APPARATUSES AND METHODS FOR MOUNTING DISPLAYS

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ABSTRACT
Methods and apparatuses for mounting a display, including flat panel television (FPD) or similar display devices. A base object is mounted to a base member with at least two joints for rotatable coupling, each joint near an opposite end of the base member. A FPD is mounted to a mounting member with at least two joints for rotatable coupling, each joint near an opposite end of the mounting member. At least two arms, a first arm member with a first end coupled to the first joint of the base member and a second end coupled to the first joint of the mounting member, and a second arm with a first end coupled to the second joint of the base member and a second end coupled to the second end of the mounting member. Other embodiments of the invention are further described herein.
APPARATUSES AND METHODS FOR MOUNTING DISPLAYS

PRIORITY CLAIM

[0001] This application claims priority to provisional application No. 60/796,048, filed on May 1, 2006. The provisional application in its entirety is hereby incorporated by reference.

TECHNICAL FIELD

[0002] Embodiments of the present invention relate to a mechanical mount device, and more specifically to a mount for flat panel televisions display or other similar display device.

BACKGROUND OF THE INVENTION

[0003] Flat panel display televisions (FPD) have reached a price point where they are becoming popular. FPDs come in a range of sizes and are associated with a range of weights. Comparing to traditional cathode ray tube electronic display devices, FPDs are generally much lighter in weight. FPDs are generally displayed on a stand or mounted on an immovable or fixed object such as a wall or a column. The trend is to mount these flat panel TVs on walls so they resemble paintings or photographs. However, a common problem with mounting FPDs on the wall is that the direction in which the wall faces is not always the direction in which a user views the FPD screen. Depending on the layout of the room or location of the viewer, the viewing angle of the FPD screen may be less than optimal.

[0004] One solution is a bracket designed to mount on a wall with an arm extending outward from the bracket and the wall. The FPD is mounted onto the arm via another joint. The joints at each end of the arm allow the TV and arm to move and rotate so the FPD can be adjusted to an optimal viewing angle. However the range of movement of the TV and the arm is limited by the size of the TV and the length of the arm. If the TV is too big, the sides of the TV will simply hit the wall in any rotational movement. Furthermore, if the TV is heavy, the joints’ strength and the arm strength should be large enough to sustain the force and moment created by the TV. Since the joints and the arm are critical, failure of either may lead to catastrophic results. This method works as long as the material and joints are strong. Consequently this may also lead to high production costs of the mount.

[0005] A better solution is proposed in this disclosure discloses a display mounting device using a novel design that provides a large range of motion and has sufficient strength to carry a large amount of weight.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0007] FIGS. 1A-1D illustrate different views of a mounting member in accordance to an embodiment of the invention;

[0008] FIGS. 2A-2D illustrate different views of a base member in accordance to an embodiment of the invention;

[0009] FIGS. 3A-3B illustrate two different side views of the display mounting device with a flat panel television display (FPD) mounted against a wall, in accordance to an embodiment of the invention;

[0010] FIGS. 3C-3D illustrate a top view and a side view of an arm member respectively, in accordance to one embodiment of the invention;

[0011] FIGS. 4A-4B illustrate two different perspective views of a FPD on a mounting member pivotally rotating about two different ends of the base member in accordance to an embodiment of the invention;

[0012] FIGS. 5A-5B illustrate two different frontal views of a FPD on a mounting member pivotally rotating about two different ends of the base member, corresponding to FIGS. 4A and 4B, respectively;

[0013] FIGS. 5C-5H illustrate cross-sectional views of the joints shown in FIG. 5A;

[0014] FIGS. 5I-5N illustrate cross-sectional views of the joints shown in FIG. 5B;

[0015] FIGS. 6A-6B illustrate different top views of the FPD on a mounting member rotating about a base member attached to a wall at different angles in accordance to an embodiment of the invention;

[0016] FIGS. 7A-7J illustrate multiple different views of a joint that can be used to connect an arm member to a mounting member and/or a base member in accordance to an embodiment of the invention;

[0017] FIGS. 8A-8C illustrate different views of two different mounting members in accordance to an embodiment of the invention; and

[0018] FIGS. 9A-9C illustrate different views of two different base members in accordance to an embodiment of the invention.

[0019] FIGS. 10A-10D illustrate different side views of two different display mounting devices with a FPD mounted against the wall in accordance with an embodiment of the invention.

[0020] FIGS. 11A-11C illustrate different perspective and side views of another different display mounting device in accordance with an embodiment of the invention.

[0021] FIGS. 12A-12C illustrate different perspective views of a cabinet with doors mounted on a similar hinge system as illustrated on display mounting devices described in accordance with an embodiment of the invention.

[0022] FIGS. 13A-13C illustrate different frontal views of a door on a frame with a similar hinge system as illustrated on display mounting devices described in accordance with an embodiment of the invention.

SUMMARY OF THE INVENTION

[0023] Described herein are methods and apparatuses for mounting, and more specifically mounting of a flat panel television or similar display devices. In one embodiment, a base object is mounted to a base member with at least two joints for rotatable coupling, each joint near an opposite end of the base member. A FPD is mounted to a mounting member with at least two joints for rotatable coupling, each joint near an opposite end of the mounting member. At least two arms, a first arm member with a first end coupled to the first joint of the base member and a second end coupled to the first joint of the mounting member, and a second arm with a first end coupled to the second joint of the base member and a second end coupled to the second end of the mounting member.

[0024] In another embodiment, a base member is configured to mount against a base object and having at least two
joints for rotatable coupling. A first joint of the base member is near one end of the base member, and a second joint of the base member is near a second end of the base member. The first joint of the base member is positioned at an offset from the second joint of the base member so they are not directly aligned. A mounting member is configured to mount to a display. The mounting member has at least two joints for rotatable coupling. A first joint of the mounting member is near a first end of the mounting member and a second joint of the mounting member is near a second end of the mounting member. The first joint of the mounting member is positioned at an offset relative to the second joint of the mounting member so they are not directly aligned. At least two arms are used to connect the mounting member and the base member. A first arm has one end coupled to the first joint of the base member and a second end coupled to the first joint of the mounting member. A second arm has one end coupled to the second joint of the base member and a second end coupled to the second end of the mounting member.

In one embodiment, the display mounting device has a first mounting member capable being mounted to a fixed object; a second mounting member capable of being mounted to a display; and at least two arm member, each arm member having a first end and a second end, wherein, a first end of a first arm member is coupled to a first joint near a first end of the first mounting member and a second end of the first arm member is coupled to a second joint near a second end of the second mounting member; and a first end of a second arm member is coupled to a first joint near a second end of the first mounting member and a second end of the second arm member is coupled to a second joint near a first end of the second mounting member.

In yet another embodiment, the display mounting device has a first mounting member configured to mount against a fixed object on a back side, the first mounting member having 2 joints, each of the two joints are placed near an opposite end of the first mounting member at an offset apart; a second mounting member configured to mount against a display on a front side, the second mounting member having two joints, each of the two joints are placed near an opposite end of the second mounting member at an offset apart; and at least two arms, each arm having a first end and a second end, each of the at least two arms coupling one joint on the second mounting member to one joint on the first mounting member, wherein the second mounting member overlaps the first mounting member in a neutral position and the second mounting member and a first arm is configured to rotated about a first end of the first mounting member, and the second mounting member and a second arm is configured to rotate about a second end of the second mounting member.

DETAILED DESCRIPTION

Embodiments of apparatuses and methods for mounting a display against an object, for example, a flat panel television display (FPD) against a wall are described herein. In the following description, numerous details are set forth. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without these specific details. In some instances, well-known structures and devices not shown in detail, in order to avoid obscuring the present invention.

Reference throughout this specification to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of the phrases “in one embodiment” or “in an embodiment” or “in another embodiment” or “in a different embodiment” etc., in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

In one embodiment, the term “joint” is used herein to refer to a point for connecting two members so the two members may move or rotate relative to each other. “Joint” should be construed broadly to include any hinge joint, ball joint, pin joints or the like that allow two members to be coupled, while allowing movement relative to each other. Thus “Joint” is broadly construed as the point of attachment of two members which may at least rotatably move about each other.

In one embodiment, the term “arm member” is used herein to refer to a member with two ends, each end connected to a joint. Each “arm member” may be of any shape, size, form in between the two ends and may be made of any material as deemed appropriate by one with ordinary skills in the art to accomplish its functional objective. For example, an “arm member” may be a flat, straight metal rod with holes on each end for coupling with hinge joints.

In one embodiment, the terms “base member” or “mounting member” are used herein to refer to a member that may both attaches to an object and movably coupled to an “arm member”, allowing the “arm member” to move freely relative to the member.

In one embodiment, the term “base object” or “fixed object” is used herein interchangeably to refer to an object which is used to provide stability and act as a stable base when mounted to a base member. The “base object” or “fixed object” may include a wall, a column, an immovable object, a fixed object or any object which can substantially counter the weight of a flat panel display television (FPD) or any other display object when it is mounted onto the mounting member. The “base object” is mounted against the base member to provide stability when moving a display on a mounting member relative to the base member. In certain embodiments, the base object may be a portion of a door frame.

