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(54) COOKING APPLIANCE

(57) A cooking appliance (10) comprises a housing (11) which defines a food preparation cavity (12), heating means for heating the cavity (12), and a door (14) for selectively closing and opening the cavity (12).

The cooking appliance (10) is characterized by the cooking appliance (10) further comprising a horizontally movable linkage system connected to the housing and the door (14), wherein the linkage system is configured to move the door between a closed position in which the door bears against the front side (15) of the housing (11) to close the oven cavity (12), via an intermediate position in which the door is lifted off from the front side of the housing, and an open position in which the door is positioned laterally aside the oven cavity, wherein during the entire path of movement the door is held in a vertical orientation.

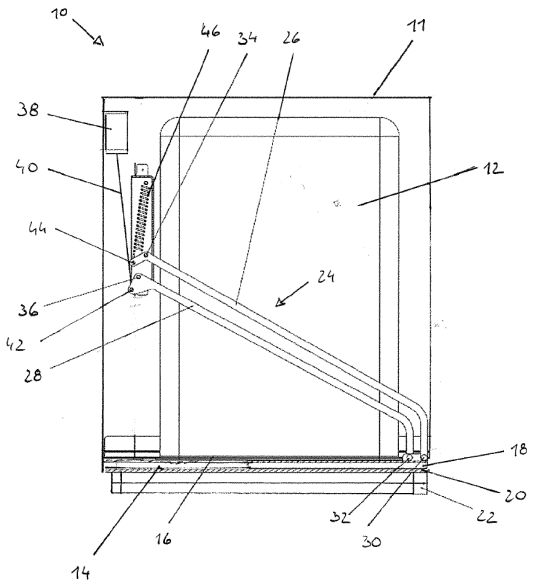

Fig. 1

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Description

[0001] The present invention relates to cooking appliances and, more specifically, to cooking appliances having a housing which defines a food preparation cavity, heating means for heating the cavity, and a door for selectively closing and opening the cavity.

Cooking appliances having a heatable cavity, such as electric heating ovens, steam ovens, convection ovens, gas ovens, microwave ovens, combination ovens or heating cabinets typically have a door that is pivotable about a horizontal axis.

[0002] In recent years it has become more and more popular to install ovens at an elevated position so that a user does not need to bend down when he wishes to visually inspect the interior of the oven cavity. Thus, while installing an oven at an elevated position has been common for many years for microwave ovens, in which the door traditionally is hinged at the oven housing to be pivotable about a vertical axis, installing a cooking or baking oven, such as a convection oven, at an elevated position is problematic, since in such ovens the oven door typically is mounted at the housing so as to be pivotable about a horizontal axis that extends below the oven cavity. Whereas the more comfortable view into the oven cavity adds to the user comfort, a problem often encountered in ovens in which the oven door is pivotable about a horizontal axis is that when the oven is installed at an elevated position and a user wants to insert food items into the cavity or wants to remove food items from the cavity the opened door is between the user and the oven. Therefore the user has to hold and manipulate the food items above the opened door in the vicinity of the door which bears the risk that the user inadvertently comes into contact with the inner side of the door which in such instances often is at a high temperature.

The prior art has attempted to address this problem by providing for an oven having a door which is pivotable about a horizontal axis that extends below the oven cavity and which in the fully opened position can be inserted into the oven housing below the cavity. While this concept effectively moves the door out of the range of possible contact with the user, this solution requires a complex mechanics and thus is expensive and prone to failure. Furthermore, such concept of stowing away the door below the oven cavity requires considerable space which, given that cooking appliances typically are manufactured to have a standardized height, inherently is lost in the volume of the cavity.

[0003] Although generally it also would be possible to transfer the concept of a vertically hinged door as it is known from microwave ovens to baking ovens, the art has been reluctant to make such transfer because in a baking oven the door is substantially larger than in a microwave oven and thus considerable space would be required in front of the oven so as to be able to pivot the door about a vertical axis. Furthermore, in view of the large radius of the door, pivoting the door bears the risk that the user gets into the range of movement of the door which may result in a collision of the door with a tray or pot which the user is holding in front of the oven or with the user himself who thus could be hurt by the contact with the moving door.

[0004] In view of the above mentioned problems, it is an object of the present invention to provide for a cooking appliance in which the door is user-friendly in handling, is cost-effective in manufacturing and does not result in considerable special restrictions for the oven cavity.

[0005] In a cooking appliance comprising a housing which defines a food preparation cavity, heating means for heating the cavity, and a door for selectively closing and opening the cavity, in accordance with the present invention the above object is solved in that the cooking appliance further comprises a horizontally movable linkage system connected to the housing and the door, wherein the linkage system is configured to move the door between a closed position in which the door bears against the front side of the housing to close the oven cavity, via an intermediate position in which the door is lifted off from the front side of the housing, and an open position in which the door is positioned laterally aside the oven cavity, wherein during the entire path of movement the door is held in a vertical orientation.

[0006] In the cooking appliance of the present invention, there is provided for a linkage system by means of which the door can be displaced to an open position in which the door is located aside the cavity where it does not interfere with the user of the cooking appliance, who when placing food items into the cavity or when removing food items from the cavity is standing in front of the cooking appliance. Furthermore, since the door when moving between the closed position and the open position does not perform a rotating movement but instead is kept during the entire path of movement in a vertical orientation, wherein for an opening movement the door first is lifted off from the front side of the housing and then is shifted sideways towards the open position, only little space is required for the movement of the door.

