United States Patent [19]

Summers, Jr.

[11] **3,712,287**

[45] **Jan. 23, 1973**

[54] **DOOR HINGE**

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[73] Assignee: **United Filtration Corporation**, Chicago, Ill.

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[52] **U.S. Cl.** **126/191**, 126/194, 16/190

[51] **Int. Cl.**.....**F23m 7/00**

[58] **Field of Search** 126/191, 194; 16/190, 145, 16/146

[56] **References Cited**

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3,503,380 3/1970 Vasaturo.....126/191

Primary Examiner—Carroll B. Dority, Jr.

Attorney—Frederick J. Olsson

[57] **ABSTRACT**

A structure especially useful as an oven door hinge comprising a spring which is self-contained within a casing and a lever system which compresses the spring upon opening of the door to develop a torque for counterbalancing.

14 Claims, 10 Drawing Figures

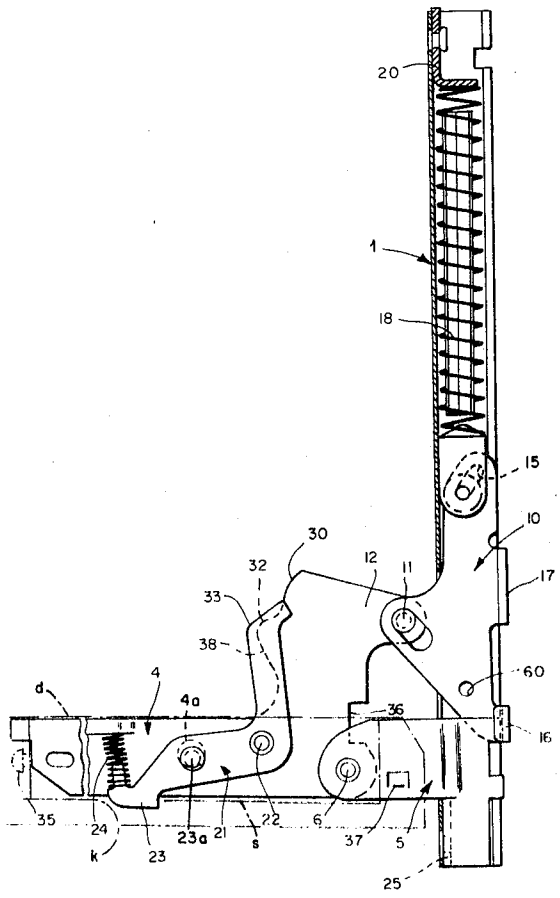

Fig. 1

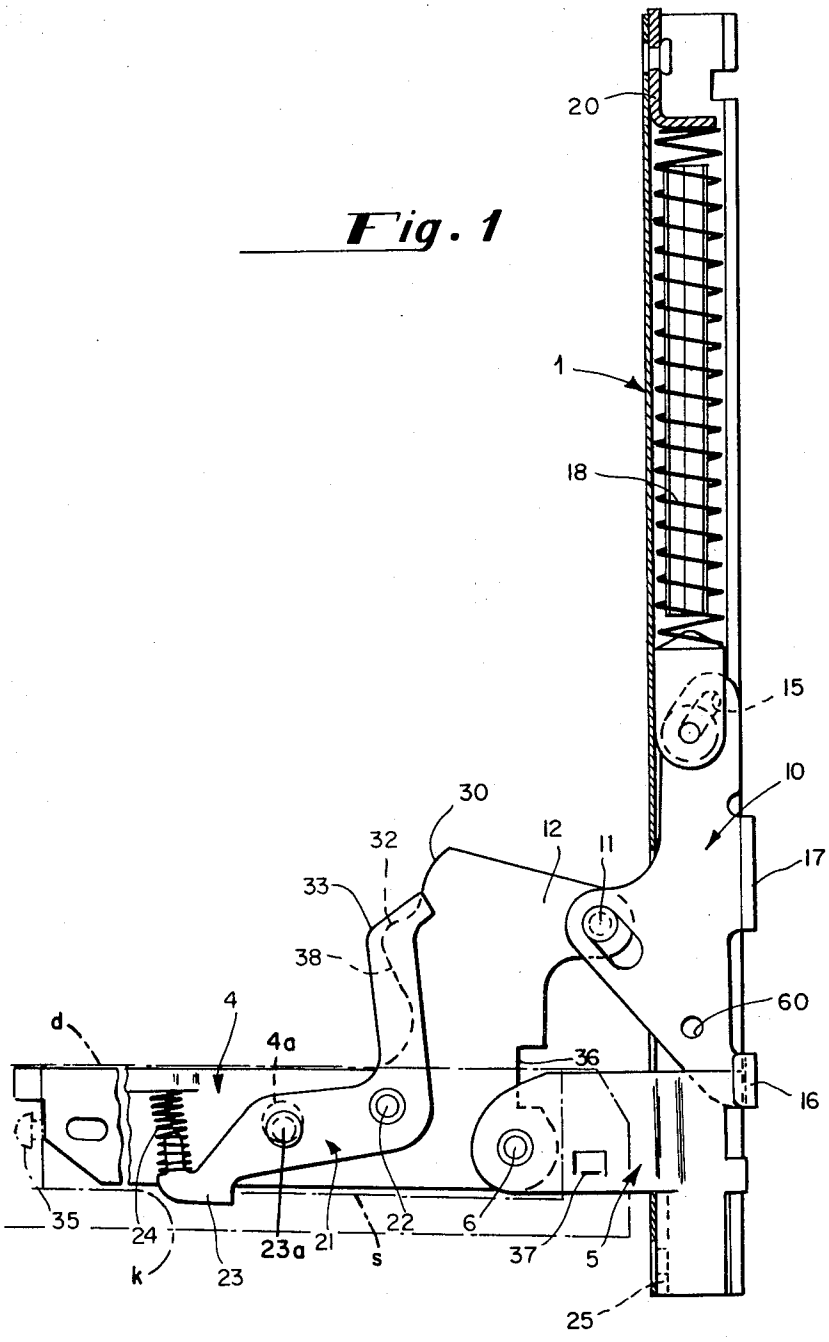
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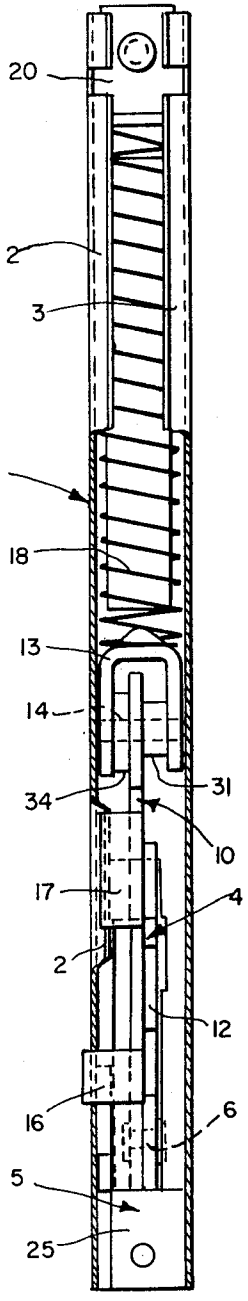
Fig. 2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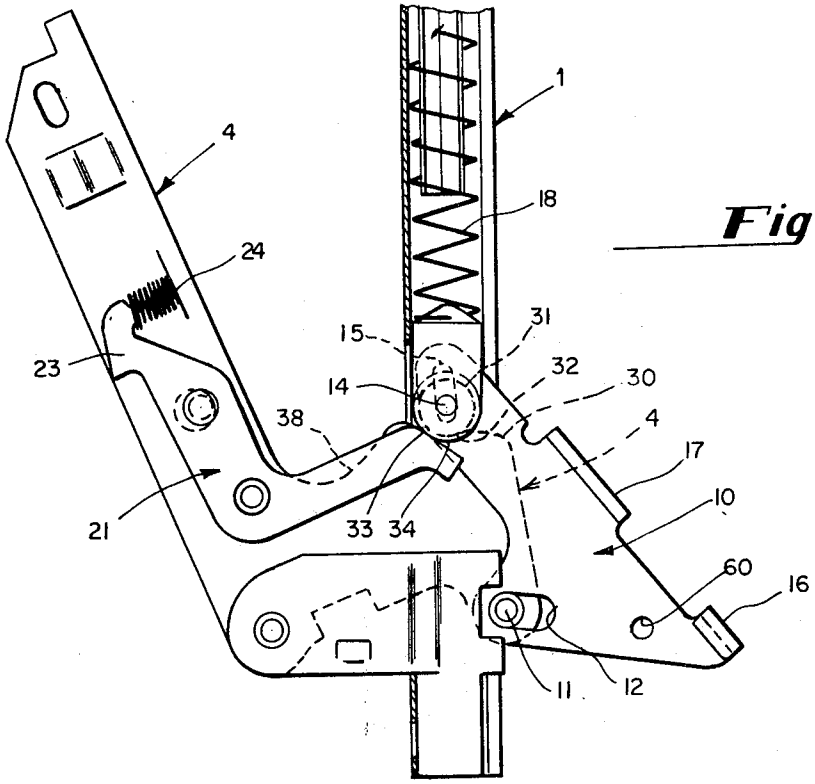
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Fig. 3

