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WILSON et al.

(54) **OVENS**

(76) Inventors: **GUY EMERSON WILSON**, Dunedin (NZ); **Robert Charles English**, Dunedin (NZ); **Matthew Craig Lazenby**, Dunedin (NZ)

Correspondence Address:
TREXLER, BUSHNELL, GIANGIORGI, BLACKSTONE & MARR, LTD.
105 WEST ADAMS STREET, SUITE 3600
CHICAGO, IL 60603 (US)

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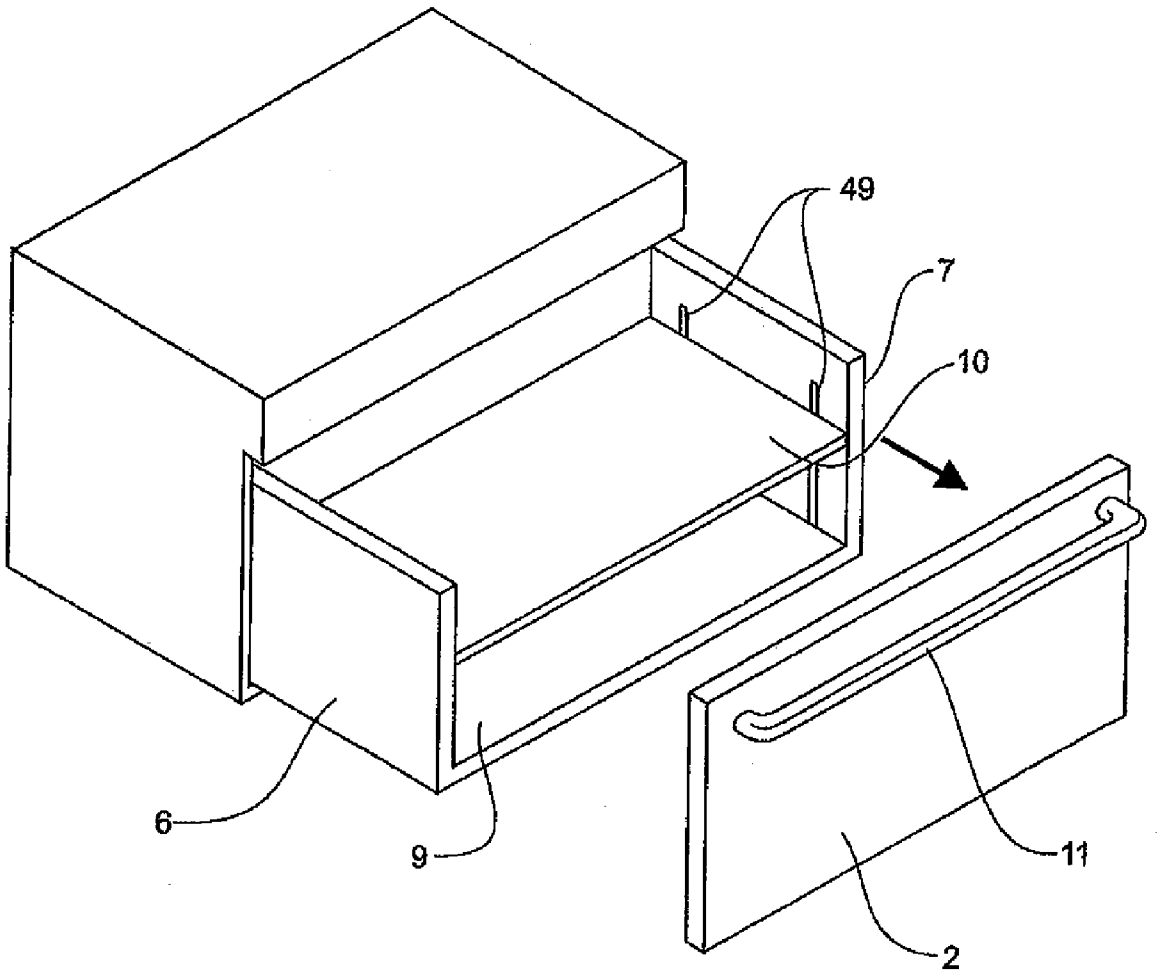
A47B 88/04 (2006.01)

(52) **U.S. Cl.** **312/410**; 312/236; 312/330.1

(57) **ABSTRACT**

An oven for cooking food comprising a cabinet with a front side that includes an opening, a door moveable between a closed position closing the opening and a fully open position allowing access to the oven interior, the oven also having a drawer which forms at least part of a cooking chamber, the drawer configured to be fully located within the cabinet when the door is closed, the oven also including a drawer support means which supports the drawer, the drawer support means supporting the drawer as it moves into and out of the cabinet, the oven also including a controllable heating source which supplies sufficient heat to the inside of the drawer to cook food positioned therein when in the closed position, the oven also including a vertically movable shelf located within the drawer which is supported by a shelf support means.



