Aug. 20, 1957 P. E. DAVEY 2,803,513

ROTATABLE SHELF STRUCTURE FOR REFRIGERATORS

Filed July 29, 1954 2 Sheets-Sheet 1

FIG. 1

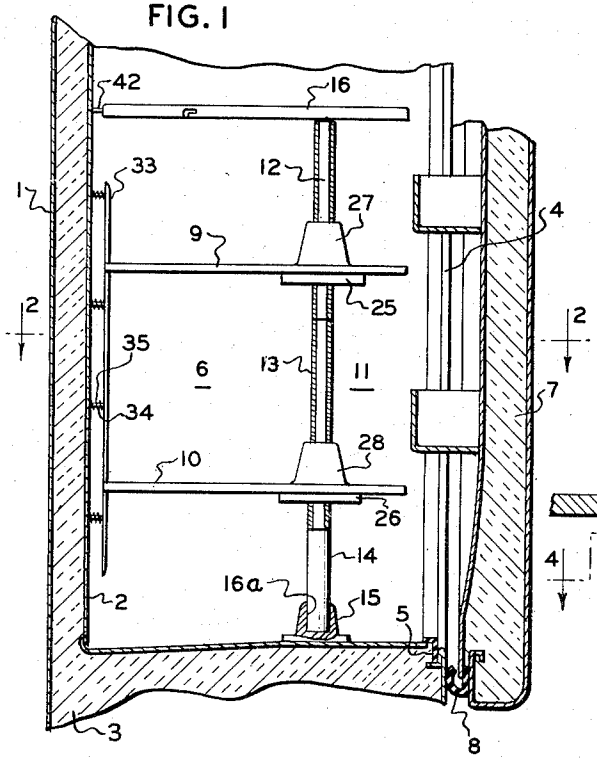


FIG. 3

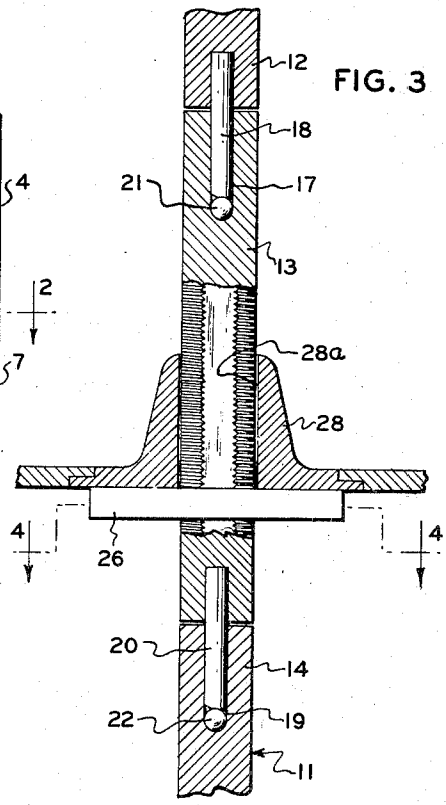


FIG. 2

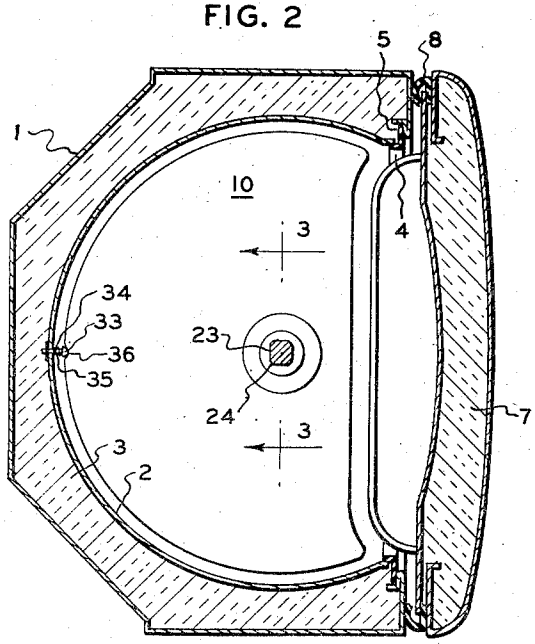
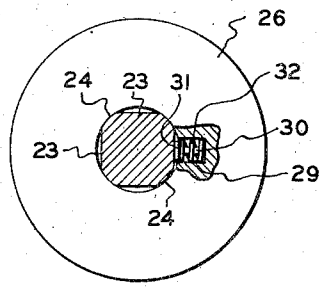