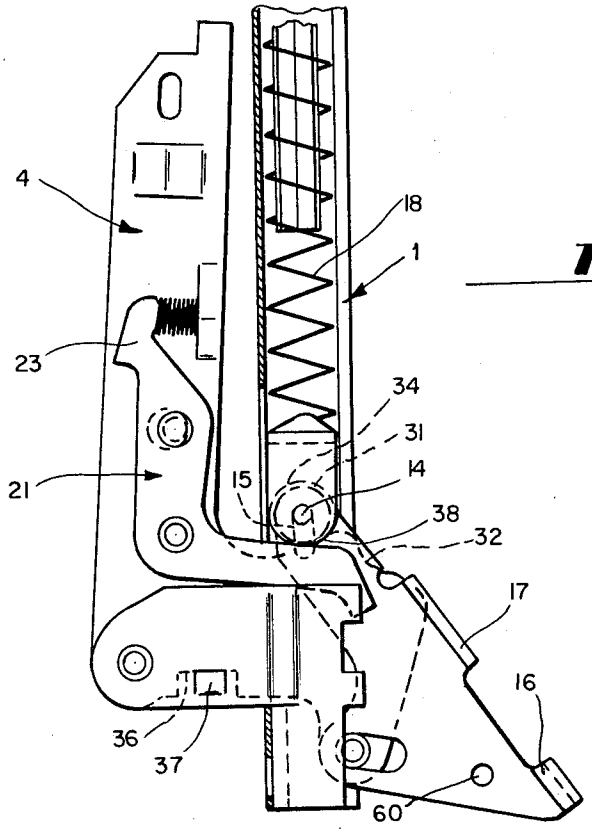
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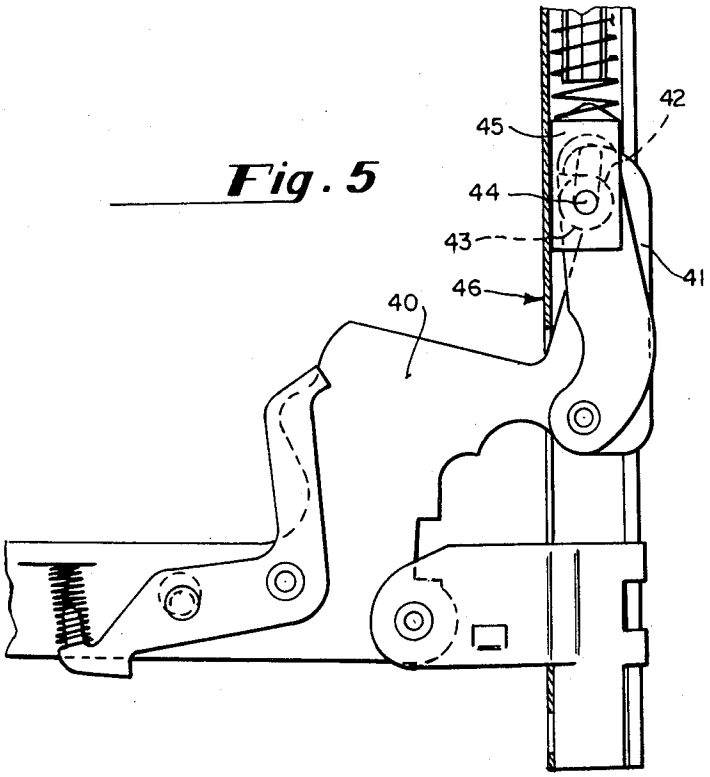
Fig. 4

Fig. 5



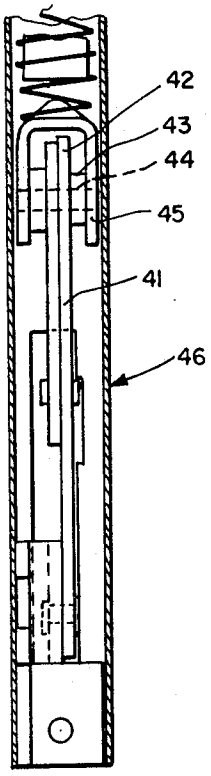


Fig. 6

Fig. 7

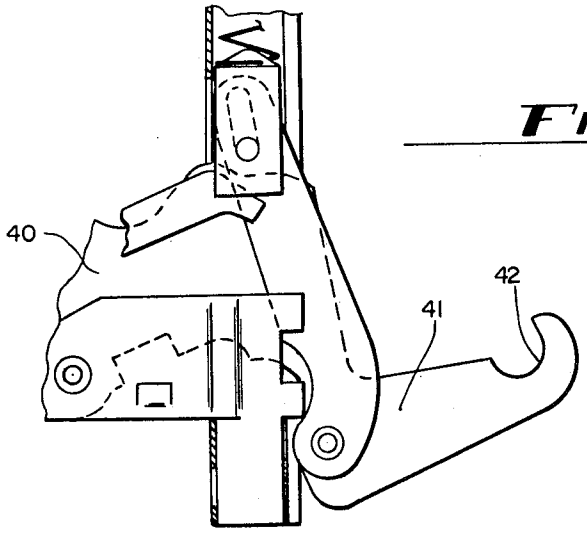
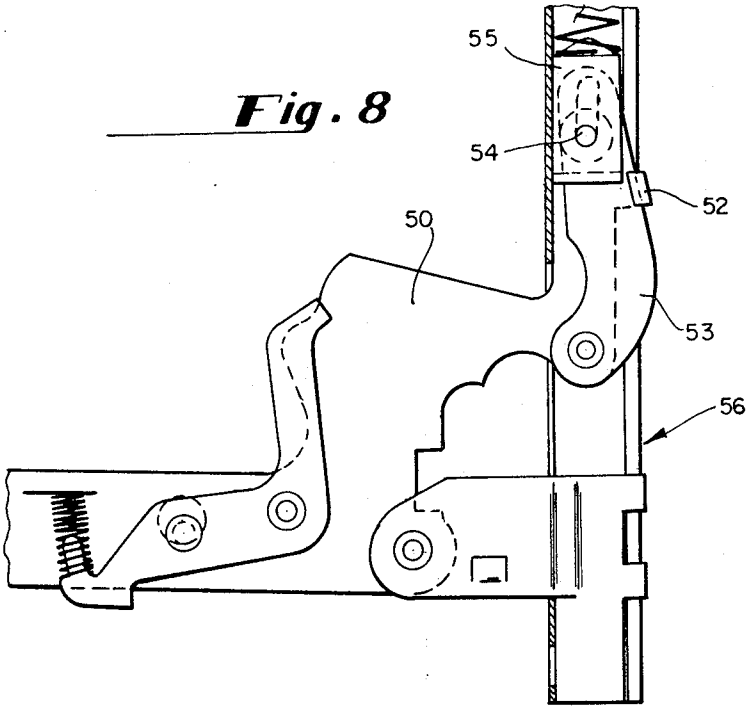


