one of the slots through which the adjustment pin extends, thereby shifting a position of the first member relative to the second member.
2. The panel display mounting bracket of claim 1, wherein the plurality of slots in the first member includes a first slot, a second slot, and a third slot, the first slot and the second slot being disposed substantially parallel to the display mounting surface and the third slot being disposed substantially perpendicular to the display mounting surface, and wherein the plurality of slots in the second member includes a fourth slot, a fifth slot, and a sixth slot, the fourth slot registered

with the first slot and disposed substantially perpendicular thereto, the fifth slot registered with the second slot and disposed substantially perpendicular thereto, and the sixth slot registered with the third slot and disposed at an angle relative thereto.

3. The panel display mounting bracket of claim 1, wherein the adjustment controls are operable to shift the first bracket vertically and horizontally relative to the second bracket.

4. The panel display mounting bracket of claim 1, wherein the second member comprises a plate member, the second plurality of slots being defined in the plate member, the second member further comprising a plurality of tab members, each of the adjustment controls being received by a separate one of the plurality of tab members.

5. The panel display mounting bracket of claim 4, wherein the plate member defines a hook for coupling with a mounting rail.

6. The panel display mounting bracket of claim 1, wherein each adjustment control comprises a rotatable knob.

7. The panel display mounting bracket of claim 1, wherein the first member comprises a strut portion, the first plurality of spaced-apart slots being defined in the strut portion, the display mounting surface being oriented substantially perpendicular to the strut portion.

8. A mounting system for a flat panel electronic display, the system comprising:
- a mounting rail;
 - a pair of panel display mounting brackets spaced-apart on the mounting rail, each of the panel display mounting brackets comprising:
 - a first member defining a first plurality of spaced-apart slots and having a display mounting surface receiving the flat panel electronic display thereon;
 - a second member defining a second plurality of spaced-apart slots and having structure for coupling to the mounting rail;
 - a plurality of adjustment pins, each adjustment pin extending through a separate one of the slots of the first plurality of slots and a corresponding one of the slots of the second plurality of slots so as to slidably couple the first member to the second member;
 - a plurality of adjustment controls, each adjustment control operably coupled to a separate one of the adjustment pins and operable to shift the adjustment pin along at least one of the slots through which the adjustment pin extends, thereby shifting a position of the first member relative to the second member.
9. The mounting system of claim 8, wherein the second member comprises a plate member, the second plurality of slots being defined in the plate member, the second member further

comprising a plurality of tab members, each of the adjustment controls being received by a separate one of the plurality of tab members.

