Feb. 8, 1944. E. F. SCHWELLER 2,341,123

REFRIGERATING APPARATUS

Filed Oct. 21, 1942 3 Sheets-Sheet 1

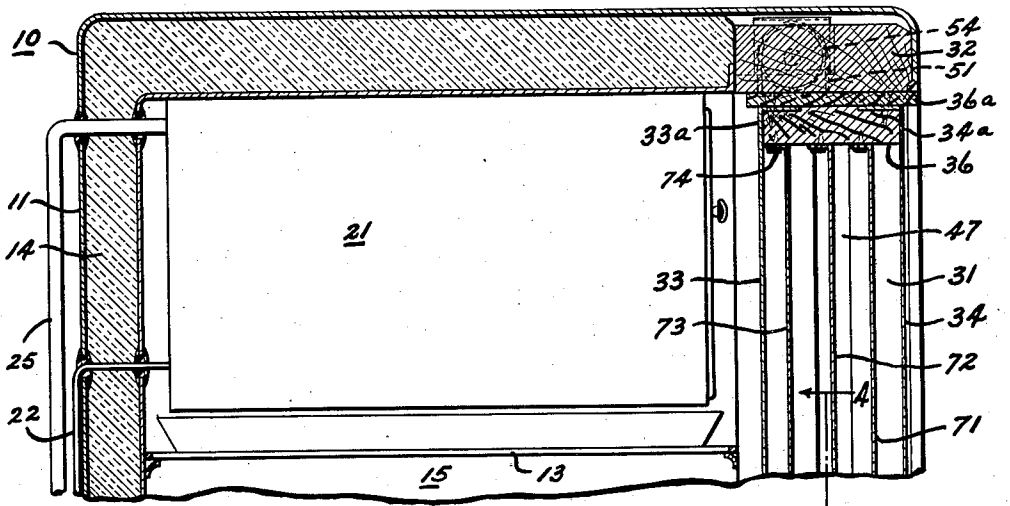


Fig. 3

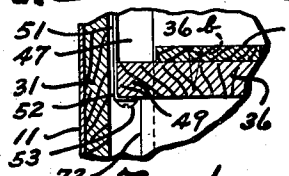


Fig. 6

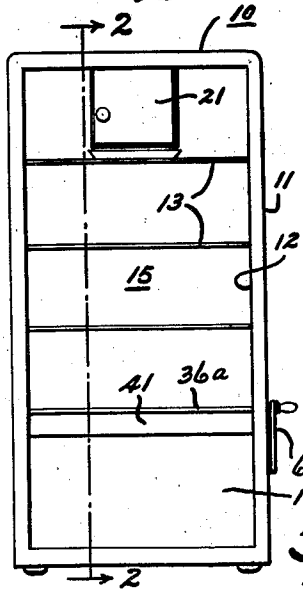


Fig. 1

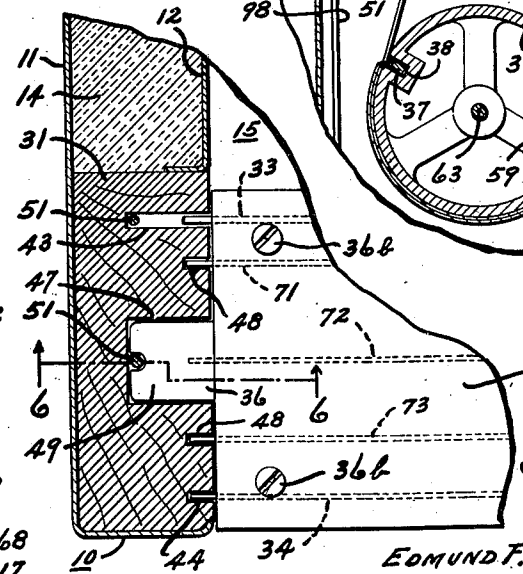


Fig. 5

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REFRIGERATING APPARATUS

Filed Oct. 21, 1942 3 Sheets-Sheet 2