FIG. 4



INVENTOR.
PETER E. DAVEY
BY Thorndike Pierce
HIS ATTORNEY

Aug. 20, 1957 P. E. DAVEY 2,803,513

ROTATABLE SHELF STRUCTURE FOR REFRIGERATORS

Filed July 29, 1954 2 Sheets-Sheet 2

FIG. 5

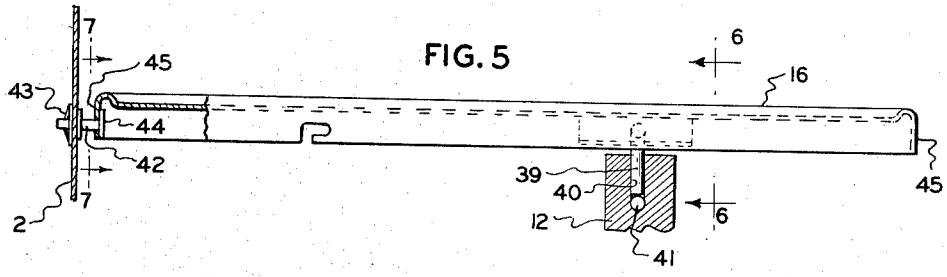


FIG. 6

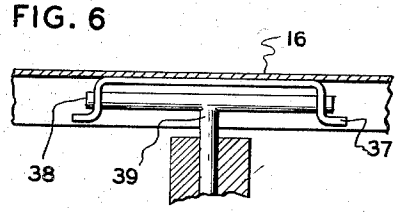
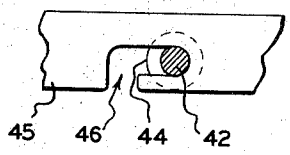


FIG. 7



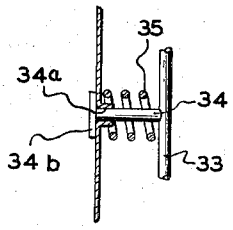


FIG. 8

INVENTOR.
PETER E. DAVEY
BY
Sheridan & Ross
HIS ATTORNEY

United States Patent Office 2,803,513 Patented Aug. 20, 1957

2,803,513

ROTATABLE SHELF STRUCTURE FOR REFRIGERATORS

Peter E. Davey, Erie, Pa., assignor to General Electric Company, a corporation of New York

Application July 29, 1954, Serial No. 446,429

6 Claims. (Cl. 312—305)

My invention relates to rotatable shelf structures and more particularly to such structures for use in household refrigerators.

Rotatable shelves may be provided in household refrigerator cabinets in order to increase the accessibility of the contents thereof. These shelves increase accessibility since through their rotation any portion thereof may be brought to the front of the cabinet for the ready removal of foodstuffs. But even though any portion of the shelves may be reached as a result of their rotation, nonetheless it is desirable that the shelves be easily removable from the cabinet for cleaning or other purposes. Accordingly it is a primary object of my invention to provide a new and improved rotatable shelf structure for use in household refrigerators, in which the shelves may be easily removed from the refrigerator.

It is another object of my invention to provide a new and improved rotatable shelf structure for use in household refrigerators, in which the shelves are all supported on a common vertical shaft but yet may be removed individually from the refrigerator.

A further object of my invention is to provide in a rotatable shelf structure of the type including a vertical supporting shaft and means for effecting vertical adjustment of the shelves along the shaft, an improved arrangement for normally restraining movement of the adjusting means relative to the shaft.

My invention also has as its object the provision of an improved vertically adjustable, rotatable shelf structure which is inexpensive to manufacture and assemble within a refrigerator cabinet.