In the open position the door does not overlap the oven cavity but is positioned laterally aside the oven cavity, so as to allow for an obstructed access to the entire oven cavity.

[0007] Preferred embodiments are defined in the dependent claims.

In particular, in the open position the door can be positioned in a plane that is located offset to, and in front of, the plane in which the door is positioned when in the closed position. The plane in which the door is positioned when in the open position can extend substantially parallel to the plane in which the door is positioned when in the closed position. By configuring the linkage system so as to provide for a path of movement of the door in which the door in the open position is oriented substantially parallel to the plane in which the door is positioned when in the closed position, the door does not project far into the room where the cooking appliance is installed, and hence

does not interfere with a user operating the cooking appliance.

[0008] Considering that cooking appliances as described herein often are installed aside further devices or items of kitchen furniture, such as a cabinet for installing another kitchen devices, such as a refrigerator, a cupboard or the like, in the open position in which the door is located sideways from the oven cavity where it may be placed in front of a neighboring kitchen element, the door is held at a distance from such neighboring elements. In this manner it is avoided that when the door is opened during or after a heating operation, in which case the inner side of the door may have been heated to a considerable temperature, heat radiating from the door thus can be dissipated in the free space thus maintained between the opened door and a neighboring device or piece of furniture.

[0009] Typically in a kitchen, the installed devices and pieces of furniture are mounted such that the fronts thereof are located in a common plane. While thus the front of a neighboring kitchen element typically will be located in the same plane as the door of the oven when in the closed position, the offset between the plane in which the oven door is positioned when in the open position and the plane in which the oven door is positioned when in the closed position advantageously has a value of between 40 mm and 80 mm plus the thickness of the door. Correspondingly, in the open position of the door there is a distance between the inner face of the door and a neighboring element which is installed flush with the cooking appliance, which distance has a value of between 40 mm and 80 mm, which in most instances is sufficient to effectively avoid damage of neighboring elements due to heat radiation from the opened door.

[0010] Whereas particularly in case of more susceptible and sensitive materials a higher distance can be selected, in most cases it is sufficient when the distance between the inner side of the door when the door is positioned in the open position, and the plane in which the exterior side of the door is positioned when the door is in the closed position is at least 40 mm, and preferably is at least 50 mm.

[0011] In preferred embodiments the horizontally movable linkage system comprises a first linkage assembly that is located above the cavity, and a second linkage assembly that is located below the cavity, which allows for a stable and reliable guiding of the door along its path of movement. While also different linkage assemblies could be used as the first and second linkage assemblies, the manufacturing can be facilitated when the second linkage assembly corresponds to the first linkage assembly.

[0012] The linkage system may comprise at least one double lever system comprising a first and a second lever pivotally linked to the housing and the door, wherein at least one of the first and the second lever can be configured as a curved lever. Providing for at least one curved lever provides more freedom in the selection of the pivot points, because by providing for a curved portion interference of the levers can be avoided also when the levers are hinged to pivot points that are located close to each other. Furthermore, providing for a curved portion particularly towards the end of the lever that is attached to the door facilitates implementing a configuration in which the door does not overlap the oven cavity, because by means of the curved portion which advantageously is provided at a position which in the open position of the door is in the vicinity of the front edge of the housing, the door can be positioned at a position that is located further sideways as if straight levers were employed.

[0013] To provide for a sideways motion of the door, the linkage system may comprise at least one lever assembly having a lever, one end of which is pivotally linked to a fixed pivot point at one of the housing and the door, and the other end of which is pivotally linked to a carriage which is guided in a rail provided at the other of the housing and the door.

[0014] A less complex implementation of the linkage system can be achieved, when the linkage system comprises at least one lever assembly having a pair of levers, preferably curved levers, each lever having a first end which is pivotally linked to a fixed pivot point at the door, and a second end which is pivotally linked to a fixed pivot point at the housing.

[0015] The at least one lever assembly can have a first and a second lever the first ends of which are pivotally linked to fixed pivot points at the door, and the second ends of which are pivotally linked to fixed pivot points at the housing, wherein the pivot points at the door are located aside each other, and wherein the pivot points at the housing are located behind each other, i.e. aligned to a side wall of the housing, or laterally offset behind each other. In this manner the two levers can be positioned substantially in the same horizontal plane which requires the least vertical space for accommodation of the lever assemblies.

[0016] The cooking appliance further can comprise a motor for displacing the lever assembly, so as to conveniently open and close the door by manually activating a button, for example a sensor provided at the door face, or for automatically activating the door by the program control of the cooking appliance.

In order to provide for more design freedom in the placement of the motor, the motor can be coupled to the lever assembly via a drive element, such as a cable, in particular a Bowden cable, a chain or a pulling wire.

[0017] The cooking appliance further can comprise sealing means between the door and the housing, the sealing means extending about the circumference of the cavity so as to seal the cavity when the door is in the closed position. In preferred such embodiments, the first linkage assembly is located above the sealing means and the second linkage assembly is located below the sealing means, so that the linkage assemblies do not interfere with the sealing means.

