APPARATUS FOR ADJUSTING VERTICALLY SPACED SHELVES

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This invention relates to shelf supporting structure, and more particularly to means for providing easy simultaneous adjustment of two vertically spaced shelves.

Although my invention is applicable broadly to shelves which may be used in storage cabinets of all types, as well as to shelves for structures such as range ovens which are virtually not for storage, but do require vertical shelf adjustability, it has proven to be very advantageous in domestic refrigerators. A principal feature of the invention is that it provides easy vertical adjustability without the bothersome necessity of first clearing the shelves of all of the multitude of packages and jars which a refrigerator shelf accommodates. Another feature is that the shelf supporting means allows either or both shelves to be of the desirable “sliding” type in which the shelves can be drawn forwardly for convenient access to articles which may be at the rear.

The vertical separation of shelves in home refrigerators has attained almost standard dimensions among various manufacturers, for this separation is based on the quite standardized dimensions of bowls, jars and bottles usually placed on refrigerator shelves. Occasionally, however, one wishes to store an unusually bulky object, such as a turkey or a watermelon, and it is necessary to increase the vertical spacing between a shelf and the upper or lower shelf or wall of the cabinet.

Applicant is aware of the various mechanisms and shelf supporting structures which have been proposed, and in some instances used, to provide vertical adjustability and lateral slidability of refrigerator shelves. While such arrangements have been mechanically quite satisfactory, most of those which are capable of vertical adjustment without first clearing the shelf are structurally complex and difficult to maintain in a sanitary condition. Those arrangements which are simple and cleanable require the shelf to be stripped of its contents before adjustment is made, or provide for quite a limited range of adjustability. Additionally, since the dimensions between shelves in refrigerators have become essentially standardized, the operator is frequently faced with the difficulty of adjusting the spacing of two shelves, since adjusting one shelf to the full height desired may result in the loss of adequate height between the adjusted shelf and the remaining shelves or top or bottom walls of the cabinet.

It is, therefore, a principal object of my invention to provide a shelf support arrangement which provides vertical adjustability in a manner which is simple for the operator to accomplish, and which provides for the relative spacing of two shelves at the same time.

A further more specific object of my invention is to provide means for use in a cabinet or compartment, for varying the relative spacing of at least two vertically spaced shelves into a plurality of positions without removing the shelves from, or extending the same outwardly of the compartment, and which means also “locks” the shelves in any one of a plurality of various elevations.

Yet another more specific object of my invention is to provide adjusting means for use in a cabinet or the like, for varying the relative spacing of at least two vertically spaced shelves, wherein the shelves exert offsetting forces on the adjusting means and “lock” it in any desired position, without the need of any additional locking mechanism.

A still further and more specific object of my invention resides in the provision of means for adjusting the relative spacing of shelves within a compartment such as a food compartment of a refrigerator cabinet, the greater part of which means is located on the outside of, but is operable from within, and preferably near the front of the compartment, whereby the adjusting means does not interfere with the storage of food in the compartment nor impair the neat appearance of the interior thereof.

In one aspect of my invention, I provide at least one wall supporting upper and lower shelves thereon. The upper and lower shelves are mounted on an adjustable means which is movable relative to the supporting wall for simultaneously raising and lowering the upper and lower shelves relative to each other. The adjustable means comprises a member mounted for reciprocal horizontal movement relative to its supporting wall. The member includes means for mounting the upper and lower shelves for opposite vertical reciprocatory movement when the member is horizontally displaced relative to its supporting wall.

In a presently preferred embodiment of the invention, two vertically disposed actuating members are disposed adjacent the sides of the shelves and in parallel planes which are perpendicular to the planes of the shelves. Upper and lower divergent cam surfaces in the form of inclined slots are formed in the actuating members. Each slot is provided with a horizontally restrained follower element adapted to ride on the corresponding cam surface. When an actuating member is reciprocated horizontally of the shelves, the followers in the slots forming the divergent cam surfaces are reciprocated vertically toward or away from one another. Upper and lower shelves are mounted on the followers, whereby the shelves are vertically displaced relative to one another to vary the distance therebetween. Reciprocation of each of the actuation members is achieved by means such as a manually rotatable knob which drives a gear having meshing relationship with rack type teeth provided on the actuating member. Alternatively, a control button is provided which imparts direct reciprocatory motion to the actuating members.

