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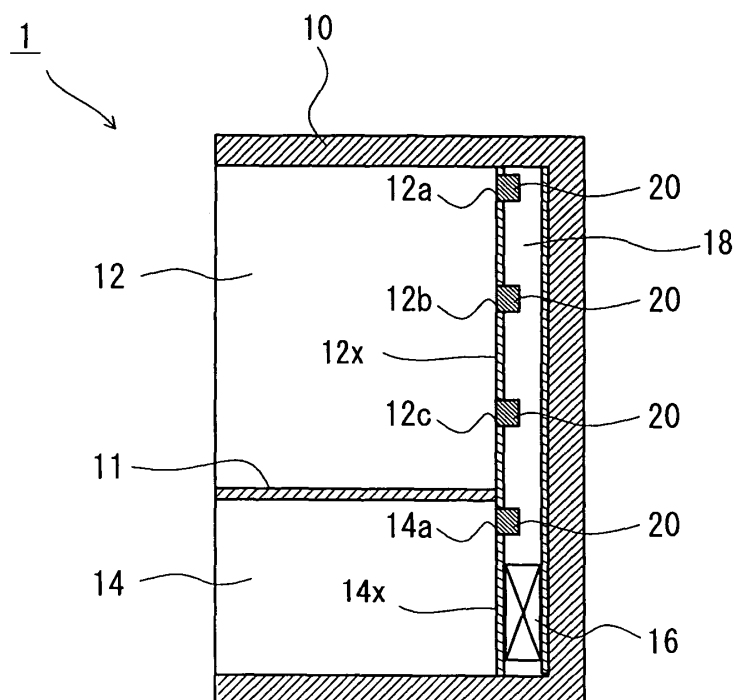
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(54) **Refrigerator**

(57) A refrigerator includes an accommodating chamber (12, 14), a duct (18) through which cold air flows, and a damper device (20) which is provided with a baffle (24) for controlling supply of the cold air into the accommodating chamber (12, 14). A cold air inflow port (12a, 12b, 12c, 14a) is provided in the duct (18) in a direction

perpendicular to a direction of the cold air flowing through the duct (18) and through which the cold air is supplied to the accommodating chamber (12, 14), and the damper device (20) is provided at the cold air inflow port (12a, 12b, 12c, 14a) so that the baffle (24) is moved in an opposite side to the accommodating chamber (12, 14) to open the cold air inflow port (12a, 12b, 12c, 14a).

Fig. 1



Description

Field of the Invention

[0001] The present invention relates to a refrigerator. More specifically, the present invention relates to a refrigerator on which a damper device for controlling cold air to be supplied to an accommodating chamber is mounted.

Background Art

[0002] In a general refrigerator (including a freezer, a refrigerator-freezer and the like, the same below), an inside of an accommodating chamber in which refrigerated articles (including frozen articles, the same below) are accommodated is maintained at a predetermined temperature by supplying cold air to the accommodating chamber from a cooler (evaporator) or the like. Amount of cold air supplied to the accommodating chamber is controlled by a damper device provided with a baffle for opening or closing a flow passage for cold air as shown, for example, in Japanese Patent Laid-Open No. Hei 09-138052.

[0003] However, when the flow passage for cold air is set to be in an open state in the refrigerator which is described in the above mentioned patent reference, the baffle of the damper device is structured to tilt on the accommodating chamber side. Therefore, a space for allowing the baffle to tilt is required to arrange on the accommodating chamber side and thus a space for the accommodating chamber is restricted to be narrow by the space for the baffle.

Summary of the Invention

[0004] In view of the problem described above, an object of the present invention is directed to providing a refrigerator in which an arrangement space of the accommodating chamber is not reduced owing to an operating space of a damper device for opening/closing a flow passage for cold air.

[0005] Thus, in accordance with the present invention, there is provided a refrigerator including an accommodating chamber in which refrigerated articles or frozen articles are accommodated, a duct through which cold air flows, and a damper device which is provided with a baffle for controlling supply of the cold air into the accommodating chamber. In this refrigerator, a cold air inflow port is provided in the duct in a direction perpendicular to a direction of the cold air flowing through the duct and through which the cold air is supplied to the accommodating chamber, and the damper device is provided at the cold air inflow port so that the baffle is moved in an opposite side to the accommodating chamber to open the cold air inflow port.

[0006] In the refrigerator in accordance with the present invention, the damper device which is provided

with a baffle for opening/closing a cold air inflow port is provided and, when the cold air inflow port is to be opened, the baffle is moved in the direction on an opposite side to the accommodating chamber. In other words, a space for the baffle setting in an open state is not required on the accommodating chamber side and thus the accommodating chamber having a sufficient size can be secured. Further, the cold air inflow port for supplying cold air into the accommodating chamber is formed in a direction perpendicular to the duct and thus the duct is not required to be bent and a plurality of damper devices can be easily disposed along the duct and, as a result, the refrigerator can be made compact.

[0007] In accordance with the present invention, it is preferable that the damper device includes a drive part for moving the baffle and a frame on which the baffle is mounted, and the drive part is disposed on a duct side with respect to an end face on an accommodating chamber side of the frame. When the drive part for driving the baffle is structured so as not to protrude from the end face on the accommodating chamber side of the frame, an arrangement space for the accommodating chamber can be further made larger.

[0008] Further, in accordance with the present invention, the frame may be inserted into the cold air inflow port. In this case, it is preferable that the frame does not protrude from the end face on the accommodating chamber side of the cold air inflow port. When the frame is mounted to be inserted into the cold air inflow port and, when the frame is mounted so as not to protrude on an outer side of the cold air inflow port, at least a part of the damper device is accommodated within the duct and thus the refrigerator can be made compact and an arrangement space for the accommodating chamber can be enlarged.

