

Refrigerator

Background of the Invention

The invention relates to a refrigerator having a drawer
5 door attached on a storage container, which is pulled out and
pushed in, and especially relates to one having enhanced volume
of the storage container that is attached on the drawer door.

In recent years, storage volume of the refrigerator is
increasing with increase of life style variations. In
10 accordance with this, increasingly adopted is a following
arrangement of compartments, comprised of: a fresh-food chamber
having a largest storage volume on top; at its beneath, an
ice-forming room and a temperature-switchable room, which have
relatively small volumes are arranged on right-hand and
15 left-hand sides as so partitioned; a vegetable chamber; and
a freezer chamber at bottom. The fresh-food chamber has a door
hinged in vicinity of right-hand-side or left-hand-side fringe
of front opening of the chamber, or a pair of doors in a French-door
arrangement, as to be closed up by rotational motion of the
20 door(s). Meanwhile, the vegetable and freezer chambers and
the ice-forming and temperature-switchable rooms have mostly
a drawer construction formed of a drawer door and a container
attached thereon as to be pulled out and pushed in, in front-rear
direction, as to facilitate putting in and taking out of storage
25 items.

Conventional construction of a drawer door with a container is shown in Fig. 8, which is a vertical sectional view of the drawer door, and is as follows. A pair of frame fixtures 51 supporting a storage container 52 is fixed on inner and rear face of a drawer door 50 and extends into a storage chamber while a gasket is arranged along fringe on the drawer door 50 as to seal gaps between the door and the main casing part of the refrigerator. The frame fixtures 51 bear on rails 53 attached on side walls on the chamber, through pulleys or wheels 55 and 56, as to be easily slidable so that the storage container 52 is pulled out and pushed by and concurrently with opening and close the door 50. Each of the frame fixtures 51, at a time pulled out by opening of the drawer door 50, is supported from the rail 53 through two pulleys 55 and 56 on front and rear positions; one pulley 55 is stationary fixed close to front opening of the chamber and another pulley 56 is attached on rear end of the frame fixture 51. In such construction, distance between the two pulleys 55 and 56 would have to be small as to cope with weight load that will become considerably large when storage amount in the container becomes large. Thus, front-rear dimension of the container 52 would become small.

To cope with this, there is proposed in JP2006-177653A (Japan's patent application publication No. 2006-177653; See paragraphs 0051 and 0061) for example, a following construction as shown in Fig. 9. In place of a single rail, a plural-rail

or slider rail unit comprised of a stationary rail 31a, a movable rail 31b and an intermediate rail 31c is adopted. The movable rail 31b is fixed on a door supporting element and a storage container 32 is engaged with the door supporting element. By
5 such construction, distance of frontward moving at pulling out of the door is increased, and noisy swinging is curbed for achieving the drawer door of high quality.

Nevertheless, the construction the rail unit shown in JP2006-177653A has following problem. The stationary rails
10 31a are attached on side faces of the inner casing 20 of the refrigerator; and the movable rails 31b are directly attached on the drawer door for a vegetable, freezer or other chamber. Thus, at a process of actually attaching the drawer door to main casing part of the refrigerator, it is required to attach
15 onto the drawer door, the movable rails of the slider rail unit that has been attached on the side walls. Thus, the attaching has to be made in a state the rail unit is extended as pulled out, thus leading to an extremely unstable attaching. This causes problems in respect of; accuracy of attaching, adjustment
20 procedure after the attaching, and extremely troublesome and difficult working procedure due to small spacing within the vegetable or freezer chamber.

