Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 1

FIG. 1

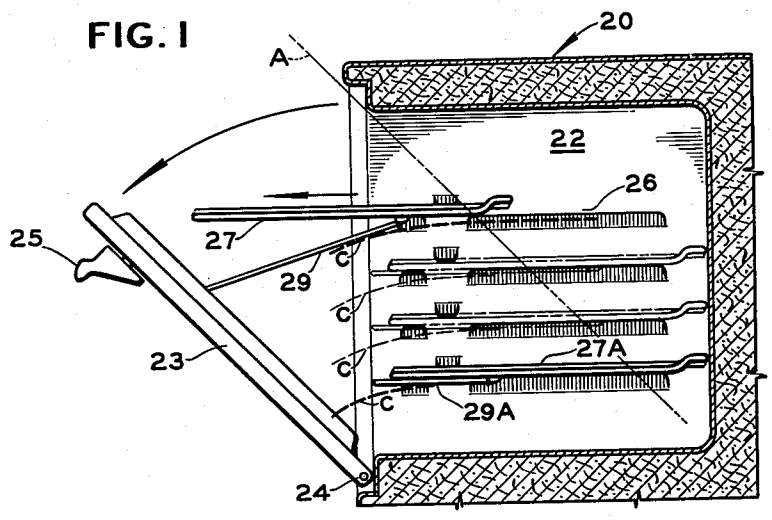
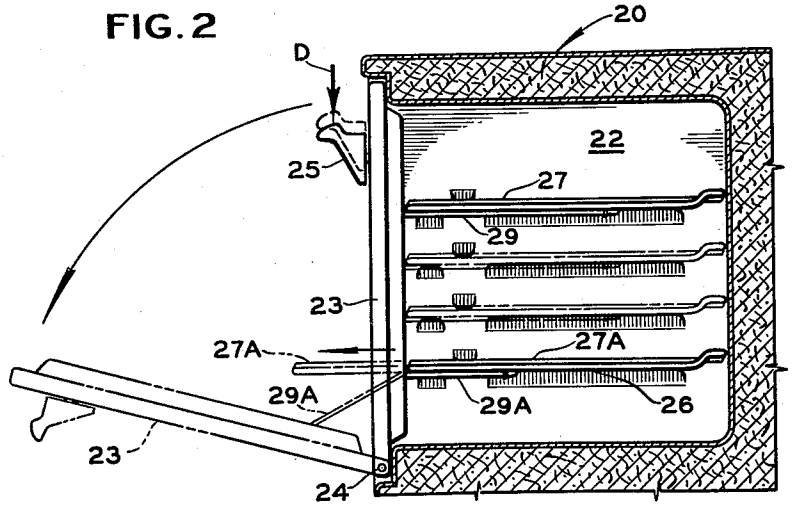


FIG. 2



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Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 2

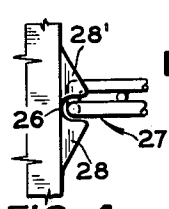


FIG. 4

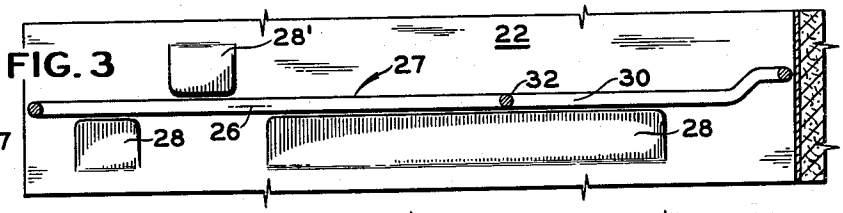


FIG. 3

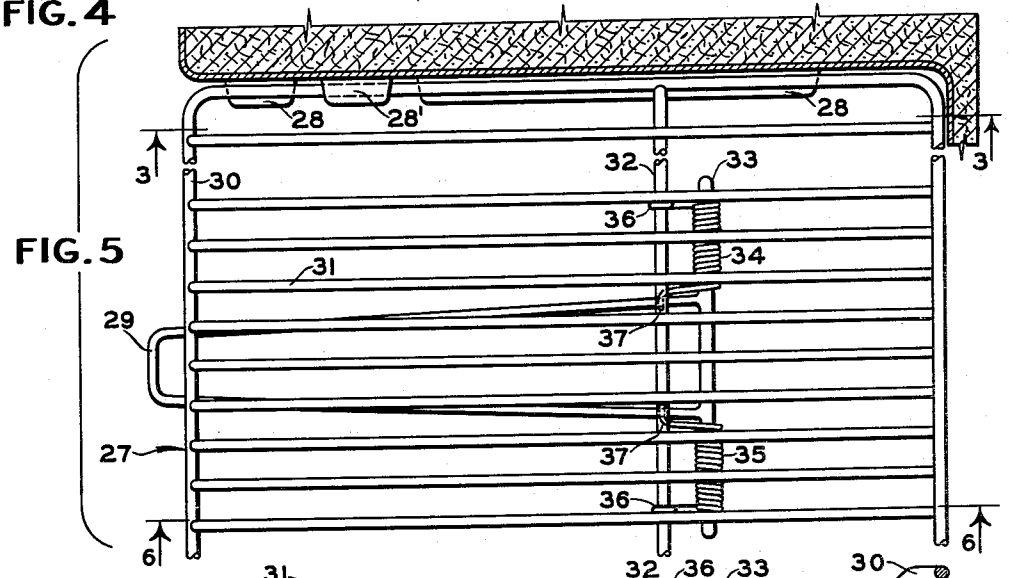


FIG. 5

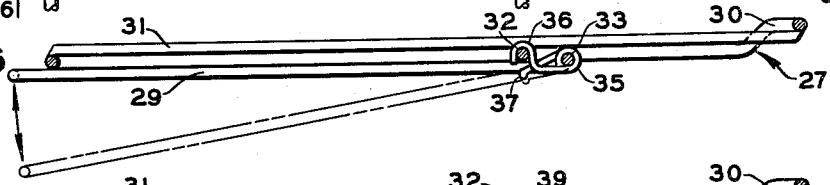


FIG. 6

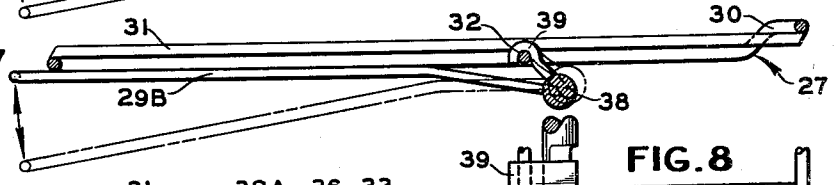


FIG. 7

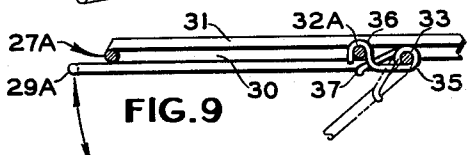


FIG. 9

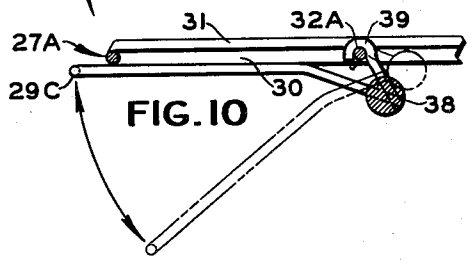


FIG. 10

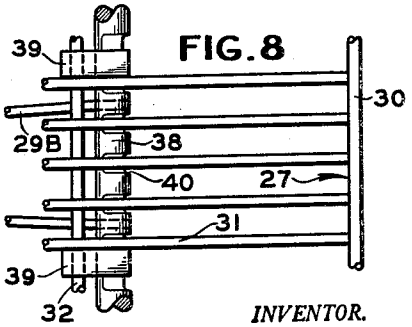


FIG. 8

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Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 3