[0018] Advantageously the cooking appliance further

comprises a coupling for releasably attaching the door to the movable linkage system. The coupling can comprise a first coupling element which comprises the pivot points at which the first ends of the levers are pivotally linked, wherein the door comprises a second coupling element, for example a snap-in connection, which can be releasably coupled with the first coupling element to mount the door at the linkage system. In this manner the door can be easily removed, for example for cleaning purposes, and also can be easily reinstalled, preferably without any tools being required.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The present invention his described in further detail below by reference to the drawings, in which:

Fig. 1 is a top elevational view of the oven with the door in the closed position;
Fig. 2 is a view similar Fig. 1 with the door shown in an intermediate position;
Fig. 3 is a view similar Figs. 1 and 2 with the door shown in the fully opened position;
Fig. 4 illustrates an embodiment of a detachable door when in the disassembled state;
Fig. 5 illustrates the detachable door of Fig. 4 when in the assembled state;
Fig. 6 is a side elevational view of the oven shown in Fig. 1; and
Fig. 7 illustrates a linkage housing of the oven shown in Fig. 6.

DETAILED DESCRIPTION

[0020] Fig. 1 shows the upper part of an oven 10 when viewed from above. The oven comprises a housing 11 in which there is provided an oven cavity 12 which can be heated in any conventional manner, such as by radiative heating elements, by hot air or steam that is introduced into the oven cavity, by gas, by microwave heating, or any combination thereof. At the front side of the oven there is provided a door 14 which abuts against the front side 15 of the housing so as to close cavity 12. To provide for a tight closing of the cavity when the door is closed, a sealing 16 is arranged between the door and the front side 15 of the housing. While in the embodiment shown in the figures, see particularly Figs. 2 and 3, the sealing 16 is attached to the front side 15 of the housing 11, in the alternative the sealing 16 could be fixed at the door 14.

[0021] The door 14 comprises a frame 18 at which there is connected a glass pane 20 which in the closed position of the door allows a free view into the cavity 12 through the central region of the door. At the front side of the door 14 there is installed a handle 22 to manually operate the door.

[0022] In contrast to conventional ovens, in which the door is held at hinges, in the oven suggested herein the door 14 is held by means of a linkage system which comprises two double lever linkage assemblies, one of which, as is illustrated in Figs. 1 to 3, is located above the cavity, and a second one of which is located below the cavity (see Fig. 6). Linkage assembly 24 comprises a first lever 26 and a second lever 28. At a first end, levers 26 and 28 are attached at pivot points 30 and 32 to the door 14. As shown in Fig. 1, pivot point 30 of lever 26 is provided at the frame 18 at a position close to one of the lateral edges of the door 14, which in the embodiment shown in the drawings is the right edge. Pivot point 32 of lever 28 is provided at the frame 18 to the left of pivot point 30.

[0023] At their second ends, levers 26 and 28 are attached at pivot points 34 and 36 that are fixed with respect to the housing 11 and which are positioned in a rear portion of the housing in the vicinity of the left wall of housing 11. As is best seen from a comparison of Figures 1 to 3, when rotating the levers 26 and 28 the door 14, starting from the closed position shown in Fig. 1 in which the door 14 bears against the front side 15 of the housing 11 in which it closes the oven cavity 12, the door is lifted off from the front side 15 of the housing 11 and is moved laterally (in the figures to the left) via an intermediate position shown in Fig. 2 into an open position shown in Fig. 3 in which the door 14 is positioned laterally aside the oven cavity 12. While as illustrated in Fig. 2, the door 14 during its travel between the closed and open positions may attain an orientation in which the door is positioned at an angle to the front side of the oven, in the closed position the door advantageously is positioned in parallel to the front side of the oven, so as not to interfere with a user who is standing or moving in front of the oven. Irrespective of whether the door during its travel between the closed and open positions is held substantially parallel to the front side of the oven, or attains an orientation in which it is positioned at an angle to the front side of the oven, during the entire path of movement the door is held in a vertical orientation.

[0024] While the door can be handled manually by the aid of handle 22, in the embodiment shown in Figs. 1 to 3 there is provided a motor 38 for actuating the linkage assembly 24. While motor 38 could be directly coupled to linkage assembly 24, in the embodiment shown in the drawings, motor 38 is connected to the linkage assembly 24 via a drive element 40 which is implemented as a cable that connects to an eye 42 provided in an extension of the second lever 28 which is located opposite lever 28 beyond pivot point 36, wherein the extension in which eye 42 is provided thus forms a short lever arm of lever 28. When the motor 38 provides a pulling force to drive element 40, lever 26 thus is pivoted in the clockwise direction about pivot point 36 to lift off the door 14 and move it towards the left as it is depicted in Figures 2 and 3. During such movement the angular orientation of the door is controlled by lever 26, which similarly as lever 28 has an extension that forms a short lever arm beyond the pivot point 34 which comprises an eye 44. A compression spring 46 acts on eye 44 of lever 26 to bias the door 14 towards the closed position.

When the motor 38 provides a pulling force to drive element 40, lever 28 is rotated together with lever 26 in the clockwise direction about its pivot point 34 thus acting on the compression spring 46, which during the further movement of the door into the fully opened position shown in Fig. 3 is further tensioned. When starting from the opened position, the door again is to be closed, motor 38 is activated in the opposite direction to release the drive element, so that the door is returned into the closed position by the action of compression spring 46.