[0009] Further, it is preferable that the drive part is disposed within the duct. When the drive part is arranged within the duct, the entire damper device can be accommodated within the duct and thus the structure of the refrigerator can be made compact.

[0010] Further, it is preferable that the drive part is disposed in a rotation shaft direction of the baffle. When the drive part is disposed in the rotation shaft direction of the baffle, the size (length) in a short side direction of the damper device (direction perpendicular to the rotation shaft) can be smaller and thus the size of a refrigerator can be largely reduced even when a plurality of the cold air inflow ports is provided. Further, in a refrigerator in which a plurality of the cold air inflow ports are provided closely, interference between the damper devices with each other can be prevented and thus the present invention is especially effective.

[0011] Further, it is preferable that the damper device is provided at the cold air inflow port so that the rotation shaft of the baffle is disposed on an outflow side of the cold air passing through the cold air inflow port. When the damper device is mounted so that the rotation shaft of the baffle is located on the cold air outflow side, cold

air can be efficiently guided to the accommodating chamber from the duct in comparison with a case that the rotation shaft of the baffle is disposed on the duct side.

[0012] In addition, the damper device may be provided with a plurality of the frames and the baffles. When the damper device is provided with a plurality of the frames and the baffles, control of cold air for flowing through a plurality of ducts can be performed with one damper device. According to this structure, the refrigerator can be made compact.

[0013] Further, the damper device may include a drive part for moving the baffle and a frame on which the baffle is mounted, the frame is formed with an opening part at its center portion, and the opening part is juxtaposed to the cold air inflow port provided in the duct, for example, the opening part is formed in parallel with the cold air inflow port. Further, it is preferable that the frame is provided with at least one of a cut-out part and a hole in order to be capable of flowing the cold air in the duct through the frame satisfactorily.

[0014] Other features and advantages of the invention will be apparent from the following detailed description, taken in conjunction with the accompanying drawings that illustrate, by way of example, various features of embodiments of the invention.

Brief Description of the Drawings

[0015] Fig. 1 is a schematic cross-sectional view showing a structure of a refrigerator in accordance with an embodiment of the present invention.

[0016] Figs. 2(a) and 2(b) are perspective outward appearance views showing a damper device which is provided in the refrigerator shown in Fig. 1.

[0017] Fig. 3 is a plan view showing a structure of a drive part in the damper device shown in Fig. 2.

[0018] Fig. 4 is a cross-sectional view showing a damper device which is mounted on a refrigerator in a state where a part of a frame is protruded from a duct.

[0019] Fig. 5 is a cross-sectional view showing a damper device which is mounted on a refrigerator in a state where a frame is accommodated and buried in a duct.

[0020] Fig. 6 is a cross-sectional view showing a damper device which is mounted on a refrigerator in a state where a frame is abutted with an outer face of a duct.

[0021] Fig. 7 is a cross-sectional view showing a damper device which is mounted on a refrigerator in a state where a frame is fixed to a rib formed in a duct.

[0022] Fig. 8 is a cross-sectional view showing a state where an entire damper device is accommodated within a duct.

[0023] Fig. 9 is a perspective outward appearance view showing a so-called double damper device in which two frames and baffles are provided for one drive part.

Detailed Description of the Preferred Embodiments

[0024] Embodiments of the present invention will be

described in detail below with reference to the accompanying drawings. Fig. 1 is a schematic cross-sectional view for explaining a structure of a refrigerator 1 in accordance with an embodiment of the present invention.

As shown in Fig. 1, the refrigerator 1 includes a cooling chamber 12, a freezing chamber 14, a cooler 16, a duct 18 and damper devices 20 within an outer case 10.

[0025] The cooling chamber 12 and the freezing chamber 14 are accommodating chambers in which refrigerated articles and frozen articles are respectively accommodated. The cooling chamber 12 and the freezing chamber 14 are divided by a partition plate 11. Further, a plurality of cold air inflow ports 12a, 12b and 12c are formed in a rear wall part 12x of the cooling chamber 12 and a cold air inflow port 14a is formed in a rear wall part 14x of the freezing chamber 14.

[0026] Cold air which is generated by the cooler 16 is forcibly sent through the duct 18 by a fan not shown. Supplying amount of the cold air into the cooling chamber 12 and the freezing chamber 14 are controlled by the damper devices 20 which are respectively disposed at the cold air inflow ports 12a, 12b, 12c and 14a that are perpendicularly formed to an extending direction of the duct 18, i.e., in the rear wall part 12x of the cooling chamber 12 and the rear wall part 14x of the freezing chamber 14. In this manner, insides of the cooling chamber 12 and the freezing chamber 14 are maintained at predetermined temperatures.

[0027] Next, the structure of the damper device 20 will be described below. Figs. 2(a) and 2(b) are perspective outward appearance views showing the damper device 20. Fig. 2(a) is a view showing a state when the baffle 24 has been opened and Fig. 2(b) is a view showing a state when the baffle 24 has been closed.

[0028] The damper device 20 includes a drive part 22, the baffle 24 for opening and closing a flow passage for cold air, and a frame 26 to which the baffle 24 is attached.

[0029] The drive part 22 is used to drive the baffle 24 and is structured so that a motor 30 and gears 32a through 32e are disposed within a case 28. In order to describe a structure of the drive part 22, a state where a cover 28a of the case 28 is detached is shown in Fig. 3.

[0030] The motor 30 is a drive source of the damper device 20, which is a well-known stepping motor. Further, the gears 32a through 32e are elected and assembled so that the baffle 24 can be driven against a fluid pressure of cold air flowing through the duct. Specifically, the mechanism is designed so that a required output which is calculated on a basis of a torque of the motor 30, a size of the baffle 24, a fluid pressure applied to the baffle 24 and the like is transmitted to the baffle 24.