A display mounting device described herein includes at least a mounting member to mount a display, a base member to mount to a base object, and at least two arm members to connect the mounting member to the base member. A unique feature of the display mounting device is that once the display is mounted on the apparatus on a base object, such as the wall, the display can freely move from a neutral position to pivotally rotate about a vertical axis at a left end of the base member or to pivotally rotate about a vertical axis at a right end of the base member. This can be performed without disconnecting any joints in the structure. While a display can be a painting, a sculpted piece of art or any form of an object for display, a flat panel television panel (FPD) will be used in this description for exemplary purpose and should not be construed to be restrictive. Similarly, a base object can be any object that can provide stability to the FPD and the display mounting device such as a wall, a
column, a frame, a stand, or any object that is substantially heavier than the FPD. In this description, the use of a wall or a column shall be used for purpose of illustration and should not be construed to be restrictive.

[0034] FIGS. 1A to 1D illustrate different views of a mounting member 100 in accordance to an embodiment of the invention. FIGS. 1A to 1D are the back view, front view, side view (from the right side) and a perspective view of a mounting member 100, respectively. FIGS. 1C and 1D provide two clear views of the unique geometry of the mounting member 100. In view FIGS. 1A to 1D, even though the mounting member 100 is one continuous piece, one can view the uniform piece as having three different portions: a top member 110, a bottom member 120, and a display attachment member or “X” cross-member 130 where the FPD attaches, and connects the mounting member top 110 to the mounting member bottom 120. As illustrated in FIG. 1C, through the voids 140 or milled out sections of the display attachment member 130, bolts 190 are used to securely attach a front side of the mounting member 100 against the back of the FPD.

[0035] FIGS. 1A and 1B illustrate the details of the mounting member 100 as viewed from the back and the front of the mounting member, respectively. All references to left and right are directed from a view from the front of the mounting member 100. Therefore, in a view from the back, left and right as referenced will be reverse of what is seen on the page.

[0036] In viewing FIGS. 1A and 1B, the top and bottom members 110, 120 are each shaped like a “U” on its side, with the “base” of the “U” facing the front and the “top” of the “U” facing the back. Each of the top member and the bottom member may be seen as divided into top pieces and bottom pieces. Specifically, mounting member top 110 may be seen as divided into a top half 110T and a bottom half 110B. Similarly, mounting member bottom 120 can be divided into a top half 120T and a bottom half 120B. Distinction of each of the upper half of the mounting member top 110T and the mounting member bottom 110B are used to identify the locations at which the arm members are attached. In this embodiment, a left hole 115L is on the top half 110T of the mounting member top 110 and a right hole 115R is on the bottom half 110B of the mounting member top 110. A right hole 125R is on the top half 120T of mounting member bottom 120 and a left hole 125L is on the bottom half 120B of the mounting member bottom 120. In one embodiment, the horizontal distance between the two holes on the mounting member top 110 is same as the horizontal distance between the two holes on the mounting member bottom 120 as all the arm members used to connect the base member to the mounting member 100 are of the same length. It should be appreciated that in this particular embodiment, four arm members (as to be illustrate below) are used to attach the mounting member 100 to the base member.

[0037] In this embodiment, placement of the holes to form joints are arbitrary, so long as there are two holes on each of the mounting member top 110 and the mounting member bottom 120, one for each end of an arm. In addition, the two holes on each mounting member top 110 or mounting member bottom 120 are at opposite ends, and there should be a vertical offset between the two holes on each mounting member top 110 and mounting member bottom 120. In other words, a different embodiment can have a hole near a right end on top half 110T of the mounting member top 110 and a hole near a left end on bottom half 110B of the mounting member top 110. The two holes on the mounting member top 110 are independent of the two holes on the mounting member bottom 120, so long as the two holes on the mounting member top are aligned with the hole that is on the same side of the mounting member bottom 120 and separated by a same horizontal distance as the two holes on the mounting member bottom 120.

[0038] FIGS. 1C and 1D, the side view and the perspective view, respectively, illustrate another unique feature in this embodiment. The cross-member 130 is attached to the mounting member top 110 and the mounting member bottom 120 near the “top” of the “U”, or at the back side of the mounting member top 110 and the mounting member bottom 120. This particular attachment of the cross-member 130 places the back of the FPD as close to the base member and the wall as possible, thus minimizing space between the FPD and the wall and provide a more elegant placement of the FPD on the wall.

[0039] An additional feature of this mounting member is that the arm members and part of the base member fits into the recesses between top half 110T and bottom half 110B of the mounting member top 110 and between the top half 120T and bottom half 120B of the mounting member bottom 120. The combination of these two features allows the display mounting device to be discreet while allowing the FPD to be as near the wall as possible, thus creating a visual effect where the FPD is like a picture hanging from the wall. This embodiment of the mounting member 100 takes advantage of the space near the edges and behind the FPD screen unoccupied by the back of the FPD for placement of arm members. In another embodiment, speakers may be mounted on the side, top or bottom of the mounting member. In yet another embodiment, a shelf or ledge or the like used to hold the remote control or user accessories for the FPD may be attached to the bottom of the mounting member or be built-in as part of the mounting member 100. Since the mounting member can rotate about two different axes near opposite ends of the base member, the mounting member and the base member can have predetermined sides, such as a predetermined right side, a predetermined left side, a predetermined bottom, and a predetermined top. This allows a designer to create features, such as a shelf on the predetermined bottom to act as a “mantle” or shelf for remote controls, etc.

[0040] Yet another embodiment has the movement or rotation of the mounting member motorized. In other words, the rotation of the mounting member can be controlled by a remote control via a control mechanism and a motor which drives the movement of the mounting member in rotating to either the left or right sides.

[0041] In one embodiment, the mounting member is preferably made of steel. But the mounting member may be made of any metal, metal alloy, polymer, or even plastic, provided that the material can withstand a substantial load, such as the load of a FPD. Since FPD ranges in sizes from 15" to over 65" and weighs from the range of about 30 lb to over 150 lbs, in particular steel, is the preferred material of choice.

[0042] FIGS. 2A to 2D illustrate different views of a base member 200 in accordance to an embodiment of the invention. FIGS. 2A to 2D illustrate a frontal view, a back view, a side view, and a perspective view of a base member,
respectively. Similar to the mounting member, the one-piece base member may be viewed as having separate portions: base member top 210, base member bottom 220, and a support structure 230. In this embodiment, voids or slots 240 are milled into the base member top 210 and base member bottom 220 for attachment to the wall. In particular, at least 3 slots are made on each of the base member top 210 and base member bottom 220 to account for attachment to studs on the wall. The voids or slots have an elongated shape to provide flexibility for attaching the base member to the wall in cases where studs are not placed at a same distance a part.

The support structure 230 serves to align the base member top 210 to the base member bottom 220 and may also provide torsional support for the base member 200. In a different embodiment, the support structure used to connect the base member top 210 to the base member bottom 220 may be used as points of attachment to the wall. It should be appreciated that FPDs has sizes ranging at least from about 15° to about 80° and weighs in the range of about 30 lbs to about 300 lbs. Therefore, depending on the size of the FPD, the base member should be attached to at least two studs if the FPD is at least 20° and weighs at least 50 lbs and should be attached to at least 3 studs if the FPD is at least 40° and weighs at least 100 lbs for support.

One should appreciate that while the cross-member 230 provides torsional support and helps to align the base member top 210 and base member bottom 220, only the portions of the base member for attaching arms to the base member and the portions of the base member to attach the base member to the wall are necessary. Therefore, potentially, the one-piece base member as shown may be replaced by 2 pieces including only the base member top 210 and base member bottom 220 in one embodiment, or replaced by 4 pieces including only the four corners of the base member 200, in another embodiment. In either of these last two embodiments, proper alignment of the pieces will be essential to connect with the arms and the mounting member.

FIG. 2A to 2C show that the base member top 210 and base member bottom 220 each has a right angle with portions 210H and 220H pointing away from the wall. FIG. 2A to 2D also illustrate four holes, two on each of 210H and 220H respectively, where the joints to the arm members are formed. As described earlier, the arm members and part of the base member top 210 and base member bottom 220 fits into the recesses in the mounting member top 110 and mounting member bottom 120 respectively. Specifically, portions 210H and 220H and their respectively attached arm members are designed to fit into mounting member top 110 and mounting member bottom 120, respectively.

FIGS. 2A to 2D also illustrate that holes 215R and 215L on the base member top are vertically aligned with holes 225R and 225L respectively and thus having a same horizontal distance between the corresponding pair of holes. It should be appreciated that the two pairs of holes 215R, 215L, 225R and 225L are drilled on the same level without a vertical offset. However, it will be appreciated that the vertical offset is obvious when the arms are both mounted on a top surface and bottom surface of 210H and 220H. Consequently, after attaching the arms to the top surface and the bottom surface, the two joints are offset essentially by the thickness of the member 210H and 220H. This will be apparent in FIGS. 3, 4 and 5. In another embodiment, the slots 240 for attachment need not be horizontally placed long voids, but may be vertical holes or voids on vertical members attaching the base member top 210 to the base member bottom 220. In one embodiment, the base member is preferably made of steel. But the base member may be made of any metal, metal alloy, polymer, or even plastic, provided that the material can withstand a substantial load, such as the load of a FPD. As explained earlier, metal, in particular steel, is the preferred material of choice. In addition, the base member may be mounted over a mechanism which allows translational motion, up, down, left and/or right movements. Such a mechanism will first be attached to the wall and the base member mounted over the mechanism. Furthermore, such a mechanism may be motorized, such that it can be controlled by remote control. Therefore, the FPD on the display mounting device attached to such a mechanism may be able to move up, down, left and/or right at a touch of a button and controlled by a viewer.