Meanwhile, JP2006-177653A also discloses a construction in which a door supporting element that has been fixed on the
25 drawer door is attached on the movable rail. The door supporting

element has a front-rear-wise dimension equivalent to a distance of pulling-out motion. Thus, attaching of the door supporting element on the movable rail has to be made at a time the rail unit is fully extended by an extent of the dimension of the door supporting element. Such attaching is unstable and troublesome as in the above. Moreover, the door supporting element having a large front-rear-wise dimension is attached on beforehand on the drawer door; and thus, positional errors or variations become large. For example, angle-wise direction of the door supporting element may not consistent with that of the rail unit that is attached on the inner casing, due to difference in parallelism between the rail unit and the door supporting element. In such occasion, the attaching is forcibly made as to increase stress formation during pulling motion of the drawer door, as to cause difficulty in sliding motion or deformation. In order to curb such drawbacks, high accuracy in attaching procedure is required in respect of parallelism of the rail units and the door supporting elements, so that the attaching procedure becomes extremely troublesome and process efficiency is damaged.

The invention is made in view of the above. When to adopt the slider rail unit formed of polarity of rails for increasing capacity of storage in the storage container; it is aimed to facilitate a procedure of attaching the drawer door onto the slider rail unit as to decrease workload in assembling; and

is aimed to curb positional errors or variation in attaching the door onto the slider rail unit as to achieve smooth sliding motion without causing stresses.

Brief Summary of the Invention

5 A refrigerator (1) of the invention comprises: a drawer door (10); frame fixtures (11) in a pair, which are fixed on inner face of the drawer door (10); right-hand-side and left-hand-side slider-rail units (13) arranged on side walls on the storage chamber (8); and rail reinforcing plates (21)
10 that are fixed at between the inner casing (4) and a heat insulator (3) as to support the slider-rail units (13); and wherein each of the slider-rail unit (13) is comprised of; a stationary rail (16) fixed on the inner casing (4); an intermediate rail (18) engaging with and sliding along the stationary rail (16); a
15 movable rail (17) engaging with and sliding along the intermediate rail (18); and a frame bearer (19) that is fixed on the movable rail (17); and each of the frame fixtures (11) has a frame beam (11b) fixed on front portion of the frame bearer (19).

20 Brief Description of the Several Views of the Drawing

Fig. 1 is a vertical sectional view of a refrigerator of an embodiment of the invention;

Fig. 2 is a side and partially sectional view of a part of Fig. 1, showing a state at which a container for vegetables
25 is pulled out;

Fig. 3 is an exploded perspective view of a slider rail unit and elements attached therewith, which are appeared in Fig. 1;

Fig. 4 is a vertical sectional view seen from front, showing left-hand-side bearing structure for the container;

Fig. 5 is a partial exploded perspective view showing how a frame beam and a frame bearer appeared in Fig. 3 are engaged with each other;

Fig. 6 is a modification to a construction shown in Fig. 5;

Fig. 7 is a partial perspective view showing relationship between the container and the bearing structure;

Fig. 8 is a vertical sectional view in essential part of a conventional refrigerator; and

Fig. 9 is a vertical sectional view in essential part of another conventional refrigerator having double slider rail units.

Detailed Description of the Invention

In following, an embodiment of the invention will be explained in dependence upon the drawings. Fig. 1 shows a vertical sectional view of a refrigerator 1 and shows fully-opened state of doors by dot-dot-solid lines. Inside of an outer casing 2 of the refrigerator 1, insulator 3 is disposed to be interposed between the outer casing 2 and an inner casing 4; and a storage space is formed at inside of the inner casing

4 as to be partitioned to a plurality of storage chambers by
insulator partition walls 5. A fresh-food chamber 6 is disposed
on top part of the refrigerator and has a pair of doors 7 in
a French door arrangement, which are respectively attached
5 through hinges on right-hand fringe and left-hand fringe of
a front opening of the chamber and freely rotate along the fringe
as to open or close up the front opening. The fresh-food chamber
6 is neighbored, from beneath, by a temperature-switchable room
7 having relatively small volume and a not-illustrated
10 ice-forming room, which are laterally arranged on right-hand
and left-hand sides. These rooms are neighbored from beneath
by a vegetable chamber 8, which is neighbored by a freezer chamber
9 on bottom of the refrigerator 1. Storage chambers other than
the fresh-food chamber 6 are formed as drawer chambers each
15 having a pull-out and push-in door, as indicated by the
dot-dot-solid lines in Fig. 1, since these storage chambers
are relatively small compared to the fresh-food chamber 6 for
sake of user's convenience.

