

June 11, 1968

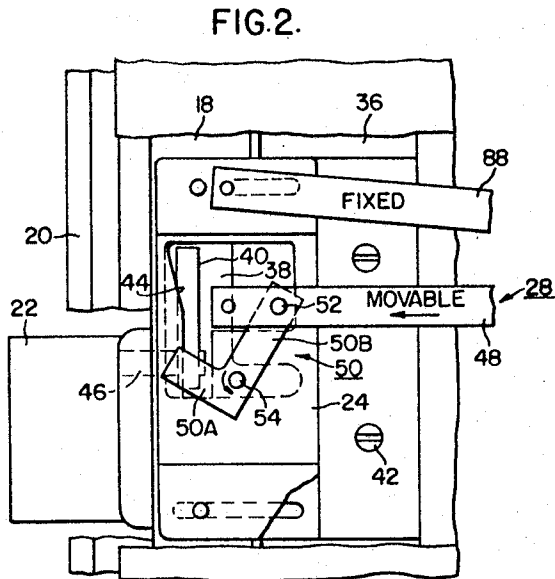
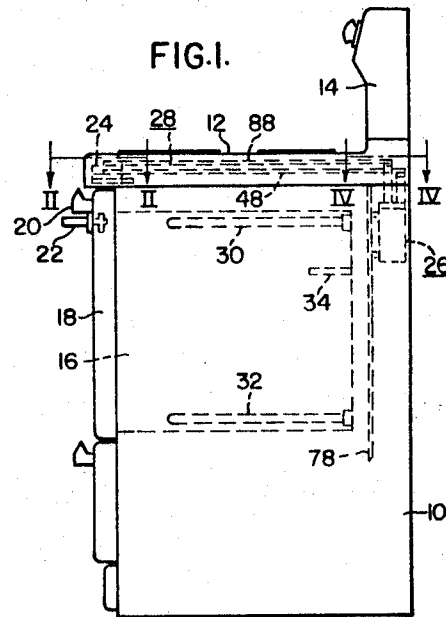
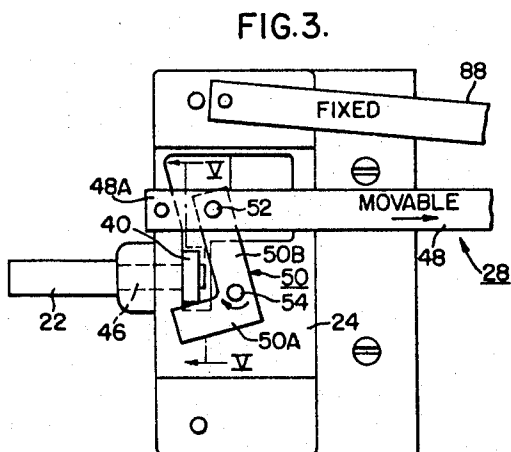
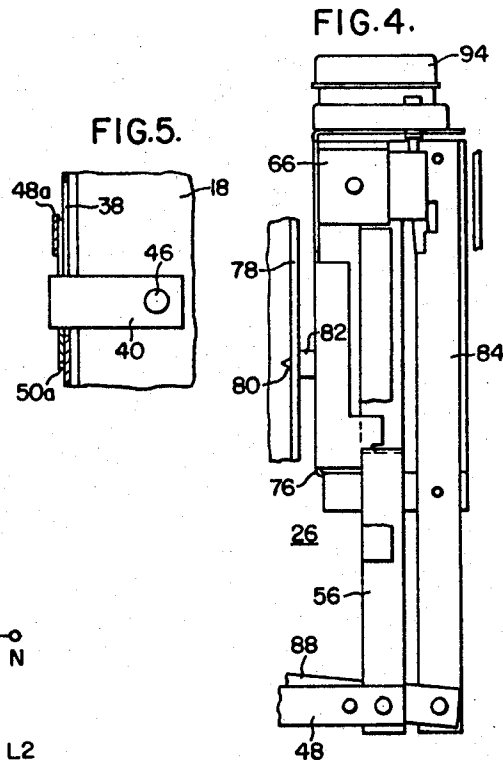
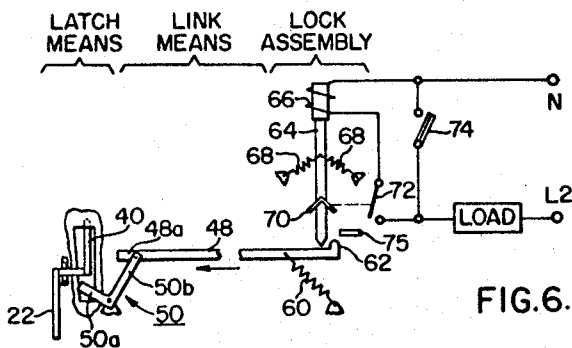
C. J. HOLTKAMP

