Sept. 12, 1950 J. T. ROMITO 2,522,465

REFRIGERATOR

Filed April 9, 1945 3 Sheets-Sheet 1

Fig. 1.

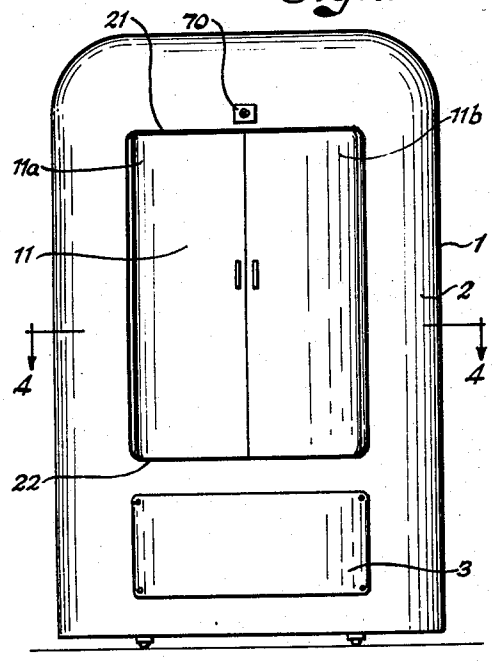


Fig. 2.

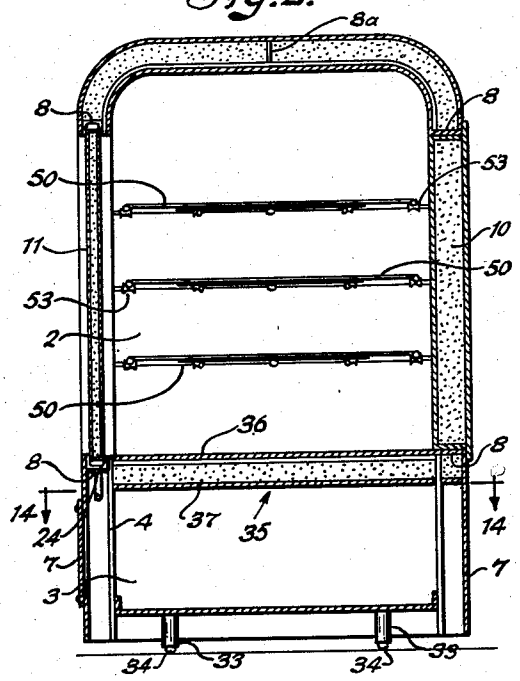


Fig. 3.

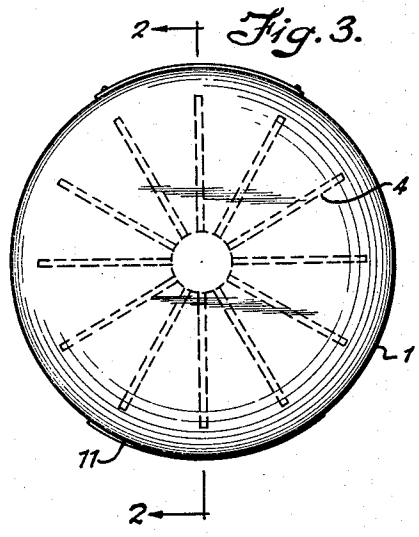
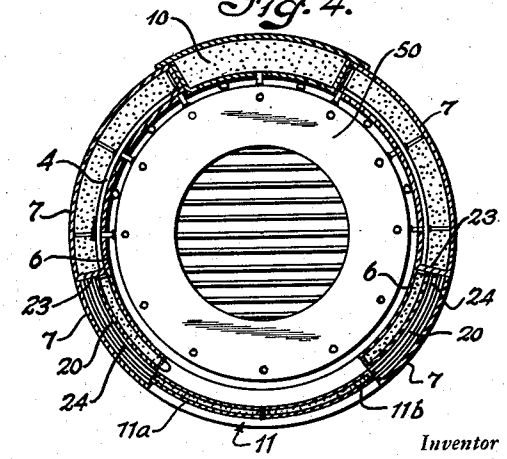


Fig. 4.



