May 20, 1952 M. G. SHOEMAKER ET AL 2,597,267

REFRIGERATOR HAVING AN EVAPORATOR PROVIDED WITH A MOVABLE SECTION

Filed Nov. 29, 1949 4 Sheets-Sheet 1

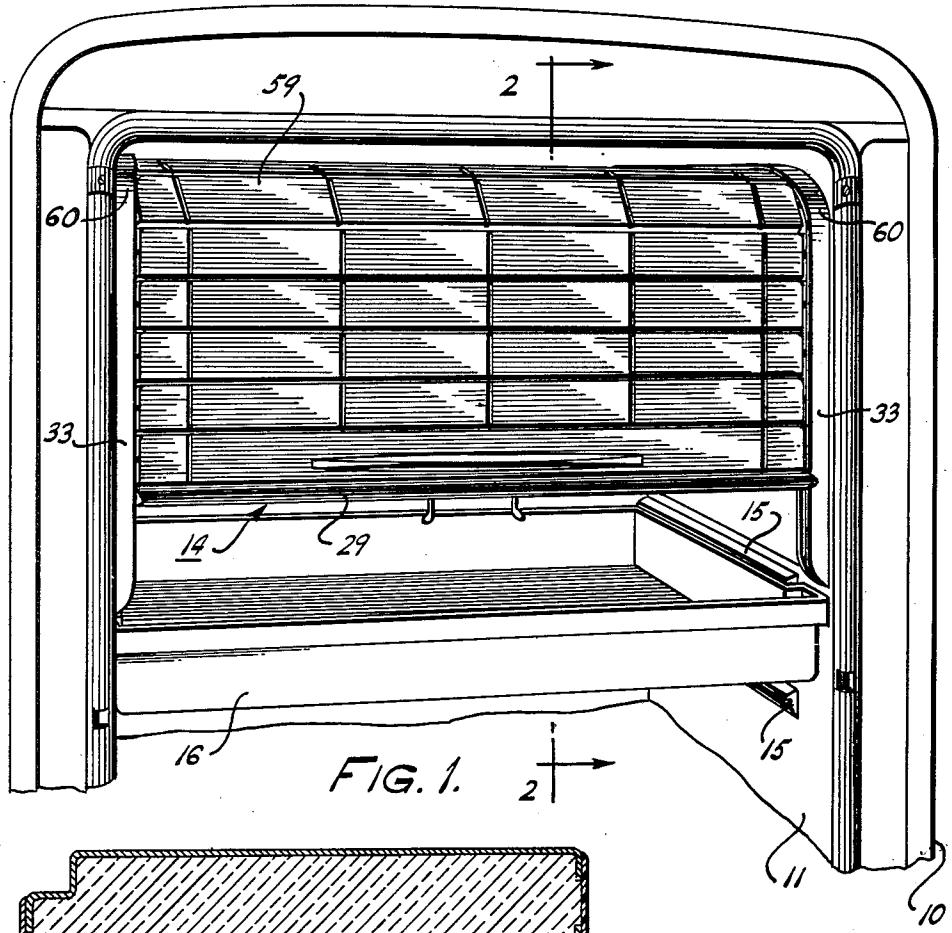


FIG. 1.

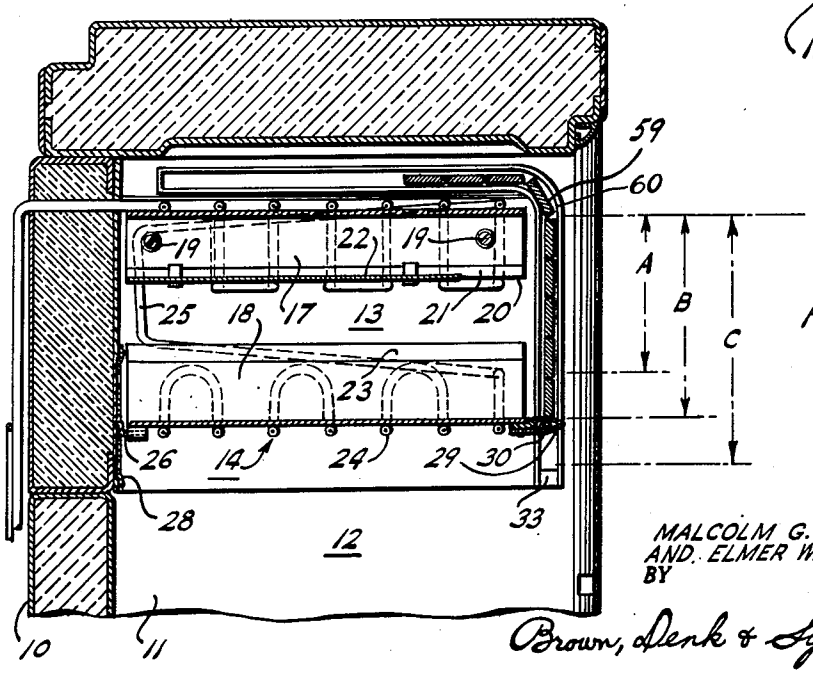


FIG. 2.

