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(54) FOOD COOKING DEVICE

(57) A food cooking device (10) comprising a hood (11) delimiting a cooking chamber (12) open at the bottom and including hollow walls (13) delimiting a gap (14) of the hood (11) having no ducts therein: The cooking device (10) further comprises a firebox (51) located outside and below the cooking chamber (12) and a duct (20) having a closed lower end (21) arranged in the vicinity of the firebox (51) and an open upper end (22) in communication with the gap (14) of the hood (11). The duct (20) and said gap (14) are filled with a mixture of salts acting as heat transfer fluid.

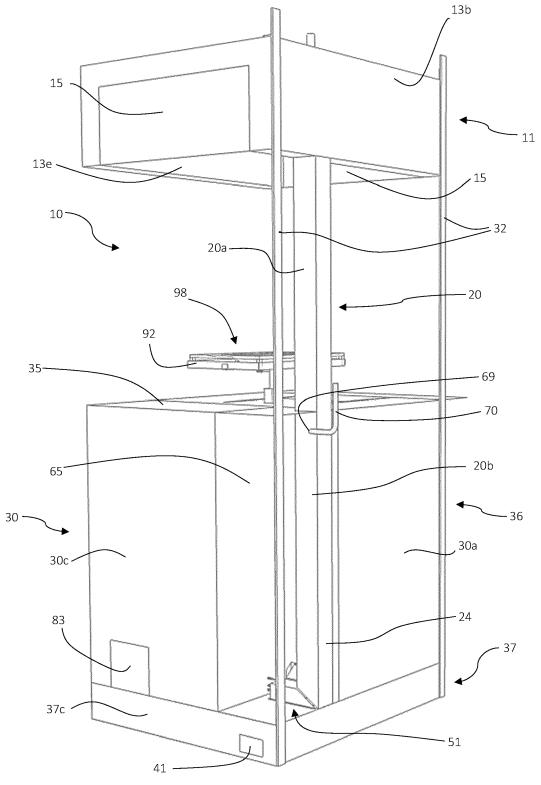

Fig. 1

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Description

Technical Field

[0001] The present invention relates to a food cooking device.

[0002] More particularly, the present invention relates to a food cooking device providing for the use of a heat transfer fluid for conducting heat required for food cooking.

Prior Art

[0003] Prior art food cooking devices include ovens in which heat required for cooking is produced by using burning wood or coal placed in an environment directly in contact wit the chamber in which food to be cooked is placed.

[0004] In said cooking devices, food is in direct contact with smokes produced by the combustion. This makes such devices unsuitable for use with low-value biomasses (for instance pruning waste, vine branches, shells of shell fruit and fruit stones) and unsuitable for use in closed spaces, because of the smokes and the bad smells.

[0005] Ovens providing for the use of a heat transfer fluid flowing in suitable channels formed in the oven walls are also known. Such ovens can be used with a heat source external to the oven, used for heating the heat transfer fluid. For instance, the oven described in document US4262026A includes a horizontal platen inside which a channel extending from a platen inlet connection to a platen outlet connection is formed. The inlet and outlet connections are connected through channels external to the platen, and hence to the oven, and arranged on the same horizontal plane as the platen. A salt reservoir, provided with a suitable heat source adapted to melt the salts, and a pump adapted to make the molten salts circulate in the channels external to the platen and the internal channel of the platen are arranged along said channels.

[0006] The Applicant has however realised that such ovens are structurally complex, since they require the provision of a circuit for the passage of the heat transfer fluid and of a pump to make the heat transfer fluid circulate in the circuit.

[0007] It is an object of the present invention to overcome the problems and the limitations of the prior art, by providing a cooking device that does not expose food to smokes produced by the combustion and that is structurally and constructively simple to be made.

[0008] It is another object of the invention to provide a versatile cooking device, adapted for low temperature cooking of light foods.

[0009] The above and other objects are achieved by means of the cooking device as claimed in the appended claims.

Description of the Invention

[0010] The cooking device according to the present invention comprises a hood delimiting a cooking chamber open at the bottom and including hollow walls. Said hollow walls delimit a gap of the hood, which gap has no ducts therein.

[0011] The cooking device further comprises a firebox (or combustion chamber) located outside and below the cooking chamber, and a duct having a closed lower end arranged in the vicinity of the firebox and an open upper end in communication with the gap of the hood.

[0012] According to the invention, the duct and the gap are filled with a mixture of salts, adapted to be molten by the heat generated by the firebox and acting as heat transfer fluid.

[0013] In accordance with the invention, a coating made of an insulating material is applied to hood surfaces facing the outside of the cooking chamber. Such a coating comprises at least one detachable portion arranged on a horizontal surface out of said surfaces facing the outside of the cooking chamber. Such a detachable portion, if detached, allows putting said horizontal surface of the hood in communication with the outside, thereby advantageously creating a conductive cooking point on which pots or pans can be placed.

[0014] The cooking device further comprises a height-adjustable support intended for a baking pan and arranged below the cooking chamber. Such a support is configured to move the baking pan from a starting position, distal from and located outside the hood, to a final position located inside the hood.

[0015] The cooking device further comprises a temperature detector associated with the support for the baking pan or with the baking pan.

[0016] According to the invention, the cooking device further comprises a weighting device on which the firebox rests. The weighting device is adapted to detect the weight of the firebox and therefore of the fuel contained in the firebox.

[0017] According to the invention, the cooking device further comprises a carbon monoxide detector adapted to detect the amount of carbon monoxide produced during combustion in the firebox.

[0018] In accordance with a further aspect of the invention, the cooking device further comprises a fuel supply system adapted to supply fuel to the firebox. According to the invention, the fuel is preferably biomass.

[0019] The cooking device further comprises a temperature detector attached to the duct and adapted to detect the temperature of an outer surface of the duct.

[0020] According to the invention, the cooking device comprises a control unit. Such a control unit is configured to control and coordinate the operation of the cooking device, by performing different tasks, including the tasks disclosed hereinafter.

[0021] The control unit is configured to control means for adjusting the height of the support for the baking pan

depending on the temperature detected by the temperature detector associated with the support for the baking pan or with the baking pan.

[0022] The control unit is configured to actuate the fuel supply system when the weight detected by the weighting device is below a given weight threshold.

[0023] The control unit is configured to stop the fuel supply system in the event that the temperature detected by the temperature detector attached to the duct exceeds a given temperature threshold.

[0024] The control unit is configured to control a fan adapted to insufflate air onto the firebox depending on the amount of carbon monoxide detected by the carbon monoxide detector.

Brief Description of the Figures

[0025] The above and other features and advantages of the present invention will become more apparent from the following description of preferred embodiments given by way of non-limiting examples with the help of the accompanying Figures:

- Fig. 1 is a perspective view of the cooking device according to the present invention, in which the inside of the first compartment can be seen;
- Fig. 2 is a perspective view of the hood of the cooking device shown in Fig. 1
- Fig. 3 is a perspective view in which part of the inside of the first and the second compartments of the cooking device according to the invention can be seen;
- Fig. 4 is a perspective view in which part of the inside of the first compartment, of the second compartment and of the double bottom of the cooking device according to the invention can be seen;
- Fig. 5 is a perspective view in which part of the inside of the second compartment of the cooking device according to the invention can be seen;
- Fig. 6 is a perspective view of the support for the baking pan and of the means for adjusting the support height, which are partly housed within the third compartment of the box-type element of the cooking device according to the invention;
- Fig. 7 is a perspective view in which the inside of the third compartment, housing the supply system, and of the first compartment of the box-type element of the cooking device according to the invention can be seen;
- Fig. 7a is a perspective view of a detail of the supply system and of the inside of the first compartment of the box-type element according to the invention;
- Fig. 7b is an enlarged view of the first rotating cylinder of the supply system according to the invention;
- Fig. 7c is an enlarged view of the second rotating cylinder of the supply system according to the invention;
- Fig. 8 is a perspective view of the outer upper part of the box-type element;
- Fig.9 is a view similar to Fig. 6, relating to an alternative embodiment of the invention;
- Fig. 10 is a perspective view of the baking pan and of a temperature detector in accordance with the alternative embodiment shown in Fig. 9;
- Fig. 10a is an enlarged view of the temperature detector shown in Fig. 10.

Description of some Preferred Embodiments of the Invention

[0026] Referring to Fig. 1, a cooking device 10 according to the present invention comprises a hood 11 delimiting a cooking chamber 12, a firebox (or combustion chamber) 51 located outside and below cooking chamber 12, and a duct 20 extending from firebox 51 to hood 11.

[0027] Referring to Figs. 2 and 3, hood 11 comprises hollow walls 13 delimiting a gap 14 inside hood 11. Such a gap 14 has no ducts therein. Duct 20, made of metal, has a closed lower end 21 arranged in the vicinity of firebox 51 and an open upper end in communication with gap 14 of hood 11. A salt mixture, for instance an eutectic mixture of sodium nitrate and potassium nitrate, characterised by an optimum heat exchange coefficient and by a reduced volume variation during the melting process and capable of attaining high temperatures (exceeding 500°C), is present in duct 20 and in gap 14 of hood 11. Said salt mixture is molten thanks to the heat produced by firebox 51 and it acts as a heat transfer fluid for transferring heat from firebox 51 to cooking chamber 12. Advantageously, the molten salt mixture also acts as a heat accumulating medium contributing to make cooking device 10 convenient from the energetic point of view and hence economical.

[0028] In accordance with the preferred embodiment illustrated, hood 11 is made in an upturned U shape, i.e. it includes a top horizontal side 11a and two vertical sides, namely a rear side 11b and a front side 11c. Hood 11 is provided at its sides with two panels 15 (side panels), hinged on a horizontal or vertical hood side, to allow opening the hood. Surfaces 13d, 13e, 13f of sides 11a, 11b, 11c of hood 11 facing the inside of cooking chamber 12 are adapted to transfer heat from gap 14 of hood 11 to cooking chamber 12. Surfaces 13a, 13b, 13c of sides 11a, 11b, 11c of hood 11 facing the outside of cooking chamber 12 are instead coated with a layer of a material insulating against high temperatures, in order to limit heat dispersion towards the outside of hood 11. Similarly, also both side panels 15 are coated with an insulating material, in order to maintain heat inside cooking chamber 12.

