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(54) **Adjustment mechanism and household appliance having the same**

(57) An adjustment mechanism and a household appliance having the same are provided. The adjustment mechanism includes: at least one adjustment hole and at least two spaced apart fixation holes, disposed on one of a first member and a second member; at least three mating holes, disposed on the other of the first member and the second member, the at least three mating holes including at least one first mating hole for mating with the at least one adjustment hole respectively and second mating holes for mating with the at least two fixation holes

respectively, and when a center of any one fixation hole coincides with a center of the corresponding second mating hole, a center of the remaining fixation hole being spaced from a center of the corresponding second mating hole in an adjustment direction; and at least two connection members, one connection member passing through the fixation holes and the second mating holes with coincident centers, and the other connection member passing through the adjustment hole and the first mating hole, so as to fix the first member and the second member.

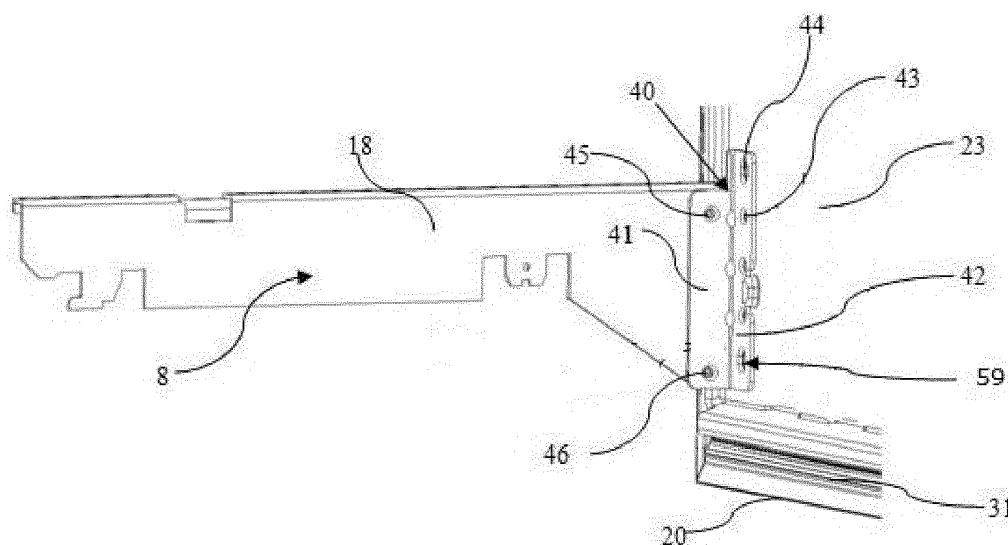


FIG. 2

Description

BACKGROUND

Technical Field

[0001] The present invention relates to a household appliance, and more particularly to an adjustment mechanism and a household appliance having the same.

Related Art

[0002] A household appliance conventionally has a drawer-type door. For example, in the field of refrigerators, a drawer-type door is supported on a cabinet through a support structure to close or open a storage compartment. Storage boxes for placing food, fruits and vegetables are installed on the drawer-type door. To prevent cold air in the storage compartment from leaking outside, a gasket having magnetic attraction to the cabinet of the refrigerator is disposed along the edge of the rear side of the drawer-type door, so that when the drawer-type door is closed, the gasket closely contacts the front side of the main body of the refrigerator.

[0003] An error may inevitably occur during the installation of the drawer-type door to the cabinet. For example, a deviation may be caused in a vertical direction of the drawer-type door relative to the original design. In the use of the refrigerator, the loaded storage box may also cause the door body to displace downward. The position displacement of the drawer-type door relative to the cabinet may even cause a serious consequence that gaps appear between the gasket and the main body of the refrigerator and lead to cold air leakage. Besides, an inappropriate positional relationship between the door and the cabinet may also affect the appearance of the refrigerator.

SUMMARY

[0004] An objective of the present invention is to provide an adjustment mechanism which has a simple structure and a low cost and is easy to operate.

[0005] Another objective of the present invention is to provide a household appliance having the adjustment mechanism.

[0006] To achieve the above objectives, the present invention provides an adjustment mechanism, for adjusting a positional relationship between a first member and a second member in an adjustment direction. The adjustment mechanism includes: at least one adjustment hole and at least two spaced apart fixation holes, disposed on one of the first member and the second member; at least three mating holes, disposed on the other of the first member and the second member, the at least three mating holes including at least one first mating hole for mating with the at least one adjustment hole respectively and second mating holes for mating with the at least

two fixation holes respectively, and when a center of any one fixation hole coincides with a center of the corresponding second mating hole, a center of the remaining fixation hole being spaced from a center of the corresponding second mating hole in the adjustment direction; and at least two connection members, one connection member passing through the fixation holes and the second mating holes with coincident centers, and the other connection member passing through the adjustment hole and the first mating hole, so as to fix the first member and the second member.

[0007] The adjustment mechanism of such a simple structure can be used to conveniently adjust a positional relationship between two members. The holes for fixing the first member and the second member form an adjustment structure, so that no additional part is required, and the cost is reduced. By applying the adjustment mechanism to the connection between the door and the main body of the refrigerator, the problem of deteriorated refrigerating effect of the refrigerator due to errors in the assembling process and long-term usage can be effectively solved.