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REFRIGERATOR HAVING AN EVAPORATOR PROVIDED WITH A MOVABLE SECTION

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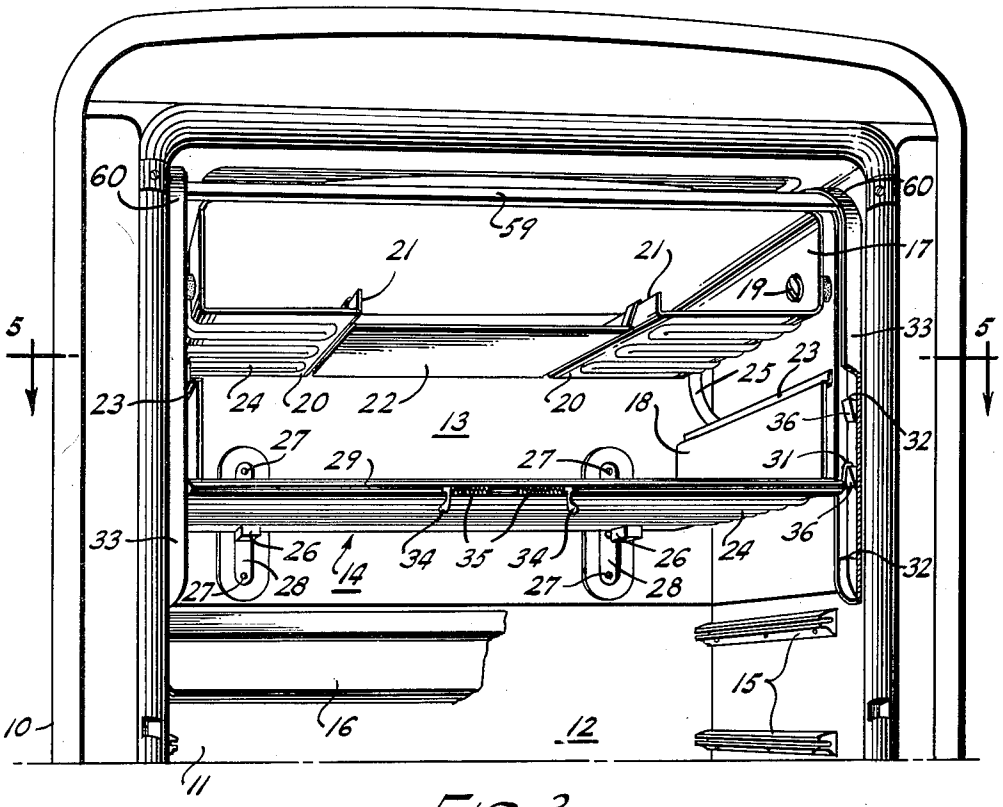


FIG. 3.