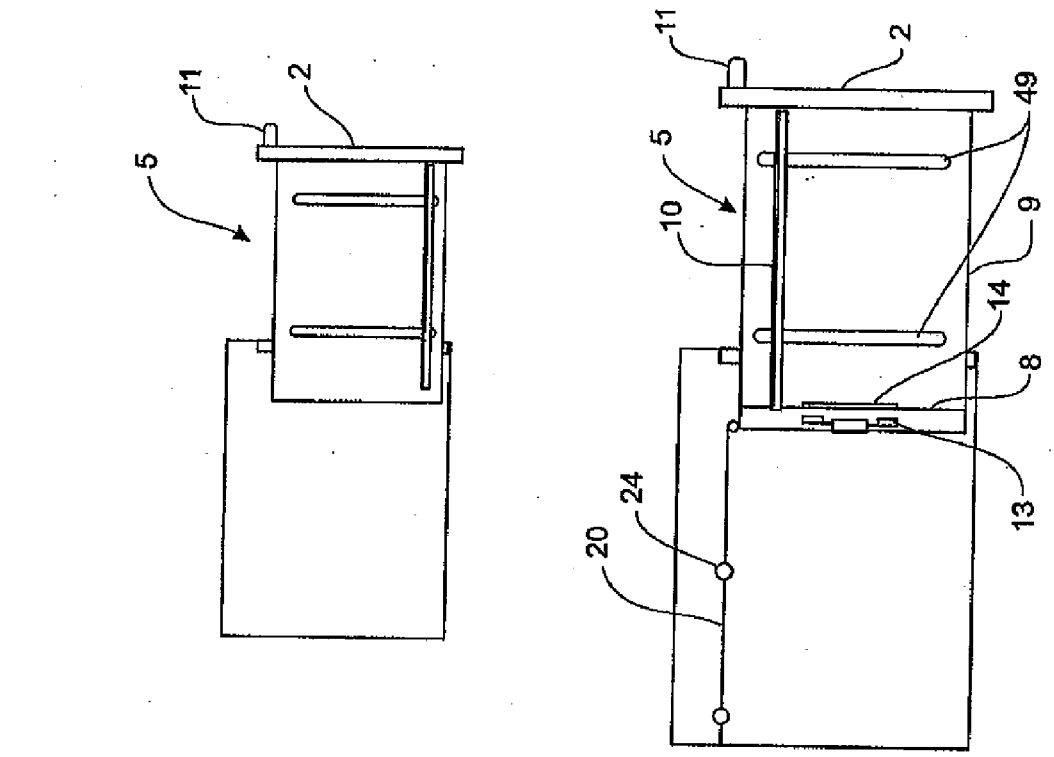


FIGURE 2

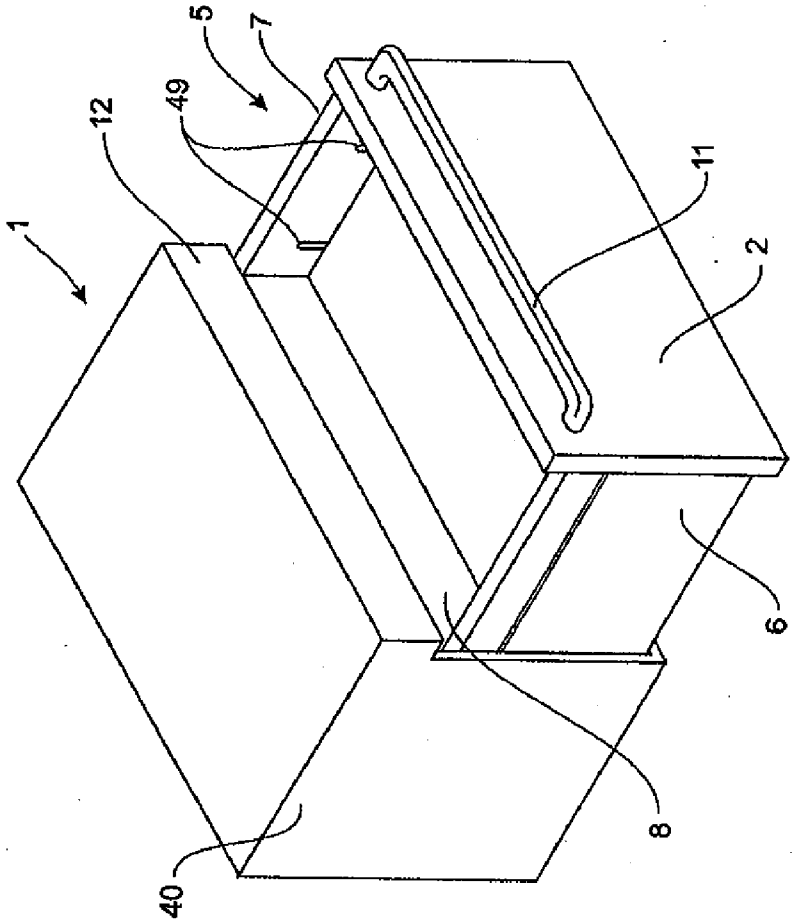


FIGURE 1

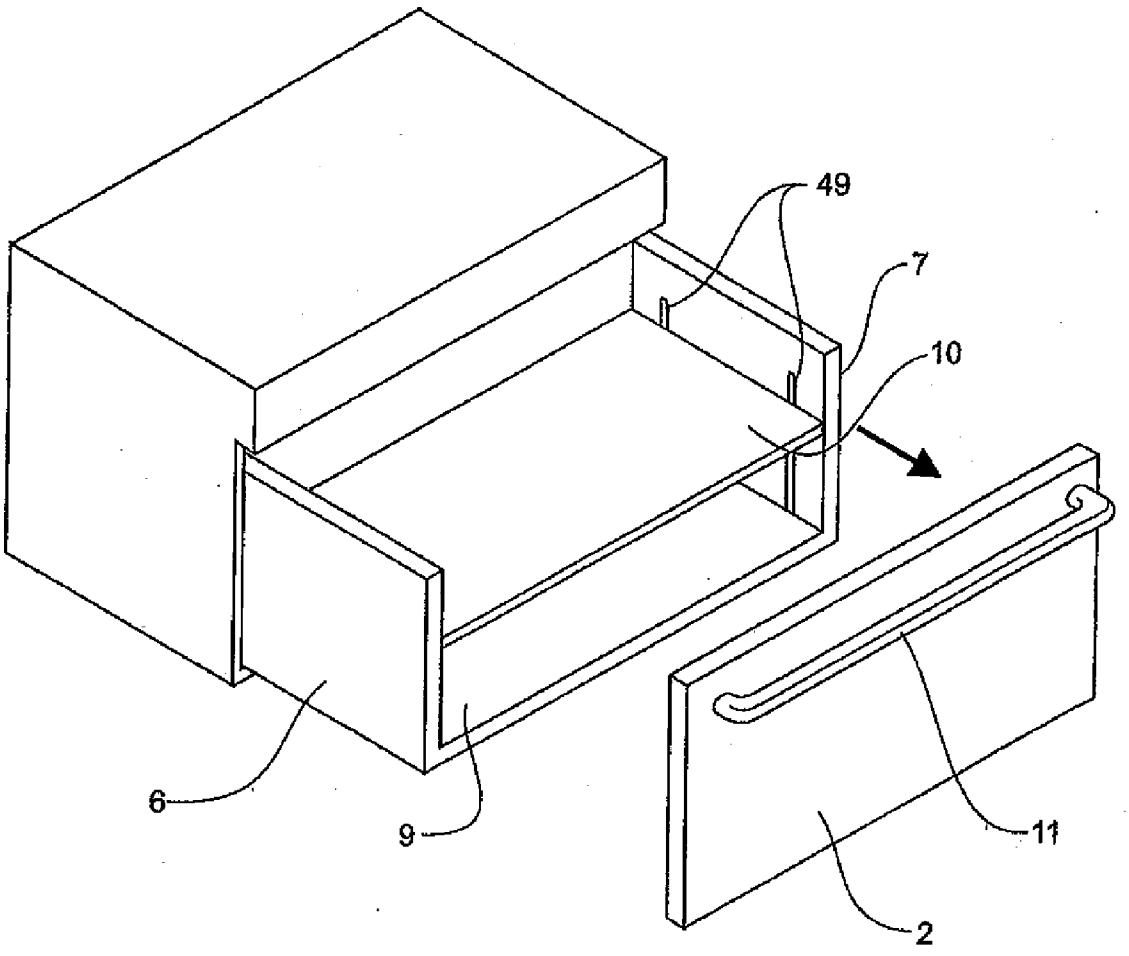


FIGURE 3a

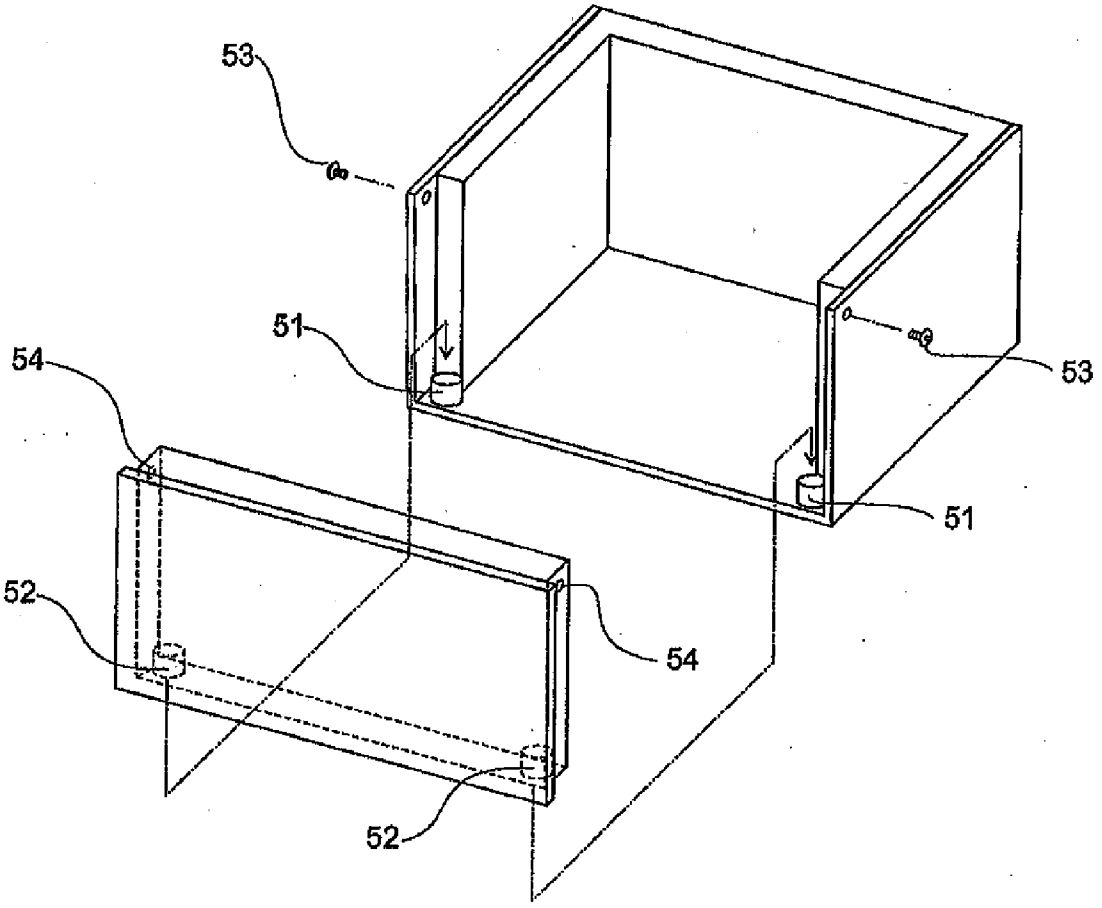


FIGURE 3b

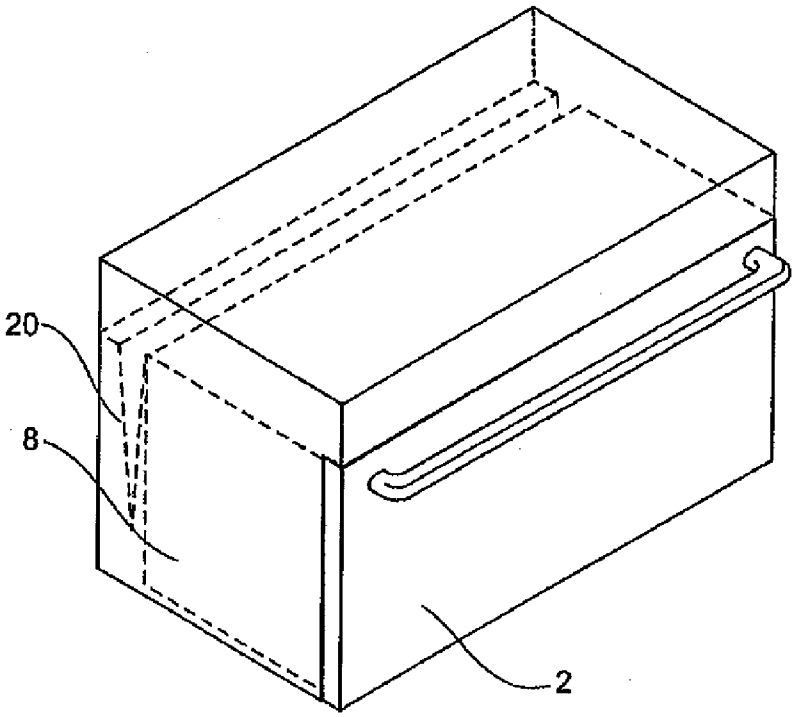


FIGURE 4

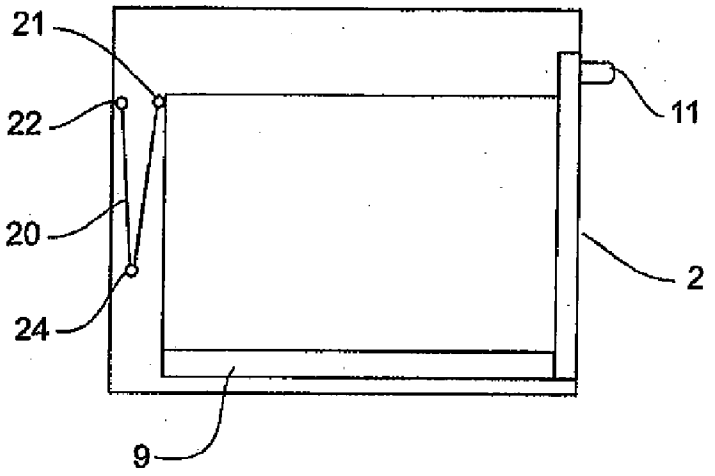
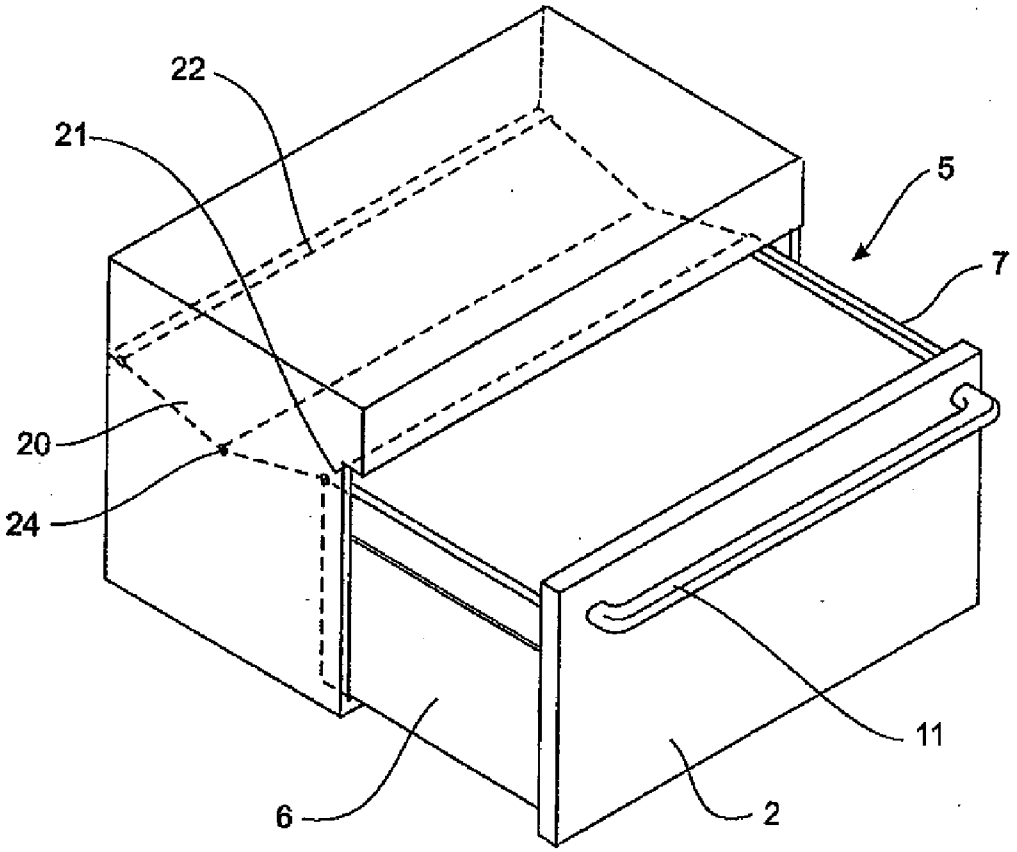


FIGURE 5



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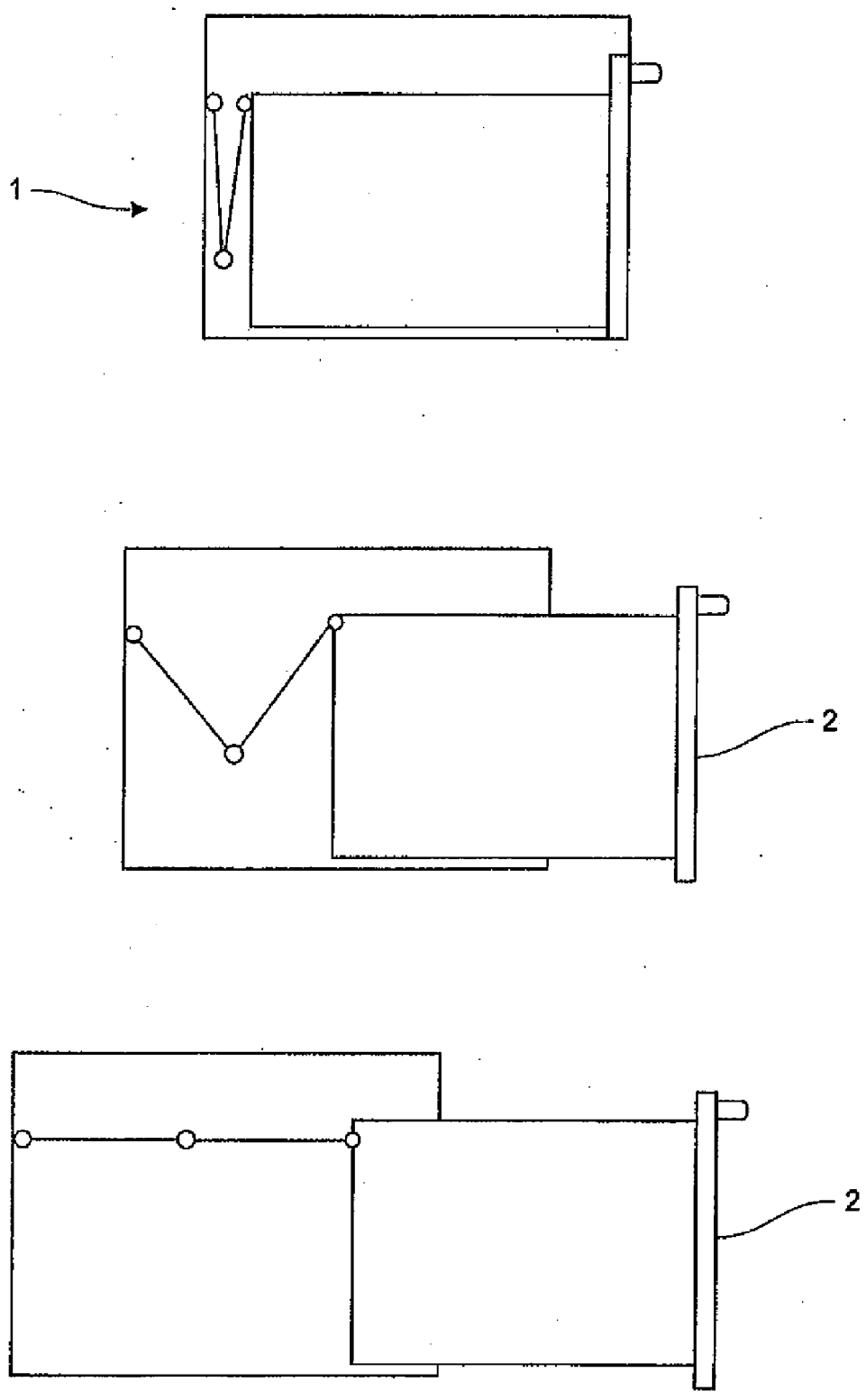


FIGURE 7

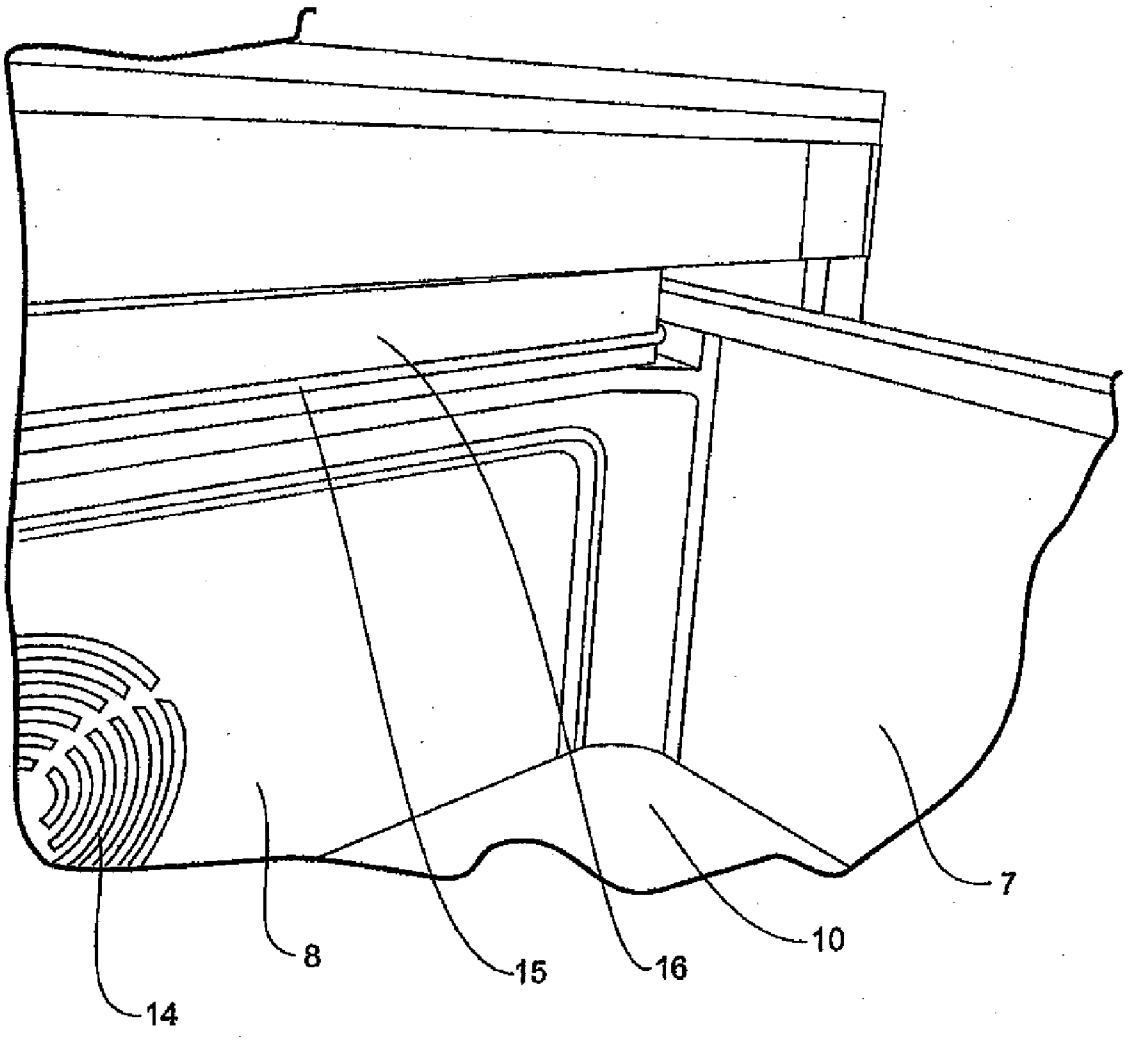


FIGURE 8

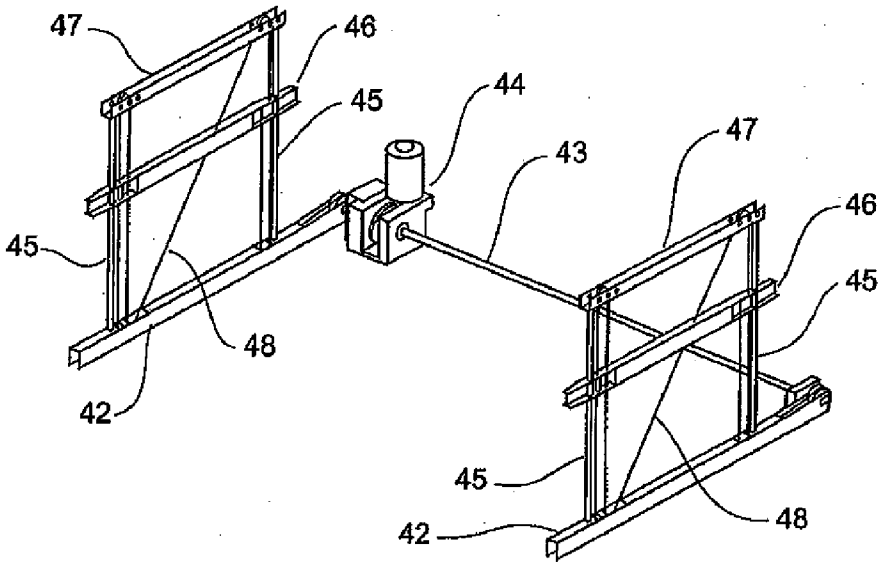
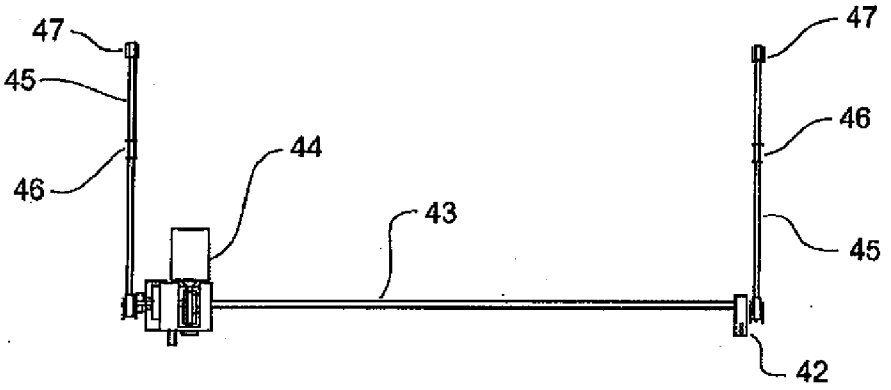


FIGURE 9



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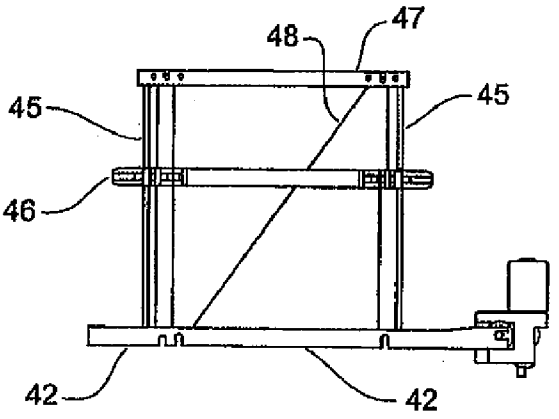


FIGURE 11

FIGURE 12

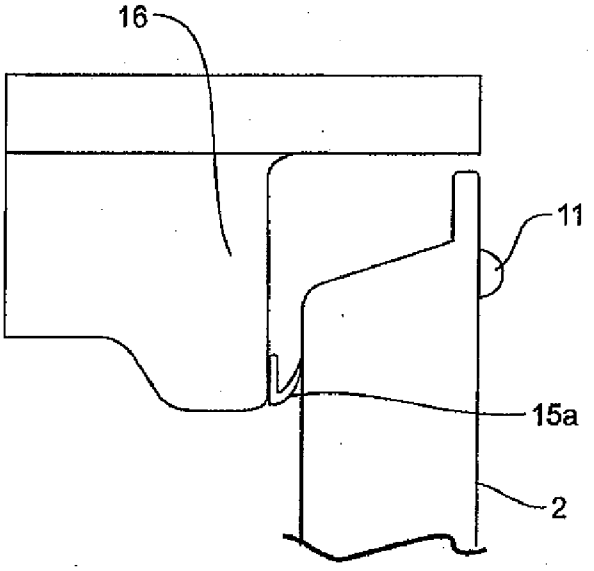


FIGURE 13

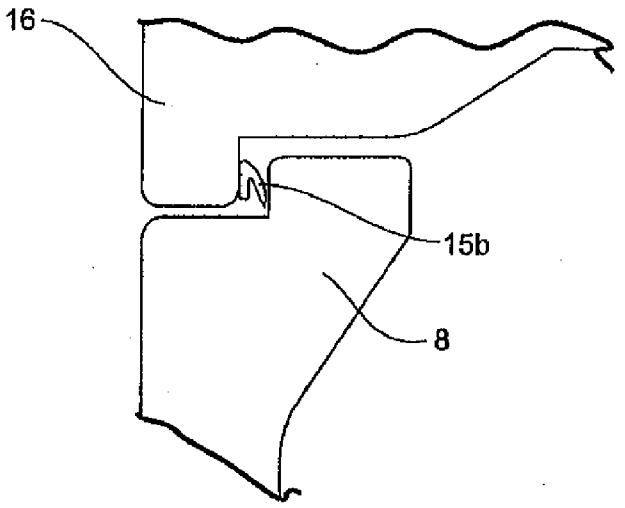
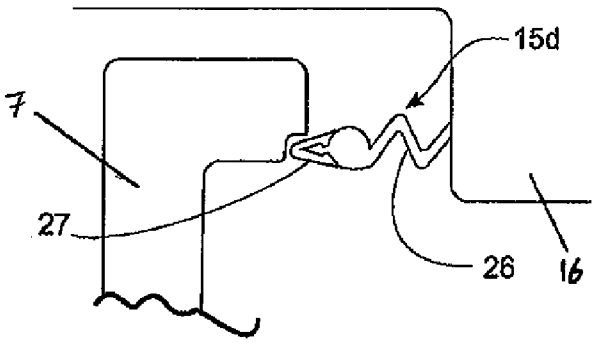