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HEAT-CLEANING OVEN LATCH AND LOCK MECHANISM

Filed April 28, 1966

4 Sheets-Sheet 1



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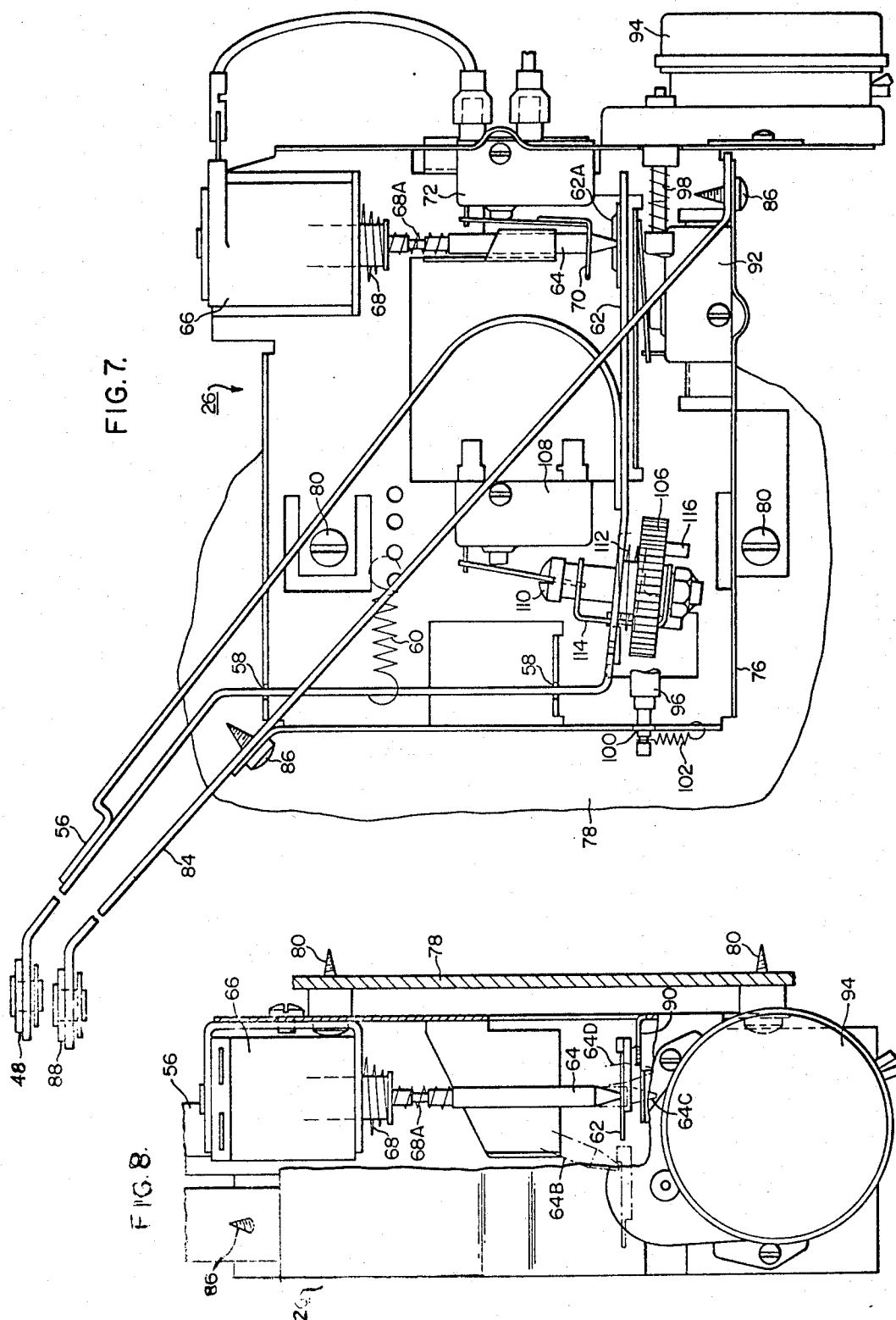
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HEAT-CLEANING OVEN LATCH AND LOCK MECHANISM