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REFRIGERATOR

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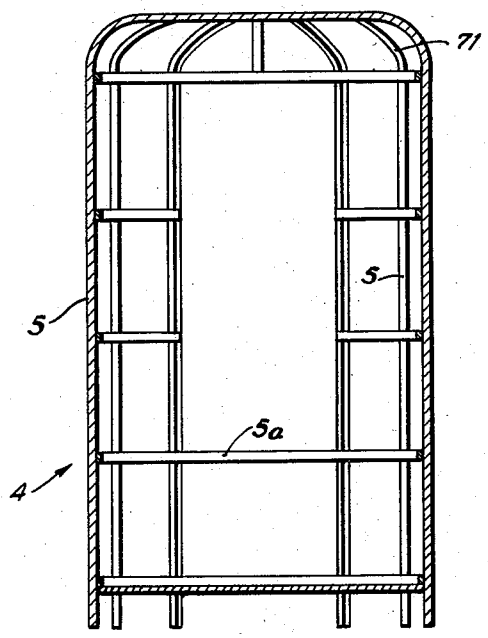


Fig. 5.

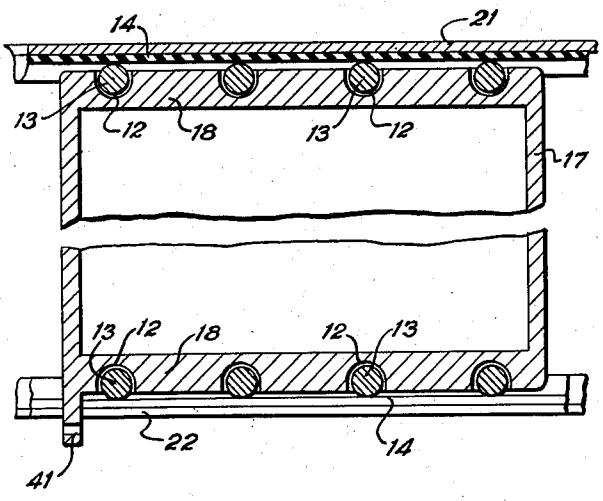


Fig. 6.

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REFRIGERATOR

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Fig. 7.

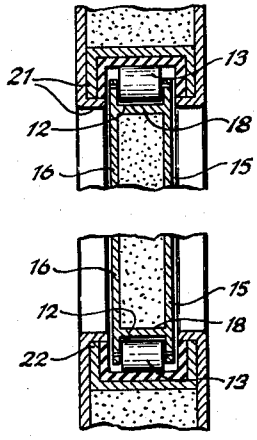


Fig. 8.

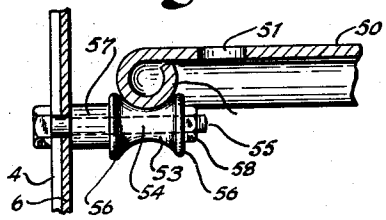
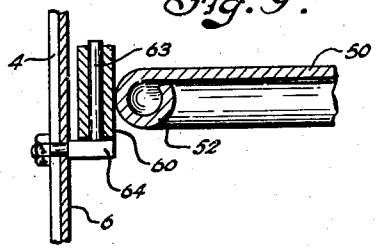


Fig. 9.



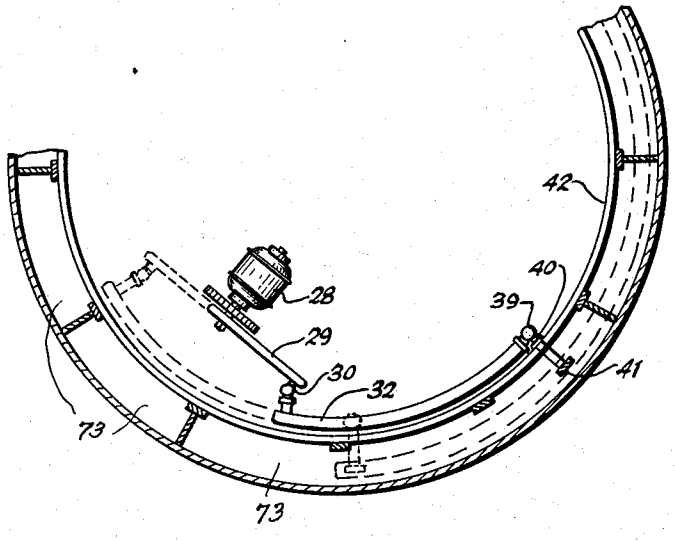


Fig. 10.