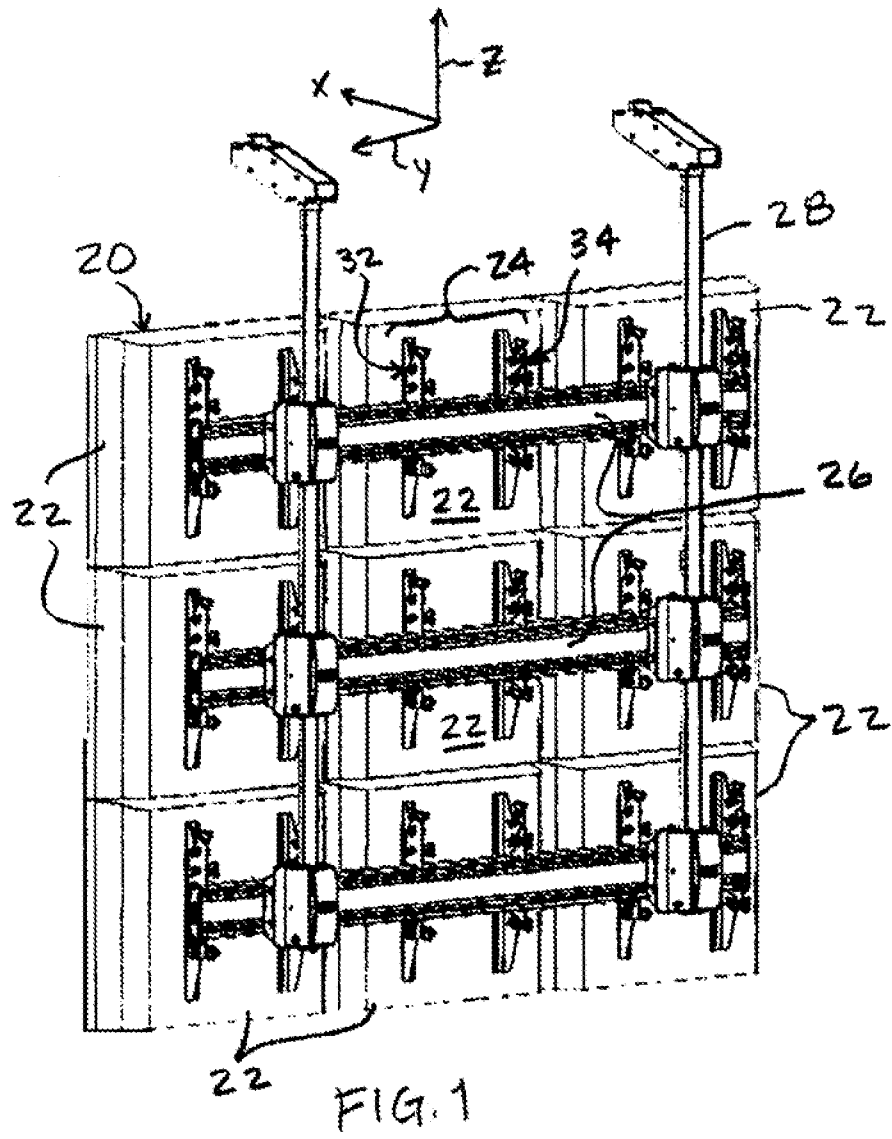
10. The mounting system of claim 9, wherein the plate member defines a hook for coupling with the mounting rail.

11. The mounting system of claim 8, wherein each adjustment control comprises a rotatable knob.

12. The mounting system of claim 8, wherein the first member comprises a strut portion, the first plurality of spaced-apart slots being defined in the strut portion, the display mounting surface being oriented substantially perpendicular to the strut portion.

13. The mounting system of claim 8, wherein the plurality of slots in the first member includes a first slot, a second slot, and a third slot, the first slot and the second slot being disposed substantially parallel to the display mounting surface and the third slot being disposed substantially perpendicular to the display mounting surface, and wherein the plurality of slots in the second member includes a fourth slot, a fifth slot, and a sixth slot, the fourth slot registered with the first slot and disposed substantially perpendicular thereto, the fifth slot registered with the second slot and disposed substantially perpendicular thereto, and the sixth slot registered with the third slot and disposed at an angle relative thereto.

14. The mounting system of claim 8, wherein the adjustment controls are operable to shift the first bracket vertically and horizontally relative to the second bracket.