In carrying my invention into effect I provide a refrigerator cabinet having inner liner which defines a food storage compartment, and within this compartment I mount my new and improved rotatable shelf structure. This shelf structure is particularly adapted for easy removal from the cabinet in that each of the rotatable shelves may be individually removed therefrom. For that purpose the shelf structure includes a main supporting shaft which is formed of a plurality of separate sections detachably secured together and individually rotatable. This shaft is mounted vertically upright in the storage compartment and in accordance with my invention the various rotatable shelves are mounted thereon, each on a separate section. The shelves are thereby individually rotatable within the food storage compartment. But further in accordance with my invention the means mounting the shaft are such that the various sections may be detached one from another and separately removed from the cabinet. With the shaft sections being individually removable from the cabinet the separate shelves mounted thereon are also individually removable, and thereby as a result of my invention an improved rotatable shaft structure is provided wherein the shelves may be readily removed from the cabinet for cleaning or other purposes.

In rotatable shelf structures it is sometimes desirable that means be included for adjusting the spacing of the shelves and thus when such adjustment is desired in my novel shelf structure I also provide adjusting means for effecting vertical adjustment of the shelves on their respective shaft sections, and in this adjusting means I include a novel arrangement for normally restraining movement of the adjusting means relative to the shaft.

The novel features which I believe to be characteristic of my invention are set forth with particularlity in the appended claims. The invention itself, however, both as to its organization and mode of operation may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a vertical sectional view of a refrigerator including a preferred embodiment of my new and improved rotatable shelf structure;

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 2 and partially broken away to show the preferred details of my novel supporting shaft;

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 3 and partially broken away to show my improved arrangement for normally restraining motion of the shelf adjusting means relative to the shaft;

Fig. 5 is a fragmentary view, partially in section, showing my preferred manner for supporting the shaft at its upper end;

Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary sectional view taken on the line 7—7 of Fig. 5; and

Fig. 8 is a fragmentary view showing a preferred manner of mounting the novel means included in my shelf structure for normally holding the shelves in their retracted position within the refrigerator.

Referring now to Figs. 1 and 2, I have illustrated therein a refrigerator cabinet which includes an outer metal wall 1 and an inner metal wall or liner 2, the space between the walls being filled with suitable heat insulating material 3. The walls are formed to provide a door opening 4 at the front of the cabinet, and the space between the walls in the area of the door frame is closed by a breaker strip 5 of suitable heat insulating material. The space 6 defined by the inner liner 2 comprises the food storage compartment of the cabinet, and the door opening 4 of course, provides access to that compartment. The opening 4 may be closed by any suitable insulated door, as for example by the vertically pivoted insulated door 7 which is sealed to the door frame when closed by a compressible gasket 8. The storage compartment is refrigerated or cooled by means of a suitable mechanical refrigerating system (not shown).

Within the storage compartment 6 there is mounted a preferred embodiment of my new and improved rotatable shelf structure. In this preferred embodiment a plurality of rotatable shelves 9 and 10 are supported by means of a vertically extending shaft indicated generally at 11. The shaft 11 is, however, not a single unitary member, but rather by my invention is formed of a plurality of separate sections 12, 13, and 14. As will be more fully explained hereinafter these various shaft sections are detachably and rotatably secured together in order that they may be rotated separately of each other and may also be taken apart and separately removed from the storage compartment. The shaft as a whole is removably mounted vertically upright within the compartment 6 by means which hold the upper and lower sections 12 and 14. More specifically the shaft is mounted by the lowermost section 14 being held by an upstanding member 15 attached to the liner 2 and by the uppermost section 12 being rotatably and releasably secured to a stationary shelf 16. The upstanding member 15 includes a long center bore 16a

which accommodates the lower portion of the shaft section **14**, and the length of engagement between the bore **16***a* and the shaft section **14** is such that the entire shaft is held upright even when the upper mounting of the shaft is released. My preferred means for rotatably and releasably securing the section **12** to the stationary shelf **16** will be more fully described hereinafter.

By reference to Fig. 3 there may be seen my preferred means for detachably and rotatably securing together the shaft sections **12**, **13**, and **14**. As there shown the means for securing together each pair of adjacent sections are the same. These means include for each pair of adjacent sections an axial recess formed in the end of one section and an axial pin protruding from the end of the other section. Thus the means attaching together the sections **12** and **13** include an axial recess **17** formed in the upper end of section **13** and an axial pin **18** protruding from the lower end of the section **12**. Similarly the means securing together the sections **13** and **14** include an axial recess **19** formed in the upper end of section **14** and an axial pin **20** protruding from the lower end of the section **13**. In the embodiment illustrated the pins **18** and **20** are each press fitted in suitable recesses provided in the lower ends of their respective sections **12** and **13**, but it should be understood that they could also be formed as integral parts of the sections. To secure together the sections **12** and **13** the pin **18** is fitted into the recess **17**, and similarly to secure together the sections **13** and **14** the pin **20** is fitted into the recess **19**. In other words, when the shaft sections are fitted together the pin provided on the end of one of each pair of adjacent recesses is accommodated by the recess formed in the other of the pair.