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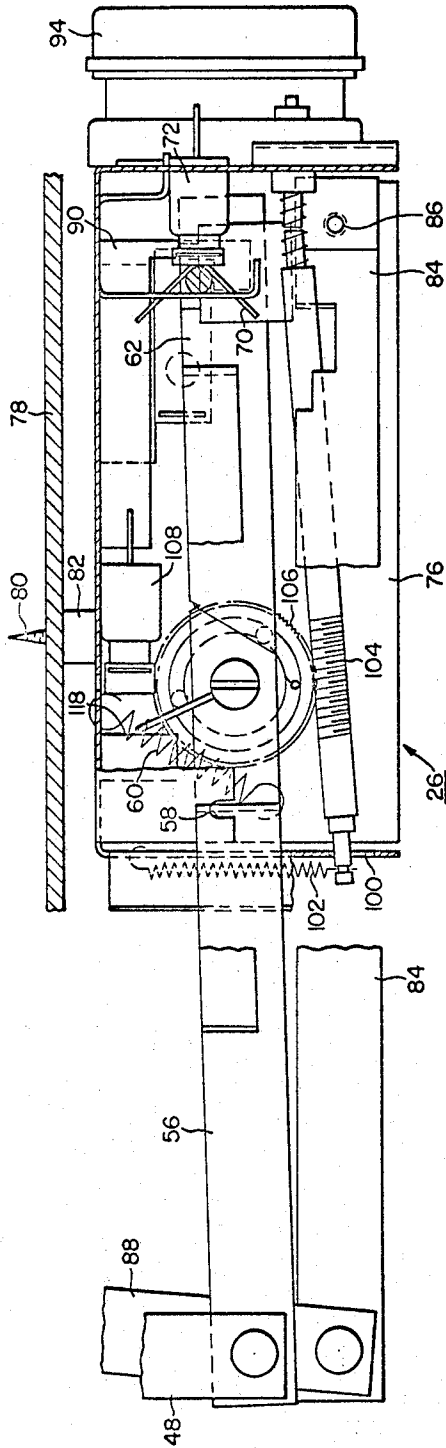
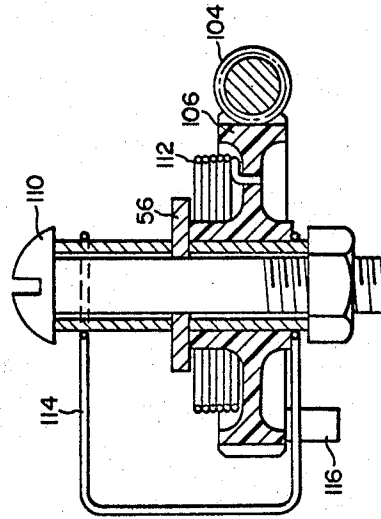
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HEAT-CLEANING OVEN LATCH AND LOCK MECHANISM

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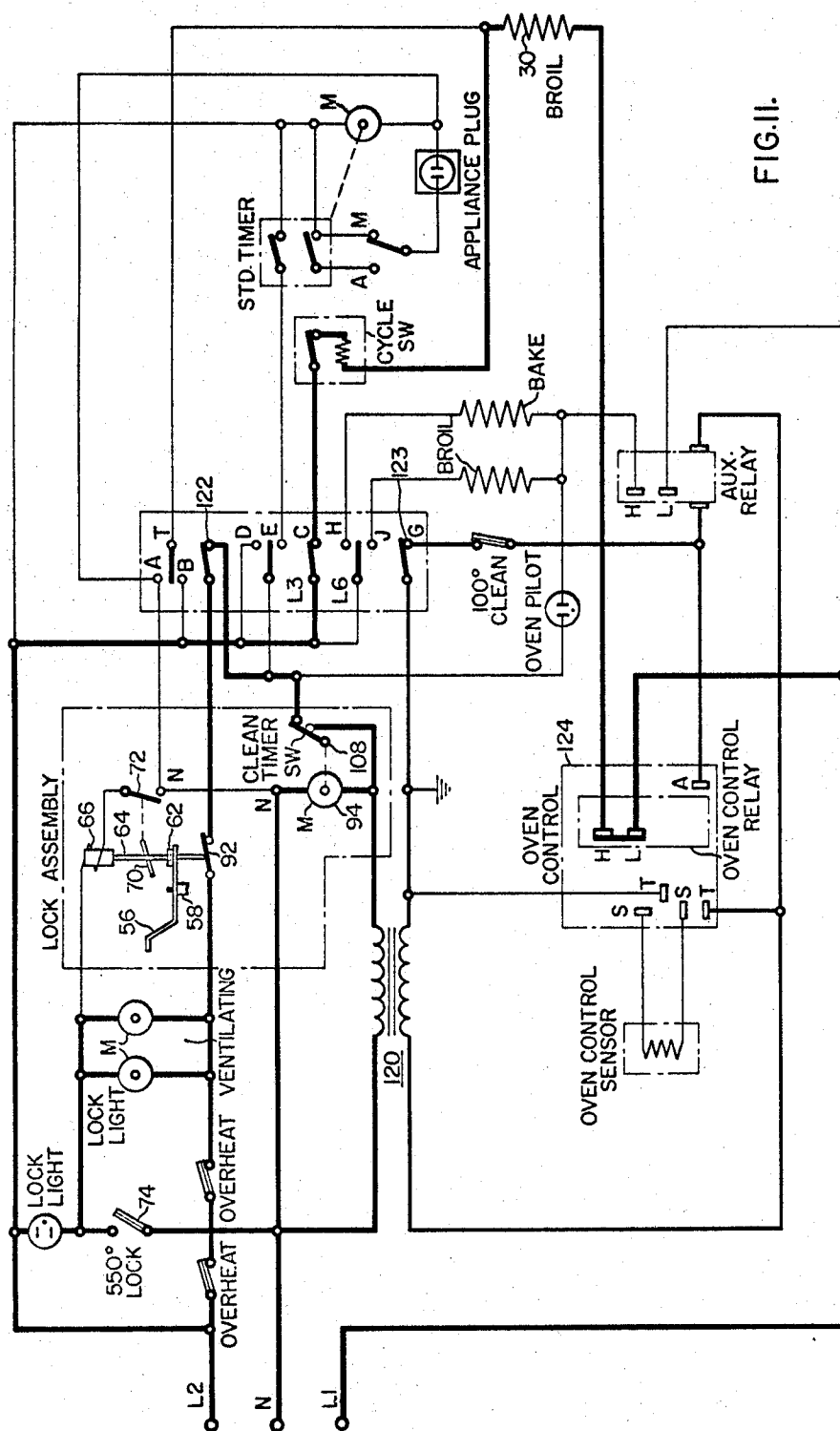
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HEAT-CLEANING OVEN LATCH AND LOCK MECHANISM