[0025] It is to be understood that the configuration of the spring 46, motor 38 and drive element 40 could be designed so that the spring 46 is a tensioning spring which biases the door 14 towards the open position, wherein either the drive element 40 provides for a pushing force, such as by the use of a Bowden cable, or the motor 38 is arranged towards the front side of the oven 10 so as to provide for a pulling force onto drive element 40 towards the front side of oven 10.

[0026] Figures 4 and 5 illustrate an embodiment in which the pivot points for levers 26 and 28 are provided on a first coupling element 48 which cooperates with a second coupling element 50 that is provided at the door. As can be best seen in Fig. 4 which illustrates the door 14 when released from the linkage system, first coupling element 48 can be configured as a plug-in connector configured for insertion into a second coupling element 50 that forms a receptacle for the plug-in connector 48, wherein the plug-in connector 48 can be arrested within receptacle 50 by means of a catch 52 which in the assembled position of the door 14 is released into a recess 54 provided in the second coupling element 50.

[0027] Fig. 6 illustrates the oven shown in Fig. 1 in a side elevational view. As illustrated, the oven 10 comprises a first linkage assembly 24 positioned adjacent the top wall 56 of housing 11 and a second linkage assembly 58 positioned adjacent the bottom wall 60 of housing 11. Both the first linkage assembly 24 and the second linkage assembly 58 comprise a first lever 26 and a second lever 28 which are movable in horizontal planes that are arranged close to each other. In the embodiment shown in Fig. 6 the first and second linkage assemblies advantageously are identical assemblies, which thus both comprise a linkage housing 62 in which the first and second levers 26 and 28 are mounted.

[0028] In particular, as is depicted in Fig. 7, the linkage housing 62 carries a first shaft 64 which acts as pivot point 34 for the first lever 26, a second shaft 66 which acts as pivot point 36 for the second lever 28, and a third shaft 68 which holds one end of spring 46, the other end of which is attached to eye 44 of the first lever 26.

[0029] In order to provide for a simultaneous actuation of the first linkage assembly 24 and of the second linkage assembly 58, there is provided a motor 38 which acts on a drive element 40 which in turn is connected to a bar 70 that is connected to the eye 42 of the second lever 28 of both the first and second linkage assemblies 24 and 58.

List of reference signs

[0030]

10	oven
11	housing
12	cavity
14	door
15	front side of 11
16	sealing
18	frame
20	glass pane
22	handle
24	linkage assembly
26	first lever
28	second lever
30	1st pivot point of 26
32	1st pivot point of 28
34	2nd pivot point of 26
36	2nd pivot point of 28
38	motor
40	drive element
42	eye
44	eye
46	compression spring
48	first coupling element
50	second coupling element
52	catch
54	recess
56	top wall of 11
58	second linkage assembly
60	bottom wall of 11
62	linkage housing
64	first shaft
66	second shaft
68	third shaft
70	bar

Claims

1. A cooking appliance (10) comprising:

a housing (11) which defines a food preparation cavity (12) ;
heating means for heating the cavity (12); and
a door (14) for selectively closing and opening the cavity (12) ;
characterized by the cooking appliance (10) further comprising:
a horizontally movable linkage system connected to the housing and the door (14), wherein the linkage system is configured to move the door between a closed position in which the door bears against the front side (15) of the housing (11) to close the oven cavity (12), via an intermediate position in which the door is lifted off from the front side of the housing, and an open

position in which the door is positioned laterally aside the oven cavity, wherein during the entire path of movement the door is held in a vertical orientation.

2. The cooking appliance (10) of claim 1, wherein in the open position the door (14) is positioned in a plane that is located offset to, and in front of, the plane in which the door is positioned when in the closed position.

3. The cooking appliance (10) of claim 2, wherein the plane in which the door (14) is positioned when in the open position extends substantially parallel to the plane in which the door is positioned when in the closed position.

4. The cooking appliance (10) of claim 3, wherein the offset between the plane in which the door is positioned when in the open position and the plane in which the door (14) is positioned when in the closed position has a value of between 40 mm and 80 mm plus the thickness of the door.

5. The cooking appliance (10) of claim 3 or 4, wherein when the door (14) is positioned in the open position the distance between the inner side of the door and the plane in which the exterior side of the door is positioned when in the closed position is at least 40 mm, and preferably is at least 50 mm.

6. The cooking appliance (10) of any of the preceding claims, in which the horizontally movable linkage system comprises a first linkage assembly (24) that is located above the cavity, and a second linkage assembly (58) that is located below the cavity (12).

7. The cooking appliance (10) of any of the preceding claims, in which the linkage system (24) comprises at least one double lever system comprising a first and a second lever (26, 28) pivotally linked to the housing (11) and the door (14) .

8. The cooking appliance (10) of claim 7, in which at least one of the first and the second lever (26, 28) is a curved lever.

9. The cooking appliance (10) of any of the preceding claims, in which the linkage system comprises at least one lever assembly (24) having a lever one end of which is pivotally linked to a fixed pivot point at one of the housing and the door (14), and the other end of which is pivotally linked to a carriage which is guided in a rail provided at the other of the housing and the door.