In following, a vegetable chamber 8 is exemplified for
20 explaining the drawer chambers. Fig. 2 is a side view of a
drawer container for vegetables with cross section of
surrounding structure, and indicates a pulled out state of the
drawer container by dot lines. As shown in Fig. 2, the drawer
container has a pull-out and push-in door 10 and a pair of frame
25 fixtures 11 on right-hand and left-hand sides, which are fixed

on inner face of the door 10. Each of the frame fixtures 11 is comprised of; an attaching portion 11a for attaching with the door 10; and a frame beam 11b running in depth-wise or front-rear direction of the chamber from the door and having
5 a substantially L-shaped cross section and length of about ten-odd centimeters. Slider rails 13 in a pair are disposed respectively along with the frame fixture beams 11, on right-hand and left-hand side walls on the vegetable chamber 8; so that an open-top box-shaped container 8 of the drawer container is
10 supported through the frame fixtures 11 and slider-rail units 13, from the side walls; and the drawer container formed of the door 10 and the container 8 freely slides frontward and backward.

On rear side of the container 8, there are disposed coolers
15 14 and 14' and fans 15 and 15', which are for forming cooled air and provide it to freezer and fresh-food compartments. On fringe of inner face of the vegetable-chamber door 10, a gasket formed of soft synthetic resin is attached as fitted so as to seal off the vegetable chamber 8 from the air when the door
20 10 has been closed.

Fig. 3 is an exploded view showing the slider-rail unit 13 and elements attached thereto; and Fig. 4 is a vertical view seen from the front, of left-hand-side bearing structure for the container 12. As shown in Figs. 3 and 4, each of the
25 slider-rail units 13 is comprised of: a stationary rail 16 that

is formed of a steel plate and consists of a flat plate part fixed on a portion of the inner casing 4, on the vegetable chamber 8, as to run in the front-rear direction as well as a pair of flanges 16a projecting inward from top and bottom fringes of the flat plate part; a frame bearer 19 whose top face engages with top flange 11c of the frame beam 11b of the frame fixture 11 as to be borne by a portion the container 12; a movable rail 17 that is integrally attached on the frame bearer 19, has a pair of flanges 17a projecting outward from top and bottom fringes of the movable rail 17 and is disposed between the pair of flanges 16a of the stationary rail 16; and an intermediate rail 18 that is disposed between the stationary rail 16 on outside and the movable rail 17 on inside and has a pair of flanges 18a, each of which is sandwiched between one of the stationary-rail flanges 16a and respective one of the movable-rail flanges 17a. Spherical bearing balls 20 or ball bearings are interposed between gaps among the stationary-rail flanges 16a, the movable-rail flanges 17a and the intermediate-rail flanges 18a. In this way, the intermediate rail 18 is freely slidable frontward and rearward; and the stationary, movable and intermediate rails 16, 17 and 18 are assembled into substantially a one-body "double-slider rail" element that is the slider-rail unit 13. The movable rail 17 may be pulled out in two steps, one of which is made by sliding of the intermediate rail 18 within the stationary rail 16 and

another of which is made by sliding of movable rail 17 within the intermediate rail 18. The frame bearer 19 is arranged on beforehand on and along inward face of the movable rail 17 and then secured onto the rail by way of rivets or the likes. The
5 frame bearer 19 has a reverse L-shaped cross section, and has a flange 19a on top part of the reverse L shape so that the flange 19a engages with top flange of the frame beam 11. The frame bearer 19 and the movable rail 17 may be integrally formed.