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HEAT-CLEANING OVEN LATCH AND LOCK MECHANISM

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6 Claims. (Cl. 292-201)

This invention relates to the type of oven adapted for high temperature cleaning of food soils, and is directed particularly to an improvement of an oven door latching and locking arrangement of the general type disclosed by George W. Nagel, U.S. patent application Ser. No. 545,967, entitled "Oven Door Latch and Lock Arrangement" and filed Apr. 28, 1966.

Both safety requirements and common sense dictate that the oven door of a heat-cleaning type oven be locked shut during the potentially dangerous portions of the heat-cleaning cycle, that is, whenever temperatures in the oven cavity are substantially above normal cooking temperatures.

The invention of the above-noted patent application is concerned with a latching and locking arrangement in which the oven door is latched by physically moving a handle to a position in which the door is mechanically restrained from direct opening before the heat-cleaning cycle temperatures are experienced, and in which the door is locked shut during the high temperature portions of the cycle. The locked shut condition means that the door is latched shut in the sense of being mechanically restrained from direct opening and that the option of cancelling the restraint (which is available while the door is latched only) is not available to the user. It is also considered a practical requirement that the locked condition for the door be automatically effected as the oven temperature rises into the heat cleaning range, and be automatically cancelled when the oven temperature falls below the range.

In the embodiment according to the noted Nagel patent application, the means for effecting the locking of the oven door are located at the rear of the range and the latching means are located at the front of the range. Link means extend from the front to the rear to coordinate the functions of the latching and locking means in accordance with the conditions existing.

In that embodiment the latch means includes a bolt which is turned up to protrude above the edge of the oven door and engage a keeper bracket mounted to the oven frame to project forwardly over the edge of the door. The link means includes a rearwardly biased drawbar connected at its forward end to a bell crank which in turn is secured to the keeper bracket. When the latch means is moved to a latched position the bolt engages and moves an arm of the bell crank which in turn causes the other arm of the bell crank to pull the drawbar forwardly. This places the forward end of the drawbar in a position preventing the movement of the latching bolt in an unlatching direction so long as the drawbar remains in its forward position. The forward movement of the rear end of the drawbar places the locking assembly, at the rear of the oven, in a condition for subsequent locking. This subsequent locking of the door is effected by obstructing the rearward movement of the drawbar through means in the locking assembly responsive to high oven temperatures. Thus, with oven temperatures in the heat-cleaning range, the drawbar is prevented from moving rearwardly

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and accordingly the bolt cannot be moved to an unlatched position because the forward end of the drawbar prevents such movement of the bolt.

Thermal expansion of the range body structure at the high temperatures experienced, tends to destroy the interfering relationship between the forward end of the drawbar and the bolt in a latched position. That is, with the locking assembly fixedly secured at the rear of the oven and the rear end of the link means being connected to cooperate with the locking assembly, thermal expansion of the range body in a front to rear direction moves the keeper bracket forwardly relative to the rear end of the range. This has the same effect as if the drawbar were moved rearwardly. Accordingly, the higher the oven temperature the more likelihood that the interfering relationship between the forward end of the drawbar and the bolt will be lost and an unlocked condition will occur.

A general object of this invention is the provision of an arrangement to prevent this condition from occurring due to thermal expansion of the range body.

I accomplish the object of my invention in one way by mounting the locking assembly at the rear of the range for pivotal movement and then providing means directly connecting the lock assembly to the keeper bracket at the front of the range so that movement of the keeper bracket in accordance with expansion and contraction of the range body will effect pivoting of the lock assembly in accordance with the movement of the keeper bracket. In this way the relationship between the forward end of the drawbar and the latching bolt remains essentially the same regardless of thermal expansion and contraction of the range body.