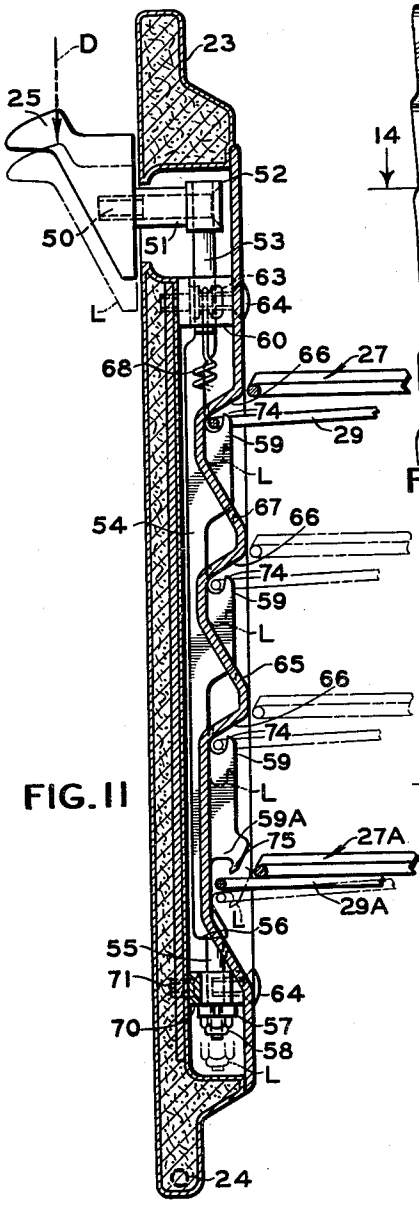


FIG. 11

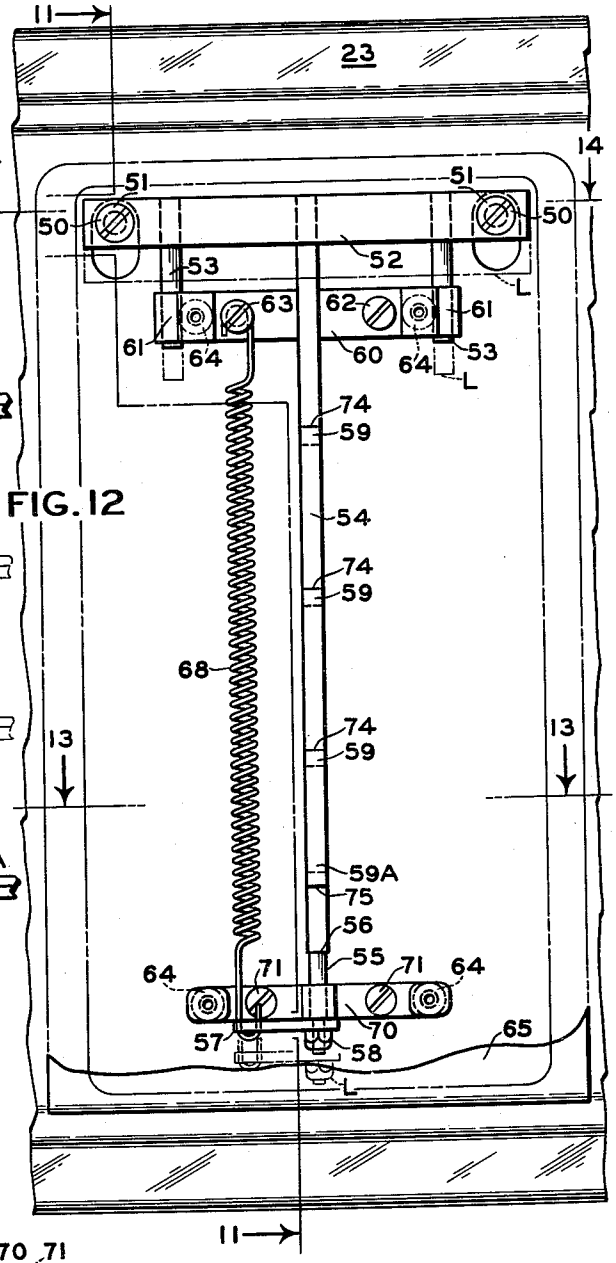


FIG. 12

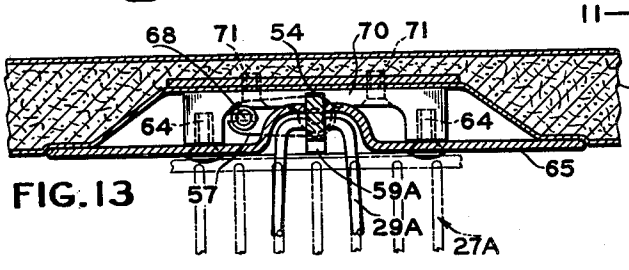


FIG. 13

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Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 4

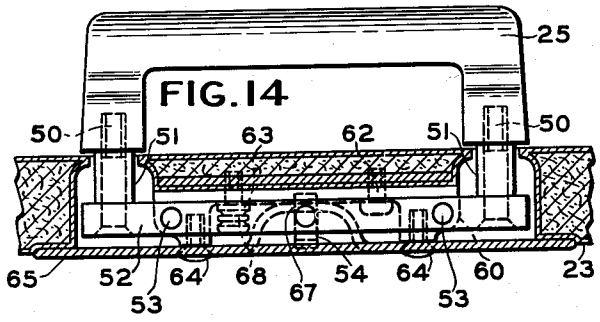


FIG. 14

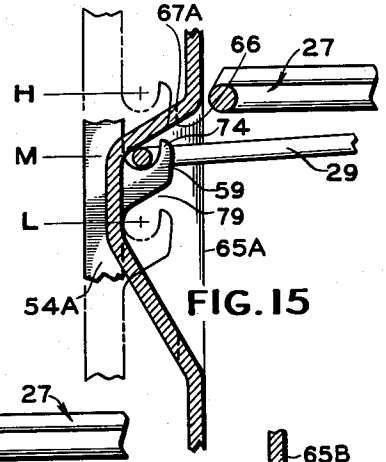


FIG. 15

FIG. 16A

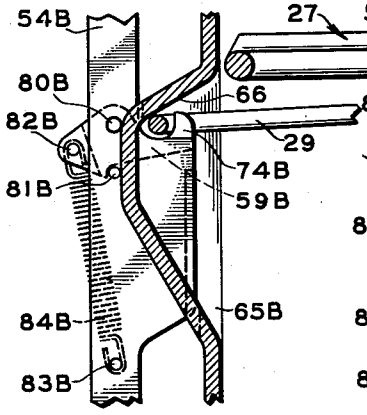
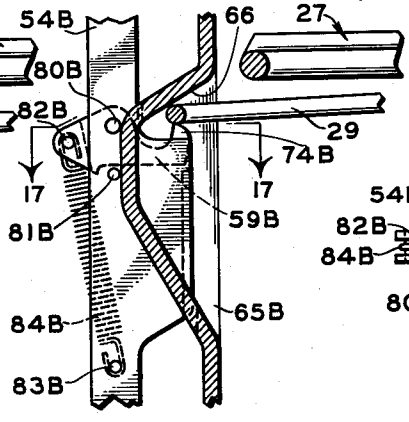


FIG. 16B



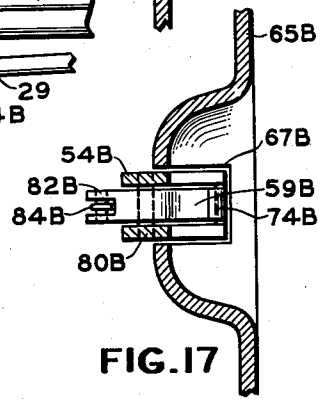


FIG. 17

FIG. 18A

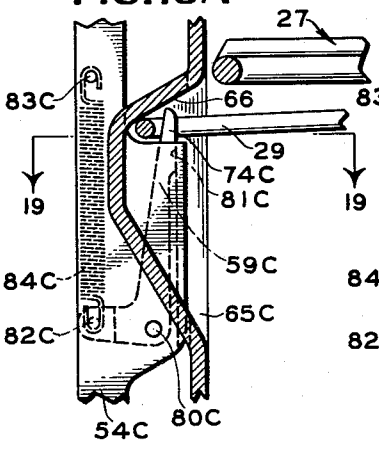
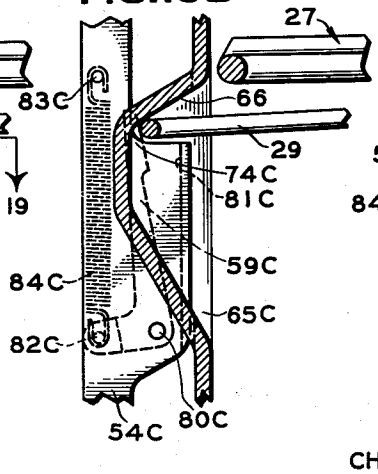


FIG. 18B



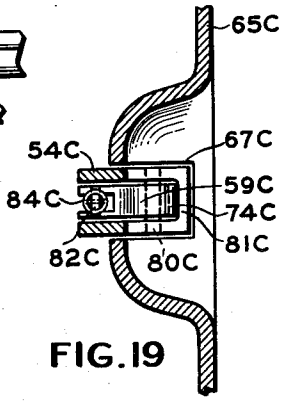


FIG. 19

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Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 5

FIG. 20A

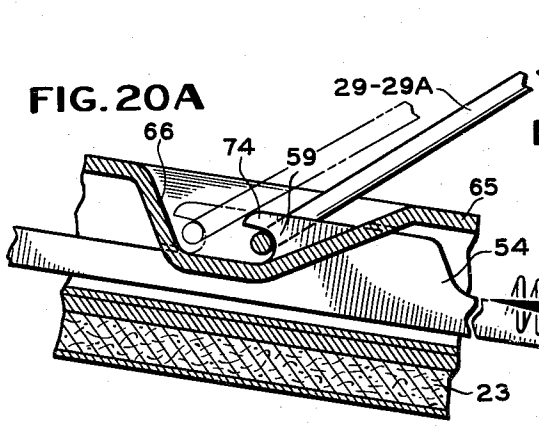
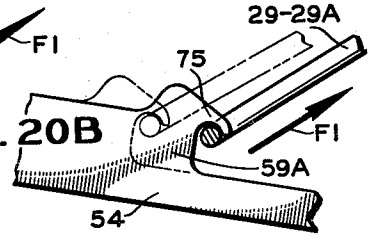