Fig. 8



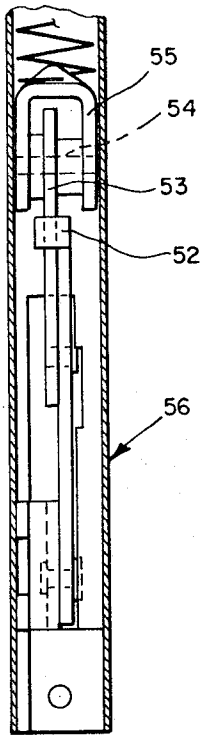


Fig. 9

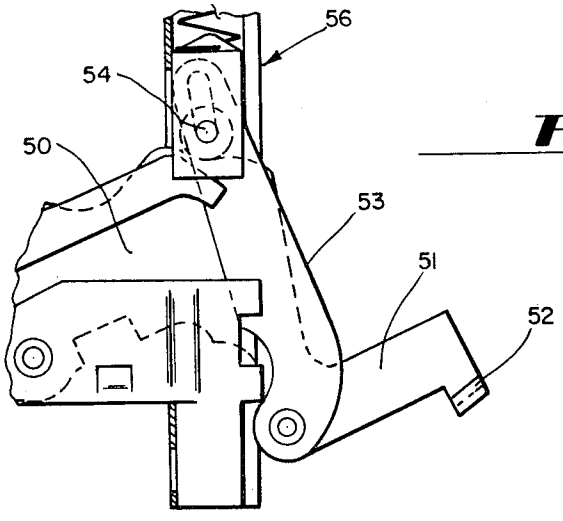


Fig. 10

DOOR HINGE

This invention is a substantial improvement in the hinge structure of U.S. Pat. No. 3,503,380.

The hinge of the present invention not only provides various advantages of the hinge of U.S. Pat. No. 3,503,380 but additionally has structural features which extend the versatility and increase the operating life of the hinge and adapt the same for use in other applications such as door closures.

One of the objects of the invention is to provide a hinge structure of the kind in question which uses a lever system to compress the spring and thereby eliminate cam wear, the elimination of wear being condusive to prolonged life, reduced maintenance and smoother operation.

Another object of the invention is to provide a hinge structure of the kind in question which has a lever and pivot system which will lock the oven door in open position and thereby eliminate dependence on the weight of the door to maintain the same in open position.

Another object of the invention is to provide a hinge structure of the kind in question having a lever system interposed between the compression spring and the oven door supporting arm, the lever system operating to compress the spring upon opening of the door so as to develop a counterbalancing force and which also provides for detenting of the door in the broil and in the closed positions.

Another object of the invention is to provide a hinge structure of the kind in question which by a simple interchange of compression springs, is adapted for use with either heavy or with the light oven doors, the spring change having no impairing effect on any of the other features of the structure.

Another object of the invention is to provide a hinge of the kind in question which is especially useful for very heavy oven doors by virtue of the structure which, when the door is in the open position, provides a wide bearing area on the hinge casing to thereby form a rigid support not only for the door itself but additionally permits the door to be used as a platform by the housewife when removing (or inserting) heavy articles such as roasts from the oven.

Another object of the invention is to provide a hinge structure of the kind in question which can be used with either the built-in or the free standing type oven without any substantial modifications of parts.

Preferred forms of the invention will be described in connection with the following drawings wherein:

FIG. 1 is a wide elevational view of a hinge structure embodying the invention, the hinge being shown in the oven door open position.

FIG. 2 is an elevational view looking to the left in FIG. 1.

FIGS. 3 and 4 are elevational views of the hinge of FIG. 1 respectively showing the hinge in the broil and in the closed position.

FIG. 5 is a fragmentary view of a modified version of the hinge structure of FIG. 1 which is particularly useful in connection with heavy oven doors.

FIG. 6 is a rear view looking to the left of FIG. 5.