[0029] The insulating layer has one or more detachable portions 16, preferably circular, on top horizontal side 11a. Such portions 16, if detached, allow putting outer surface 13a of top side 11a directly in communication with the outside, thereby advantageously creating conductive cooking points on which pots or pans can be placed.

[0030] Hood 11 further has an opening 17, preferably

located in the lower face of one of the vertical sides, for instance rear side 11b, and associated with open upper end 22 of duct 20 so as to put gap 14 of hood 11 in communication with duct 20.

[0031] Hood 11 further has an opening 18 that can be closed, preferably formed in an upper face of vertical side 11b, in opposite position relative to opening 17. Opening 18 that can be closed is for instance a threaded bore in which a bolt can be screwed. Through such an opening 18 that can be closed it is possible to introduce the salt mixture into gap 14 and hence into duct 20.

[0032] Cooking device 10 further comprises a box-type element 30 acting as a bearing member for the device and internally housing firebox 51, as it will be disclosed in more detail below. For instance, box-type element 30 is substantially parallelepiped shaped, with a rectangular base having substantially the same size (width and length) as top horizontal side 11a of hood 11, and it comprises a rear wall 30a, a front wall 30b, a first side wall 30c and a second side wall 30d. Two vertical supports 32 extend upwards from a wall of box-type element, for instance from rear wall 30a. Hood 11 is fastened to such supports 32, for instance by means of two metal tongues 33 bent in "L" shape, one tongue for each support. A vertical portion 33a of each tongue 33 is applied on the corresponding support 32 and is fastened thereto, for instance by means of screws, and the horizontal other portion 33 is applied on horizontal side 11a of hood 11 and is fastened thereto, for instance by means of screws.

[0033] Box-type element 30 is closed at its top by a top horizontal panel 35 (lid) and is vertically divided into an upper part 36 and a lower double bottom 37 defined by a first lower horizontal panel 38 and by a second lower horizontal panel 39 located at a height exceeding the height of the first one.

[0034] Referring to Figs. 1, 2 and 3, in accordance with the preferred embodiment illustrated, duct 20 has an upper portion 20a located outside box-type element 30 and a lower portion 20b located inside box-type element 30. Lower end 21 of duct 20, which is located slightly above the second lower horizontal panel 39 of double bottom 37, is preferably wedge-shaped, with a front face 23 inclined down to become joined with a rear face 24 of duct 20. Moreover, duct 20 is externally coated with a layer of insulating material, except on front face 23 of the wedge, which forms the element through which heat produced by the firebox is transferred to the salt mixture contained in duct 20.

[0035] Preferably, a temperature detector (not shown) is applied onto duct 20, for instance, in upper part 20a of the duct, and is placed in direct contact with the metal surface of the same duct, in correspondence of an opening formed in the insulating layer.

[0036] Referring to Figs. 3 and 4, a rectangular opening 40 is provided in the second lower panel 39 of box-type element 30, in correspondence of wedge-shaped end 21, and it puts double bottom 37 in communication with upper part 36 of box-type element 30. A drawer 41, sliding on suitable guides (not shown) towards a first side wall 37c of double bottom 37, is provided in double bottom 37, in correspondence of opening 40 of the second lower panel 39. Moreover, a weighting device 45, preferably of electronic type, is provided below the guides, the weighting device being arranged on the first bottom panel 38 and in correspondence of said opening 40 of the second lower panel 39. Weighting device 45 is laterally equipped with two pantographs 46, which extend upwards through opening 40 and on which firebox 51 rests, and it is configured to detect the weight of the fuel contained in firebox 51.

[0037] Referring to Fig. 3, according to the embodiment illustrated, firebox 51 is a box-type element comprising a bottom horizontal base 52, a front vertical surface 53 and two side vertical surfaces 54 shaped as rectangular trapezia having the great bases 54a at the bottom and the small bases 54b at its top. Bottom base 52 of firebox 51 rests on pantographs 46 and it is riddled in order to allow ash produced by the combustion to fall down towards drawer 41 below, which advantageously prevents ash from depositing on weighting device 45. In this manner, weighting device 45 only detects the weight of the fuel contained in firebox 51.

[0038] Two holes, namely a lower hole 53a and an upper hole 53b, located below one another, are formed in front vertical surface 53 of firebox 51. Moreover, firebox 51 is open at its top, both between oblique sides 54c and between small bases 54d of trapezoidal side surfaces 54. Moreover, oblique sides 54c preferably have substantially the same inclination as inclined front face 23 of wedge-shaped lower end 21 of duct 20, and the open surface between said oblique sides 54c is closed by said inclined front face 23 of said wedge-shaped lower end of duct 20. The geometry of firebox 51 described above allows optimising heat exchange between firebox 51 and duct 20. Since firebox 51 must be adapted to be weighted by means of weighting device 45, it is not fastened to duct 40 and thus, in operating conditions, the weight of the fuel contained in firebox 51 will cause a slight lowering of the same firebox and consequently a small spacing between duct 20 and firebox 51.

[0039] Upper portion 36 of box-type element 30 is characterised by an internal division into compartments, functional to the different components it houses.

[0040] A first compartment 61 of box-type element 30 internally contains firebox 51 and lower portion 20b of duct 20, and it is delimited by a first internal partition 64 extending from rear wall 30a of box-type element 30, preferably perpendicularly thereto, and by a second internal partition 65 extending from the first internal partition 64 to the first side wall 30c of box-type element 30, preferably perpendicularly to the latter. The internal surfaces of said first compartment 61 are preferably coated with an insulating layer. It is to be appreciated that rear wall 30a and the first side wall 30c of box-type element 30 have been omitted in Fig. 1 in correspondence of the first compartment 61, so as to make the inside thereof

visible.

[0041] An opening 66, preferably rectangular, is formed in the first internal partition 64 of the first compartment 61 and is located in correspondence of firebox 51 at a height slightly above the same firebox. Through said opining, which has a width that preferably does not exceed the length of small bases 54d of trapezoidal side surfaces 54 of firebox 51, fuel is supplied to the firebox, as it will be illustrated below.

[0042] Three holes, namely a lower hole 61a, an intermediate hole 61b and an upper hole 61c, arranged in line below one another, are provided in the second internal partition 65 of the first compartment 61. Among said holes, lower hole 61a is aligned with lower hole 53a of firebox 51 and is connected thereto by means of a pipe 67, intermediate hole 61b is aligned with upper hole 53b of firebox 51 and upper hole 61c is located at a height slightly exceeding the height of firebox 51. It is to be appreciated that the second internal partition 65 has been omitted in Fig. 3 for the sake of clarity, even though bottom hole 61a, intermediate hole 61b and upper hole 61c formed therein remain visible.

[0043] An outer wall of the first compartment 61, preferably side wall 30c, is provided with an opening closed by a door 68, allowing access to the same compartment. Moreover, rear wall 30a of the compartment has a hole 69, laterally arranged relative to duct 20 in the upper portion of the wall. The combustion smokes are channelled by means of a sucking fan (not shown) from said hole into pipes 70, at the beginning of which a carbon monoxide detector (not shown) is provided.

[0044] A second compartment 62 is delimited by the second internal partition 65 and by a third internal partition 72 extending from front wall 30b of box-type element 30, preferably perpendicularly thereto, to the second internal partition 65.

[0045] Referring in particular to Figs. 3 and 4, priming means adapted to prime combustion in the firebox are housed in the second compartment 62. Said priming means consist for instance of a resistor 75 mounted on a movable slide 76 configured so as to move resistor 75, through hole 61b, from a starting position outside firebox 51 to a final, priming position inside firebox 51, by making resistor 75 pass through upper hole 53b of firebox 51.

[0046] Slide 76 is for instance slidably mounted on guides (not shown), fastened to a scaffold 77, and it is integral with a rack 76 coupled with a motor-driven pinion 79, whereby the rotation of pinion 79 causes the forward or rearward movement of slide 76. Pinion 79 is driven by a respective motor (not shown).

[0047] The second compartment 62 also houses a motor-driven fan 81 adapted to insufflate air into firebox 51 through bottom hole 61a of the second internal partition 65, communicating with lower hole 53a of firebox 51 through pipe 67, previously described.

[0048] Cooking device 10 preferably further comprises a flame detector 82, received in upper hole 61c of the second internal partition 65 and adapted to detect whether a combustion process is occurring in firebox 51.

[0049] Preferably, an outer wall of the second compartment 62, for instance side wall 30c, is provided with an opening, closed by a door 83 (shown in Fig, 1), allowing access to the same compartment.

[0050] Referring in particular to Fig. 6, in accordance with the embodiment illustrated, cooking device 10 further comprises a height-adjustable support 91 for a baking pan 92, onto which a grid 98 can be placed. Such a support 91, consisting for instance of two orthogonally arranged horizontal small metal bars 91a, 91b, the one arranged lengthways and the other arranged widthways, is associated with height-adjusting means configured to raise and lower support 91 in order to move baking pan 92 from a starting position, distal from and outside hood 11, to a final position inside hood 11.

[0051] The means for adjusting the height of the support comprise a rack 93 and a motor-driven pinion 94. Rack 93, vertically arranged, preferably in a central region of box-type element 30, extends from the inside of box-type element 30 up to a height above lid 35 of box-type element 30, passing through a suitable opening formed in lid 35. Support 91 for the baking pan is secured to an upper end 93a of rack 93. Preferably, rack 93 slides inside a section bar 95 acting as a guide. Such a section bar 95, having for instance rectangular cross sectional shape, extends from the second lower panel 39 of box-type element 30, to which it is fastened, up to a height above lid 35 of box-type element 30, and it too passes through said opening in lid 35, which preferably has the same shape and size as section bar 95. Below lid 35, section bar 95 has an opening 95a uncovering a portion of the toothing of rack 93, where motor-driven pinion 94 is coupled with the same rack. Pinion 94 is driven by a respective motor (not shown), for instance a brushless electric motor, secured to lid 35 of box-type element 30. It is to be appreciated that lid 35 has not been shown in Fig. 6, in order to show the portion of the adjusting means located inside box-type element 30. Moreover, also the third internal partition 72 is not shown.