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UNITED STATES PATENT OFFICE

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REFRIGERATOR

Joe T. Romito, Ravenna, Ohio

Application April 9, 1945, Serial No. 587,331

3 Claims. (Cl. 312—168)

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This application is a continuation in part of my application Serial No. 465,864, now abandoned.

This invention relates to refrigerators such as used in homes, kitchens, restaurants, and in similar places for storing food and other articles, and it has for its main object to improve the construction of the refrigerator generally so that greater solidity and sturdiness, an improved thermal efficiency, a greatly improved manipulation, a greater storing capacity and a greater ability to be used in places of limited available space will result.

These results, although apparently without technical connection, may nevertheless all be attained by a suitable shape and basic construction of the refrigerator.

One of the main features of the invention is therefore the basical shape of the refrigerator which is cylindrical. This shape when properly utilized by adjusting the design of all constructive elements in accordance therewith, may produce most of the improvement above-mentioned.

Cylindrical or rather partly cylindrical refrigerators have already been proposed, but it has not been clearly realized that a completely cylindrical shape of the refrigerator may be utilized for the general improvement of all constructive details and elements. If the shape and the construction of the details and elements designed for the refrigerator of the usual square or rectangular shape are retained, little use is derived from the cylindrical shape itself. It is, therefore, an important object of the invention to adapt the entire construction to the cylindrical shape whereby the above mentioned improvements will result.

A main factor as regards easy manipulation as well as the extent of the space which is practically occupied by the refrigerator are the doors. Most refrigerators as hitherto known use doors which are mounted on hinges and which have to be swung around in order to open the refrigerator. The door opening has to be sufficiently large to allow the mounting of the refrigerator unit, to permit the insertion of relatively large objects, and to permit access of all parts and corners of the refrigerator as well as a certain amount of manipulation with the objects stored inside. The door opening, therefore, as a rule occupies about 4/5 and more of the front wall area of the refrigerator and the manipulation of the door requires much space. The refrigerator has to be placed at a distance from the side wall approximately equal to its width and at a distance about equal

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to width plus depth from the opposite wall or from furniture opposing it. It is thus seen that much more floor space is practically occupied than is actually covered by the base of the refrigerator itself. This holds good for refrigerators of all sizes and all shapes, square, rectangular, or cylindrical, when the known method of arranging the door is employed.

This method also puts a rather heavy load on the hinges and on the parts of the door and of the cabinet supporting them as doors of such a size are heavy and the weight is suspended on long lever arms.

The drawbacks associated with the size and arrangement of the door are eliminated if use is made of arcuate doors curved along a cylindrical surface identical with or parallel to that of the refrigerator cabinet. Such doors have only been proposed in refrigerating apparatus of a different type without double walls enclosing an insulation or a partial vacuum. According to the invention sliding doors are used which may be moved into the space between cylindrical double walls while maintaining the insulated or partially evacuated space between the double walls along the entire circumference of the cabinet.

A still further object attainable with the described shape consists in the provision of movable and rotatable shelves, which may be turned to reach the objects, stored on the shelf. These shelves may be of circular shape in a completely cylindrical refrigerator and they may therefore be turned around on rollers or balls provided on ledges arranged close to the wall or in the wall. It is thus possible to reduce the size of the door as manipulation within the refrigerator is reduced to handling objects which are located in the front part and only access to objects stored at about ½ of the entire depth is required.

A further advantage may be obtained by using a frame work in the shape of a cylindrical cage which carries the covering sheets of the walls between which the insulation is introduced.

Many further objects and advantages will be apparent from the following detailed specification illustrating one modification of the invention. It is however to be understood that the fact that only one modification is described and illustrated is not to be regarded as a limitation. This modification of the invention is to be considered as an example showing how the invention may be embodied in a specification.

The accompanying drawings illustrate the abovementioned modification.

Figure 1 is an elevational view of the refrigerator.