The invention will be described in connection with the accompanying drawing illustrating a currently preferred embodiment by way of example, and wherein:

FIG. 1 is a side elevational view of a range of the heat cleaning type incorporating the invention;

FIG. 2 is a fragmentary horizontal sectional view corresponding to one taken along the line II—II of FIG. 1 and illustrating the latching means and the forward part of the link means in an unlatched position;

FIG. 3 is a top view of the latching means similar to FIG. 2 illustrating the relationship of parts when the latching means is in a latching position;

FIG. 4 is a fragmentary horizontal sectional view corresponding to one taken along the line III—III of FIG. 1 and presenting a top view of the lock assembly and the rear part of the link means with the parts in an unlocked condition;

FIG. 5 is a fragmentary vertical sectional view corresponding to one taken along the line V—V of FIG. 4 and illustrating the relationship of the bolt of the latching means relative to a part of the link means;

FIG. 6 is a schematic view in the nature of a force diagram illustrating the operating relationship of the latching, linking and locking means;

FIG. 7 is a fragmentary, enlarged rear elevation view of the lock assembly and the rear part of the link means view of the lock assembly and the rear part of the link means located at the rear of the range;

FIG. 8 is a fragmentary end view, partly broken, of the lock assembly as viewed from the right of FIG. 7;

FIG. 9 is a fragmentary plan view of the lock assembly and the rear part of the link means;

FIG. 10 is a vertical sectional view of a part of a timing mechanism; and

FIG. 11 is a schematic view of a currently preferred electrical circuit for a range incorporating the invention.

Range and oven structure (FIG. 1)

The general exterior appearance of the illustrated domestic cooking range incorporating the invention is conventional. It includes an outer housing 10 supporting a top wall cooking surface 12 and a control panel 14 extending along the top rear of the range. The outer housing encloses a forwardly-open oven cavity 16 provided with top and bottom heating elements 30 and 32, respectively, and various thermostatic means represented by part 34. The oven is adapted to be closed by the hinged drop door 18. A fixed handle 20 extends across the width of the door near its top edge and is used for opening and closing the door during normal cooking operations. An operable handle 22 is mounted closely below the fixed handle. By rotating the handle 22 about a quarter turn, a bolt is turned up to project out of the top edge of the door and engage a keeper assembly 24 mounted on the oven framing structure.

It is noted that the latch means has all its movable parts carried by the door 18. The lock effecting assembly generally designated 26, with parts of the timing mechanism incorporated therein, is located at the rear of the range and is connected to function in accordance with the operation of the latch means by link means generally designated 28.

Latch means—Keeper (FIGS. 2-4)

The keeper bracket 24 which receives the latch bolt 40 is mounted on the frame structure 36 which frames the oven cavity front opening. The bracket projects forwardly with the bolt receiving opening 38 located over the top edge of the closed door 18. The bracket 24 comprises two nesting parts, the underlying one being rigidly secured by screws 42 to the oven frame structure 36, and the top one being adjustably secured to the underlying one. The forward edge 44 of the keeper opening is angled relative to plane of rotation of the bolt 40 to provide a cam surface which the bolt engages when the latching means is operated to a latched position. This pulls the oven door 18 toward a sealed position.

Latch means—Operating parts (FIGS. 2-4)

The operating parts of the latch means carried by the door take the general form of a Z-shaped crank pivotal about the axis of the bight portion 46 which is the connecting shaft between the operating handle 22 and the bolt 40. In an unlatched position with the door closed (FIG. 2) the handle 22 extends horizontally in one direction and the bolt 40 extends horizontally in the opposite direction. When the handle 22 is pushed downwardly at its right end (as viewed facing the oven) toward a latching position, the bolt 40 will be turned upwardly into the keeper opening 38 and move along the camming surface 44. Thus with the latching means in a latched position (FIG. 3), the operating handle 22 points down, and the bolt 40 projects up out of the top edge of the door and up into the keeper opening.

Link means (FIGS. 2-5)

In the currently preferred form, the link means generally designated 28 includes: a rearwardly-biased drawbar 43 extending between the front latch means and rear lock effecting means 26; a bell crank 50 at the front end of the drawbar, the crank having the end of one leg 50b pivotally secured at 52 to the drawbar, and having the junction of its legs pivotally secured at 54 to the keeper bracket 24; and, a rear link 56 (FIG. 4) having one end pivotally connected to the rear end of the drawbar 43, the link extending at a right angle from the drawbar into the lock assembly structure 26 where it is mounted to pivot about a vertical axis.

The link means tells the lock effecting means 26 what position the latching means is in, and under a condition requiring locking the door obstructs the release of the latch. This works as follows. When the latching means is

operated from its unlatched FIG. 2 position to its latched FIG. 3 position the bolt 40 turning through the keeper slot 38 engages the leg 50A of the bell crank and turns the bell crank about its pivotal securement 54 to the FIG. 3 position. As the bell crank 50 pivots, its leg 50B pulls the drawbar 43 forwardly to place the extreme forward end 48A in a position to obstruct the movement of the bolt 40 back toward an unlatched position. As is perhaps best seen in FIG. 5, the bolt may not be turned back to an unlatched position until the forward end 48A of the drawbar is retracted.

Latch, link, lock operational relationship (FIG. 6)

The schematic view of FIG. 6 shows in simplified form this operational relationship. When the latching means is turned to a latched position with bolt 40 turning the bell crank 50 to draw the bar 43 forward against the force of biasing spring 60, the ear 62 at the rear end of the bar is pulled past a lock pin 64 which then obstructs the return of the bar to its rearward position. The lock pin is retractable out of an obstructing position by energization of the solenoid 66. The springs 68 represent forces biasing the lock pin toward engagement with the cooperating parts of the link means, and also biasing the lock pin to a yieldable centered position which permits it to be deflected one way and another as the rear end of the link means moves one way and another in accordance with latch movement.