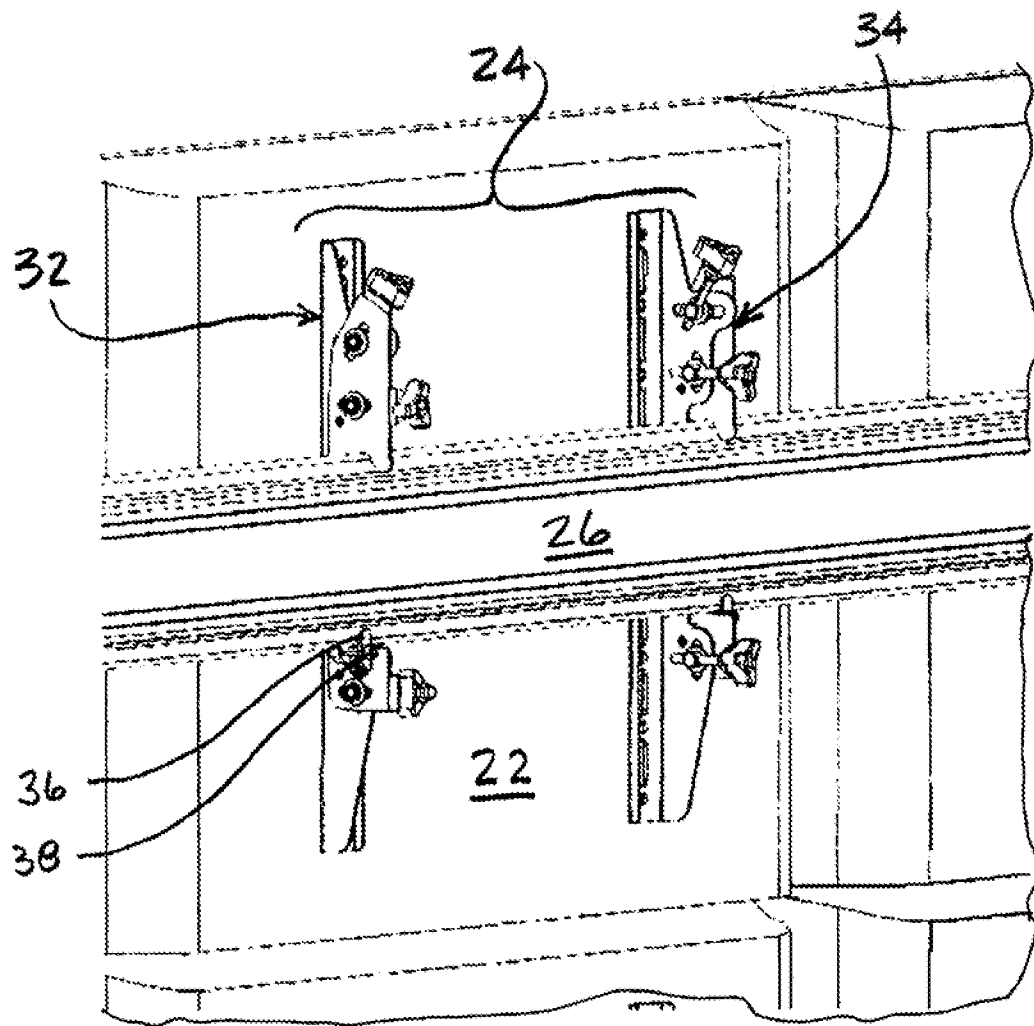


FIG. 2

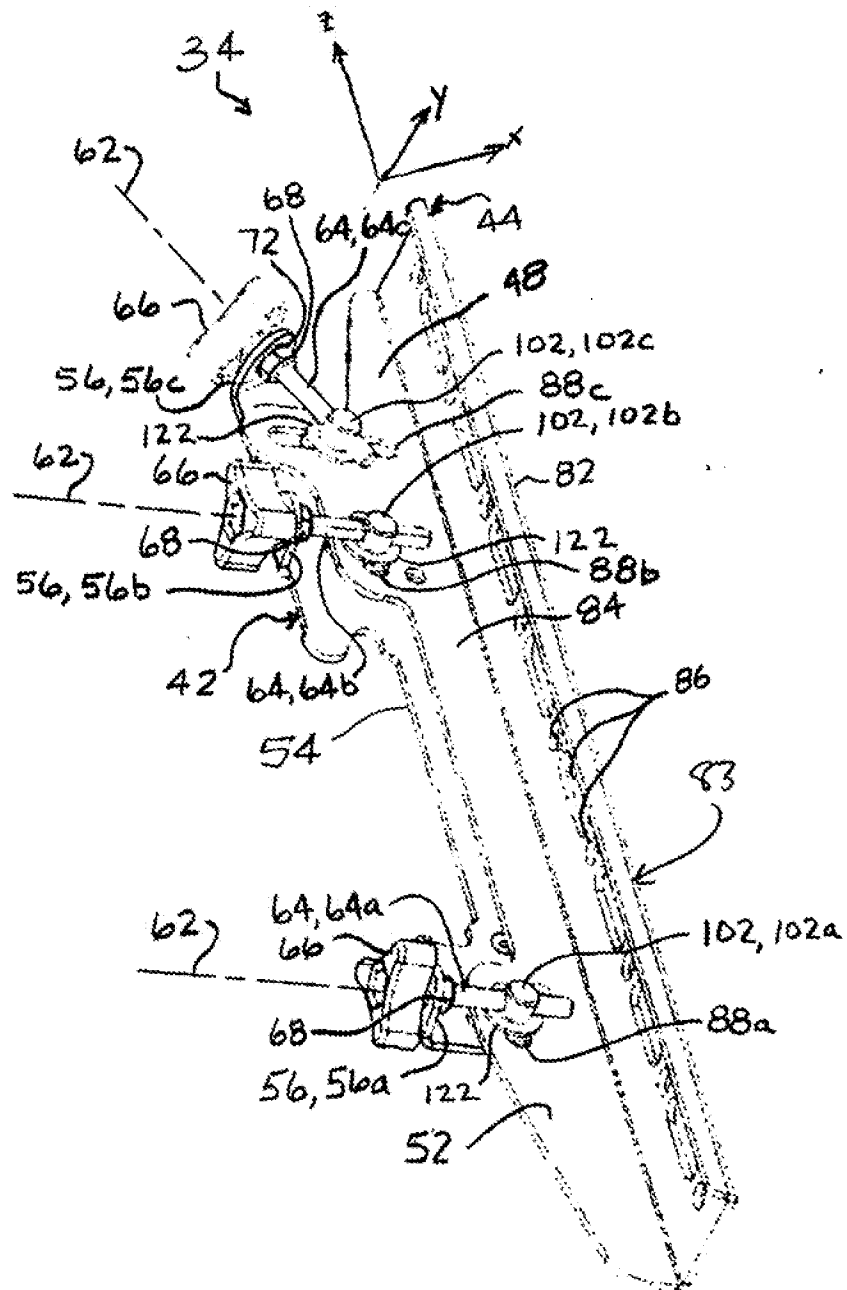