In order to provide for rotation of the various sections relative to each other the fit between the recesses **17** and **19** and the pins **18** and **20** respectively accommodated thereby is not a tight one. Rather it is relatively loose. This allows the pins to rotate freely within the recesses and thereby, of course, permits rotation of the shaft sections relative to each other. Furher the loose fits allow the pins to be freely withdrawn from the recesses so that the various shaft sections may be detached one from another for separate removal from the food storage compartment.

To provide an easy, relatively frictionless rotation of the individual shaft sections ball bearing means may also be included in the arrangement attaching them together. Thus as shown in Fig. 3 a ball bearing may be positioned at the bottom of each of the recesses **17** and **19**. These ball bearings **21** and **22** are of slightly less diameter than the recesses so that they may roll freely but yet remain centered therein. The bases of the pins **18** and **20** rest on the ball bearings when the pins are accommodated by the recesses and thereby the thrust load of the pins is taken up by the ball bearings rather than by the bottoms of the recesses themselves. As a result rolling rather than sliding friction takes place at the bases of the pins upon the rotation of the shaft sections, and thereby a much easier, more friction-free movement is obtained.

As shown in Fig. 1 each of the shelves **9** and **10** is mounted on a separate shaft section in order to be individually rotatable and also so that they may be individually removed from the refrigerator. Specifically the shelf **9** is mounted on the shaft section **12** and the shelf **10** on the shaft section **13**. In my preferred embodiment the shelves are both mounted so as to be vertically adjustable on their respective sections and the improved means providing this vertical adjustment may be best seen by reference to Figs. 3 and 4.

In my preferred mounting arrangement the sections **12** and **13** of the shaft **11** do not have a truly round configuration, but rather are more or less square having a plurality of flat sides **23** joined by a plurality of rounded corners **24**. These rounded corners are provided with a screw thread, but the flat sides are left with a more or less smooth surface. For supporting the shelves **9** and **10** respectively separate collar members **25** and **26** are threaded respectively on the rounded corners of the shaft sections **12** and **13**. The shelves **9** and **10** respectively include center hub or sleeve portions **27** and **28** and these hub portions rest on the collar members **25** and **26** respectively. Through this support of the hub portions by the collar members the shelves themselves are maintained in position on the shaft.

The rotation of the shelves is accomplished through the rotation of the shaft sections. To accomplish this result the hubs **27** and **28** are each provided with a center hole or slot through which their respective shaft sections fit, the slot **28***a* of hub **28** being shown in Fig. 3. These slots are, however, not of a round cross-section but rather are of a square configuration. In other words, the center slots of the hubs have flat sides which engage the flat sides of the shaft when the hubs are placed in position. Thus when a rotating force is applied to either shelf, this force is transmitted to its shaft section through the engagement of these flat sides and thereby the shelf and the shaft section rotate together as a unit.

The vertical adjustment of the shelves along their respective shaft sections is accomplished by means of the aforesaid threaded collar members **25** and **26**. By rotating these collar members relative to the shaft, the collar members will move up or down the shaft because of their threaded engagement therewith. Since the hubs **27** and **28** are not secured to their shaft sections, but rather are free to slide up and down along them, therefore this vertical movement of the collar members also results in a vertical movement of the shelves. Thus vertical adjustment of the shelves may be accomplished by simply rotating the supporting collar members **25** and **26** on their respective shaft sections.

Normally, however, it is desirable that the collar members be restrained from movement relative to the shaft. In other words, during the normal operation of the shelves it is desirable that the collar members or adjusting means be restrained from movement relative to their respective shaft sections and thus from vertical change along the shaft. To accomplish this result I have mounted novel motion restraining means on each of the collar members. The motion restraining means for the collar member **26** may be clearly seen by reference to Fig. 4, it being understood that similar means are provided for the collar member **25**.