The V-shaped element 70 shown as straddling the lock pin 64 is responsive to movement in either direction of the lock pin to close solenoid switch 72 momentarily when movement of the bar 43 causes flexure in either way of the lock pin. The thermostatic switch 74 is normally open and closes in response to a high oven temperature indicating a cleaning cycle is starting. When it closes, the solenoid switch 72 and solenoid 66 are shunted out of the circuit so that the solenoid cannot be energized. In other words, the solenoid is disabled at high temperatures.

The general operation of the latching and locking arrangement may now be readily appreciated with respect to its operation under various conditions. If the oven door is latched shut in the absence of electrical power to the range, the solenoid 66 does not retract the lock pin 64 away from the ear 62. Hence the pin end moves with the ear rather than moving into an obstructing position as the drawbar 43 is moved forwardly. It will be appreciated then that in the absence of electrical power, the door may be latched and unlatched without any locking taking place. With electrical power available, the usual case, as the lock pin is deflected by the ear it causes switch 72 to close momentarily by engaging wire lever 70. The solenoid 66 is energized and the lock pin momentarily retracted as the ear moves forwardly. Upon retraction, the lock pin assumes its undeflected position and is centered relative to wire lever 70. Switch 72 opens, deenergizing the solenoid, and the lock pin springs into an obstructing position relative to the link means. However, the lock pin may be readily moved out of an obstructing position with electrical power still available by simply operating the latch means to an unlatched position. This permits the biasing spring 60 to draw the bar rearwardly and again cause energization of the solenoid through deflection of the lock pin in the other direction and closing of switch 72. This retracts the lock pin out of the obstructing position.

However, if the lock pin 64 is in an obstructing position while the oven temperature is in the high heat range, the thermally responsive switch 74 closes and disables the solenoid. Accordingly, the biasing spring 60 is unable to draw the bar 43 rearwardly against the obstruction of the lock pin which may be deflected rearwardly only to a limited extent in the obstructing position because of the stop 75, even though the limited deflection closes switch 72.

One notable feature of the invention of my noted other patent application is the arrangement of the biasing spring 60 to constitute the sole force for urging the bar 43 rear-

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wardly. No force is exerted by the latching means upon the linkage means to effect the rearward movement of the linkage means. Thus, with the oven door latched and locked, if the user attempts to force the latch to an open position, the latching bolt 40 simply bears against the forward end 48A of the drawbar in a direction at right angles to the normal direction of movement of the drawbar. This force is carried directly through the connection 52 of the drawbar to the bell crank leg 50B, and to the keeper bracket and frame structure of the oven. Since such a force is not carried back to the back assembly through the linkage, the drawbar and the cooperating parts in the locking assembly may be of relatively lightweight material not required to resist large stresses.

Lock effecting means (FIGS. 7-9)

The currently preferred arrangement embodying lock effecting means 26 according to the invention of my noted application is shown in FIGS. 7-9. A lightweight sheet metal shell 76 serves as a base for carrying a number of the parts concerned with locking. The shell is secured to the back face of a vertical rear wall 78 spaced rearwardly from the vertical rear wall of the oven liner. Thermal insulation occupies the space between the liner and the rear wall 78. The shell is mounted to this rear wall for limited pivotal movement about a vertical axis passing approximately through vertically aligned upper and lower fasteners 80. The fasteners extend through spacers 82 which space the shell from the wall 78 to permit the shell to rock slightly upon the spacers. This mounting arrangement is used to compensate for thermal expansion and contraction of the range body, and to prevent the forward end of the drawbar from being pulled out of the unlatching path of the bolt during the heat cleaning cycle. The compensating arrangement includes an arm 84 rigidly connected to two opposite corners of the shell by fasteners 86 (FIG. 7) and a bar 88 connected to the outboard end of the arm. The bar 88 is fixed at its forward end to the keeper assembly 24 and extends rearwardly to its pivotal connection with the outboard end of the arm. The bar 88 is preferably a duplicate of the drawbar 48 for minimizing manufacturing costs. Also, for all practical purposes, expansion and contraction of both drawbar 48 and bar 88 will be the same since they are subject to essentially the same temperatures. The lever arm distance as measured from the vertical pivot axis of the fasteners 80 to the pivot connection between arm 84 and bar 88 on the other hand, and to the pivot connection of the drawbar 48 to the link extension 56 on the other hand, is the same preferably.

With my thermal compensating arrangement, as the range body frame expands and contracts and thus changes the distance between the keeper assembly and lock assembly, the shell 76 will rock as required to keep the relationship between the forward end of the drawbar and the bolt the same, and also keep the same adjusted relationship between the rear link 56 and the operating parts in the locking assembly.