FIG. 20B



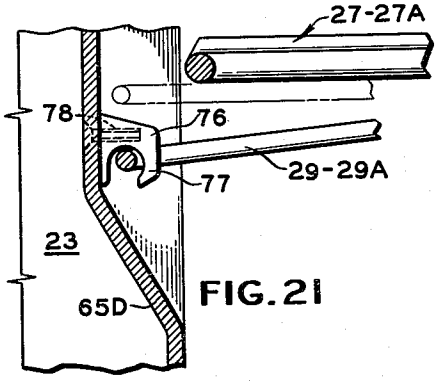


FIG. 21

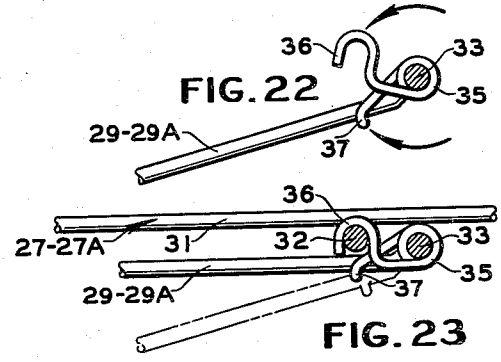


FIG. 22

FIG. 23

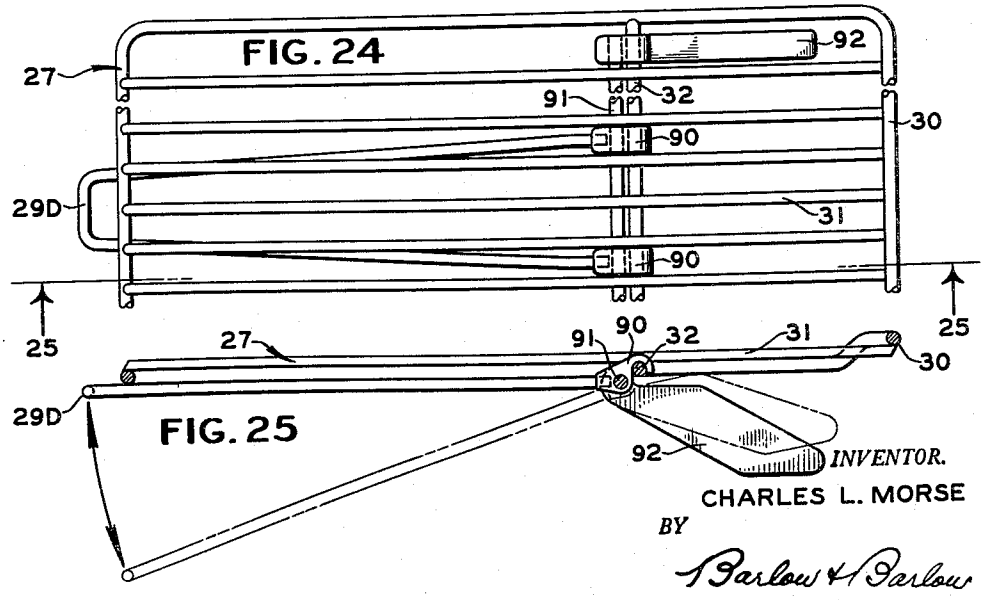


FIG. 24

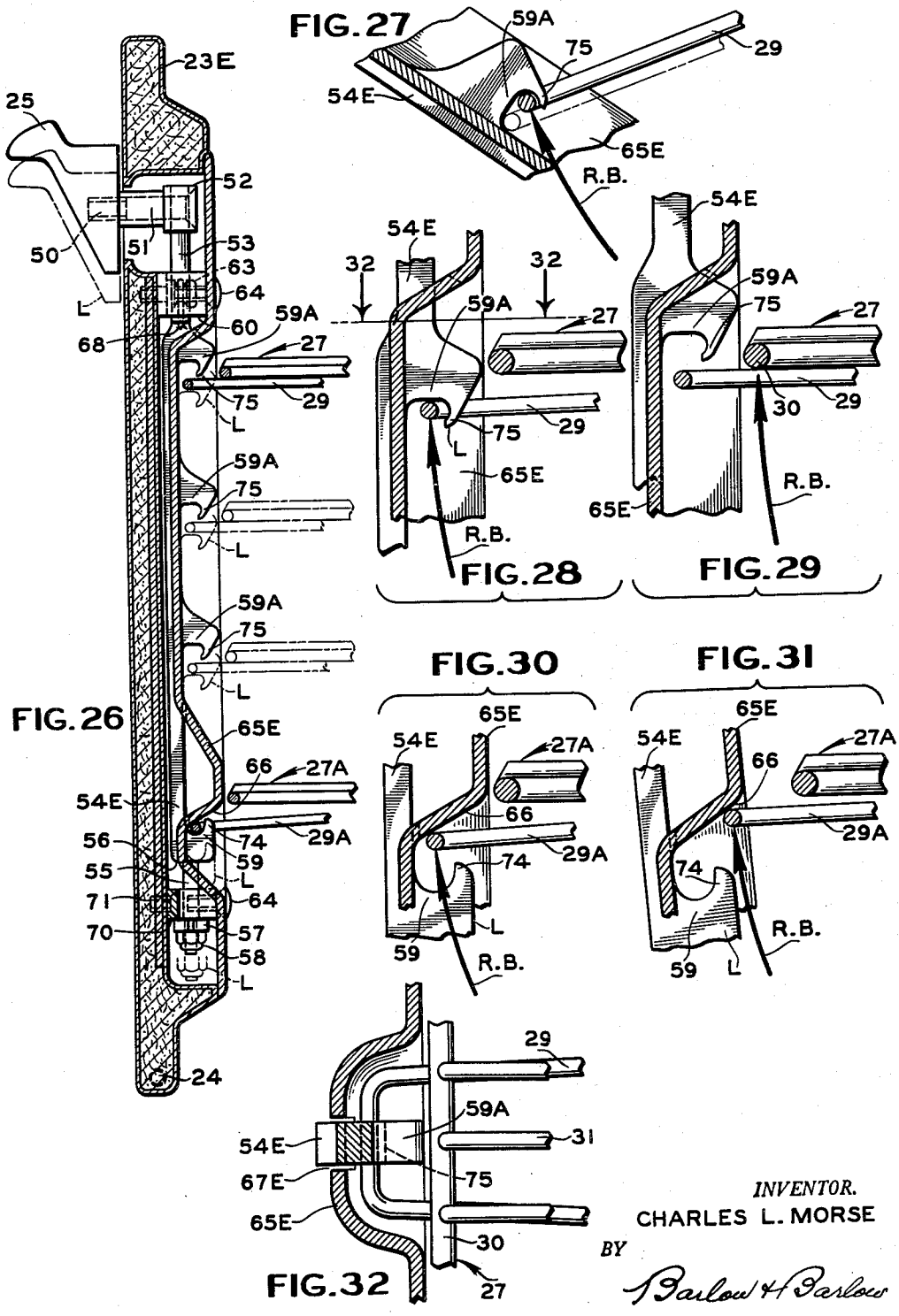
FIG. 25

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Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 6