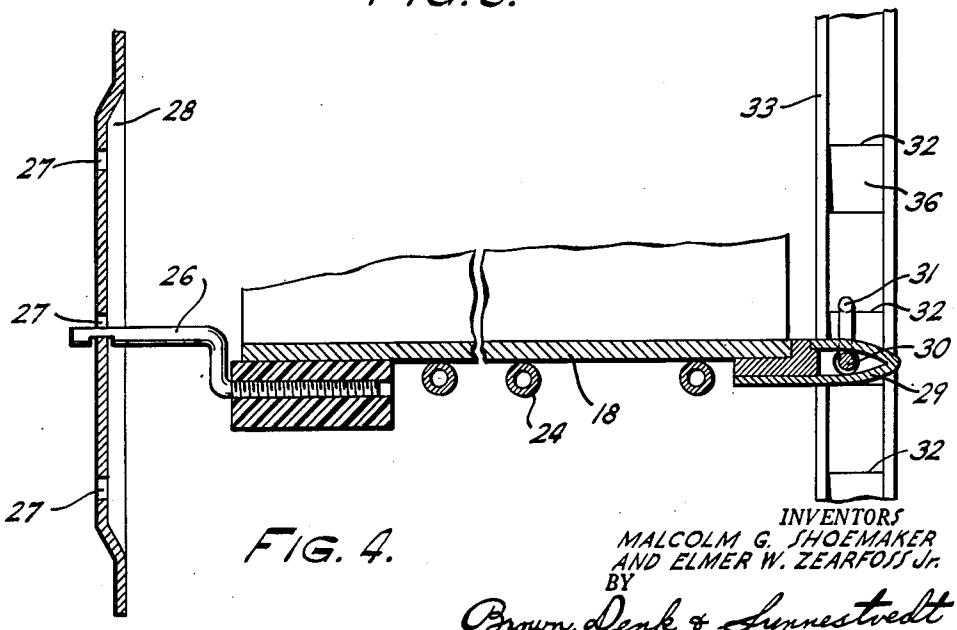


FIG. 4.

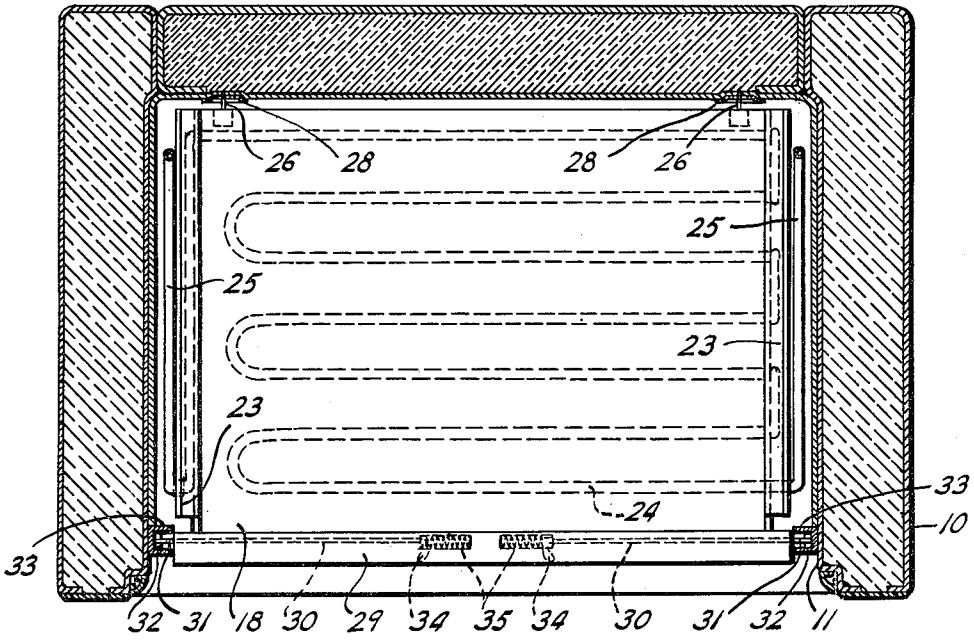
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FIG. 5.