[0008] Optionally, the centers of the at least two fixation holes are arranged in a line in the adjustment direction, which is convenient for punching and assembly.

[0009] Optionally, the centers of the at least one adjustment hole and the at least two fixation holes are arranged in a line in the adjustment direction.

[0010] Optionally, the centers of the at least two fixation holes have a distance therebetween in a direction perpendicular to the adjustment direction, that is, the centers of the at least two fixation holes may not be arranged in a line in the adjustment direction, and can be disposed at any positions as long as it is ensured that the fixation holes correspond to the corresponding mating holes, which is convenient for actual connections.

[0011] Optionally, the adjustment mechanism includes at least two adjustment holes, the at least two fixation holes being located between the two adjustment holes, so that the connection is more secured and the operation is more convenient.

[0012] Optionally, the adjustment hole is a slot hole, and the relative positions of a fixed member and the door are changed by adjusting the position of a screw in the slot hole. An error of the door in a vertical direction can be adjusted by using the slot hole in a certain range instead of with a set value, because an exact value of the displacement error of the door in the vertical direction is unpredictable, but the error range is predictable, so that the slot hole can be used to eliminate the error according to the actual condition.

[0013] Optionally, the connection members are screws and connect the first member and the second member by threaded connection, which is simple, convenient, and quite reliable.

[0014] Optionally, one of the at least two fixation holes is a reference fixation hole, and when a center of the reference fixation hole coincides with a center of the cor-

responding second mating hole, a center of the at least one adjustment hole exactly coincides with a center of the corresponding first mating hole.

[0015] Optionally, the adjustment mechanism includes at least three pairs of paired fixation holes and second mating holes. When the center of the reference fixation hole coincides with the center of the corresponding second mating hole, the remaining fixation holes are equally spaced from the pairing second mating holes in the adjustment direction. By setting three pairs of paired fixation holes and second mating holes, upward or downward adjustment of the first member relative to the second member may be implemented, which provides more options.

[0016] Optionally, the adjustment mechanism includes at least three pairs of paired fixation holes and second mating holes. The fixation holes include a reference fixation hole, and when a center of the reference fixation hole coincides with a center of the pairing second mating hole, the remaining fixation holes are equally spaced from the pairing second mating holes in the adjustment direction.

[0017] To achieve the above objectives, the present invention also provides a household appliance, including a first member and a second member. The household appliance further includes the adjustment mechanism for adjusting a positional relationship between the first member and the second member in an adjustment direction according to any one of claims 1 to 10.

[0018] Optionally, the household appliance includes an appliance body and a door supported on the appliance body, and the adjustment mechanism adjusts the door to move relative to the appliance body with a predetermined amplitude. By applying the adjustment mechanism to the connection between the door and the main body of the refrigerator, the problem of deteriorated refrigerating effect of the refrigerator due to errors in the assembling process and long-term usage can be effectively solved.

[0019] Optionally, the adjustment mechanism is disposed to adjust a position of the door relative to the appliance body in a vertical direction or a horizontal direction.

[0020] The structure, other objectives and beneficial effects of the present invention will be better understood in the description of preferred embodiments with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] As a part of the specification and for further understanding of the present invention, the accompanying drawings are used to explain the exemplary embodiments of the present invention, and are used to describe the principle of the present invention together with the specification, wherein:

FIG. 1 is a schematic three-dimensional view of a

household appliance according to a first embodiment of the present invention;

FIG. 2 is a schematic structural view of a connection part between a door and a movable guide rail in the household appliance according to the first embodiment of the present invention;

FIG. 3 is a three-dimensional view of a guide rail support rack according to the first embodiment of the present invention;

FIG. 4 is a comparison view of holes on a fixed member and a liner of the door according to the first embodiment of the present invention;

FIG. 5 is a comparison view of holes on a fixed member and a liner of a door according to a second embodiment of the present invention;

FIG. 6 is a comparison view of holes on a fixed member and a liner of a door according to a third embodiment of the present invention; and

FIG. 7 is a comparison view of holes on a fixed member and a liner of a door according to a fourth embodiment of the present invention.

DETAILED DESCRIPTION

[0022] Referring to FIG. 1, a household appliance is, for example, a refrigerator in this embodiment. It can be understood that, the present invention is also applicable to household appliances such as a dishwasher or a sterilizer. The refrigerator 10 includes a heat-insulating cabinet 28 with two confined storage compartments. In this embodiment, the storage compartment includes a refrigerator compartment 12 and a freezer compartment 14 disposed longitudinally. It can be understood that, the refrigerator may also have other arrangements.

[0023] In a first embodiment, the refrigerator compartment 12 includes a refrigerator compartment inner wall 30 and a door 26 that is located at a front opening and can be selectively closed or opened, the inner wall 30 and the door 26 together defining the space of the refrigerator compartment 12. The door 26 is connected to the cabinet 28 of the refrigerator through an upper hinge and a lower hinge (not shown) fixed on a side of the door 26, and is opened or closed by rotation about a connecting line of the upper hinge and the lower hinge in a horizontal direction.