FIG. 3

4/8

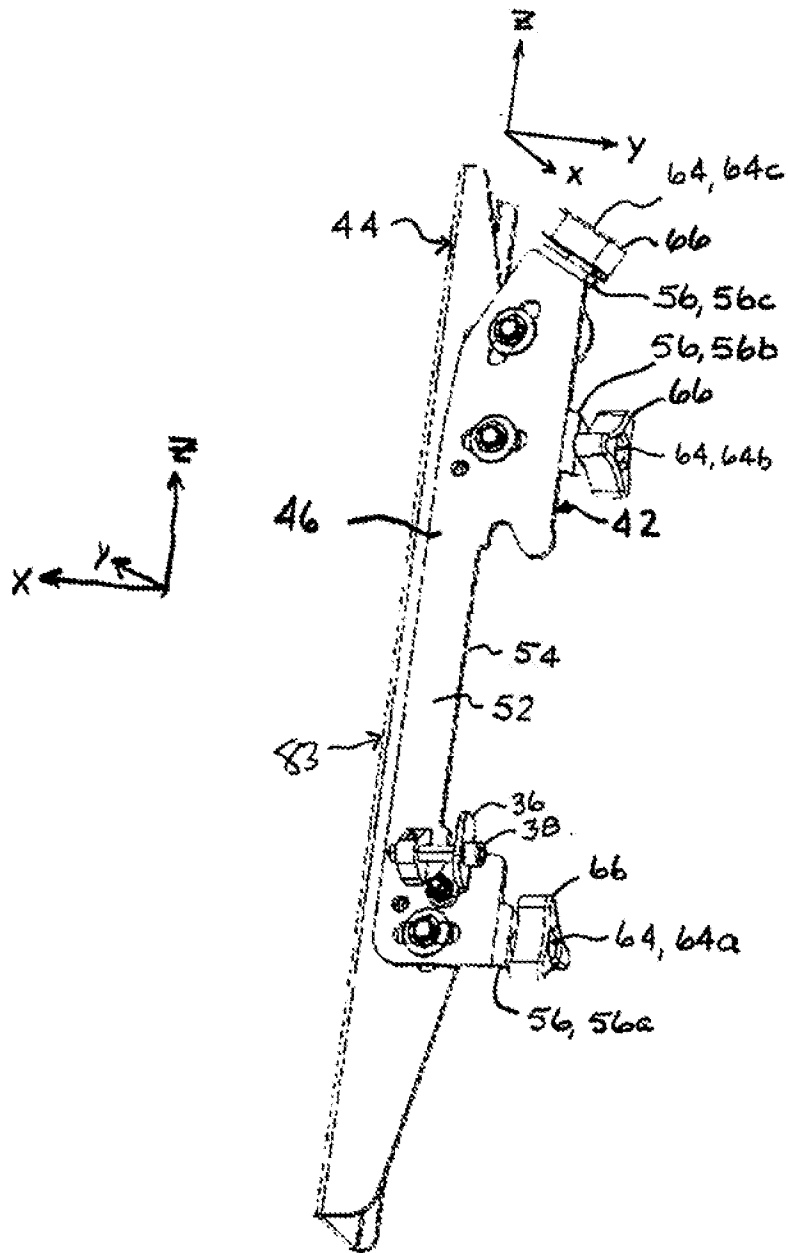


FIG. 4