Other features and advantages of my invention will be apparent from the following detailed description of presently preferred embodiments thereof, read in connection with the accompanying drawings in which:

FIGURE 1 is a front view in perspective of a cabinet with an upper and lower shelf therein, with portions of the cabinet broken away and illustrating parts of a device for adjusting the shelves to vary their relative spacing in the compartment;

FIGURE 2 is an enlarged fragmentary vertical sectional view taken on line 2—2 of FIGURE 1 showing parts of the shelf adjusting means supporting the movable shelves in one position;

FIGURE 3 is an enlarged fragmentary sectional view taken on line 3—3 of FIGURE 1 and showing a first specific hand operable control means for the shelf adjusting device;

FIGURE 4 is a fragmentary plan sectional view taken on the line 4—4 of FIGURE 3 and showing the relationship of the lower shelf to the cabinet wall;

FIGURE 5 is a fragmentary vertical sectional view taken on the line 5—5 of FIGURE 2 and showing a connection between elements of the shelf adjusting means; and

FIGURES 6, 7, and 8 are views similar to FIGURES 2, 3, and 5, respectively, and show a second embodiment of the hand operated control means for the shelf adjusting device.

Referring now to the drawings, and more particularly to FIGURE 1 thereof, there is shown generally a portion
of a conventional refrigerator cabinet 1. Cabinet 1 is of rectilinear configuration and comprises an outer shell 2 and an inner metal liner 3, with any suitable or conventional insulating material 4 disposed therebetween. A conventional door (not shown) may be used to close the compartment. The insulating material 4, at least along the upright side of the liner 3, is formed so as to leave a rectangular compartment 5 in parallel side walls of the cabinet.

Disposed within cabinet 1 are identical upper and lower shelves, 6 and 7 respectively. The shelves 6 and 7 are essentially conventional, and may include a rectangular structure having a pair of side members 8 and transversely extending front and rear members 9 and 10. The side and rear members may be formed of a continuous length of heavy wire; the front member 9 may be a decorative strip of extruded or rolled formed material. The side members 8 are mutually parallel; the other members may have any curvature or shape appropriate to appearance or functional requirements. The shelf has suitable transversely or longitudinally extending wires 11 or the like defining the actual supporting surface.

Affixed to each side member 8 is a shelf supporting means 12, comprising a lower support plate 13 which has a longitudinal semi-circular groove 14 extending the full length thereof.

Each support plate 13 has two pockets 18 formed in the lower faces thereof which extend transversely in relation to the longitudinal groove 14. Support members 12 are adapted to be mounted by way of pockets 18 on the adjusting means hereinafter described. The support members 12 are affixed to side members 8 of the shelves by an overlying plate 15, which has a longitudinal semi-circular groove 16 in the lower face thereof. Top plate 15 abuts the top of support plate 13, and longitudinal grooves 14 and 16 of the opposing faces of the top and bottom plates form a channel of slightly larger cross-section than side member 8. Top plate 15 is fastened to support 13 by any suitable fastening means such as screws 17.

Shelves 6 and 7 are thus slidable mounted in support members 12, and the shelves may be drawn forward of the cabinet a limited amount to facilitate retrieval of the rearmost article which may be placed thereon. The shelves are held in rigid horizontal position even when drawn forward, because top plate 15 prevents any rotation of the shelf due to uneven loading.

A first preferred embodiment of the adjusting means forming the subject matter of my invention is seen in FIGURES 1, 3, 4, and 5. The details of only a single adjusting mechanism are shown, as the shelves may be cantilevered from a single supporting wall if so desired. Where a single supporting wall is not strong enough to carry the weight, the adjusting mechanism of my invention may be used in opposing parallel walls, as shown more generally in FIGURES 1 and 3. Turning first to FIGURE 1, the adjusting means is shown in detail in one side wall of the cabinet 1, and is located within rectangular compartment 5 which is formed within insulation 4.