Figs. 3A and 3B illustrate two different side views of the FPD attached to the display mounting device using mounting member 100 and base member 200 as described in FIGS. 1A-1D and 2A-2D, against a wall. FIG. 3A is a view from the left side of the FPD and FIG. 3B is a view from the right side of the FPD, both views are of the FPD and the display mounting device in a neutral position mounted on a wall. It may be appreciated that the mounting member 100 and the base member 200 are fitted into each other. Specifically, portion 210H and 220H of the base member 200 is fitted into the recesses between 110H and 110H and between 120T and 120B of the mounting member 100 respectively. Note also that the back 302 of the FPD is placed closer to the wall because the back of the FPD 302 is attached to the attachment member 130 which is recessed close to cross member 230. It should be reminded that a top, bottom, left, and right views of the display mounting device is defined by the neutral position when the FPD is attached to the display mounting device which in turn is mounted to the wall. The wall defines the back side, the FPD defines the front side, the floor defines bottom and the ceiling of a room defines the top.

FIGS. 3A and 3B also shows the locations of attachment of arms members 310, 320, 330 and 340 from a view from the left and from the right respectively. One should appreciate that the attachment configuration, or joint locations, of arm members 310-340 to the mounting member 100 and to the base member 200 may differ than illustrated. In this embodiment, arm member 310 is attached on a top surface of 210H (FIG. 3B) and a bottom surface of 110T (FIG. 3A). Arm member 320 is attached on a top surface of 110B (FIG. 3B) and a bottom surface of 210H (FIG. 3A). Arm member 330 is attached on a bottom surface of 120T (FIG. 3B) and a top surface of 220H (FIG. 3A). Arm member 340 is attached on a top surface of 120B (FIG. 3B) and a bottom surface of 220H (FIG. 3A). While the attachment configuration of the arms may differ, the unique feature of this embodiment is to take advantage of the space directly above and below the back of the FPD 302 for placement of the arm members, to permit the FPD to be closer to the wall.

FIGS. 3C and 3D illustrate the side view and the top view of an arm member 300. Each arm member 300 has two holes near each opposite end, one for attachment to the mounting member and another for attachment to the base member. It should be appreciated that for each arm, each end of the arm is attached to a different member. For example, if the left hole 395L is attached to the mounting member, the
right hole 395R should be attached to the base member, and vice versa. It is clear that both holes of the member cannot be attached to the same member. In one embodiment, all arm members have a same distance 391 between a left hole 395L and a right hole 395R. While this embodiment shows the arm member to be a flat piece, with a flat center section 393 and flat end sections 392 and 394, the shape and geometry of the arm member may differ according to the application. In the embodiment of a display mounting device as illustrated, the flat arm member is used to reduce vertical space about the top and bottom portions of the mounting member and the base member. In another embodiment, the arm may have flat end sections 392 and 394 but with a mid section 393 that is twisted 90 degrees from the end sections to accommodate for the geometry of the mounting piece or the application in which the arm member and the hinge joint is used. In a preferred embodiment, the arm members are made of metal or metal alloy, preferably steel. The arm members should be able to withstand high tension and high compression generated by the weight of the FPD when mounted onto the mounting member. However, with advance of material science, other materials such as polymer, plastic or non-metals may also be possible, but cost may be prohibitive.

[0049] FIGS. 4A and 4B illustrate perspective views of a FPD mounted onto a display mounting device that is attached to the wall. FIG. 4A shows the FPD pivotally rotated about a left end of the base member while FIG. 4B shows the FPD pivotally rotate about the right end of the base member. One should appreciate that the unique hinge system used in this display mounting device allows the FPD on a mounting member 100 to both pivotally rotate about the left end 492 of the base member and to pivotally rotate about the right end 494 of the base member. When the FPD is in a neutral position, the FPD is mounted with its back on the display mounting device flat against the wall. In one configuration, the FPD can pivotally rotate to the left as in FIG. 4A to accommodate a different view angle from the left. In another configuration, the FPD can pivotally rotate to the right as in FIG. 4B to accommodate for a different view angle from the right. The unique pivoting ability of this display mounting device is particularly applicable for placement at a location where the FPD may be viewable from different angles.

[0050] FIGS. 4A and 4B also illustrate the unique arm member movements as the FPD pivots about a left end 492 of the base member and pivots about a right end 494 of the base member. One should be aware that while a first set of arm members (320, 330) move with the mounting member 100 when the mounting member 100 pivotally rotate to the left, a second set of arm members (310, 340) stays with the base member 200 (see FIG. 4A). In contrast, the second set of arm members (310, 340) move with the mounting member 100 when the mounting member 100 pivotally rotate to the right, the first set of arm members (310, 340) stays with the base member 200 (see FIG. 4B). FIGS. 5A-5N shall illustrate the exact placements of the joints where the arm members 310-340 attach to the mounting member 100 and the base member 200. FIGS. 5A and 5B also distinguish the arm members that pivot with the mounting member 100 when the FPD swings to the left or the right.

[0051] FIGS. 5A and 5B show the frontal views of the display mounting device when the FPD is pivotally rotated toward the left and toward the right, respectively. FIGS. 5A and 5B are similar to FIGS. 4A and 4B, respectively. FIGS. 5A and 5B shows the frontal view of the FPD rotated to the left and to the right respectively. Therefore, FIGS. 5A and 5B show the frontal view of the base member 200 and the back view of the mounting member 100 respectively. The difference between FIGS. 5A and 5B is that in FIG. 5A, the mounting member 100 with FPD 101 is to the left of the base member 200 on the wall 303, and in FIG. 5B, the mounting member 100 with FPD 301 is to the right of the base member 200 on the wall 303.

[0052] In the following descriptions regarding FIGS. 5A and 5B, left and right are referred to according to the frontal views of both the mounting member 100 and the base member 200 (see FIGS. 1A, 1D and FIGS. 2A, 2D), therefore left and right of the mounting member 100 would be reversed when viewed from the back (as shown in FIGS. 5A and 5B).

[0053] FIG. 5A shows a FPD 301 mounting onto a mounting member 100 pivotally rotated to the left of the base member 200 which is mounted onto a wall 303 or column. It should be noted that the mounting member 100 is now viewed from its back with the FPD 301 mounted on its front side. Arm member 310 has its right end attached near the right end on the top surface of 210I of the base member and its left end attached near the left end on the bottom surface of 110T of the mounting member 100; arm member 320 has its left end attached on a bottom surface of 210I of the base member 200 and its right end attached near the right end on the top surface of 110I of the mounting member 100. Similarly, arm member 330 has its right end attached near the right end on the bottom surface of 120T of the mounting member 100 and its left end attached near the left end on the top surface of 220I of the base member 200; arm member 340 has its left end attached on a left end on a top surface of 120T of the mounting member 100 and its right end attached near the right end on the bottom surface of 220I of the base member 200.

[0054] FIGS. 5C to 5H illustrate the cross sectional view of the joints or arm members attachments to various locations of the mounting member 100 and the base member 200 as the mounting member 100 is pivotally rotated toward the left as shown in FIG. 5A. FIG. 5C shows the attachment of arm 320 near a right end on a top surface of 210I as viewed from the right side of the mounting member. FIG. 5D shows the attachment of arm 310 onto a bottom surface near a left end of 110T and the attachment of arm 320 near a left end onto a bottom surface of 210I, as viewed from the left side of the mounting member 100 and the base member 200. FIG. 5E shows the arm member 310 attached near a right end onto a top surface of 210I as viewed from the right. FIG. 5F shows arm member 330 attached near a right end onto bottom surface of 120T as viewed from the right. FIG. 5G shows arm member 330 attached near a left end onto a top surface of 220I and arm member 340 attached near a left end onto a top surface of 120B as viewed from the left. FIG. 5H shows arm member 340 attached near a right end onto a bottom surface of 220I as viewed from the right side of the mounting member 100 and the base member 200.

[0055] Note that a first pair of arm members 310 and 320 and a second pair of arm members 330 and 340, and their respective attachments to the mounting member 100 and the base member 200, form two similar but independent hinge systems. In one embodiment, two pairs of similar but independent hinge systems are used, one pair on top and one pair on bottom to provide an equal balance of loads and
forces on the arms. Each hinge system by itself is capable of the unique feature to pivotally rotate a mounting member to the left in one configuration and to the right in another configuration. Furthermore, it should be noted that arm members 320 and 330 are rotated to the left along with the mounting member 100. Thus, the joint joining the arm member 320 near a left end on the bottom surface of 210H and the joint joining the arm member 330 near a left end on the top surface of 220H is responsible for the left pivoting rotating movement. One should appreciate that while in this embodiment, arm members 320 and 330 with their left ends attached to the left ends of 210H and 220H are points of pivot for the mounting member 110, a different configuration is also possible. For example, an alternate embodiment, right end of arm member 310 may be attached near a right end on a bottom surface of 110T with a left end of arm member 310 attached near a left end on a top surface of 210H and right end of arm 340 may be attached near a right end on a bottom surface of 220T with a left end of arm member 340 attached near a left end on a top surface of 220H for the mounting member 100 to rotate about the base member 200.

