United States Patent

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[54] **ROTARY THERMAL LOCK WITH SLIP CLUTCH**
10 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **292/210,** 126/197; 292/113
[51] **Int. Cl.** **E05c 3/30**
[50] **Field of Search** ..... 292/113, 153, 196, 210, 223, 242, (LOF), (U377), (WMCL), 108; 70/(B-10); 126/197

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ABSTRACT: A thermally controlled lock for rendering inseparable a door latching device, comprising a rotary locking member movable under thermal control into a position to prevent operation of the latching device at a predetermined elevated temperature, the locking member having associated therewith means for preventing further rotary movement of the locking member upon continued temperature rise, and a slip clutch for permitting continued rotary movement of the supporting means for the locking member, which clutch functions to remove the locking member from locking position upon decrease in temperature before the supporting means returns to its initial position.

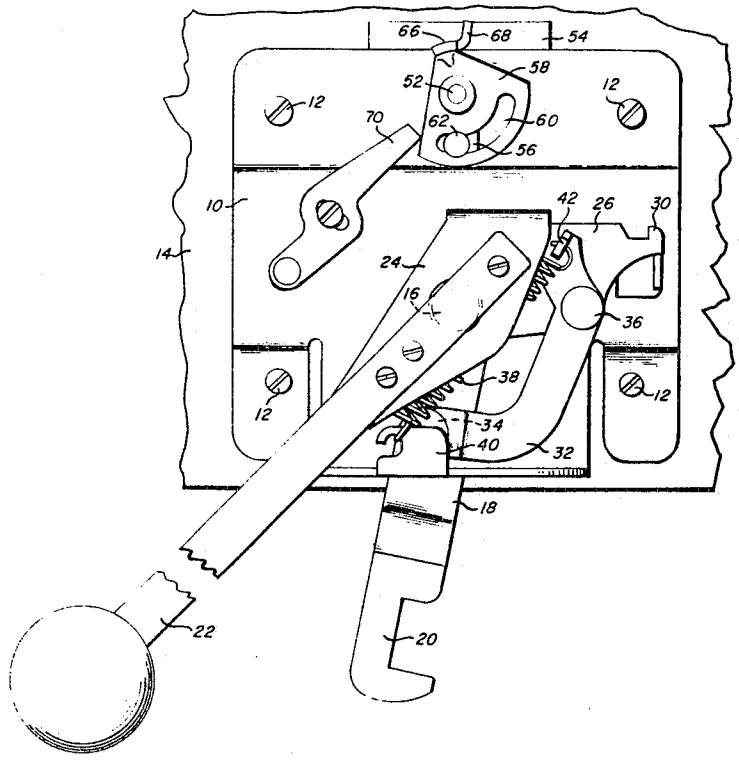


FIG. 1

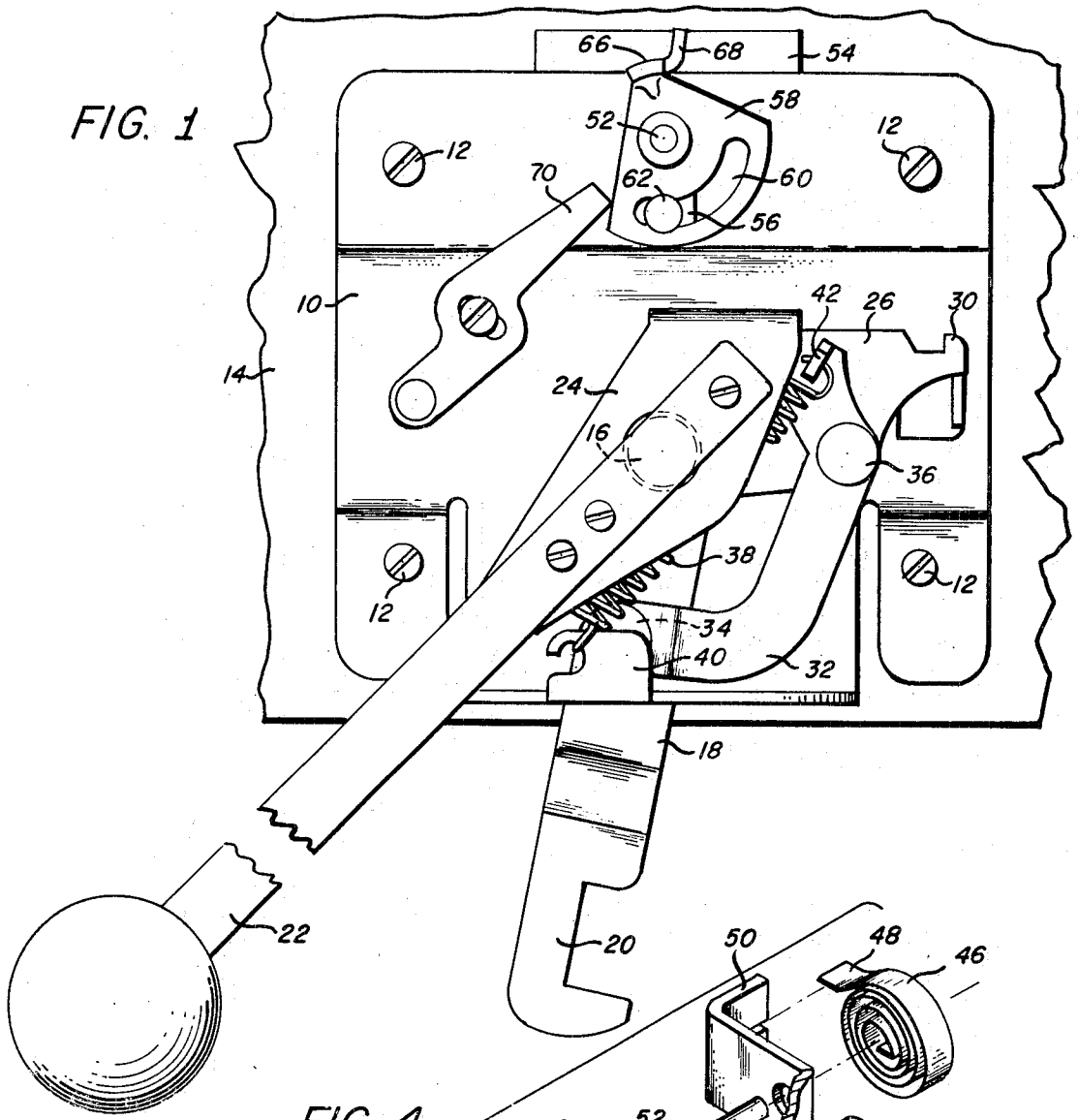
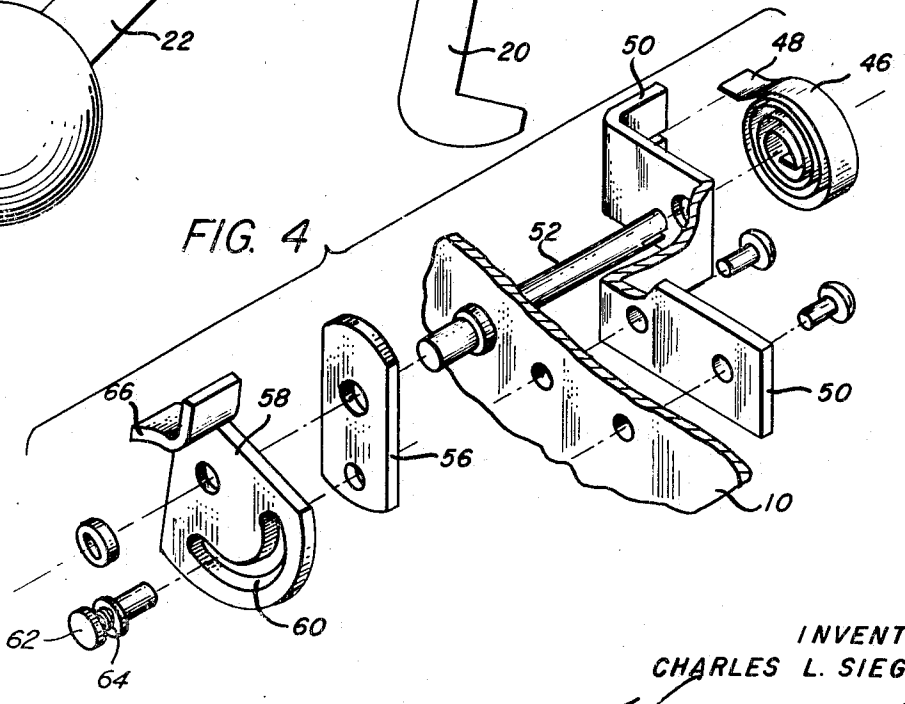