[0052] In accordance with a further embodiment, the cooking device includes two supports with a respective baking pan (and grid, if any), each equipped with its own height-adjusting means like those described above. This advantageously allows cooking simultaneously foods at different temperatures.

[0053] Referring to the embodiment shown in Fig. 6, in the vicinity of upper end 93a of rack 93 a temperature detector 96 is provided, ferrule 96a of which is supported for instance by means of a circumference-adjustable collar 97 secured to rack 93.

[0054] In accordance with a further embodiment, temperature detector 96 is arranged slightly above grid 98 in order to detect the temperature closer to food being cooked. For instance, as shown in the embodiment illustrated in Figs. 9 and 10, a tubular support 110, fastened to baking pan 92, extends up to a height above grid 98, and a clamp 111 configured to clamp temperature de-

tector 96 is located at its upper end. More particularly, referring to Fig. 10a, clamp 111 comprises for instance a first small bar 111a secured to tubular support 110 and a second, movable small bar 110b, connected to the first small bar 111a by means of bolts 112, so as to clamp temperature detector 96 between the first and the second small bars. Cable 96b of temperature detector 96 passes inside tubular support 110 and exits through a hole of baking pan 92, formed at the base of tubular support 110, and a corresponding hole 91c formed in support 91. Preferably, moreover, a grommet 113 is secured to section bar 95 in order to guide cable 96b (only partly shown). It is to be appreciated that lid 35 has not been shown in Fig. 9, in order to show the portion of the adjusting means located inside box-type element 30. Moreover, also the third internal partition 72 is not shown.

[0055] Furthermore, the means for adjusting the height of support 91 are equipped with a settable stop member adapted to prevent food on baking pan 92 or grid 98 from contacting hood 11, more particularly surface 13d of horizontal side 11a of hood 11, and becoming burnt, since such a surface 13d is the heat source for cooking chamber 12.

[0056] Referring to Fig. 7, a third compartment 63 of box-type element 30, separated from the two other compartments by the first internal partition 64 and the third internal partition 72, houses a supply system 100 adapted to supply firebox 51 with fuel It is to be appreciated that lid 35, front wall 30b, the second side wall 30d and the third internal partition 72 have not been represented in Fig. 7, in order to show the inside of the third compartment 63, with supply system 100, and the inside of the first compartment 61.

[0057] Supply system 100 comprises a fuel container 101, a mechanical arm 102 equipped with a gripper 102a, and a chute 103.

[0058] Container 101 is adapted to contain fuel to be supplied to firebox 51, more particularly granular fuel, for instance biomass in form of pellets or woodchips or even low-value biomass, such as pruning waste, vine branches, shells of shell fruit, fruit stones and so on. Such different fuels can be used both separately and mixed together.

[0059] The container, located in a front region of the third compartment 63, preferably has a frusto-conical upper portion 101a connected at its bottom with a cylindrical lower portion 101b. Upper portion 101a having, in use, a substantially vertical axis, is open at its top to allow loading the fuel Lower portion 101b, having axis inclined relative to the vertical direction, for instance by about 60°, towards a rear region of the third compartment 63, has a side surface 101c open at its top to allow taking fuel by means of gripper 102a of mechanical arm 102, and a bottom end closed by means of a closing wall 101d, for instance of hemispherical shape.

[0060] Mechanical arm 102 is preferably arranged between container 101 and chute 103 and is configured to take fuel from container 101 by means of gripper 102a and to release said fuel onto chute 103.

[0061] Advantageously, the arrangement of container 101 spaced apart from chute 103 allows preventing a possible combustion propagation from firebox 51 towards the fuel present on chute 103 from reaching also container 101, thereby making supply system 100 safer.

[0062] Chute 103, preferably made of refractory material, comprises an inclined plane 103a delimited by two vertical side walls 103b, and extends from a top end, secured for instance to the second side wall 30d of box-type element 30, to a bottom end 103d located in the first compartment 61, immediately above firebox 51, passing through opening 66 formed in the first internal partition 64 and located, as described before, in correspondence of firebox 51, slightly above the same.

[0063] Referring in particular to Figs. 7a and 7b, supply system 100 further comprises a first, motor-driven rotating cylinder 104, provided with a plurality of flexible bristles 104a, radially extending from a core of said cylinder and having a length preferably ranging from 5 cm to 25 cm, more preferably ranging from 10 cm to 20 cm Preferably, bristles 104a are uniformly distributed over the whole length of cylinder 104 and have a density ranging from 3 to 6 bristles/cm.

[0064] The first rotating cylinder 104 is arranged above inclined plane 103a of chute 103, transversely thereto and in such a manner that ends 104b of bristles 104a proximal to inclined plane 103a are spaced apart from said inclined plane 103a by a distance preferably ranging from 4 mm to 8 mm, more preferably a distance of 6 mm, so as to allow passage of fuel having a grain size smaller than said distance and to allow bristles 104a to interact with fuel granules of greater size, thereby making them advance in downstream direction. For instance, the first rotating cylinder 104 is arranged with its axis of rotation on side walls 103b of chute 103.

[0065] Preferably, moreover, the first rotating cylinder 104 is located at a distance from bottom end 103d of chute 103 ranging from 15 cm to 40 cm, more preferably from 25 cm to 35 cm, ie. at about one third the overall length of chute 103 starting from said bottom end 103d, so that the fuel granules are kept uniformly distributed down to said bottom end 103d. Indeed, a greater distance would entail that the granules, since they move down along the chute at different speeds (due to their different shapes), could become again accumulated.

[0066] Referring in particular to Figs. 7a and 7c, a transverse opening 106 is provided in the lower portion of chute 103, in the third compartment 63, slightly before opening 66 of the first internal partition 64. A second motor-driven rotating cylinder 105 is located in correspondence of said transverse opening 106, and its axis of rotation 105d is arranged below inclined plane 103a of chute 103, whereas its surface 105a has a plurality of grooves 105b alternating with ridges 105c arranged lengthways on the cylinder. A portion of surface 105a of cylinder 105 extends through said transverse opening 106, slightly above inclined plane 103a of chute 103. The

distance between two subsequent ridges 105 preferably ranges from 1 cm to 3 cm and more preferably is 2 cm. Grooves 105b are preferably 2 mm to 5 mm deep, and more preferably are 3 mm deep. It is to be appreciated that internal partition 64 has been omitted in Fig. 7c for the sake of clarity.

[0067] Advantageously, the first rotating cylinder 104, thanks to the spacing between end 104b of its bristles 104a and inclined plane 103a of chute 103, allows passage of fuel having a grain size smaller than the same spacing, which fuel thus freely reaches the second rotating cylinder 105. Fuel having a coarser grain size stops on the contrary against bristles 104a of the first rotating cylinder 104 that, while rotating, make the fuel orderly advance towards the second rotating cylinder 105.

[0068] Advantageously, the second rotating cylinder 105, thanks to its grooves 105b and ridges 105c, allows pushing fuel towards bottom end 103d of chute 103 and hence down to firebox 51, preventing it from becoming accumulated in the lower portion of chute 103.

[0069] Advantageously, moreover, fuel supply system 100 can be used with biomass of different grain size. For instance, fuels having a size ranging from pellets, having a diameter of about 5 mm, up to woodchips, having a thickness of up to five centimetres, can be used. Moreover, the different fuels can be used both separately and mixed together.

[0070] Referring to Fig. 8, the third compartment 63 of box-type element 30 is accessible through an opening formed in lid 35 and closed by a detachable panel 107. Such an opening is located between two guides 108 placed on lid 35, preferably parallel to rear wall 30a of box-type element 30. Moreover, such guides 108 extend beyond lid 35 of box-type element 30 on the side of the second side wall 30d of box-type element 30, and a working plane 109, useful for instance for supporting food and kitchen tools, is placed on the guide portions extending beyond lid 35. Guides 108 are adapted to act as a support for an optional removable trolley (not shown), on which there are mounted a baking pan (not shown) and, above the baking pan, a motor-driven spit (not shown), so as to extend the cooking possibilities and to make the cooking device even more versatile. It is to be appreciated that baking pan 92 and grid 98 placed on support 91 have been omitted in Fig. 8 for the sake of clarity

[0071] Advantageously, cooking device 10 further comprises a control unit 120, for instance a PLC. Such a control unit 120, which preferably is housed within the second compartment 62 (Fig. 5), is configured to control and coordinate the operation of cooking device 10, by performing different tasks, disclosed below. The control unit is preferably powered by a battery (not shown), also housed within the second compartment 62, which also supplies the different motors described above.

[0072] Control unit 120 is connected to temperature detector 96 (by means for instance of cable 96b) associated with support 91 for baking pan 92 (as shown in Fig. 6) or with baking pan 92 (as shown in Figs. 9 and 9a) and controls the means for adjusting the height of support 91 depending on the temperature indicated by said temperature detector 96. This advantageously allows keeping food placed on baking pan 92 or on grid 98 at the desired temperature, by moving baking pan 92 towards or away from surface 13d of horizontal side 11a of hood 11. Moreover, the possibility of moving baking pan 92 away from hood 11 is particularly advantageous for the finest foods, requiring lower cooking temperatures.

[0073] Control unit 120 is further connected to electronic weighting device 45 on which firebox 51 is placed, and it actuates fuel supply system 100 depending on the weight detected by weighting device 45. This allows precisely controlling the amount of fuel present in firebox 51 since, as explained before, ash leaving firebox 51 through its riddled bottom base 52 becomes deposited in drawer 41 and does not influence the measurement by weighting device 45. Checking the amount of fuel present in firebox 51 allows keeping such an amount always within an optimal range of values, in particular by actuating supply system 100 when the weight detected by weighting device 45 is lower than a predetermined minimum weight threshold, and stopping it when the weight detected exceeds a predetermined maximum weight threshold. This feature is particular advantageous since, owing to the granular structure of the fuel used (biomass), controlling the supply system through a timer would not ensure a fuel supply uniform in time.