The parts in FIGS. 7-9 which correspond to the parts in the schematic of FIG. 7 carry the same numeral. The locking member 64 takes the form of a pin normally biased downwardly by the helical compression spring 68 which bears against the lower face of the solenoid 66 mounting. The pin is mounted for lateral deflection by a sleeve-shaped, tight helical spring 68A. The part 62 which engages the lower end of the locking pin 64 is located at the right end (FIG. 7) of the link extension 56. When the drawbar 48 is moved forwardly or rearwardly the linkage extension 56 pivots about the vertical axis 58 (FIGS. 7-9) formed by several notches (also designated 58) in rearwardly-directed flanges of the shell 76. The forward edge of a vertical rim of the extension link 56 seats in these notches.

The right end (FIGS. 7 and 9) of the link extension moves toward the rear (i.e., toward the views of FIG. 7)

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when the drawbar is pulled forwardly during latching, and conversely moves toward the front when the drawbar retracts during unlatching. A raised shoulder 62A engages the end of the downwardly-biased locking pin 64 and deflects the pin toward the rear when the drawbar is moved forwardly. This carries the locking pin into engagement with the "V" formed wire 70 and results in closure of switch 72 in series with the solenoid 66. The locking pin is retracted against the bias of spring 68, and assumes a vertical position which again centers it with respect to the wire form V. This permits the switch 72 to again open. The force of the biasing spring 68 then drives the pin downwardly past the link end 62.

The sequence of movements of the locking pin relative to the movement of the end 62 as the link extension 56 is moved between its positions is perhaps best shown in FIG. 8. The solid line representation of the link end 62 and pin 64 corresponds to an unlatched condition. The dash-dot showings represent successive positions. As the link end 62 moves to the left as viewed in FIG. 8, the locking pin is deflected to a position 64B by engagement of the shoulder with the end of the locking pin. This deflection, as explained before, energizes the solenoid momentarily, and the pin takes the centered depressed position 64C. If the link end 62 is moved back toward its solid line position, its leading edge engages the end of the locking pin 64 and carries it toward a 64D position. If the solenoid 66 is not then disabled in response to a high oven temperature, the solenoid is again energized to retract the pin and permit the link end 62 to move back under the end of the centered pin 64. However, if the solenoid is disabled the end 62 forces the locking pin end over to the 64D position against the edge of a flange 90 and prevents the return of link end 62 to its solid line position. It is noted that the movement of the link end 62 from the dashed line position to its solid position is effected by the force of the biasing spring 60 and not by any force transmitted back through the linkage mechanism from the latching means. However, the force moving the link end 62 from the solid line position to the broken line position is derived from the latching operation and is in opposition to the force of the biasing spring 60.

When the locking pin 64 descends to a position in which it is not supported by the link end 62, it also closes a normally-open interlock switch 92 in series with other parts which function during the high temperature period.

Timing (FIGS. 7-10)

The timing arrangement for terminating the supply of heat to the oven is also provided in connection with the lock assembly. A timer motor 94, which may be a single, inexpensive clock motor, is mounted on the shell 76 and has its output shaft flexibly connected through a helical spring sleeve 98 to a drive shaft 96. The shaft 96 is slidably supported at its left end (FIGS. 7 and 9) in a horizontal slot 100. A tension spring 102 urges the slidable left end of the shaft 96 in a direction toward the front of the range. The output shaft includes a worm-thread drive section 104 (FIG. 9) adapted to be engaged by a wheel 106 carried by the extension link 56 for movement therewith and provided with teeth on its periphery adapted to mesh with the teeth of the worm drive section 104. The function of the timer, timer drive and wheel is to cause the opening of a normally-closed switch 108 after a predetermined period of engagement of the drive shaft and the wheel, when the door is latched shut. In the current arrangement, the timer drive and wheel are designed so that after one hour of engagement the switch 108 will be opened to terminate the supply of heat.

The structural arrangement of the timer wheel assembly is perhaps best understood from the vertical sectional view of FIG. 10 taken through the wheel and associated structure. The wheel 106 is mounted for rotation about a bolt 110 which secures it to the link extension 56. A

helical return spring 112 has one end pinned to the wheel 106 and the other end connected to the link 56 to exert a force urging the wheel 106 in a counterclockwise direction (as viewed from above) to a start (i.e. rest) position. A U-shaped wire or member 114 is carried at the ends of its legs from the bolt for turning movement relative to the bolt. The wheel 106 includes one or more depending lugs 116 disposed to engage the lower leg of the wire form 114 when the wheel rotates sufficiently in either direction. The bight of the wire form 114 is confined between a stop 118 (FIG. 9) on the one side, and the actuating lever for the switch 108 on the other side.

When the link extension 56 is in an unlatched position, the wheel 106 is out of engagement with the worm drive section 104, and the return spring 112 urges the wheel 106 in a counterclockwise direction until a depending lug 116 engages a leg of the wire form 114 and is stopped by the wire form engaging the limit flange 118. When the link extension 56 is moved to a latched position, the wheel is carried into engagement with the worm drive section. With the timer 94 energized, the wheel is slowly rotated in a clockwise direction and carries the depending lugs around. After the leading lug engages the lower leg of the wire form 114, it carries the bight portion of the wire form into engagement with the actuating lever of normally-closed switch 108. When switch 108 opens, heat cleaning energization is terminated, and the timer motor 94 is deenergized. Subsequently, after the oven has cooled sufficiently, and after the latch means is operated to an open position, the wheel will be moved back away from the drive worm section 104 and the return spring will act to reset the wheel to its initial position from which it started. With this arrangement, each time the latch means is moved from a latched to an unlatched position, the timing system is reset for a subsequent full cycle, regardless of whether a full or only partial cycle has been completed. The system permits interrupting a cycle at any since the timing does not "lock" the controls in a condition requiring completion after a cycle has started.