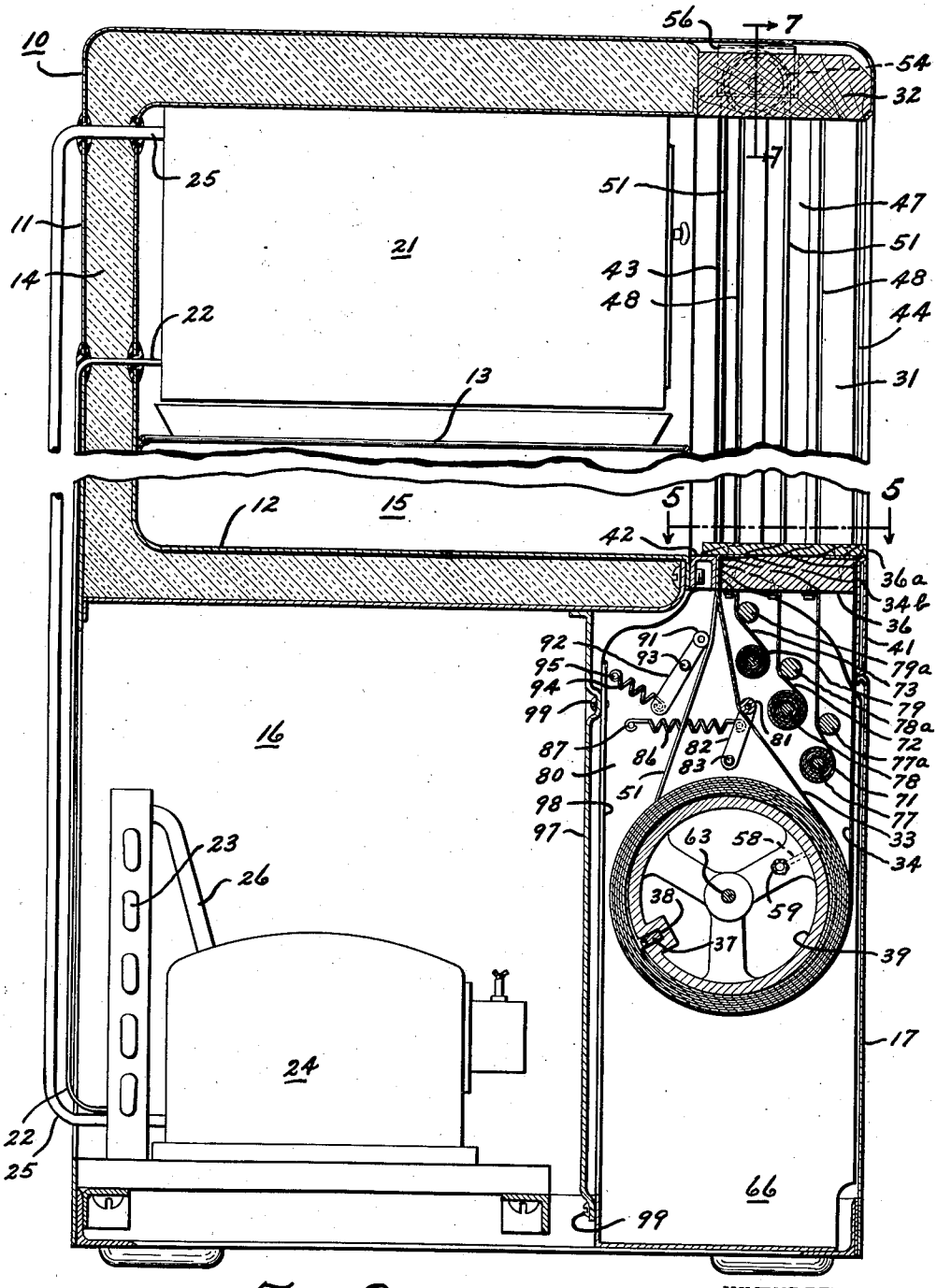


Fig. 2

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REFRIGERATING APPARATUS

Filed Oct. 21, 1942 3 Sheets-Sheet 3

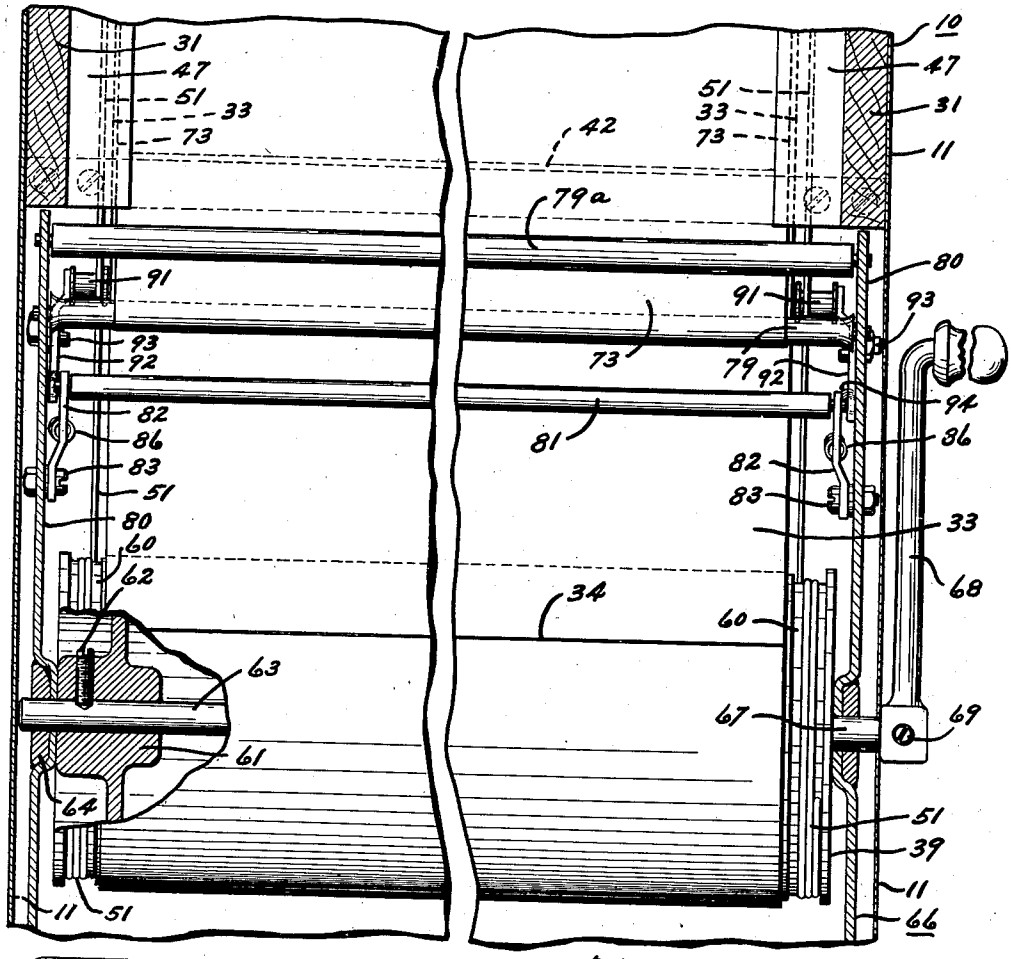


Fig. 4

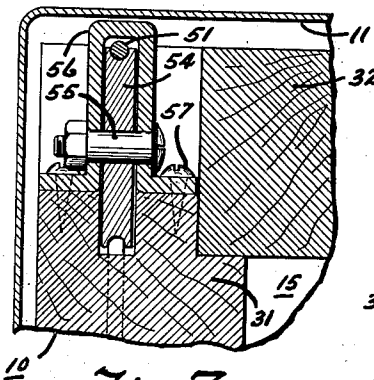


Fig. 7

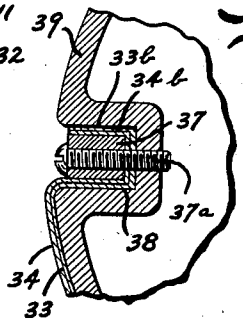


Fig. 8

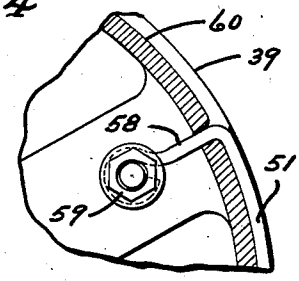


Fig. 9

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Patented Feb. 8, 1944 2,341,123

UNITED STATES PATENT OFFICE

2,341,123

REFRIGERATING APPARATUS

Edmund F. Schweller, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application October 21, 1942, Serial No. 462,792

10 Claims. (Cl. 160—120)

This invention relates to refrigeration and particularly to household refrigerator cabinets having a refrigerating system associated therewith.