FIGURE 14



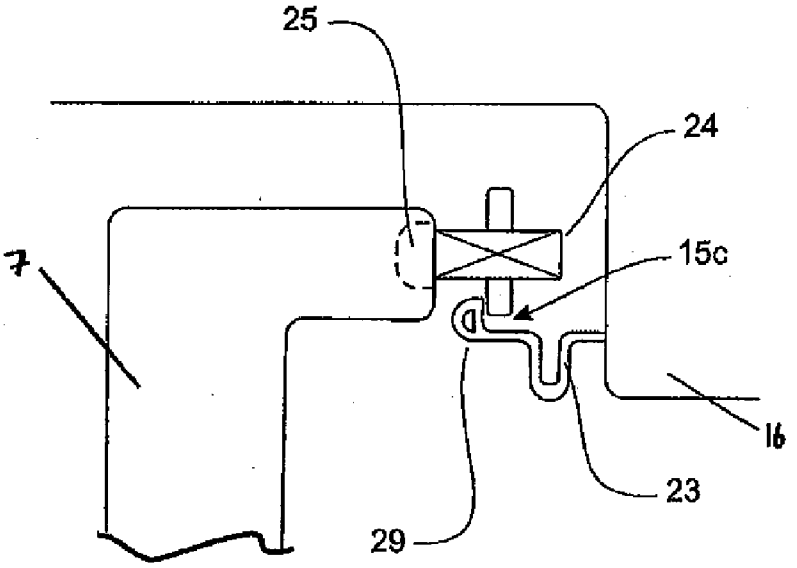


FIGURE 15

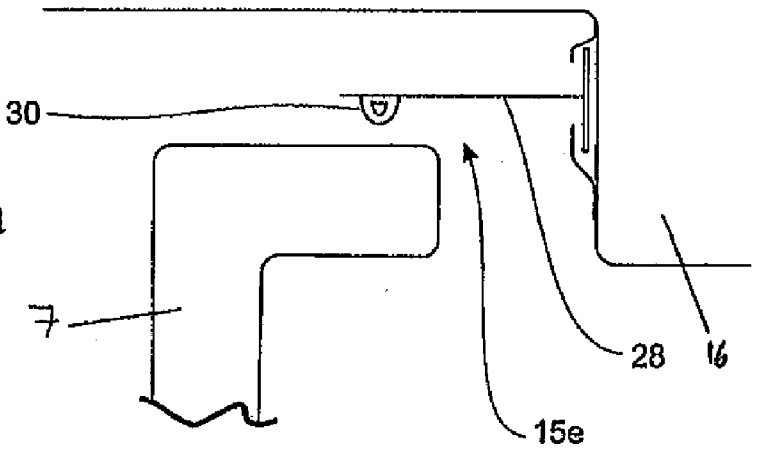


FIGURE 16a

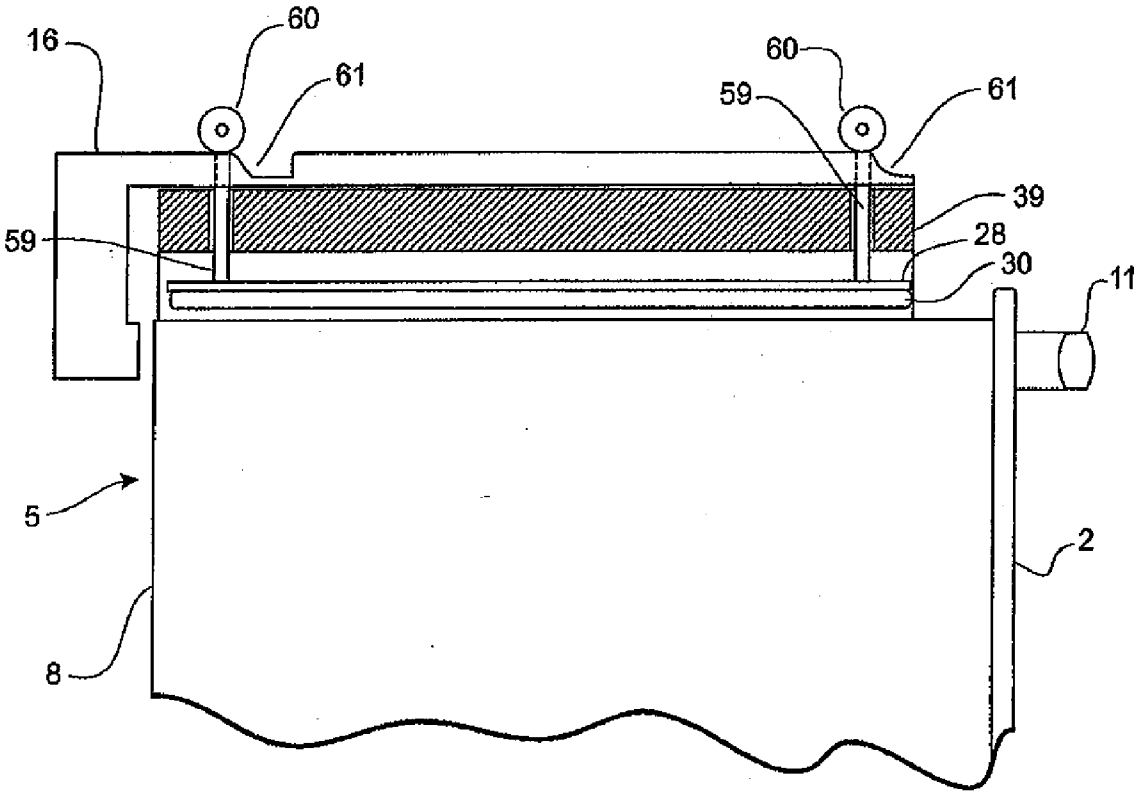


FIGURE 16b

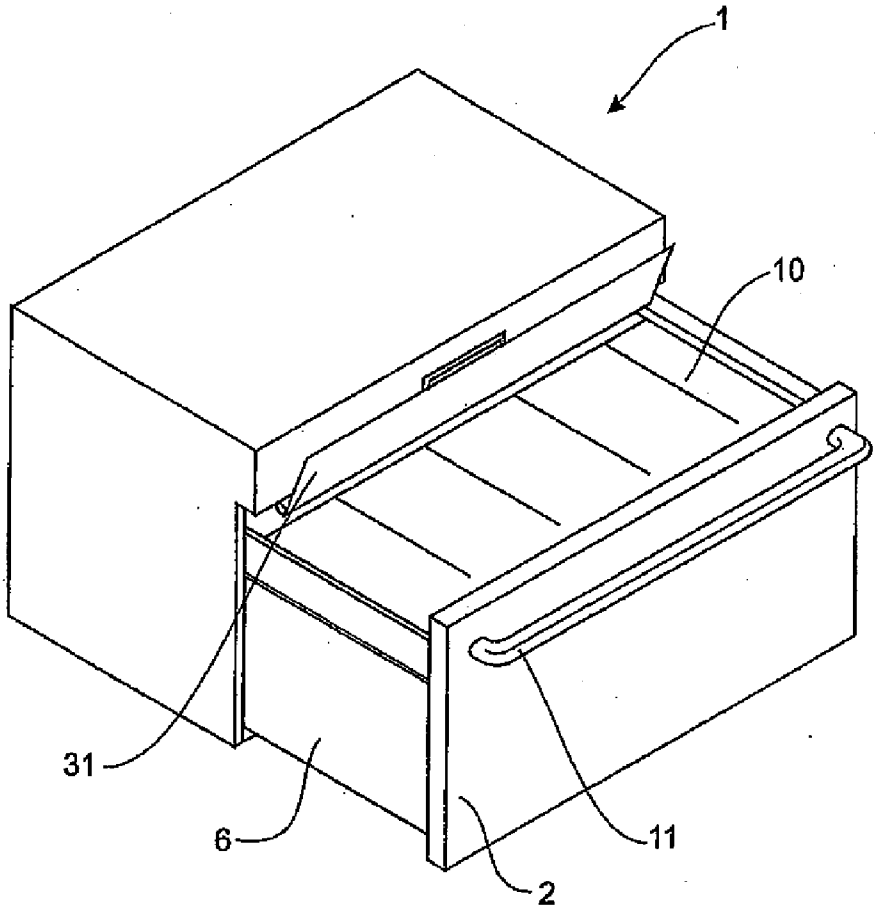


FIGURE 17a

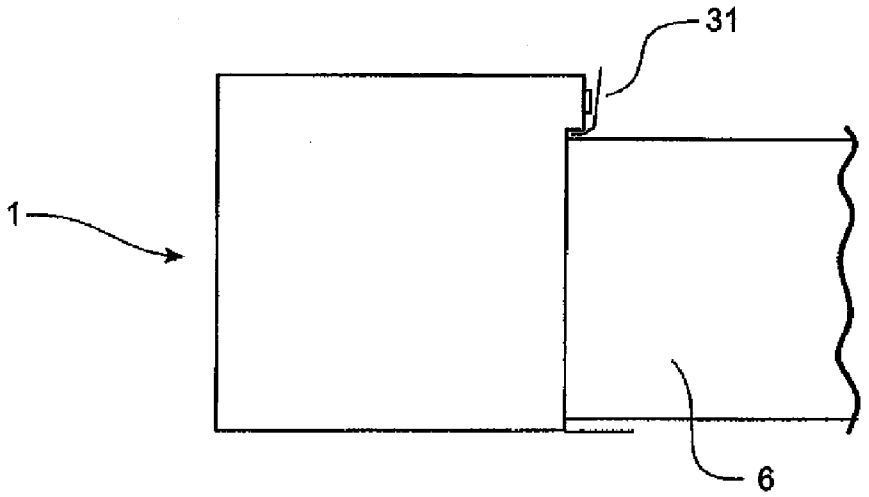


FIGURE 17b

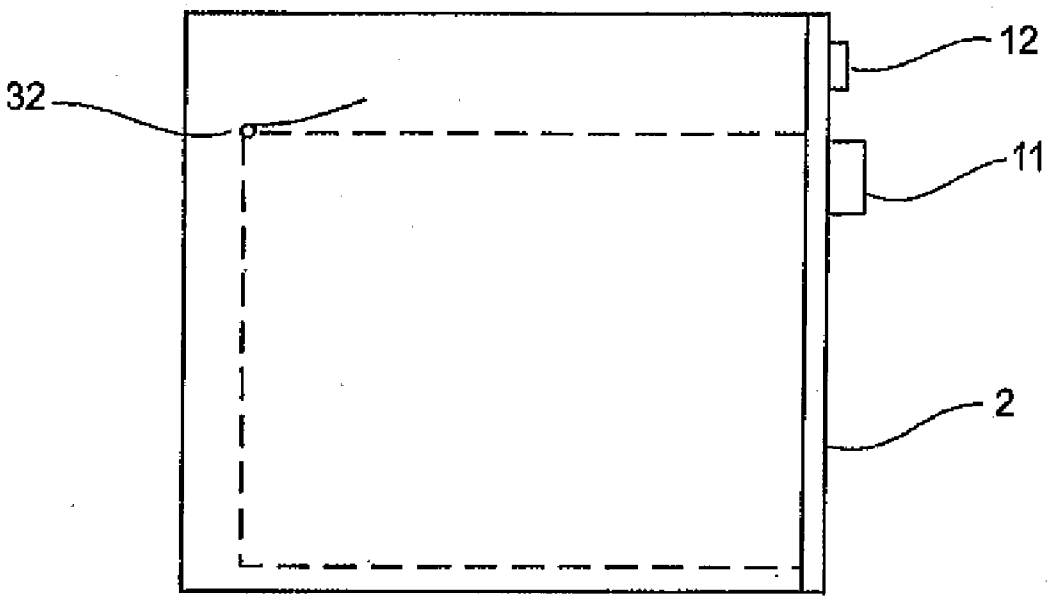


FIGURE 17c

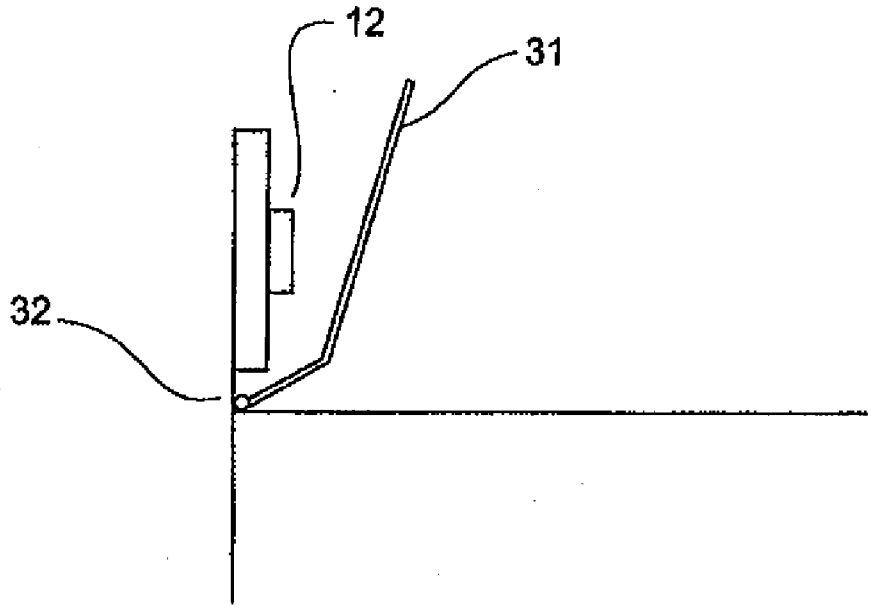


FIGURE 17d

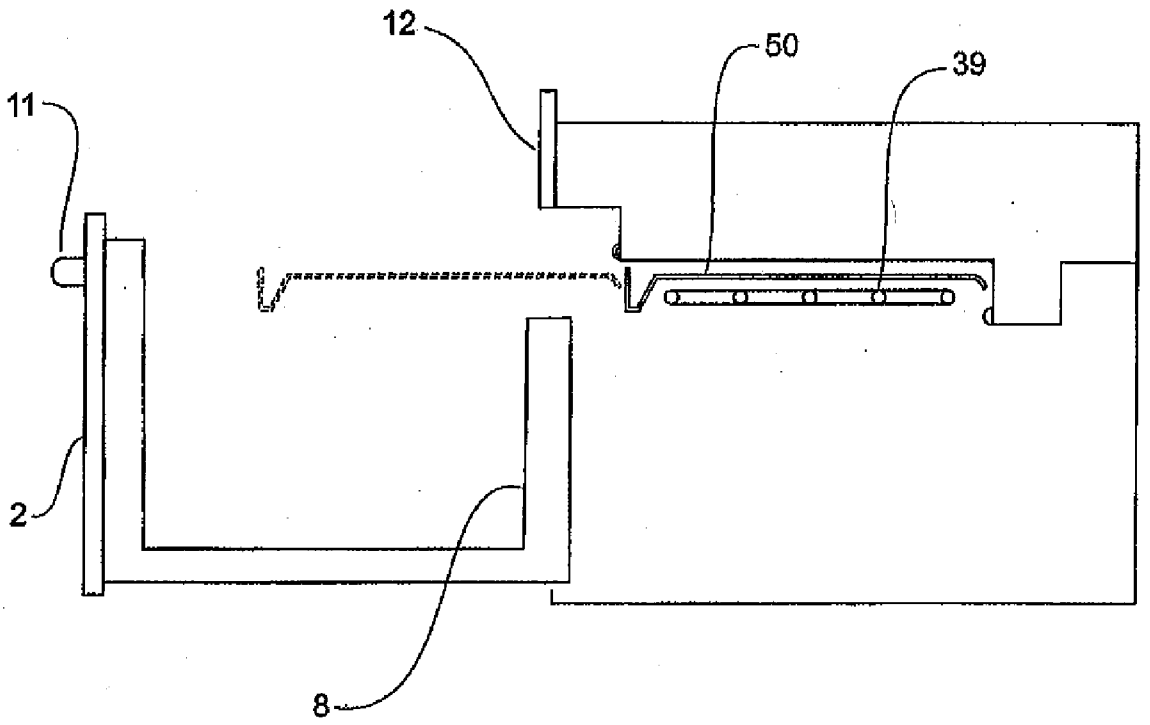


FIGURE 18

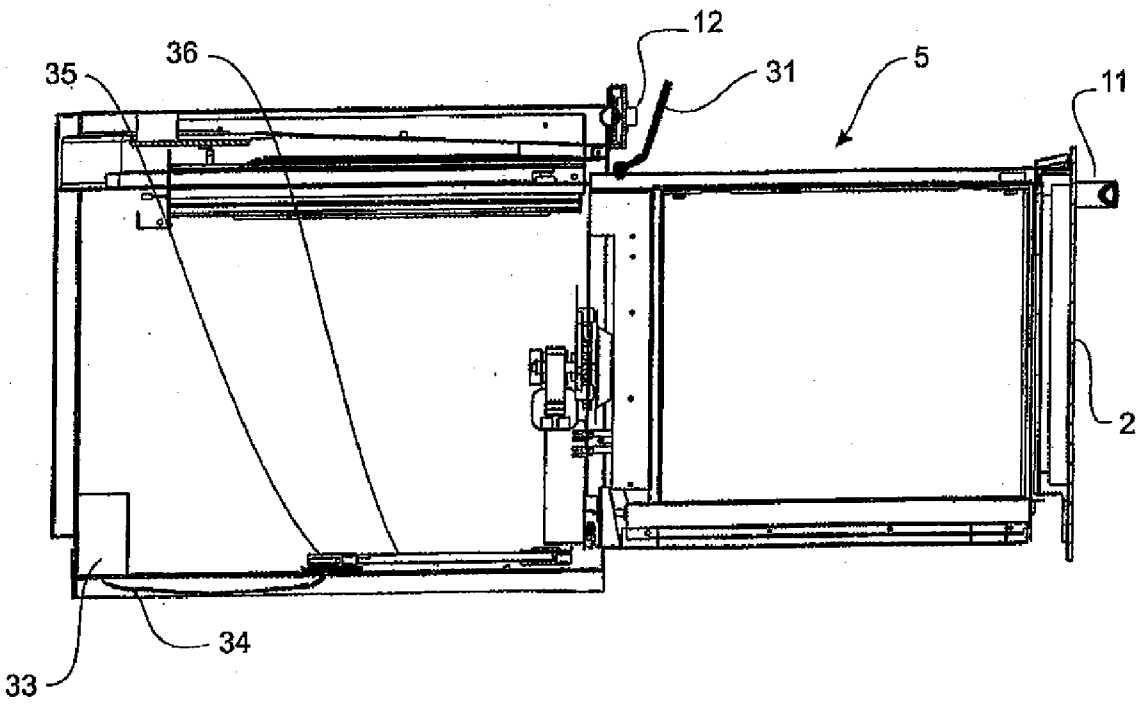


FIGURE 19a

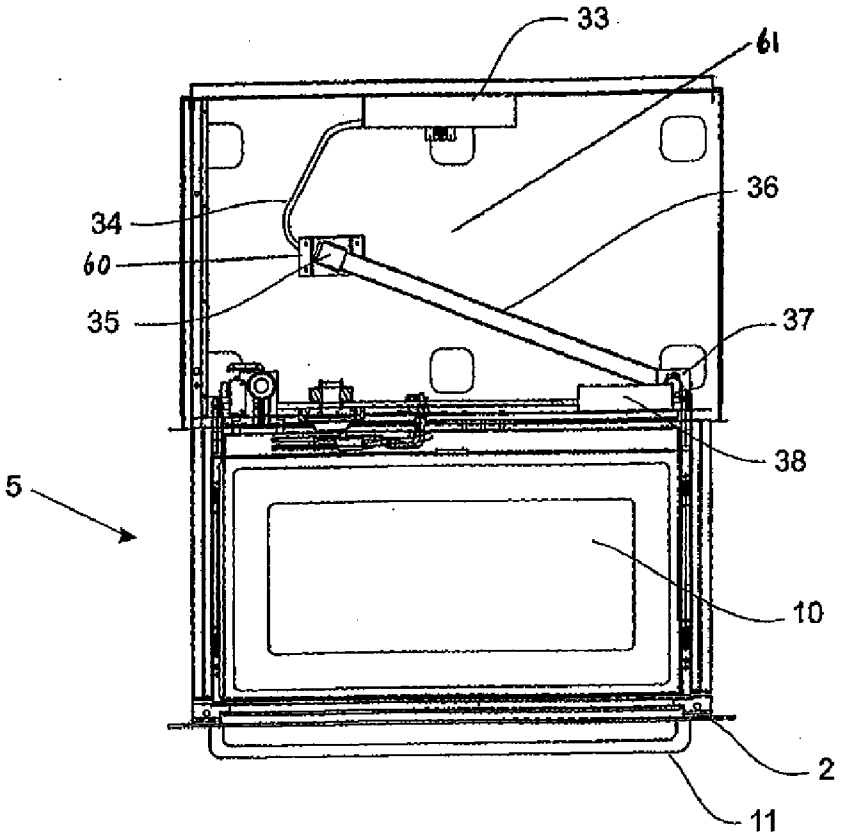


FIGURE 19b

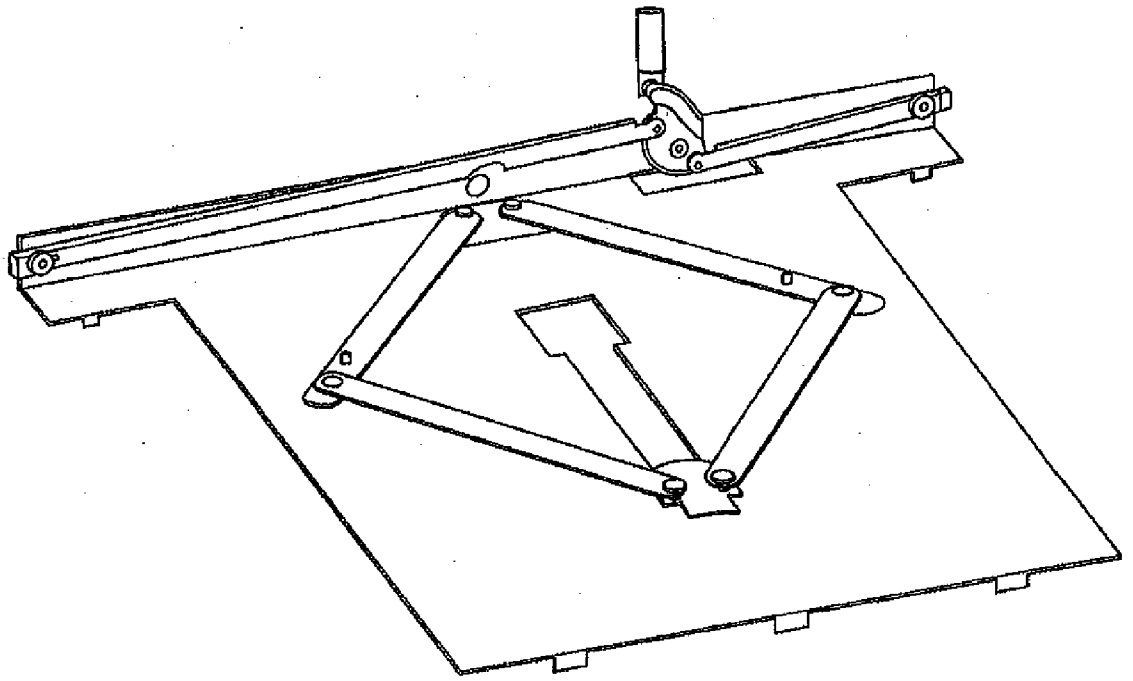


FIGURE 20
(Prior Art)