10. The cooking appliance (10) of claims 7 and 8, in which the linkage system comprises at least one lever assembly (24) having a pair of levers (26, 28), each lever having a first end which is pivotally linked to a fixed pivot point (30, 32) at the door, and a second end which is pivotally linked to a fixed pivot point (34, 36) at the housing (11).

11. The cooking appliance (10) of claim 10, in which the at least one lever assembly (24) has a first and a second lever (26, 28) the first ends of which are pivotally linked to fixed pivot points (30, 32) at the door (14), and the second ends of which are pivotally linked to fixed pivot points (34, 36) at the housing, wherein the pivot points (30, 32) at the door (14) are located aside each other, and the pivot points (34, 36) at the housing are located behind each other.

12. The cooking appliance (10) of claim 10 or 11, further comprising a motor (38) for displacing the lever assembly (24) .

13. The cooking appliance (10) of claim 12, wherein the motor (38) is coupled to the lever assembly (24) via a drive element (40), such as a cable, a chain or a pulling wire.

14. The cooking appliance (10) of any of the preceding claims, further comprising sealing means (16) between the door (14) and the housing (11), the sealing means (16) extending about the circumference of the cavity (12) so as to seal the cavity (12) when the door (14) is in the closed position.

15. The cooking appliance (10) of claim 14 when dependent on claim 6, wherein the first linkage (24) assembly is located above the sealing means (16) and the second linkage assembly (58) is located below the sealing means.

16. The cooking appliance (10) of any of the preceding claims, further comprising a coupling (48, 50) for releasably attaching the door (14) to the linkage system.

17. The cooking appliance (10) of any of the preceding claims, which is an electric heating oven, a steam oven, a convection oven, a gas oven, a microwave oven, a combination oven or a heating cabinet.