[0074] Control unit 120 is further connected to temperature detector 25 applied on duct 20 and it controls fan 81 and fuel supply system 100 depending on the temperature indicated by said detector. This advantageously allows decreasing the speed of or stopping fan 81 and/or stopping fuel supply system 100 in the event that the temperature detected exceeds a determined temperature threshold.

[0075] Control unit 120 is further connected to flame detector 82 and is configured to control combustion priming means 75 depending on the combustion activity detected by said flame detector.

[0076] Control unit 120 is further connected to the carbon monoxide detector and is configured to control fan 81 depending on the amount of carbon monoxide produced by the combustion in the firebox.

[0077] Control unit 120 is associated with a control interface (not shown), which is preferably located outside the second compartment 62, above door 83, and through which it is possible to set the weight and temperature threshold values mentioned above and to set up the operation of control unit 120.

[0078] Some phases of the operation of cooking device 10 according to the present invention are described hereinafter.

[0079] Upon cooking device 10 being turned on, control unit 120 actuates the combustion priming means, by moving resistor 75 into firebox 51.

[0080] Control unit 120 then actuates supply system

100, so that mechanical arm 102 takes the fuel from container 101 and deposits it on chute 103. The first cylinder 104, equipped with bristles, makes the fuel advance and uniformly distributes it, and the second cylinder 105, provided with grooves 105a, makes the fuel fall into firebox 51.

[0081] When the fuel has reached firebox 51, resistor 75, with the help of fan 81, causes priming of the combustion.

[0082] When the combustion has started, control unit 120 governs supply system 100, fan 81 and height-adjusting means 93, 94 depending on the various detectors in device 10, as disclosed before. More particularly:

- supply system 100 is stopped if the temperature detected on duct 20 is excessive;
- supply system 100 is stopped if the weight detected by weighting device 45 exceeds a given maximal threshold, and is actuated again when the weight becomes lower than a minimum threshold;
- fan 81 is turned on when the carbon monoxide detected exceeds a given threshold;
- means 93, 94 for adjusting the height of support 91 for baking pan 92 are actuated to move baking pan 92 away from or towards hood 11 depending on the temperature detected by detector 96 associated with support 91.

[0083] The cooking device as described and illustrated can undergo further changes and modifications lying within the same inventive principle.

Claims

1. A food cooking device (10) comprising: a hood (11) delimiting a cooking chamber (12) open at the bottom and including hollow walls (13) delimiting a gap (14) of the hood (11), said gap having no ducts therein; a firebox (51) located outside and below the cooking chamber (12); a duct (20) having a closed lower end (21) arranged in the vicinity of the firebox (51) and an open upper end (22) in communication with the gap (14) of the hood (11), said duct (20) and said gap (14) being filled with a mixture of salts acting as heat transfer fluid.

2. The device according to claim 1, wherein a coating made of an insulating material is applied to surfaces (13a, 13b, 13c) of the hood (11) facing the outside of the cooking chamber (12), said coating comprising at least one detachable portion (16) arranged on a horizontal surface (13a) out of said surfaces facing the outside of the cooking chamber.

3. The device according to claim 1 or 2, comprising a height-adjustable support (91) intended for a baking pan (92) and arranged below the cooking chamber (12).

4. The device according to any of the preceding claims, further comprising a temperature detector (96) associated with the support (91) for the baking pan (92) or with the baking pan (92).

5. The device according to any of the preceding claims, further comprising a weighting device (45) on which the firebox (51) lies, said weighting device being adapted to detect the weight of the firebox (51) and therefore of the fuel contained in the firebox (51).

6. The device according to any of the preceding claims, further comprising a fuel supply system (100) adapted to supply fuel to the firebox (51).

7. The device according to any of the preceding claims, further comprising a temperature detector (25) attached to the duct (20) and adapted to detect the temperature of an outer surface of the duct (20).

8. The device according to claim 3 and 4, comprising a control unit (120) configured to control means (93, 94) for adjusting the height of the support (91) for the baking pan (92) depending on the temperature detected by said temperature detector (96).

9. The device according to claim 5 and 6, comprising a control unit (120) configured to actuate the fuel supply system (100) when the weight detected by the weighting device (45) is below a given weight threshold.

10. The device according to claim 7, comprising a control unit (120) configured to stop the fuel supply system (100) in the event that the temperature detected by the temperature detector (25) attached to the duct (20) exceeds a given temperature threshold.

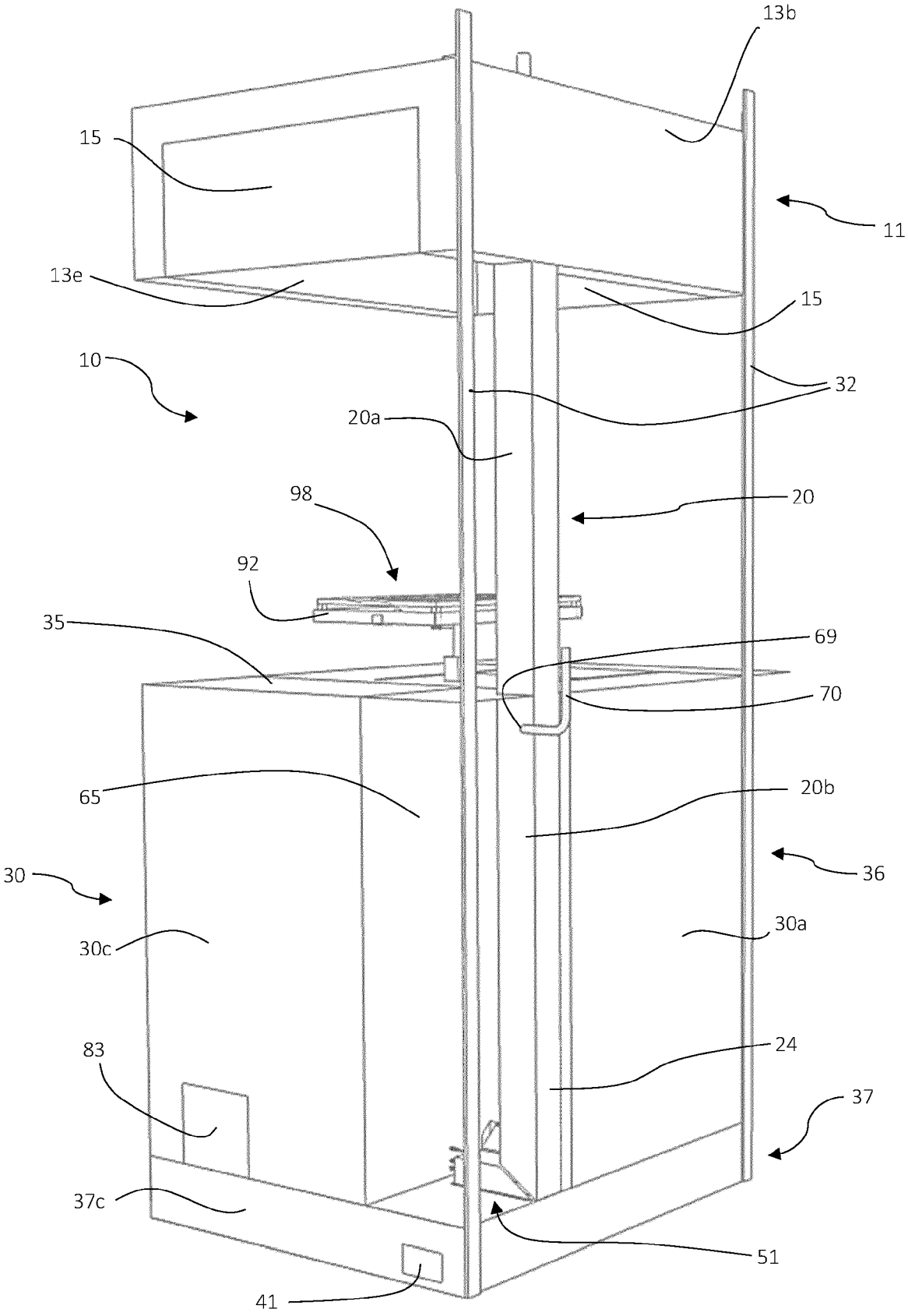

13b
15
11
13e
15
10
32
20a
98
20
92
35
69
70
65
20b
36
30
30a
30c
24
83
37
37c
51
41