Overall circuit (FIG. 11)

The relationship of the timing arrangement circuitry to the remainder of the oven circuitry as concerned with a heat cleaning cycle or operation is generally illustrated in FIG. 11. A three-wire power source is indicated by the conductor terminals N, L1 and L2. A stepdown transformer 120 and the timer motor 94 are energized across neutral and L2 when the "Clean" position contacts 122 of the selector switch are closed, and the latching means have been operated to a latched position to effect closure of the normally open interlock switch 92 engaged by the locking pin 64. The secondary of the transformer 120 provides power through another set of contacts 123 in the selector switch in a "Clean" position to operate control relay means 124 to a position energizing the top heating element 30 in the oven. Until the temperature in the oven rises above a level, such as 550° F., normally encountered in cooking, the normally-open lock thermostat switch 74 remains open. Above that temperature, the thermostatic switch 74 closes to shunt out the solenoid 66 and the solenoid switch 72 so that these elements are disabled. Thus, the oven door will be locked shut (since the lock pin 64 cannot be retracted out of the way of the link means) until the switch 74 subsequently opens as the oven temperature falls into the normal cooking range of temperatures. Closing of lock switch 74 also energizes an indicating light and ventilating fans.

After the latching means have been in a latched position with the selector switch in a "Clean" position for about an hour, the timer operated switch 108 is opened in the manner previously explained. It is noted that this switch 108 could be placed in the circuit between switch 92 and selector switch element 122 rather than where it is shown. Opening of switch 108 deenergizes the trans-

former 120 and results in opening the circuit to the element supplying heat to the oven cavity. Then when the oven temperature cools below the set temperature of the lock switch 74, this switch opens and the solenoid 66 may again be energized by operating the latching means toward an unlatched position. Further details as to the functioning of the various parts of the circuit may be found in Kastovich U.S. patent application Ser. No. 552,663, entitled "Oven," and filed Apr. 26, 1966, a continuation-in-part of Kastovich U.S. patent application Ser. No. 521,932 filed Jan. 20, 1966, now abandoned.

I claim as my invention:

1. In an oven of the type adapted to undergo heat-cleaning, and including latching means adjacent the front of the oven structure, lock effecting means adjacent the rear of the oven structure, and movable link means extending between said latching means and said lock effecting means to relate the operation thereof in accordance with existing conditions;

frame means carrying the operational elements of said lock effecting means in generally fixed relation to each other;

means mounting said frame means to said oven structure for limited movement of said frame means as a whole;

means connecting the rear end of said link means to said operational elements so that movement of said link means influences the operation of said operational elements, the forward end of said link means being disposed relative to said latching means under high oven temperature conditions to prevent operation of said latching means to an unlatched position; and

means for moving said frame means, in accordance with changes in spacing between said lock effecting means and said latch means arising from thermal expansion and contraction of said range body, to maintain substantially the same relationship between said latch means and the forward end of said link means to prevent the occurrence of an unlocked condition with high oven temperatures.

2. An oven according to claim 1;

said frame mounting means is of a character securing said frame means to said oven structure for pivotal movement; and

said frame moving means includes means generally paralleling said link means and being rigidly secured at its forward end to said oven structure and pivotally secured at its rear to effect said movement of said frame means.

3. In an oven according to claim 2;

said link means includes a generally front-to-rear extending drawbar; and

said bar for effecting movement of said frame means is substantially a duplicate of said drawbar.

4. In a door latching and locking arrangement for a heat-cleaning oven of the type in which latching means is mounted at the front of the oven, the means for effecting locking is at the rear of the oven, and link means connect the latching means to the lock effecting means to coordinate their functions, the improvement comprising:

means mounting said lock effecting means for pivotal movement at the rear of said oven;

means rigidly fixed to the front of said oven to receive the bolt portion of said latching means so that the oven door is restrained from opening when said bolt portion is so received;

means associated with the forward end of said link means for obstructing movement of said bolt in an unlatching direction; and

means connecting said rigidly fixed means to said lock effecting means to effect pivoting of said lock effecting means in accordance with the change in spacing between said rigidly fixed means and said lock effecting means occasioned by thermal expansion and contraction of said oven.

5. In an arrangement according to claim 4:

said link means includes a drawbar, and said connecting means includes a bar which substantially duplicates said drawbar.

6. In an arrangement according to claim 5:

said link means includes a transverse arm pivotally connected to the rear portion of said drawbar for transferring motion information of said link means to said lock effecting means,

said connecting means includes a second transverse arm pivotally connected to the rear portion of said bar and rigidly connected to said lock effecting means.

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