FIG. 4



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FIG. 2

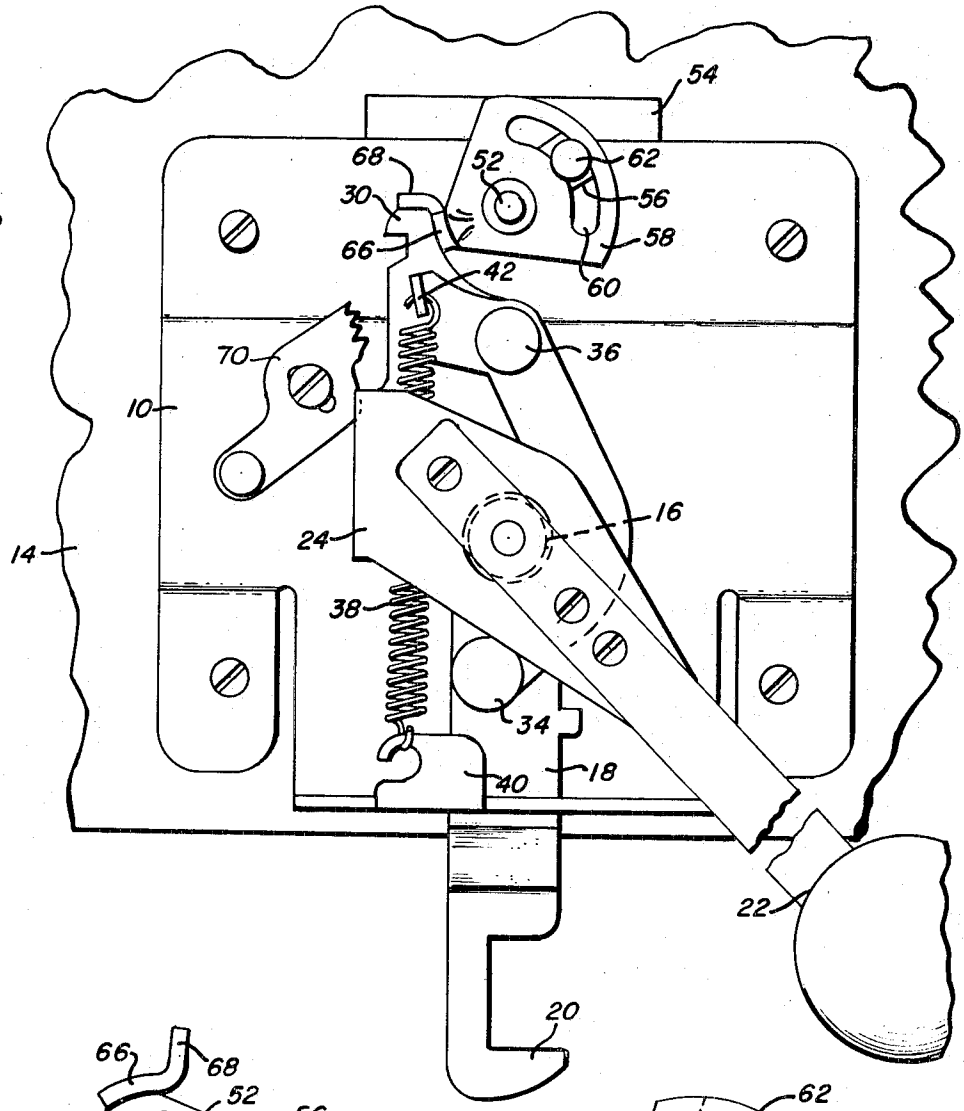


FIG. 5

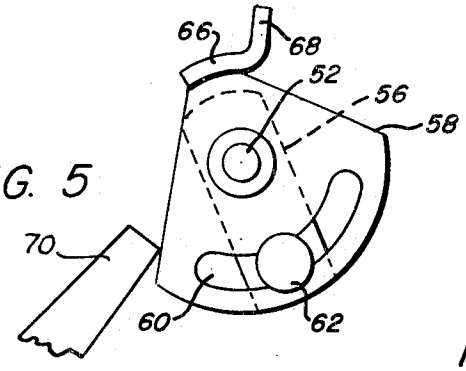
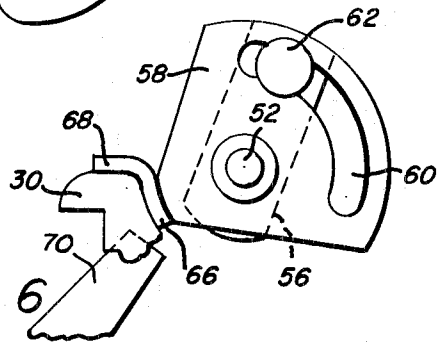