Fig. 1

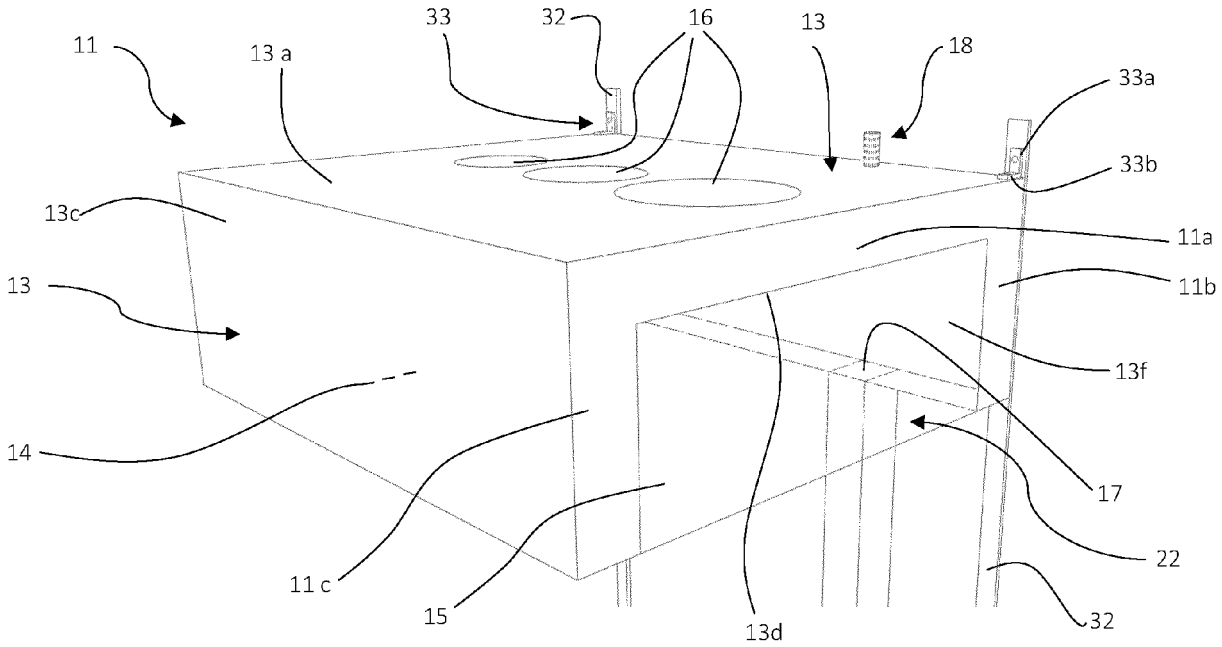

11
13 a
33
32
16
13
18
33a
33b
13c
11a
13
11b
13f
14
17
22
11 c
15
13d
32

Fig. 2

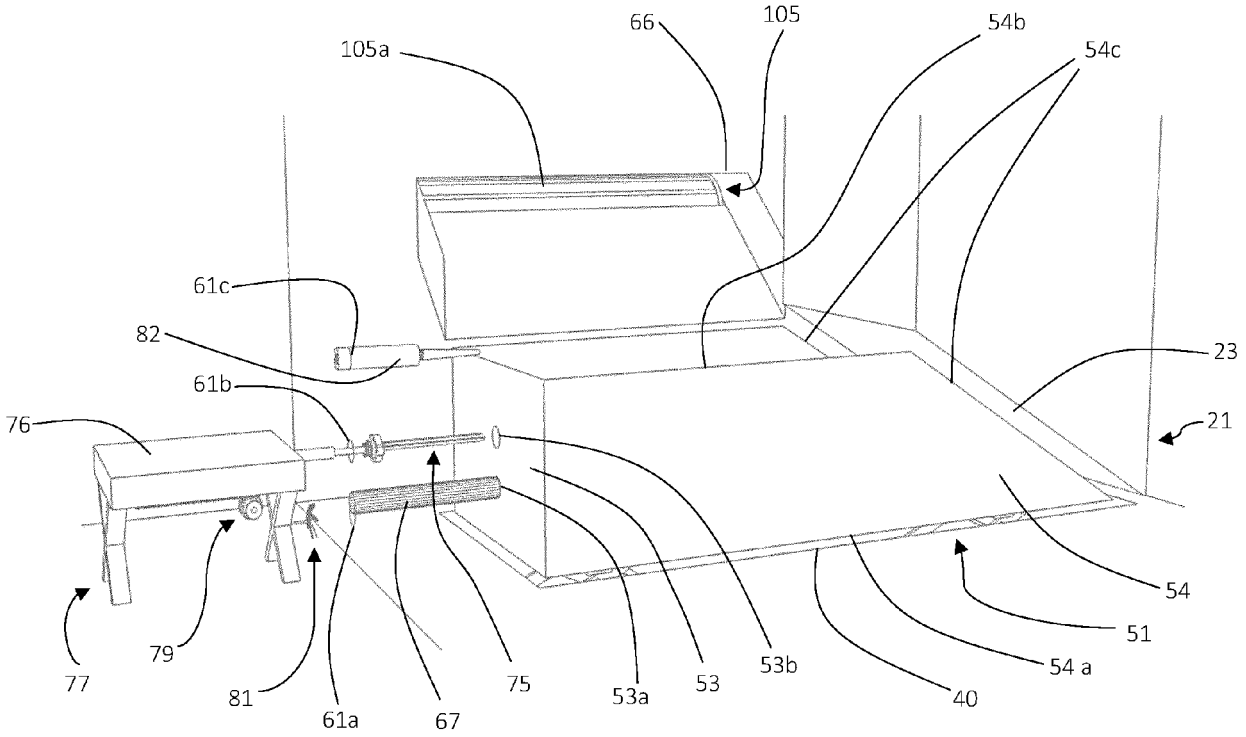
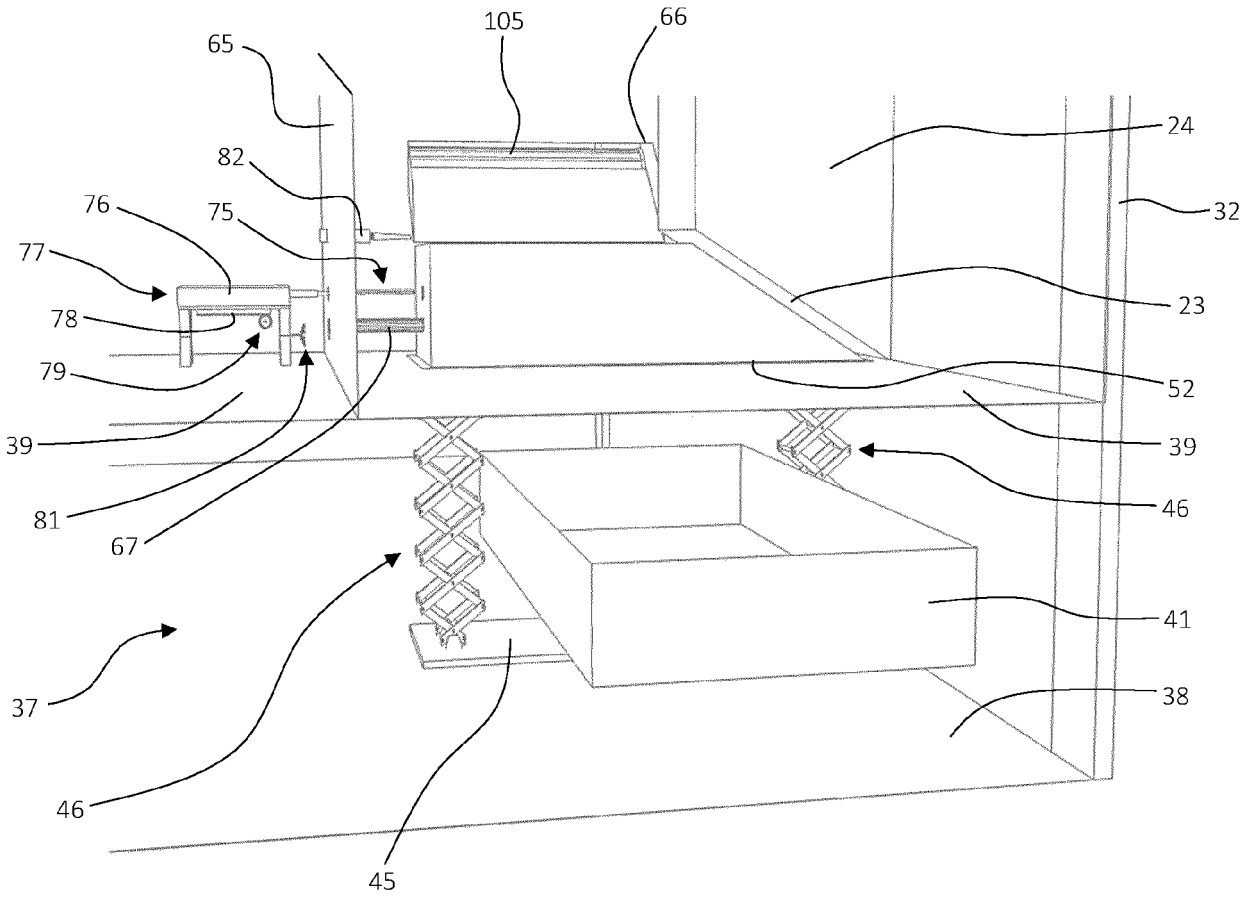

105a
66
105
54b
54c
61c
82
23
61b
21
76
54
51
54 a
79
53b
77
81
61a
67
75
53a
53
40

Fig. 3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105
66
82
24
76
75
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52
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39
81
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38
46
45

Fig. 4

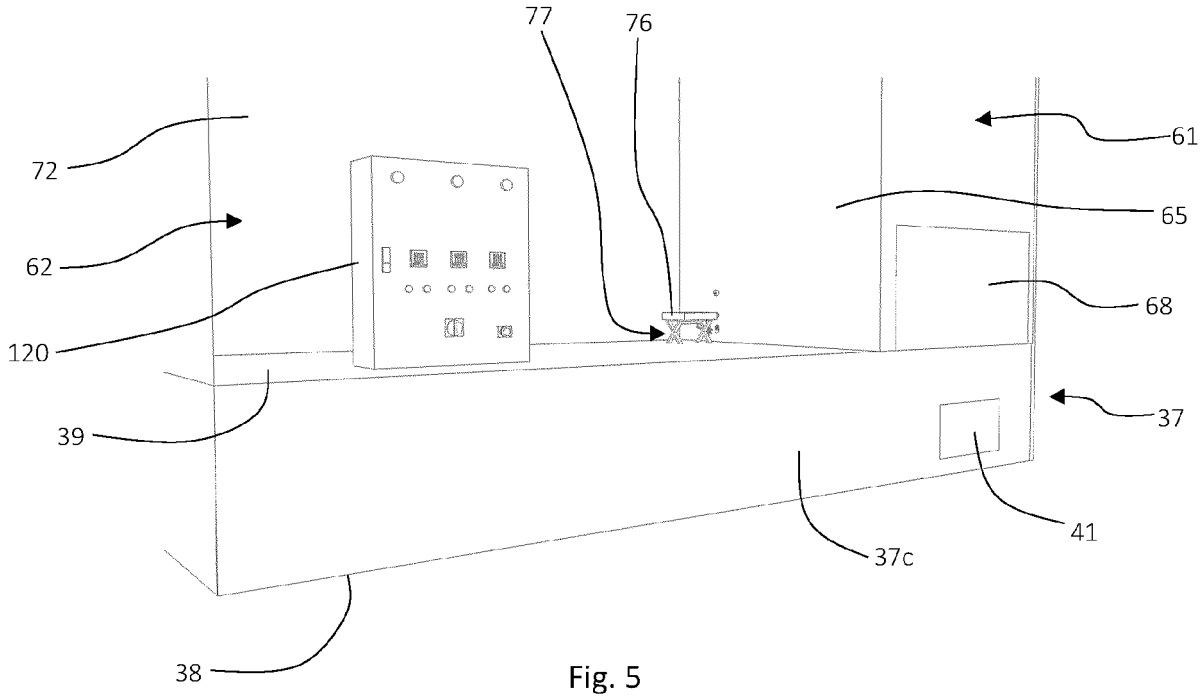
77
76
72
61
65
62
68
120
37
39
41
37c
38