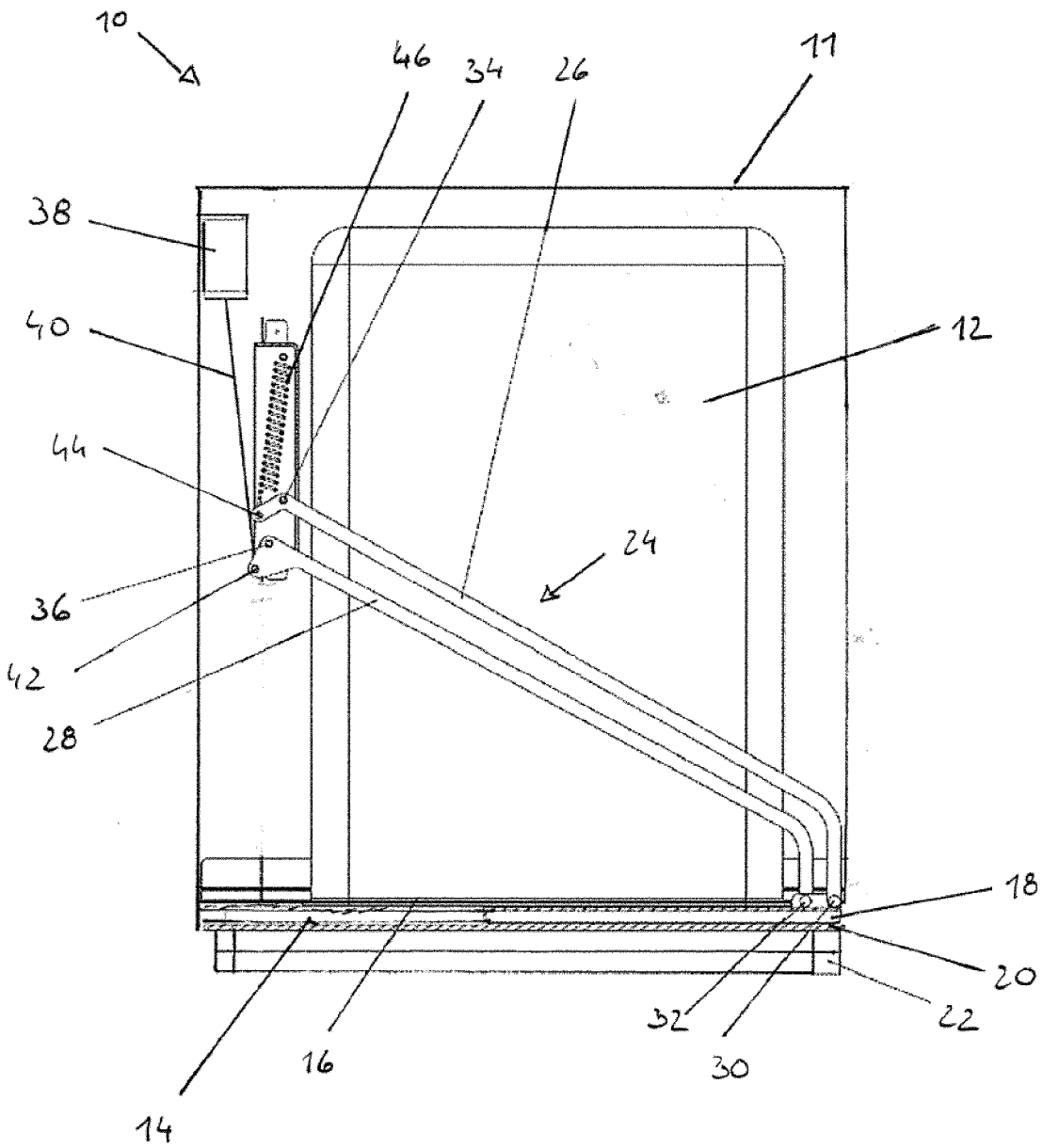

Fig. 1

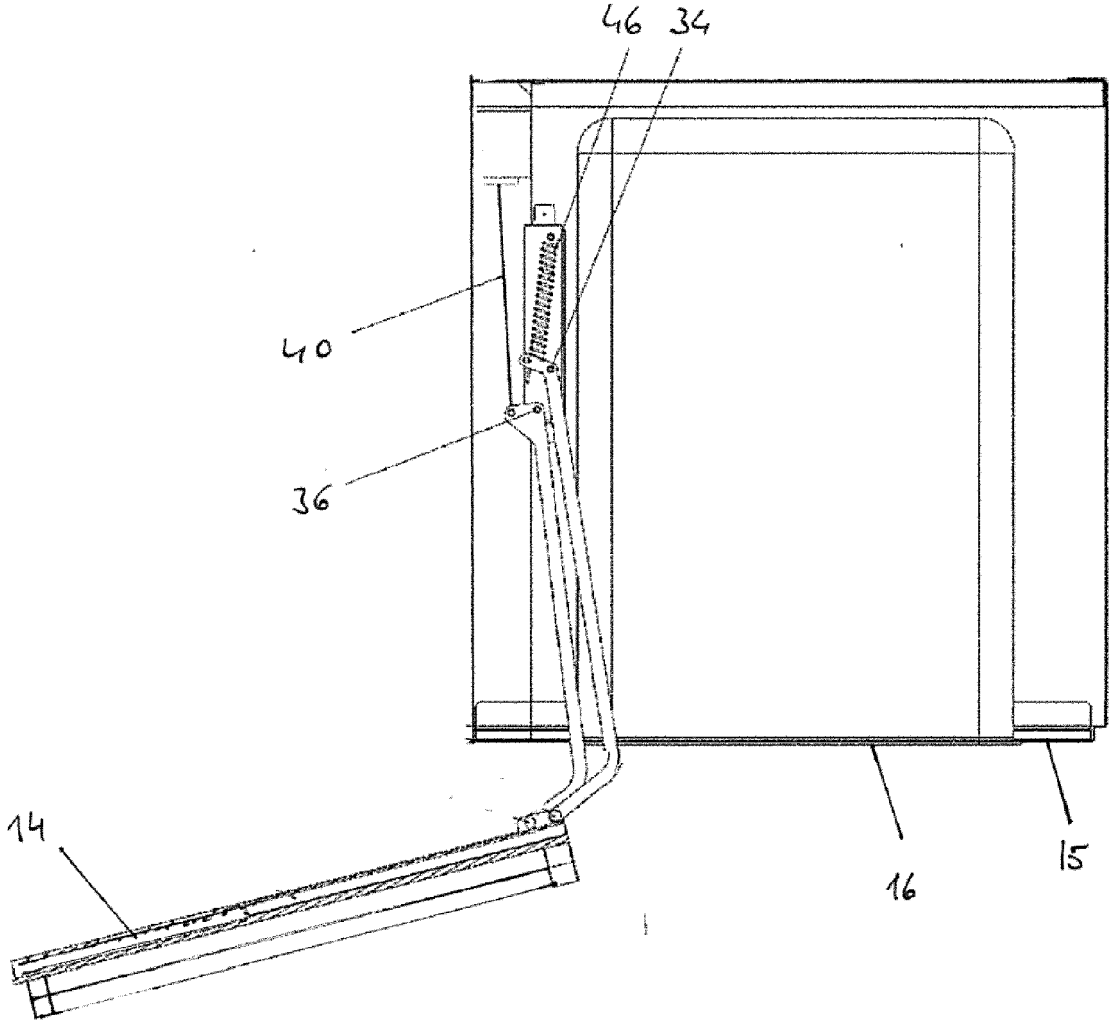

Fig. 2

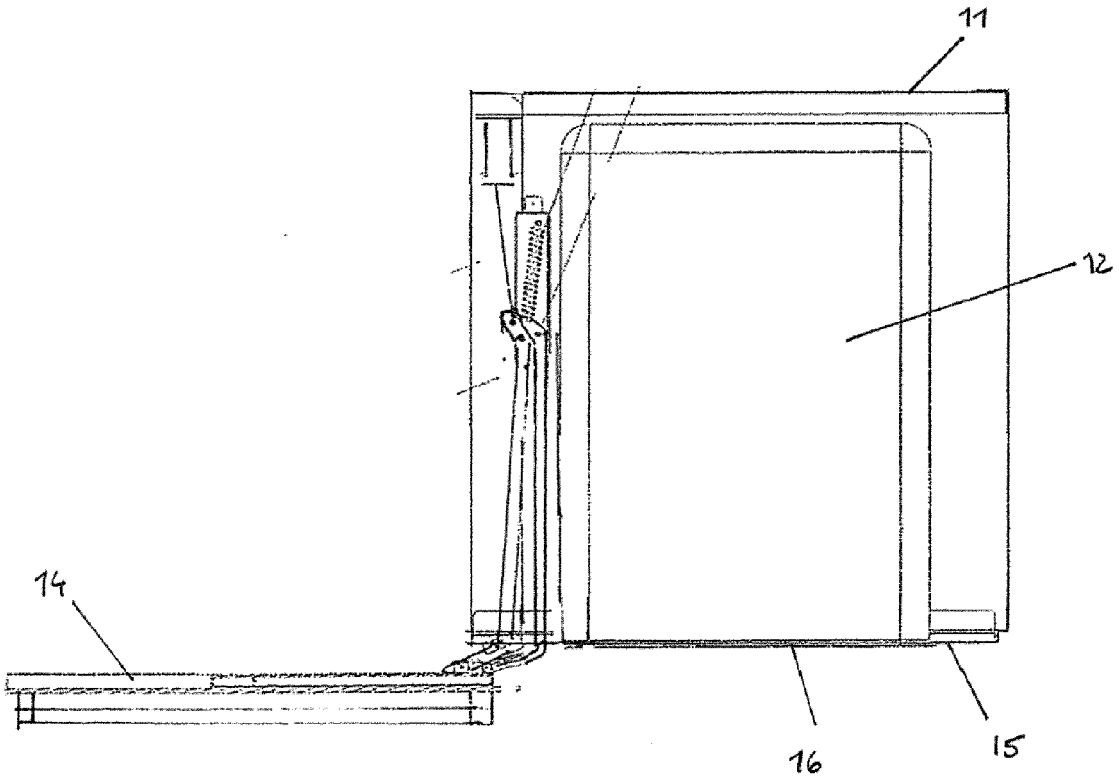

Fig. 3

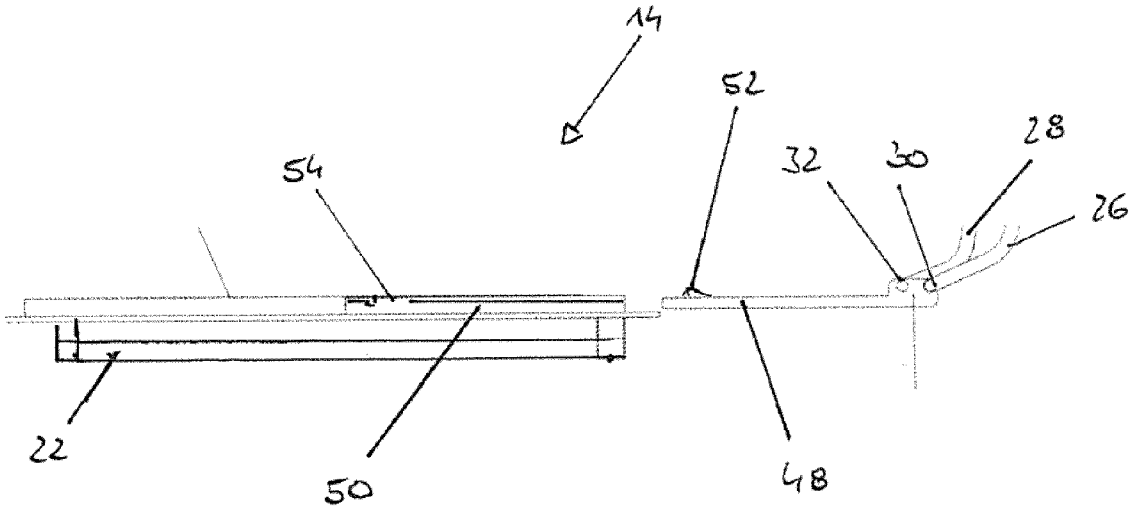

Fig. 4

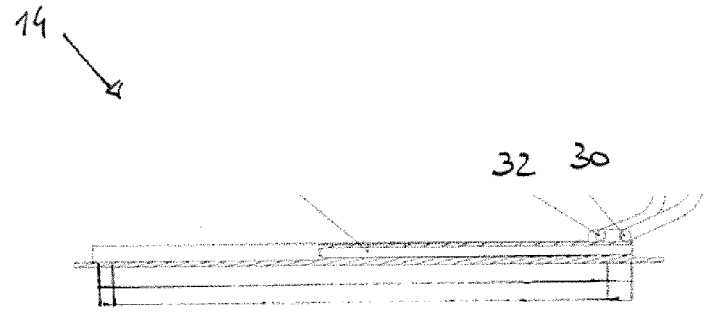

Fig. 5

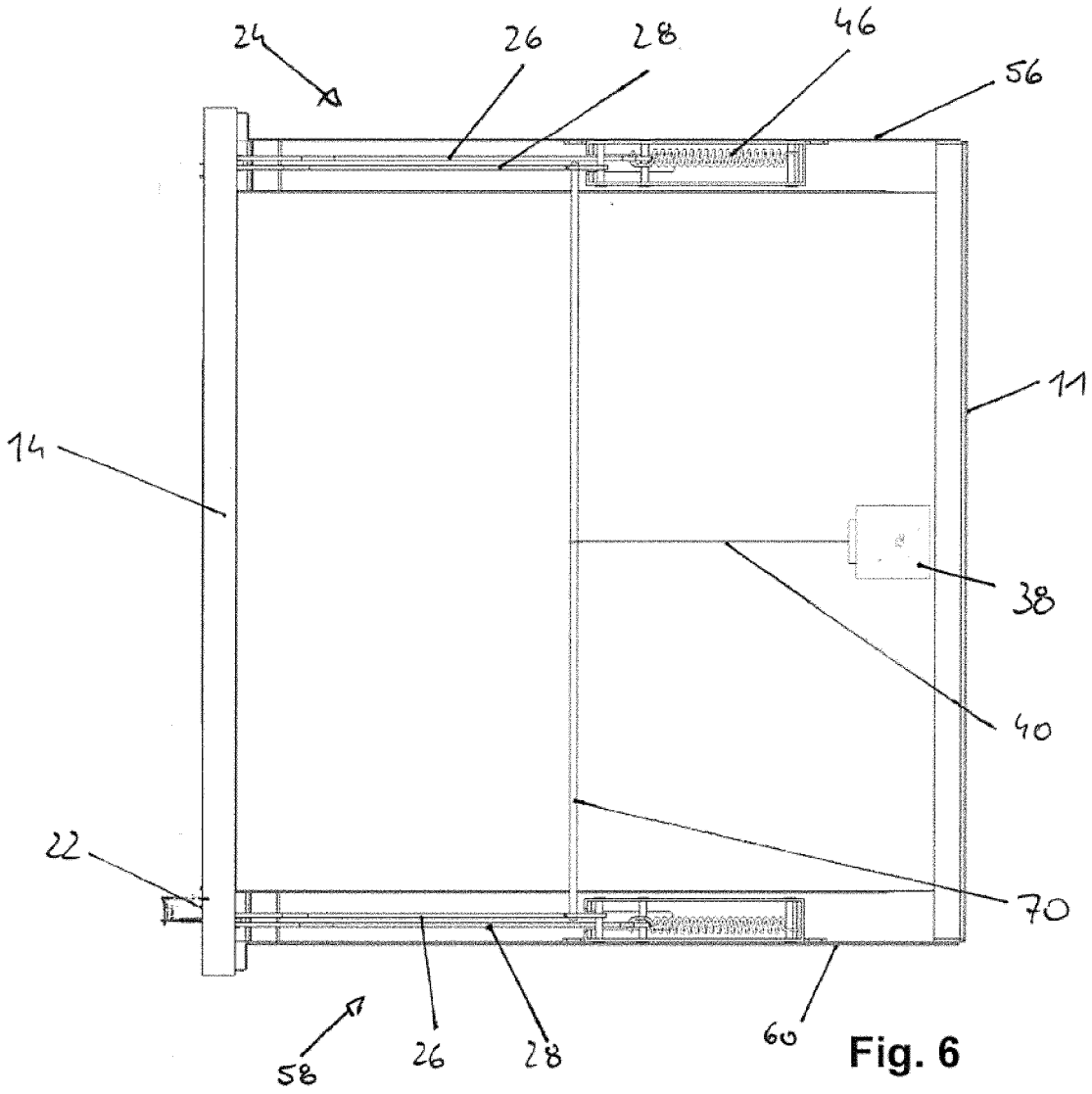
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Fig. 6

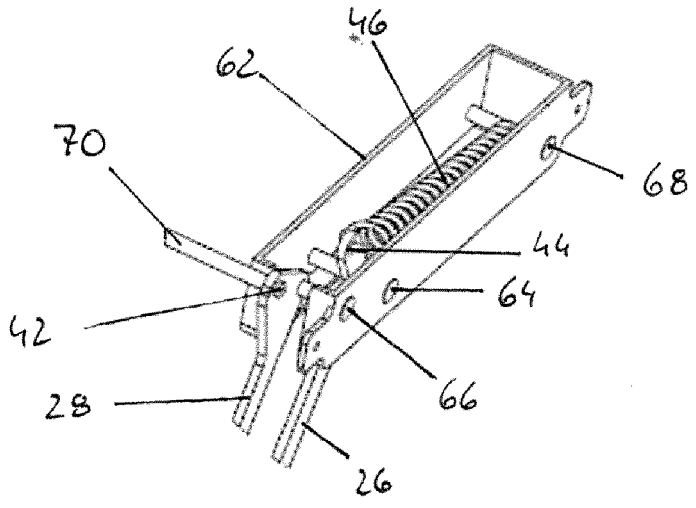
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Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 16 2582

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 754 920 A1 (GAZ DE FRANCE [FR]) 22 January 1997 (1997-01-22) * column 4, line 54 - column 5, line 12; figures 1,2,5-8 *	1-17	INV. F24C15/02 E05F15/627
X	FR 2 705 138 A1 (CEPEM [FR]) 18 November 1994 (1994-11-18) * abstract; figures *	1	
X	US 2009/321430 A1 (JEONG SANG JIN [KR]) 31 December 2009 (2009-12-31) * figures *	1	
X	US 3 157 176 A (PEARCE GEORGE C ET AL) 17 November 1964 (1964-11-17) * figures 2,5,6 *	1	
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			TECHNICAL FIELDS SEARCHED (IPC) F24C E05F E05D H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 September 2018	Verdoodt, Luk

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 16 2582

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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14-09-2018

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