To summarize, a first end of a first arm is connected to a first end of the mounting member and a second end of the first arm is connected to a first end of the fixed member; a first end of a second arm is connected to a second end of the mounting member and a second end of the second arm is connected to a second end of the fixed member. When rotating the mounting member about the first end of the fixed member, the first arm connected to a first end of the mounting member will move with the mounting member about the first end of the fixed member while the second arm remains fixed with the fixed member. When rotating the mounting member about the second end of the fixed member, the second arm connected to the second end of the fixed member will move with the mounting member as the mounting member rotates, while the first arm will remain fixed with the fixed member.

FIG. 5I shows a FPD 301 mounting onto a mounting member 100 pivotally rotated to the right side of the base member 200 which is mounted onto a wall 303 or column. It should be noted that the mounting member 100 is now viewed from its back and so the left and right of the mounting member 100 is reversed similar as in FIG. 5A. Arm member 310 has its left end attached near the left end on the bottom surface of 110T of the mounting member 100 and its right end attached near the right end on the top surface of 210H of the base member 200; arm member 320 has its left end attached on a bottom surface of 210H of the base member 200 and its right end attached near the right end on the top surface of 110H of the mounting member 100. Similarly, arm member 330 has its right end attached near the right end on the bottom surface of 120T of the mounting member 100 and its left end attached near the left end on the top surface of 220H of the base member 200; arm member 340 has its left end attached on a left end on a top surface of 120H of the mounting member 100 and its right end attached near the right end on the bottom surface of 220H of the base member 200.

FIGS. 5I to 5N illustrate the cross sectional view of the joints or arm attachments to various locations of the mounting member 100 and the base member 200 as the mounting member 100 is pivotally rotated toward the right as shown in FIG. 5I. FIG. 5I shows the attachment of arm 320 near a left end on a bottom surface of 210H of the base member as viewed from the left of the base member 200. FIG. 5J shows the attachment of arm 310 onto a top surface near a right end of 210H and attachment of arm 320 near a right end on a top surface of 110H, as viewed from the right of the mounting member 100 and the base member 200. FIG. 5K shows the arm member 310 attached near a left end on a bottom surface of 110T as viewed from the left. FIG. 5L shows arm member 330 attached near a left end on top surface of 220H as viewed from the left. FIG. 5M shows arm member 330 attached near a right end on a bottom surface of 120T and arm member 340 attached near a right end on a bottom surface of 220H as viewed from the right. FIG. 5N shows arm member 340 attached near a left end on a top surface of 120H as viewed from the left.

In FIG. 5B, arm members 310 and 320 and arm members 330 and 340, form two similar but separate pairs of hinge systems, similar to FIG. 5A. As described, two parallel and similar hinge systems are used to provide an equal balance of loads and forces on the arms. Each pair of hinge system is capable of the unique feature to pivotally rotate a mounting member to the left in one configuration and to the right in another configuration. In contrast to FIG. 5A, it should be noted that in FIG. 5B, arm members 310 and 340 are rotated to the right along with the mounting member 100. Thus, the joint joining the arm member 310 near a right end on the top surface of 210H and the joint joining the arm member 340 near a right end on the bottom surface of 220H are responsible for the right pivotally rotating movement. One should appreciate that a different configuration is also possible for the reason as described above.

FIGS. 6A and 6B show a top view of the display mounting device and the ranges in which the mounting member can rotate as mounted on a flat wall or a column. FIG. 6A illustrates a FPD mounted on the wall using a display mounting device. In one configuration, FPD is capable of rotating at an angle of 630, about 90 degrees, when the mounting member 610L is pivotally rotated to the left. In a second configuration, FPD is capable of rotating at an angle of 650, about 90 degrees, when the mounting member 610R is pivotally rotated to the right. The ranges of rotation in both of the configurations are limited by the wall and the FPD thickness (distance as measured from the screen of the FPD to the back of the FPD).

FIG. 6B illustrates a FPD mounted on the column using a display mounting device. The column will generally have a width that is less than the width of the display mounting device, as measured from a left end of the device to the right end of the device. Theoretically, in one configuration, the FPD is capable of rotating at an angle of 650, about 270 degrees when the mounting member 610L is pivotally rotated to the left. In a second configuration, FPD is capable of rotating at an angle 650, about 270 degrees, when the mounting member 610R is pivotally rotated to the right. The limit of the pivot rotation in either configuration is limited by the thickness of the FPD and the width of the column. If the column is much narrower than the width of the display mounting device, the FPD and the mounting member can potentially rotate more than 270 degrees, but if the column is similar to the width of the display mounting device, the FPD and the mounting member may rotate less than 270 degrees.

While the display mounting device may theoretically rotate to about 270 degrees as described, a factor that may prevent the FPD from rotating beyond 90 degrees is the
strength of the joints or arm attachments. When the mount-
ing member is rotated past 90 degrees and approaches 180
degrees, reinforcement or a change in the design of the arm
and/or joints may be preferred to prevent structural failure.
Such a design by using a mounting member top or mounting
member bottom to assist with transferring the load to the
base member top or base member bottom is shown in an
embodiment in FIGS. 11A-11C.

[0063] FIGS. 7A to 7J illustrate some of the different joints
and configurations of attachments which are possible
between the arms and the mounting or base members. FIG.
7A illustrates a member 720 attached to arm 710. Member
720 in this embodiment is similar to the base member as
described in earlier figures. Member 720 has an additional
portion 725 on the member 720 which may be used to
increase the range of pivotal rotation. Additional portion 725
increases the rotation range by moving the point of pivot
further away from the wall. The distance to which addition
portion 725 moves away from the wall is limited by the
distance or space available for the space where the mounting
member and the base member overlap by taking advantage
of the depth of the back of FPD as described earlier.

[0064] FIG. 7B shows arms 710A and 710B attached to
member 780 which resembles the mounting member top and
mounting member bottom as described in FIGS. 1, 2, 4, 5
eetc. Note there is little to no gap between arm members 710A
or 710B and the surfaces of the mounting member 780 to
which they are attached. It should be appreciated that both
arm members 710A and 710B are housed inside the recess
created by the top piece 780A and the bottom piece 780B in
a neutral position when the mounting member is not pivo-
tally rotating about the base member (e.g., FIG. 7B). FIG. 7C
shows each arm 710A and 710B rotating outward and there
is still little to no gap between either arm members 710A or
710B.

[0065] FIGS. 7D to 7H show different joints that are
possible for attaching the arm to the member as described
in FIGS. 7A to 7C and previously describe embodiments in
FIGS. 4, 5 and 6. FIG. 7D illustrates an arm 710 flat on top
of member 720. FIG. 7D shows a member with tapped
grooves 730 in the member 720 and an arm 710 with a hole
744 having a larger diameter than the screw 740. A sleeve
746 with a similar height as thickness of the arm 710 can
optionally be inserted in the hole 744 to allow rotational
movement of the arm 710 about the sleeve. The sleeve 746
and the arm 710 are then secured by threading the screw 740,
preferably with a flat top having a diameter larger than the
hole 744, with or without a washer 742, through the sleeve
746 into the tapped grooves 730 of the member. This
embodiment may result in at least a small gap between
the arm members which are both inside the mounting member
780 as shown in FIG. 7B. While a big gap is shown between
the arms 710A and 710B inside mounting member 780,
the gap can be minimized or eliminated by using joint configu-
rations as in at least FIGS. 7D and 7E. Generally, the arm
710 and the member 720 as shown may each have a
thickness ranging from about ¼” to about ½” and thus the
screw used will generally have a length ranging from about
¼” to about 1” long. Furthermore, the diameter of the screw
may range from about ¼” to about ½”.

[0066] FIG. 7E shows one embodiment of a joint or
attachment that may eliminate a gap between arms 710A and
710B as shown in FIG. 7I. An arm 710 is shown on top of
a member 720. The arm 710 has tapped grooves 750 and the
member 720 has tapped grooves 730. In one embodiment, a
screw which is longer than both the thickness of arm 710 and
member 720 can be completely threaded through tapped
grooves 750 and into tapped grooves 730 for the full
thickness of the member 720. The remaining portion of the
screw which may be protruding from the top of 710 may be
cut off flush on the top surface of 710. The result is a cut off
screw that is threaded into both the arm 710 and the member
720. When the arm pivotally rotates, it merely follows the
thread pattern of the tapped grooves to thread in or thread
out as if the screw is loosening or tightening. In another
embodiment, rather than using a screw and cut of its top
portion, a screw 755 having its length similar to the com-
bined thickness of arm 710 and member 720 and has an
indented hexagonal shape screw top fitting an allen wrench
can also be used. In this embodiment, the hexagonal headed
screw can be removed using an allen wrench as oppose to
the cut off screw where the screw, without its screw top,
cannot be removed easily.