Fig. 5

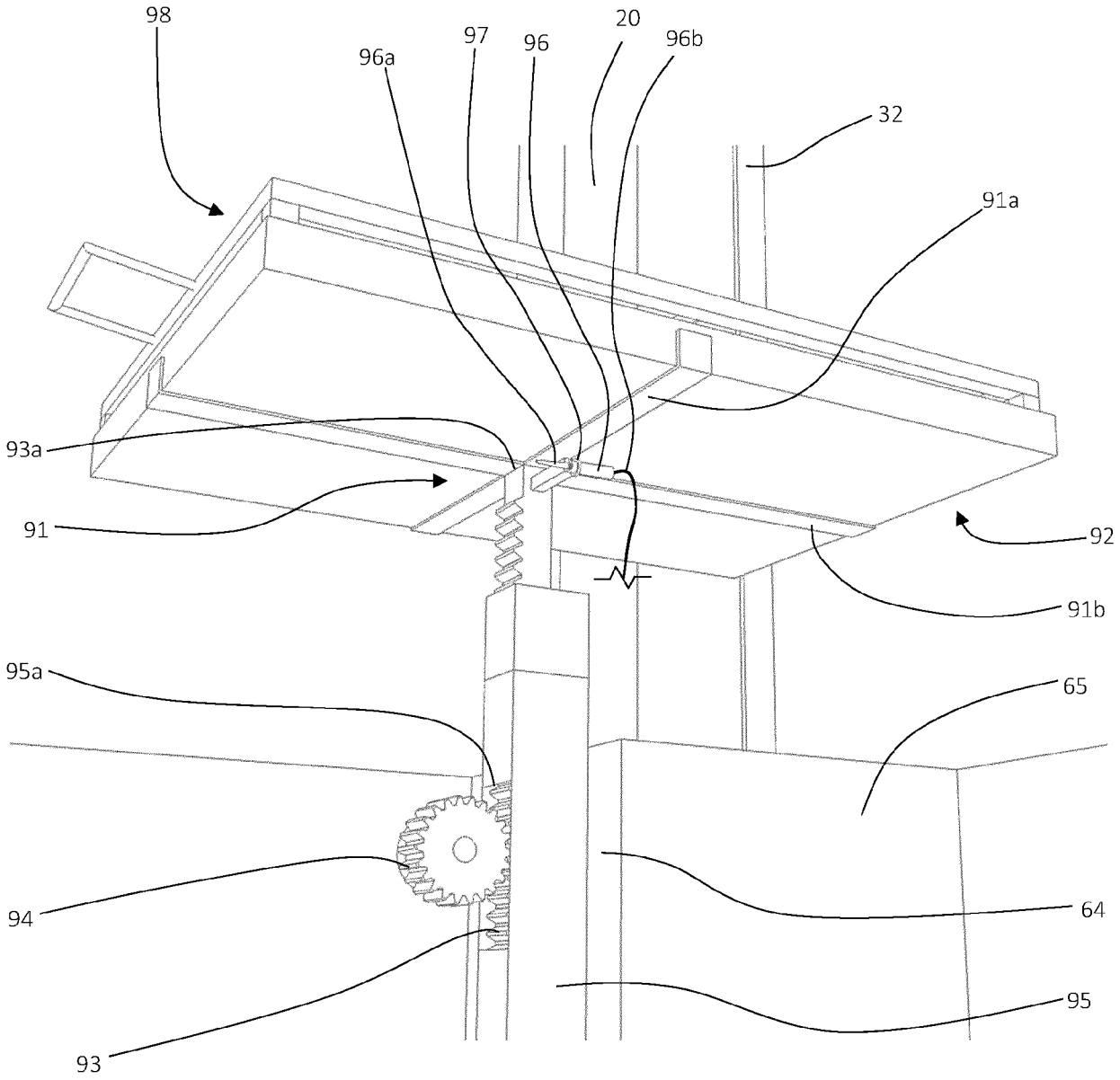

Fig. 6

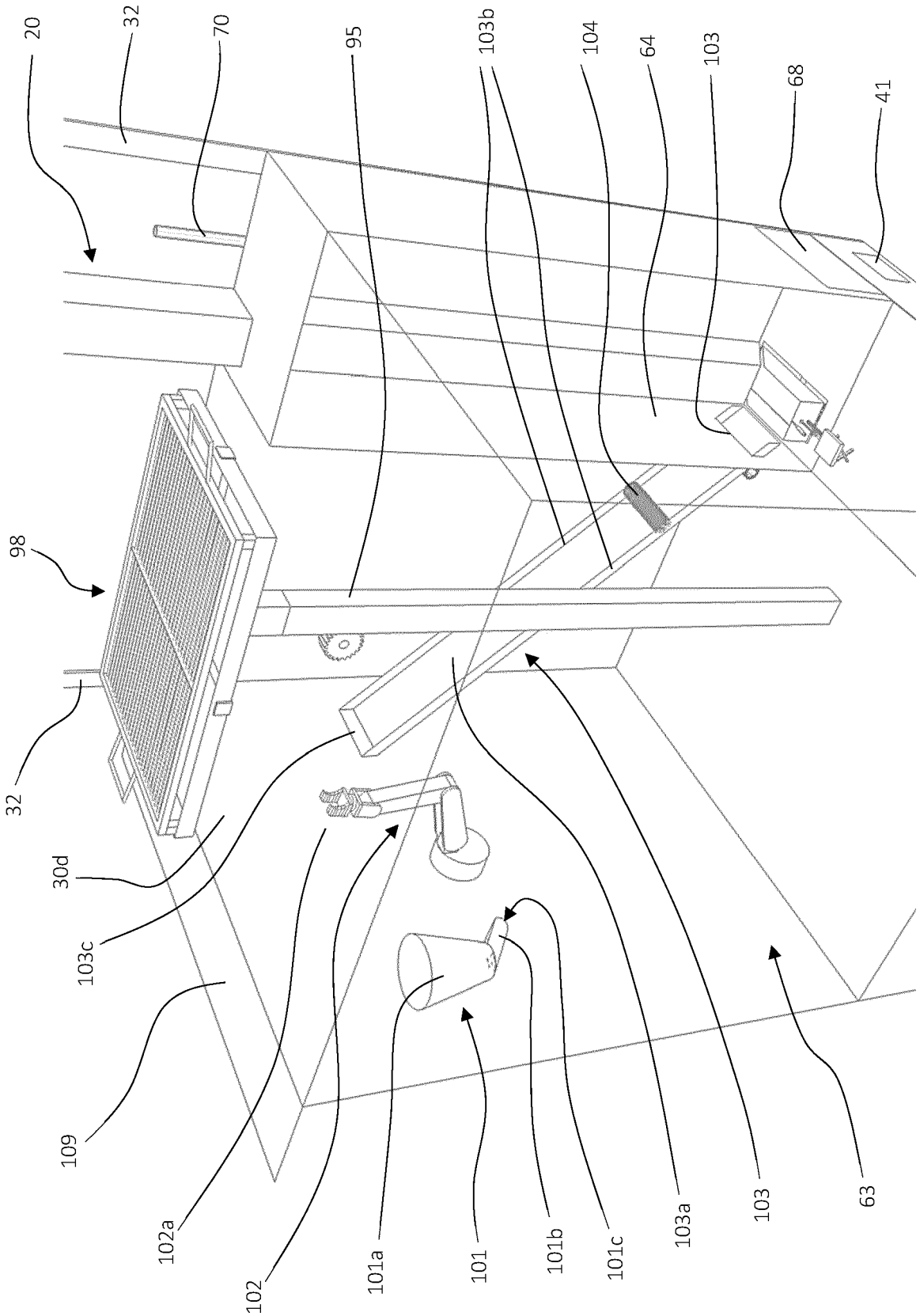
20
32
70
95
103b
104
64
103
68
41
98
32
30d
103c
109
102a
102
101a
101
101b
101c
103a
103
63