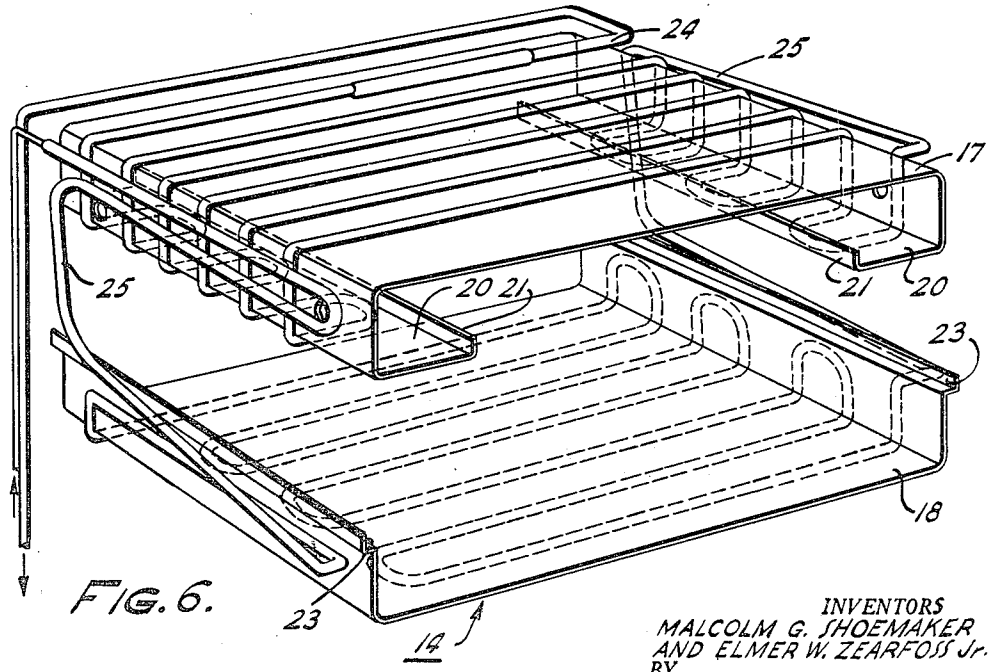


FIG. 6.

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REFRIGERATOR HAVING AN EVAPORATOR PROVIDED WITH A MOVABLE SECTION

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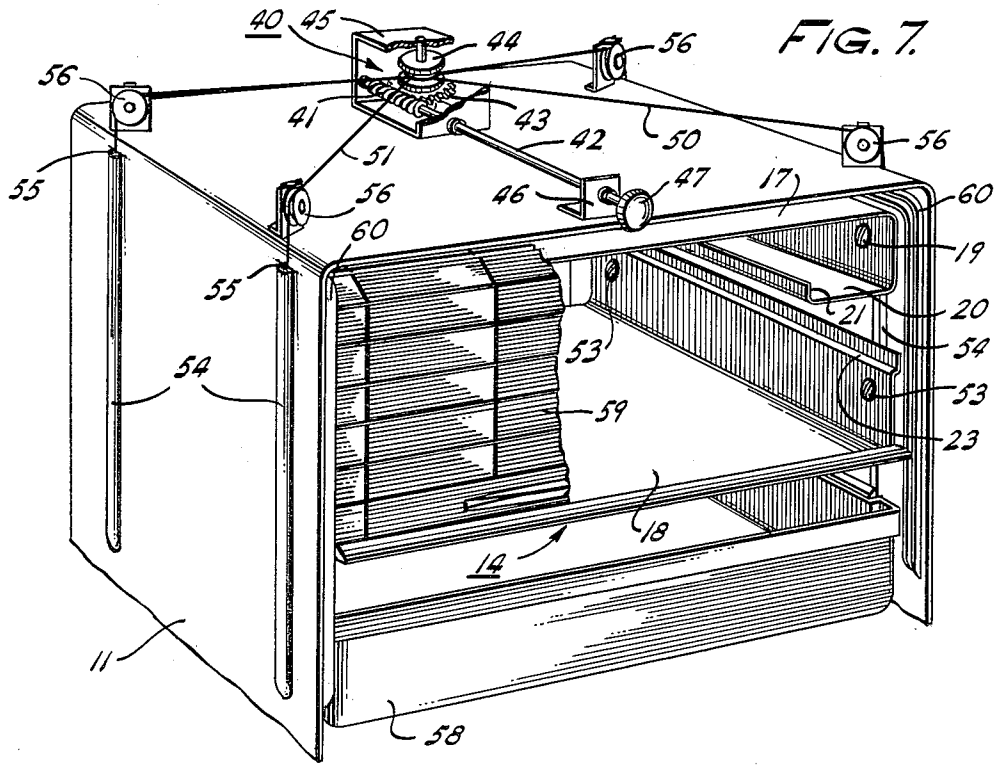


FIG. 7.

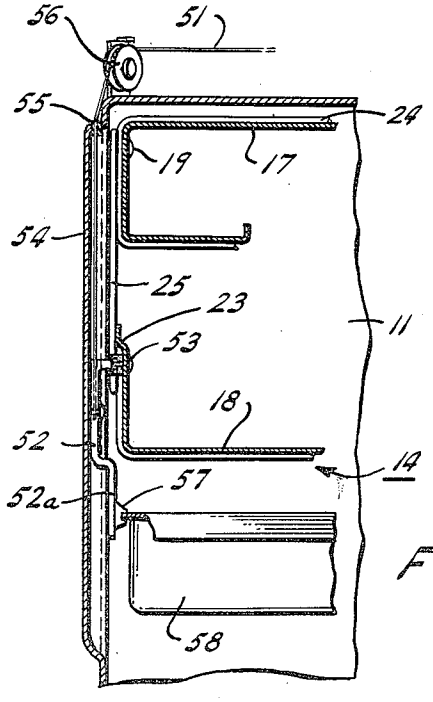


FIG. 8.