[0024] It can be seen from FIG. 1 that, a door 20 of the freezer compartment 14 in this embodiment is a push-pull door, and can be pushed in or pulled out along a direction 22 in FIG. 1, so as to close or open the freezer compartment 14. The drawer-type door 20 includes a liner 23 made of a plastic board in a non-cutting manner, a covering board 32 which is connected with the liner 23

to form the main body of the door 20 and used as an outer surface layer, and an isolation layer 25 formed by foaming in a limited space between the liner 23 and the covering board 32. To prevent cold air in the storage compartment from leaking outside, a gasket 31 having magnetic attraction to the cabinet is disposed along the edge of the rear side of the door 20.

[0025] The door 20 is connected to the cabinet 28 through a pair of support mechanisms. The support mechanisms include guide rails through which the door 20 can be pushed in or pulled out. The support mechanisms further include a pair of support racks 8 which are respectively fixed at the rear side of the door 20 and are parallel to each other. A storage container (not shown) for placing food is supported on the support racks 8 and moves in or out of the freezer compartment 14 with the door 20.

[0026] In this embodiment, the support rack 8 includes a support member 18 which is substantially strip-shaped and perpendicular to a rear surface of the door 20 and a fixed member 40 fixed on the door 20. The support member 18 is connected to the fixed member 40 so as to be fixed on the door 20.

[0027] Referring to FIG. 2, FIG. 2 only shows one support member 18 connected to the door 20, and a movable guide rail in parallel with the support member 18 is not shown. The movable guide rail is substantially strip-shaped and is perpendicular to the surface of the door 20.

[0028] Referring to FIG. 3, the fixed member 40 includes a fixed portion 42 and a connection portion 41. The fixed portion 42 is connected to the door 20, and the connection portion 41 is connected to the support member 18. In this embodiment, the fixed portion 42 and the connection portion 41 are joined by a fold line 48 (see FIG. 3), and are perpendicular to each other. The fixed portion 42 and the connection portion 41 may be substantially rectangular, and the fixed portion 42 is slightly longer than the connection portion 41; therefore, the joint part is step-like. To prevent unnecessary puncture or scratching, the edges of the fixed portion 42 and the connection portion 41 are both arc-shaped.

[0029] According to an embodiment of the present invention, the fixed portion 42 is provided with three round fixation holes 43, 51, 52 and two slot holes 44, 53. The two slot holes 44, 53 extending in a direction parallel with the fold line 48 are disposed on two sides of the three fixation holes 43, 51, 52 the centers of the three fixation holes 43, 51, 52 are arranged in the same connecting line, and the connecting line is parallel with the fold line 48.

[0030] The fixed portion 42 and the door 20 are respectively provided with multiple installation holes through which the fixed member 40 is fixed on the door 20. During the installation, at least two connection members pass through at least two corresponding fixation holes to fix the fixed member 40.

[0031] In this embodiment, a reinforced board (not shown) is mounted inside the door 20 and at a position

close to the door liner 23, and a hole mating with the fixed portion 42 is disposed on the reinforced board. When the above members are assembled, the reinforced board is first disposed on one side of the refrigerator liner, and a screw passes through the hole on the fixed portion 42 and then passes through the mating holes on the refrigerator liner and the reinforced board, to make the fixed portion 42, the reinforced board and the refrigerator liner 23 fixedly connected to each other. Thereby, the reinforced board is securely fixed in the cabinet through foaming and curing of a thermal insulation layer of the refrigerator.

[0032] In an embodiment, an adjustment mechanism 59 is provided for adjusting a positional relationship between a first member 20 and a second member 28, 8 in an adjustment direction. The adjustment mechanism 59 includes: one adjustment hole 44 and two spaced apart fixation holes 51, 52, disposed on one of the first member 20 and the second member 28, 8; three mating holes 61, 63, 64, disposed on the other of the first member 20 and the second member 28, 8, the at least three mating holes 61, 63, 64 including one first mating hole 61 for mating with the adjustment hole 44 and second mating holes 63, 64 for mating with the at least two fixation holes 51, 52 respectively, and when a center of any one fixation hole 51 coincides with a center of the corresponding second mating hole 63, a center of the remaining fixation hole 52 being spaced from a center of the corresponding second mating hole 64 in the adjustment direction; and two connection members, one connection member passing through the fixation holes 51, 52 and the second mating holes 63, 64 with coincident centers, and the other connection member passing through the adjustment hole 44 and the first mating hole 61, so as to fix the first member 20 and the second member 28, 8.

[0033] In FIG. 4, the left side shows the arrangement of the installation holes on the reinforced board, in which the centers of the five round holes 61, 62, 63, 64, 65 are arranged in the same vertical line and are equally spaced from each other by a distance b ; while the right side shows the arrangement of the slot holes and the three fixation holes on the fixed portion 42, in which the centers of the two slot holes 44, 53 and the centers of the three fixation holes 43, 51, 52 are also arranged in the same vertical line, and the distance from the center of the slot hole 44 to the center of the fixation hole 51 as well as the distance from the center of the slot hole 53 to the center of the fixation hole 51 is $2b$, while the distance from the center of an upper-end central hole of the slot hole 44 to the center of the fixation hole 43 as well as the distance from the center of a lower-end central hole of the slot hole 53 to the center of the fixation hole 52 is b . In FIG. 5, the displacement a of the fixation holes 43, 52 relative to the holes 62, 64 is equal to the distance from the centers of the slot holes 44, 53 to the center of the upper-end central hole or the center of the lower-end central hole.