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Barlow & Barlow

Jan. 9, 1962 C. L. MORSE 3,016,276

OVEN CONSTRUCTION

Filed March 14, 1960 7 Sheets-Sheet 7

FIG. 33

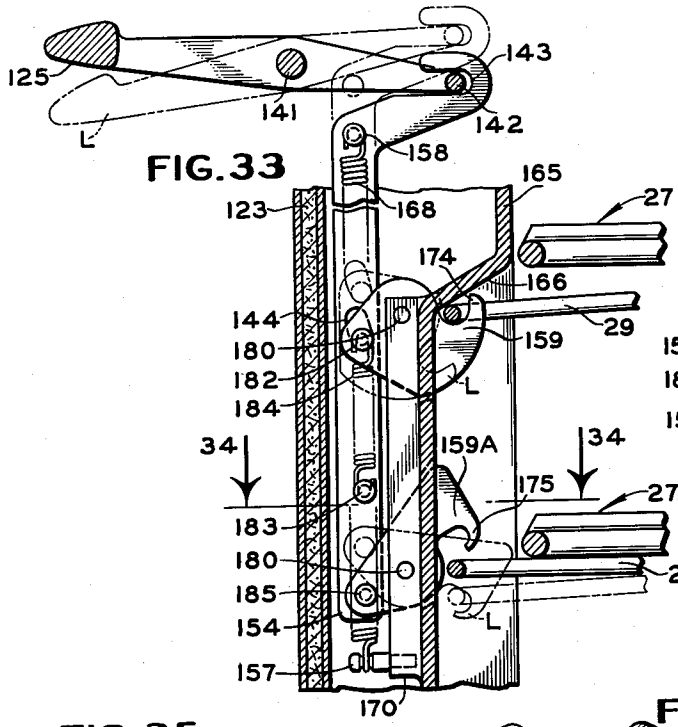


FIG. 34

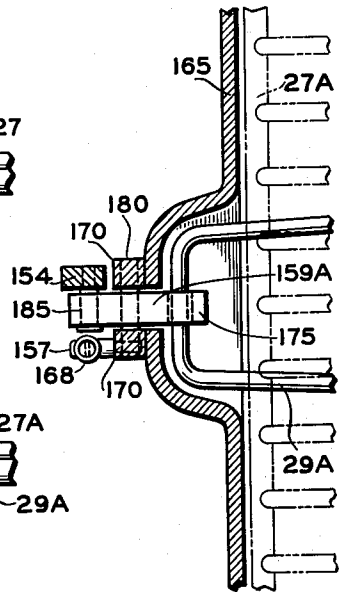


FIG. 35

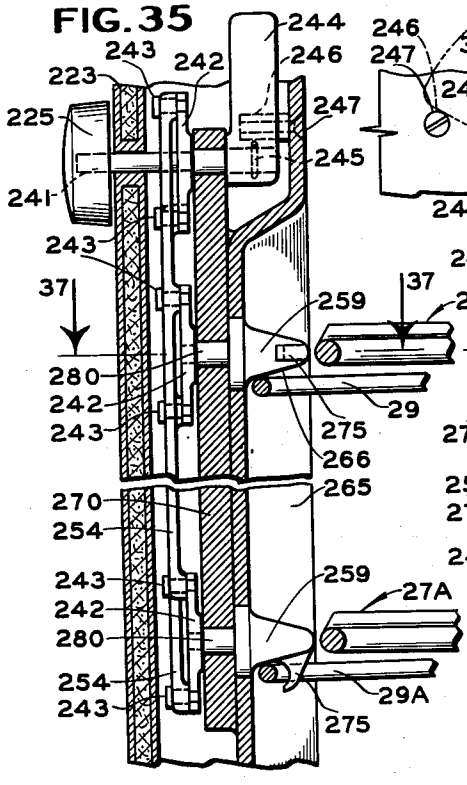


FIG. 36

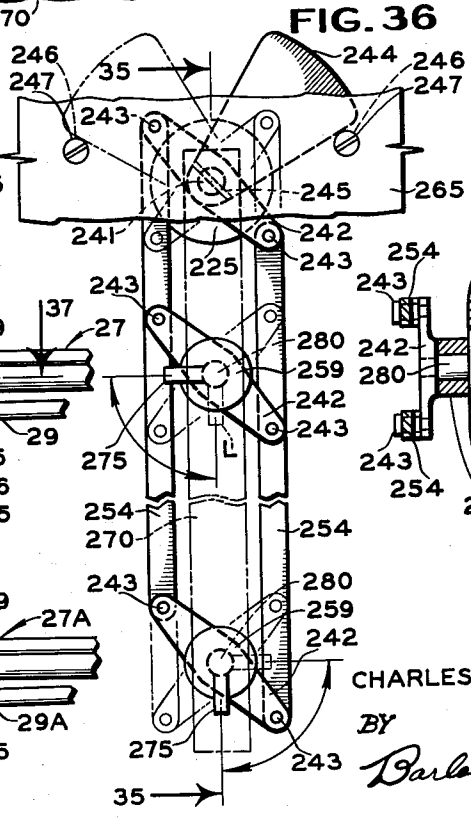
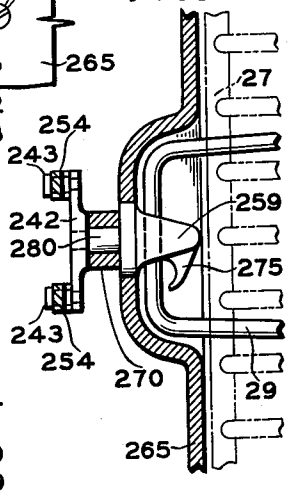


FIG. 37



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Barlow & Barlow

United States Patent Office 3,016,276 Patented Jan. 9, 1962

3,016,276
OVEN CONSTRUCTION

Charles L. Morse, P.O. Box 156, South Dartmouth, Mass.

Filed Mar. 14, 1960, Ser. No. 14,673
17 Claims. (Cl. 312—274)

This invention relates to cooking apparatus and particularly to oven construction and is a continuation in part of application Serial No. 645,569, filed March 12, 1957, and now abandoned. More specifically, it provides a simplified mechanism for sliding the shelves of an oven by a linkage arm that is operated by a controlling means in the oven door. Thus by selectively using the controlling means, the oven shelf can be made to slide in or out of the oven compartment automatically when the door is opened. It has been found in practice that in the case of present ranges, which generally locate an oven beneath the table top level, that the person using the oven of necessity has to stoop to pull out the oven shelf in order to inspect the contents. The present construction, therefore, has been devised to facilitate the inspection or the serving of food that is being cooked, and it also eliminates the need of an insulating pad or pot holder when sliding the shelves in or out. These automatic shelves are also intended for built-in, wall-type, industrial or other forms of oven or cabinet devices.

There are in general two distinct types of oven doors, namely, the door that is vertically hinged at the side and the door that is horizontally hinged at the bottom of the oven. It will be apparent to those skilled in the art that it is relatively easy to devise a mechanism to slide out shelves in a vertically-hinged door as the controllable linkage is in the same plane as the shelf. However, with a horizontally-hinged door it is apparent that the linkage, if one is used, operates in a plane different from and usually at right angles to the plane of the shelf. Further problems complicate the situation as the linkage must not interfere with other shelves or cooking operations and furthermore must operate at several shelf levels.

It is, therefore, one of the main objects of this invention to provide a simple, practical shelf sliding mechanism for use with horizontally-hinged doors.

Another object of the invention is a rugged, foolproof, controllable linkage that gives fast shelf ejection.

Another object of the inveniton is the use of a simple catch which is constructed so as to engage a linkage arm resiliently coupled to the shelf in the oven, said linkage arm so proportioned and constructed as to give maximum clearance to objects mounted below the shelf.

Another object of the invention is the incorporation of the control for the catch into the handle of the door.

Another object of the invention is the use of a door handle control so constructed that selectively either a top or bottom shelf may be withdrawn from the oven or, optionally, both shelves may be uncoupled from the ejection linkage.

A still further object of the invention is the provision for a rotationally-biased linkage arm easily attached to the shelf without the use of mounting brackets and coupled thereto through a torsion spring or a hooked counterweight, automatically retaining the arm flat against the underside of the shelf when the arm is not in use.

Still another object of the invention is the provision for a striker plate to automatically correct misalignment of the shelf linkage due to shelf sag under heavy load conditions, manufacturing inaccuracies, etc.

Another object of the invention is the incorporation in the catch of a shock absorber which will absorb the impact of the shelf being pulled out to its limit-stops by the door.

A major object of the invention is to provide maximum convenience for the operator by the use of automatic

shelves that are linked closely to the oven door, thus giving the operator quick and easy access to cooking operations even with the door only partially open.

With these and other objects in view, the invention consists of certain novel features of construction as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

FIG. 1 is a cross sectional view of the oven with the door partially open and the top shelf pulled forward by linkage;

FIG. 2 is a cross sectional view of the oven with the door closed, and a superimposed phantom view showing the door open and the bottom shelf pulled forward by linkage;

FIG. 3 is a partial sectional view of the wall of the oven compartment taken on lines 3—3 of FIG. 5, and showing a shelf trackway;

FIG. 4 is a frontal view of that shelf trackway shown in FIG. 3;

FIG. 5 is a fragmentary top view of a shelf and trackway;

FIG. 6 is a sectional view of a shelf taken on line 6—6 of FIG. 5 and showing a spring-biased linkage arm;

FIG. 7 is a sectional view of a modified shelf construction showing a weight-biased linkage arm;

FIG. 8 is a fragmentary top view of FIG. 7;

FIG. 9 is a partial sectional view of a shelf showing a short, spring-biased linkage arm;

FIG. 10 is a partial sectional view of a shelf showing a short, weight-biased linkage arm;

FIG. 11 is a sectional view substantially through the mid-line of the oven door taken on line 11—11 of FIG. 12 showing the catch mechanism engaged with the linkage arm of the top shelf and disengaged from the linkage arm of the bottom shelf;

FIG. 12 is a partial view of the interior face of the oven door with the cover plate broken away showing the catch mechanism;

FIG. 13 is a sectional view taken on line 13—13 of FIG. 12;

FIG. 14 is a sectional view taken on line 14—14 of FIG. 12;

FIG. 15 is a partial sectional view showing a modified catch mechanism with greater hook travel;

FIGS. 16A and 16B are partial sectional views showing a modified catch mechanism with a resilient hook;

FIG. 17 is a sectional view taken on line 17—17 of FIG. 16B;

FIGS. 18A and 18B are partial sectional views showing another modified catch mechanism with resilient means to prevent latching with the shelf linkage;

FIG. 19 is a sectional view taken on line 19—19 of FIG. 18A;

FIGS. 20A and 20B are partial sectional views of the catch mechanism showing how the mechanism absorbs the shock when the shelf hits its limit stops;

FIG. 21 is a partial sectional view of a simplified construction showing a fixed hook;

FIGS. 22 and 23 are partial sectional views showing the installation of a spring-biased linkage arm on a shelf;

FIG. 24 is a partial top view of a shelf showing a weight-biased linkage arm with the weights offset to the side for maximum clearance below the shelf;

FIG. 25 is a sectional view taken on line 25—25 of FIG. 24;

FIG. 26 is a sectional view similar to FIG. 11 except with the top and bottom catch hooks reversed and the catch mechanism disengaged from the linkage arm of the top shelf and engaged to the linkage arm of the bottom shelf;

FIG. 27 is a partial sectional view of the rotationally-biased shelf linkage arm engaging a hook of the catch

mechanism with the oven door in the partially open position;

FIG. 28 is a partial sectional view of a catch hook shown in engagement with the rotationally-biased shelf linkage arm;

FIG. 29 is a partial sectional view of a catch hook shown out of engagement with the rotationally-biased shelf linkage arm;

FIGS. 30 and 31 are partial sectional views of a rotationally-biased shelf linkage arm deflected into correct latching position with the alternate catch hook;

FIG. 32 is a sectional view taken on line 32—32 of FIG. 28;

FIG. 33 is a fragmentary sectional view taken adjacent the mid-line of the oven door showing another form of catch mechanism;

FIG. 34 is a sectional view taken on line 34—34 of FIG. 33;

FIG. 35 is a fragmentary sectional view taken on line 35—35 of FIG. 36 and showing still another form of catch mechanism;

FIG. 36 is a fragmentary view of the inside face of the oven door with parts broken away to disclose the catch mechanism;

FIG. 37 is a sectional view taken on line 37—37 of FIG. 35.