Hence, when the slider-rail unit 13 is pulled to be extended
10 frontward from the vegetable chamber 8, the container that is borne on the flange 19a of the frame bearer 19 may be pulled out frontward to a "fully opened" position at which rear end of the container comes on front side of the front opening of the vegetable chamber 8, by the "double-slider rail" bearing
15 mechanism using all of the rails 16, 17 and 18. Extent of pulling forward is much larger than that achieved by a conventional "single sliding rail" bearing mechanism. Each of the slider-rail units 13 is attached on main casing of the refrigerator 1 in a following way. On beforehand, a
20 rail-reinforcing plate 21 running in the front-rear direction and made of steel was positioned and temporally attached on outer or back face of the inner casing 4. Then, a gap between the outer and inner casings 3 and 4 is filled by foam molding of urethane foam. The rail-reinforcing plate 21 is attached
25 on the foam-insulator-side face of the inner casing 4 by use

of a urethane anchor that protrudes outward and subsequently, embedded in the foam insulator 3 as to be firmly secured on such position in course of curing of the foam insulator 3. The stationary rail 16 is securely attached to the rail-reinforcing plate 21 by screws 22, at front and rear two separate positions. The stationary rail 16, the intermediate rail 18 and the movable rail 17 are integrally assembled in one body as the slider-rail unit 13, which is in this way secured on the inner casing 4 of the refrigerator.

10 As shown in Fig. 2 and in partially enlarged perspective views of Figs. 5 and 7, the frame beam 11b extending rearward, of each of the frame fixtures 11 is engaged with front-end portion of the frame bearer 19, and thereby with near-to-door portion of the slider-rail unit 13; a hole 11d on the top flange 11c at rear end of the frame beam 11 engages with a hook 19b that has been formed by cutting and bending upward of a portion of the top flange 19c of the frame bearer 19, and in this way, the frame beam 11b is overlaid on the frame bearer 19. By keeping the frame bearer 19 as pulled forward, engagement of the hook 15 19b with the hole 11d is maintained. The top flange 11c of the frame beam 11b is in same time fixed, at its front-side part near to the door 10, on front-end portion of the flange 19a overlaid with the top flange 11c, of the frame bearer 19 by way of a screw 23 as seen in Figs. 3 and 8.

25 As a result of above constructions, the door 10 having

the frame fixture 11 is easily attached on the slider-rail units 13, even though such attaching process would be troublesome due to procedures having to be made through a small space in vicinity of front-opening of the vegetable chamber 8 and due to frontward and rearward constant moving of the rails. The hook 19b on front-end portion of each of the sliding rail elements 13 is hooked in the hole 11d on the frame fixture 11 having been attached on the door 10. Then, in this fixed state, the frame fixture 11 is easily secured on the slider-rail units 13 by way of screws. Thus, the slider rails do not have to be pulled forward to front-end limit of sliding as in conventional refrigerator. Only a very small extent of pulling forward of the slider rails is enough, and thus, the attaching process is significantly facilitated.

Positional relationship between the hook 19b and the hole 11d may be reversed, as needless to say. The positional relationship mentioned in the above is made to cope with tensile stress pulling forward as in occasion of pulling out the door 10. Alternatively, in order to effectively cope with occasion of pushing in the door 10, following construction as shown in Fig. 6 may be adopted; the hook 19b' that has been cut out, bent as erected and bent to point toward the door 10; and thereby, the hook 19b' engages with the hole 11d' on the frame beam 11b when the door 10 has been pushed on and close the chamber, so that the frame beam 11b and the frame bearer 19 are easily secured

with each other, by a screw, in such fixed state.

The frame fixtures 11 fixed on the vegetable-chamber door 10 are borne by the slider-rail units 13 through the frame bearer 19. Because each of the frame beams 11b protrudes into the chamber by a rather small dimension and has an L-shaped cross section, length of a region at which the frame bearer 19 and the frame beam 11b are engaged with each other is rather small. And, there is some extent of freedom in relative shifting in width direction of the door 10, between the frame fixture 11 and the frame bearer 19. Thus, at a time of frontward and rearward sliding, parallelism between right-hand and left-hand sides is maintained in respect of the slider-rail units 13 on right-hand and left-hand side walls on the inner casing 4; and hence achieving an effective mechanism for pushing in and pulling out of the drawer container. Therefore, overlapping between a rail and a door-supporting element do not long as depthwise dimension of the container 12 in a conventional refrigerator. Resultantly, there occurs no abnormal and stress-causing assembling due to positional errors or relatively large variations; and stress on the slider-rail unit 13 or the door 10 caused by assembling process are absorbed, only by use of simple construction, without necessitating use of expensive material or high accuracy of assembling work. Moreover, cost for the frame fixture 11 becomes small because its dimensions is small; and a dimension between the hook 19b and the screw