The adjusting means comprises a metal actuating plate 19, mounted for horizontal movement within compartment 5. Actuating plate 19 has lips 20 and 21 formed at the respective upper and lower edges thereof. Plate 19 is slidingly supported by four double flanged rollers 22, each rotatably secured to the inner supporting liner 3 of cabinet 1 as by double-shouldered rivets 23. Upper and lower lips 20 and 21 respectively of plate 19 are supported and guided by the tracks formed by the double flanged rollers 22.

Plate 19 has a pair of upper slots 24 which are inclined upwardly from front to rear, and a pair of lower slots 25 which are inclined downwardly from front to rear. Two pairs of vertically disposed slots, 26 and 27, are formed in the inner supporting liner 3. The upper and lower ends of slots 26 of inner liner 3 are in substantial horizontal alignment with the upper and lower ends respectively of slots 24 of actuating plate 19. In a similar fashion, the upper and lower ends of slots 27 in liner 3 are in substantial horizontal alignment with the upper and lower ends of lower slots 25 in actuating plate 19.

Two pairs of double flanged rollers, 28 and 29, reside in each set of slots 24 and 25 respectively of actuating plate 19; the edges of the slots serve as rails on which the rollers ride as plate 19 is horizontally reciprocated within compartment 5.

Cylindrical support extensions 28A and 29A extend transversely from the axes of rollers 28 and 29 respectively, through vertical slots 26 and 27 in metal liner 3, and into the cabinet proper. The diameter of support extensions 28A and 29A is substantially identical to the width of pockets 18 of shelf support plates 13 previously described. As seen in FIGURES 3, 4, and 5, the upper and lower shelves 6 and 7 are removably mounted in the cabinet by placing shelf support members 12 over the support extensions 28A and 29A so that the extensions are nested in pockets 18 of lower support plates 13. Inclined slots 24 and 25 of actuating plate 19 serve as divergent cam surfaces for adjusting the vertical distance between the shelves. Rollers 28 and 29 act as cam followers, and because roller extensions 28A and 29A extend through the fixed vertical slots 26 and 27 of the inner liner 3, these slots limit the followers to a vertical movement as plate 19 is horizontally reciprocated relative to its supporting wall.

It will be observed that the actuating mechanism is shielded from the cabinet proper by the inner liner 3. Reciprocation of the actuating plate 19 is achieved by means which extend from the actuating plate 19, through inner liner 3, and into the cabinet proper, where the control means is easily accessible. As one embodiment, best illustrated in FIGURES 2, 3, and 5, the control means is comprised of a rotatable knob 30, having a hub 31 which extends through a matching opening in inner liner 3 at a point approximately midway between the first vertically aligned slots 26 and 27. The opening in inner liner 3 has an outwardly turned flange portion 32 which forms a bearing surface for hub 31. Extending from the center of knob 30 through hub 31 and into compartment 5, is a shouldered shaft 33 on which gear 34 is held by split ring 35. Gear 34 is in meshing relationship with a series of rack type teeth 36 formed along the bottomly extending rectangular slot 37 in actuating plate 19. A vertical shield 38, of substantially the same length as slot 37, is secured by welding or brazing to actuating plate 19 along the upper edge of slot 37. Shield 38 extends downwardly over gear 34 and maintains it in operative vertical alignment with rack teeth 36.

Affixed to metal liner 3 just below flange portion 32 is a U-shaped member 39, one leg of which serves as a fixed indicating finger for knob 30, which may have a plurality of numbers stamped or embossed thereon as shown in FIGURE 3. Where the shelves are mounted on opposed supporting walls, an adjusting member will be needed for each wall, and they should be operated simultaneously to insure level shelves. The numbers on the knobs will insure that the shelves may easily be properly aligned in a horizontal plane.