[0031] The baffle 24 is a plate-shaped member which is driven by the drive part 22 and mounted on the frame 26 through a rotation shaft 34 which is formed integrally with the baffle 24. The rotation shaft 34 is connected with a final gear 32e which is formed in a fan-like shape. An elastic member 36 is adhered on a surface of the baffle 24 so as to be capable of covering an opening part 38 of

the frame 26.

[0032] The frame 26 is a member for supporting the baffle 24 as described above and is formed with the opening part 38 at its center portion. Since the damper device 20 is disposed at the cold air inflow ports 12a, 12b, 12c and 14a so that the opening part 38 is arranged so as to be disposed in the same direction as the cold air inflow ports 12a, 12b, 12c and 14a, i.e., the opening part 38 is arranged in a parallel manner to the cold air inflow ports 12a, 12b, 12c and 14a, and the opening part 38 is formed to be a flow passage of cold air which is applied to the cooling chamber 12 and the freezing chamber 14. In this embodiment, the cold air inflow ports 12a, 12b, 12c and 14a and the opening part 38 are arranged in a parallel manner to each other. However, they are not required to be arranged in a parallel manner to each other. For example, even when the opening part 38 is inclined to some extent to the cold air inflow ports 12a, 12b, 12c and 14a, the flow of cold air can be controlled satisfactorily in the case that they are juxtaposed each other.

[0033] In the damper device 20 which is structured as described above, when the motor 30 is rotated in a predetermined direction from an open state of the opening part 38 (see Fig. 2(a)), the baffle 24 is turned around the rotation shaft 34 as a support shaft to be pressed to the opening part 38 (see Fig. 2(b)). Since the elastic member 36 is adhered on the surface of the baffle 24, the baffle 24 is tightly abutted with the frame 26 and thus the opening part 38 is completely closed. In other words, cold air which is passed through the cold air inflow ports 12a, 12b, 12c and 14a to be supplied to the cooling chamber 12 and the freezing chamber 14 is completely shut off.

[0034] On the other hand, the motor 30 is driven in the reverse direction from the state that the opening part 38 is closed, the baffle 24 is tilted in an opening direction of the opening part 38 (see Fig. 2(a)). In this manner, the cold air inflow ports 12a, 12b, 12c and 14a are opened and cold air is supplied into the cooling chamber 12 and the freezing chamber 14.

[0035] In this embodiment, a cross sectional area of the duct 18 which is perpendicular to a flowing direction of the cold air is larger than an area of the baffle 24. Therefore, even when the baffle 24 is tilted to the direction where the opening part 38 is opened, the duct 18 is not closed and the cold air inflow side of the duct 18 remains in communication with its cold air outflow side.

[0036] The damper device 20 structured as described above may be mounted on a refrigerator 1 as follows. Fig. 4 is a cross-sectional view schematically showing the damper device 20 which is mounted at the cold air inflow ports 12a (12b, 12c, 14a) formed in the duct 18 or the rear wall part 12x of the cooling chamber 12.

[0037] As shown in Fig. 4, the frame 26 is fitted to the cold air inflow port 12a and the damper device 20 is fixed to the duct 18 or the rear wall part 12x. In this case, the damper device 20 is mounted so that the baffle 24 is driven and turned as shown by the arrow in the drawing. In other words, the damper device 20 is mounted in such

a manner that, when the cold air inflow port 12a is to be in an open state, the baffle 24 is driven and turned in a direction toward the duct 18, i.e., in an opposite direction to the cooling chamber 12 (freezing chamber 14).

[0038] Therefore, according to this embodiment, a space for the baffle 24 moving to the open state is not required on the cooling chamber 12 side and on the freezing chamber 14 side and thus sufficient spaces for the cooling chamber 12 and the freezing chamber 14 can be secured. Further, since a part of the damper device 20 (a part of the frame 26) is fitted into the cold air inflow port 12a, a size of the refrigerator 1 can be made compact and the cooling chamber 12 and the freezing chamber 14 can be designed larger.

[0039] In addition, in this case, as shown in the drawing, the drive part 22 (case 28) does not protrude from the end face 26a on the cooling chamber 12 side and on the freezing chamber 14 side of the frame 26 (end face where the opening part 38 is formed). Therefore, a further large space can be secured as an arrangement space for the cooling chamber 12 and the freezing chamber 14. In addition, the drive part 22 is disposed in an axial line direction of the rotation shaft 34 (in a longitudinal direction of the frame 26). In other words, a size in a short side direction of the damper device 20 becomes smaller and thus a size (height) of the refrigerator 1 in which a plurality of damper devices 20 is disposed can be reduced.

[0040] Further, the damper device 20 can be mounted so that its rotation shaft 34 is located on the cooling chamber 12 side and the freezing chamber 14 side, i.e., on the outflow side of the cold air. Therefore, the cold air from the duct 18 can be effectively supplied to the cooling chamber 12 or the freezing chamber 14.

[0041] Further, Figs. 5 through 8 are cross-sectional views schematically showing the damper device 20 in accordance with other embodiments. In other words, as shown in Fig. 5, the damper device 20 may be mounted so that the frame 26 is buried within the duct 18 and the baffle 24 is driven and turned in the opposite direction to the cooling chamber 12 and the freezing chamber 14. In this case, the frame 26 is mounted so as not to protrude from an end face (X) on the accommodating chamber side of the cold air inflow ports 12a (12b, 12c, 14a). In this embodiment, although flowing of cold air through the duct 18 is disturbed a little by the frame 26, a space of the cooling chamber 12 and the freezing chamber 14 can be made larger than that of the embodiment shown in Fig. 4. In this case, a structure in which a cut-out part 26b or a hole 26c for flowing cold air in an extending direction of the duct is formed in the frame 26 may be adopted to reduce disturbance in flowing of cold air. The cut-out part 26b may be formed largely in the frame 26.