[0067] FIGS. 7F and 7G shows an embodiment of arm 710
that may be used in combination with the embodiment of
arm attachment as described in FIGS. 7D and 7E. FIG. 7F
shows a side view of an arm 710 with a screw 764 having
a flat head and tapered top of the screw. FIG. 7G shows a
counter-sink or bored hole 762 where the counter-sunk or
bored out area fits the tapering of the flat screw head of
screw 764. In other words, this embodiment similarly
achieves the objective of reducing protrusion of the screw
head above the surface of arm 710. One can apply this
combination of arm 710 with a bored hole 762 and a screw
764 with either a tapped grooves in both arm 710 and
member 720 as in FIG. 7E or a tapped groove only in
member 720 as in FIG. 7D.

[0068] FIG. 7H illustrates an embodiment wherein a ball
joint 759 is used to connect the arm 710 and the member
720. While the use of a ball joint gives extra movement in
a vertical direction this may not be necessary. Similarly, a
disadvantage of using a ball joint is that it will lead to a
bigger joint. Most importantly, the extra play or movement
in the vertical direction in the joint may lead to undesired
slack in the system when the mounting member is pivotally
rotating about the base member. Nevertheless with the
appropriate control of tension and compression of the arm
members, the slack in the ball joint may be controlled.

[0069] FIGS. 7I and 7J illustrate the use of a clevis hinge
joint which may be used as a hinge system in the display
mounting device. This is illustrated and used extensively in
FIGS. 10A to 10D and FIGS. 11A to 11C. In essence a clevis
hinge joint is a member fitted into an open slot wherein any
pin, rivet, or similar device is used to lock the member in
place such that the member can freely rotate about the pin,
in and out of the slot. In this embodiment, a clevis hinge is
a slot member 790 shaped like a “U” with a pin or a rivet or
a rod 770 connecting the top piece of the member 790T to
the bottom piece of the member 790B with the arm 710
sandwiched in between. The rivet or pin rod is securely
fishten or locked onto the top piece 790T and the bottom
piece 790B so that the pin will not slide out. A hole in the
arm 710 is formed with a diameter slightly larger than the
diameter of the pin or rivet or rod 770 of the clevis joint to
allow for the arm to pivotally rotate about the pin or rivet
and rod 770. It should be appreciated that pin, rivet or rod
is merely exemplary and other manners of fastening an arm to
a clevis hinge to function in the same manner may also be
used. One benefit of the use of a clevis joint is that there is extra strength in the joints. The length of the member 790 that sandwiches the arm extending a certain distance from the end of the arm into the mid section of the arm provides extra support to the arm and also strength to the joint itself. This is slightly different than the joint as described above where the arm is only supported in either a top surface or a bottom surface as shown in FIGS. 4, 5 etc. and by a bolt or screw only. While the gap between the arm 710 and the top piece 790T and bottom piece 790B is visible, the gap can be reduced to a minimal by selecting the proper combination of arm thickness and distance between the top piece 790T and bottom piece 790B of the member 790 in forming a clevis hinge.

[0070] FIGS. 8A to 8C shows two different embodiments of mounting members. The mounting members used in FIG. 8A to 8C uses a clevis joint as described. FIG. 8A shows the frontal view of a mounting member 800 which is common to both FIGS. 8B3 and 8C. FIGS. 8B3 and 8C shows different configurations of the clevis joints which on the backside of the mounting member 800 with a FPD 801 mounted onto the front side of the mounting member 800.

[0071] FIG. 8A shows the front side of the mounting member 800 having a mounting member top 810 and a mounting member bottom 820. The mounting member 800 also has an attachment member or cross-member 830 where the back of the FPD is mounted against. The voids or adjustment slots 840 are positioned on the attachment member 830 for screws or bolts to fasten or attach the front side of the mounting member 800 against the back of the FPD. It should be appreciated that if the attachment member does not directly mount on the back of the FPD, it is common that adaptors provided with the FPD can be used as an intermediary to attach the FPD to the attachment member. FIGS. 8A and 8B3 are front and back side of the same member.

[0072] The mounting member 800 share a similar cross-member 830 for attachment to the back of the FPD as the previously illustrated mounting member shown in FIGS. 1, 4, 5 etc., but has three arms each near mounting member top 810 and mounting member bottom 820 instead of two arms each as previously illustrated. As viewed from the front in FIG. 8A, areas 812 and 822 are where two clevis joints attach to two arm members and areas 814 and 824 are where one clevis joint attaches to one arm member. If viewed from the back in FIG. 8B3, it is clear that two clevis joints 813A and 813B are located in the area 812 and a single clevis joint 815 is located in the area 814. Clevis joints 813A, 813B and 815 are cross arm attachment members on the top portion of the mounting member 800. Similarly, two clevis joints 823A and 823B are located in the area 822 and a single clevis joint 825 is located in area 824 where three arms are attached to the lower portion of the mounting member 800.

[0073] In an alternative embodiment, FIG. 8C shows a back side of a mounting member with its front side attached to a FPD 801, but has a different clevis joint placement configuration compared to mounting members illustrated in FIG. 8B3. The mounting member still has a mounting member top 810 connected to a mounting member bottom 820 by a cross-member 830 with voids or slots 840 in the cross-member 830 for attachment to the back of the FPD 801. However, in this embodiment, instead of having enlarged areas 812, 822 for two clevis joints each and 814, 824 for one clevis joint each, there are only two slightly enlarged areas 817, 819 near mounting member top 810 and mounting member bottom 820 respectively, each having a single clevis joint 813L and 815R, respectively. The concept of this embodiment is that as described earlier, only one pair of hinged arm system is necessary to permit a mounting member to both pivotally rotate about the left end of the base member and to rotate about the right end of the base member. This embodiment contains the minimal number of arms and hinge systems, at the locations near the top and bottom of the display mounting device to take advantage of the space occupied by the back of the FPD between the screen and the wall. Although this embodiment only requires a two-armed hinged system to perform the function as designed, unless the arms and the clevis hinge or any other hinged system used in place of the clevis is extremely strong, the strength and stability of the system may benefit from having additional frame support, which may be in the form of one or more arms and hinges (see FIG. 11A-11C) or may use the mounting member top or bottom to support against the base member top or bottom (see FIG. 11).

[0074] FIGS. 9A to 9C each illustrates a base member 900 corresponding to the mounting members in FIGS. 8A to 8C. FIG. 9A is a back view of the base member 900, while FIG. 9B is a frontal view of the base member 900 mounting against the wall 903 with three clevis hinge joints near each of the base member top and base member bottom. FIGS. 9A and 9B correspond to the front back side and front side of one embodiment. FIG. 9C is a frontal view of the base member with one clevis hinge joint near each of the base member top and base member bottom, a different configuration compared to FIG. 9B.

[0075] FIG. 9A shows the back view of the base member 900 having a base member top 910 and a base member bottom 920. FIG. 9A also has enlarged areas 912 and 922 near the top and bottom portions of the base member where two arms each are attached and enlarged areas 914 and 924 near the top and bottom portions of the base member where one arm each is attached. Instead of a cross-member used in the previous description of a base member in FIGS. 2, 4, 5 etc., or in the mounting members described earlier, this base member has a different configuration using three columns or bars 930 connecting the base member top 910 to the base member bottom 920. Each bar 930 has voids or slots 940, in addition to the voids and slots in the base member top 910 and base member bottom 920, for added security in fastening the base member 900 against the wall or fixed object. It should be appreciated that this bar connection may also be applied to the mounting member for connecting the mounting member top and the mounting member bottom. In another embodiment, at least one vertical bar may also be slidable to adjust to slid or other building members behind a wall.