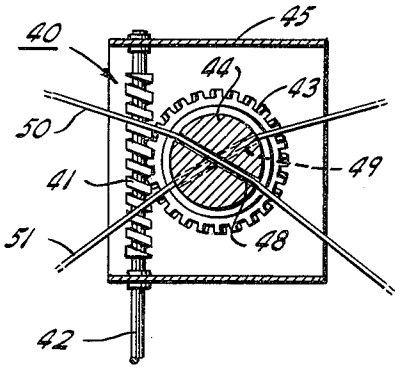


FIG. 9.

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2,597,267

REFRIGERATOR HAVING AN EVAPORATOR PROVIDED WITH A MOVABLE SECTION

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Application November 29, 1949, Serial No. 129,934

3 Claims. (Cl. 62—99)

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The present invention relates to refrigerators and, particularly, to household refrigerators of the type in which provision is made for the storage of food at temperatures below freezing, as well as for the storage of food at temperatures above freezing.

It will be appreciated that, for practical reasons, the over-all size of a refrigerator which is adapted for household use, must be kept within certain limits. This limitation in the over-all size of the refrigerator, of course, controls the volume of the space which is available for the storage of food within the refrigerator. Moreover, since the interior of a refrigerator of the above-mentioned general type must provide for a compartment maintained within a non-freezing temperature range and a compartment maintained within a freezing temperature range, it becomes necessary to effect a compromise between the storage capacity of the non-freezing compartment and the storage capacity of the freezing compartment. Because, in the average household, the bulk and quantity of food to be stored at freezing temperatures is, ordinarily, considerably less than the bulk and quantity of food to be stored at non-freezing temperatures, it has become common practice to design the freezing compartment (usually the evaporator) so as to occupy a minor portion of the interior of the refrigerator, the remaining and major portion of said interior constituting the non-freezing storage space. However, at times, the user may want to store food in bulk or in quantity greater than the predetermined storage space afforded by the conventional freezing compartment, will allow. At other times, the bulk or quantity of food to be stored in the freezing compartment may be small and, in such instances, valuable storage space within the refrigerator becomes a total loss.

It is, therefore, the primary object of this invention to construct the freezing compartment or evaporator of a household refrigerator in such a manner as to provide for selective and ready adjustment of said compartment or evaporator, to increase or to lessen its storage capacity in accordance with the bulk or quantity of the food to be stored. As a result, the user may vary the size of the freezing compartment to suit existing needs, and thus gain full advantage of the space within the refrigerator to satisfy various storage exigencies.

With more particularity, it is an object of the invention to provide, within a household refrigerator, an expansible freezing compartment which may be made to occupy a minimum amount of

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the space within the refrigerator, when little or no food is to be placed in said compartment, and which may be conveniently and easily expanded to accommodate food in larger bulk or quantity. Thus there is provided a refrigerator in which it is possible to vary the ratio of freezing space to total storage space. Under all conditions the compartment can be so adjusted that the greatest possible amount of storage space, within the refrigerator, is left unobstructed for the storage of foods which need not be kept at freezing temperatures.

Briefly stated, the preferred structure which this invention provides to realize the above stated general objectives, comprises complementary sections cooperating with each other to define a freezing compartment within the space outlined by the inner liner of a household refrigerator cabinet. The complementary sections are relatively adjustable so that the size of the compartment which they define, can be varied at the will of the user. The mentioned sections are advantageously constructed to form two separable halves of an evaporator of generally rectangular configuration and adapted to extend substantially across the full width and depth of the space defined by the walls of the inner liner. In practice, one half of the evaporator is conveniently mounted in fixed position, and the other half of the evaporator is mounted in such a manner as to be moved toward or away from the fixed half. Means is cooperatively associated with the movable half section of the evaporator to effect its adjustment and its retention in adjusted position. A closure structure adapted for adjustment in conformity with the relative adjustment of the complementary half sections, is provided to seal the open side of the freezing compartment or evaporator.

The above-mentioned and other objects, and the manner in which they are attained, will be more fully understood from the following detailed description based on the accompanying drawings in which:

Figure 1 is a perspective view of a portion of a household refrigerator incorporating one embodiment of the invention;

Figure 2 is a vertical sectional view looking in the general direction of arrows 2—2 of Figure 1;

Figure 3 is a perspective view, generally similar to Figure 1, with the evaporator door open and certain parts broken away, to illustrate certain constructional features;

Figure 4 is an enlarged sectional view illustrating constructional details of the means which

provides for adjustment of the movable half section of the evaporator;

Figure 5 is a horizontal sectional view looking in the general direction of arrows 5—5 of Figure 3;

Figure 6 is a perspective view showing an evaporator constructed in accordance with the invention;

Figure 7 is a perspective view illustrating another embodiment of the invention;

Figure 8 is a sectional fragmentary view of a portion of the arrangement shown in Figure 7; and

Figure 9 is an elevational sectional view, on an enlarged scale, of the windlass device employed in the embodiment shown in Figure 7.