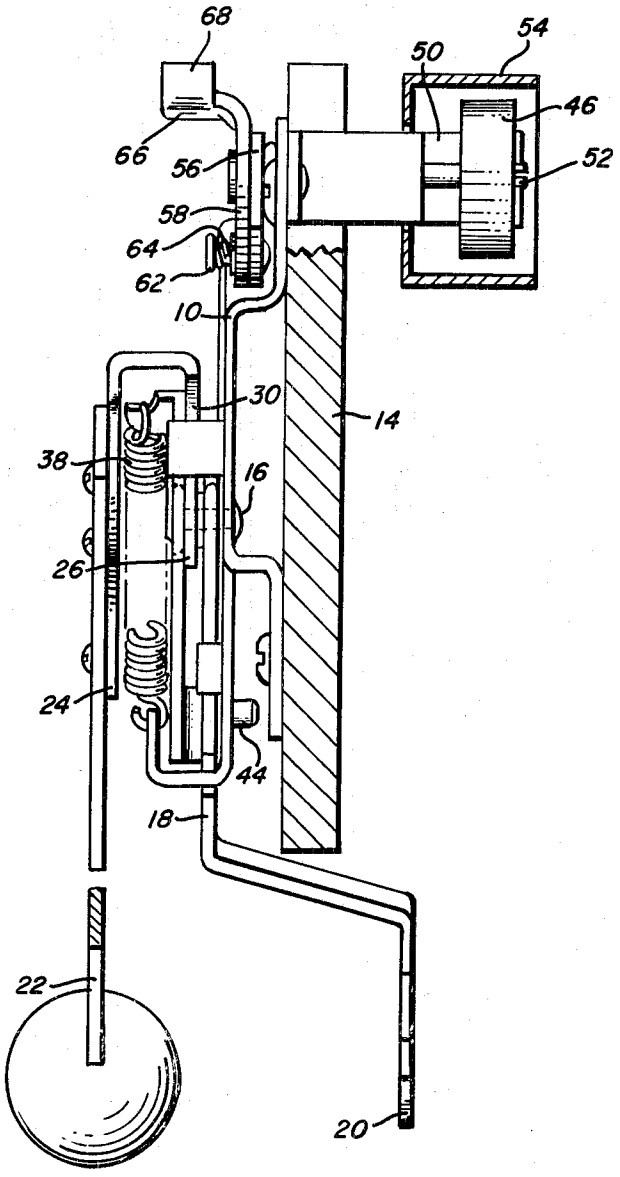


FIG. 6



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FIG. 3



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ROTARY THERMAL LOCK WITH SLIP CLUTCH