I have found that by careful selection of the location within a food chamber of a refrigerator cabinet for the storage of certain articles that are frequently removed from and replaced in the chamber, a door structure for closing the chamber access opening can be provided which will greatly conserve refrigeration within the food chamber and render the apparatus employed to refrigerate the interior of the chamber more efficient in operation while at the same time affording advantages over a horizontally swinging door commonly used for closing the refrigerator chamber access opening.

An object of my invention is to provide an improved closure or door for closing the access opening of a food storage chamber of a refrigerator cabinet.

Another object of my invention is to provide the access opening of a refrigerated food storage chamber with a door which can be vertically moved to a partially open position to afford access to a part of the interior of the chamber while at the same time closing off the remainder of the chamber from outside air.

A further object of my invention is to provide a door for the refrigerated food storage chamber of a refrigerator cabinet which can be partially opened from the top downwardly to gain access to articles stored in the uppermost portion of the chamber and to ice trays contained in an evaporator of a refrigerating system, which evaporator is usually mounted at the top of the chamber, without opening or exposing the entire chamber to outside air.

A still further object of my invention is to provide a vertically slidable door for closing the access opening of a food storage chamber of a refrigerator cabinet, which door comprises flexible sheet members extending continuously along the access opening in spaced apart relation to one another to form air spaces therebetween for more effectively insulating the door.

In carrying out the latter object, it is a more specific object of my invention to provide means which, when operated in one direction, will flex and roll the sheet door members thereupon to cause opening of the door, and which, when operated in an opposite direction, will unroll the sheet members to cause closing of the door.

Other and more specific objects and advantages reside in novel combinations and arrangements of the various parts of the apparatus to accomplish the purposes of my invention as will more fully appear in the course of the following description.

In the drawings:

Fig. 1 is a front view of a refrigerator cabinet having my invention incorporated therein and showing the food storage chamber door in open position;

Fig. 2 is an enlarged fragmentary vertical sectional view of the refrigerator cabinet shown in Fig. 1 and is taken on the line 2—2 thereof;

Fig. 3 is a view similar to Fig. 2 showing the food storage chamber door of the refrigerator in closed position;

Fig. 4 is a fragmentary sectional view of the refrigerator taken on the line 4—4 of Fig. 3 showing roller means for the members of the food chamber door;

Fig. 5 is an enlarged fragmentary horizontal sectional view through the door opening of the cabinet and is taken on the line 5—5 of Fig. 2;

Fig. 6 is a small fragmentary vertical sectional view taken on line 6—6 of Fig. 5 showing a cable attached to the head portion of the refrigerator cabinet door.

Fig. 7 is an enlarged fragmentary sectional view taken on the line 7—7 of Fig. 2 showing a pulley for the cabinet door cable;

Fig. 8 is an enlarged sectional view of a part of a drum employed to roll sheet members of the door thereupon and showing means for fastening the ends of the members thereto; and

Fig. 9 is an enlarged fragmentary view showing means for fastening one end of a cable employed for moving the door to the drum.

Referring to the drawings, in order to illustrate my invention, I have shown in Fig. 1 thereof a household refrigerating apparatus comprising a cabinet generally represented by the reference character 10. Cabinet 10 includes a plurality of metal walls 11 forming an outer shell or wall surface for the cabinet and a metal liner member 12 (see Fig. 2) within the upper portion of the cabinet surrounded by any suitable insulating material 14 and forming walls of a food storage chamber 15. Chamber 15 is divided into a plurality of food storage spaces by partitions or shelves 13. The cabinet outer walls 11 extend downwardly beyond the insulated chamber 15 to enclose or provide an apparatus or machine compartment 16 at the bottom of the cabinet 10. A metal panel or the like 17 cooperates with the cabinet walls 11 to close the front of compartment 16 while the back of the machine compartment is left open for air circulation there-