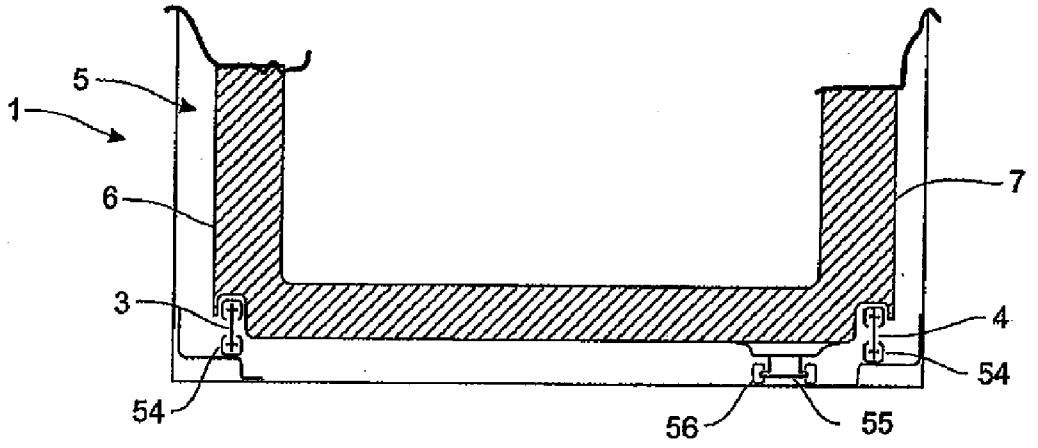


FIGURE 21

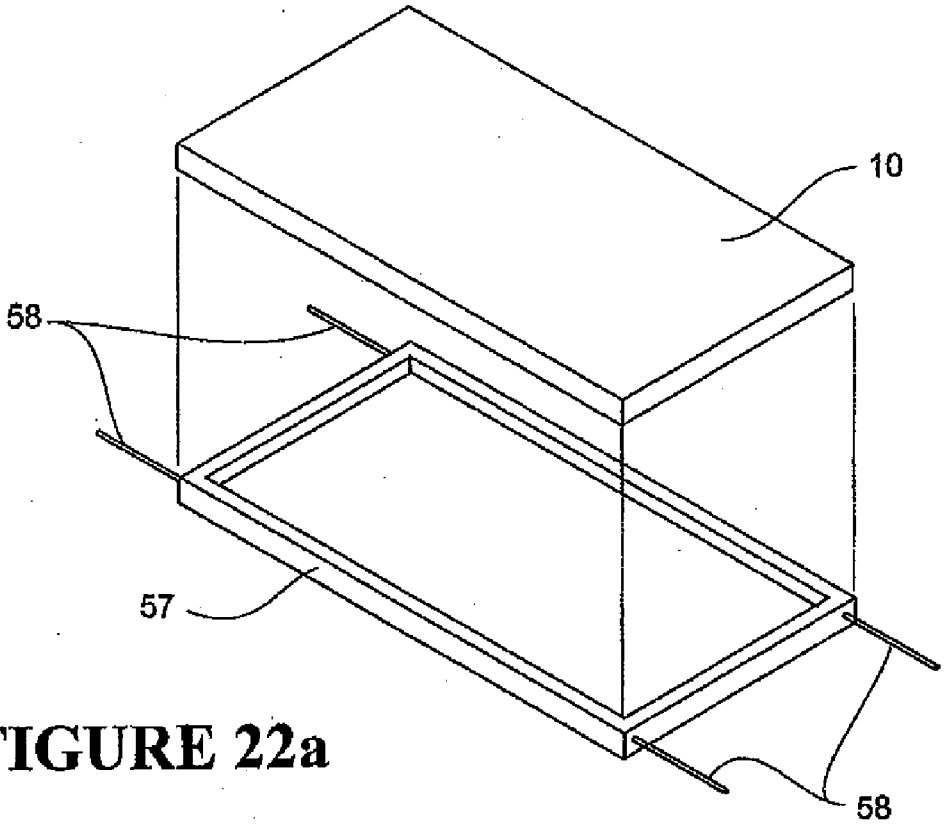


FIGURE 22a

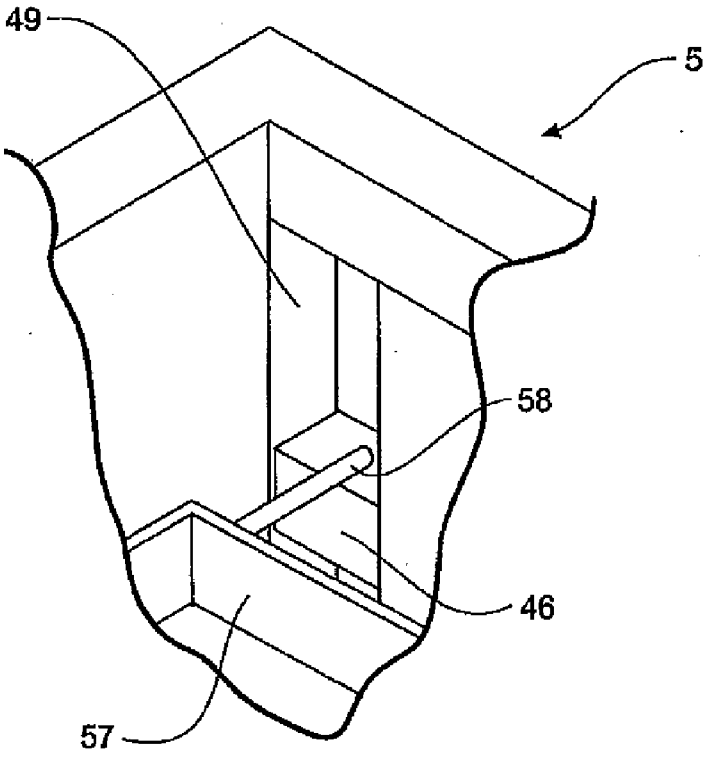


FIGURE 22b

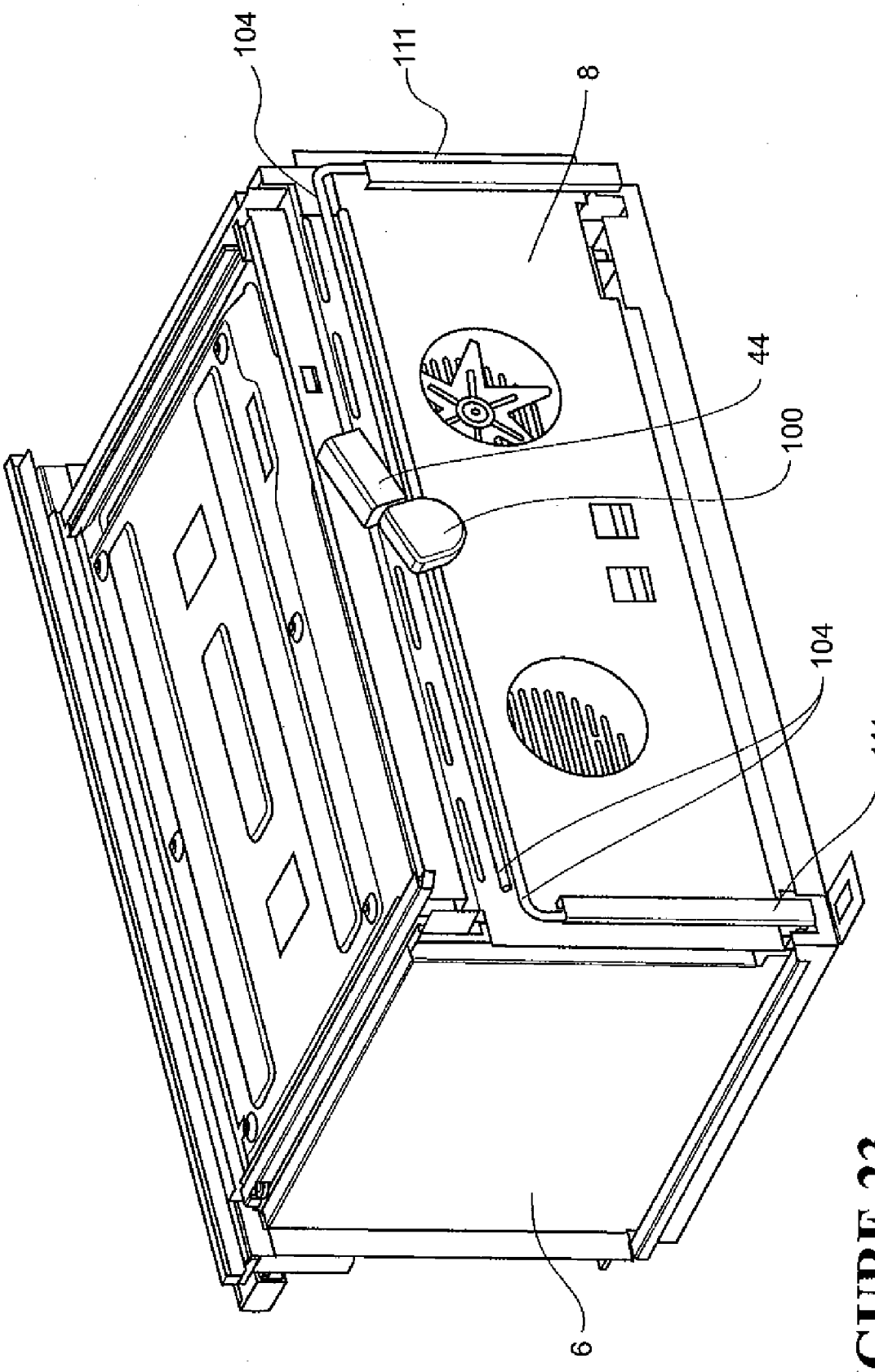


FIGURE 23

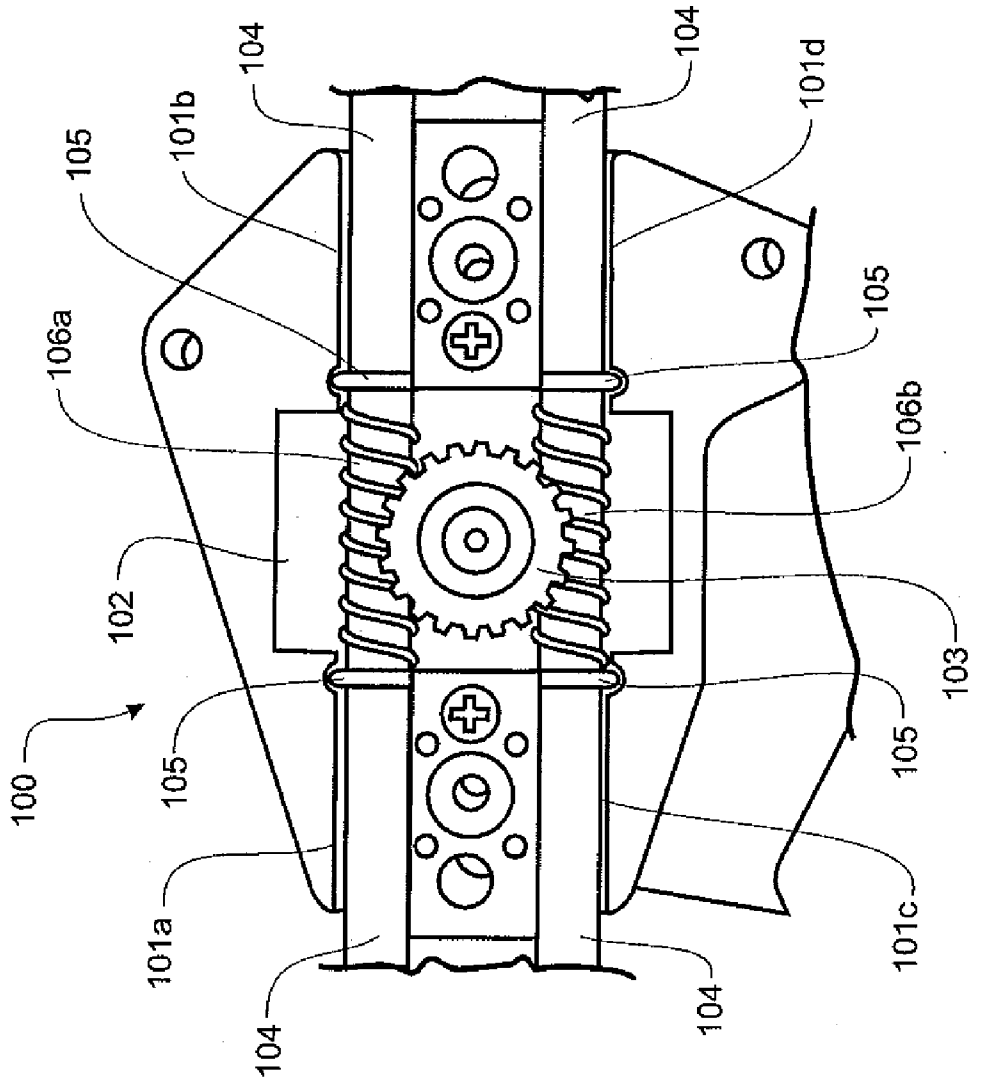

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FIGURE 24

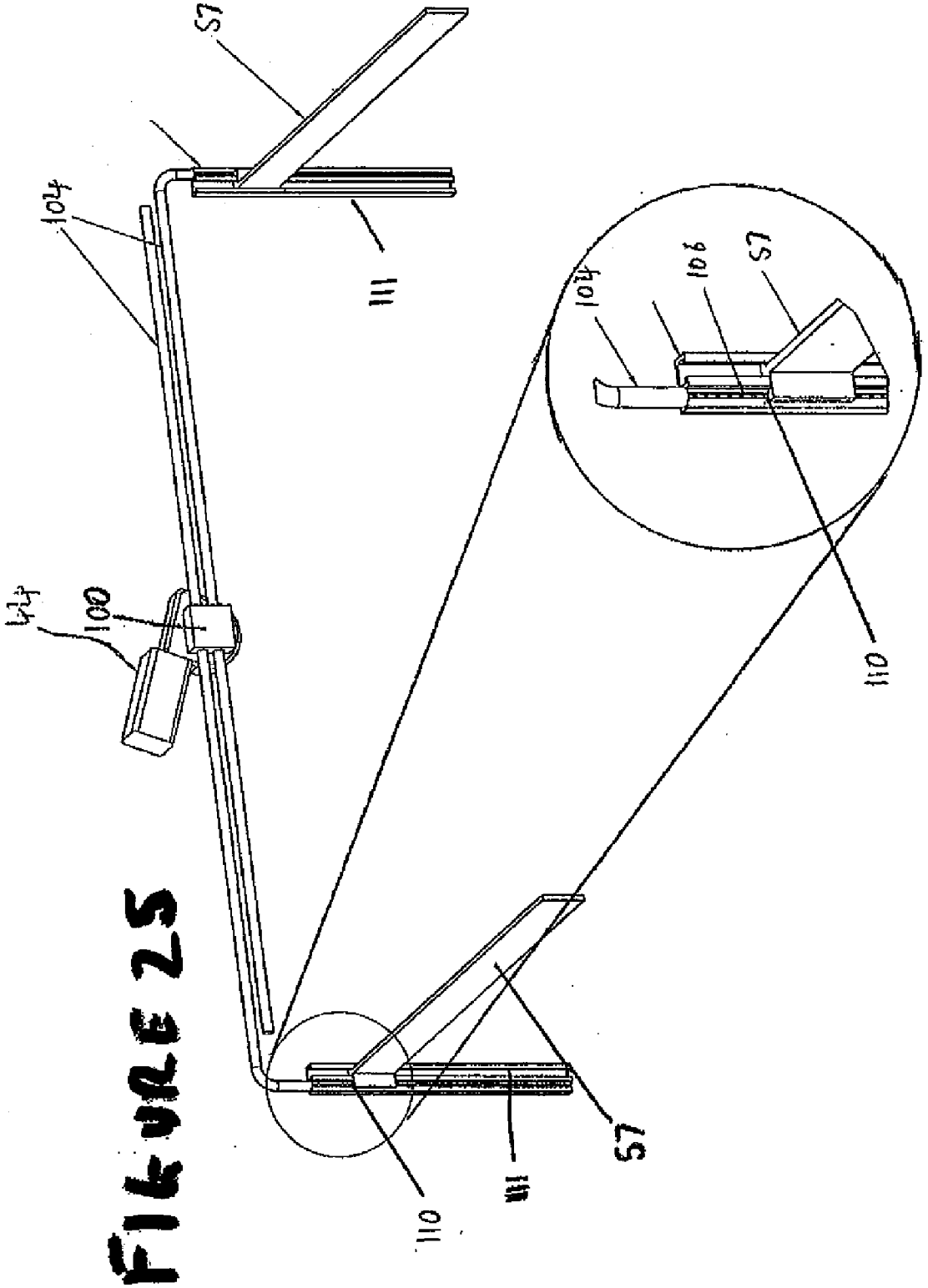

FIGURE 25

OVENS

[0001] This application is a continuation-in-part of PCT/NZ2006/000309, entitled "Improvements Relating to Ovens" which has an international filing date of Nov. 22, 2006, which was published in English on May 31, 2007 under International Publication Number WO 2007/061323, which claims priority of U.S. Provisional Application Ser. No. 60/775,655, filed on Feb. 22, 2006, and entitled "Improvements Relating to Ovens" and New Zealand Patent No. 543764, filed on Nov. 24, 2005, which are all hereby incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of Invention

[0003] This invention relates to improvements to convection ovens and radiant heating ovens, or combination convection and radiant heating ovens, or microwave ovens, or combination microwave, convection and radiant heating ovens, or any combination of the above.

[0004] 2. Description of the Prior Art

[0005] A long-standing problem with ovens, especially those used domestically, is that the oven chamber is usually inconveniently located for either the addition or removal of foodstuffs. For example, in typical domestic cookers, the cooking chamber is usually located low down and close to floor level, with the top surface of the cooker forming a separate cooking area for boiling, frying and the like. To add or remove food to the oven chamber, a user is therefore required to bend down and manhandle heavy and awkward trays or pots in and out of a relatively small and inconveniently located chamber. This problem is exacerbated when the food, the container and the chamber are hot at the end of the cooking process, as the user has to bend down to grasp a hot tray or pot (at the same time as protecting their forearms and hands from contact with hot surfaces on either the container or the oven chamber). Furthermore, the user also has to deal with very hot air striking their face and arms when the door is opened.

[0006] Most ovens have shelves or racks that can be pulled in and out of the oven to aid with the removal or insertion process. These push-pull devices vary in sophistication from simple supports built into the sides of the oven chamber, with the user having to overcome the friction between the shelf and the supports to push or pull the shelf in or out, through to complex designs for drawer rails that are heat-resistant and low-friction, and which allow the shelves to be moved easily to more convenient locations. An example of a shelf rail system of this type is disclosed in WO 2004/025186.

[0007] Several prior art specifications describe devices that are directed towards solving the problem of having the food located closer to floor level than is convenient for a user. Both U.S. Pat. No. 1,777,529 and U.S. Pat. No. 1,851,183 disclose shelving systems that have both horizontal and vertical shelf movement, so that the oven shelf can be moved out of the oven chamber, and then moved from close to ground level to a location where the user can access the foodstuff on the shelf more conveniently.

[0008] In the device disclosed in U.S. Pat. No. 1,777,529, the user is required to bend down to move the adjustable rack out of the oven chamber. A user is required to adjust the shelving height by manually operating a handle, which is slow and inconvenient if the shelf needs to be moved over greater distances, such as from the bottom of the oven chamber to the top, where it would be more conveniently located for a user. The mechanism used to achieve the height adjustment converts horizontal motion to vertical motion using a gearing system. Whilst gearing ratios are not explicitly discussed in the disclosure of this specification, it is clear that the system disclosed requires a user to rotate the handle through multiple rotations in order to move the shelf through its full range of motion, adding to the inconvenience.

[0009] U.S. Pat. No. 1,851,183 discloses a shelving system that can be adjusted both horizontally and vertically using two separate handles which in the embodiment described are manually operated but which it is noted can be power operated. The shelf is supported by a telescoping sliding rail arrangement.

[0010] U.S. Pat. No. 6,114,665 discloses a system where a set of oven shelves are removeably attached to, and cantilevered backwards from, an oven door. The oven door is slid open on runners or similar, so that it remains in the vertical plane for the entire range of movement. Separate shelves can be added or removed from the stack as required.

[0011] Another problem that can occur with ovens of this type is the problem of hot air escaping from the oven chamber when the door is opened. Typically, this hot air rushes out as a user is attempting to remove or place foodstuffs on the oven shelf. This hot air can cause a user difficulty in placing the food correctly, and also discomfort. Also, it is easy for a user to inadvertently contact the hot surfaces (e.g. the shelving etc), and injure themselves. This is especially easy to do if a user has become temporarily unsighted due to hot air striking their face.

[0012] U.S. Pat. No. 2,133,639 describes an oven that attempts to solve this problems by having a horizontally opening door with a moving rear plate or wall attached at the rear of a shelf and door support mechanism. The rear plate substantially blocks the open front of the oven when the door is in the fully open position.

[0013] Yet another difficulty with ovens of this type is that of adequately protecting sensitive components that are located in a hot oven cavity. As ovens become more complex, and capable of a wider range of cooking functions, it is becoming increasingly common and necessary for the oven to include sophisticated control mechanisms and temperature measuring devices. Also, automated mechanical mechanisms to move the shelves or carry out other automated tasks within the oven cavity, either with the door open or closed, are increasingly being used. One problem with using mechanisms of this type is that of protecting them from heat, and changes in temperature within the oven cavity. Locating these mechanisms behind an inner, protective wall of an oven cavity can be impractical, and it would be useful for users to have the choice of an alternative mechanism.

[0014] Yet another known problem with convection ovens is that of achieving an even heat throughout the cooking chamber. Although it is known to use an integral oven fan or fans to circulate the hot air within the cooking chamber, hot spots can still develop, leading to uneven or unsatisfactory cooking of foodstuffs.

SUMMARY OF THE INVENTION

[0015] It is an object of the present invention to provide an oven that goes some way towards overcoming the above disadvantages, or which will at least provide the public with a useful choice.

[0016] In a first aspect the invention consists in an oven for cooking food comprising:

[0017] a cabinet having a front side with an opening formed therein,

[0018] a door moveable between a closed position closing the open front of the cabinet, and a fully open position allowing access to the interior of the cabinet via said opening,

[0019] a drawer, located within said cabinet when said door is in said closed position, said drawer forming at least part of a cooking chamber when in said closed position,

[0020] a drawer support means at least located within said cabinet when said door is in said closed position, supporting said drawer, and configured to allow said drawer to move from a position within said cabinet, to a position where said drawer is at least partially located outside said cabinet,

[0021] a controllable heating source provided within said cabinet or drawer for supplying sufficient heat to the inside of the drawer to cook food positioned therein,

[0022] and at least one vertically movable shelf located within said drawer, supported by a shelf support means.

[0023] To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] A preferred form of the present invention will now be described with reference to the accompanying drawings in which

[0025] FIG. **1** is an isometric view of a preferred form of the oven of the current invention, showing the outer casing that forms the open-fronted cabinet of the oven, an oven door in an open position, and a bin or drawer that forms a cooking chamber withdrawn from the oven, the drawer including a vertically moving shelf, the drawer in use sliding horizontally with the oven door to locate within the oven.

[0026] FIG. **2** is a cutaway side view of the oven of FIG. **1**, showing the drawer, with the shelf towards the top of the drawer, and the oven door in the open position, with the rear wall of the drawer also shown, the rear wall including a fan and shroud.

[0027] FIG. **3***a* is an isometric view of the oven of FIGS. **1** and **2**, showing the drawer withdrawn from the oven, with the oven door removed, and the shelf approximately halfway between the bottom and top of the drawer.

[0028] FIG. **3***b* is an isometric view of the drawer of FIG. **3***a*, with the shelf and oven not shown, showing hidden detail of the mechanism used to secure the oven door in place on the front of the drawer.

[0029] FIG. **4** is an isometric view of the oven of the present invention with the door in the closed position, showing hidden detail of the drawer fully located within the oven, and a heat shield located behind the drawer in a stored configuration.

[0030] FIG. **5** is a cutaway side view of the oven of FIG. **4**.