Fig. 7

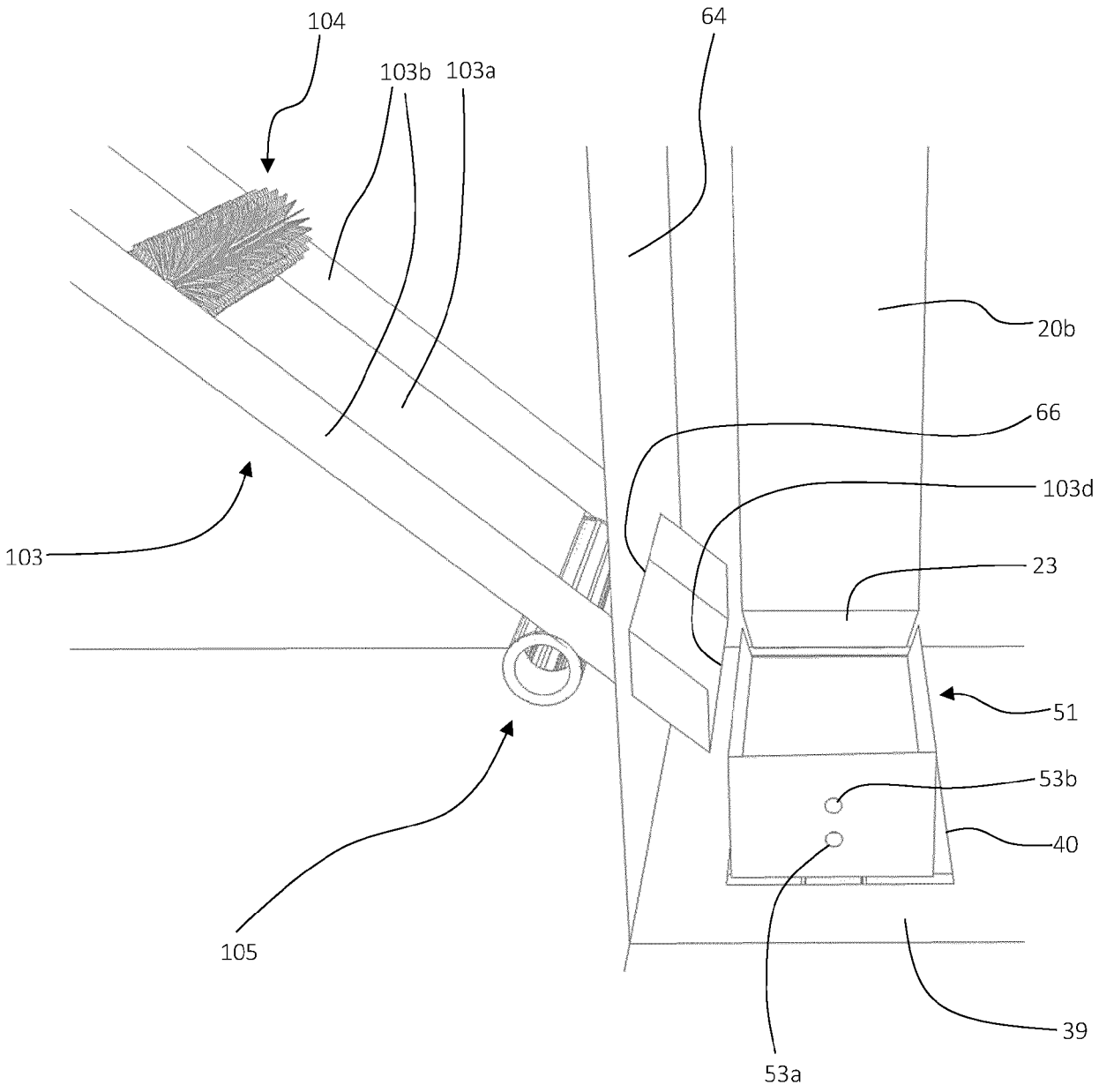

Fig. 7a

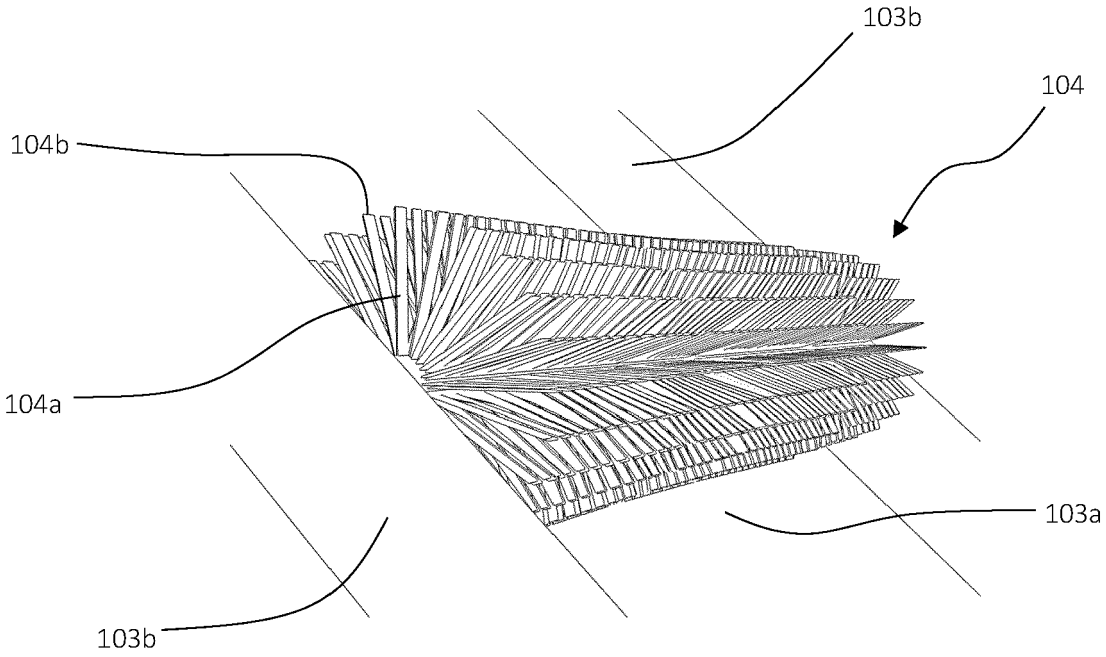
103b
104
104b
104a
103a
103b

Fig. 7b

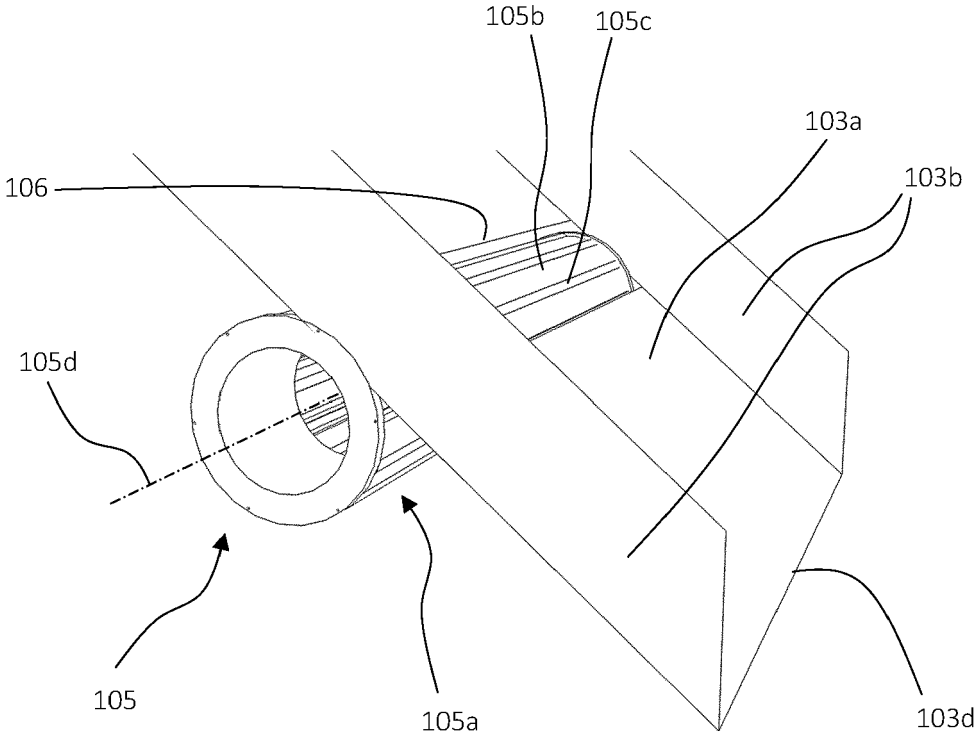
105b
105c
103a
106
103b
105d
105
105a
103d