Figure 2 is a sectional elevational view of the refrigerator, showing the refrigeration compartment.

Figure 3 is a top view of the refrigerator.

Figure 4 is a sectional plan view showing a horizontal section through the refrigerator compartment, the section being taken along the plane 4—4 of Figure 1.

Figure 5 is an elevational sectional view showing the frame of the refrigerator in section.

Figure 6 is an elevational view of the door, after having been developed into the plane of the drawing.

Figure 7 is an elevational cross sectional view of the door, the cross section being taken along a radial plane.

Figures 8 and 9 are sectional elevational views illustrating in detail the guiding and supporting of the shelves.

Figure 10 is a sectional plan view through the compressor compartment illustrating the movement of the doors by means of curved connecting rods, permitting to move said rod in a circle.

The refrigerator according to the invention is cylindrical and is provided with arcuate doors, sliding within the cylindrical walls of the refrigerator so that the space required for location and manipulation is smaller than that required for refrigerators of other types.

The refrigerator cabinet 1 comprises the refrigerator compartment 2 and the motor and compressor compartment 3, the latter as usual, occupying a lower position. The showing of the motor, of the compressor and of the refrigerating unit has been omitted throughout, as these parts are identical with those in common use.

The refrigerator comprises a frame 4 (Figures 2, 3 and 9) consisting of a lattice of vertical and horizontal flat strips 5 and 5a respectively resembling very much a round cage. It is provided with a dome-shaped top structure 71. As this structure is of great solidity and strength on account of its cylindrical shape it can be made of relatively thin strips of metal without any reinforcement.

The frame 4 reaches to the bottom and therefore covers the compressor compartment 3, which however need not be insulated in the same way in which the refrigerating compartment is insulated. Preferably, the outer and inner cover sheets 6 and 7 reach down to the bottom, and one of the sheets is secured to the frame 4.

Feet 33 are attached to the base of the frame and accommodate rubber balls 34 on which the refrigerator may be moved in all directions without difficulty.

The compressor compartment 3 is separated from the refrigerating compartment 2 by a bottom part 35 consisting of two cover sheets 36, 37 with insulating material between them. The compression compartment is not insulated, and spacers 73 have been provided to hold the cover sheet 7 at the proper distance.

To this frame 4 one of the cover sheets 6 consisting of sheet iron of thin gauge is secured. Preferably the inner cover sheet 6 is attached to the frame. The outer sheet 7 is held at the appropriate distance in the well known manner by braces 8a and annular wall sections 8 at the upper and lower end of the refrigerating compartment. The space between the inner and outer cover sheets or walls 6 and 7 is filled with insulating material for instance with glass wool.

The outer side of sheets 6 and 7 and of sheets 36 and 37 may be provided with enamel or porcelain finish as usual.

In the back the refrigerator compartment 2 is provided with a back door 10, which is firmly secured by screws or otherwise to the walls of the compartment. A permanent connection may be used as this door should not be opened normally by the persons who use the refrigerating compartment. As a rule, this door is facing the door 11. The back door facilitates the mounting and repair of the parts and especially the introduction, repair and adjustment of the shelves.

The sliding door 11 through which the refrigerator is accessible may consist of one panel only (especially in refrigerators of small size) moving in a circle around the axis of the cylinder. Preferably however two door panels 11a, 11b are used, so as to reduce the width of each panel. The panel may simply consist of an outer and inner sheet 15 and 16 joined by transverse framework sections 17, 18 welded to the front and back sheets 15 and 16, the space between the said sheets being filled with insulating material. Reinforcing angle irons may be applied if found necessary in special cases in the usual way. The doors are finished at the outside in the same way in which the walls are finished.

It is preferable to provide the doors 11 with the best insulation available regardless of the weight, as with the present construction the door is permanently and centrally supported. The use of air insulation or of vacuum insulation in order to reduce the weight of the door is therefore unnecessary. It is more important to use insulation materials which will reduce the thickness of the door to a minimum. The thickness of the door may be about ½ of the distance between the sheets 6 and 7, so that the door can be accommodated completely within the space 20 left between the adjoining walls of the refrigerator compartment 6, 7. If the door is of minimum thickness part of this space 20 is still unfilled by the door panel 11 when the latter is retracted and may therefore be filled with insulating material as shown in Figure 4. By increasing the distance between the outer and inner cover sheets 6 and 7 of the refrigerating compartment somewhat above the minimum requirements and by reducing the thickness of the door panel 11 as far as possible, a satisfactory all round insulation may be obtained.