[0031] FIG. **6** is an isometric view of the oven of FIG. **4**, showing hidden detail of the heat shield in a semi-deployed position, with the door and drawer partway between a fully closed position and a fully open position.

[0032] FIG. **7** is a series of cut-away side views of the oven of FIG. **5**, showing (in sequence from the top) the door and drawer moving from a fully closed to a fully open position, with the heat shield moving from the stored position to the deployed position as the door opens and the drawer is withdrawn from the oven.

[0033] FIG. **8** shows the oven with the drawer and door in a fully open position, with the oven viewed from the front looking towards the rear, and angled towards the side of the oven, the view showing detail of a seal used at the front of the oven located on a chassis upper structure or block, the block protruding downwards from the inner upper surface of the oven.

[0034] FIG. **9** is an isometric view of the shelf support mechanism of the present invention, shown without the drawer or oven in place, and showing detail of upper and lower brackets connected by supporting rods, with shelf supports running vertically on the supporting rods.

[0035] FIG. **10** is a front view of the shelf support mechanism of FIG. **9**.

[0036] FIG. **11** is a side view of the shelf support mechanism of FIG. **9**.

[0037] FIG. **12** is a sectional close-up side view of a sealing mechanism used with the oven of the present invention to seal the gap between the drawer and the door of the oven, showing detail of the seal, the door and a chassis upper structure located on the roof of the oven.

[0038] FIG. **13** is a sectional close-up side view of a sealing mechanism used to seal the gap between the rear of the drawer and the oven outer structure, showing detail of the seal, the rear wall of the drawer and the chassis upper structure.

[0039] FIG. **14** is a close up view from the front of one embodiment of a seal used to seal the gap between the side walls of the drawer and the oven outer structure, showing detail of the seal, the left side wall of the drawer (looking into the oven), and the roof structure of the oven.

[0040] FIG. **15** is a close up view from the front of an alternative embodiment of a seal used to seal the gap between the side walls of the drawer and the oven outer structure, showing detail of the seal, the left-hand side wall of the drawer (looking into the oven), and the roof structure of the oven.

[0041] FIG. **16***a* is a close up view from the front of part of an alternative embodiment of a seal used to seal the gap between the walls of the drawer and the oven outer structure, showing detail of the seal, the left-hand side wall of the drawer (looking into the oven), and the roof structure of the oven.

[0042] FIG. **16***b* is a cut away side view of the oven of the present invention, showing detail of the alternative seal of FIG. **16***a*, with the door slightly open.

[0043] FIGS. **17***a-d* show isometric, side and cutaway side views of a control panel protector that can be used with the oven of FIG. **1**.

[0044] FIG. **18** shows a cut-away side view of a roof liner that can be used with the oven of FIG. **1**.

[0045] FIG. **19***a* is a cut away side view of the oven of FIG. **1**, with the drawer fully withdrawn, showing detail of a power linkage mechanism that is located between the static cabinet of the oven and the mobile drawer.

[0046] FIG. **19***b* shows the oven of FIG. **19***a* from a cut away top view, with the drawer withdrawn.

[0047] FIG. **20** shows a prior art motorised system used for opening and closing drawer-style devices, which can be adapted for use with the oven **1** of the present invention.

[0048] FIG. **21** is a front view of the lower part of the oven of the present invention, showing the base and side walls of the external shell or cabinet, the base and side walls of the drawer, and the drawer and door support mechanism of the preferred form of the present invention.

[0049] FIGS. **22***a* and **22***b* show views of a shelf support and shelf which can be used with the oven of FIG. **1** and the shelf support mechanism of FIGS. **9**, **10** and **11**.

[0050] FIG. **23** shows a view of an alternative form of oven drawer and shelf support mechanism from the rear and slightly above, the oven drawer in this form including side walls and a rear wall, a sub-housing located at the top centre of the rear wall of the drawer with two cable sheaths that form part of the shelf support mechanism running horizontally along the rear wall of the drawer close to the top edge, through the sub-housing and then running vertically along the side edges of the rear wall of the drawer.

[0051] FIG. **24** shows detail of the inside of the sub-housing of FIG. **23** detached from the rear wall of the drawer and viewed from the front, with a central cog, gear or sprocket located in a recess or central cavity in the centre of the sub-housing, and the cable sheaths shown with their sub-housing ends adjacent to the recess, with cables that run through the cable sheaths also shown running through the recess in the sub-housing and interfacing with the central gear, one cable on each side of the gear.

[0052] FIG. **25** shows detail of the shelf support mechanism of FIG. **23**, the surrounding structure of the oven drawer not shown for clarity, the cables shown with their entire length enclosed by the cable sheaths except inside the sub-housing and at their inner ends, the inner ends of the cables connecting with a shelf support arm at each side of the drawer, the cables in use moving the shelf support arm vertically, each of the shelf support arms also supported by a vertical guide channel located adjacent to the inner ends of the cables.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0053] While the invention is susceptible to embodiment in different forms, a specific embodiment is shown in the drawings, and described in detail. The present disclosure is to be considered an exemplification of the principles of the invention, and is not intended to limit the invention to that as illustrated and described herein.

[0054] The preferred embodiment of the present invention will now be described in detail with reference to the Figures. As shown in FIG. **1**, the present invention consists of a drawer-type oven **1**. That is, an oven with a horizontally opening door **2** connected to the front of a drawer structure. The basic structure of the oven **1** is an outer casing, external shell or cabinet **40** with an open front face. The oven **1** can be of the type that is fitted independently, or used with a separate cooktop located above the oven **1**, for frying, boiling etc. In the embodiment shown in the Figures, no cooktop is shown. The oven of the present invention is suitable for either of gas burner or electric element cooking, or both.

[0055] In the preferred embodiment, a control panel **12** is located on the upper front part of the front face of the oven **1**, just above the open front. Alternatively the control panel could be mounted on the front face of the oven, vertically to the left or the right of the open front. The open front of the oven **1** is closed in use by the door **2**. The door **2** can include a handle **11** that can be grasped by a user, and pulled to move the door **2** open. The door **2** opens and closes horizontally via a door support mechanism located within the cabinet **40**, with the door support mechanism connected to the door **2**. The door support mechanism can be any one of a number of alternatives such as are known in the art for horizontally sliding door or drawer structures. The preferred embodiment of the door support mechanism is shown in FIG. **21**. A pair of three-part, full-extension ball-bearing slide assemblies or support assemblies are used. Each of the assemblies is a combination of a static rail and extending slides or rails. Extending rails **3**, **4** support the door **2** and co-operatively slide with the pair of static supports **54** located within the oven **1**. It should be noted that two-part slides or any other suitable mechanism could also be used to support the door **2**. For example, sliding or extending rail and static supports similar to those described and shown could be located at the sides, rather than underneath.

[0056] The front ends of the rails **3**, **4** are connected to the inner face or inner structure of the door **2**, close to the lower comers of the door **2**.

[0057] In the preferred embodiment of the oven **1**, a bin, tub or drawer **5** is used to form an open-topped cooking chamber or cavity within the cabinet **40** of the oven **1**. The bin or drawer **5** can be withdrawn from a position located within the outer casing **40**, to a position outside the outer casing **40**. The drawer **5** of the preferred embodiment is connected to the inner surface or inner structure of the door **2**, so that the door **2** also acts as the front wall or face of the drawer **5**. The drawer **5** slides into and out of the cabinet **40** as the door **2** is opened and closed. The preferred embodiment of the drawer **5** is an open-topped receptacle, having four vertical or substantially vertical walls (two side walls **6**, **7**, a rear wall **8** and a front wall formed by the door **2**), plus a base **9**. In the preferred embodiment, the front wall of the drawer **5** is connected to, or is part of, the door **2**. The drawer **5** is sized so that it will fit within the space formed by the cabinet **40** of the oven **1**. The drawer **5** forms a cooking chamber which can be slid into and out of the cabinet **40** of the oven **1**. The door **2** in the closed position closes the open front of the cabinet **40**.