on the frame fixture beam 11 and the frame bearer 19 have to be some minimum dimension or more for achieving a required strength of the door 10 on the drawer and supporting structure because of the overlapping, and may be same or smaller than
5 half of depth dimension of the container 12, for example. Moreover, each of right-hand-side and left-hand-side flanges 12a of the container 12 is borne on a framework formed of; the top flange 11c of the frame fixtures 11 and the top flange 19a of the frame bearer 19, when the vegetable-chamber door 10 is
10 pulled out along with the frame fixtures 11. In this way, the container 12 is kept as to be easily pulled out. As shown in Fig. 2, the container 12 may be pulled out along with the door 10 to an extent even rear end of the container 12 is out of main casing part of the refrigerator; and hence, foods for
15 storage are easily put in and taken out.

The intermediate rail 18 and the movable rail 17 have some length-wise areas for overlapping with the stationary rail 16. Thus, swinging in right-left-wise direction is curbed as to prevent large swinging of the door 10. Moreover, closing
20 of the door 10 by pushing it along with the container 12 is smoothly made. As shown in Fig. 7, each of the right-hand-side and left-hand-side flanges 12a of the container 12 has a cross section of a reverse U shape, which is formed of; a horizontal part along top opening of the container 12, and a hanging part
25 downwardly extended from outer fringe of the horizontal portion

as to sufficiently cover up the top flange 19a of the frame
bearer 19. The flanges 12a are borne on the top flanges 11c
and 19a of the frame fixtures 11 and the frame bearers 19. Such
a construction of the flanges 12a improves strength of the
5 container 12 to cope with "inward tilting" of upper portions
of side walls of the container 12 due to weight of storage foods
that are heavily inputted in to the container 12. Even when
such "inward tilting" occurs, the hanging part of the flange
12a abuts on the flanges 11c and 19a of the support structure
10 so that further deformation of the container 12 is curbed as
to prevent dropping down of the container 12 from the support
structure. Resultantly, exposing of top flanges 11c and 19a
of the frame fixture 11 and the frame bearer 19 is curbed because
the inward tilting is curbed whereas a storage container in
15 conventional refrigerator would cause exposing of the top
flanges 11c and 19a due to deformation of the container. While
exposing of the top flanges 11c and 19a having metal plate edges
might cause a cut or wound on fingers of users due to burring
on the edges or the like, such cut or wound is prevented by
20 the above construction of the flange 12a.

The right-hand-side and left-hand-side flange 12a of the
container 12 have reinforcing ribs 12b at inside of reverse
U-shaped bent portions, each of which is formed by the top
horizontal part and the hanging part. Each of the reinforcing
25 ribs 12b runs between the top horizontal and hanging parts of

the flange 12a and the side wall. Bottom ends of the reinforcing ribs 12c are abutted or come close to the top flanges 11c and 19a of the frame fixture 11 and the frame bearer 19 of the slider-rail unit 13. The ribs 12c further increase overall strength of the container 12 and curb local gap formation between the top flange 11c of the frame fixture 11 and the top flange 19a of the frame bearer 19, by pressing these top flanges 11c and 19a from upward as to curb deformation of the container 12, so as to cope with following situation. In a conventional construction, dimensions of the frame fixtures 11 on the door 10 are decreased and in such a way engaged with the frame bearer 19; and hence, on course of pulling out of the door 10 and the container 12, positional relationship between the frame fixture 11 and the frame bearer 19 would slightly deviate from a predetermined one as to cause the local gap formation between the top flanges 11c and 19a due to positional errors or deviations at a time of the assembling.