Referring more particularly to the drawings, the refrigerator, as shown, is of the usual upright type comprising a cabinet construction having an outer shell 10 and an inner shell or liner 11 which is spaced from the outer shell and is insulated therefrom in the customary well known manner. The inner liner defines a space of predetermined height, width and depth within the cabinet, and this space is accessible through the open front of the cabinet which is normally closed by means of a door (not shown) of conventional construction.

As best seen in Figures 2 and 3, the space which is defined by the inner liner is divided into two compartments 12 and 13. One compartment 12 is adapted to be maintained within a non-freezing temperature range for the storage of food to be kept at non-freezing temperatures, and the other compartment 13 is adapted to be maintained within a freezing temperature range for the storage of food to be kept at freezing temperatures. The latter or freezing compartment is advantageously provided by means of an evaporator structure which is designated, in its entirety, by the reference character 14, and which forms a part of the usual refrigerator system (not shown).

Following customary practice, the evaporator structure is located in the upper part of the space defined by the inner liner, and is adapted to span the liner walls so that the underside of the evaporator cooperates with said walls to provide the non-freezing compartment which, thus, occupies all of the space available below the evaporator. As illustrated in Figures 1 and 3, channels 15 are conveniently provided on the side walls of the inner liner, below the evaporator, to support removable trays and shelves which serve to support the food placed within the non-freezing compartment. The tray 16, shown in Figures 1 and 3, can be advantageously used as a meat pan and, because of its construction and location, can and does act as a baffle for the air circulating about the evaporator and the air circulating within the non-freezing compartment. This tray may also be used as a drip pan during defrosting of the evaporator.

In accordance with the present invention, the evaporator is so constructed that the compartment which it outlines, can be increased or decreased in size to accommodate the storage of food in various bulk or quantity. For that purpose, the evaporator preferably comprises two complementary sections, that is, an upper half section 17 and a lower half section 18, each section having a horizontal wall and vertical end wall portions. The upper half section 17 of the evaporator is fixedly mounted as by means of screw threaded elements 19 which fasten said upper half section to the opposite side walls of the liner, adjacent the top of the latter. The lower half section 18 is mounted to be lowered or raised with respect to the fixed upper half section, thereby separating the horizontal walls of the sections to a greater or lesser extent and, accordingly, increasing or decreasing the vertical dimension of the freezing compartment, as is graphically represented by arrows A, B and C in Figure 2. The vertical end wall portions of the upper half section of the evaporator may be conveniently provided with horizontal extensions 20 terminating with upturned flanges 21. These extensions are directed inwardly of the evaporator structure and serve as shelves for supporting ice trays or the like. If desired, an additional shelving member 22 which, as best seen in Figure 3, has the form of a flat metal plate, may be removably hung from the upturned flanges of extensions 20, to provide a horizontal continuation of said extensions. The vertical end wall portions of lower half section 18 of the evaporator are advantageously provided with L-shaped flanges 23 which form seats accommodating the end wall portions of the upper half section of the evaporator, when said wall portions of the upper and lower half sections are brought into vertical abutting relationship by movement of the lower half section to its uppermost position.

As more clearly appears in Figure 6, a refrigerant circulating conduit 24 is arranged in a continuous circuitous path about the upper and lower half sections of the evaporator. Those portions of the conduit which run across the evaporator sections are suitably affixed to said sections to become parts thereof. However, portions of the conduit which run from one section to the other section of the evaporator, are supported free of said sections. In practice, these latter portions are disposed adjacent the opposite ends of the evaporator structure and are formed to provide elongated vertical loops 25 which substantially parallel the end wall portions of the evaporator sections. It will be understood that the presence of the loops 25, because of their elongated formation and their freedom to flex, provide for the circulation of refrigerant from one evaporator section to the other without interfering with the up or down movement of the evaporator lower half section.