Fig. 7c

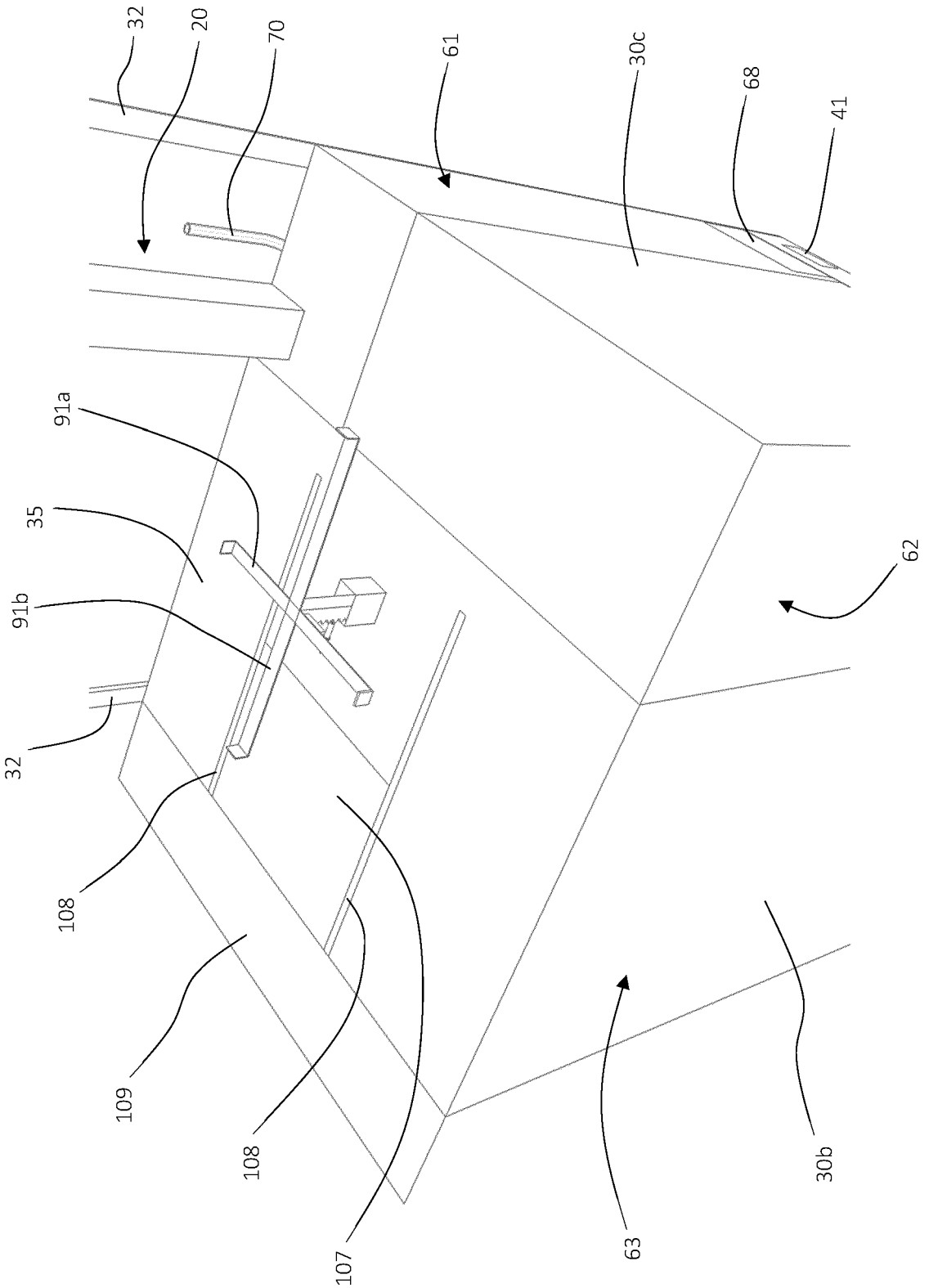

Fig. 8

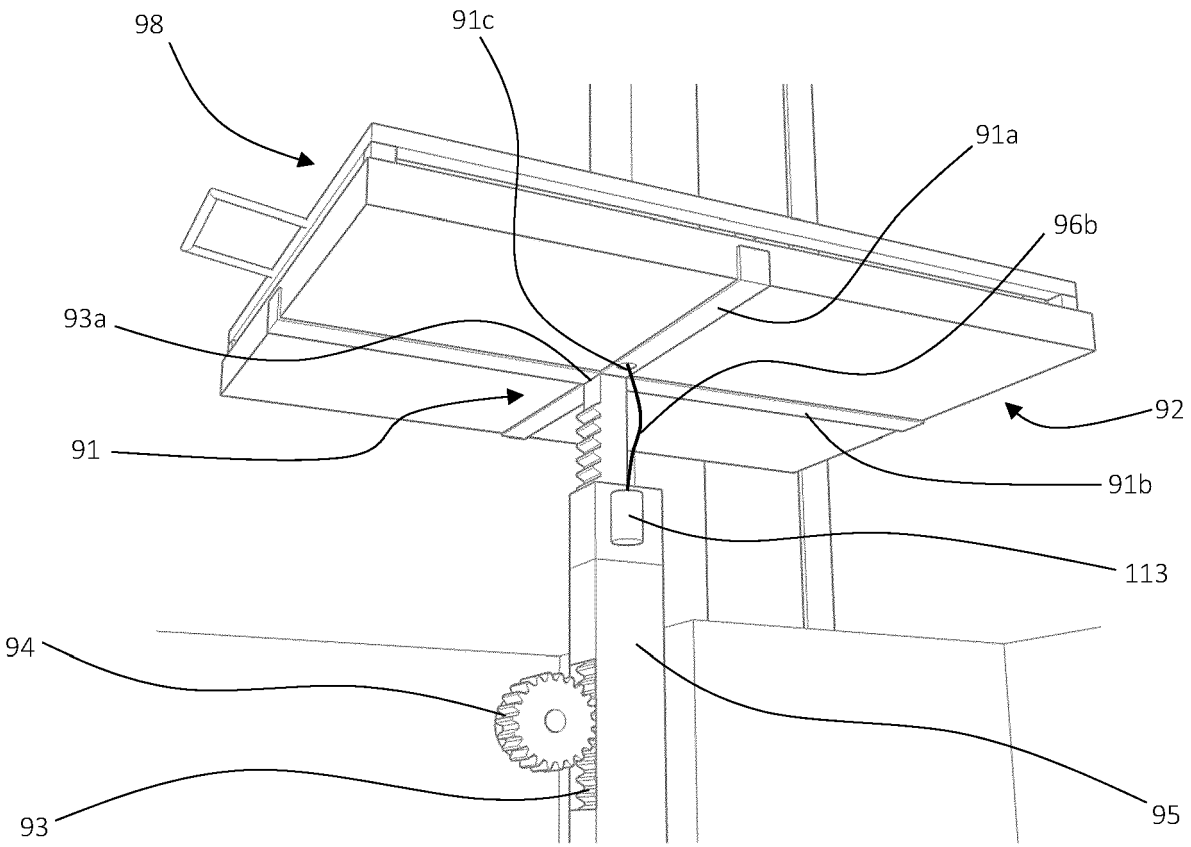

Fig. 9

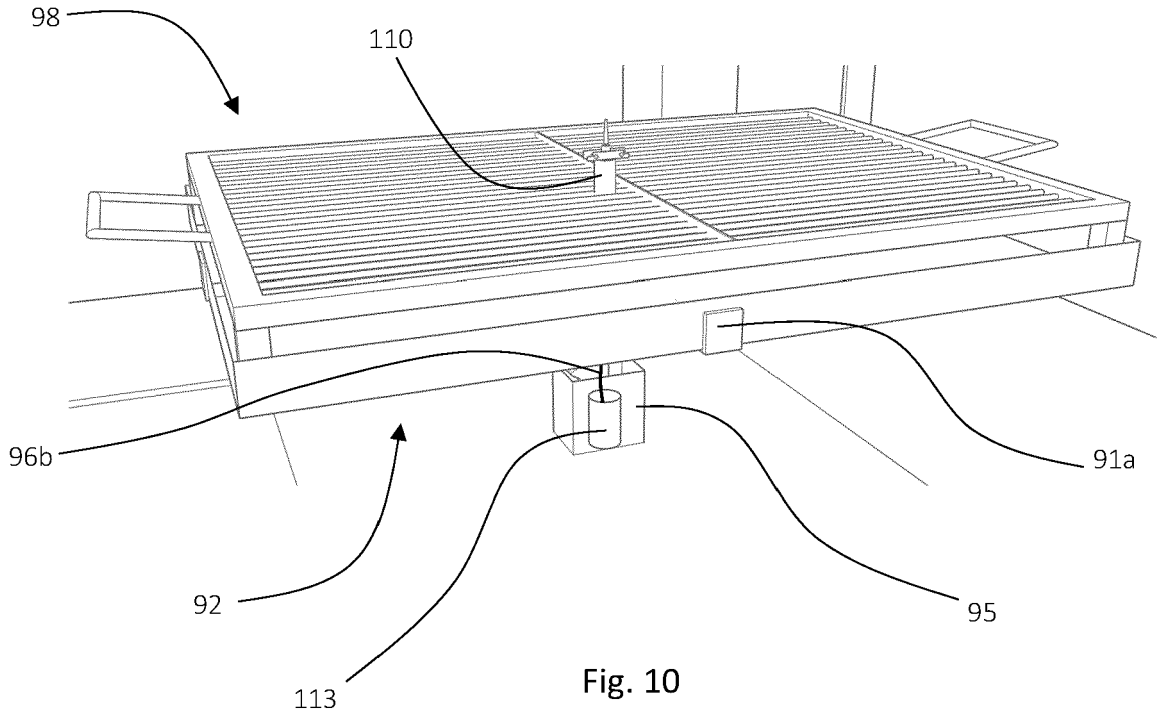

Fig. 10

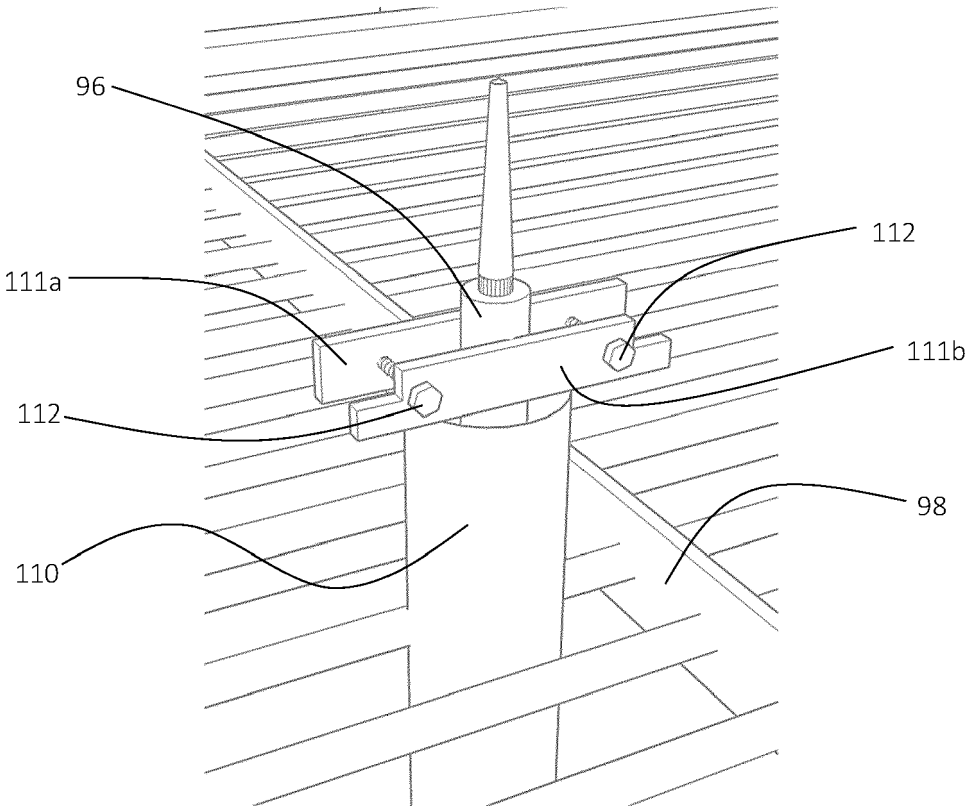

Fig. 10a

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 2169

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 658 884 A (UNICA) 17 October 1951 (1951-10-17) * page 1, lines 67-91; figures 1-3 *	1-10	INV. F24B1/188 F24B1/26
A,D	US 4 262 026 A (KORKMAZ ISHAK) 14 April 1981 (1981-04-14) * column 2, lines 44-49; figure 1 *	1-10	
A	GB 498 207 A (MERLIN GERIN) 4 January 1939 (1939-01-04) * figure 1 *	1-10	
A	US 4 986 253 A (BIENERT WALTER B [US] ET AL) 22 January 1991 (1991-01-22) * claim 1; figure 1/1 *	1-10	
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			TECHNICAL FIELDS SEARCHED (IPC) F24B A21B F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 September 2020	Adant, Vincent

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11-09-2020

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