[0076] FIG. 9B shows the frontal view of the base member, with its back attached to a wall 903, having three clevis joints each near the top and bottom of the base member. Two clevis hinges 913A and 913B are positioned in the enlarged area 912 near the top portion of the base member for attachment to two arms, while one clevis hinge 915 is positioned in the enlarged area 914 near the top portion of the base member at an opposite end to area 912 to receive and attach to one arm. Similarly, two clevis hinges 923A and 923B are positioned in the enlarged area 922 near the bottom portion of the base member for attachment to two arms, while one clevis hinge 925 is positioned in the enlarged area 924 near the base member at an opposite end to area 922 to attach to one arm. In combination with the mounting mem-
ber as describe in FIGS. 8A and 8B, a total of six arms, three on the top and three on the bottom can be used to connect the base member 900 to the mounting member 800. [0077] FIG. 9C shows the frontal view of the base member corresponding to the mounting member in FIG. 8C. This base member, attached to the wall 903, similarly has a base member top 910 and base member bottom 920 connected by three bars 930 with voids 940 in the bars and on each of the base member top 910 and base member bottom 920. However, this base member is designed only to be connected to two arms, one near the top of the base member and one near the bottom of the base member. A clevis hinge 913R can be found at an enlarged area 917 near the top of the base member and another clevis hinge 915L can be found in enlarged area 919 near the bottom of the base member. Two arms, one near the top and one near the bottom are used to connect the mounting member to the base member. As described in FIG. 8C, unless the joint and arms used in this configuration are extremely strong, extra support in the means of mounting and base member design (see FIGS. 11A to 11C) or adding at least an arm or more to this minimum number of hinges necessary to carry out the pivotal rotations left and right as described, is preferred. [0078] FIGS. 10A and 10B are left and right side views of the mounting member of FIGS. 8A and 8B connected to the base member of FIGS. 9A and 9B when the FPD and the mounting member is in a neutral position mounted on a wall 1003. FIGS. 10A and 10B show the FPD with its back 1002 mounted to the attachment member 830 on the mounting member 800 and the base member 900 attached to the wall 1003 by screws 1090. The mounting member 800 is attached to the base member 900 via the various clevis joints and the six (6) arm members 1010-1060. It should be noted that in this configuration, the attachment member 830 is not shown to be recessed as the embodiment shown in FIGS. 1, 4, 5 etc. But long as the clevis hinges 913A, 913B, 815 near the top on the right side, 813A, 813B, 915 near the top on the left side and the clevis hinges 923A, 923B, 825 near the bottom on the left side and 823A, 823B, 925 near the bottom on the right side can be fitted above and below the back of the FPD 1002, having a attachment member 830 is possible. Similarly, FIGS. 10C and 10D shows the FPD 1001 with its back 1002 mounted to the attachment member 830 on the mounting member 800 and the base member 900 attached to the wall 1003 by screws 1090. The only difference from FIGS. 10A and 10B is that 10C and 10D shows a total of 2 arms 1070, 1080 and 4 clevis hinges 813L, 815R, 913R and 915L. [0079] FIG. 11A to 11C illustrate another embodiment of a display mounting device using clevis hinges (such as shown in FIGS. 7I and 7J that are similar to those presented in FIGS. 9 and 10. Each of the clevis hinges 1112, 1114, 1116, 1132, 1134, and 1136 maybe the same as the levis hinge shown in FIG. 7J. FIG. 11A is a perspective view of a FPD 1101 on a mounting member 1170 of a display mounting device pivotally rotated or turned towards the left with the base member 1190 of the display mounting device mounted on a wall 1103. FIG. 11B is a perspective view of the FPD 1101 on the mounting member 1170 of a display mounting device pivotally rotated or turned towards the right with the base member 1190 of the display mounting device mounted on the wall 1103. FIG. 11C is a side view from the right of the display mounting device when the FPD 1101 is in a non-rotated, neutral position. [0080] FIG. 11A and 11B show a uniform mounting member 1170 made of a mounting member top 1110 and a mounting member bottom 1120 with two (2) vertical columns or bars 1115R, 1115L connecting the top 1110 and bottom 1120 members. Bars 1115R and 1115L are used in the mounting member 1170 for attaching the FPD 1101 to the front side of the mounting member. Three clevis hinge joints 1112, 1114, and 1116 are rigidly coupled to and located on the back side of the mounting member 1170. Each clevis hinge joint in FIGS. 11A and 11B includes a pin which is inserted through a hole in an arm; for example, the clevis hinge joint 1112 includes a pin inserted through a hole in arm 1152. Two clevis joints 1114 and 1116 are mounted near the top and near the left end on the back side of the mounting member 1170 onto bar 1115L. The single clevis joint 1112 is mounted near the top and near the right end on the back side of the mounting member 1170 onto bar 1115R. In this embodiment the clevis joints are welded, near the top portion of the bars. Therefore, joint 1112 is near a right side of the mounting member while joints 1114 and 1116 are near a left side of the mounting member 1170. Joints 1114 and 1116 are spaced at about twice the offset between 1114 and 1112 and the offset between 1116 and 1112. When viewed from either side, 1112 is sandwiched in the middle with 1114 on top and 1116 on the bottom and each joint is spaced at a same vertical offset from each other. Each of these joints will be rotatably attached to a first end of an arm where a second end of the arm is rotatably connected to the corresponding clevis joints mounted on the base member. It should be noted that the joints 1114 and 1116 are vertically aligned, and the horizontal distance between joints 1114 and 1112 and the horizontal distance between joints 1116 and 1112 are the same in this embodiment. The ends of the slotted bodies of the clevis joints 1114 and 1116 where the pin are used to connect the arm are positioned away from the main body of the mounting member. Similarly, the slotted body of the clevis joint 1112 where the pin is used to connect the arm is positioned away from the main body of the mounting member. [0081] These two (2) bars 1115L and 1115R also have slots or holes 1117 on the attachment sites for attaching a front side of the mounting member 1170 onto the back of the FPD 1101. Another configuration of attaching the FPD’s back to an adaptor device before attaching to the back of the mounting member is also possible. The mounting member 1170 also has four (4) notches 1181, 1183, 1185, 1187 at the top right, bottom right, top left, and bottom left corner of the mounting member 1170 (as viewed from the front of the mounting member). These four notches are mated to the knobs 1182, 1184, 1186 and 1188, respectively, which are on the base member 1190. The notches and knobs provide releasable rotational joints to provide more stable and secure rotation and provide more support for the weight of an FPD. [0082] FIG. 11A and 11B also illustrate a base member 1190 made of a base member top 1130 and base member bottom 1140 with three (3) vertical columns or bars 1135R, 1135M, 1135L connecting the top 1130 and bottom 1140 members. Three clevis hinge joints 1132, 1134, and 1136 are rigidly coupled to and located on the front side of the base member 1190. Two clevis joints 1134 and 1136 are mounted near the top and near the right end on the front side of the base member 1190 onto bar 1135R. The single clevis joint 1132 is mounted near the top and near the left end on the
front side of the base member 1190 onto bar 1135L. In this embodiment, the clevis joints are welded near the top portion of the bars, same as for the mounting member 1170. Thus, joint 1132 is near a left side of the base member while joints 1134 and 1136 are near a right side of the base member 1190. Joints 1134 and 1136 are spaced vertically at twice the vertical offset between joints 1134 and 1132 and the vertical offset between 1136 and 1132. When viewed from either side, 1132 is sandwiched in the middle with 1134 on top and 1136 on the bottom and each joint is spaced at a same vertical offset from each other. Each of these joints will be rotatably attached to a first end of an arm where a second end of the arm is rotatably connected to the corresponding clevis joints mounted on the mounting member. It should be noted that the joints 1134 and 1136 are vertically aligned, and the horizontal distance between joints 1134 and 1132 and the horizontal distance between joints 1136 and 1132 are the same in this embodiment. The ends of the slotted bodies of the clevis joints 1134 and 1136 where the pins are used to connect the arms are positioned away from the main body of the base member. Similarly, the slotted body of the clevis joint 1132 where the pin is used to connect the arm is positioned away from the main body of the base member. [0083] Three (3) bars 1135L, 1135M and 1135L each have slots or holes 1137 on the bars for attaching the back of the base member 1190 onto the face of a wall or fixed object. Three (3) bars are used for connection instead of two because some FPDs are larger and heavier than others and may require the stability of attaching the base member to three studs or other building structures behind a wall rather than two. One should appreciate that other embodiments where the one or more bars can slide horizontally may be used to accommodate studs or building structures behind the wall which are not spaced equally. Furthermore, slots or holes (not shown) on the base member top 1130 and base member bottom 1140 may be added in addition to the slots and holes on the vertical member for attachment. The bars 1135L, 1135M, and 1135L may, in certain embodiments, be sized and spaced such that they may be attached to studs or other building members behind a wall; for example, the distance between the bars may match the standard distance between the studs so that they overlap and the bars may be attached to the studs with screws or other mechanisms. [0084] Corresponding to the four notches 1181, 1183, 1185 and 1187 on the mounting member, four (4) knobs 1182, 1184, 1186 and 1188 are found near the top right, bottom right, top left and bottom left portions of the base member. A knob can be found near each end of base member top 1130 and each end of base member bottom 1140. [0085] The mounting member and the base member are connected together by three (3) arms, 1151, 1152 and 1153 of equal length. Arm 1151 is above arm 1152, which is above arm 1153. The first end of arm 1151 is rotatably connected to the joint 1134 near the top right portion of the base member 1190, and the second end of arm 1151 is rotatably connected to the joint 1144 near the top left portion of the mounting member 1170. The first end of arm 1152 is rotatably connected to the joint 1114 near the top right portion on the back side of the mounting member 1170, and the second end of arm 1152 is rotatably connected to the joint 1132 near the top left portion of the base member 1190. The first end of arm 1153 is rotatably connected to the joint 1136 near the top right portion of the base member 1190, and the second end of arm 1153 is rotatably connected to the joint 1116 near the top left portion of the mounting member 1170. [0086] The vertical offset of each arm after they are connected to their respective joints are shown in FIGS. 11A–11C of this embodiment. This also shows that the vertical offset between joints 1134, 1132, 1136 on the base member 1190 is the same as the vertical offset between joints 1114, 1112, 1116 on the mounting member 1170. Similarly, the horizontal distance between 1132 and 1134 and between 1132 and 1136 on the base member are same as the horizontal distance between 1112 and 1114 and between 1112 and 1116. In this embodiment, when the arms are connected, joints 1114 and 1132 are offset by the same vertical distance, as are joints 1132 and 1116. Similarly, joints 1134 and 1112 are, in this embodiment, offset by the same vertical distance as the vertical offset between joints 1112 and 1136. Therefore, when connected, the three arms 1151, 1152, 1153 are parallel to each other. As described below, in function, arm 1152 serves to rotate the mounting member 1170 to the left of base member 1190 while arms 1151 and 1153 serve to rotate the mounting member 1170 to the right. One should appreciate that arms 1151 and 1153 function in the same way and one of these arms is redundant and serves only to increase the strength of the system. [0087] In this embodiment, instead of using two pairs of hinge system as illustrated in the embodiment shown in FIGS. 1, 4, 5, 6 etc., one pair of hinge system plus an extra hinge is used to pivotally rotate the mounting member 1170 and the FPD 1101 in either left or right directions. This redundant hinge merely serves to strengthen the system and does not add to the function already provided by the pair of hinges. To provide stability to the display mounting device, the mounting member top 1110 and mounting member bottom 1120 are designed in combination with base member top 1130 and base member bottom 1140 to provide stability to the system via the notches 1181, 1183, 1185, 1187 and the knobs 1182, 1184, 1186, 1188 as explained below. [0088] In FIG. 11A, when the FPD 1101 and the mounting member 1170 is pivotally rotated towards the left, to counter the weight of the FPD, tension is build up on arm 1152 and compression is build up on mounting member bottom 1120. Note that only arm 1152 moves with the mounting member 1170 as mounting member 1170 is rotated, while the other two arms 1151 and 1153 stay fixed with the base member 1190 when moving the mounting member 1170 to the left. In other words, as the weight tends to pull the mounting member off the wall, tension builds in arm 1152 connected by joints 1132 on the base member 1190 and 1112 on mounting member 1170, compression builds on mounting member bottom 1120 to push against base member bottom 1140 to counter this weight. The notch 1187 on mounting member bottom 1120 is fitted against knob 1188 near a bottom left portion of the base member bottom 1140 during rotation or movement to keep the mounting member bottom 1120 and base member bottom 1140 aligned in position relative to each other during rotation to the left. The knob 1188 also should be able to withstand the compression forces that are translated from the mounting member bottom 1120 onto the base member bottom 1140. [0089] Similarly, in FIG. 11B when the FPD 1101 and the mounting member 1170 is pivotally rotated towards the right (as shown in FIG. 11B), to counter the weight of the FPD 1101, tension builds up on arms 1151 and 1153 and com-
pression builds up on mounting member bottom 1120. Note that in this case, both arms 1151 and 1153 move along with the mounting member 1170 as mounting member 1170 is rotated, while the single arm 1152 stays fixed with the base member 1190 when moving the mounting member 1170 to the right. In other words, as the weight tends to pull the mounting member off the wall, tension builds in arm 1151 and 1153 connected by joints 1134, 1114 on the base member 1190, and 1136, 1116 on mounting member 1170, compression builds on mounting member bottom 1120 to push against base member bottom 1140 to counter this weight. The notch 1183 on mounting member bottom 1120 is fitted against knob 1184 near a bottom right portion of the base member bottom 1140 to keep the mounting member bottom 1120 and base member bottom 1140 aligned in position relative to each other during rotation to the right. Again, the knob 1184 also should be able to withstand the compression forces that are translated from the mounting member bottom 1120 onto the base member bottom 1140.