[0034] The adjustment mechanism for adjusting a positional relationship between the fixed member 40 and

the door 20 is formed through the installation holes on the fixed member 40 and the door 20, which reduces the cost and is easy to operate through accurate location of the fixation holes during the adjustment.

[0035] The slot hole 44 is provided on the fixed portion 42 for enabling adjustment on the door in the vertical direction when an error is caused in the manufacturing or assembly process. When no error occurs in the manufacturing and assembly process, fixation is implemented through the centers of the two slot holes 44, 53, the middle fixation hole 51 and the corresponding holes 61, 65, 63 on the door liner 23; when an error occurs and the fixed portion 42 needs to move upward relative to an error-free position, fixation is implemented through the upper-end central holes of the two slot holes 44, 53, the fixation hole 43 close to the slot hole 44 and the corresponding holes 61, 65, 62 on the door liner 23; and when an error occurs and the fixed portion 42 needs to move downward relative to an error-free position, fixation is implemented through the lower-end central holes of the two slot holes 44, 53, the fixation hole 52 close to the slot hole 53 and the corresponding holes 61, 65, 64 on the door liner 23. The connection portion 41 is provided with two fixation holes 45, 46, and screws pass through the fixation holes 45, 46 to connect the support member 18.

[0036] Further referring to FIG. 5, FIG. 5 is a comparison view of holes on a fixed member and a liner of a door according to a second embodiment of the present invention. Similar to FIG. 4, in FIG. 5, the left side shows the arrangement of the holes on the door liner 23, in which the centers of the three holes 61, 63, 64 are arranged in the same vertical line, the distance from the center of the hole 61 to the center of the hole 63 is $2b$, and the distance from the center of the hole 63 to the center of the hole 64 is b ; while the right side shows the arrangement of the slot holes and the three fixation holes on the fixed portion 42, in which the center of the slot hole 44 and the centers of the two fixation holes 51, 52 are also arranged in the same vertical line, when the center of the slot hole 44 coincides with the center of the hole 61 on the door liner 23, the center of the fixation hole 51 also coincides with the center of the hole 63, and a deviation a exists between the fixation hole 52 and the hole 64 in the vertical direction, where the deviation a is an amplitude of which the door can be adjusted in the vertical direction. The door in this embodiment can only be adjusted upward in the vertical direction by an amplitude a .

[0037] In the second embodiment, the first adjustment mechanism 59 includes two fixation holes 51, 52, one slot hole 44, three corresponding holes 61, 63, 64 on the door liner and a connection device for connecting the fixed portion 42 to the door 20. Generally, the connection device may be a screw.

[0038] FIG. 6 is a comparison view of holes on a fixed member and a liner of a door according to a third embodiment of the present invention. The difference between the third embodiment and the second embodiment lies in that, the center of the hole 63 and the centers of

the remaining two holes 61, 64 on the door liner 23 are not arranged in the same line; the center of the fixation hole 51, the center of the slot hole 44 and the center of the fixation hole 52 on the fixed portion 42 are not arranged in the same line, but the fixation hole 51 still corresponds to the hole 63, that is, when the center of the slot hole 44 coincides with the center of the hole 61 on the door liner 23, the center of the fixation hole 51 still coincides with the center of the hole 63, and a deviation a exists between the fixation hole 52 and the hole 64 in the vertical direction.

[0039] FIG. 7 is a comparison view of holes on a fixed member and a liner of a door according to a fourth embodiment of the present invention. The difference between the fourth embodiment and the first embodiment lies in that, when the center of the slot hole 44 coincides with the center of the hole 61 on the door liner 23 and the center of the slot hole 53 coincides with the center of the hole 65 on the door liner 23, a deviation c exists between the fixation hole 43 and the hole 62 in the vertical direction, and a deviation a exists between the fixation hole 52 and the hole 64 in the vertical direction, where c is unequal to a . In this embodiment, the door may be adjusted downward by an amplitude c or adjusted upward by an amplitude a . In addition, other unequal upward and downward adjustment amplitudes can be set accordingly.

[0040] In the above embodiments, the adjustment hole and the fixation holes are disposed on the fixed member, and the mating holes are disposed on the door. However, in an alternative embodiment, the mating holes may also be disposed on the fixed member, and the adjustment hole and the fixation holes are disposed on the door.

Claims

1. An adjustment mechanism (59), for adjusting a positional relationship between a first member (20) and a second member (28, 8) in an adjustment direction, **characterized in that** the adjustment mechanism (59) comprises:

at least one adjustment hole (44) and at least two spaced apart fixation holes (51, 52), disposed on one of the first member (20) and the second member (28, 8);

at least three mating holes (61, 63, 64), disposed on the other of the first member (20) and the second member (28, 8), wherein the at least three mating holes (61, 63, 64) comprise at least one first mating hole (61) for mating with the at least one adjustment hole (44) respectively and second mating holes (63, 64) for mating with the at least two fixation holes (51, 52) respectively, and when a center of any one fixation hole (51) coincides with a center of the corresponding second mating hole (63), a center of the remain-