In FIGURE 3 of the drawings, the shelves 6 and 7 are shown in their two extreme positions. The solid lines illustrate the position of the shelves when actuating member 19 is in the position shown in solid lines in FIGURE 2. The roller followers, 28 and 29, are at the extreme forward end of their respective cam surfaces 24 and 25. As actuating member 19 is displaced to the left as shown in FIGURE 3, upper followers 28 are displaced downwardly upwardly by cam surfaces 24. Simultaneously, lower followers 29 move vertically downward along cam surfaces 25. The followers are restricted to vertical movement because extensions 28A and 29A thereof are guided by the vertical slots 26 and 27 in metal liner 3. Since the
shelves are secured to these extensions, they in turn will be vertically adjusted relative to one another as actuating member 19 is horizontally displaced. The broken lines in FIGURES 2 and 3 illustrate the shelves and actuating member in their second extreme position.

An important advantage of my structure is that the shelves may be adjusted to any intermediate position by merely displacing actuating member 19 to any position desired, without the need of additional locking mechanisms prevalent in many of the vertically adjustable shelf structures used today. The downwardly directed forces of the upper shelf 6 on followers 28 tend to drive the followers 28 downwardly along their inclined cam surfaces 24, and thus force actuating member 19 to the right as shown in FIGURE 2. The downwardly directed forces from followers 29 of lower shelf 7 have a component which would normally force actuating member 19 to the left as shown in FIGURE 3. These offsetting forces on member 19 will "lock" the shelves in any desired position. Additionally, since each shelf exerts a force on the actuating member, manual adjustment is facilitated, since the force exerted by one of the shelves will always assist the operator.

In the embodiment of FIGURES 6, 7, and 8, the actuating member 19 is essentially the same as actuating plate 19, except that wire bent to the desired configuration, is substituted for the metal plate 19. The major difference in the two embodiments is in the control means. In the embodiment heretofore described, a rotatable knob is used, and additional means are required to change the rotary motion of the knob to reciprocatory motion of the actuating plate. In the second embodiment, a manually operable member, such as button 40, extends through a horizontally disposed slot 41 in metal liner 3. Button 40 is rigidly secured to actuating member 19. A suitably inscribed escutcheon 42 may be mounted on inner liner 3 over slot 41. In this embodiment, direct horizontal displacement of the manually operated button 40 will effect direct horizontal displacement of actuating member 19 relative to its supporting wall. The escutcheon serves as a fixed index so the shelves may be properly aligned in a horizontal plane.

From the foregoing it is apparent I have provided an improved shelf arrangement for a cabinet. In my present arrangement the shelves may be shifted outwardly and inwardly of the cabinet proper through its opening to thereby render articles on the rear portion of the shelf readily accessible to the user. The height of the shelves may be quickly and easily varied without removing the same from the cabinet proper, without disassembling any parts of the structure, and while articles are supported thereon.

The shelf adjusting member locks the shelves in the desired position without the need of additional locking means. In the present disclosure most of the shelf adjusting mechanism is on the exterior of the food compartment of a refrigerator and is concealed within the refrigerator cabinet, so as not to impair the neat appearance of the interior of the food storage compartment and so as not to require highly finished metal for parts of the mechanism.

While there has been described what is at present thought to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