BACKGROUND OF THE INVENTION

In the manufacture and use of thermally controlled locks, such as may be used in appliances which are operated at relatively high temperatures, it has been found desirable to provide means for selecting the unlocking temperature as well as the locking temperature of a thermal lock. Heretofore, only one temperature, either the locking or unlocking temperature, could be chosen, with the other temperature being determined by the inherent properties of the bimetal coil of the thermal lock. This is especially true in household ovens of the so-called "self-cleaning" type which require the use of oven temperatures approaching or even exceeding the range of 900—1100 °F. for pyrolytic cleaning of the inner walls thereof. For assuring safety of an operator, it is required that the oven door be locked whenever the oven reaches a predetermined minimum temperature and that it stay locked until the temperature is thereafter reduced to a predetermined same of different level.

For example, in a self-cleaning oven, the door may be safely opened during normal baking or broiling operations wherein oven temperatures never exceed about 650°F. However, when the oven is operated in a "self-clean" cycle, the oven door must be locked when the oven temperature reaches about 675°F., for example, and must remain locked until the cleaning cycle is completed and the oven temperature reaches a safe level of, for example, not more than about 550°F., at which time the oven can again be used for normal bake or broil operations.

The prior art teaches that a rotary thermal lock may be operated to perform a locking function when the oven air temperature reaches the predetermined level. This is achieved by employing a bimetallic coil which, upon thermal expansion, causes rotary movement of a locking member. It has been found, however, that, where the locking mechanism is remote from the temperature-controlled area, the lock must be adjusted in accordance with the differences in temperature. For example, in a self-cleaning oven structure, the door latching and locking mechanism is not located within the oven but is positioned above the oven below the cooktop. Therefore, the thermal element will become heated more slowly than the oven interior. In such a case, the lock may be adapted to function when the thermal element is heated to about 500°F., at which time the oven air temperature is at a level of about 675°F.

Conversely, it has been found that the oven cools faster than the thermal element. If the element is intended to unlock the door when the oven temperature is reduced to about 550°F., for example, it will actually perform its unlocking function when the oven temperature is about 400°F. Thus, the oven cannot be used for normal bake or broil operations for a much longer period of time than is actually necessary. This is often inconvenient.

This problem is created at least in part by the fact that when the thermal element operates to rotate the locking element into a position where it locks the door at 675°F. oven temperature, continued increase in temperature will cause the thermal element to rotate the locking element a still greater amount. Consequently, when the oven is cooling, the locking element must return along its path of movement a considerable distance before it releases the door. In the meantime, the oven has cooled to a much lower temperature than is actually required.

SUMMARY OF THE INVENTION

In accordance with the present invention, means is provided for limiting the extent of movement of the locking member during the heating cycle and thereafter, during the cooling cycle, for moving the locking member only a relatively short distance to unlocked position, while permitting the thermal element to unrestrainedly move the supporting means for the locking element throughout its full extent consistent with thermal expansion and contraction of the thermal element. Such means includes an extension, stop, dog, or the like on the locking member which engages the door-latching or other device when the locking member is in locking position and prevents further movement of the locking member during the heating cycle. The means further includes support means upon which the locking member is mounted in such a manner that when the locking member is prevented from further movement during a heating cycle the support means will continue movement in response to the thermal element entirely independently of the locking member. The locking member and support means during the heating cycle move together as a unit until the locking member engages the latching device or other stop means. Thereafter, during the cooling cycle the support means and locking member again move together as a unit, but in the opposite direction, whereby the locking member releases the latching device in a shorter time interval than is permitted in prior art devices. The support means comprises a plate mounted on the thermal element for rotation about the same axis. Sliding movement of the plate with respect to the locking member is permitted by a slot and pin arrangement, with spring means being provided to ensure cooperative simultaneous rotary movement of the two parts except when the locking member engages the stop, after which relative movement is effected against the resistance of the spring.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a top plan view of a latching and locking device embodying a preferred form of the invention shown in unlatched position;

FIG. 2 is a view similar to FIG. 1 showing the device in latched position;