FIG. 7 is a fragmentary view of FIG. 5 with the hinge in the broil position.

FIG. 8 is a modified version of the hinge of FIG. 1 especially useful for heavy door applications, the hinge being in the oven door open position.

FIG. 9 is a rear elevational view looking toward the left in FIG. 8.

FIG. 10 is a fragmentary view of FIG. 8 with components in the broil position.

The conventional cook oven has a hollow body with an access door which is hinged on the bottom. The door is rotatable in a vertical direction as between a closed position wherein the door extends vertically (to seal off the oven) and an open position wherein the door extends horizontally so as to provide free access to the interior of the oven. Most of the conventional ovens require a broil position wherein the door extends at an angle to the vertical so as to leave a small opening between the top of the door and top of the oven. Ordinarily in the broil position the door is removable for cleaning purposes and the like.

The hinge of the present invention relates to an oven having the open, broil and closed positions. It will be understood, of course, that a pair of hinges are used, one on each side of the door.

With reference to FIG. 1 the hinge structure includes an elongated casing 1 which is adapted to be fixed in the frame of a free standing or a built-in type oven. The casing is U-shaped in cross section and the back of the casing (FIG. 2) is provided with a pair of inwardly extending flanges 2 and 3.

A carrier arm is indicated at 4. The carrier arm mounts the oven door indicated by dot-dash lines d. Preferably the mounting is done by the arm being inserted within a socket indicated by dotted line s formed in the door. A pivot bracket 5 is mounted directly on the bottom of the casing 1 and has a pivot means 6 which connects the casing and the carrier arm and provides for the arm (and door) to rotate as between the open position of FIG. 1, the broil position of FIG. 3 and the closed position of FIG. 4. A lever arm is indicated at 10 and a pin 11 operating within the elongated slot 12 on the lever arm forms a pivot means which interconnects the lever arm and the carrier arm and provides for the arms to be relatively rotatable.

Disposed within the casing 1 is a bracket 13. The bracket is slidable up and down the casing. The bracket carries pin 14 operating within an elongated slot 15 formed on the lever arm. The pin and slot arrangement provides a pivot means which interconnects the lever and bracket arm and provides for the lever and bracket to be relatively rotatable. The pin 14 operating within the slot 15 performs additional functions which will be described later.

The open position of the door is defined by the stops 16 and 17 on the lever arm 10, the stop 16 being engaged with the pivot bracket 6 and the stop 17 being engaged with the flange 2.

A compression spring 18 is disposed within the casing 1, the bottom end of the spring engages the bracket 13 and the top end is fixed to the casing by its engagement with the spring retainer 20.

A latch arm 21 is pivotally connected to the carrier arm as by the pivot 22. The latch arm has a latch 23 and a spring 24 biases the latch arm so that the latch 23 extends outwardly as shown. The outward position of the latch arm is determined by the boss 23*a* on the latch arm engaging the bottom of the aperture 4*a* on the carrier arm. The function of the latch 23 is to project into a slot or keeper k on the door socket s and prevent the door from being pulled off from the carrier arm in the

open position. The latch is moved out of the keeper in the broil position as will be explained later. For a typical door-socket-oven arrangement of the kind mentioned reference may be had to U.S. Pat. 3,505,380.

The structure of the hinge provides several distinct functional advantages when the hinge is in the open position. These are commented on following.

The pivot arrangement provides that the door to be automatically locked in the open position. It will be apparent from an inspection of FIG. 1 that the force of the spring **18** is transmitted through the bracket **13**, the pin **14** and thence to the lever arm **10** by virtue of the pin **14** being bottomed in the slot **15**. Also, it will be observed that the centers of the pivots **6** and **14** lie along the same straight line, for example, the line L and that the center of the pivot **11** lies outside of the straight line L. Thus, the force of the spring tending to move the lever arm **10** downwardly will (through the medium of pivot **11** acting in the slot **12**) tends to cause the carrier arm **4** to rotate counterclockwise. The carrier arm **4** will pull on the leverl arm **10** and thus firmly engage the stops **16** and **17**. With this feature it is unnecessary to depend upon the weight of the door to maintain itself in the open position.

Another advantage in the open position is the stop arrangements which not only define the open position but provide a wide bearing area for increasing the rigidity. The stop **16** bears against the pivot bracket **5** which in turn has a section **25** engaging the bottom of the casing **1**. The bearing area therefore comprises the area over which the pivot bracket contacts the casing. Additionally, the stop **17** which bears against the flange **2** augments the over-all bearing area.

With the two point stop as described, not only does the hinge form a rigid support for even the heaviest of doors, but in addition permits the door to serve as a platform for use by the housewife when removing or inserting heavy food items.

In the movement from the open position of FIG. 1 to the broil position of FIG. 3, the hinge operates to counterbalance the door. This is commented on following:

As understood in the trade, the term counterbalancing means a force which may be of a magnitude simply to overcome part of the door weight so that the door is easier to swing upwardly or downwardly or may refer to a force of magnitude which is enough to effectively cancel out the weight of the door, whereby the door will remain stationary if placed in any position between open and broil.