As shown in Fig. 4 the collar member **26** has a recess **29** provided in the inner peripheral edge thereof. Within this recess there is mounted a locking plunger member **30** having a flat outer face **31**, this locking member **30** being biased toward the center shaft section by means of a coil spring **32** also positioned in the recess. Due to this spring bias the outer flat face **31** of member **30** engages the shaft section **13** mounting the collar member **26**. Or more exactly it engages a flat face **23** of the shaft section, the particular face **23** engaged depending upon the angular position of the collar member relative to the shaft. This engagement of the locking member **30** with a flat side of the shaft tends to prevent rotation of the collar member **26** with respect to the shaft. However, if a sufficient rotational force is supplied to the collar member the bias of the spring **30** can be overcome so that the collar may rotate relative to the shaft. Unless, however, the housewife does desire to adjust the vertical position of the shelf, the collar member will normally remain locked to the shaft due to the engagement of the plunger **30** with a flat side of the shaft. Thus no unwanted automatic adjustment of the collar member will take place upon the usual rotation of the shelf. Rather the shaft sections, the shelf and the collar member will all rotate together during normal use of the shelf structure.

In my preferred embodiment I have also provided means for normally preventing rotation of the shelves themselves unless the housewife should want to move

them to an outward accessible position. In other words, I have provided means which normally hold the shelves in their retracted position within the refrigerator. As may be best seen in Figs. 1 and 2 this means comprises a long flexible rod **33** which extends vertically along the rear wall of the liner **2**. The rod **33** is mounted on a plurality of pins **34** which, as shown in Fig. 8, extend through apertures **34***a* in the rear wall of the liner **2** and which are provided with flanged heads **34***b* on their inner ends. A coil spring **35** is mounted on each of the pins **34** between the liner wall and the rod so that the rod is normally biased outwardly toward the shelves. The flanged inner heads **34***b* of the pins, of course, limit the outward movement of the rod. The shelves **9** and **10** each have small depressions formed in the rear portion of their edges and when the shelves are in their normal position the rod **33** fits into these depressions. Thus as may be seen in Fig. 2 the shelf **10** includes a depression **36** into which the rod **33** fits. This engagement of the rod by the depressions normally prevents the rotation of the shelves. However, when the housewife applies a turning force to any shelf, the locking effect applied by the springs **35** is easily overcome so that the depression of the shelf will move off the rod and the entire shelf will rotate outwardly. The engagement between the rods and the depressions of the shelves is, however, strong enough to prevent movement of the shelves upon slamming of the door **7** or other shaking of the refrigerator.

Preferably, to insure that the rod **33** does not allow wobbling or other movement of the remaining shelves when one shelf is moved outwardly, it is so mounted that it is flexible in one plane only. More exactly the rod is mounted to be flexible in a plane parallel to the sides of the refrigerator cabinet but relatively rigid in a plane parallel to the face or front of the cabinet. To accomplish this result the apertures **34***a* through which the pins **34** extend are flanged somewhat outwardly so that they serve as guides causing the pins **34** to move in and out in a straight line normal to the rear wall of the liner. This restricts the bending of the rod **33** to the plane parallel to the sides of the cabinet and prevents it from flexing sidewards. As a result when a turning force is applied to one of the rotating shelves the rod **33** curves or bends toward the rear wall of the liner enough to release that shelf. However it can not flex enough to either side to allow wobbling of the other shelf or shelves.

As mentioned above my new and improved rotatable shelf structure has the distinct advantage that it may be readily disassembled and removed from the refrigerator. In other words, it has the advantage that each of the shelves **9** and **10** may be removed separately from the refrigerator. To accomplish this result I have, of course, mounted each of the shelves on a separate shaft section, and as will now be explained I have further mounted the shaft itself so that its various sections and thereby the shelves may be removed individually from the refrigerator.

As above mentioned, the upper end of the shaft **11** is mounted by means of a stationary shelf **16** positioned in the top portion of the refrigerator. This upper mounting of the shaft is, however, such that the shaft may be disengaged from the mounting means. In fact, my preferred detachable mounting may be seen by reference to Figs. 5, 6, and 7.