FIG. 3 is a side elevational view partly in section of the device shown in FIG. 1;

FIG. 4 is an exploded view of the parts of the thermal control and locking elements;

FIG. 5 is an enlarged view of the locking elements of the invention showing the device in unlocked position; and

FIG. 6 is an enlarged elevational view similar to FIG. 5 showing the locking elements in locked position with respect to the latch.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings wherein like characters of reference designate like parts throughout the several views, there is shown in FIG. 1 a combination latching and locking device wherein both parts of the device are in inoperative position. The operative elements of the device are mounted on a base plate **10** which may be suitably mounted as by screws or the like **12** upon a support **14**.

Hingedly mounted as by a pivot **16** to a central portion of the base plate **10** is one end of latch arm **18** having at its opposite end a latch portion **20** which is shaped to engage and latch with a suitable cooperative member (not shown) for the purpose of latching the member in a closed position. For example, this device may be utilized with the door of an oven and may be, for this purpose, mounted upon a portion of the oven in a position where the latching portion **20** cooperatively engages with a portion of the oven door for the purpose of latching the door in closed relation with respect to the oven cavity.

The latch **18** is shown in FIG. 1 in open or unlatched position. In order to operate the device, there is provided a manually operable handle **22** which is provided with one end extending freely outwardly from the device and with its other end suitably attached to a yoke **24**. Yoke **24** is substantially U-shaped, as shown clearly in FIG. 3, with the portion thereof to which handle **22** is attached being disposed outwardly with

respect to a parallel portion 26 thereof. Portion 26 of the yoke is rotatably mounted with latch 18 on pivot 16, but independently of the latch as will be described, and is provided with an outwardly or radially projecting portion 30, hereinafter called a jam. When handle 22 is moved in a counterclockwise direction to the position shown in FIG. 2, the outer yoke portion 24 will move simultaneously about the axis of pivot 16 and will move with it the inner plate or jam portion 26. This is accomplished through a linkage which comprises an angled arm 32 having one end fixedly connected to latch 18 as by rivet 34 and having its other end pivotally connected by pivot member 36 to jam portion 26. Thus, when handle 22 is moved in a counterclockwise direction, as stated, it will effect simultaneous rotary movement of the latch 18 through arm 32 and jam portion 26 to a position where the latch 20 on member 18 will become suitably engaged in order to latch the oven door or other device with which this invention is to be used. A coil spring 38 is provided to maintain tension in these parts and is connected at one end to a flange 40 which is struck upwardly out of the base plate 10 for this purpose, the other end of the spring 38 being connected to a hook 42 formed on the far end of angled arm 32. Thus, all operation of the latching mechanism is accomplished against the tension exerted by the spring 38. Movement of the latch 18 is controlled by a guide in the form of a pin 44 (FIG. 3) which extends outwardly from rivet 34 in a rearward direction and which engages with and slides within an angled slot (not shown) provided therefor in base plate 10. The upper end of the latch 18 is also provided with a longitudinally extending slot (not shown) so that it may slide with respect to pivot 16 as the latch 18 is moved.

The device described in the foregoing constitutes known prior art and, therefore, greater detail of the structure and operation is not believed necessary here.

It will be understood that, when the latch is in the position shown in FIG. 2, the jam element 30 is extended in a direction opposite to the latch portion 20.