Referring to the drawings wherein like parts have similar reference numerals with added suffixes and particularly FIGS. 1 and 2, I have shown diagrammatically a cross-sectional view of an oven indicated generally by the reference number 20 which has a generally rectangular shaped oven compartment 22. An oven door 23 is hingedly secured along the lower edge of compartment 22 with a horizontal hinge as at 24 in any suitable manner, and door 23 is provided with an operating handle 25. The oven compartment 22 may be provided with a plurality of internal trackways 26 or other suitable supports which are adapted to receive shelves 27 and 27A. The shelves are substantially rectangular and planar. The edges of the shelves shown here are slidably received within a trackway 26, thus giving the simplest means of mounting the shelves. However a more elaborate mounting may also be achieved with suitable rollers and track.

The drawing of oven 20 shows four shelf levels although any suitable number of levels may be used. In accordance with common cooking practice, the bottom shelf 27A will remain at the bottom level and the top shelf 27 may be shifted between the three top levels. However, in all of these drawings, the top shelf 27 will always be shown at the top level, and where necessary, will be outlined in phantom at the second and third levels. Shelf 27 has a rotationally-biased linkage arm 29 hingedly secured beneath the shelf about two thirds of the distance back from the front edge of the shelf 27 to the rear edge in the rearmost portion thereof. The linkage arm 29, illustrated in FIG. 5, has an elongated U-shape with the bite of the U extending forwardly to latch with a corresponding hook, hereinafter described, recessed into the interior face of the oven door 23. The bottom shelf 27A of the oven is similarly constructed except that a shorter linkage arm 29A may be used. This shorter arm 29A is pivotally related between one third and two thirds of the distance back from the front edge of shelf 27A. Thus the arms 29 and 29A are located between the foremost quarter and rearmost section of the shelves 27, 27A.

In FIG. 1 door 23 is shown opening and simultaneously withdrawing top shelf 27 by means of linkage arm 29. In this view the bottom shelf remains dormant. When the door 23 is closed, the shelf 27 is returned to the oven compartment 22. Now, referring to FIG. 2, the door 23 is shown in the closed position. In accordance with the preferred embodiments by applying a downward force D to handle 25, the top linkage 29 is uncoupled from door 23 and the bottom linkage 29A then becomes attached to the door. This force D on the handle 25 must be held until the door is at least partially opened whereupon the force D may be released but the coupling remains complete until the door is again closed. At the position of the door 23, shown in phantom, the bottom shelf 27A is being drawn out by linkage 29A, also shown in phantom.

The amount of shelf withdrawal, or travel, is greatest at the upper levels and least at the bottom level. The precise amount of travel depends somewhat on each individual oven design, and in the illustrated embodiments the top shelf 27 will have maximum travel at the top level and the second from top level, in either case the shelf being withdrawn fully to the shelf limit-stops. At the third from top level, shelf 27 may be withdrawn about 75% at maximum door opening, and at the bottom level, shelf 27A may be withdrawn about 50%. This of course refers only to automatic operation as all shelves may be extended 100% when operated manually.

Although it is perfectly feasible to have linkage arms 29 and 29A the same length, there are nevertheless two advantages that may be derived by shortening arm 29A: First, the shorter arm gives greater shelf ejection travel (the horizontal length component shortens as the arm rotates) and, second, the shorter arm gives greater clearance to an oven heating unit (not shown) located at the bottom of the oven.

The shelf-operating mechanism favors maximum shelf ejection where it is needed most, namely at the top levels, or near the relatively inaccessible roof of the oven. The limited shelf ejection at the lower shelf levels is not seriously detrimental. Referring to FIG. 1, the phantom line A indicates generally the limit of visibility for the operator and also the limit of easy access to the contents of the oven. Thus shelf ejection is provided directly in proportion to the need for it.

The shelf-operating linkage 29 gives an ejection of shelf 27 that closely follows the opening door 23. When the door is initially opened, the shelf and the correspondingly opposite portion of the door are travelling at the same speed, the shelf neither bumping the door nor lagging behind it. Thus, the contents of the oven immediately come into view for inspection or serving. The automatic shelves 27, 27A do not require the delaying mechanism, lost-motion linkage or deeply recessed shelves common to the prior art.

Maximum access to the oven with minimum door opening is of prime concern to the operator. Again observing FIG. 1, it will be noted that the oven door 23 is half open (45°) and the shelf 27 is shown ejected more than 50% from the oven compartment. Actually, the shelf has travelled about 80% of the permissible distance before striking the shelf limit stops. Thus the relatively small travel of the door and the quick shelf ejection are a delight to the operator as this rapid shelf action requires minimum effort. As an oven is essential to an average kitchen and generally is in use almost daily, the convenience of easy operation is of major importance and cannot be overemphasized. This convenience to the operator is in fact the entire purpose of the present invention.

Again referrin gto FIG. 1, the dotted line C designates the necessary clearance required for linkage arms 29, 29A as they swing down. As previously mentioned, the preferred location for hingedly securing linkage arm 29 to shelf 27 is about two thirds of the distance back from the front edge. A greater distance back would cause interference between arm 29 and cooking operations on bottom shelf 27A; a shorter distance forward might cause inefficient shelf ejection. As can be readily seen by observing dotted line C, the clearance is fully adequate for all normal cooking operations.

Referring to FIGS. 3 and 4 a simple trackway 26 is shown mounted on the sidewall of oven compartment 22, and a corresponding trackway is mounted on the opposite sidewall of compartment 22. The trackway 26 consists of a series of ridges 28, with ridge 28' serving as a limit

stop. This limit stop 28' prevents the accidental complete withdrawal of shelf 27 from the oven. Shelf 27 has a circumscribing frame 30, the rearmost portion of frame 30, as shown in FIG. 3, curving upwardly so that when the shelf approaches maximum extension, its curved portion engages limit stop 28'. The shelf 27, however, may be completely removed from the oven by raising the front edge thereof and then completing the withdrawal by lifting the shelf out. Whereas this method of mounting a shelf is not new to the art, a new means to reduce the impact shock of shelf 27 hitting limit stop 28' so that the shock will not be transmitted into oven door 23 will hereinafter be described.

FIGS. 5 and 6 show the shelf 27 and the rotationally-biased linkage arm 29, the linkage arm being horizontally pivoted on an axis parallel to the planar extent of the shelf to underlie the shelf with a portion thereof free of the forward end of the shelf. The shelf 27 is illustrated as being made of the usual wire construction and consists of the previously mentioned circumscribing frame 30, a reinforcing cross rod 32, and a working surface consisting of spaced wire rods 31. The cross rod 32 serves as a point of attachment for the arm 29 and for its right- and left-hand supporting torque springs 34 and 35. FIG. 6 shows a side view of torque spring 35 which has a hooked end 36 that fits over cross rod 32 and another hooked end 37 that fits under and supports arm 29. The arm 29 and torque springs 34, 35 are integrated by a pivot bar 33 that is welded or otherwise secured to arm 29. It should be noted that arm 29 rotates about pivot bar 33 and not about cross rod 32.

FIGS. 22 and 23 show enlarged views of the torque spring 35 attachment. An important feature of this invention is the manner in which arm 29 and pivot bar 33 are attached to the shelf 27 solely through spring action and without the need for additional supporting brackets. Thus a standard shelf and an automatic shelf may be manufactured as interchangeable units, with the former shelf being converted to the latter by merely adding the arm and spring, no other modifications to the shelf itself being required. FIG. 22 shows the manner of spring installation, the arrows denoting the direction of spring rotation or clamping action. FIG. 23 shows the arm 29 after installation on cross rod 32. The torque spring 35 rotationally biases the arm 29 in a clockwise direction and by reaction biases itself and the pivot bar 33 in a counter-clockwise direction. It will be noted in FIG. 23 that the main coil of torque spring 35 touches and is restrained by the surface rods 31. In order for arm 29 to function properly, at least a small clearance must be provided between arm 29 and cross rod 32 directly beneath the cross rod 32. Returning to FIGS. 5 and 6, it can be seen that the rotational bias of arm 29 is restricted by the shelf frame 30. This is the normal inactive position for arm 29.

In FIG. 7, shelf 27 is shown with a linkage arm 29B that is attached to and rotationally biased by counterweight 38 so that it tends to underlie the shelf as shown. One end of hook 39 fits over cross rod 32 and the other end is welded or otherwise secured to counterweight 38. Thus the cross rod 32 acts as a pivot for the linkage arm. It will be noted that hook 39 is installed on the cross rod generally in a veritcal direction whereas the arm 29 lies in a generally horizontal direction. By having the hooks 39 at right angles to the arm 29, push-and-pull forces may be extended longitudinally through the arm without dislodging hook 39 from cross rod 32. This condition will exist through all normal rotational attitudes of the arm 29 as the hook will naturally rotate with the arm and will be perpendicular to the thrust forces transmitted through the arm.