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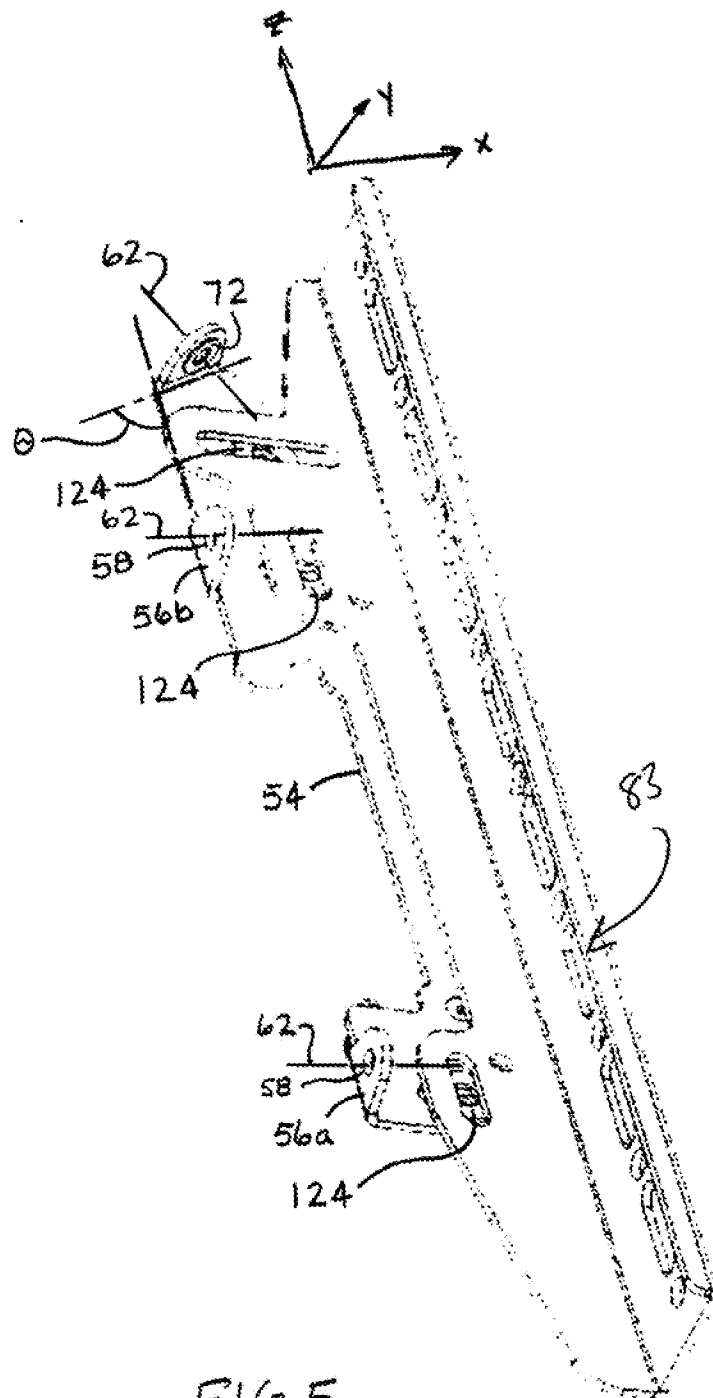