As illustrated in the drawings, the movable lower half section of the evaporator is adjusted and supported in an intermediate position. From this position, said movable section may be adjusted and supported at a higher or lower level as is indicated, for instance, in Figure 2. For that purpose, according to the embodiment shown in Figures 1 through 5, hangers 26 are affixed in spaced relationship along the rear edge portion of the evaporator lower half section. These hangers project from said edge portion and are adapted for selective engagement with apertures 27 (see Figures 3 and 4) arranged in vertical rows in recessed plates 28 which are conveniently mounted on the back wall of the inner liner, in position to register with said hangers. A generally tubular trim member 29 is suitably attached along the front edge portion of the evaporator lower half section and receives slidable rods 30 having outwardly directed hook ends 31 selectively engageable with stops 32 which are conveniently arranged in vertical rows within channels 33 secured to the side walls of the inner liner. The number of stops 32 is equal to the

number of apertures 27, and said stops and apertures are so disposed with respect to each other that, when the lower half section of the evaporator is properly adjusted in any one of its operative positions, said section is maintained in a substantially horizontal plane. The inner ends of rods 30 are spaced from each other and have depending handles 34 which project through elongated slots provided at an intermediate portion of the trim member 29. Coil springs 35 are retained in said slots and bear against said inner ends of the rods to impart a longitudinal thrust to said rods, thereby urging hook ends 31 outwardly to the extent allowed by the engagement of the handles within the slots in trim member 29.

A convenient way of manipulating the lower half section of the evaporator to change it from one to another of its positions, will be best understood by referring to Figure 4. As will appear from this figure, the evaporator section 18 may first be lifted so as to permit disengagement and withdrawal of hangers 26 from the associated apertures in plates 28. The evaporator movable section may then be angularly raised (or lowered) so that the back portion of said section brings the hangers in position to register with other apertures in said plates, the hook ends 31 in engagement with the associated stops 32 serving as pivots during this raising (or lowering) movement of the section. Thereafter, the forward edge portion of the evaporator movable section is raised (or lowered) so as to bring hook ends 31 in engagement with a new set of stops, thereby leveling the evaporator section in its new position. In practice, each stop 32 is advantageously provided with a downwardly tapered surface 36, thereby permitting the hook ends 31 to ride over the stops, and eliminating the necessity of manipulating handles 34 when the movable section is raised from a lower to a higher position. During handling of the movable evaporator section to lower the same, the handles 34 are manually drawn toward each other to retract rods 30 against the force of coil springs 35, so that the hook ends may clear the upper stops. The recessed plates in which apertures 27 are provided, and the channels in which stops 32 are arranged, advantageously serve as guides for hangers 26 and the hooks 31 when moving up or down during adjustment of evaporator section 18.

According to the embodiment shown in Figures 7, 8 and 9, a windlass device indicated, generally, at 40, is employed to adjust the movable half section of the evaporator. The use of a device of this kind makes unnecessary the direct handling of the movable evaporator section to effect its movement to and from its various positions. Further, such a device eliminates the use of elements like the apertured plates, stops, hangers and retractable hooks. As clearly seen in Figures 7 and 9, the windlass device comprises a worm screw 41 provided at one end portion of an elongated shaft 42, and a worm wheel 43 with which a spool 44 is rigidly connected, in concentric relationship. In practice, the worm gear and spool are advantageously made as integral parts which, together with the worm screw carrying shaft, are rotatably mounted in a bearing bracket 45, affixed upon the top wall of the inner liner. A second bracket 46 which is also disposed on the top wall of the inner liner, supports the forward end portion of rotatable shaft 42. This latter end portion of the rotatable shaft extends beyond the front edge of the liner, and is provided with manipulating means, such as knob 47, which is accessible for manual operation of the windlass device.

The spool 44 is provided with radial bores 48 and 49 (Figure 9) which cross each other approximately at the center of rotation of said spool, in planes which lie one above the other. Flexible cables 50 and 51 are threaded through bores 48 and 49, respectively. The cables have their ends securely attached to the corner portions of the evaporator movable section by means of connecting brackets, one of which is clearly shown at 52 in Figure 8. These brackets are rigidly connected, as at 53, to said movable section, and are vertically slidable in guides which are conveniently provided by means of elongated vertical embossments 54 formed in the side walls of the inner liner. The upper extremities of the embossments or guides are open and provided with apertured sealing plugs 55 through which the cables pass. The cables, as best seen in Figure 7, are guided by means of pulleys 56 disposed at the opposite corner portions of the top of the inner liner. As more clearly seen in Figure 8, each connecting bracket 52 is advantageously provided with an extension 52a having a horizontal channel member 57. These channel members slidably receive and support a tray 58 beneath the evaporator movable section at a predetermined fixed position with respect to said movable section.