through. In order to refrigerate articles stored in and to cool the air within the food chamber 15, an evaporator 21 of any desirable construction and preferably of the sheet metal variety is mounted in the upper part thereof. This evaporator is of conventional design and includes walls forming a freezing compartment in which trays containing a grid and filled with water may be located for freezing the water into ice blocks or cubes for table use. Evaporator 21 is connected by a liquid refrigerant supply conduit 22 with a condenser 23 of a refrigerant compressing and circulating unit located in the machine compartment 16 (see Fig. 2). The refrigerant compressing and circulating unit includes a sealed motor-compressor 24 communicating with the evaporator 21 by way of a gaseous or evaporated refrigerant conduit 25. Refrigerant evaporated within evaporator 21, to effect cooling of the interior of chamber 15, is drawn into the compressor of the motor-compressor 24 where it is compressed and circulated or forwarded under pressure, through conduit 26, into the condenser 23. The compressed refrigerant is cooled and liquefied in condenser 23 and circulated or returned to the evaporator 21 by way of the supply conduit 22. An expansion valve or restrictor usually interposed in the conduit 22 controls the flow of liquid refrigerant into the evaporator 21. Any suitable thermostatic switch or the like, as is conventional in the art, may be provided for starting and/or stopping operation of the motor-compressor 24 to maintain a predetermined low temperature within the evaporator 21 and consequently within food storage chamber 15.

Since my invention is particularly directed to conserving refrigeration within a refrigerated food storage chamber of a refrigerator cabinet, I provide a unique and improved door for closing the chamber access opening which door, in addition to forming the sole closure means for the chamber, also operates in a manner to conserve refrigeration and render the refrigerating system, associated with the cabinet, more efficient. In the present disclosure, wood or moulded insulating pieces 31 form the side walls of the access opening of chamber 15 and a wood or moulded piece 32 forms the top wall thereof (see Figs. 2 and 7). The bottom wall of the access opening of chamber 15 is open for a purpose which will become apparent hereinafter. A closure means or door is slidably associated with the chamber access opening wall pieces 31 and 32. This closure means or door includes an inner flexible metal member or sheet 33 and an outer flexible metal member or sheet 34, both of which are formed of thin sheet metal such as stainless steel and extend continuously along the length of the access opening of chamber 15. One end 33a and 34a of each sheet member 33 and 34 respectively is secured between two wood slats or the like 36 and 36a by screws 36b and the secured together slats form an edge of the door (see Figs. 3 and 5). The other end 33b and 34b of each sheet member 33 and 34 respectively is fastened by a clamp 37 and screws 37a within a groove 38 provided in a roller means or drum 39 located within the machine compartment 16 (see Fig. 8). These sheet members 33 and 34 extend, in spaced apart relation to one another, through the open bottom wall of the chamber access opening and are guided therethrough by an outer metal piece 41 and an inner metal piece 42 which extend across the front portion of cabinet 10. The side edges of the sheet metal members 33 and 34 extend into guiding slots 43 and 44 respectively provided in the side wall pieces 31 of the access opening of chamber 15 (see Figs. 2 and 5). The slot or groove 43 provided in the side wall pieces 31 is narrow and deep as compared to the slot or groove 44 for a purpose to be presently described. Each end of the heavy lower slat 36 of the door head is provided with an ear 49 which extends into a deep wide slot or groove 47, provided in the wood pieces 31, to guide the head of the door during vertical movement thereof. Wires or airplane cables 51, such as Roebling cables, have their one end portion 52 bent around the end of ear 49 on slat 36 and secured thereto by any suitable means such as by screws 53 (see Fig. 6). These cables extend upwardly through the central deep slots 47 in pieces 31 and over pulleys 54 pivotally mounted by shafts 55 to brackets 56, which brackets are secured by screws 57 to the top of the wood pieces 31 (see Fig. 7). These cables 51 then depend through slot 43 in pieces 31 to the roller means or drum 39. The end portion 58 of cables 51 extend through an opening in the wall of drum 39 and are fastened to this drum by any suitable securing means such as by bolts 59 (see Fig. 9). Each of the cables 51 is adapted to be spirally or horizontally wound upon the drum 39 within an undercut portion 60 adjacent each end of the drum and beyond the side edges of the sheets 33 and 34. Sheet members 33 and 34 together with cables 51 form an endless belt-like device cooperating with and secured to drum 39. The roller means or drum 39, located in the machine compartment 16 of cabinet 10, includes web parts having a bearing portion 61 secured, as by keys or screws 62, to a shaft 63 (see Fig. 4). One end of shaft 63 extends thrcugh a bearing 64, provided on bracket means 66, and terminates adjacent a side wall 11 of compartment 16. The other end 67 of shaft 63 is mounted in a bearing similar to bearing 64 and projects through an opening in the metal wall 11 of machine compartment 16. This end 67 of shaft 63 is, in the present disclosure, provided with means for rotating shaft 63 and consequently drum 39 which is in the form of a manually actuated crank 68 secured to shaft 63 by screw 69 (see Fig. 4). The crank 68 is shown so as to simplify the illustration of the present invention, and it is to be understood that the shaft 63 of drum or roller means 39 may, and should preferably, be connected, with proper gearing or belting, to a mechanism operated by a reversible electric motor controlled by a push button switch arrangement. Such mechanism and control therefor is conventional and may be of the type commonly employed for opening and closing garage doors where one button of a switch is pushed to operate the door in one direction and another button is pushed to operate the door in an opposite direction In using such mechanism in the present invention, a third button incorporated in the switch would be employed to break the electric circuit at the switch so as to stop the food chamber door at any desired point along its path of travel The crank 68 therefore merely serves in the present disclosure as means operable to rotate the roller means or drum 39, for causing vertical movement of the door.