The upper and lower transverse wall 18 of the door may be reinforced and shaped in such a manner that it accommodates grooves 12 having the shape of half cylinders. Into these grooves rollers 13 are inserted running on U-shaped upper and lower tracks 14, preferably made of rubber, which have been fastened to the upper and lower sections 21, 22 of the door opening of the refrigerator compartment.

The space 20 near the door opening of the compartment 2 is tightly sealed by walls 23.

The door panels 11 may be provided with means for holding a rubber tube near the outer edge, in order to seal off as far as possible the space 20 from communication with the outer air.

This space, however, communicates by means of a slot 24 in the lower track 14 with the lower or compressor compartment 3 of the refrigerator. This compartment is usually filled with air at a uniform temperature not varying with the temperature of the room in which the refrigerator is located. The door panels 11a and 11b may be

shifted by hand in the customary way by using a handle attached to the panels. However, in the modification shown a small motor is used to move the door panel.

If only one door panel is used to close the door a small special motor **28** may be used to drive the door panel directly by means of a crank or disc **29** having a ball shaped crank pin **30** forming part of a ball or universal joint connecting said crank or disc with a connecting rod **32**. The latter carries in its turn a ball **39** forming part of a ball or universal joint, whose second part **40**, cooperating with pin **39** is attached to a lug **41** projecting from the rear part of the door **11**.

The said lug may either project to the rear or may project through the slot **24** of the track **14** as shown, while the connecting rod **32** or its ball pin **40** reaches the lug through a slot **42** in the inner cover sheet.

As the lug moves along a circular path and as the central part of the compressor compartment **3** is occupied by the motor and compressor and the components annexed thereto, and as it is finally of advantage to move the door along its circular path while maintaining an approximately constant value of the angle of the connection rod **32** with the path along which the lug travels it is of advantage to provide a rod **32** which is curved along a circle approximately coinciding with that of the track of the door. If the disc or crank is placed in a proper position the angular deviation of the curved rod from the circle during the rotation of the crank or disc **29** is almost negligible and never exceeds a very small angle. Practically therefore the rod reciprocates within a cylindrical surface.

If both door panels should be moved this may be done by providing a motor and disc for each panel, or by arranging the motor at the rear end with a bevelled gear driving two cranks or discs each arranged with its axis along a radius of the cylindrical compartment.

The starting of the motor is performed by means of a button switch **70** preferably located above the door panels. The stopping of the motor which has to take place when the crank or disc **29** has reached a certain place, is effected in the usual manner by means of contacts arranged in the circuit of the motor which are separated when the crank or disc reaches the end position assigned to it. As this arrangement, usually called limiting switch, is well known it has not been shown in the drawings.

The interior of the refrigerator compartment is subdivided by means of shelves. These shelves are of circular shape and may be made rotatable around the axis of the cylindrical cabinet without using any central structure. Such an arrangement permits bringing those foods, containers and other goods stored in the rear part to the front and this construction reduces the width of the door as the space required for manipulation within the refrigerator is reduced.

To obtain the rotatable arrangement the shelves **50** are made of sheet metal provided with finger grooves or holes **51** and they are bent or curved as shown at **52** at this circumference, so that an annular circular or half circular torus or a toroidal ring is formed at the periphery of the shelf. This ring **52** serves as a support, as a bearing and as a reinforcement of the shelf.

It cooperates wth a set of rollers **53** protruding from the inner cover sheet of the refrigerating

cabinet which is secured to the frame. These rollers **53** may have a corresponding shape with a delineation into which the toroidal annular parts **52** of the shelves **50** are fitted. The rollers are preferably made of rubber and turn on axles formed by steel rods **54** provided with screw threads **55** on which the rollers **53** are fixed by means of washers **56**, sleeves **57** and nuts **58**. The projecting ends of the rods may be fixed to the frame by screwing them into screw threaded holes of the frame (not shown), or by attaching them by means of nuts.