Different ways of balancing of tension and compression forces using frame members and arm members allow different configurations of the display mounting device using the hinge system as described. In a different embodiment, two arms connected by four joints near a top of the display mounting device may be used to selectively withstand the tension forces depending on which arm moves with the mounting member, while a mounting member bottom is used to counter compression. In another embodiment, one arm each is used to sustain the tension during rotation towards the left or the right in two pairs of hinges, while the mounting member bottom is used to counter the compression when the FPD and mounting member is both rotated to the left or the right. In yet another embodiment, the reverse may also be possible. One may use a mounting member top, which is firmly attached to a hinge joint in connecting with the base member top for overcoming the tension on the FPD as the mounting member rotates to both left and right, while the two arm system on the bottom may be used to counter the compression. Any variation of the above can be designed as long as a two arm hinged system is used while appropriately balancing the tension and compression forces created by the FPD.

FIG. 11C illustrates a side view of the display mounting device as viewed from the right. The back side of the FPD is attached onto the attachment bars 1115R and 1115L on the front side of the mounting member 1170. The bars 1115R and 1115L connect the mounting member top 1110 and the mounting member bottom 1120. The notch 1181 is seen on the mounting member top 1110 fitted against the knob 1182 while the notch 1183 is seen on the mounting member bottom 1120 near the knob 1184. This view from the right shows the back of the base member 1190 attached to the face of the wall via bars 1135R, 1135M and 1135L, (1135M, 1135L not shown). The bar 1135R, as seen, connects the base member top 1130 and base member bottom 1140. Joints 1134 and 1136 are seen mounted onto bar 1135R. Arms 1151 and 1153 are fitted into the joints 1134 and 1136 respectively. Similarly, joint 1112 is mounted onto bar 1115R. Arm 1152 is fitted in the joint 1112.

FIGS. 12A to 12C show the two-arm hinged system as described being applied to a cabinet door. FIG. 12A is a perspective view of a cabinet. FIG. 12B is a perspective view of a cabinet having its right door pivotally rotated or opened toward the right with the use of 4 arms and 8 hinges in accordance with the hinge system as described. FIG. 12C is a perspective view of a cabinet having its right door pivotally rotated or opened toward the left with the use of 4 arms and 8 hinges in accordance with the hinge system as described.

Since FIGS. 12A to 12C and 13A to 13C are generally similar including the same 4 arms and hinge joint attachments, FIG. 13A to 13C will be described as a general representation of both sets of FIGS. 12 and 13. FIG. 13A shows the frontal view of a door 1310 being mounted in a doorway in a frame having a right member 1313 and 1315 respectively. Each door has four (4) arms 1320, 1340, 1360 and 1380 and eight (8) hinges 1322, 1324, 1342, 1344, 1362, 1364, 1382, 1384 that attaches the door to the members 1313 and 1315. As described before, the feature allowing the door to open left and to open right is that two (2) of the four (4) arms move with the door 1310 when the door 1310 is rotated or open towards the right, and two (2) remaining different arms move with the door 1310 when the door 1310 is rotated or open towards the left. This can be seen in FIG. 13B where arms 1340 and 1380 move with the door toward the left while arms 1320 and 1360 stay fixed in the door frame. Whereas, in FIG. 13C arms 1320 and 1360 move with the door toward the right while arms 1340 and 1380 stays fixed in the door frame.

As shown in FIG. 13B, the hinges 1322 and 1362 attaches the right end of the arms 1320 and 1360 respectively to the fixed member 1313 whereas the hinges 1324 and 1364 attaches the left end of the arms 1320, 1360 to the inner surface of the door. These two arms 1320, 1360 and mainly the joints 1322 and 1362 are responsible for pivoting the door toward the left, while joints 1324 and 1364 are responsible for fixing the arms 1320, 1360 against the door so the arms 1320, 1360 can guide the door throughout the movement. Similarly shown in FIG. 13B, the hinges 1344 and 1384 attaches the left end of the arms 1340 and 1380 respectively to the fixed member 1315 whereas the hinges 1342 and 1382 attaches the right end of the arms 1340, 1380 to the inner surface of the door. These two arms 1340, 1380 and the joints 1344 and 1384 are responsible for pivoting the door toward the right, while joints 1342 and 1382 are responsible for fixing the arms 1340, 1380 against the door so the arms 1340 and 1380 can guide the door throughout the movement.

In applying this hinge system to either the cabinet door or the door, an important aspect is to ensure that the two arm members which are not moving with the door is not an obstruction to the opening when the door is open to either left or right. One application is to use thin arm members and the thin joints illustrate in FIGS. 7D to 7G for application in the display mounting device as illustrated in FIGS. 1, 2, 4, 5 etc. The clevis hinge or other types of joint connections and arms may also be possible. An improvement to a cabinet door design is that there may need to be a fixed member like
in between cabinet doors. Rather, the hinges can be mounted at the top and bottom of the frame with a slight protrusion hanging from the top and standing up from the bottom, thus both increasing the opening to the cabinet as well as allowing easy user access by opening the door to either direction.

It is to be understood that the above description is intended to be illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reading and understanding the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

What is claimed is:

1. An apparatus, comprising:
   a base member configured to mount against a base object and having at least two joints for rotatable coupling, a first joint of the base member near one end of the base member, and a second joint of the base member near a second end of the base member, the first joint of the base member is positioned at an offset from the second joint of the base member so they are not directly aligned; and
   a mounting member configured to mount to a display, having at least two joints for rotatable coupling, a first joint of the mounting member near a first end of the mounting member and a second joint of the mounting member near a second end of the mounting member, the first joint of the mounting member is positioned at an offset relative to the second joint of the mounting member so they are not directly aligned, and
   at least two arms, a first arm with one end coupled to the first joint of the base member and a second end coupled to the first joint of the mounting member, and a second arm with one end coupled to the second joint of the base member and a second end coupled to the second joint of the mounting member.

2. The apparatus of claim 1 wherein each of the base member, the mounting member and the arm member may be made of any material including metal and metal alloy that may withstand the weight of a display ranging from about 20 lb up to about 300 lb mounted on the mounting member.