FIG. 5

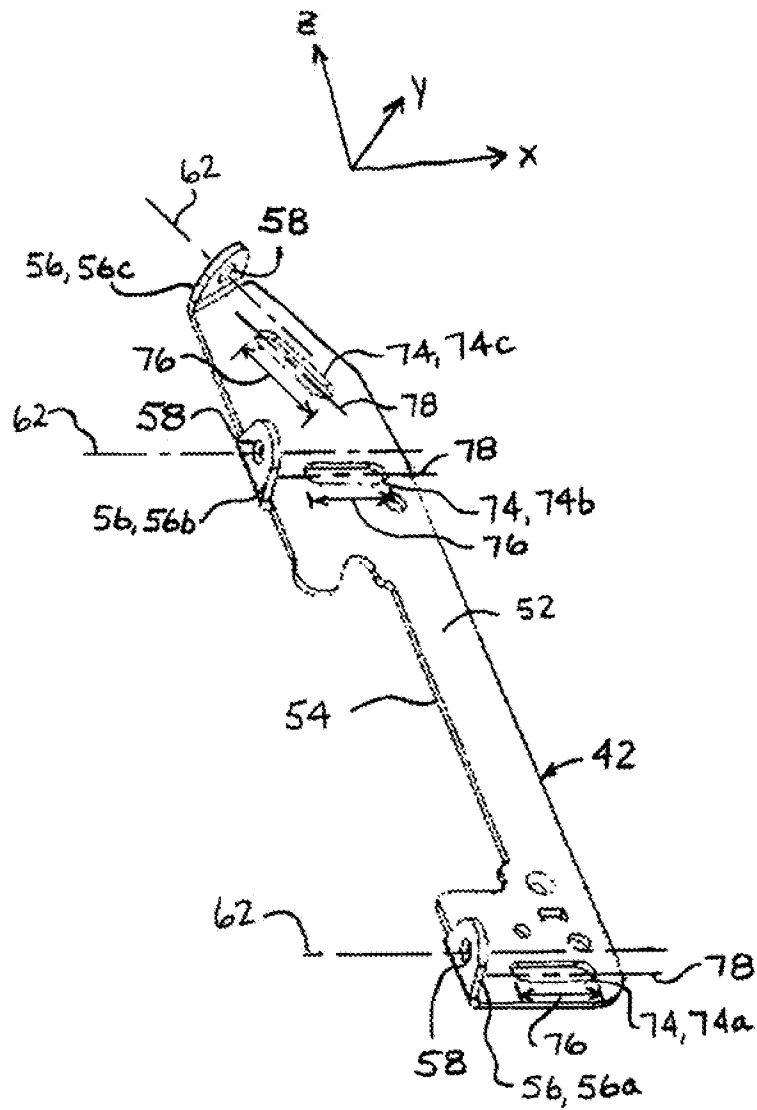


FIG. 6

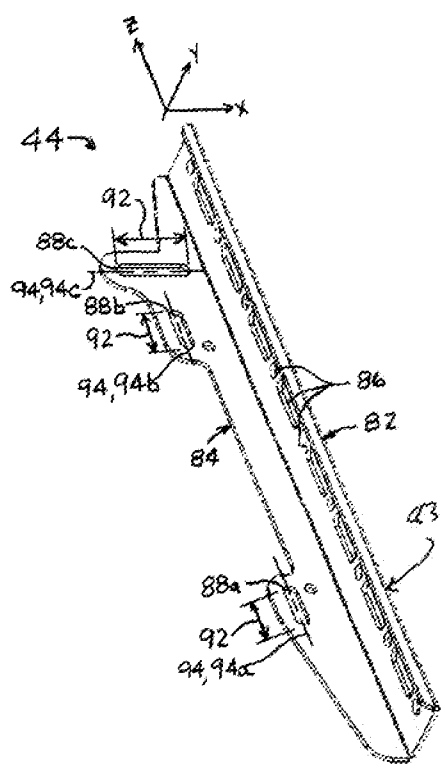


FIG. 7