In addition to the metal sheet members 33 and 34, I provide the food storage chamber door with other intermediate spaced apart sheet members 71, 72 and 73. These members 71, 72 and 73 may be formed of flexible aluminum foil or they

may be formed of fabric provided with a suitable coating or impregnating material to reduce or prevent passage of air therethrough. The members 71, 72 and 73 are spaced from one another and are also spaced from the members 33 and 34 to divide the space intermediate the inner and outer metal face members of the door into a plurality of substantially closed or dead air spaces to better the insulating property of the door. Sheet members 71, 72 and 73 extend continuously throughout the length of the food chamber access opening and each has its one end secured to the door head slat 36 by any suitable fastening means such as by a plurality of tacks or the like 74 (see Fig. 3). The other end of each member 71, 72 and 73 is secured to separate spools or independent roller means 77, 78 and 79 respectively located immediately below the bottom of the food chamber access opening (see Figs. 2 and 3). Stationarily located rolls 77*a*, 78*a* and 79*a*, having their ends rotatably mounted in openings provided in upright portions 80 of bracket means 66, are adjacent each spool 77, 78 and 79 and serve to direct the side edges of sheets 71, 72 and 73 into their respective grooves in wood pieces 31. These spool or roller means 77, 78 and 79 are each provided with a spring (not shown) which is placed under tension when the sheet members are unrolled from the rollers such as, for example, when the food chamber door is moved to closed position. In this respect, the sheet members 71, 72 and 73 and their corresponding roller means 77, 78 and 79 are conventional and are similar to ordinary window curtains with the stop-lock thereof removed. The spring tensioned rollers 77, 78 and 79 will cause the sheets 71, 72 and 73 to roll thereupon when the door is moved downwardly to open position. The side edges of sheet members 71 and 73 are located in opposite guide slots or grooves 48 provided in the wooden pieces 31 while the side edges of sheet member 72 are located in the opposite wide slots 47 of the pieces 31 (see Fig. 5). These spools or rollers 77, 78 and 79 have their ends mounted in suitable holes provided in the upright portions 80 of the bracket means 66 which bracket means comprises an inverted U-shaped metal member rigidly secured to the cabinet 10 in any suitable manner within the machine compartment 16 thereof.

It is to be noted that the inner metal sheet member 33 and cables 51 are provided with a slack or relatively loose portion adjacent the roller means upon which they are to be rolled. The slack or loose portion in the members mentioned is for the purpose of supplying sufficient length to the sheet member 33 and cable 51 to account for the difference in rolling speed of the members 33 and 34 upon one another on drum 39. Obviously, the spools or rollers 77, 78 and 79 will rotate much faster than drum or roller means 39 to afford the same speed of up and down movement of sheets 71, 72 and 73 as is imparted to metal sheets 33 and 34 by the drum. At the slack or loose portion of metal sheet member 33, I provide a roll 81 which extends entirely across the sheet member and has its ends mounted in arms 82 located adjacent the side edges of sheet member 33. Each arm 82 is pivotally mounted as by a pin 83 to the upright portions 80 of bracket means 66, and a spring 86 having its one end secured to a stud 87 and its other end fastened to an arm 82 forces the roll 81 against sheet member 33 to maintain the same taut at all times whereby the slack or loose portion does not wrinkle or become tangled. At the slack or loose portion of each cable 51, I provide a short roller 91 mounted upon an arm 92 which arm is pivotally secured, as by a pin 93, to the upright portion 80 of bracket means 66. A spring 94 having its one end secured to a stud 95 and its other end associated with the arm 92 applies tension to the cables 51 through the rollers 91 to take up the slack therein and maintain these cables taut. Thus, it will be seen that the arms 82 and 92 may move against the tension of springs 86 and 94 respectively when the sheet member 33 and cables 51 are pulled tight. A plate 97 is attached to inwardly directed ear portions 98 on upright parts 80 of bracket means 66 by screws 99 and this plate isolates the door moving elements from that portion of the machine compartment 16 containing the heat dissipating unit or motor-compressor 24. Plate 97, therefore, serves to prevent heat generated by the motor-compressor 24 and condenser 23 from flowing upwardly between the sheet members of the door of the refrigerated chamber 15.