From the foregoing description of the arrangement as shown in Figures 7 and 8, it will be understood that the evaporator movable half section may be raised (or lowered) by actuation of the windlass device through manipulation of the handle or knob 47. Referring to Figure 9, the windlass device as shown is in the condition it assumes when the movable section of the evaporator is in its lowermost position. In this condition, the cables are fully unwound and the length of each cable is such that the connecting brackets are suspended within the lower end portions of embossments 54 on the side walls of the inner liner. From Figure 9, it will be understood that actuation of the windlass device to cause rotation of the spool 44 either in clockwise direction or in counter-clockwise direction, will take up the connected portions of cables 50 and 51, and wind them about the spool. Accordingly, the brackets, in the channeled embossments 54, are pulled upwardly and the evaporator movable section is raised toward the fixed section. When the evaporator movable section has once been raised, it can again be lowered by actuation of the windlass device to cause rotation of the spool in a direction opposite to that in which it was initially rotated to elevate said movable section, because rotation of the spool in said opposite direction unwinds the connected portions of the cables, and allows said section to slide downwardly under the influence of its own weight.

In the embodiment shown in Figures 1 through 5, as well as in the embodiment shown in Figures 7 and 8, the open front of the evaporator structure is adapted to be closed by means of a suitable door 59 which is capable of being adjusted to conform with the adjustment of the evaporator lower half section in relation to the evaporator upper half section. A flexible door of the type illustrated in the drawings is suitable for the purpose. Such a door is guided in the aforementioned channels 33 which are disposed adjacent the front ends of the evaporator structure and extended upwardly and rearwardly, as shown at 60, along the side edges of the top

wall of the fixed half section 17, so that the door can be rolled up to open the freezing compartment, and rolled down to close said compartment. The door is such that, when closed, it reaches the forward edge portion of the bottom wall of lower half section 18 of the evaporator, regardless of the position in which said section is adjusted.

By employing the invention as embodied in either form herein shown and described, it will be appreciated that a household refrigerator can be made to conform most readily to the need of the user who, on occasions, may want to store, within the freezing compartment of the refrigerator, food in bulk or quantity larger than could be accommodated in refrigerators of conventional design. The invention, therefore, enhances the usefulness of household refrigerators by making it possible to adapt the storage capacity of a freezing compartment, such as is defined by the walls of an evaporator, to suit the requirements of the user. Especially, the provision of an expandable evaporator constructed in accordance with the invention, has the decided advantage that the evaporator can be made to occupy a minimum amount of the space within the household refrigerator whenever no extraordinary need exists for storing food at freezing temperatures, and still can be made, within reasonable limits, to take care of eventualities which demand more space for the storage of food at freezing temperatures.

While, for purposes of illustration, two preferred embodiments of the invention have been illustrated and described with particularity, it will be understood that such embodiments are susceptible of changes and modifications without departing from the essential spirit of this invention. The invention contemplates mounting of a refrigerated plate, or other form of evaporator in such a way as to make it possible to vary the ratio of freezing space to total storage space within the cabinet, and, in the broader aspect of the invention, the evaporator may take a variety of forms. It will be recognized, however, that such changes and modifications are contemplated, as come within the scope of the appended claims.

We claim:

1. In a refrigerator, an inner liner defining a space within a refrigerator, complementary

sections cooperating with each other to define a freezing compartment within said space, said sections being mounted for selective adjustment with respect to each other to vary the size of said compartment, and a closure structure for said compartment adapted for adjustment in conformity with the relative adjustment of said sections.

2. A refrigerator evaporator comprising upper and lower complementary sections cooperable to provide top and bottom walls of a freezing compartment, the upper section having a pair of spaced downwardly extending wall portions each of which is provided with a shelf portion extending inwardly of the freezing compartment, the lower section being movable toward and away from said upper section to vary the size of said freezing compartment, and pan-carrying means depending from and movable with said lower section.

3. In a refrigerator, an inner liner having walls defining a space within the refrigerator, a refrigerant evaporator constructed of two separable complementary sections cooperating with each other to define a freezing compartment within said space, one section cooperating with certain walls of the inner liner to define a non-freezing compartment within said space, and means supporting said one section for selective adjustment in said space with respect to the other section and to said certain walls of the inner liner, said last mentioned means including a windlass device supported on the inner liner and connected with the evaporator adjustable section.

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