8/8

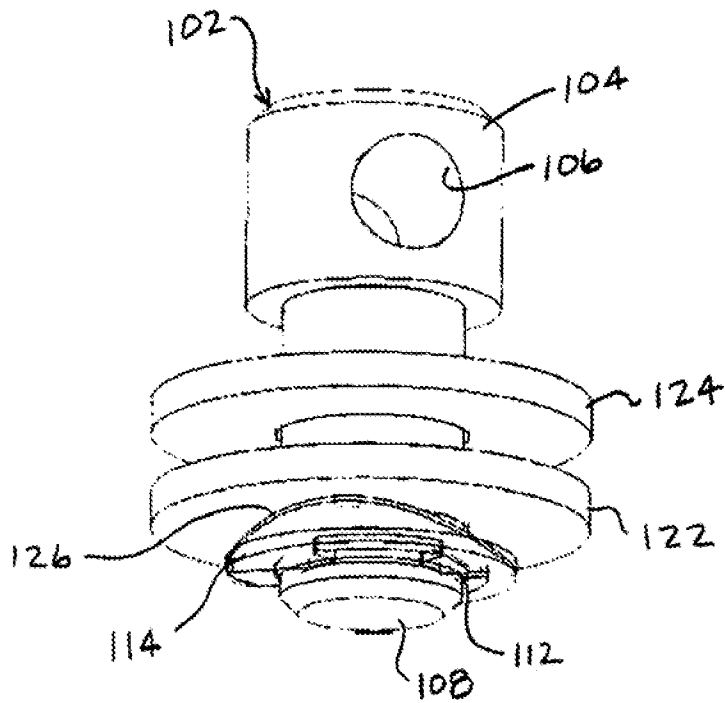


FIG. 8

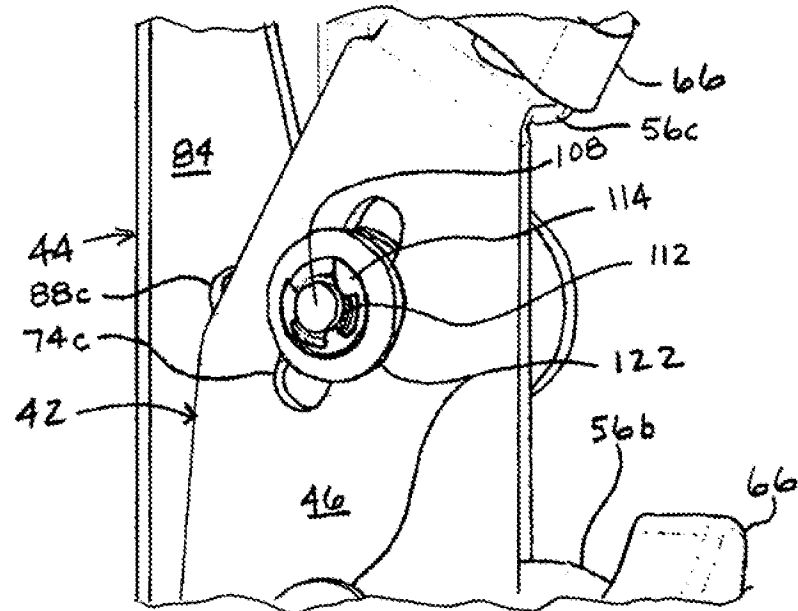


FIG. 9