As the carrier arm is moved counterclockwise the pivot arrangement **11** causes the lever arm to slide downwardly in the casing. During the first part of the movement the spring, of course, is compressed at its maximum and therefore exerts a greater amount of force to counterbalance the weight of the door. As the carrier arm and door move up, the effective weight of the door becomes less and the spring force also becomes less by that the lever arm moves down to let the spring expand.

The counterbalance effect is accomplished through the lever system comprising the carrier and lever arm. The force of the spring is not transmitted via a cam surface as is in U.S. Pat. No. 3,503,380. Thus, one of the primary advantages of this arrangement is the elimination of cam wear. Consequently, the hinge is much smoother in operation, its operating life is extended and there is no maintenance due to cam wear.

The carrier arm and door are continually counterbalanced until reaching the broil position of FIG. 3. When the carrier arm has rotated clockwise closely adjacent to broil position, the carrier arm surface **30** picks up the cam roller **31** which then moves into the broil detent **32**. The pin **14** (carrying roller **31**) is spaced away from the bottom of slot **15** as indicated in FIG. 3. At this point it will be seen that the pressure of the spring **18** acting on the bracket **13**, pin **14** and cam roller **31** exerts a force directly on the broil detent **32** so that the cam roller is tightly engaged. The door therefore is firmly held in the partially open or broil position. The structure of the slot **15** to accomplish this purpose therefore is of importance in the operation of the hinge.

In the broil position the oven door can be removed as explained following.

In the broil position the cam surface **33** on the latch arm contacts the latch roller **34**. The latch arm is rotated clockwise against the force of the spring **24**. As a consequence, the latch **23** is extracted from the keeper. This allows the door to be pulled off.

In those instances where it is desired that the door remain permanently attached, the latch bar is not used and screw means such as the screw **35** fixes the arm in the door socket.

As the carrier arm is moved from the boil position of FIG. 3 to the closed position of FIG. 4 the slot **15** permits the lever arm to move while also permitting the cam roller **31** to remain in contact with the carrier arm. When the carrier arm reaches the closed position the abutment **36** on the carrier arm contacts the abutment **37** on the pivot bracket. The engagement defines the closed position. At this time the cam roller **31** is on contact with the closed detent **38**.

The pin **14** (carrying the roller **31**) is spaced away from the bottom of the slot **15**. The pressure of the spring **18** acting on the bracket **13**, pin **14** and cam roller **31** exerts a force directly on the closed detent **38**. Thus, the cam roller **31** is tightly engaged and the door is firmly held in the closed position.

From the foregoing description it will be apparent from those skilled in the art that the compression spring **18** can be of a size which is compatible with the amount of force necessary for the counterbalancing function. Thus, the spring can be much heavier or lighter or can even be compounded to provide the necessary counterbalancing force. It will be apparent that regardless of the size or force developed by the spring for counterbalancing the lock-out function in the open position and the detenting functions in the broil and closed positions are not affected.

The modification shown in FIGS. **5–7** is essentially the same in function and operation as the hinge just described with the principal exception that the carrier arm rather than the lever arm is used to attain wide bearing support in the open position. Thus, with particular reference to FIG. 7 it will be seen that the carrier arm **40** has an extension **41** having a hook-like end **42**. When the carrier arm is in the open position of FIG. **5** it will be observed that the hook-like end **42** makes contact with the cam roller **43**. This engagement defines the open position. The force exerted by the

hook-like end 42 on the cam roller is transmitted through the roller, through the pin 44 to the bracket 45 and thence into the bottom part of the casing 46. In this way the thrust or force is distributed over a wide area on the casing.

FIGS. 8, 9 and 10 show a further modification which in function and operation is substantially the same as the hinge in FIG. 1 except that the carrier arm is modified to provide for a wide bearing in the open position. The carrier arm 50 has an extension 51 on which is a stop 52. When the hinge is in the open position as indicated in FIGS. 8 and 9, the stop 52 engages the lever arm 53, the force generated by the stop 52 on the lever arm 53 is transmitted from the lever arm to the pin 54, into the bracket 55 and thence to the bottom of the casing 56. The open position is defined by the engagement of the stop 52 and lever arm 53.

Returning to the hinge structure of FIGS. 1, 2 and 3 the combined lever arm structure has the additional advantage of adapting the same for use in free standing and built-in ovens without change. Thus, it will be observed that in any of the open, broil or closed positions of the hinges the carrier arm and/or lever arm extends substantially flush with the bottom of the casing. There is no substantial extension of any parts below the bottom of the casing. In this way it is possible for the hinge structure to fit inside of the oven frame work even in those cases where there is an overhand without modification for downwardly extending parts.

Another important feature of the invention is the fact that the structure is easily and readily adaptable for use in those applications where the stove manufacturer desires to use the conventional tension spring. The manner in which this is accomplished is explained following.

With reference to FIG. 1 the hinge structure is assembled without the compression spring 18, the spring retainer 20, the latch arm 21 and the spring 24. When the modified structure is set up in the oven, the end of the tension spring can be connected to the lever arm by inserting the spring hook into the aperture 60 in the lever arm 10.