[0058] In the preferred embodiment, the door support mechanism also acts as a drawer support mechanism, with the drawer **5** and the door **2** supported by the support rails **3**, **4** and static supports **54**. The rails **3**, **4**, and the supports **54** take the vertical load of the drawer **5** and door **2** (or alternatively, the rails and supports can be located at the sides of the drawer **5**).

[0059] In order to help prevent racking of the door **2** and drawer **5** as they are moved into and out of the cabinet **40**, or rocking of the drawer **5** and door **2** from side to side, a third full-extension rail and static support can be used. The third rail **55** is located on the underside of the drawer **5**, between the base of the drawer **5** and the base of the oven **1**. The corresponding static support **56** is connected to the base of the oven. The alignment of the rail **55** and support **56** when viewed from the front as in FIG. **21**, is at an angle to the support rails **54** and the runners **3**, **4**. Preferably this angle is perpendicular, or 90 degrees, from the angle of the support rails **54** and the runners **3**, **4**. Due to this angle, the third rail **55** and support **56** give little or no vertical support to the drawer **5** and door **2**, but act to maintain the horizontal alignment of the drawer, so that racking is prevented. Alternatively, racking could be prevented by a conventional anti-racking system such as a rack and pinion style system.

[0060] It is preferable that the door is removable from the support, as shown in FIGS. **3***a* and **3***b*. This assists cleaning and maintenance. The door **2** is located in place on the drawer

5 by a pair of upright pins 51 at the front of the base 9 of the drawer 5, which fit into a pair of corresponding slots 52 on the base of the door 2. A pair of screws 53 pass through holes in the outer side walls 6, 7, of the drawer 5 and into holes close to the top of the door 2 to hold door 2 in place during everyday use.

[0061] The door 2 and the door support can also be connected to a linear motor or similar (not shown), and opened and closed by activating the motor via the control panel 12. A suitable prior art motorised system for opening and closing drawer-style devices is shown in FIG. 20. This can be adapted for use in the oven 1 of the current invention.

[0062] In normal day-to-day use, the support rails 3, 4 allow the door 2 and the drawer 5 to be pulled a certain distance out of the oven 1, to a fully open position which in the preferred embodiment is a position where the rear wall 8 of the drawer 5 is located substantially at the front of the oven cabinet. A stop mechanism on the rails and supports prevents the rails 3, 4, and the drawer 5 and door 2 from being pulled completely free of the supports, and stops forward motion of the drawer 5 at this point.

[0063] In the preferred embodiment, the support rails 3, 4 and the static supports 54 can also be 'over-extended' by way of an over extension mechanism, in order to move the door 2 and the drawer 5 further forward. This allows access behind the drawer in order to aid cleaning and maintenance. This over-extension would be activated by the release of a detent mechanism or similar on the rails 3, 4. The inventors envisage a combined stop and over-extension mechanism which comprises a sprung loaded pin on each of the slides or rails 3, 4. The pins provide the stop mechanism during normal operation. By pressing each pin down a user can then pull or slide the drawer 5 and the door 2 further out, and remove the drawer 5 from the support rails 3, 4, completely if necessary.

[0064] An example of a suitable rail and runner system, or support assembly, for supporting the door 2 and the drawer 5 would be Quadro type runners, such as those manufactured by Hettich. These are 3-part runners and rails that use ball bearing supports. These could be used for the rails 3, 4, and the supports 54, and the angled runner and rail assembly, rail 55 and support 56.

[0065] In the preferred embodiment, the door 2 includes a window (not shown) allowing a user to view the inside of the oven.

[0066] The upper part of the oven 1 forms a 'lid' for the cooking chamber, with the relative sizes of the drawer 5 and the oven 1 chosen to minimise any gap between the upper edges of the walls of the drawer 5, and the upper internal surface of the oven 1.

[0067] In the preferred embodiment, the drawer 5 is moved into and out of the oven 1 by sliding horizontally. The door 2 is connected to the front of the drawer 5, so when a user opens the door 2, the drawer 5 slides horizontally out of the cabinet 40, supported by the drawer (and door) support.

[0068] It is preferred that the inner surface or inner window pane of the door 2 covers the entire to drawer aperture or front face of the drawer. That is, the glass of the window overlaps the front edges of the side walls 6, 7. This ensures that any food spillages or soiling is contained on the inner surface of the door, making this surface easier to clean.

[0069] The two side walls 6, 7 of the drawer 5 of the preferred embodiment are insulated, so that the outer surfaces of the walls 6, 7 will be cooler than the inner surfaces of the drawer 5. This insulation ensures that the outside surfaces of the drawer are cool enough for a user to touch, and the user will not bum themselves by inadvertent contact with the side walls 6, 7 when the drawer 5 and door 2 are in the open position. The door 2 can be configured with or without a window as described above, but in the preferred embodiment it is also at least partially insulated so that the outer surface remains cool and will not bum a user if they contact the outer surface of the door 2.

[0070] The oven 1 of the preferred embodiment is the type that has an upper heater 39, such as a radiant element, grill element or gas flame array located on or in the internal upper surface of the oven 1. When the drawer 5 is located within the oven 1, any foodstuffs within the cooking chamber formed by the drawer 5 will be exposed to heat from this upper heater 39.

[0071] In the preferred embodiment, the base 9 of the drawer 5 also includes a lower heating element (not shown). This lower or base heating element fulfils a similar function to the baking elements or heaters of ovens known from the prior art, and can be a gas array, a heating element, or any other suitable heater that is known in the art.

[0072] It should also be noted that other heater can be used either separately or in combination with the oven of the present invention. For example, microwave heating could be used either as the main heater or as a supplementary heater, with gas or electric elements also providing heating.

[0073] The preferred embodiment of the drawer 5 also includes a vertically moving or substantially vertically moving shelf 10. Foodstuffs are placed on the shelf 10 by a user, so that they can be cooked. The shelf 10 is connected to, or rests on, a shelf support mechanism. In the preferred embodiment, this shelf support mechanism is located in the side walls 6, 7 of the drawer 5. Vertical slots 49 in the inner surfaces of the walls 6, 7 allow connection from the shelf support mechanism to the shelf 10, and allow the shelf 10 a range of movement from the bottom of the drawer 5 to the top of the drawer 5. In the preferred embodiment, this shelf support mechanism is a pulley and cable arrangement.

[0074] In the preferred embodiment, the shelf 10 is fitted closely to the side and rear walls 6, 7, 8 of the drawer 5, and the drawer front wall formed by the door 2. The base 9 of the shelf 10 is also depressed below the level of the shelf edges, so that spillages are contained on the shelf, and kept within an easily accessible and cleanable area.

Shelf Support Mechanism

[0075] The preferred form of the shelf support mechanism will now be described with reference to FIGS. 9, 10, and 11.

[0076] The side and rear walls 6, 7, 8 of the drawer 5 are double-skinned, with a hollow space between the inner and outer skins. A framework is located in this space which supports the shelf 10, and controls vertical movement of the shelf 10. The framework is comprised as follows:

[0077] A pair of lower horizontal support arms or lower brackets 42 are located at the bottom of the spaces in the side walls 6, 7, running from the front to the rear of the drawer 5. A pair of upper horizontal support arms or upper brackets 47 are located at the top of the spaces, also running from the front to the rear of the drawer 5. The lower and upper brackets 42, 47 are separated by spacing rods 45, one pair of rods 45 on each side of the drawer 5. A pair of shelf supports or lifter carriages 46, one on each side, are also guided by the rods 45. The lifter carriages 46 move freely between the top and bottom of the drawer 5 along the rods 45. A combination motor and gearbox 44 is located at the lower rear of the drawer 5,

external to the rear wall of the drawer **5**. A transmission mechanism transfers power from the motor/gearbox **44** to the lifter carriages **46**. In the preferred embodiment, the transmission mechanism is a double-ended drive shaft **43**, which runs horizontally across the lower rear of the rear wall **8** of the drawer **5**.

[0078] Alternatively, two motor/gearboxes could be used, one at each end, removing the need for a driveshaft such as driveshaft **43** described above.

[0079] The motor/gearbox **44** drives the shaft **43** in a rotary motion. The rotary motion is transferred to the lifter carriages **46** via a system of pulleys (not shown), bowden cables **48**, and drums (not shown) which in the preferred embodiment are mounted on the frame formed by the lower and upper brackets **42**, **47**, the rods **45** and the lifter carriages **46**. The cables **48** pass through the rear wall of the drawer **5** to connect between the shaft **43** and the lifter carriages **46**. The rotary motion is converted to vertical motion by this system. If the shelf **10** is manufactured as one solid unit, pins on the shelf **10** project horizontally inwards through the slots **49** to be supported by the lifter carriages **46** so that the shelf **10** is supported in the drawer **5**. Alternatively, as shown in FIG. **22**, a support frame **57** can be used to support the planar shelf **10**, the support frame **57** running the width of the drawer **5**, pins **58** on the sides of the support frame **57** passing through the slots **49** to support the frame **57**, with the shelf **10** resting on top of, or fitted to, the frame **57**. It should also be noted that beams or rods attached to the support frames **57** and running the width of the drawer **5** could be used to support the shelf **10**. It should also be noted that the pins could also be located on the lifter carriages **46** if required, passing through the slots **49**, into the interior of the drawer **5** to support the shelf **10**.

[0080] In an alternative form, the shelf support mechanism comprises a toothed cable and helical sprocket drive system as shown in FIGS. **23** to **25**. A sub-housing **100** is connected to the drawer **5**, preferably at the centre upper rear, external to the rear wall of the drawer **5**, and preferably co-located with the motor and gearbox **44**. The sub-housing **100** includes four parallel channels or passages **101***a*, **101***b*, **101***c*, **101***d* which when the sub-housing **100** is connected to the rear wall **8** of the drawer **5** lead from the sides of the sub-housing **100** to a central cavity **102**, the passages **101***a-d* generally horizontally aligned in use when the sub-housing is attached to the rear wall **8**. The passages or channels **101** are arranged in two pairs, an upper pair (**101***a*, **101***b*) and a lower pair (**101***c*, **101***d*). The passages that make up a pair are aligned in line or linearly with each other (**101***a* with **101***b*, and **101***c* with **101***d*), with one each of the pair on each side of the cavity **102**. A cog, gear or sprocket **103** is located in the recess or central cavity **102**, and is connected to the motor/gearbox combination **44** so that in use it can be driven in either direction by the motor. Tubes or cable sheaths **104** are located in the passages **101***a*-d, with their inner ends **105** aligned with the side edges of the central cavity **102**. The bodies of the tubes or cable sheaths **104** extend outwards from the ends of the passages **101***a-d* to the drawer side walls **6**, **7** (or alternatively to each side or edge of the rear wall **8**). Cables **106** are located in the cable sheaths **104** in use—an upper cable **106***a* and a lower cable **106***b* (referring solely to their in use position as the cables pass through the sub-housing **100**. The cables **106***a*, **106***b* are notched or geared on their outside surface, for example by including a continuous helical groove on the outer surface of each cable **106***a*, **106***b*. It can be seen that part of the body of each of the cables **106***a*, **106***b* will be exposed (i.e. not enclosed by the sheath **104**) as it passes through the sub-housing **100**. The helical sprocket **103** in use meshes or interfaces with both the upper cable **106***a* and the lower cable **106***b*, one cable on each side of the sprocket **103**, so that in use as the sprocket **103** rotates cable **106***a* is driven in the opposite direction to cable **106***b*. That is, when the helical sprocket **103** rotates in use, it will drive one cable in one direction (left or right) and the other cable in the other direction. The inner ends, or 'drawer' ends of the cables are in the preferred embodiment connected one each to each of the lifter carriages **46** (or a variant thereof). This connection is made either directly or via a traveller element (not shown) located between the lifter carriage and the cable. Alternatively, the traveller could be connected directly to the shelf **10**, or the inner end of the cable **106** could be connected directly to the drawer **10**, so that the lifter carriages can be dispensed with completely. The shelf **10** could (as in the preferred embodiment described above) be supported by pins passing through slots in the side walls **6**, **7** of the drawer. In any of the variants (direct connection, indirect connection, etc), the inner ends of the cables **106** can be said to be 'connected' to the shelf **10**. It should also be noted that the rear ends of the lifter carriages **46** can be located in a guide channel **111** if required. The sheaths **104** are long enough that the other ends of the cables **106***a*, **106***b* should never be exposed (i.e. they should never be external to the sheath), but will remain inside the sheath at all times over the full run of the shelf **5** from the top of the oven cavity to the bottom. In the preferred form, this part of the sheath **104** runs horizontally along the rear wall **8** of the drawer to keep it out of the way, and to allow the cables **106** to move or run freely within the sheath **104**. It can be seen that the movement of both of the two cables **106** is controlled by the one motor/gearbox combination **44**. When the helical sprocket **103** rotates, the cables **104** will always move simultaneous to one another and at the same speed. The cables **104** will never become unsynchronised. As noted above, the inner ends **110** of each of the cables **104** are connected (directly or indirectly) to the drawer **10**, either to the sides, or at each side of the rear edge—that is, connected to opposed portions of the shelf **10**. As the cables **104** move at the same speed, the drawer **5** will always be horizontally aligned—one side will never move up or down faster than the other—it will always remain horizontally aligned.

[0081] Other mechanisms could be used to support the shelf **10**. Examples of these mechanisms include worm gears and threaded blocks (or recirculating ball bearing/ballscrew type blocks) located in the wall spaces, and supporting the shelf via pins through the slots **49**. The worm gears could also be located in the rear wall **8**, with the shelf supported by cantilevered beams from the rear shelf. It would also be possible to have this mechanism in the front wall of the drawer **5**, or the rear wall in some embodiments if preferred. However, this is not the preferred location. A scissor-type mechanism could also be used. Sprocket and mini-chain drives could also be used, or other mechanical raising and lowering mechanisms that are well-known in the art. These could also be located in the side, rear or front walls if required.

[0082] The shelf support mechanism is preferably powered by the same linear motor used to operate the door **2**, although a separate motor can be used if required. A user can control movement of the shelf **10** from the control panel **12**. A user can raise or lower the shelf **10** with the drawer **5** located within the oven **1**, changing the vertical location of the shelf **10**, in order to ensure that foodstuffs located thereon are

correctly cooked. For example, moving the shelf from a position in which the food has been baked, to a position close to the upper heater **39**, where the upper surface of the food can be grilled and crisped before serving.

[0083] The vertical location of the shelf **10** within the drawer **5** can also be controlled by a user when the drawer **5** is withdrawn from the oven **1**. However, it is preferred that when the door **2** and drawer **5** are moved to the fully open position, the control system of the oven **1** will automatically move the shelf **10** to an upper position. In the preferred embodiment, this upper position is just below the upper edges of the two side walls **6**, **7**, as shown in FIG. **2**. This position is convenient for loading and unloading. With the shelf **10** in this upper position, the surface of the shelf is close to or at the same level as a worksurface or work bench. This proximity to a worksurface ensures that a user will be able to load and unload foodstuffs with less effort than that which would be required if they need to bend or squat to lift or lower foodstuffs into or out of the oven **1**, or onto a shelf located at a lower position. Furthermore, with the shelf **10** in this position, the likelihood of a user contacting a hot surface on the inside of the oven **1** or the internal surfaces of the drawer **5** is minimised. As described above, the walls of the drawer **5** are cool to the touch. Therefore, when the door **2** is opened and the shelf **10** is raised, only the shelf **10** is accessible to a user as a hot surface. In this position, the shelf also acts to retain the heat inside the oven, as the open front of the oven will be blocked by the walls and base **9** of the drawer **5** and the shelf **10**. As the shelf **10** and the work surface are as close to the same horizontal plane as possible, a user will also need to expend less effort to move foodstuffs from one location to another.

[0084] It is preferred that the controls of the oven **1** include a mechanism that controls movement of the shelf **10** and door **2** relative to one another, so that the shelf **10** cannot be raised vertically to the load/unload position until the drawer **5** has been fully withdrawn from the oven **1**. As described above, a user can alter the vertical position of the shelf **10** while the drawer **5** is located inside the oven, in order to achieve the desired cooking effect.

[0085] It is also preferred that the initial vertical position of the shelf is dependent on the selected cooking function. For example, if the oven is set to carry out a 'bake', 'convection bake' or 'roast' function, the initial vertical position of the shelf will default to a low position. If the oven is set to carry out a 'grilling' or 'broiling' function, the controls will allow the shelf **10** to enter the oven **1** at a higher position. In the preferred embodiment, the control panel **12** includes a display or indicator that shows the vertical position of the shelf **10**. This allows a user to assess the shelf height without looking through the window, when the drawer **5** is located within the oven **1**.

[0086] A microswitch, sensor, or other suitable device such as a light curtain can be added at or close to the top surface of the oven, so that the shelf cannot inadvertently be pressed onto the upper heater **39**. Activation of this mechanism or sensor will cut power to the shelf support, so that it will not move any further upwards.

[0087] As described above, the control panel **12** is located on the front face of the oven **1**, and remains static. If required, additional controls can be added inside the drawer **5**, for example, just inside the door **2** at the top. Alternatively these controls could also be added on the front outer surface of the door in an easily accessible location, such as on the door handle. This aids a user in adjusting the shelf position when adding or removing foodstuffs from the oven **1**.

[0088] If required, the shelf **10** can be sized and shaped to allow improved circulation of hot air from the lower element located in or on the base **9**, below the shelf **10**, into the cooking chamber. For example, the shelf **10** can be sized so that there is a narrow gap between the front of the shelf **10** and the front wall of the drawer **5**, to allow air to circulate. Also, holes can be included in the shelf **10**, to improve the air circulation from the lower element or heater to the foodstuffs located on the shelf **10** above.

[0089] It is preferred that the oven **1** also includes at least one fan **13** to improve air convection around the cooking chamber. In the preferred embodiment, the fan or fans **13** is located behind the inner surface of the rear wall **8** of the drawer **5**. Preferably the wall **8** is hollow, to allow the fan **13** and other oven utilities to be located within it. Air passes to and from the fan **13** via a shroud **14** located in front of the fan **13**, the shroud **14** located in the rear wall **8** and flush with the rear wall **8**. If required for improved air circulation, the shroud **14** can be a rotating shroud, as described in the applicants co-pending application PCT/NZ2005/000056.