[0042] Further, as shown in Fig. 6, the damper device 20 may be mounted so that the frame 26 is abutted with the outer face of the duct 18 and the baffle 24 is driven to turn in an opposite direction to the cooling chamber 12 and the freezing chamber 14. According to this embodiment, a sufficient space for the cooling chamber 12

and the freezing chamber 14 can be secured without disturbing flow of cold air through the duct 18.

[0043] Alternatively, as shown in Fig. 7, the damper device 20 may be mounted so that a rib 181 is formed at portions where the cold air inflow port 12a (12b, 12c, 14a) in the duct 18 is provided and the frame 26 is inserted into the rib 181 and the baffle 24 is driven to turn in the opposite direction to the cooling chamber 12 and the freezing chamber 14. Also in this case, the frame 26 is mounted so as not to protrude from the end face (X) on the accommodating chamber side of the cold air inflow ports 12a (12b, 12c, 14a). According to this embodiment, a sufficient space for the cooling chamber 12 and the freezing chamber 14 can be secured and the damper device 20 can be fixed to the duct 18 firmly.

[0044] Alternatively, as shown in Fig. 8, the damper device 20 may be mounted so that the entire damper device 20 including the drive part 22 is accommodated within the duct 18 and the baffle 24 is driven to turn in the opposite direction to the cooling chamber 12 and the freezing chamber 14. When the entire damper device 20 is accommodated within the duct 18, a mounting space for the damper device 20 is not required and thus the structure of a refrigerator 1 can be made further compact. In this case, when a cut-out part 26b or a hole 26c is formed in the frame 26, disturbance in flow of cold air can be reduced. Alternatively, a center portion of the frame 26 is removed largely and this large removed portion may be regarded as the cut-out part 26b.

[0045] In the damper device 20 in the embodiments described above, one baffle 24 is driven by one drive part 22. However, as shown in Fig. 9, the present invention may be applied to a damper device 21 (so-called double damper device) in which two or more baffles 24 are driven by one drive part 22. According to the damper device 21 as described above, opening and closing controls for cold air flowing through a plurality of ducts 18 can be performed by one damper device. Therefore, the structure of the refrigerator 1 can be made further compact.

[0046] As described above, according to the refrigerator 1 in accordance with the embodiments of the present embodiment, the damper device 20 providing with the baffle 24 is provided at the cold air inflow ports 12a, 12b, 12c and 14a which are formed in the duct 18, or the rear wall part 12x of the cooling chamber 12 and the rear wall part 14x of the freezing chamber 14 for shutting/passing cold air which is to be supplied to the cooling chamber 12 or the freezing chamber 14 (accommodating chamber). In addition, it is structured that the baffle 24 is moved in the opposite direction to the cooling chamber 12 or the freezing chamber 14 when the cold air inflow ports 12a, 12b, 12c and 14a are to be in an open state. In other words, a space for the baffle 24 to be in an open state is not required on the cooling chamber 12 side or the freezing chamber 14 side and thus a sufficient space for arranging the cooling chamber 12 and the freezing chamber 14 can be secured in comparison with the conventional case. Further, the cold air inflow ports 12a, 12b,

12c and 14a for supplying cold air into the cooling chamber 12 or the freezing chamber 14 are formed in the direction perpendicular to the duct 18. Therefore, the duct 18 is not required to bend and a plurality of damper devices 20 are easily disposed on the rear wall part 12x of the cooling chamber 12 along the duct 18 and thus the refrigerator 1 can be made compact.

[0047] Further, when the drive part 22 for driving the baffle 24 is structured so as not to protrude from the end face 26a on the accommodating chamber side of the frame 26, spaces for the cooling chamber 12 and the freezing chamber 14 can be made further larger.

[0048] In addition, when the frame 26 is inserted into and mounted on the cold air inflow ports 12a, 12b, 12c and 14a and, alternatively, when the frame 26 is mounted so as not to protrude on the accommodating chamber side from the cold air inflow ports 12a, 12b, 12c and 14a, at least a part of the damper device 20 is accommodated within the duct 18 and thus the structure of the refrigerator 1 can be made compact and sizes of the cooling chamber 12 and the freezing chamber 14 can be made further larger.

[0049] Further, when the entire damper device 20 including the drive part 22 is mounted so as to be accommodated within the duct 18, a mounting space for the damper device 20 is not required and thus the structure of the refrigerator 1 can be made further compact.

[0050] Further, the drive part 22 is disposed in a direction of the rotor shaft 34 of the baffle 24 and thus a size (length) in a short side direction of the damper device 20 (direction perpendicular to the rotor shaft 34) is reduced and the size of the refrigerator 1 in which a plurality of the cold air inflow ports 12a, 12b, 12c and 14a are provided can be reduced.

[0051] Further, since the damper device 20 is mounted so that the rotor shaft 34 of the baffle 24 is located on the cold air outflow side, cold air from the duct 18 can be guided to the cooling chamber 12 or the freezing chamber 14 efficiently in comparison with a case when the rotor shaft 34 of the baffle 24 is located on the duct 18 side.

[0052] Further, in a so-called double damper device which is a damper device provided with a plurality of the frames 26 and a plurality of the baffles 24, opening and closing operation for cold air flowing through a plurality of the ducts 18 can be controlled by one damper device 21. Therefore, the structure of the refrigerator 1 can be made compact.

[0053] Although the present invention has been shown and described with reference to specific embodiments, various changes and modifications will be apparent to those skilled in the art from the teachings herein.

[0054] For example, in the above-mentioned embodiment, the refrigerator 1 is a refrigerator which includes the cooling chamber 12 and the freezing chamber 14 as accommodating chambers. However, the present invention may be applied to a refrigerator which includes another accommodating chamber such as a so-called chilled chamber or vegetable chamber.