An advantage of the counterweighted linkage arm is that it is easily and instantly removable from the shelf, either for cleaning purposes or to discontinue automatic shelf operation for one reason or another. It can be seen by observing FIG. 7 that the hook 39 can be readily lifted off or replaced back onto cross rod 32.

FIG. 8 is a fragmentary top view of the shelf shown in FIG. 7. The counterweight 38 may be extended to any convenient length in order to give proper counterbalancing. Optionally the counterweight may be notched as at 40 to prevent interference between the counterweight and the surface rods 31. The use of a long counterweight bar 38, such as that shown here, is to provide a shallow counterweight with maximum clearance beneath the shelf, thus reducing interference with cooking operations at a lower shelf level.

FIGS. 24 and 25 show a shelf 27 and linkage arm 29D with very good clearance immediately beneath the shelf as the counterweights 92 have been offset to either side. The linkage arm 29D is attached to a hook 90 that hinges on cross rod 32. A torque rod 91 extends through and is fixedly attached to hooks 90 and counterweights 92, so that the counterweights rotationally bias arm 29D in a clockwise direction as shown in FIG. 25. In order to help support its own weight, the counterweight 92 is formed in a shape so that it hooks over cross rod 32 in a manner similar to that of hook 90. The counterweighted linkage arm may be easily and quickly removed from the shelf as previously described.

FIGS. 9 and 10 shows a modified shelf 27A with two versions of a shortened linkage arm. It will be noted that the usual cross rod 32 has been moved towards the front edge of the shelf to become cross rod 32A. In FIG. 9 there is a spring-biased linkage arm 29A which, although shortened, is in every other way similar in operation and installation to arm 29. In FIG. 10 there is a shortened, weight-biased arm 29C similar to arm 29B previously described.

Referring now to FIGURES 11, 12, 13, and 14, there is shown one of the preferred embodiments of the catch mechanism including the operator therefor. As previously noted, the door 23 is provided with a handle 25 and this handle is adapted to be vertically reciprocated. To this end, the handle is affixed by means of bolts 50 and spacers 51 to a cross bar 52, the cross bar in turn is guided for vertical reciprocation by means of a pair of rods 53 fixedly attached to the cross bar and slidably received in two slide bearings 61 of the bearing block 60 which is attached to the oven door by machine screw 62 and machine screw 63 that has a collar. Also, fixedly attached to cross bar 52 is a catch bar 54, the lower end of the catch bar being formed as a cylindrical rod portion 55 which is slidably received in the lower bearing block 70, this block being attached to the oven door by machine screws 71. The rod portion 55 extends through and above this bearing block 70 for a distance equal to the desired travel of the catch bar. This travel is limited one way by a shoulder portion 56, and it is limited the other way by a limit stop such as lug 57 which is secured against a reduced, stepped portion of rod 55 by nut 58. The lug 57 also serves a second purpose as it extends to one side and is adapted to receive one end of a tension spring 68. The other end of spring 68 is attached to the oven door by hooking onto a suitable support such as the collar of machine screw 63 previously mentioned. The tension spring 68 keeps the catch bar-and-handle assembly in a normal upward position so that the limit stop lug 57 is against the bottom of bearing block 70. At several points throughout the drawings, the downward or low position of this assembly is outlined in phantom and designated by the letter "L."

It will be apparent from the above that reciprocation of the handle 25 will cause a similar movement of the catch bar 54 through the intermediary of the cross bar 52. These parts form a single rigid assembly that is stably mounted on three slide bearings affixed to the inside face of the oven door, the assembly being urged upwardly by tension spring 68. The upward force of tension spring 68 may be overcome by the downward force applied to handle 25, this force being illustrated by the arrow D. When downward pressure is removed from the handle 25, the spring 68 urges the catch bar

54 upwardly to its normal static position as shown in the solid outlines in FIGS. 11, 12, and 26.

The catch bar 54 (FIG. 11) has affixed thereto a plurality of hook-shaped members 59 and 59A which in the present instance are shown as being integral with the catch bar for movement therewith. These hook-shaped members 59 and 59A are also located in a vertical disposition that is compatible with the spacing of the shelf guides and are adapted to be moved into and out of engagement with the bight of arms 29 and 29A, one hook moving into engagement while the other moves out of engagement. This action is controlled by the door handle, thus permitting the operator to select the desired shelf for removal from the oven. The use of two shelves in an oven is common practice, and so this is why this particular form of oven is shown. However it would be perfectly feasible to use either type of hook in a single-shelf oven if desired.

Again referring to FIG. 11, hook-shaped member 59, shown in multiple, points generally upwardly, terminating in tongue portion 74. This type of hook cannot retain the shelf arm 29 by itself but needs another element consisting of a deflection surface 66. As hook 59 is spring loaded upwardly (as part of catch bar 54), the shelf arm 29 is retained in locked position between the hook 59 and the deflection surface 66. Thus as the door 23 is opened, shelf 27 is withdrawn from the oven and as the door is closed the shelf is returned to the oven compartment.

The deflection surface 66 is best formed by indenting the cover plate 65. The deflection surface 66 is approximately in alignment with the front edge of the shelf 27, and angled so as to downwardly deflect shelf arm 29 as the door 23 is closed. Also the cover plate 65 has a slot 67 through which catch bar 54 and the hooks 59, 59A extend. Using the cover plate in the dual role of striker plate simplifies construction and gives a clean design. The primary purpose of the deflection surface 66 is to position shelf arm 29 for correct latching position and to automatically correct for misalignment of the shelf linkage due to shelf sag under heavy load conditions, manufacturing inaccuracies, heat distortions, vertical rise of the hook as it passes over hinge pin 24 upon door opening, etc. The cover plate 65 is attached to the upper and lower bearing blocks 60 and 70 by four machine screws 64. By attaching the cover plate directly to the bearing blocks, the cover plate 65 is assured perfect alignment with the catch mechanism.

In addition to the upward pointing hook 59, the catch bar 54 has a single downward pointing hook 59A located opposite the bottom shelf level. Hook 59A is not dependent on deflection surface 66 of cover plate 65 for its successful operation as was the previously described hook 59. Hook 59A is adapted to be moved into and out of engagement with the bight of arm 29A and is provided with an elongated tongue 75 to allow freedom of movement of the shelf linkage arm 29A therein and to prevent the linkage arm from being disengaged upon angular movement of the door relative thereto, as will be explained further in connection with FIG. 27. The shelf linkage arm 29A will normally lie beneath and against the shelf in a plane just under the lower edge of tongue portion 75 when the catch bar 54 is in the at rest position. Thus should it be desired to withdraw lower shelf 27A, it is necessary merely to press downwardly on the door handle 25 which will then automatically release the upper shelf linkage and engage the hook 59A with the adjacent linkage arm 29A, and then by angular or swinging movement of the door the lower shelf 27A will be withdrawn. Upon returning the door 23 to the closed position, the shelf will be moved inwardly to initial position within the oven. As the arm 29A hinges against the bottom of shelf 27A and is therefore restrained by it, the hook 59A rises above and out of engagement with the bight of arm 29A and arm 29A assumes a position in register, but out of engagement, with the entrance to hook 59A as shown in FIG. 11.

In FIG. 11, the selection of the top shelf to be normally coupled to the door for automatic operation and the bottom shelf to remain normally uncoupled is entirely a matter of personal choice. The selection shown here is probably the preferred embodiment because the top shelf is generally used more frequently than the bottom shelf. However, there is no reason why this selection cannot be reversed. Referring now to FIG. 26, an oven door 23E with a modified catch mechanism is shown. It can be seen that the bottom shelf 27A normally remains coupled to the oven door and the top shelf 27 normally remains uncoupled, this condition being reversed by depressing handle 25. The modified catch bar 54E has three hooks 59A at the top shelf levels and a single hook 59 at the bottom shelf level. The cover plate 65E is modified to agree with the new hook locations, and the oven door 23E is in every other way similar to door 23 previously described. Thus, it readily can be seen that the present invention may be adapted to whatever embodiment is preferred.

FIGURES 27, 28, 29, 30, 31 and 32 are enlarged, fragmentary views showing the two hooks 59, 59A and their relationship with shelf linkage arms 29, 29A. The arrows "R.B." denote the rotational bias of the shelf linkage arms. This rotational bias is essential for the successful coupling and uncoupling of the linkage arms with the hooks. For hook 59A the rotational bias of arm 29 is necessary throughout all stages of door opening in order to maintain the arm in place on the hook. Although during the initial opening of the door the hook must be held down by means of handle 25, the downward pressure on handle 25 may thereafter be released and the arm 29 will remain engaged to hook 59A, since, in the rotationally outward movement of catch bar 54 as the door opens, the position of the hook 59A relative to the planar extent of the shelf has been shifted downward. Thus, regardless of the action of the handle control, the coupling will remain complete until the shelf is returned to the oven. FIG. 27 shows the hook 59A with the door about half way open. The bight of arm 29 favors the tongue 75 portion of the hook as the shelf is withdrawn from the oven, the tip end portion of tongue 75 retaining the biased arm 29 even when the door has been opened to a full 90°. However, when the door initially starts to close, the bight of arm 29 is pushed over, or slides across, the hook to the phantom position shown in this view. The reason that arm 29 stays engaged throughout the entire opening and closing cycle of the door is entirely due to this essential rotational bias of the arm.