In order to mount the upper end of the shaft the shelf **16** has mounted thereon a bracket **37**. This bracket **37** holds a shaft positioning member **38** which has a pin **39** extending downwardly therefrom. The pin **39** fits into a recess **40** provided in the upper end of the topmost shaft section **12**, and thereby holds the upper end of the shaft in position. As shown, a ball bearing **41** may be positioned in the bottom of the recess **40** so as to take up any thrust load of the pin and thereby reduce friction between the shaft section and the pin. In other words, the same type of detachable, rotatable connection, is provided between the stationary shelf **16** and the shaft section **12** as between the various shaft sections themselves. Thus, the top shaft section **12** may rotate relative to the shelf and may also be detached therefrom.

To prevent wobbling of the top end of the shaft, it is necessary that the stationary shelf **16** itself be firmly held in position. As shown in Figs. 5 and 7 the shelf **16** is firmly held by means of a plurality of mounting studs to accomplish this result. Specifically, the shelf **16** is held by a plurality of studs **42** which extend through the apertures in the liner **2** and are held in place by clamps **43**. At their inner ends, these studs **42** have flanged heads **44**, and the depending rear and side edge **45** of the shelf includes slots **46** which fit over the body portions of the studs intermediate the liner wall and the flanged heads. Preferably, the slots **46** are of the bayonet type so that the ends of the slots are first placed over the studs **42** and then the shelf is rotated slightly to move the studs into the inner ends of the slots. With this bayonet type of mounting, the shelf is prevented both from moving up and down and also from moving sideways. The engagement of the body portions of the studs **42** with the top and bottom edges of the slots **46** prevents a vertical movement and the engagement of the flanged heads **44** of the studs with the depending edge **45** of the shelf surrounding the slot prevents sideways movement of the shelf. Thus the shelf is held firmly in position so that it will not move and cause wobbling of the top edge of the shaft.

To remove the shelf structure from the refrigerator it is only necessary to release the top mounting of the shaft. After that the shelf sections may be detached one from another and removed from the refrigerator. Since the shelves are each mounted on a separate shaft section, they will, of course, be removed individually with the shaft section. In my preferred embodiment, the top mounting of the shaft is released by lifting the stationary shelf upwardly. This pulls the pins **39** out of the recess **40** and thereby completely releases the top end of the shaft. To pull the shelf upwardly it is first rotated slightly so that the pins **42** come out of the bayonet slots **46**. Then the stationary shelf may, of course, be lifted upwardly. Thus not only the removal of the rotating shelves from the refrigerator after the release of the shaft but also the release of the shaft itself from its mounting means may be accomplished very simply and easily.

From the above it will be seen that I have provided a new and improved rotatable shelf structure in which the shelves may be removed separately from the refrigerator. By detaching the shaft sections one from another the shelves may be simply and easily lifted from the refrigerator. Since no complicated attaching means are used the shelf structure may then be readily reassembled merely by fitting together the various sections of the vertical shaft. Moreover, when my preferred attaching means are used, efficient bearing means are provided for facilitating the separate rotation of the shaft sections and the shelves mounted thereon. Further, although adjusting means are provided in my preferred embodiment to allow vertical adjustment of the shelves up and down the shaft, the normal rotation of the shelves does not cause such adjustment. As a result of my new and improved locking means incorporated in the adjusting means the shelves are normally restrained from vertical motion along the shaft except when the housewife definitely desires to effect vertical adjustment thereof.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention it should be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a refrigerator having a food storage compartment, a rotatable shelf structure removably mounted in said compartment and comprising a threaded shaft formed of a plurality of separate sections, one of each pair of adjacent sections having an axial recess in the end thereof and the other of each pair having a pin protruding axially therefrom, with said pin being removably accommodated in said recess thereby to detachably and rotatably secure together said pair of adjacent sections, whereby all of said sections are detachably and rotatably secured together, means releasably mounting said shaft in a vertically upright position in said food storage compartment, a plurality of collar members each rotatably mounted on a separate one of said shaft sections, separate releasable locking means engaging each of said collar members with the shaft section thereof for releasably restraining rotation of said collar members relative to said shaft section, said locking means disengaging when said collar is rotated and a plurality of rotatable shelves each associated with a separate one of said shaft sections thereby to be individually removable therewith from said storage compartment upon the detaching of said shaft sections one from another, said shelves being separately supported on said shaft sections by said collar members threaded thereon and being adjustable along said sections by the rotation of said collar members.