Above-described construction for the drawer chamber may be adopted, not only for the vegetable chamber 8 as exemplified in above explanation, but also for the freezer chamber 9, the ice-forming room and the temperature-switchable room and so on.

Claims

1. A refrigerator (1) comprising:

a drawer door (10), which closes up and opens a front
5 opening of a storage chamber (8) when pushed in and pulled out;

a container (12) that has right-hand-side and
left-hand-side flanges (12a), each of which extends in
front-rear direction and has a horizontal part extending outward
from fringe of top opening of the container (12), and a hanging
10 part extended downward from an outward fringe of the horizontal
part;

reinforcing ribs (12b) that are arranged at inside spaces
defined by the horizontal and hanging portions in a manner to
connect the horizontal and hanging portions, as distributed
15 in the front-rear direction in a predetermined interval;

right-hand-side and left-hand-side frame fixtures (11)
in a pair, which are fixed on inner face of the drawer door
(10) and pulled out along with the drawer door (10);

right-hand-side and left-hand-side slider-rail units
20 (13) that run in front-rear direction of the storage chamber
(8) and arranged on side walls on the storage chamber (8) as
to support the container (12) in combination with the frame
fixtures (11); and

rail reinforcing plates (21) that are fixed on an inner
25 casing (4) defining the storage chamber (8) at between the inner
casing (4) and a heat insulator (3) as to support the slider-rail

units (13); and wherein

each of the slider-rail unit (13) is comprised of;

a stationary rail (16) fixed on the inner casing (4);

an intermediate rail (18) engaging with and sliding along
5 the stationary rail (16);

a movable rail (17) engaging with and sliding along the
intermediate rail (18); and

a frame bearer (19) that is fixed on the movable rail
(17) over a region from front portion to rear portion of the
10 movable rail (17); and wherein

each of the frame fixtures (11) has a frame beam (11b)
extending along the slider rail unit (13), as extended from
an end of an attached portion (11a) on the inner face to have
a front-rear dimension smaller than half of that of the container
15 (12), so that the frame beam (11b) and only a front-end portion
of the frame bearer (19) are overlapped with each other and
engaged and fixed with each other within their overlapping part;
and

the container (12) is borne on the frame beam (11b) and
20 the front-end portion of the frame bearer (19) through the
reinforcing ribs (12b), at least on front and rear vicinities
of said overlapping part and on within said overlapping part.

2. A refrigerator according to claim 1, wherein the frame beam
25 (11b) of the frame fixture (11) and the frame bearer (19) are

bent back to have a substantially L-shaped cross section and to respectively form a bearing portion (11c) and a flange (19a), which are overlapped and fixed with each other.

5 3. A refrigerator according to claim 1 or 2, wherein the frame beam (11b) has, at its rear portion, an engagement portion (11d) as to engage with a corresponding engagement portion (19b) that is formed on the frame bearer (19); and the frame beam (11b) and the frame bearer (19) are fixed with each other at a portion
10 that is within their overlapping part and is distanced from an engagement position where said engagement portions (11d) (19b) are engaged with each other; so that, at a time of assembling the drawer door (10) onto the slider rail unit (13), said engaging bay way of said engagement portions (11d) (19b)
15 is made on first hand, and then said fixing at the portion distanced from there is made.

4. A refrigerator according to any one of claims 1-3, wherein the movable rail (17) has a pair of flanges (17a) projecting
20 outward from top and bottom fringes of the movable rail (17) and is disposed between the pair of flanges (16a) of the stationary rail (16); and an intermediate rail (18) has a pair of flanges (18a), each of which is sandwiched between one of the stationary-rail flanges (16a) and respective one of the
25 movable-rail flanges (17a), through spherical bearing balls

(20) interposed therebetween.

5. A refrigerator according to any one of claims 1-4, wherein said overlapping part is made in a manner that front-end portion 5 of the frame beam (11b) is left as not overlaid with the frame bearer (19).