In accordance with the present invention, novel means is provided for locking the latching device in latched position so that the latching device may not be operated to unlatch the door until a predetermined selected time. For example, if the device is to be used in an appliance such as a self-cleaning oven, wherein the oven may be used for normal bake or broil operations or for self-cleaning operation, it is desired that the latch be operable at all times during the bake or broil operations so that the housewife or cook will at all times have access to the interior of the oven during these operations. However, during a self-clean operation, it is desired that the oven door be locked so that the cook will not have access to the interior of the oven because the oven assumes temperatures of dangerous levels. Therefore, applicant has provided a novel lock which comprises a thermal element 46 (FIGS. 3 and 4) which is adapted to be located in an area subject to the heat to be controlled. The thermal element may comprise a bimetallic element formed in the configuration of a coil, as shown in FIG. 4, with the outer end 48 thereof being restrained by a suitable restrainer 50 and with its other end being supported within a slot in a pin or rod 52. The restrainer 50 is immovably fixed to the base plate 10, and the pin or rod 52 extends through the base plate 10 for free rotation therein. Thus, when the thermal element 46 expands and contracts in response to thermal changes, it will cause resultant rotation of rod 52 about its longitudinal axis. The thermal element may be protected, if desired, by a suitable enclosure 54. Mounted on the end of rod 52 opposite thermal element 46 is a plate or arm 56 upon which is freely superimposed a locking plate 58. Arm 56 and plate 58 are both mounted on rod 52, arm 56 being rigidly affixed to rod 52 to rotate therewith in response to thermal element 46, while locking plate 58 is freely rotatable thereon. Locking plate 58 is provided with an arcuate slot 60 which is adapted to receive a pin 62 fixedly carried by arm 56. The outer end of pin 62 is provided with a head portion to provide means for retaining between it and plate 58 a coil spring 64. Thus, through the tension exerted by spring 64, motion of arm 56 is transmitted through pin 62 to plate 58, whereby the plate 58 will be caused to rotate with arm 56.

At an end of the plate 58 opposite slot 60 there is provided a lock or dog member 66 which, upon rotation of plate 58, is adapted to be moved into a position to block movement of the jam 30 on the latch mechanism when the latching mechanism is locked in latching position as shown in FIG. 2.

In operation of the device, the oven may be heated up to a selected temperature, 675°F. for example, during which time the thermal element will contract or expand only sufficiently to move the plate 58 a short distance which is not sufficient to position the lock 66 opposite jam 30. Therefore, the latching mechanism may be operated at all times at temperatures below the selected temperature. However, when the oven is operated for self-cleaning purposes, temperatures may rise to 1000°F. or higher. Therefore, it is highly desirable that access to the interior of the oven not be permitted. Therefore, since the thermal element has been adjusted to lock the latching device at a temperature above 675°F., the mechanism operates so that at about 675°F. the plate 50 is rotated sufficiently to cause lock 66 to intercept any movement of the jam 30, thus preventing the door from being opened.

However, in accordance with the present invention, there is provided means for preventing undue rotary movement of the plate 58 after lock 66 has been moved adequately into position to lock the latching mechanism. It has been found that when temperatures in the oven increase substantially above 675°F., the thermal element will continue to rotate the arm 56 substantially beyond the initial point necessary to render the latching mechanism inoperable. Thus, when the self-cleaning cycle is over and the oven is allowed to cool, it is necessary for the arm 56 and plate 58 having the lock thereon to return through a substantial amount of its path of travel before the latching mechanism may be released. In such a case, it has been found that an oven will become cooled to a level well below that at which the oven door may be safely opened.

Therefore, in accordance with the present invention, the plate 58 is provided with means for limiting the extent of travel of the locking portion or element 66 thereon. This is achieved by the provision of a lug 68 which extends outwardly at right angles from the lock element 66 and, when the lock element 66 intercepts the jam 30, the lug 68 will abut against the adjacent end of the jam 30 as shown clearly in FIG. 2. This prevents further movement of the lock 66 and plate 58 as heat increases. When this occurs, the thermal element 56, through rod 52, will continue to move arm 56, which will cause the pin 62 to move along slot 60 against the tension exerted by spring 64. In FIG. 2, the device is shown with the pin 62 having traveled along the slot 60 for a distance slightly over half the length of the slot. In FIG. 6, the pin 62 is shown as having moved to a position near the end of the slot 60 at which time the heating cycle is completed. Then, when the appliance is allowed to become cooled, the pressure exerted by spring 64 upon plate 58 and arm 56 will cause the arm 56 to move the plate 58 simultaneously in the reverse direction. This, therefore, causes the lock 66 to be moved out of the path of movement of the jam 30 within a relatively short period of time. Thus, an oven door may be opened when the temperature in the oven is lowered to a level of about 550°F., for example, as opposed to a temperature of about 400°F. at which it opens in the absence of the present invention.