3. The apparatus of claim 1 wherein the first arm moves with the mounting member, while the second arm remains fixed with the base member, when the mounting member pivots about a first end of the base member and the second arm moves with the mounting member, while the first arm remains fixed with the base member, when the mounting member pivots about a second end of the base member.

4. The apparatus of claim 3 wherein the at least two arms are of the same length.

5. The apparatus of claim 4 wherein the two joints on the base member are offset vertically by a same vertical offset as the two joints on the mounting member.

6. The apparatus of claim 5 wherein the two joints on the base member are separated horizontally along an axis at a same distance as a distance between the two joints on the mounting member along a horizontal axis.

7. The apparatus of claim 1 wherein the joints further comprise at least one of a hinge joint, a clevis pinhole joint, a ball joint, or any type of joint that allows a rotational movement.

8. The apparatus of claim 1 wherein each of the mounting member and the base member has a predetermined top and bottom.

9. The apparatus of claim 8 wherein the bottom of the base member is configured to have ports or an attachment to route cables.

10. The apparatus of claim 9 wherein the bottom of the base member or the mounting member is configured to hold at least a remote control of a flat panel television display (FPD).

11. The apparatus of claim 8 wherein the top and bottom portions of the mounting member and the base member are configured to take advantage of space available between the top portion and bottom portion of a FPD for placement of the at least two arms so as to minimize distance between the back of the FPD and the wall.

12. The apparatus of claim 11 wherein the top and bottom portions of the mounting member is configured to have a recess to receive the top and bottom portions of the base member respectively.

13. The apparatus of claim 1 wherein a base object is mounted to a back side of the base member and a display is mounted on the front side of the mounting member.

14. The apparatus of claim 13 wherein the joints of the base member are near a top and/or bottom portion of the base member and the joints of the mounting member are near a top or bottom portion of the mounting member.

15. The apparatus of claim 14 wherein the base member has at least 4 points of attachment to the base object.

16. The apparatus of claim 15 wherein the fixed object is at least one of a wall, a column or a fixed object substantially heavier than a display.

17. The apparatus of claim 16 wherein the display is a flat panel television display (FPD) with a screen size ranging from about 15" to about 80" and weighs from about 20 lbs to about 300 lbs.

18. The apparatus of claim 17 wherein the at least 4 points of attachment are equally divided to attach against at least 2 studs on the wall or if the FPD has a screen larger than 22" or weighs heavier than 50 lb.

19. The apparatus of claim 17 wherein at least 6 points of attachment are equally divided to attach against at least 3 studs on the wall or the column if the FPD has a screen larger than 40" or weighs heavier than 100 lb.

20. The apparatus of claim 1 wherein the base member may be mounted onto a slideable truck mechanism which is mounted onto the base object, the base member and the truck mechanism configured to allow the base member slide on the base object along the track.

21. The apparatus of claim 1 wherein the mounting member may be attached to a separate member that mounts to the display.

22. The apparatus of claim 21 wherein the separate member is configured for translational or rotational movement of the display.

23. The apparatus of claim 1 wherein the base member comprises at least two wall attachment portions which are sized and spaced to attach to studs or other building members behind a wall.

24. An apparatus, comprising:
   a first mounting member capable of being mounted to a fixed object;
   a second mounting member capable of being mounted to a display;
at least two arm members, each arm member having a first end and a second end, wherein,
a first end of a first arm member is coupled to a first joint near a first end of the first mounting member and a second end of the first arm member is coupled to a second joint near a second end of the second mounting member; and
a first end of a second arm member is coupled to a first joint near a second end of the first mounting member and a second end of the second arm member is coupled to a second joint near a first end of the second mounting member.

25. The apparatus of claim 24 wherein a first arm member moves with the mounting member, while the second arm member remains fixed with the first mounting member, when the second mounting member pivots about a first end of the first mounting member and a second arm member moves with the second mounting member, while the first arm member remains fixed with the first mounting member, when the second mounting member pivots about a second end of the first mounting member.

26. The apparatus of claim 25 wherein the at least two arms are of the same length.

27. The apparatus of claim 26 wherein each of the base member, the mounting member and the arm member may be made of any material including metal and metal alloy that may withstand the weight of a display ranging from about 20 lb up to about 300 lb mounted on the mounting member.

28. The apparatus of claim 24 wherein each of the mounting member and the base member has a predetermined top and bottom.

29. The apparatus of claim 28 wherein the bottom of the base member or is configured to have ports or an attachment to route cables.

30. The apparatus of claim 28 wherein the bottom of the base member or the mounting member is configured to hold at least a remote control of a flat panel television display (FPD).

31. The apparatus of claim 28 wherein the top and bottom portions of the mounting member and the base member are configured to take advantage of space available between the top portion and bottom portion of a FPD for placement of the at least two arms so as to minimize distance between the back of the FPD and the wall.

32. The apparatus of claim 31 wherein the top and bottom portions of the mounting member is configured to have a recess to receive the top and bottom portions of the base member respectively.

33. An apparatus comprising:
means for fixing a first mounting member onto a fixed object;
means for fixing a display onto a second mounting member;
means for rotatably coupling the first mounting member to the second mounting member by at least two arm members, wherein the second mounting member is positioned directly over the first mounting member in a neutral position, the second mounting member and a first arm member are further configured to pivot about a first end of the first mounting member from the neutral position and the second mounting member and a second arm member are configured to pivot about a second end of the first mounting member from the neutral position.

34. The apparatus of claim 33 wherein a first arm member moves with the mounting member when the mounting member pivots about a first end of the base member and a second arm member moves with the mounting member when the mounting member pivots about a second end of the base member.

35. The apparatus of claim 33 wherein the at least two arms are of the same length.

36. The apparatus of claim 33 wherein the two joints on the base member are offset vertically by a same vertical offset as the two joints on the mounting member.

37. The apparatus of claim 33 wherein the two joints on the base member are separated horizontally along an axis at a same distance as a distance between the two joints on the mounting member along a horizontal axis.

38. The apparatus of claim 33 wherein each of the mounting member and the base member has a predetermined top and bottom.

39. The apparatus of claim 38 wherein the bottom of the base member or is configured to have ports or an attachment to route cables.

40. The apparatus of claim 38 wherein the bottom of the base member or the mounting member is configured to hold at least a remote control of a flat panel television display (FPD).

41. The apparatus of claim 38 wherein the top and bottom portions of the mounting member and the base member are configured to take advantage of space available between the top portion and bottom portion of a FPD for placement of the at least two arms so as to minimize distance between the back of the FPD and the wall.

42. The apparatus of claim 41 wherein the top and bottom portions of the mounting member is configured to have a recess to receive the top and bottom portions of the base member respectively.

43. An apparatus comprising:
a first mounting member configured to mount against a fixed object on a back side, the first mounting member having two joints, each of the two joints are placed near an opposite end of the first mounting member at an offset apart;
a second mounting member configured to mount against a display on a front side, the second mounting member having two joints, each of the two joints are placed near an opposite end of the second mounting member at an offset apart; and

at least two arms, each arm having a first end and a second end, each of the at least two arms coupling one joint on the second mounting member to one joint on the first mounting member, wherein the second mounting member overlaps the first mounting member in a neutral position and the second mounting member and a first arm is configured to rotate about a first end of the first mounting member, and the second mounting member and a second arm is configured to rotate about a second end of the second mounting member.

44. The apparatus of claim 43 wherein each of the mounting member and the base member has a predetermined top and bottom.

45. The apparatus of claim 44 wherein the bottom of the base member or is configured to have ports or an attachment to route cables.
46. The apparatus of claim 44 wherein the bottom of the base member or the mounting member is configured to hold at least a remote control of a flat panel television display (FPD).

47. The apparatus of claim 44 wherein the top and bottom portions of the mounting member and the base member are configured to take advantage of space available between the top portion and bottom portion of a FPD for placement of the at least two arms so as to minimize distance between the back of the FPD and the wall.

48. The apparatus of claim 47 wherein the top and bottom portions of the mounting member is configured to have a recess to receive the top and bottom portions of the base member respectively.

49. An apparatus, comprising:
   a base member with at least two joints for rotatable coupling, a first joint near a first end of the base member, and a second joint near a second end of the base member;
   a mounting member with at least two joints for rotatable coupling, a first joint near a first end of the mounting member and a second joint near a second end of the mounting member, and
   at least two arm members, a first arm member with a first end coupled to the first joint of the base member and a second end coupled to the first joint of the mounting member, and a second arm with a first end coupled to the second joint of the base member and a second end coupled to the second joint of the mounting member.

50. The apparatus of claim 49 wherein a first arm member moves with the mounting member when the mounting member pivots about a first end of the base member and a second arm member moves with the mounting member when the mounting member pivots about a second end of the base member.

51. The apparatus of claim 50 wherein the at least two arms are of the same length.

52. The apparatus of claim 51 wherein the two joints on the base member are offset vertically by a same vertical offset as the two joints on the mounting member.

53. The apparatus of claim 52 wherein the two joints on the base member are separated horizontally along an axis at a same distance as a distance between the two joints on the mounting member along a horizontal axis.

54. The apparatus of claim 49 wherein the base member is at least a portion of a door frame and the mounting member is a door.

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