[0055] While the description above refers to particular embodiments of the present invention, it will be understood that many modifications may be made without departing from the spirit thereof. The accompanying claims are intended to cover such modifications as would fall within the true scope and spirit of the present invention.

[0056] The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims, rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

1. A refrigerator comprising:

an accommodating chamber (12, 14) in which refrigerated articles or frozen articles are accommodated;
a duct (18) through which cold air flows;
a damper device (20) which is provided with a baffle (24) for controlling supply of the cold air into the accommodating chamber (12, 14); and

characterized in that

a cold air inflow port (12a, 12b, 12c, 14a) is provided in the duct (18) in a direction perpendicular to a direction of the cold air flowing through the duct (18) and through which the cold air is supplied to the accommodating chamber (12, 14); and
the damper device (20) is provided at the cold air inflow port (12a, 12b, 12c, 14a) so that the baffle (24) is moved in an opposite side to the accommodating chamber (12, 14) to open the cold air inflow port (12a, 12b, 12c, 14a).

2. The refrigerator according to claim 1, wherein the damper device (20) includes a drive part (22) for moving the baffle (24) and a frame (26) on which the baffle (24) is mounted, and the drive part (22) is disposed on a duct (18) side with respect to an end face (26a) on an accommodating chamber (12, 14) side of the frame (26).
3. The refrigerator according to claim 2, wherein the frame (26) is inserted into the cold air inflow port (12a, 12b, 12c, 14a).
4. The refrigerator according to claim 3, wherein the frame (26) does not protrude from an end face (X) on an accommodating chamber (12, 14) side of the cold air inflow port (12a, 12b, 12c, 14a).
5. The refrigerator according to at least any one of the claims 2 to 4, wherein the drive part (22) is disposed

in the duct (18).

6. The refrigerator according to at least any one of the claims 2 to 4, wherein the drive part (22) is disposed in a rotation shaft (34) direction of the baffle (24).
7. The refrigerator according to at least any one of the claims 2 to 6, wherein the damper device (20) is provided with a plurality of the frames (26) and a plurality of the baffles (24).
8. The refrigerator according to at least any one of the preceding claims, wherein the damper device (20) is provided at the cold air inflow port (12a, 12b, 12c, 14a) so that a rotation shaft (34) of the baffle (24) is disposed on an outflow side of the cold air passing through the cold air inflow port (12a, 12b, 12c, 14a).
9. The refrigerator according to claim 1 or 2, wherein the damper device (20) includes a drive part (22) for moving the baffle (24) and a frame (26) on which the baffle (24) is mounted, the frame (26) is formed with an opening part (38) at its center portion, and the opening part (38) is juxtaposed to the cold air inflow port (12a, 12b, 12c, 14a) provided in the duct (18).
10. The refrigerator according to claim 9, wherein the frame (26) is formed with at least one of a cut-out part (26b) and a hole (26c) for flowing the cold air through the duct (18).
11. The refrigerator according to claim 9 or 10, wherein the damper device (20) is provided at the cold air inflow port (12a, 12b, 12c, 14a) so that a rotation shaft (34) of the baffle (24) is disposed on an accommodating chamber (12, 14) side.
12. The refrigerator according to at least any one of the claims 9 to 11, wherein the frame (26) is inserted into the cold air inflow port (12a, 12b, 12c, 14a).
13. The refrigerator according to claim 12, wherein the frame (26) does not protrude from an end face (X) on an accommodating chamber (12, 14) side of the cold air inflow port (12a, 12b, 12c, 14a).
14. The refrigerator according to at least any one of the claims 9 to 13, wherein the drive part (22) is disposed in the duct (18).
15. The refrigerator according to at least any one of the claims 9 to 14, wherein the damper device (20) is provided with a plurality of the frames (26) and a plurality of the baffles (24).

Fig. 1

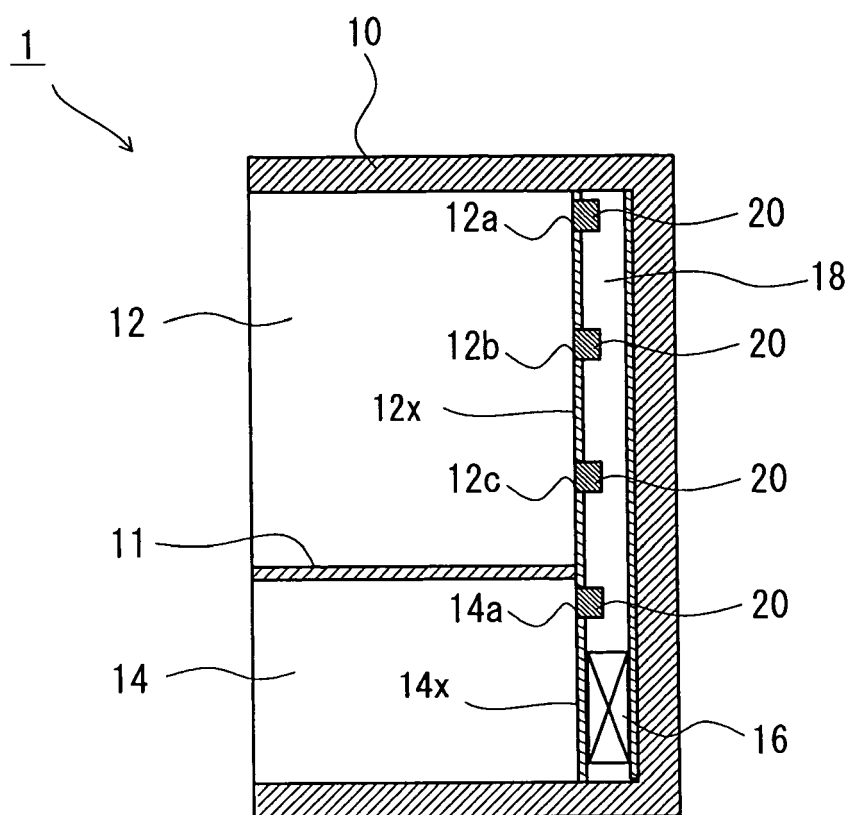


Fig. 2(a)