- ing fixation hole (52) is spaced from a center of the corresponding second mating hole (64) in the adjustment direction; and
at least two connection members, wherein one connection member passes through the fixation holes (51, 52) and the second mating holes (63, 64) with coincident centers, and the other connection member passes through the adjustment hole (44) and the first mating hole (61), so as to fix the first member (20) and the second member (28, 8).
2. The adjustment mechanism according to claim 1, **characterized in that** the centers of the at least two fixation holes (51, 52) are arranged in a line in the adjustment direction.
 3. The adjustment mechanism according to claim 1, **characterized in that** the centers of the at least one adjustment hole (44) and the at least two fixation holes (51, 52) are arranged in a line in the adjustment direction.
 4. The adjustment mechanism according to claim 1, **characterized in that** the centers of the at least two fixation holes (51, 52) have a distance therebetween in a direction perpendicular to the adjustment direction.
 5. The adjustment mechanism according to claim 1, **characterized by** comprising at least two adjustment holes (44, 53), wherein the at least two fixation holes (51, 52) are located between the two adjustment holes (44, 53).
 6. The adjustment mechanism according to claim 1, **characterized in that** the adjustment hole (44) is a slot hole.
 7. The adjustment mechanism according to claim 1, **characterized in that** the connection members are screws and connect the first member (20) and the second member (28, 8) by threaded connection.
 8. The adjustment mechanism according to any one of the above claims, **characterized in that** one of the at least two fixation holes is a reference fixation hole (51), and when a center of the reference fixation hole (51) coincides with a center of the corresponding second mating hole (63), a center of the at least one adjustment hole (44) exactly coincides with a center of the corresponding first mating hole (61).
 9. The adjustment mechanism according to claim 8, **characterized by** comprising at least three pairs of paired fixation holes (43, 51, 52) and second mating holes (62, 63, 64), wherein when the center of the reference fixation hole (51) coincides with the center of the corresponding second mating hole (63), the remaining fixation holes (43, 52) are equally spaced from the pairing second mating holes (62, 64) in the adjustment direction.
 10. The adjustment mechanism according to any one of claims 1 to 7, **characterized by** comprising at least three pairs of paired fixation holes (43, 51, 52) and second mating holes (62, 63, 64), wherein the fixation holes (43, 51, 52) comprise a reference fixation hole (51), and when a center of the reference fixation hole (51) coincides with a center of the pairing second mating hole (63), the remaining fixation holes (43, 52) are equally spaced from the pairing second mating holes (62, 64) in the adjustment direction.
 11. A household appliance (10), comprising a first member (20) and a second member (28, 8), **characterized in that** the household appliance (10) further comprises the adjustment mechanism (59) for adjusting a positional relationship between the first member (20) and the second member (28, 8) in an adjustment direction according to any one of claims 1 to 10.
 12. The household appliance (10) according to claim 11, **characterized in that** the household appliance comprises an appliance body (28, 8) and a door (20) supported on the appliance body (28, 8), and the adjustment mechanism (59) adjusts the door (20) to move relative to the appliance body (28, 8) with a predetermined amplitude.
 13. The household appliance (10) according to claim 12, **characterized in that** the adjustment mechanism (59) is disposed to adjust a position of the door (20) relative to the appliance body (28, 8) in a vertical direction or a horizontal direction.