In the tension spring arrangement just described, it is important that the slot 15 be configured so that in the closed position the spring will pull down on the lever arm and cause the stop end of the slot to engage the pin 14. This will pull the cam roller down tight against the closed detent. Also, with this arrangement, it is preferred that the slot 12 be somewhat elongated. This provides for a smoother operational characteristic of the hinge.

In certain instances it may be desirable that the door be somewhat overbalanced, that is to say, when moved from the open position upwardly the spring exerts a force which is greater than the force necessary for counterbalancing and thus tend to assist the door in its upward rotation. For such purposes, of course, the spring is selected to produce the desired result.

Before closing, it is pointed out that the lever system for moving the compression spring, particularly the feature of the minimum outward extension of the lever arm, nicely adapts the structure for use in other applications, for example, door closures. For this purpose means are provided to attach the casing to a door jam together with means to connect the carrier arm to the door including a sliding connection to take into account the effect of the door hinge axis and the pivot axis being off-set. In such an application the spring is chosen so that as the door is moved to an open position, a force will be exerted tending to cause the door to close.

I claim:

1. A structure to be connected between two relatively rotatable members for developing a torque for rotating the members in a direction toward each other:
- an elongated casing having means for connecting the casing to one of the members;
- a first arm having means for connecting the arm to the other of the members;
- first pivot means connecting the casing and the first arm and providing for the same to be relatively rotatable toward and away from one another;
- a second arm;
- second pivot means connecting the second arm to the first arm and providing for the arms to be rotatable relative to one another;
- a bracket slidably mounted on the casing;
- third pivot means connecting the second arm and the bracket and providing for the second arm to rotate relative to the bracket;
- a compression spring on said casing, one end of the spring being fixed to the casing and the other end engaging the bracket; and
- the structure operating as follows: relative rotation of said members in a direction away from one another to a position causing the arms to relatively rotate, the latter motion causing the second arm to push the bracket along the casing and thereby compress the spring, the compression of the spring developing a counteracting torque operating to rotate the members away from said position in a direction toward each other.

2. A hinge structure providing for one member to rotate relative to another in a vertical direction as between first and second positions with the weight of the rotating member being counterbalanced;
- an elongated casing adapted to be mounted in a fixed position on one member wherein the casing extends vertically;
- a rotatable carrier arm having means for supporting the member to be rotated;
- pivot means connecting the casing and the carrier arm and providing for the arm to rotate relative to the casing in a vertical direction as between the first and second positions, the weight of the member mounted on the carrier arm developing a torque to cause the member and the carrier arm to rotate about the pivot in a downward direction;
- a lever arm;
- pivot means connecting the lever arm to the carrier arm and providing for the arms to be rotatable relative to one another;
- a bracket slidably mounted on said casing;
- pivot means connecting the lever arm and the bracket and providing for the same to be rotatable relative to one another; and
- a compression spring on said casing, one end of the spring being fixed to the casing and the other engaging the bracket, relative rotation of the carrier arm in a downward direction causing the lever arm

to push the bracket along the casing and thereby compress the spring, the compression of the spring developing a torque on the carrier arm to counterbalance the weight of the member.

3. A hinge structure for a cook oven having a hollow body with a door providing access to the body, the hinge permitting the door to rotate in a vertical direction relative to the body as between closed, broil and open positions;

an elongated casing adapted to be mounted in a fixed position on the body of the oven wherein the casing extends vertically;

a rotatable carrier arm having means for supporting an oven door for rotation therewith;

pivot means connecting the casing and carrier arm and providing for the arm and the door mounted thereon to rotate in a vertical direction as between the closed, broil and open positions, the weight of the door developing a torque to cause the door and the carrier arm to rotate about the pivot in a downward direction;

a lever arm;

pivot means connecting the carrier arm and the lever arm and providing for the arms to be rotatable relative to one another;

a bracket slidably mounted on the casing;

pivot means connecting the lever arm and the bracket and providing for the same to be rotatable relative to one another and to provide for relative sliding motion as between the bracket and the lever, the pivot comprising a pin mounted on the bracket and a slot on the lever arm within which the pin is disposed;

means on said carrier arm forming a closed detent and also forming a broil detent, the detents to be respectively engaged by a cam roller for establishing the closed and broil positions of the carrier arm;

a cam roller on said pin for engaging the detents respectively in the closed and the broil positions; and

a compression spring on the casing, one end of the spring being fixed to the casing and the other engaging the bracket and operating to push the bracket, the pin and cam roller along the casing in a direction toward the lever arm.

4. A construction in accordance with claim 3 wherein, for the open position of the carrier arm, the pivot means connecting the lever arm and the bracket and the pivot means connecting the carrier arm and the casing lie along a straight line and the pivot means connecting the cam and lever arms lies outside of the line in a direction whereby the spring develops a torque on the carrier arm tending to rotate the arm in a downward direction and further including stop means defining the open position.

5. A construction in accordance with claim 3 further including an abutment on the pivot means connecting the casing and the carrier arm and an abutment on the carrier arm, the two abutments engaging to define the closed position.