2. The combination of claim 1 wherein said shaft includes a plurality of flat sides and a plurality of rounded corners between said sides with said corners being threaded, and said separate locking means for each collar member includes a movable locking member having a flat face, said locking member being mounted on said collar member, and spring means biasing said locking member against said shaft whereby said flat face of said locking member yieldably engages one of said flat sides of said shaft to normally prevent rotation of said collar member with respect to said shaft except upon a turning force being applied directly to said collar member.

3. In a refrigerator having an inner liner defining a food storage compartment and a stationary shelf removably mounted in the upper portion of said storage compartment, a rotatable shelf structure removably mounted in said storage compartment and comprising a shaft formed of a plurality of separate sections detachably secured together and individually rotatable, a plurality of rotatable shelves each mounted on a separate one of said shaft sections, and means including said stationary shelf releasably mounting said shaft vertically upright in said compartment, said means supporting said shaft at the lower end thereof and said shelf having a member attached to the lower surface thereof adapted to detachably engage the uppermost section of said shaft thereby to hold the upper end of said shaft, whereby upon said stationary shelf being moved to detach said member from said uppermost shaft section said shaft sections may be detached one from another and said shelves individually removed therewith from said compartment.

4. In a refrigerator having a food storage compartment, a rotatable shelf structure removably mounted in said storage compartment and comprising a shaft formed of a plurality of separate sections detachably secured together and individually rotatable, means releasably mounting said shaft vertically upright in said storage compartment, a plurality of collar members each threadably mounted on a separate one of said shaft sections, separate releasable locking means engaging each of said collar members with the shaft section thereof for releasably restraining rotation of said collar members with respect to said shaft sections, said locking means disengaging when said collar is rotated and a plurality of rotatable shelves each associated with a separate one of said shaft sections thereby to be individually rotatable therewith and individually removable therewith from said storage compartment upon the detaching of said shaft sections one from another, said shelves being separately supported on said shaft sections by said collar members threaded thereon and being adjustable along said sections by the rotation of said collar members.

5. The combination of claim 4 wherein said shaft includes a plurality of flat sides and a plurality of rounded corners between said sides with said corners being threaded, and said separate locking means for each collar member includes a movable locking member having a flat face, said locking member being mounted on said collar member, and spring means biasing said locking member against said shaft whereby said flat face of said locking member yieldably engages one of said flat faces of said shaft to normally prevent rotation of said collar member with respect to said shaft except upon a turning force being applied directly to said collar member.

6. In a refrigerator having a food storage compartment, a rotatable shelf structure removably mounted in said storage compartment and comprising a shaft formed of a plurality of said sections detachably secured together and individually rotatable, means releasably mounting said shaft vertically upright in said storage compartment, a plurality of collar members each threadably mounted on a separate one of said shaft sections, separate releasable locking means engaging each of said collar members with the shaft section thereof for releasably restraining rotation of said collar members with respect to said shaft sections, said locking means disengaging when said collar is rotated, a plurality of rotatable shelves each associated with a separate one of said shaft sections thereby to be individually rotatable therewith and individually removable therewith from said storage compartment upon the detaching of said shaft sections one from another, said shelves being separately supported on said shaft sections by said collar members threaded thereon and being adjustable along said sections by the rotation of said collar members, each of said shelves having a notch within its marginal edge, and a flexible rod mounted on a wall of said refrigerator and yieldably engaging said notch in said shelves to retain said shelves normally in retracted positions within said compartment.

References Cited in the file of this patent

UNITED STATES PATENTS

132,624	Brown	Oct. 29, 1872
1,101,849	Hines	June 30, 1914
1,372,100	Siffert	Mar. 22, 1921
1,730,494	Dyer	Oct. 8, 1929
2,182,003	Roark	Dec. 5, 1939
2,519,880	Boddy	Aug. 22, 1950
2,698,776	Stoeckl	Jan. 4, 1955

FOREIGN PATENTS

11,223	Great Britain	1904