During the initial part of the cooling cycle described above, the pin 62 will maintain its position with respect to the slot 60 until the plate 58 engages a stop 70 (FIGS. 1 and 5) whereupon during the remainder of the cooling cycle continued reverse movement of the arm 56 will be accomplished against the tension of spring 64, until the end of the cooling cycle when the arm 56 and plate 58 will again assume the positions shown in FIG. 1.

From the foregoing, it will be apparent that all of the objectives of this invention have been achieved by the novel mechanism shown and described. It is to be understood, however, that certain modifications may be made in the structure

shown and described without departing from the spirit of the invention as expressed in the accompanying claims.

I claim:

1. A latching device having a latch movable into and out of latched position, a thermal element positioned to assume variations in temperature, and control means responsive to said thermal element when said thermal element varies in temperature for locking and unlocking said latch, said control means comprising a locking member movable into locking relation with said latch at a predetermined locking temperature of the thermal element when the thermal element is subjected to a rising temperature and adapted to remain in locked relation during continued rise in temperature of the thermal element, and means for moving the locking member out of locking relation with the latch during a decline in temperature of the thermal element and at a temperature of the thermal element which is substantially higher than said predetermined locking temperature.

2. A latching device as set forth in claim 1 wherein said control means includes a shaft connected to said thermal element and rotatable in one direction in response to increases in temperature of the thermal element and in the opposite direction in response to decreases in temperature of the thermal element, and an arm fixed tc said shaft and rotatable therewith, the locking member being disposed for rotary movement about said shaft independently thereof, and connecting means connecting the arm and the locking member for effecting movement of the locking member in response to movement of the arm.

3. A latching device as set forth in claim 2 wherein said connecting means is a yieldable connection which permits movement of the arm independently of the locking member when the locking member is restrained from movement in said one direction.

4. A latching device as set forth in claim 3 wherein said connecting means comprises cooperative pin and slot means in said arm and member.

5. A latching device as set forth in claim 4 wherein said locking member has an arcuate slot therein, the pin is mounted on the arm and extends freely through said slot, and a spring is disposed on said pin in engagement with said locking member for yieldably effecting movement of the member in response to movement of the arm.

6. A latching device having a latch movable into and out of latched position, thermal control means including a thermal element for locking the latch in latched position at a predetermined locking temperature of the thermal element, and means connected with said thermal control means for unlocking the latch at a temperature of the thermal element which is substantially higher than said locking temperature.

7. A latching device as set forth in claim 6 wherein said thermal control means includes a thermal element, a locking member movable in response to increases in temperature of the thermal element through a given path of travel to a blocking position with respect to said latch when said predetermined locking temperature of the thermal element is reached, means for preventing additional movement of said locking member during continued increase in temperature of the thermal element through a range of temperatures above said locking temperature, and yieldable means for effecting movement of the locking member in the reverse direction out of blocking relation to the latch during decreases in temperature of the thermal element and while the temperature thereof is still within said range of temperatures above said locking temperature.

8. A latching device as set forth in claim 7 wherein said means for preventing additional movement of said locking member comprises abutment means on said locking member and rotatable therewith, and stop means positioned in the path of movement of said abutment means for engagement thereby when the locking member has moved along said path to an extent sufficient to move it into blocking relation to said latch.

9. A latching device as set forth in claim 7 wherein said yieldable means comprises an arm rotatably movable in opposite directions in response to changes in temperature of the thermal element, the locking member being movable with said arm into blocking relation to the latch, and connecting means between said arm and locking member for yieldably permitting continued movement of the arm with respect to the locking member when the locking member is restrained from movement during increases in temperature of the thermal element above said predetermined locking temperature and for effecting movement of the locking member with said arm in an unlocking direction when the temperature decreases.

10. A latching device as set forth in claim 9 wherein said yieldable means comprises an arcuate slot in said locking member, a pin on the arm and extending freely through the slot, and a spring on said pin and engaging said locking member for yieldably effecting movement of the member in response to movement of the arm.