I claim as my invention:
1. In a cabinet having a pair of opposed walls supporting upper and lower shelves therein:
(a) adjustable means mounting said upper and lower shelves in said cabinet, said adjustable means being movable relative to said opposed supporting walls for simultaneously raising and lowering said shelves relative to each other;
(b) said adjustable means comprising a pair of parallel, vertically disposed actuating means mounted for reciprocable horizontal movement relative to their respective opposed supporting walls; and
(c) means on said vertically disposed actuating means for mounting said upper and lower shelves for opposite vertical reciprocatory movement when said vertically disposed actuating means are horizontally reciprocated relative to said support walls.
2. The combination according to claim 1 wherein said means mounting said upper and lower shelves to said actuating members includes means permitting said shelves to be slidably extended from within said cabinet.
3. In a cabinet having a pair of opposed walls supporting upper and lower shelves therein:
(a) adjustable means mounting said upper and lower shelves in said cabinet, said adjustable means being movable relative to said opposed supporting walls for simultaneously raising and lowering said shelves relative to each other;
(b) said adjustable means comprising a pair of parallel, vertically disposed actuating means mounted for reciprocable horizontal movement relative to their respective opposed supporting walls;
(c) each of said actuating members including means forming at least one pair of divergent cam surfaces, said cam surfaces including an upper cam surface inclined upwardly and a lower cam surface inclined downwardly; and
(d) upper and lower follower means supported on said upper and lower cam surfaces respectively, said follower means restricted to reciprocate in vertically opposite directions relative to said supporting walls as said actuating members are reciprocated horizontally relative to said supporting walls, and
(e) means securing said upper and lower shelves to said upper and lower followers respectively to move vertically therewith, whereby said shelves are vertically displaced relative to one another to vary the distance therebetween as said actuating members are horizontally reciprocated.
4. The combination according to claim 3 wherein said divergent cam surfaces include a parallel pair of upper cam surfaces inclined upwardly from front to rear, and a parallel pair of lower cam surfaces inclined downwardly from front to rear.
5. The combination according to claim 3 wherein each supporting wall comprises:
(a) an inner supporting liner, and an outer wall spaced therefrom, one of said vertically disposed actuating members being slidably mounted in the space between said inner support liner and said outer wall;
(b) said inner supporting liner including a plurality of vertically disposed slots therein; and
(c) means extending from said actuating members through said vertically disposed slots in said inner liner and into the cabinet proper, said last named means adapted to support said upper and lower shelves thereon.
6. The combination according to claim 5, including control means for reciprocating said vertically disposed actuating members; said control means being operatively associated with each of said vertically disposed actuating members, and said control means extending through said inner supporting liner and into the interior of the cabinet, whereby said shelves may be adjusted from within the cabinet proper.
7. The combination according to claim 6, wherein each of said control means comprises:
(a) a rotatable knob within said compartment proper, said knob including a shaft extending transversely therefrom through said inner supporting liner and into the space between said inner supporting liner and said outer wall;
(b) gear means secured to the end of said shaft; and
(c) said vertically disposed actuating member having a horizontally disposed row of rack type teeth formed thereon and operatively engaging said gear means, whereby, upon said knob being rotated, said vertically disposed actuating member will be displaced horizontally relative to said supporting wall.

8. The combination according to claim 6 wherein said control means comprises:
   (a) a manually operable member within said cabinet proper;
   (b) a horizontally disposed slot in said inner liner; and
   (c) means extending from said manually operable member through said horizontally disposed slot to said actuating member and rigidly affixed thereto, whereby horizontal movement imparted to said manually operable member will effect direct horizontal movement of said actuating member.

9. The combination according to claim 3 wherein said opposed supporting walls each comprise:
   (a) an inner support liner and an outer wall spaced therefrom;
   (b) means affixed to said inner support liner for slidably mounting one of said vertically disposed actuating members for horizontal reciprocation in the space between said inner support liner and said outer wall;
   (c) said inner support liner having upper and lower vertically disposed slots whose upper and lower ends respectively are in substantial horizontal alignment with the respective upper and lower ends of the upper and lower divergent cam surfaces on said actuating members;
   (d) support means rigidly secured to said upper and lower followers, said support means extending through said vertically disposed slots in said inner support liners and into the cabinet proper, said vertically disposed slots thereby constraining said upper and lower followers to a vertical component of movement as said followers ride on said cam surfaces; and
   (e) means mounting said upper and lower shelves on said support means for movement therewith, whereby said shelves may be vertically displaced relative to one another as said actuating members are displaced horizontally relative to said support walls.

10. In a cabinet having a pair of opposed walls supporting upper and lower shelves therein:
   (a) at least one wall supporting upper and lower shelves thereof;
   (b) adjustable means mounting said upper and lower shelves on said wall, said adjustable means being movable relative to said supporting wall for simultaneously raising and lowering said upper and lower shelves relative to each other;
   (c) said adjustable means comprising a member mounted for reciprocable horizontal movement relative to said supporting wall, said member including upper and lower divergent cam surfaces thereon; and
   (d) upper and lower follower means mounted for movement on said respective upper and lower cam surfaces, said upper and lower shelves being mounted on said upper and lower follower means respectively for opposite vertical reciprocatory movement when said member is horizontally reciprocated relative to said support wall.

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