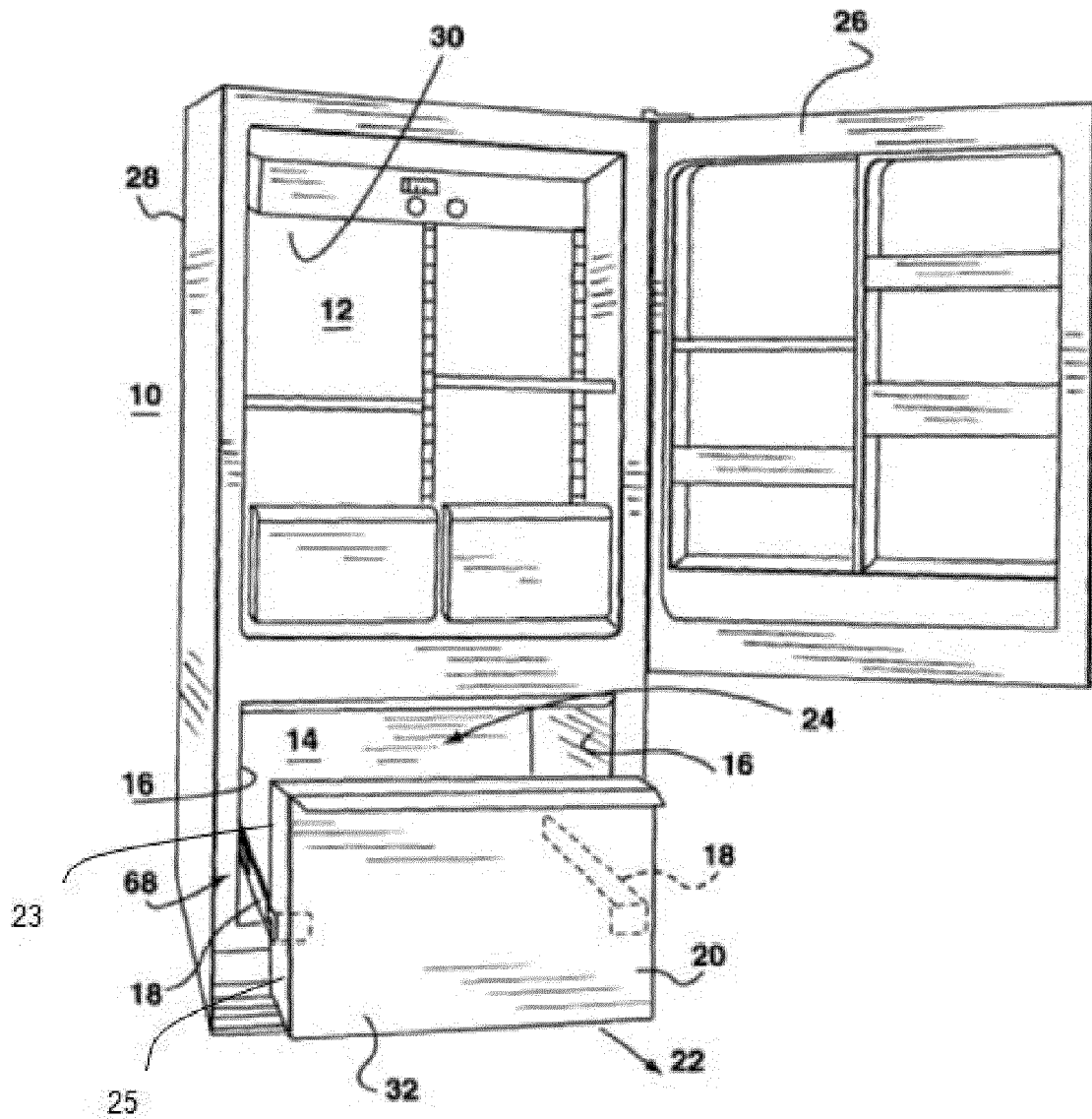


FIG. 1

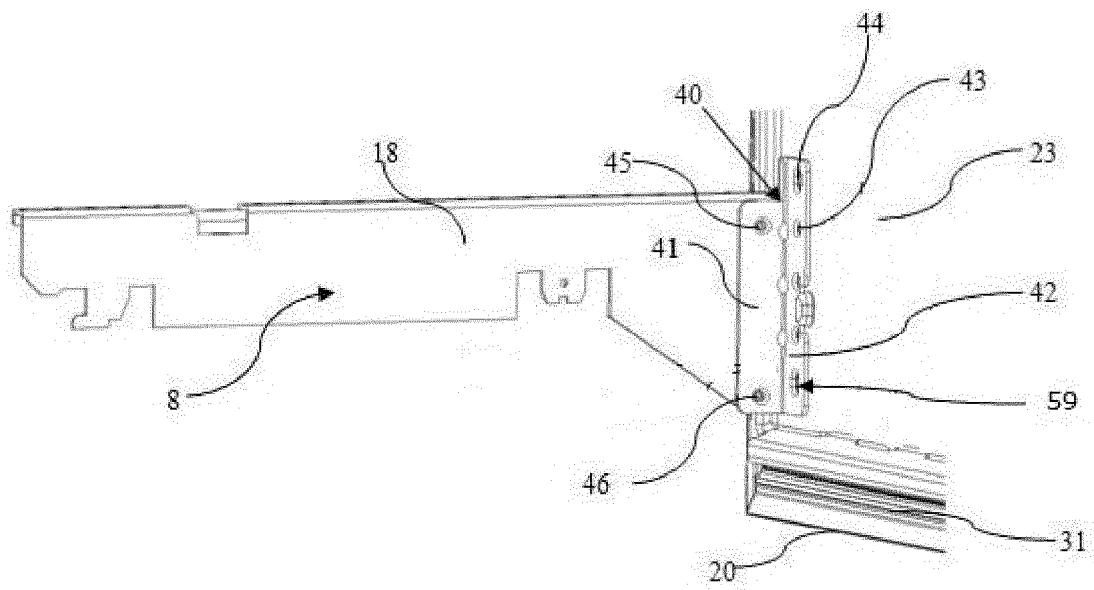


FIG. 2