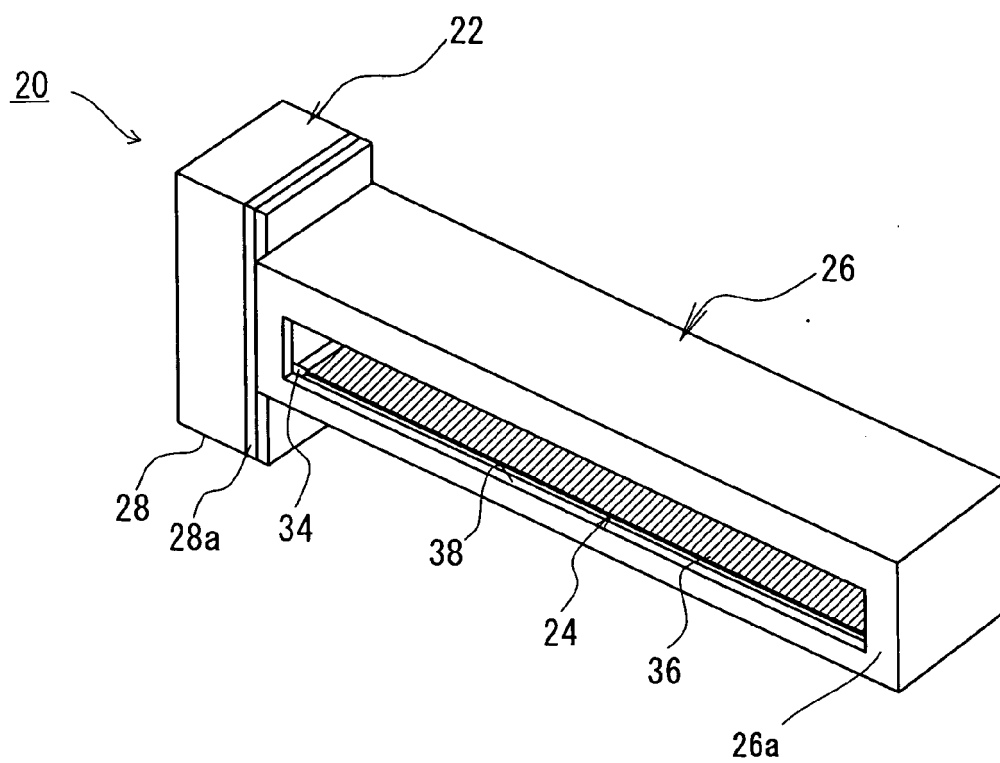


Fig. 2(b)