6. A construction in accordance with claim 3 further including abutment means on the casing and abutment means on the lever arm, the two abutments engaging one another in the open position whereby to define that position.

7. A construction in accordance with claim 3 further including a flange on the lever arm engaging the casing in the open position.

8. A construction in accordance with claim 3 further including an abutment on said carrier arm which, in the open position, engages the cam roller to define the open position.

9. A construction in accordance with claim 3 further including an abutment on said carrier arm adapted to engage the lever arm in the open position whereby to define the same.

10. A construction in accordance with claim 3 further including:

a door latch arm pivotally mounted on said carrier arm;

a latch formed on the latch arm for engaging a keeper, the keeper being formed on a door mounted on said carrier arm;

a spring normally biasing the latch arm to rotate so that the latch is engaged with the keeper whereby in the open position the door cannot be removed from the carrier arm;

a cam formed on the latch arm; and

a second cam roller on said pin adapted to be engaged by the cam on the latch arm when the door is in the detent position to rotate the arm so as to disengage the latch from the keeper whereby the door can be removed from the arm.

11. A hinge structure for a cook oven having a hollow body with a door providing access to the body, the hinge permitting the door to rotate in a vertical direction as between open and closed positions;

an elongated casing adapted to be mounted in a fixed position on the body of the oven wherein the casing extends vertically;

a rotatable carrier arm having means for supporting an oven door for rotation therewith;

pivot means connecting the casing and carrier arm and providing for the arm and the door to rotate in a vertical direction as between open and closed positions;

a bracket slidably mounted on the casing;

a compression spring on the casing, one end of the spring being fixed to the casing and the other engaging the bracket;

means connected between the carrier arm and the bracket to cause the bracket to slide along the casing with rotation of the carrier arm;

a door latch lever arm pivotally mounted on said carrier arm;

a latch formed on the latch arm;

a keeper for the latch formed on the door;

a spring normally biasing the latch arm to rotate to disengage the latch from the keeper whereby in the detent position the door can be removed from the carrier arm;

a cam formed on the latch arm; and

a cam roller on the bracket and adapted to be engaged by the cam on the latch arm when the door is in the open position to rotate the arm so as to insert the latch in the keeper whereby to prevent the removal of the door.

12. A hinge structure for a cook oven having a hollow body with a door providing access to the body, the hinge permitting the door to rotate in a vertical direction relative to the open body as between closed

and open positions, the weight of the door being counterbalanced during the movement and the structure comprising:

an elongated casing adapted to be mounted in a fixed position on the body of the oven wherein the casing extends vertically;

a rotatable carrier arm having means for supporting an oven door for rotation therewith;

pivot means connecting the casing and the carrier arm and providing for the arm and the door mounted thereon to rotate in a vertical direction as between closed and open positions, the weight of the door developing a torque to cause the door and carrier arm to rotate about the pivot in a downward direction;

a lever arm;

pivot means connecting the lever arm to the carrier arm and providing for the arms to be rotatable relative to one another;

a bracket slidably mounted on said casing;

pivot means connecting the lever arm and the bracket and providing for the arms to be rotatable relative to one another;

means on said lever arm to accept one end of a tension spring, the other end of which is adapted to be connected to the body of the oven;

rotation of the carrier arm in a downward direction causing the lever arm to rotate on the carrier arm and slide the bracket along the casing, the movement of the lever arm being resisted by the tension spring, the tension of the spring developing a torque on the carrier arm to counterbalance the weight of the door.

13. A construction in accordance with claim 1 having a construction whereby the members when moved relatively apart to a predetermined position, the first and third pivot means lie in the same straight line and the second pivot means lies outside of the line and the said pivot positions causing the torque developed by the spring to move the members relatively in a direction away from one another.

14. A hinge structure for a cook oven having a hollow body with a door providing access to the body, the hinge permitting the door to rotate relative to the body in a vertical direction as between open and closed positions, the hinge comprising:

an elongated casing adapted to be mounted in a fixed position on the body wherein the casing extends vertically and mounts the hinge on the oven;

a rotatable carrier arm constructed to support an oven door for rotation therewith;

pivot means connecting the casing and the carrier arm and providing for the arm to rotate relative to the casing in a vertical direction as between the open and closed positions; to provide for the door to be rotatable as between the open and closed positions;

a lever arm;

pivot means connecting the lever arm to the carrier arm and providing for the arms to be rotatable relative to one another;

a bracket slidably mounted on said casing;

pivot means connecting the lever arm and the bracket and providing for the same to be rotatable relative to one another;

a compression spring mounted on the casing, one end of the spring being fixed to the casing and the other end engaging said bracket and the force of said spring being transmitted to the carrier arm via the bracket and lever arm; and

the parts operating as follows: when the carrier arm rotates toward the open position, the lever arm also rotates and the bracket slides along the casing in a direction whereby the spring is compressed; and when the carrier arm rotates toward the closed position, the lever also rotates and the bracket slides along the casing in a direction whereby the spring expands.

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