FIGS. 28 and 29 show hook 59A with the oven door shut. In FIG. 28 the catch bar 54E is in the down position so that the hook 59A engages arm 29, again illustrating how the rotational bias holds the arm against the hook. In FIG. 29 the catch bar 54E is in the high position and hook 59A is out of engagement with arm 29. However the rotational bias of the arm is needed to hold arm 29 in stored position or inactively up against frame 30 of shelf 27.

Referring to hook 59A in FIG. 28 and elsewhere, it will be noted that the back side of tongue 75 is bevelled about 30° or more from the vertical. The purpose of this bevel is to prevent damage to the latching mechanism in case the door is slammed shut when the hook is out of phase with the arm. For example, assuming that an uncoupled shelf is left within the oven and an unskilled operator closes the door while inadvertently depressing the door handle 25, the sloping backside of tongue 75 deflects the arm 29 downwardly so that no damage results. The bight of arm 29 then slips over the tip of tongue 75 and into the open hook portion, the entire action made possible by the resilient, rotational bias of arm 29.

FIGS. 30 and 31 are enlarged, fragmentary views showing hook 59 in the unlatched or low position so that the shelf linkage arm 29A may be moved in and out of latching position. FIG. 30 shows the door in the closed position and FIG. 31 shows it slightly open. In either case it is clearly shown how the rotational bias R.B. of arm 29A holds the arm against the deflection surface 66.

FIG. 32 is a section taken on line 32—32 of FIG. 28. It shows generally the manner in which cover plate 65E is indented to receive the bight of the shelf linkage arm 29. It also clearly illustrates the catch bar 54E extending through slot 67E of the cover plate 65E.

Having thoroughly described the several functions of the rotational bias R.B. of the shelf linkage arm 29, it should be understood that the use of the biased arm need not be limited to the catch mechanism described herein as it can be applied to many forms of hooks. For example FIG. 21 shows a fixed hook 76 with a tongue 77, the hook being secured to a modified cover plate 65D with a machine screw 78. The shelf linkage arm shown here as either 29 or 29A is manually attached to the hook when the oven door is open. The arm in phantom shows the disengaged position. This type of simplified hook member might be applicable to a single shelf oven where the shelf would normally be engaged to the door for long periods of time, but nevertheless the shelf could easily be disengaged when needed for special cooking operations or for shelf removal from the oven for cleaning purposes.

A problem inherent to any automatic shelf device with full shelf extension is the absorption of the impact when the shelf is extended fully to its limit stops. Referring now to FIGS. 20A and 20B, fragmentary views show both hooks 59 and 59A at moment of maximum impact resulting from this condition. The force of impact is transmitted as a tension force, designated F1, through arm 29—29A into the hook 59 or 59A. From there the force travels down catch bar 54 into lug 57 and is then absorbed by an equal force F2 from the tension spring 68. Immediately after the impact is absorbed, the hooks 59 or 59A return to their original positions shown here in phantom. Thus the shock-absorbing characteristic of the catch mechanism is an inherent quality of the present invention and is achieved with the existing structure and without modifications thereof. Depending somewhat on individual oven design, this shock-absorbing means is needed especially for the top shelf because of its greater travel.

The basic invention has now been fully described. However, it is possible and desirable to modify the hook design either to increase the utility of the mechanism or to make the catch hooks engage more compatibly with the shelf linkage arm. Referring first to FIG. 15, a catch hook 59 is shown in the middle position M of three possible positions: high H, middle M, or low L. The modified catch bar 54A is mounted and operated similarly to bar 54 previously described except that it has a greater travel than bar 54. Bar 54A also has a cut-away potrion 79 immediately behind or under hook 59. The cover plate 65A has a modiled slot 67A to accommodate the greater travel of catch bar 54A and hook 59. In the middle position M, as shown in the drawing the limit stop action of the bar 54A is provided by hook 59 clamping the bight of arm 29 against deflection surface 66 of cover plate 65A, thus providing normal automatic shelf action. Now assuming that the operator wishes to discontinue automatic shelf operation, this may be done quite simply by depressing the oven handle to move hook 59 into the low position L, then partially opening the oven door, releasing the door handle so that hook 59 goes into high position H, and reclosing the oven door. As the oven door closes, deflection surface 66 moves the bight of arm 29 to its usual position. The arm 29 is entirely clear of hook 59 and enters into cut-away portion 79. The operator may re-engage the shelf at any time by reversing the action just described.

In the basic embodiments shown in FIGS. 11 and 26, the tongue portion 74 is shaped to allow the entrance of shelf linkage arm 29 into latched position even if the oven door is returned to the closed position without first having withdrawn a shelf. Tongue 74, as part of catch bar 54, is spring loaded upwardly by tension spring 68. Thus the bight of arm 29 wedges itself between the deflection surface 66 and tongue 74, forcing itself past the tongue and into latched position.

FIGS. 16A, 16B, and 17 are enlarged fragmentary views showing a more resilient hooking means that will engage the bight of arm 29 without jarring the catch bar 54 or the handle 25. The catch bar 54B has a slot that is milled or otherwise hollowly formed to receive a pivoted hook 59B mounted on pin 80B affixed to catch bar 54B and located approximately horizontally opposite the bight of arm 29 when the bight is in latched position. The pivoted hook is restrained in a counterclockwise direction by the limit-stop pin 81B affixed to catch bar 54B and is resiliently restrained against forces applied in a clockwise direction by the tension spring 84B operating counterclockwise which is attached at one end to pin 82B affixed to hook 59B and in the other direction is attached to pin 83B affixed to catch bar 54B. The cover plate 65B has a slot 67B that receives the catch bar assembly, as shown in FIG. 17. In FIG. 16A, the shelf linkage arm 29 is in normal latched position. In FIG. 16B, the oven door is shown shutting, and the shelf linkage arm 29 is initially striking and depressing the tongue portion 74B of hook 59B just prior to latching. From an operational point of view, 59B differs from 59 only in having a resilient tongue 74B whereas the latter has a fixed tongue 74.

FIGS. 18A, 18B and 19 are enlarged fragmentary views showing a different form of resilient hook that may be used to accept or reject the shelf linkage arm 29 according to the desire of the operator. The catch bar 54C has a slot that is milled or otherwise hollowly formed to receive a pivoted hook 59C mounted on pin 80C affixed to catch bar 54C and located below the bight of arm 29. The pivoted hook is restrained in a clockwise direction by the limit-stop wall 81C and is resiliently restrained against forces applied in a counterclockwise direction by the tension spring 84C operating clockwise which is attached at one end to pin 82C affixed to hook 59C and at the other end is attached to pin 83C affixed to the catch bar 54C. The cover plate 65C has a slot 67C that receives the catch bar assembly as shown in FIG. 19. In FIG. 18A, the shelf linkage arm 29 is in normal latched position. In FIG. 18B, the shelf linkage arm 29 has rejected the hook 59C after striking and moving the tongue portion 74C out of latching position. This operation is done by closing the door on a shelf previously located within the oven. The operator may at any time re-engage the coupling by pressing down and then releasing handle 25.

FIGURES 33 and 34 show a modified catch mechanism in which similar parts to those previously described bear like tens numerals in the one hundred series. The upper hook 159 and the lower hook 159A are mounted relative to the door 123 rather than relative to a catch bar as has been previously described for hooks 59 and 59A. The two hooks 159 and 159A operate entirely by rotation and not by reciprocation as did hooks 59 and 59A. Referring to FIG. 33, the oven door 123 is shown more or less schematically with a door handle 125 pivotally mounted to the door as at 141. This handle may be depressed to the low position, designated L and shown in phantom, in order to selectively latch and unlatch the hooks. The handle 125 as shown is in effect a lever with a pin 142 at one end engaging an open slot 143 in the catch operator bar 154. When the handle 125 is rocked about pivot 141, the catch operator bar 154 will be rectilinearly reciprocated and will in turn rock the hooks 159, 159A in

order to engage and disengage them with their corresponding shelf linkage arms 29, 29A.

Referring now to cover plate 165 located on the inside face of the oven door 123, it will be noted that the plate is indented and slotted to receive and support hooks 159, 159A, these hooks being mounted on pivot pins 180, 180 affixed to two bearing blocks 170, 170, said blocks being welded or otherwise affixed to the cover plate 165 to form an integral unit therewith. The bottom hook is pivotally related to the common operator bar 154 by pin 185, and the top hook is similarly related to bar 154 by pin 182. The catch operator bar 154 is biased in a downward direction by the tension spring 168 secured to the bar by pin 158 and to one of the bearing blocks 170 by pin 157. In order to make hook 159 more compatible to latching operations with arm 29 when the hook is in the closed position, the hook is given a limited freedom to rotate within the limits of pin 182 traveling in slot 144 of bar 154. This pin 182 is, however, resiliently biased downwardly by spring 184 which is attached to bar 154 by means of pin 183. Hook 159 normally points upwardly to engage the bight of arm 29 against the deflection surface 166, the arm being restrained from disengaging from the hook 159 by the tongue portion 174. Hook 159A points generally downward and is shown here out of engagement with arm 29A. By pressing handle 125 downwardly, hook 159A rotates to the low position L shown in phantom and engages arm 29A. The arm 29A is then retained in latched position by the tongue portion 175.