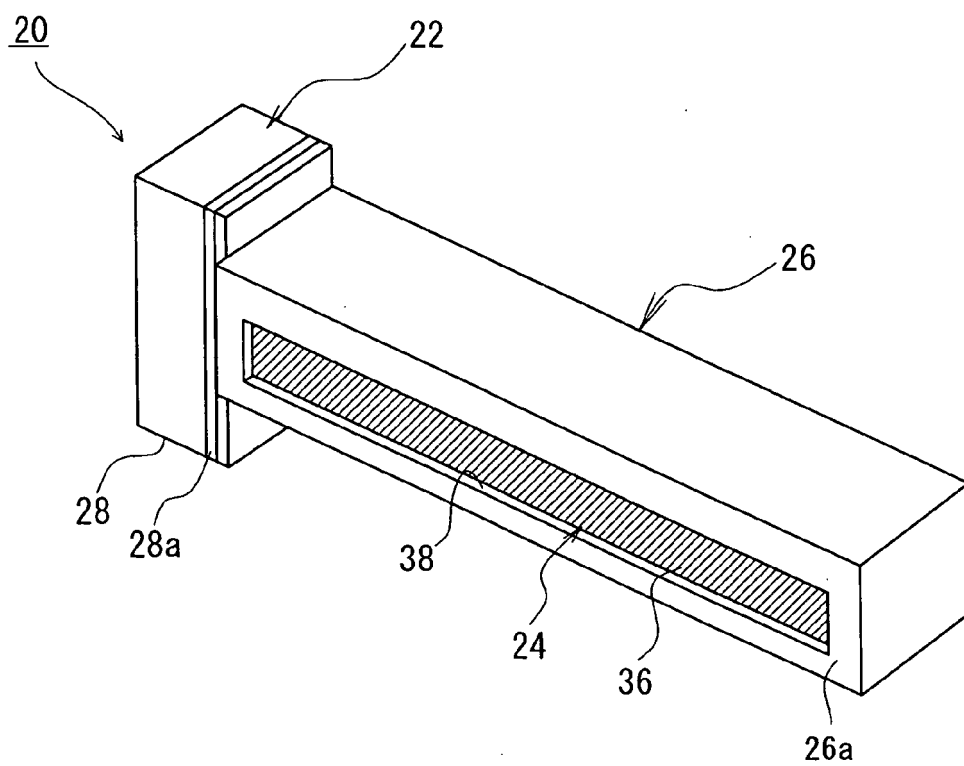


Fig. 3

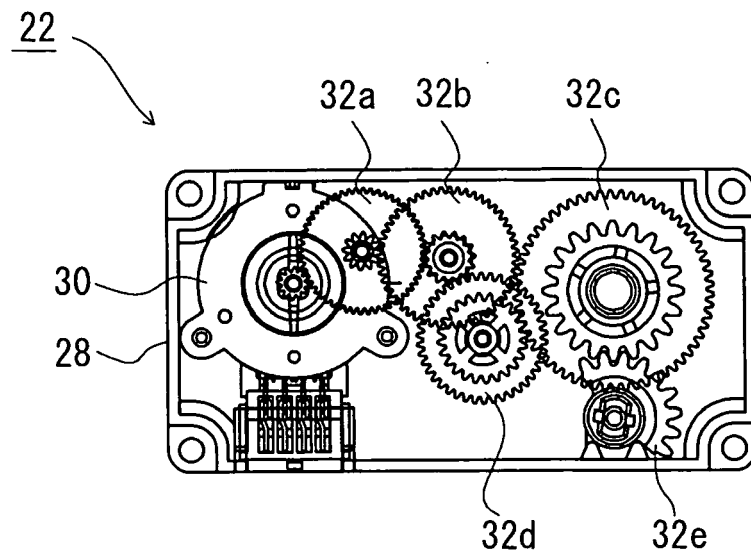


Fig. 5

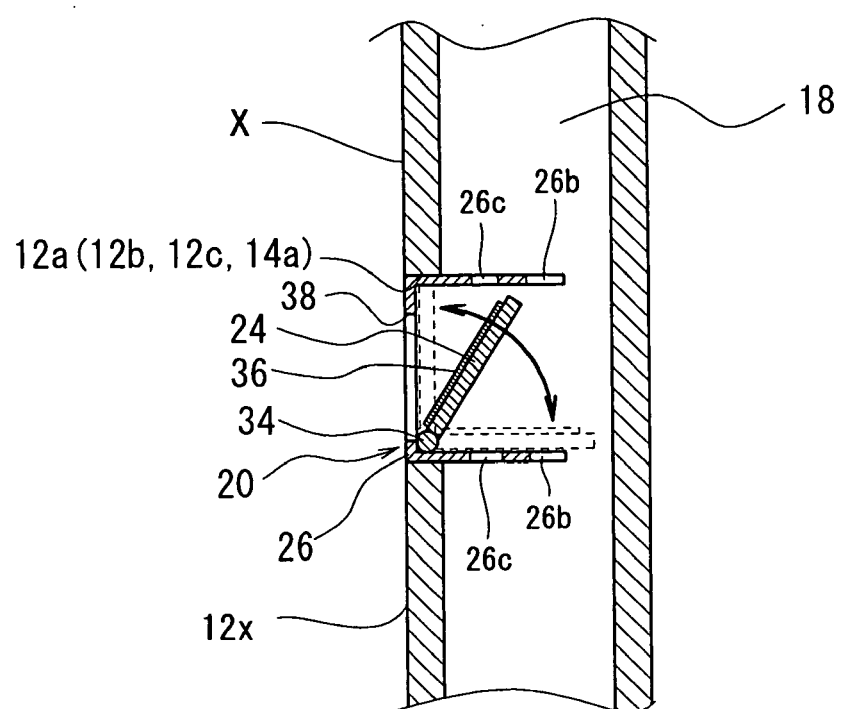


Fig. 6

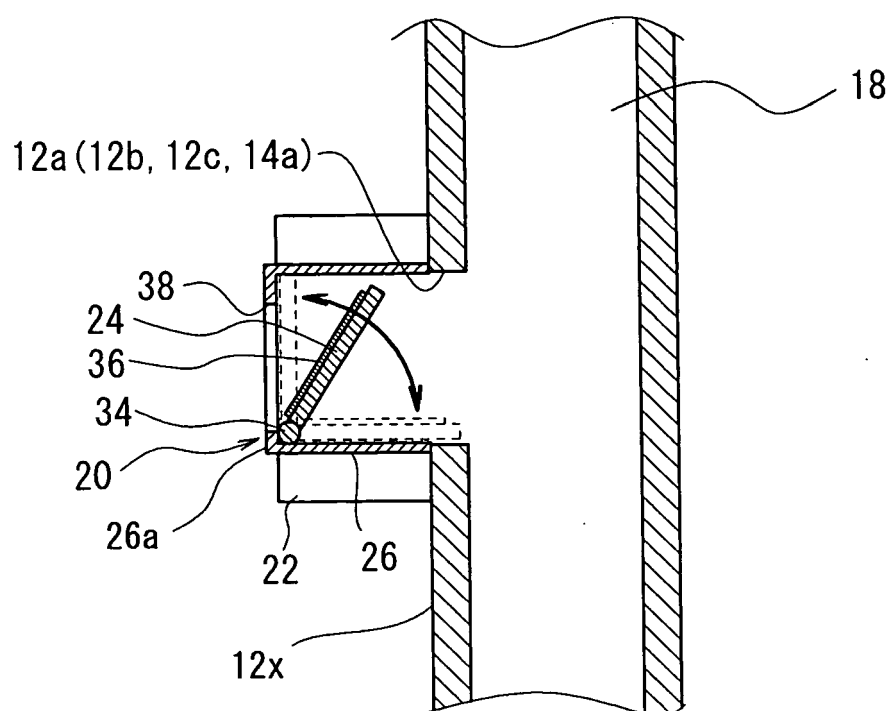


Fig. 7