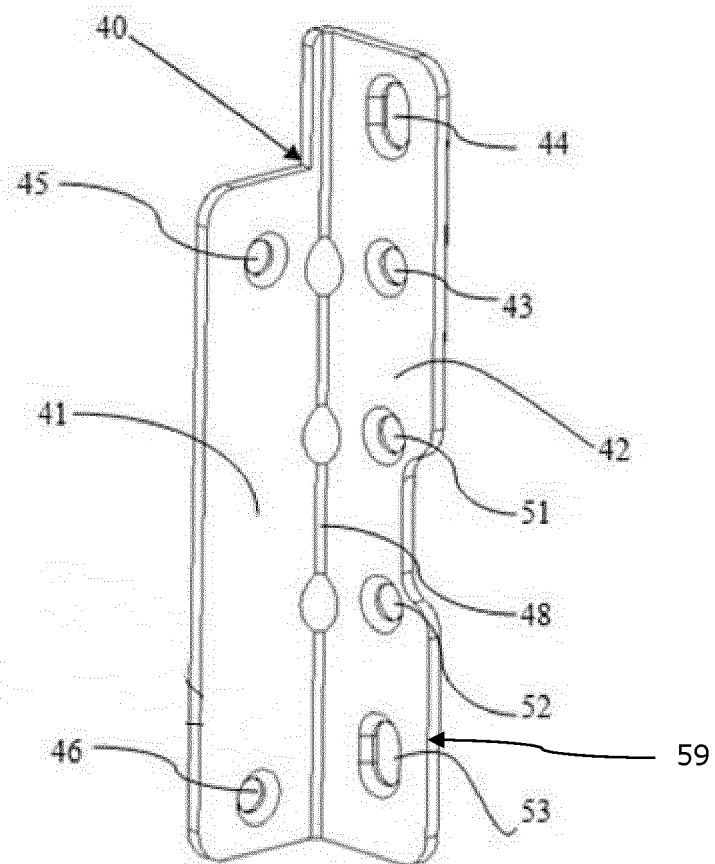


FIG. 3

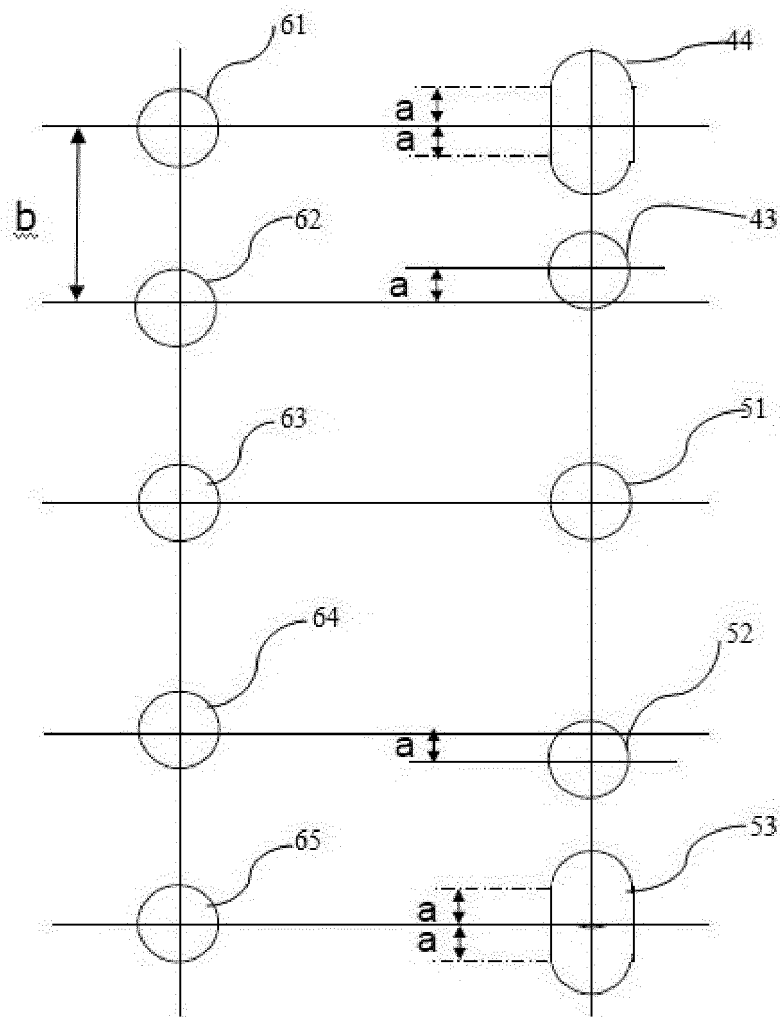


FIG. 4

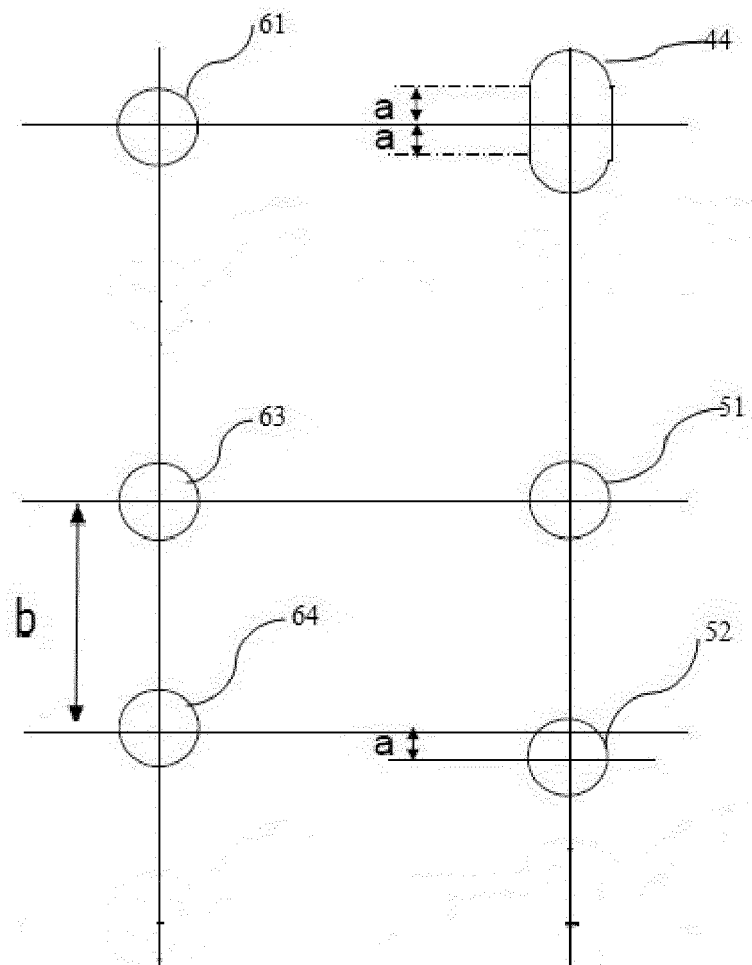