Control Panel Protector

[0090] One problem that can occur when the drawer **5** is withdrawn from the oven, and the shelf **10** raised to the upper position, is that of foodstuffs or foodstuff by-products such as grease splashing the oven **1**, and in particular, the control panel **12** at the top front of the oven. The preferred embodiment of the oven **1** of the present invention includes a control panel protector **31** that will now be described with reference to FIGS. **17***a-d*.

[0091] The control panel protector **31** is located attached to the top rear of the drawer **5**, and comprises a rigid panel or length of material, such as a thermoset plastic or similar, that runs the full width of the rear of the drawer. The rear edge of the protector **31** is pivotally connected to or close to the upper rear edge of the drawer **5**. When the drawer is located inside the oven, as shown in FIG. **17***c*, the protector **31** pivots about its rear edge to lie generally flat, roughly aligned with the top of the drawer **5**. The protector **31** is shaped such that the front, upper edge is angled slightly upwards when the protector **31** is in this stored position. The protector **31** is sprung or otherwise spring-loaded, either by springs (not shown), or at least partially under its own elasticity, so that when the drawer **5** is fully withdrawn from the oven **1**, as shown in FIGS. **17***a*, **17***b* and **17***d*, the control panel protector **31** deploys by rotating about the rear edge **32** in such a manner that the body of the protector **31** is aligned facing upwards and angled slightly forwards. The height of the protector **31** is sufficient to block any direct splash lines, or line of sight between the control panel **12** and the shelf **10**. When the drawer **5** is pushed back into the oven, the protector **31** rotates downwards about the rear edge, as shown in FIG. **17***b*, to a storage position. The protector **31** can also be located on the oven chassis, with the protector **31** pulled forward into the deployed position as the drawer **5** is pulled into the fully open position.

Drawer Sealing Mechanism

[0092] It can be seen that when the drawer **5** is located within the oven **1**, the majority of the heat from both the upper and lower elements or heaters will be directed into the drawer **5**. However, unless blocked in some manner, some heated air

will pass over the top edges of the walls of the drawer **5**, and into the space between the walls of the drawer **5** and the inner surfaces of the oven. This has the undesirable effect of heating up the external surfaces of the side walls **6**, **7** of the drawer **5**. It also causes the temperature in the oven cavity to rise, which can cause damage to oven components located in this space.

[0093] In order to protect heat-sensitive components that may be located in this space, the oven **1** and drawer **5** are fitted with a seal to close this gap. The seal can be any suitable arrangement that helps to prevent heat from exiting the drawer over the top edges. One problem with adding a seal of this type is that of drag and wear on the seal when the door **2** is opened and closed, and the drawer **5** is moved into and out of the oven.

[0094] Several different forms of seal which form part of the present invention will now be described with reference to FIG. **8** and FIGS. **12-16**.

[0095] It can be seen that it is the gap between the walls of the drawer **5** and the internal walls of the oven **1** that require sealing. That is, a seal is required between each of the side walls **6**, **7** of the drawer **5**, and the internal surfaces of the side walls of the oven **1**. A seal is also required between the internal surface of the rear wall of the oven **1**, and the rear wall **8** of the drawer **5**. A seal is also be required at the front of the oven, between the door **2** and the internal surfaces of the oven **1**. That is, separate front, rear and side seals are preferred in order to achieve full protection. In order to provide the best protection, the seals along the sides of the drawer **5** will need to run the full depth of the drawer **5**. That is, from the front to the rear of the drawer **5**.

[0096] A first embodiment of a front seal suitable for use in the gap between the door **2** and the oven surfaces will now be described with reference to FIG. **8** and FIG. **12**. That is, a front seal.

[0097] FIG. **8** shows the oven **1** of the preferred embodiment, with the drawer **5** in the open position.

[0098] The oven includes a chassis upper structure or block **16**, the front face of which is located at or towards the front of the oven cavity, protruding downwards from the inner top surface of the oven **1**. There is a gap each side of the block **16** to allow the side walls **6**, **7** of the drawer **5** to pass into the oven cavity. The rear wall **8** of the drawer **5** is slightly lower than the side walls **6**, **7**, so it just fits underneath the block **16**. A front seal or gasket **15** as shown in FIG. **8** is shown on the front face of the block **16**, running horizontally the full width of the block **16**. There is vertical overlap between the front face or front portion of block **16** and the door **2**. When the user closes the door **2**, the inner surface of the door **2** is brought into contact with the front seal **15** to create an airtight seal along the front edge of the drawer **5**. Further detail of this arrangement is shown in FIG. **12**, which shows a section or cut away side view of the front of the oven **1**. The door **2** is shown in the closed position, with the inner surface of the door **2** butting against a seal **15***a* (a preferred form of the seal **15**). An example of a suitable material for the front seal **15***a* is silicone. The seal **15***a* could also be made from woven fibreglass. Any other material with suitable heat resistant and flexibility properties could also be used.

[0099] The rear seal between the rear of the drawer **5** and the rear wall of the oven **1** shall now be described with reference to FIG. **13**.

[0100] The block **16** is sized over the majority of its depth (front to rear size) so that its lowest portions lie just over the top of the upper surfaces of the walls of the drawer **5**. The rear portion of the block **16** protrudes downwards slightly lower than the majority of the block **16** so that there is some vertical overlap between the rear portion of the block **16** and the rear wall **8** of the drawer **5**. A rear seal **15***b* is located on this protrusion, facing towards the open front of the oven **1** and running the full width of the block **16**. The rear face of the rear wall **8** of the drawer **5** abuts against the rear seal or gasket **15***b* when the drawer **5** is located fully inside the oven **1**, to create an airtight seal along the rear edge of the drawer **5**. As with the front seal **15***a*, the rear seal **15***b* can be made from silicone, woven fibreglass, or any other suitable material.

[0101] Different embodiments of the side seal used to form a seal between the side walls **6**,**7**, of the drawer **5** and the walls of the oven **1** shall now be described, with reference to FIGS. **14** and **15**.

[0102] FIG. **15** illustrates one form of side seal that forms part of the present invention. FIG. **15** is a sectional view of the upper left hand portion of the oven **1**, looking into the oven **1** from the front, with detail of a left hand side seal **15***c*, the left hand side wall **7** of the drawer **5**, and the block or chassis upper structure **16** shown. The left hand side seal **15***c* comprises a gasket **29** mounted to a floating arm **23**, which is attached to the chassis upper structure or block **16** The seal **15***c* further comprises at least two roller wheels **24**, one each at the front and rear, and attached to the floating arm **23**, which roll along the side wall **7** of the drawer **5** as the drawer **5** is moved into and out of the oven **1**. In this position, the floating arm **23** is under some compression. When the drawer **5** reaches the closed position each of the rollers **24** is pushed into a dimple **25** on the side wall **7**. These dimples **25** are sized so that the side sealing gasket **15***c* is pushed by the floating arm **23** onto the surface of the wall **7** and hence creates a seal. A similar, symmetrical, arrangement is used on the other side of the oven **1**.

[0103] An alternative side seal is shown in FIG. **14**, which is a sectional view of the upper left hand portion of the oven **1**, looking into the oven **1** from the front, with detail of a left hand side seal **15***d*, the left hand side wall **7** of the drawer **5**, and the block or chassis upper structure **16** shown. The side seal **15***d* comprises a hard frictionless or low-friction tip **27**, mounted on a spring gasket **26**. The low-friction tip **27** is pushed onto the left hand drawer sidewall **7** by the spring gasket **26**, which is connected to the chassis upper structure **16**. The spring gasket **26** maintains a constant sealing force between the drawer side wall **7** and the tip **27**. This side seal **15***d* has the advantage that any misalignment between the drawer **5** and the oven **1** is easily compensated for. Also, the need for any moving parts is removed by having a seal that is always in contact with the drawer sidewall. Again, a similar, symmetrical, arrangement is used on the other side of the oven **1**. The side seal **15***d* is sized so that it runs substantially the full depth of the oven, to close the gap between the side walls **6**, **7** of the drawer **5** and the walls of the oven **1**.

[0104] The front and back seals used with this alternative side seal can be the same as has already been described above.

[0105] It should be noted that when using a combination of front, rear and side seal as described above for **15***a*, **15***b*, **15***c* and **15***d*, it is expected that there will be a small amount of heat leakage. The inventors expect that the overall sealing provided by these seals will still provide adequate function even if the drawer **5** is not completely sealed.

[0106] Another alternative form of seal will now be described with reference to FIGS. **16***a* and **16***b*.

[0107] The seal of this alternative embodiment simplifies the sealing surface by sealing on the top of the drawer **5** all the way around the perimeter of the upper surface of the walls of the drawer **5**. This seal also has the advantage that a continuous seal is created all around the perimeter of the drawer **5**, reducing heat leakage.

[0108] FIG. **16***a* shows a sectional view of the upper left hand portion of the oven **1**, looking into the oven **1** from the front, with detail of the left hand part of the upper seal **15***e*, the left hand side wall **7** of the drawer **5**, and a block or chassis upper structure **16** shown, which shall be referred to as the second chassis upper structure to differentiate it from that already described.

[0109] This seal **15***e* has the advantage that the faces of the seal **15***e* and the drawer sealing faces (that is, the upper surfaces of the walls of the drawer **5**) have a similar profile all the way around the top perimeter of the drawer **5**, and heat leakage is reduced. Also, wear on the contact surfaces of the seal **15***e* is reduced.

[0110] The seal **15***e* of this embodiment comprises a floating member **28**, which is able to move vertically, and which forms a lid for the drawer **5**, and a sealing gasket **30**. When the user pushes the drawer **5** into the oven **1**, the floating member **28** is lowered by an actuating system to bring the gasket **30** into contact with the top faces of the walls of the drawer **5**, running around the full perimeter of the top of the drawer **5**. The actuating mechanism will instantaneously raise the floating member and thus the sealing gasket **30** from the upper rim or perimeter of the drawer **5** when the drawer **5** is opened or moved from the closed position. The preferred embodiment of the actuating mechanism will now be described in more detail with reference to FIG. **16***b*.

[0111] Attached to the front and the back of the floating arm **28** are guide pins **59** which protrude vertically upwards through the upper heating element **39** and the second chassis upper structure **16**. The guide pins **59** have a rolling wheel **60** attached to the upper end of each of the pins **59**, each of the wheels **60** rolling in the horizontal plane. Each of the wheels **60** rolls horizontally on top of the second chassis upper structure **16**. In this embodiment, at least the top part and rear part of the second chassis upper structure **16** are capable of some limited movement in the horizontal plane, with part of the second chassis upper structure **16** protruding down behind the drawer **5**, so that there is vertical overlap between the second chassis upper structure **16** and the drawer **5**. As the drawer **5** is closed, the rear of the rear wall **8** comes into contact with the rear portion of the second chassis upper structure **16**, which is pushed horizontally backwards towards the rear of the oven **1**. As the second chassis upper structure moves to the rear of the oven, the rolling wheels guide pins **59** stay in place. The top of the second chassis upper structure includes grooves **61**. As the second chassis upper structure **16** moves rearwards the grooves **61** pass under the wheels **60**, so that the wheels **60** drop into the grooves **61**. This in turn lowers the guide pins **59**. This causes the floating arm **28** and the gasket **30** to drop from an initial position, spaced from the drawer **5**, onto the top of the drawer **5**, creating the seal. When the drawer **5** is opened, the rolling wheels **60** track up the angled rear side of the grooves **61**, raising the seal **30** off the drawer **5**.

[0112] If required, springs (not shown) aligned vertically can be included between the second chassis upper structure **16** and the floating arm **28**, to ensure that the wheels **60** track correctly, and to provide a positive sealing force between the gasket **30** and the drawer **5**.

[0113] In alternative embodiments, shaped hooks or protrusions could be used instead of the wheels **60**, the protrusions sliding along the top of the second chassis upper structure **16** to locate into the grooves **61**.

[0114] It should also be noted that any suitable actuating system can be used in place of that described above. For example, the floating member **28** and gasket **30** could be moved vertically up and down by a motor connected to a suitable system such as a screw and worm gear combination.

[0115] By using the seals **15***a*, or **15***b*, or **15***c*, or **15***d*, or **15***e*, or any combination of these seals, or any other suitable sealing mechanism to prevent hot air from escaping from the drawer **5** and into the space between the drawer **5** and the internal surfaces of the oven **1**, sensitive components and oven parts that are located in this space are protected from excess heat. A further advantage is in cooking efficiency, as less power is needed to keep the cooking chamber temperature at the correct level.

Umbilical Power Link

[0116] One difficulty that arises from having a moving drawer **5** with associated utilities or electrical loads such as a shelf **10**, a fan built into the rear wall **8**, and a lower heater underneath the shelf **10** is that of providing power, or control signals, or both, to these utilities. The oven **1** of the present invention includes a power link to provide power from a static source to the utilities or electrical loads in the moving drawer **5**.

[0117] The preferred embodiment of the power link will now be described with reference to FIGS. **19***a* and **19***b*.

[0118] The function of the power link is to provide an electrical link between the static base of the oven **1** and the rear wall **8** of the moving drawer **5** so that power can be provided to the drawer **5**, and if required, information can be sent to and from the drawer **5**. The power link is comprised as follows: A chassis board **33** is located at or towards the lower rear of the oven **1**. In the preferred embodiment, at least part of board **33** is a printed circuit board (PCB) assembly. The chassis board **33** provides a link or junction to an external mains power connection, and can include a transformer or power modulator if required. It is preferred that the link provides both low voltage power for shelf motion and signals, as well as mains voltage for elements. The mains power does not come from a power supply within the product—it is provided by a mains connection. However, a separate power supply could also be placed on the drawer for drawer power and control signals.

[0119] An inner swivelling connector or clip **35** is connected to a static pivot point **60** on the base **61** of the oven **1**, at a point approximately midway between the front and the rear of the oven cavity, and offset slightly to one side. A wiring harness **34** provides power from a mains connection outside the oven **1**, and runs from the rear wall of the oven **1**, along the base **61** of the oven **1**, from the chassis board **33** to the static pivot point, and up into the main oven cavity through the inner swivelling clip **35**. This inner swivelling connector **35** is rigidly connected to one end of a rigid or stiff swinging arm **36**. The wiring harness **34** runs the length of the swinging arm **36** and is supported and protected by the swinging arm **36**. The wiring harness carries both low voltage signals (e.g. control signals for the oven **1** and shelf motion power signals)

and mains power supply. The other end of the arm **36** is connected via an outer swivelling clip or connector **37** to a drawer board **38**, which provides a link to the electrical items on the drawer **5**. In the preferred embodiment, at least part of drawer board **38** is a printed circuit board (PCB) assembly. The connection of the arm **36** to the outer connector **37** is not rigid, and the arm **36** can slide within the connector **37**. That is, a slidable connection is made between the connector **37** and the arm **36**. This could be reversed, so that a slidable connection is made between the connector **35** and the arm **36**. In the preferred embodiment, the drawer board **38** is connected to the base **9** of the drawer **5** preferably at the lower rear corner, where the rear wall **8** meets the base **9** of the drawer **5**. However, it can be connected at any other suitable location, including a location off the drawer **5**, for example on the base of the oven **1**. As the drawer **5** is opened and closed, the arm **36** pivots about both the inner and outer swivelling connectors **35**, **37**, through an arc with an angle of approximately 35 degrees, with the drawer **5** passing over the top of the arm **36** and both connectors **35**, **37**. The advantage of this mechanism is that the wires in the harness **34** have to flex through a relatively small angle when the drawer **5** is opened and closed. That is, the angle is minimised. This reduces the likelihood of fatigue failure. It is preferred that the arm **36** has the form of a hollow or U-shaped tube, allowing the harness wires to run inside the tube. 'Hollow' as written in this specification should be taken to mean either hollow or U-shaped. It is not strictly necessary for the angle to be as small as it possibly can be, and the overall configuration of the oven components will affect the overall angle. However, as described above, it is preferred that the angle is kept small so that fatigue is minimised.

[0120] It should be noted that in the preferred embodiment described above, the moving parts of the power link (the swivelling connectors **35**, **37** and the arm **36**) are located on the base of the oven **1**. If required, alternative configurations could have the moving parts located between one of the side walls of the drawer **5**, and one of the side walls of the outer shell.

[0121] It should further be noted that the power link arm arrangement described above would also be suitable for providing a power connection for any drawer style appliance. For example, a similar arrangement could be used in drawer style dishwashers such as the dishdrawer™, manufactured by the applicant.

Oven Cavity Roof Shield

[0122] One issue with drawer-style ovens is the difficulty of accessing the roof of the oven cavity. That is, the difficulty of access to the underside of the top surface of the oven **1**. In the oven **1** of the present invention, this difficulty is compounded by the walls of the drawer **5**, which further hinder access. To help with cleaning and maintenance, an oven cavity roof shield is used. The preferred form of the oven cavity roof shield will now be described with reference to FIG. **18**.

[0123] As stated above, the oven **1** includes an upper heater **39**, which can act as a grill element. The oven cavity roof shield comprises a slide out roof liner **50**, which is located above the upper heater **39**, between the upper heater **39** and the underside of the oven roof, and covers substantially the entire surface area of the roof. The roof liner **50** can be slid forward on rails, rollers or any other similar support mechanism in order to remove it from the oven **1** for cleaning or maintenance. FIG. **18** shows the roof liner **50** in the 'use' position (shown by solid lines), with the liner **50** fully located inside the oven above the upper heater **39**, and also in the 'withdrawn' position (shown by dotted lines), where it has been at least partially withdrawn from the oven for cleaning or maintenance.

Heat Shield

[0124] A further advantage of the oven of the present invention shall now be described with reference to FIGS. **2**, **4**, **5**, **6** and **7**.

[0125] It can be seen that when the drawer **5** is withdrawn or pulled out of the oven **1**, the heat from the upper heater **39**, which in use is directed into the cooking chamber formed by the drawer **5**, will radiate directly into the interior of the oven **1**, unless directed elsewhere. Heat radiating into the oven **1** can damage sensitive components. Mechanical components that are vulnerable to excess heat can warp, and components that should slide freely over one another can seize. Electronic components subjected to heat can become inefficient, or otherwise lose effectiveness. It is therefore undesirable for this heat to be radiated directly into the interior space of the oven **1**.

[0126] In order to prevent this, the oven **1** of the preferred embodiment is fitted with a heat shield **20**. It is preferred that the heat shield **20** is used with the preferred embodiment of the drawer **5** described above.