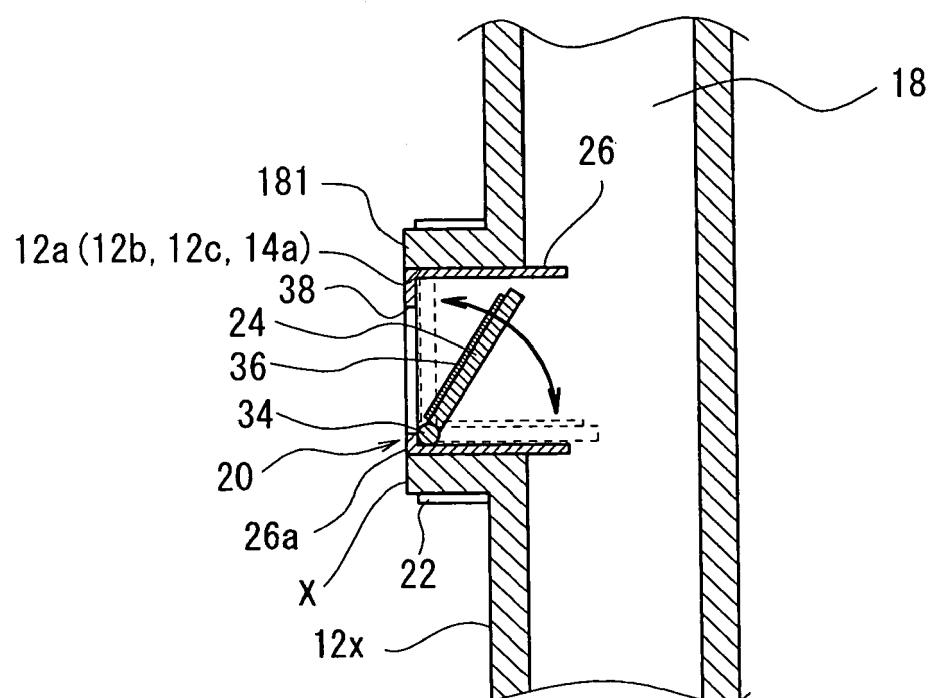


Fig. 8

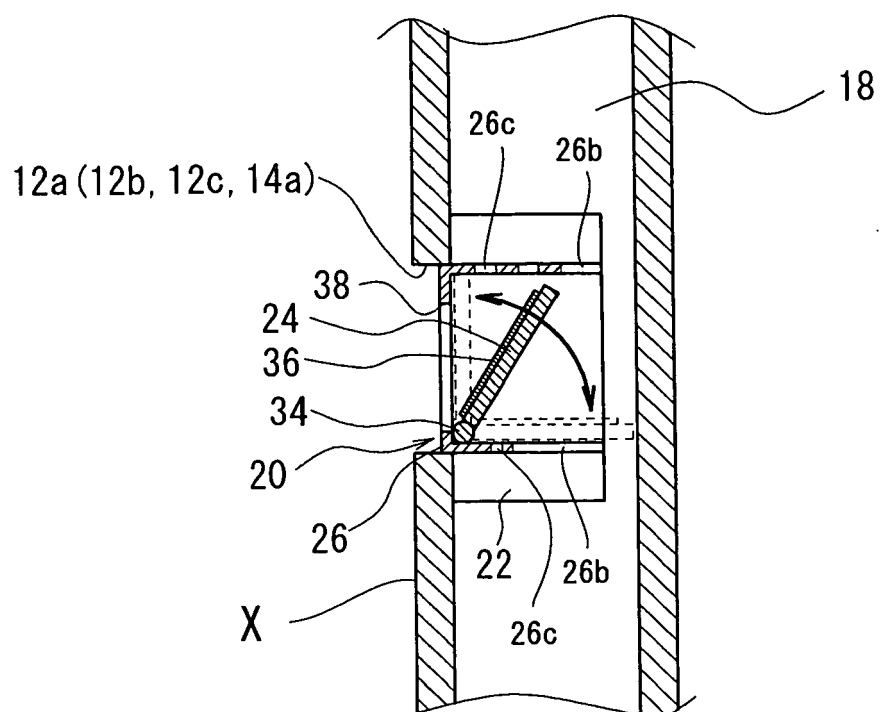
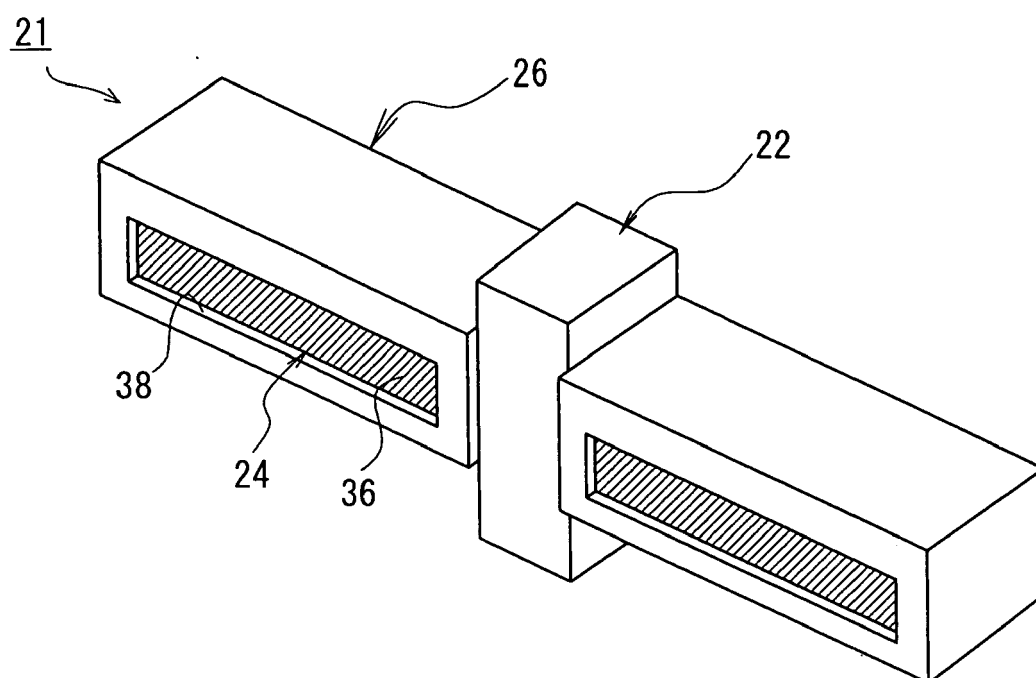


Fig. 9



REFERENCES CITED IN THE DESCRIPTION

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