In FIGURES 35, 36, and 37, there is shown another modified catch mechanism similar in operational results to the showings of the catch mechanisms in FIGS. 11 and 26 in which like parts bear similar reference numerals in the two hundred series. The hooks 259 are mounted relative to the door rather than relative to the catch bar as in the original embodiment. These hooks rotate on an axis perpendicular to the planar extent of the door. The special advantage of these hooks is that they lend themselves to a very neat, tight installation and can be designed to form a relatively tight seal with the cover plate 265. This tight seal reduces heat loss and helps to prevent contamination of the operating linkage by condensation of cooking fumes. In this modified design, the top hook 259 is identical to the bottom hook 259 and is generally comparable in operation to hook 59A previously described. One hook 259 is mounted at 90° to the other hook 259 so that when one is rotated into engagement with a shelf arm, the other is rotated out of engagement with the other shelf arm.

In order to show a broad adaptation of automatic shelf linkage, a different type of control handle is shown in FIG. 35. The control knob 225 is shown separate and independent of the oven door handle which is not shown. However it should be understood that optionally these may be combined into a single unit if so desired. The oven door 223 has the control knob 225 affixed to shaft 241 which is rotatably held in the bearing block 270. This bearing block is welded or otherwise secured to cover plate 265. Also affixed to shaft 241 is the lever arm 242 which extends equally in opposite directions perpendicular to the shaft and is pivotally related at each end of the arm to catch operator bar 254 by pin 243. The duplication of bar 254 is intended to provide a statically balanced linkage. The catch operator bars 254, 254 are pivotally attached to a similar arm 242 at each shelf level. Each arm 242 is joined onto one end of a shaft 280, the other end of the shaft being fastened to a hook 259, and shaft 280 being rotationally held in bearing block 270. In the instant embodiment, the hook 259 is generally conical in shape with a tongue portion 275 for securing the hook with shelf arms 29, 29A. The purpose of the conical shape is to provide a deflection surface 266 to help position arms 29, 29A. However, it should be understood that this deflection characteristic constitutes a supplemental value rather than the essential value of the deflection surface previously described in connection with upwardly pointing hooks 59 and 159.

As mentioned earlier the desired hook rotation is 90°. To accomplish this, a counterweight 244 is rigidly attached to the shaft 241 by pin 245. Shaft 241, counterweight 244, arm 242 and knob 225 rotate as one integral unit, the rotation being limited to 90° by the counterweight striking limit stops 246, 246. The limit stops are attached to cover plate 265 by machine screws 247, 247. The counterweight 244 is positioned on shaft 241 so that it may fall 45° either side of the vertical, thus holding the hooks 259, 259 fully engaged with or fully disengaged from arms 29, 29A.

In summary the present invention offers a simple, rugged, dependable and economically manufactured automatic shelf ejection system for use with either single- or double-shelf ovens, with provision in the latter case for selecting either or rejecting both shelves, inherent automatic shock absorption between the shelf and the door, and foolproof provision to automatically correct latching incompatibilities due to the inexperience of or the abuse by the operator, said automatic shelves so designed as to closely follow the oven door as it opens and thus providing maximum convenience for the operator due to the easy access and good visibility of the cooking operations within the oven.

I claim:

1. An oven or cabinet device having an opening, a door for said opening, said door being hingedly attached to said oven so as to have a horizontal hinge axis adjacent the lower edge of said opening, at least one shelf having substantial planar extent within said oven, shelf supporting means for supporting said shelf at any one of one or more levels therein for sliding movement in or out of said oven, said shelf having an arm pivotally related thereto on an axis parallel to the general plane of said shelf and between the foremost quarter and rearmost portions thereof, said arm being located under said shelf and having a rotational-biasing means to rotationally bias said arm rotationally forwardly and upwardly in a plane perpendicular to said shelf to underlie said shelf substantially parallel to the planar extent thereof, the free end of said arm lying adjacent and free of the forward end of said shelf, said door having at least one catch means mounted thereon projecting from the inner side theerof, means associated with the free end of said arm cooperating with said catch means whereby when said catch means engages said arm said shelf will slide in and out of said oven as said door moves between open and closed positions.

2. A structure as in claim 1 wherein said rotational-biasing means is a spring.

3. A structure as in claim 1 wherein said rotational-biasing means is a counterweight.

4. A structure as in claim 1 including control means for moving said catch means in and out of engagement with said arm.

5. A structure as in claim 1 wherein said shelf arm at point of pivotal relation has a pivot bar affixed thereto generally at a right angle to said arm and positioned parallel to the front end of said shelf, said pivot bar lying beneath but free of said shelf and having free ends to receive torque springs thereon each of said springs having two hooked ends pointing generally in a forward direction, one of said ends hooked downwardly onto said shelf in fixed relation thereto, and the other of said ends hooked upwardly under said arm to support and rotationally bias said arm upwardly against the forward end of said shelf.

6. A structure as in claim 1 wherein said shelf arm has secured thereto at least one counterweight and at least one hook, said hook having portions thereof generally perpendicular to said arm to resist axial thrust by said arm, said hook having an opening for installation on and removal from said shelf, said shelf having a pivot rod affixed thereto to receive said hook portion.

7. The structure as defined in claim 1 including at least two shelves slidably mounted within said oven, an arm pivotally mounted under each of said shelves at a point between the foremost quarter and rearmost sections thereof on an axis parallel to general plane of the related shelf to be movable therewith and movable relative thereto, each of said arms being rotationally resilient and rotationally biased forwardly and upwardly in a plane of rotation perpendicular to its related shelf to lie under its related shelf, the free ends of said arms lying adjacent and free of the forward end of said shelf, a striker surface affixed to said door to deflect the free end of said arm of one shelf into latching position with said door, said door having a plurality of catches movably mounted relative thereto, and means connected to said catches for selectively engaging the related arm of a selected one of said shelves, whereby one of said shelves may be coupled to said door for movement therewith.

8. An oven or cabinet device as in claim 1 wherein said catch means are a plurality of catches mounted on a bar guided for reciprocation in said door, said bar being connected to a handle means extending outside said door, at least one of said catches having a hook portion pivotally related to said bar and resiliently biased to a position to lie substantially in the horizontal plane of engagement with said arm and at least another of said catches being fixedly attached to said bar to lie in a position outside of the plane of one of said arms.

9. A structure as in claim 1 including a plurality of catches each comprising a hook-shaped member coupled to a common operator, said hook-shaped members being spaced from each other by distances equal to the spacing of the shelf supporting means so that one of said members may engage said arm at any one of said shelf levels.

10. A structure as in claim 9 wherein said hook-shaped members are pivoted on axes perpendicular to the general plane of said door, said members being coupled to said bar by a linkage to produce rotary motion therein toward and away from latching position.

11. A structure as in claim 9 wherein said catch and common operator consists of a bar in said door guided for limited vertical reciprocation thereon and said hook-shaped members are integral therewith, a control handle attached to said bar, a spring attached to said door and to said bar to bias said bar to a position so that said members will normally not engage said arm.

12. A structure as in claim 9 wherein said oven door has secured thereto at least one deflection surface to position said shelf arm into correct latching position, at least one of said hook-shaped members closing on said deflection surface to engage said shelf arm.

13. A structure as in claim 12 wherein each of said hook-shaped members has a resilient tip portion to receive and hold said shelf arm when said member is in normal position for engagement with said arm.

14. A structure as in claim 12 wherein each of said hook-shaped members has a resilient tip portion to optionally hold or reject from engagement said shelf arm when said member is in normal position for engagement with said arm.

15. A structure as in claim 11 including a control handle attached to said bar, a striker plate affixed to said door, said striker plate having a deflection surface to deflect and position said shelf arm into latching position when said oven door is closed, a spring attached to said door and to said bar to bias said bar to a position so that one of said members normally engages said arm.

16. A structure as in claim 11 including a handle affixed to said bar for movement thereof, a striker plate affixed to said door, said striker plate having a deflection surface to deflect and position said shelf arm into latching position when said oven door is closed, a spring attached to said oven door and to said bar to bias said bar upwardly to retain said shelf arm in latched position between said member and said striker plate, and a slot opening through the deflection surface of said striker plate to permit said member to pass through said striker plate into inactive position after said arm has been removed from engagement with said member.

17. A cooking oven having five sides, a horizontally-hinged swinging door for said oven having a hinge axis along the lower edge thereof, a shelf slidably mounted within said oven, an arm pivotally mounted on said shelf at a point generally between the foremost quarter and rear sections thereof on an axis parallel to the planar extent of said shelf for movement therewith and relative thereto, said arm being located under said shelf and being rotationally resilient and rotationally biased upwardly in a plane of rotation perpendicular to said shelf to lie thereunder, the free end of said arm lying adjacent and free of the forward end of said shelf, said door having a catch mounted thereon adapted to be moved to engage with said arm, resilient means connected to said catch for holding said catch engaged with said arm, and handle means located outside said door connected to said catch moving the same into and out of engagement with said arm, whereby said shelf may be coupled to or disconnected from said door during the movement thereof.

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