FIG. 5

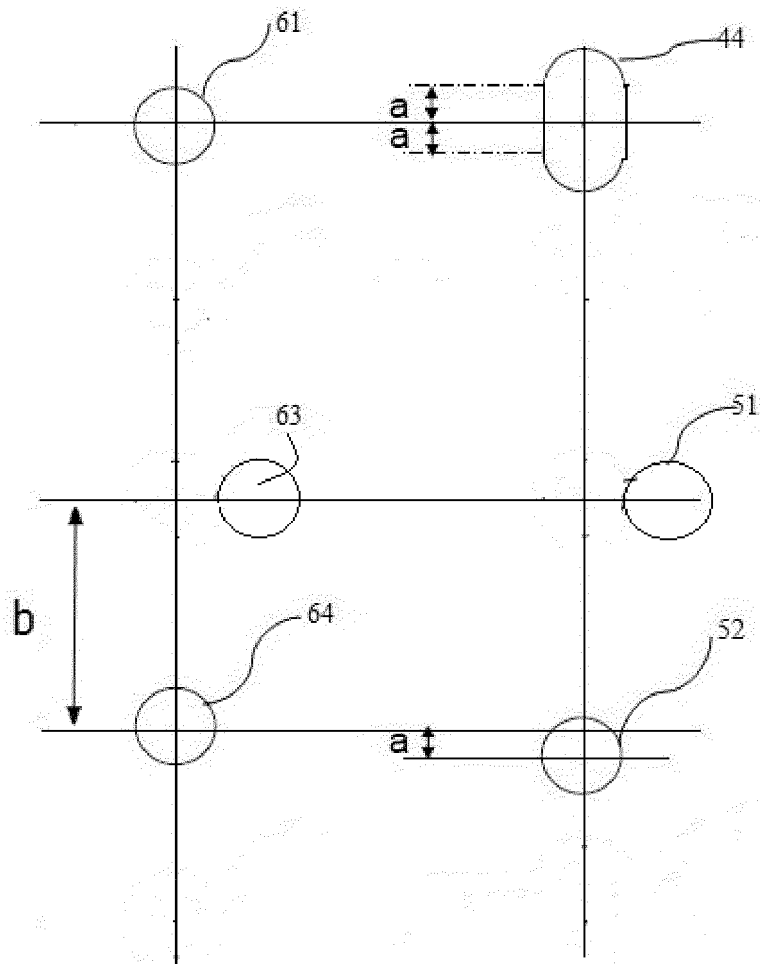


FIG. 6

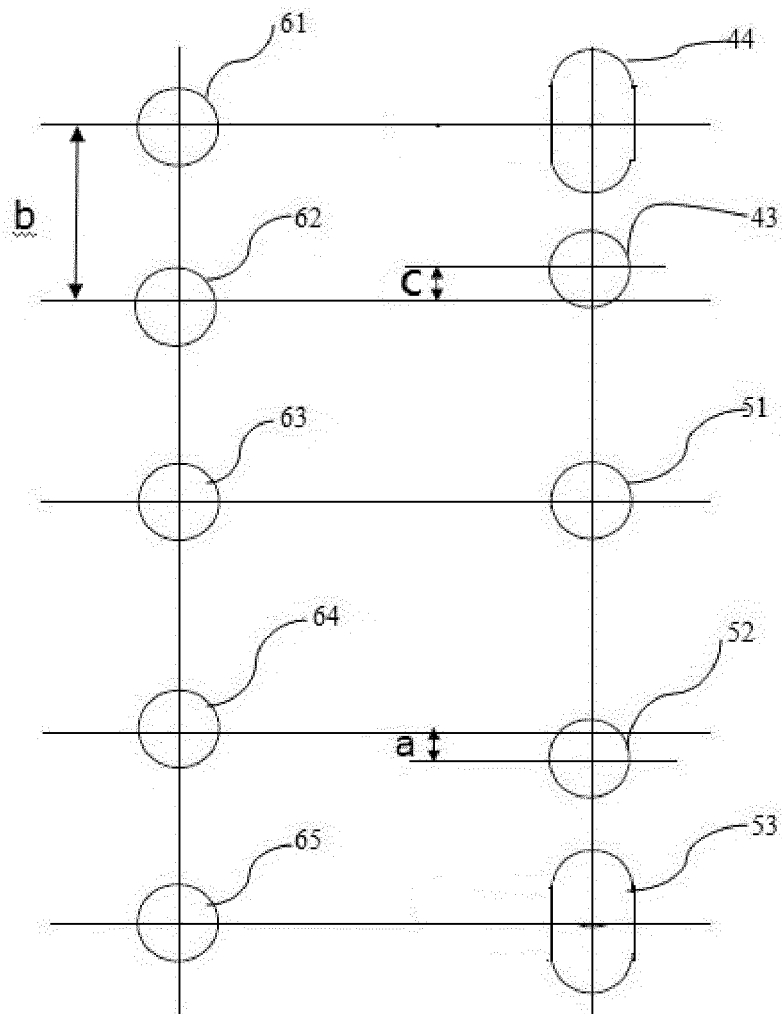


FIG. 7