[0127] The heat shield **20** is located behind the drawer **5**, and deploys when the drawer **5** is withdrawn from the oven **1**. In the preferred embodiment, the shield **20** is a generally flat and rectangular reflector, folding into a stored position when the drawer **5** is located inside the oven **1**, and unfolding to a deployed position when the drawer **5** is withdrawn from the oven **1**, as shown in FIGS. **5**, **6**, and **7**.

[0128] In the preferred embodiment, and as shown in FIGS. **2**, **6** and **7**, the shield **20** is sized so that in the deployed position it will unfold to form a generally horizontal plane, located just underneath the upper heater **39** of the oven **1**, with the drawer **5** fully withdrawn from the oven. In the preferred embodiment, the shield **20** runs across substantially the full internal width of the oven **1**.

[0129] The front edge **21** of the shield **20** is connected to the rear wall **8** of the drawer **5**. The rear edge **22** of the shield **20** is connected to the inner surface of the oven rear wall. That is, the inner surface of the outer casing. The preferred form of the shield **20** folds in half by means of a fold line or hinge **24** located between the two parts, folding into these two halves as the shield traverses from the deployed, planar position to the storage position. Each half of the shield **20** is approximately the same size as the other. Each part is stiff enough so that they will not bend or sag under normal operating conditions, or their own weight. The hinge **24** and the shield **20** are biased so that when the drawer **5** is pushed into the oven **1** from the open position, the two parts of the shield **20** fold downwards, and will not fold upwards to interfere with the upper heater **39**.

[0130] It is preferred that at least the upper surface of the shield **20** is formed from a heat reflective material. For example, a metallic foil.

[0131] It would be preferable for the front of the heat shield to be located towards the top of the drawer. However, there will clearly be at least a partial shielding effect if the heat shield **20** is angled downwards from the rear edge at the rear of the oven. It can be seen that there will also be at least a partial shielding effect for the lower part of the oven **1** if the shield **20** cannot be located towards the top of the oven, and is

located partway between the uppermost and lowest positions. This flexibility in the location the shield **20** allows for it to be used with ovens of different internal configurations.

[0132] As stated above, it is preferred that the heat shield is used with the preferred embodiment of the drawer **5** described above. However, the heat shield could also be used with non-drawer ovens that have a shelf support mechanism similar to that described above, or prior art ovens where the shelf can be withdrawn from the oven. In ovens of this type, the front edge **21** of the heat shield would be attached to the rear edge of the shelf, or at a suitable location on the shelf support mechanism. For example, the corners of the heat shield could be attached to the rear of the shelf supports or lifter carriages **46**, so that as the shelf is brought forward, the shield deploys from a stored position to a deployed position. When attachment of the heat shield to a shelf support mechanism is referred to, this should be taken as meaning either the back of the drawer **5** in the preferred embodiment, or the rear edge of the shelf, or the shelf support mechanism, or any other appropriate location.

[0133] It should also be noted that a substantial advantage of using a heat shield as described above is that racking of the drawer **5** or door **2**, or both, is substantially prevented (that is, twisting or angling of the drawer **5** or door **2** on the runners or other types of supports, which prevents smooth transit of the door or drawer from one position to another). The heat shield **20** will prevent racking as it will act to keep the drawer aligned with the runners or other types of supports. It is preferred that the material of the shield is stiff enough to convey this advantage.

[0134] In the preferred embodiment, the oven **1** includes one shelf **10**. A user may require extra shelf space, for example, to cook two items simultaneously. It is known in the art for ovens to have two or more shelves stacked vertically, so that different foodstuffs can be placed at different vertical heights in the oven, the heights corresponding roughly to different temperature zones within the oven. It is difficult to achieve anything more than a crude variation in the temperature between the different oven heights. It can also be difficult for a user to access the lower shelf in these stacked configurations. If required, in order to achieve a similar result as a multi-shelf prior art oven, the oven **1** can be constructed with an oversize width, so that the shelf space of the one shelf **10** is similar to the shelf space of a prior art double shelf oven. Two or more separate upper heaters can be used, side by side, so that foodstuffs in the oven, on opposite sides, can be cooked separately, with only one side of the upper heaters activated, or separate parts of the upper heaters activated at different power levels. If required, a partition could be added between the sides of the shelf, in order to separate the foodstuffs, and create a temperature differential.

[0135] Another possible solution is to use different cooking chambers, which can more easily be set to different temperature conditions as required. This is not generally possible for most users, as it currently requires two ovens. This is expensive, and uses space that is not available in most domestic kitchens.

[0136] The height of a standard prior art oven unit is usually approximately 600 mm, with the oven sized to fit under a standard height benchtop, benchtops usually being between 900 and 960 mm (approximately).

[0137] If a single shelf oven **1** such as the one described above is used, the overall height of the unit can be reduced. For example, it is possible to reduce the height of the cavity from 900 mm to approximately 280 mm. If an intermediate oven cavity height is chosen—e.g. 480 mm, it is possible to fit two ovens **1** of this height under one benchtop, stacked one on top of the other. This has the advantage that each of the ovens **1** is completely separate from the other. Full temperature control of each unit, independent of the temperature of the other, would therefore be possible, allowing foodstuffs that require very different cooking conditions to be cooked simultaneously. It should be noted that if two oven cavities are stacked on top of one another in this manner, the outer casing or chassis can if required be common to both (that is, enclosing both), with two drawers, a first drawer and a second drawer, plus the associated first and second sets of drawer supports, shelf supports and independent heaters all contained within a common outer casing. Also, the control panel for both oven cavities can be made common to both, allowing the controls for the lower oven to be placed at an ergonomically accessible height.

[0138] If a two-drawer oven is required, the drawers and shelves can be supported by any of the mechanisms that have been described in this specification, in combination if required (for example, using one type of drawer support on a first drawer and another on the second drawer). The first and second drawers would ideally be independently powered or heated, so that different foodstuffs can be cooked in each drawer at different temperatures and timings.

[0139] Described above is the preferred embodiment of the oven **1**, with preferred forms of the drawer and door support mechanism, the drawer **5** and the heat shield **20** described. Alternative forms of the door and drawer support mechanism will now be described.

[0140] An alternative arrangement of the door support means is an upper pair of rails and supports, which can be used in tandem with the lower supports and rails **3**, **4**. Alternatively, the upper support rails could be used in place of the lower rails, with the drawer and door hanging from the supports.

[0141] As yet another alternative, a horizontally expanding and contracting multiple-linkage scissor type mechanism can be used as the door support mechanism, drawer support mechanism, or both.

[0142] If it is preferred as an alternative, the oven **1** can be constructed so that the drawer **5** does not have to be connected to the door **2**, and can move into and out of the oven **1** independently of the door **2**. The door **2** of this alternative will open and close independently of any movement of the drawer **5**. If the movement of the door **2** and drawer **5** is independent, the oven **1** can be constructed so that the door **2** can open horizontally on a separate support system from the drawer. Alternatively, the door **2** can be of the type that that pivots or rotates open on a hinge. If the movement of the door **2** and the drawer **5** is independent, then a separate drawer support mechanism can be used. This can be any of the alternatives outlined above for the door support mechanism, or any other suitable mechanism. The drawer support mechanism and the door support mechanism could also be combined as one mechanism that allows the drawer **5** and the door **2** to move separately, if required.

[0143] As described above for the preferred embodiment, the bin or drawer **5** has side walls **6**, **7**, a rear wall **8**, and a front wall (formed as part of the door **2** in the preferred embodiment).

[0144] An alternative embodiment of the drawer **5** is a structure with a static rear wall. That is, a mobile side wall **6**,

7 and a front wall only. The rear wall of the cooking chamber of this alternative embodiment is formed by a static internal wall, at or towards the rear of the oven **1**.

[0145] Another alternative way of forming the cooking chamber inside the oven is for there to be a static base located within the oven **1**. The vertical side, front and rear walls of the drawer structure move into and out of the oven **1**, and align with the static base when inside the oven **1** to form a cooking chamber. Alternatively, both the base and the rear wall could remain static. The seal or seals used with the alternative embodiments described above would be generally similar to that described above for the rear and front seals of the preferred embodiment.

[0146] When 'drawer' is used in this specification, it will normally refer to the preferred embodiment. That is, an open-topped bin or drawer, with four walls and a base, and the walls and base of the drawer moving into and out of the oven **1**. However, when reading this specification, 'drawer' should also be taken to mean a structure without a moving base or rear wall. The rear wall and base of the cooking chamber would be formed by a static rear wall and base located within the cabinet when the drawer is inside the cabinet. These options are not excluded unless otherwise stated.

[0147] It should also be noted that if a drop-down or hinging door is used instead of the horizontally sliding door **2** described, the drawer **5** can be fitted with a separate insulated front face or wall to shield a user from any hot air or hot components when the door **2** is opened. The drawer **5** of this alternative embodiment will slide into and out of the oven **1** via a connection to a drawer support mechanism that can be part of the door support mechanism, or which can be a separate drawer support mechanism.

[0148] Alternative forms of the heat shield **20** will now be described.

[0149] Other embodiments of the heat shield **20** are possible. For example, the shield **20** can be fan or concertina-shaped, folding flat against the rear wall of the oven **1** when in the stored position, and unfolding to a substantially flat, planar shape when in the deployed position.

[0150] The shield **20** can also be a roll of reflective foil, winding onto a spool located either on the drawer **5** or the rear wall of the oven **1** when in the stored position, and unwinding into a substantially flat and horizontal deployed position when the drawer **5** is withdrawn from the oven **1**. In this embodiment, although the rear edge may not be rigidly connected to the rear of the oven, the rear of the heat shield does not move horizontally with respect to the oven, and the rearmost part of the spool or reel should be taken as the rear edge of the heat shield for the purposes of reading this specification.

[0151] The shield **20** can also be manufactured as a single rigid item. In this embodiment, either the front or rear edge of the shield pivots about a fixed horizontal axis, with the other of the front or rear edge moving vertically from a stored position by way of pins or similar located at each corner, the pins located in a pair of vertical slots. In this embodiment, the shield **20** in the stored position lies substantially vertically against the rear wall of the oven **1**, and moves to a deployed position where the shield is substantially horizontal by pivoting about the fixed edge. The opposed edge moves vertically along the slots until the shield is in a substantially horizontal orientation.

[0152] It should also be noted that the heat shield **20** described above could be used with variations of ovens that do not include a drawer **5** with a rear wall **9**. For example, the heat shield **20** could be used with any shelf support structure that has a moving rear portion. In these ovens, the front part of the heat shield **20** is connected to the mobile rear part of the support structure, or between two rear uprights of the shelf support structure. For example, the heat shield could be used with a structure the same as or similar to that described in the applicants co-pending application NZ 538105. As outlined above, in the preferred embodiment, the front edge of the heat shield is connected to the rear wall of the drawer. For the purposes of this specification, and as outlined in the alternative embodiments outlined above, the rear wall can be understood to be part of a shelf support mechanism when the heat shield is used with the drawer of the preferred embodiment.

[0153] While a preferred embodiment of the present invention is shown and described, it is envisioned that those skilled in the art may devise various modifications of the present invention without departing from the spirit and scope of the appended claims.

1. An oven for cooking food comprising:

a cabinet having a front side with an opening formed therein,

a door moveable between a closed position closing the open front of the cabinet, and a fully open position allowing access to the interior of the cabinet via said opening,

a drawer, located within said cabinet when said door is in said closed position, said drawer forming at least part of a cooking chamber when in said closed position,

a drawer support mechanism at least located within said cabinet when said door is in said closed position, supporting said drawer, and configured to allow said drawer to move from a position within said cabinet, to a position where said drawer is at least partially located outside said cabinet,

a controllable heating source provided within said cabinet or drawer for supplying sufficient heat to the inside of the drawer to cook food positioned therein,

and at least one vertically movable shelf located within said drawer, supported by a shelf support mechanism.

2. An oven as claimed in claim **1** wherein said drawer includes side walls and said shelf support mechanism is located substantially within at least one of said side walls.

3. An oven as claimed in claim **2** wherein said door is connected to, and forms the front face of, said drawer.

4. An oven as claimed in claim **2** wherein said drawer support mechanism includes a set of runners connected at least to said drawer, which slide co-operatively with a set of static rails located within said cabinet.

5. An oven as claimed in claim **2** wherein said shelf support mechanism comprises a framework located substantially within at least one side wall of said drawer, said framework including;

a lower bracket located at or towards the bottom of said at least one side wall,

an upper bracket located at or towards the top of said at least one side wall,

said upper and lower brackets connected by at least one substantially vertically aligned rod,

a shelf support running along said rod or rods in said at least one side wall,

at least one slot in said at least one side wall, said or each of said slots running substantially the height of said at least

one side wall, substantially vertically, said shelf in use supported by pins passing through said slots,

at least one electric power motor,

at least one cable and associated pulleys,

a double-ended drive shaft, located between said at least one motor and said shelf supports, said shaft driven in a rotary motion by said power motor to cause movement of said shelf supports along said rods by way of said cables and pulleys.

6. An oven as claimed in claim **2** wherein said shelf support mechanism comprises at least one worm gear and at least one co-operating threaded block or recirculating ball bearing/ballscrew type block, located within said cabinet and running substantially the height of said side wall, substantially vertically, said shelf in use supported by pins passing through said slots.

7. An oven as claimed in claim **6** wherein said worm gears and co-operating threaded blocks or recirculating ball bearing/ballscrew type blocks are located in at least one wall of said drawer, said wall including at least one slot running substantially the height of said side wall, substantially vertically.

8. An oven as claimed in claim **2** wherein said shelf support mechanism comprises a scissor mechanism located in at least one wall of said drawer, said wall including at least one slot, running substantially the height of said side wall, substantially vertically, said shelf in use supported by pins passing through said slots.

9. An oven as claimed in claim **2** wherein said shelf support mechanism comprises a sprocket and mini-chain drive mechanism located in at least one wall of said drawer, said wall including at least one slot, running substantially the height of said side wall, substantially vertically, said shelf in use supported by pins passing through said slots.

10. An oven as claimed in claim **2** wherein said drawer also includes a rear wall connected to said side walls, and a base.

11. An oven as claimed in claim **2** wherein said cabinet includes a chassis upper structure, protruding downwards from the top of the front side of said cabinet such that there is vertical overlap between said door and said chassis upper structure, and a front gasket is provided on either said door or the front face of said chassis upper structure, said front gasket running substantially horizontally, substantially the entire width of said chassis upper structure, said front gasket closing the gap between said door and said chassis upper structure when said drawer is located fully within said cabinet.

12. An oven as claimed in claim **11** wherein there is vertical overlap between the rear portion of said chassis upper structure and said rear wall of said drawer, said rear portion or said rear wall of said drawer including a rear gasket that runs substantially horizontally, substantially the entire width of said drawer and which closes the gap between said drawer and said chassis upper structure when said drawer is located within said cabinet.

13. An oven as claimed in claim **12** wherein said cabinet and said drawer also include a pair of spring gaskets, each having a low friction tip, each spring gasket mounted on a respective side wall of said cabinet facing outwards towards said drawer, said spring gaskets running substantially the entire depth of said cabinet and located towards the top of said drawer, each of said tips biased against said side walls of said drawer by said spring gaskets.

14. An oven as claimed in claim **2** wherein said cabinet and said drawer also includes a pair of side gaskets, each of said side gaskets mounted on a floating arm, said floating arms mounted on said cabinet facing towards said drawer, said floating arms running substantially the entire depth of said drawer, said floating arms located towards the top of said drawer, and being generally horizontally elastically compressible,

at least one roller wheel provided on each side of said drawer, said rollers connected to said floating arms and spacing said gaskets from said drawer side walls when said drawer is in any position except located fully within said cabinet,

said drawer side walls including inwardly facing dimples, which said roller wheels locate into when said drawer is located fully within said cabinet, such that said gaskets are pressed into contact with said drawer side walls by said floating arms.

15. An oven as claimed in claim **2** wherein said cabinet and said drawer also includes

a gasket mounted on a floating member suspended from the upper portion of said cabinet, said gasket contacting around the perimeter of the opening of said drawer when said drawer is located fully within said cabinet, said gasket spaced from said drawer when said drawer is in any position except located fully within said cabinet, said floating member forming a lid for said drawer in said closed position,

said gasket lowered into contact with said drawer when said drawer is located fully within said cabinet by an actuating mechanism connected to said floating member.

16. An oven as claimed in claim **15** wherein said actuating mechanism comprises;

a second chassis upper structure, connected to the upper inner surface of said cabinet such that there is vertical overlap between said second chassis upper structure and a portion of said drawer, said second chassis upper structure including at least one groove on its upper surface, said second chassis upper structure capable of limited horizontal movement,

at least one pin connected to said floating member and protruding upwards through said second chassis upper structure,

a wheel or slider connected to the upper end of each of said pin or pins, sized to fit at least a portion thereof within said groove,

said second chassis upper structure having an initial position, said drawer contacting and moving said second chassis upper structure from said initial position towards the rear of said cabinet as said drawer moves from an open to said fully closed position, said movement aligning said grooves with said wheels or sliders when the drawer is in said fully closed position, such that said wheels or sliders locate at least partially within said grooves and as a result said floating member is lowered towards said drawer such that said gasket contacts said perimeter of said drawer,

said second chassis upper structure returning to said initial position as said drawer opens from a fully closed position, said wheels or sliders rising out of said grooves to lift said floating member and raise said gasket out of contact with said perimeter of said drawer.

17. An oven as claimed in claim **2** wherein said controllable heating source is positioned in an upper part of said cabinet and said oven also includes an oven cavity roof shield, said

roof shield comprising a roof liner and liner support, located between said controllable heating source and the inner surface of the top of said cabinet, said roof liner sized to substantially cover the inner surface area of the top of said cabinet, said liner at least partially removable from said cabinet by sliding substantially horizontally relative to said liner support.

18. An oven as claimed in claim **2** wherein said drawer has no rear wall and oven utilities are located in the rear wall of said cabinet, wherein the rear wall of said cooking chamber is formed by said cabinet rear wall when said drawer is in said closed position.

19. An oven as claimed in claim **2** wherein said shelf support mechanism comprises:

at least one electric power motor,

a helical sprocket, connected to said electric power motor so that in use said sprocket can be driven in either direction,

two cables, helically geared on their outside surface and interfacing with said sprocket one on each side, so that in use each of said cables is driven in an opposite direction to the other of said cables,

the inner ends of said cables connected to opposed portions of said shelf.

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