In moving the food storage chamber access door of the refrigerator cabinet 10 of the present disclosure, the crank 68, or any other suitable operating means for roller or drum 39, is operated to cause rotation of drum 39 in one direction for flexing and rolling or winding the sheet metal members 33 and 34 thereupon while at the same time unwinding the cables 51 from the end portions 60 of the drum. Such operation causes vertical movement of the door of chamber 15 and this door moves downwardly from the position shown in Fig. 3 to the position shown in Fig. 2 of the drawings. The sheet members 71, 72 and 73 are simultaneously wound upon the small roller means or spools 77, 78 and 79 by the action of the springs incorporated in or associated with these spools. Operation of the crank 68, or other suitable operating means for drum 39, in the opposite direction will cause rotation of the drum 39 in an opposite direction to wind the cables 51 upon the end portions 60 of drum 39 while at the same time unwinding the sheet members 33 and 34 from the drum. Winding of the cables 51 upon drum 39 causes the ends 52 of the cables to pull upwardly on the ears 49 of piece 36 of the door head. This pulling moves the members 33, 34, 71, 72 and 73 upwardly within their guiding slots or grooves of side pieces 31 to bring the door head into engagement with the top wall piece 32 of the chamber access opening so as to close the door and seal the chamber 15. The upward movement of the sheet members 71, 72 and 73 tightens the springs incorporated in or associated with the spools 77, 78 and 79 so that these springs will have sufficient tension to automatically wind or roll the sheet members thereupon when the door is again moved down. As before stated, the articles which are frequently placed in or removed from the food storage chamber 15 of cabinet 10 should be arranged on the uppermost food storage shelf 13 within chamber 15 and at the sides of the evaporator 21. Thus, the acquisition or serving of such articles and/or the removing of ice blocks from evaporator 21 necessitates opening of the food chamber door only to a point slightly below the upper shelf within the chamber 15. The remainder of the chamber or that portion thereof from the upper shelf to the bottom wall is thereby maintained closed to conserve the cold air within the chamber during frequent operation of the door to gain

access to those articles or food products which are frequently removed from and replaced in the chamber.

In view of the foregoing, it will be seen that I have provided an improved door structure for closing the access opening of a food storage chamber of a refrigerator cabinet. The improved door, in addition to conserving the cold air within a refrigerated chamber, also presents other advantages which makes its use practical and desirable. By providing a door which substantially rolls up upon itself within the confines of the refrigerator cabinet walls and which moves in a vertical direction, I permit a refrigerator cabinet to be installed in any location without danger of the door opening or swinging in a direction which will interfere with other objects of furniture or appliances adjacent the refrigerator. The vertical movement of the door permits the user to stand directly in front of the cabinet during opening of the door so as to be in a position to facilitate placing of articles in or the removal of such articles from the refrigerated chamber. My improved door structure forms the sole means of closing the food storage chamber while at the same time eliminating the use of other auxiliary or additional doors, curtains and the like heretofore commonly employed to conserve cold air in a food chamber of a refrigerator.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a plurality of flexible sheet members connected to one another and extending continuously in spaced apart relation along said chamber access opening to form a door normally closing same, roller means within said cabinet adjacent said chamber access opening for flexing and winding said members thereupon to cause sliding movement of said door, and said roller means being operable to cause the door to open said chamber access opening.

2. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a plurality of flexible sheet members connected to one another and extending continuously in spaced apart relation along said chamber access opening to form a door normally closing same, horizontally disposed roller means within said cabinet adjacent said chamber access opening for flexing and winding said members thereupon to cause vertical movement of said door, and said roller means being operable to cause the door to open said chamber access opening.

3. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof and a machine compartment beyond said chamber, a plurality of flexible sheet members connected to one another and extending continuously in spaced apart relation along said chamber access opento form a door normally closing same, horizontally disposed roller means within said machine compartment adjacent said chamber access opening for flexing and winding said members thereupon to cause vertical movement of said door, and said roller means being operable to cause the door to open said chamber access opening.

4. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a door associated with said cabinet and forming the sole means of closing said chamber access opening, said door comprising a plurality of sheet members extending continuously in spaced apart relation along said chamber access opening, roller means within said cabinet adjacent said chamber access opening operable in one direction for winding said members thereupon and causing said door to move downwardly to open said chamber access opening, means connected to said door and associated with said roller means, and said last named means causing unwinding of said members from said roller means and movement of said door upwardly to close said chamber access opening when said roller means is operated in a direction opposite said one direction of operation thereof.

5. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a door normally closing said chamber access opening and comprising a plurality of flexible sheet members extending continuously in spaced apart relation along the entire length of said chamber access opening, one of said sheet members forming the inner face of said door and the other of said sheet members forming the outer face of the door, said door also comprising a plurality of flexible sheet members intermediate said first named sheet members extending continuously in spaced apart relation along the entire length of said chamber access opening and dividing the space between the inner and outer faces of said door into a plurality of spaces, roller means within said cabinet adjacent said chamber access opening for winding said members thereupon, and certain of said roller means being operable to cause movement of said door to open said chamber access opening.

6. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a door normally closing said chamber access opening and comprising a plurality of sheet metal members extensible continuously in spaced apart relation along the entire length of said chamber access opening, one of said sheet metal members forming the inner face of said door and the other of said sheet metal members forming the outer face of the door, said door also comprising a plurality of flexible sheet members extensible continuously in spaced apart relation along the entire length of said chamber access opening intermediate said sheet metal members and dividing the space therebetween into a plurality of spaces, a common roller means within said cabinet adjacent said chamber access opening for winding said sheet metal members thereupon, said common roller means being operable to cause sliding of said door in a vertical direction to open said chamber access opening, and separate roller means for each of said intermediate flexible sheet door members operable upon operation of said common roller means for winding the intermediate door members thereupon.

7. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a plurality of sheet members extending continuously in spaced apart relation along said chamber access opening and providing a door normally closing said opening, a roller within said cabinet, one end of each of said sheet members being connected together in

the vicinity of said chamber access opening and the other end of each of said sheet members being attached to said roller, cables having their one end portion connected to the connected together ends of said sheet members and their other end portion wound around and attached to said roller, said roller being operable in one direction of rotation to cause unwinding of said cables therefrom and winding of said members thereupon to move said door to open the chamber access opening, and said roller being operable in a direction opposite said one direction of rotation thereof to cause winding of said cables thereupon and unwinding of said members therefrom to move said door to close said chamber access opening.

8. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a door associated with said cabinet and normally closing said chamber access opening, said door comprising a plurality of spaced apart sheet members extending along said chamber access opening and having their one end connected together, roller means within said cabinet having the other end of said sheet members attached thereto, and said sheet members being wound upon said roller means when said door is moved to open said chamber access opening.

9. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a door normally closing said chamber access opening and comprising a first means forming the inner face of said door and a second means spaced from said first means and forming the outer face of the door, said door also comprising a plurality of sheet partitioning members extending substantially parallel to and intermediate the inner and outer faces of said door and dividing the space therebetween into a plurality of spaces, and roller means adjacent said food storage chamber for winding said first means, said second means and said partitioning members thereupon when said door is moved to open the chamber access opening.

10. In a refrigerator, a cabinet structure including a food storage chamber having an access opening in a wall thereof, a door for closing said chamber access opening, said door comprising a first sheet member of flexible metal forming the inner face of said door and a second sheet member of flexible metal spaced from said first sheet metal member and forming the outer face of said door, said door structure also comprising spaced apart sheet partitioning members intermediate the sheet metal members, said spaced apart sheet partitioning members extending substantially parallel to and being spaced from the inner and outer faces of said door to divide the space therebetween into a plurality of spaces, means about which said sheet members may be flexed when the door is moved to open said chamber access opening, and guide means for guiding said door when being moved into access opening and access closing positions.

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