It will be clear that the shelves may turn around in the manner of a turntable when the fingers are inserted into the holes or grooves **51**.

The center of the shelf may be covered with the usual gridwork to permit the passage of the air currents. The distance of the edge of the shelf from the inner cover sheet of the refrigerator compartment may be so chosen as to permit an air current to pass, so that the air, by selecting suitable cross-sections, may circulate within the refrigerator in a predetermined manner.

It is preferable to provide passageways for the cold air in succeeding shelves of diminishing cross-section so that the cold air spreads through the compartments formed between the shelves.

The construction shown in Figure 8 does not exclude lateral shifting of the shelf by accident although the annular toroidal or semi-toroidal section and the shape of the rollers prevent such displacement and will even return the shelf if ever it occurs.

If for some reason it is imperative to exclude a lateral shifting of the shelf, rollers **60**, may be arranged as shown in Figure 9, turning on a vertical axis. The rollers may be provided with ball bearings (not shown) or simply turn around axles **63** fixed in supports **64**.

The refrigerator according to this invention therefore presents a number of advantages which are obtainable either by the cylindrical shape of the refrigerator itself or by making use of this shape to design other parts or elements of the refrigerator in such a way as to improve the adaptability of the installation or its operation. Insulation is improved and the steel frame permits a greater solidity rendering it possible to place the refrigerator unit on feet having supporting balls.

I claim:

1. A refrigerating cabinet of cylindrical shape provided with a door opening comprising, a cylindrical wall consisting of a cylindrical lattice frame with a dome-shaped upper portion, two spaced cover sheets, both covering the entire cylindrical surface with the exception of the door opening, insulating material between said cover sheets, one of said sheets being secured to the lattice frame, the other being arranged at a distance therefrom, an arcuate door panel concentric with the cylindrical walls, a third arcuate sheet arranged within an arcuate portion of the space enclosed between the two cover sheets next to the door opening along an arcuate length corresponding to the length of the door panel, insulating material filling the space between the said third sheet and the inner cover sheets, an arcuate empty space forming a narrow compartment being left between the said third sheet and the other cover sheet, the said arcuate door panel being adapted to be moved into and out of said arcuate compartment.

2. A refrigerator comprising, a cylindrical refrigerating chamber provided with a door opening, a cylindrical lattice frame provided with a dome-shaped upper portion, two spaced cover sheets, both covering the entire cylindrical surface with the exception of the door opening, one of the sheets being fastened to the said frame, an arcuate door panel concentric with the cylindrical refrigerator consisting of two sheets joined at their four sides with insulating material between the same, substantially half cylindrical recesses in the top and bottom portions of the door panel, a further metal sheet spaced from the cover sheets arranged near the door opening and extending through an arcuate length near the door opening substantially equal to the arcuate length of the door panel, leaving a space between it and the outer cover sheet, forming a narrow compartment wider than the thickness of the door panel, insulating material inserted between the two cover sheets filling the space along which these cover sheets are facing each other and further insulating material inserted between the third sheet and the inner cover sheet, horizontal connecting portions closing the said compartment, tracks on said horizontal portions, the said door panel being adapted to be moved into and out of the said arcuate space on said tracks, and rollers in the recesses of the top and bottom portions of the door for guiding the door panel on the tracks.

3. A refrigerator comprising a cylindrical refrigerating cabinet with two openings at diametrically opposite sides, a cylindrical lattice frame with a dome-shaped top portion provided with two openings at diametrically opposite sides of the frame, two spaced cover sheets, both covering the entire cylindrical surface with the exception of the door openings, one of said sheets being fastened to the frame, two further metal sheets, spaced from the cover sheets, arranged on both sides of one of the two door openings, insulating material inserted between the two cover sheets and further insulating material inserted between the two further sheets and the inner cover sheet, an arcuate empty space forming a narrow compartment being left between each of the said further sheets and the outer cover sheet, arcuate door panels concentric with the cylindrical chamber adapted to be moved into and out of the compartments formed by the arcuate spaces near the door opening between the two further sheets and the outer sheet, and a normally fixed door panel removable for assembly purposes consisting of two sheets joined at their edges with insulating material inserted between them, said door panel closing the second door opening.

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