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(54) **BAKING OVEN AND METHOD FOR OPERATING A BAKING OVEN**

(57) A baking oven comprises a muffle with muffle walls, an opening to the muffle and a door for closing it. Several heating devices are arranged in the muffle, wherein a power supply for them is provided. A baking oven control is connected to the power supply for controlling the heating device and for evaluating their functional state is provided. The baking oven has mechanical drive means, which have an electric drive or a motor and an output connection having a coupling device for a force-

transmitting mechanical or magnetic connection to a movement device in the muffle. The movement device can preferably be a cooking vessel with a flexible shaft as force-transmitting connection. The coupling device is accessible at least from the muffle or projects into the muffle. The baking oven control is connected to the mechanical drive means or to the electrical drive for controlling the same.

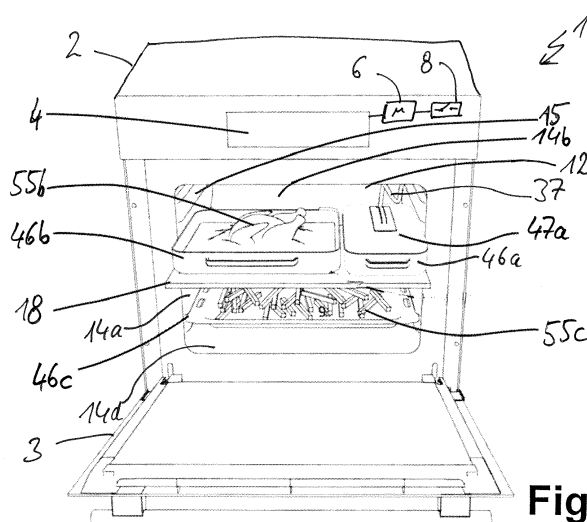


Fig.1

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Description

TECHNICAL FIELD AND PRIOR ART

[0001] The invention is directed to a baking oven with a muffle and means such as a movement device for moving food in the muffle, in or on a food carrier, such as a vessel. The invention is also directed to a method for operating such a baking oven, wherein a cooking state of the food to be cooked is derived on the basis of a force detected by sensor means or detection means during the transmission of force from the mechanical drive means to the movement device. As a result, the further cooking process is changed and adapted with regard to cooking temperature and/or cooking duration.

SUMMARY OF THE INVENTION

[0002] It is the object of the invention to provide a baking oven and a method for operating such a baking oven with a practical and technically reliable function for providing a good way to prepare food in the baking oven.

[0003] This object is solved by a baking oven with the features of claim 1 and by a method for operating such a baking oven with any of the features of claims 16 to 19. Advantageous and preferred configurations of the invention are the subject of the further claims and are explained in more detail below. Some of the features may be described only with regard to the baking oven or only with regard to one of the methods. However, independent and regardless of this, they are intended to be able to apply by themselves for the baking oven and for the method for operating a baking oven independently of one another. The wording of the claims is made to the content of the description by means of express references.

[0004] A baking oven according to the invention comprises a muffle with muffle walls, an access opening to the muffle and a closure for closing this access opening, preferably a conventional door. The baking oven also comprises at least one heating device for the muffle, in particular two or three heating devices. The heating device preferably is arranged on an inner side of the muffle or on the inside on a muffle wall, in particular on the underside of the ceiling wall of the muffle. A power supply for the heating device is provided as well as a baking oven control being connected to this power supply. This serves to control the heating device and to evaluate its functional state. The baking oven has mechanical drive means, which have an electric drive and an output connection, wherein the output connection has a coupling device for force-transmitting mechanical or magnetic connection to a movement device in the muffle. The coupling device is accessible at least from the muffle or projecting into the muffle, such that any connection to the movement device can be easily established on the one hand and disconnected on the other hand. Such a connection may include a flexible shaft or the like. The

baking oven control is also connected to the mechanical drive means or to the electrical drive for controlling the same, such that the baking oven control can be the central control for the whole baking oven. In a further embodiment, more than one output connection with a coupling device may be provided, for example two or three of them at separate locations. They may have common drive means with a common electric drive. Alternatively, each output connection with a coupling device may have its own drive means with its own common electric drive.

[0005] The invention thus allows for a baking oven to be able to move food while being prepared in the baking oven, while the oven may also be used in a state where no movement device is present in the muffle. This is a gain for additional space in the muffle. Further options become available, which will be described later on. The movement device may be a part of the baking oven according to the invention, although it may be separate from the oven.

[0006] In an embodiment of the invention, the heating device can be arranged internally on a ceiling wall of the muffle, preferably arranged at the underside of the muffle ceiling wall. This is a conventional location for the heating device to be placed. Further heating devices can be placed at the rear side of the muffle, preferably in the form as in a hot air oven.

[0007] The coupling device can preferably be arranged on a muffle side wall or on a muffle rear wall, which in both cases is a location that can be reached in easy manner for a user to activate the coupling device.

[0008] A further option is that the coupling device can be designed to operate magnetically for a power transmission, preferably as a mechanical force, for example as a rotating force. This allows for easily designing the coupling device in closed manner without any depressions or projections. Such magnetic coupling devices are well known in the art and are able to transmit sufficient force or power, respectively, for the movement device.

[0009] A preferred option for the coupling device is to be designed in form-locking manner, preferably with a projection with specific shape on a flexible shaft to the movement device and a receptor with corresponding shape on the coupling device. Such a shape may be polygonal with square or hexagonal shape. Such a form-locking manner guarantees a good force transmission.

[0010] In an embodiment of the invention, the movement device for the food can be selected from the following group: stirrer, mixing device, rotating device, comminuting device. The movement device can be chosen depending on the food to be prepared.

[0011] In a further embodiment of the invention, sensor means for detecting a magnitude of a force transmission from the mechanical drive means to the movement device are provided. They can either be provided directly on the mechanical drive means, for example as a torque sensor in the electric drive, preferably in a motor. Such a torque sensor means could be provided in any coupling.

Alternatively, they could be integrated as a strain sensor or strain gauge, respectively, but also to measure any mechanical force directly.

[0012] In an alternative embodiment of the invention, detection means for detecting or monitoring such a magnitude of the force transmission from the mechanical drive means to the movement device are realized electrically and integrated into the electric drive. They may preferably be integrated into a motor power supply for the electric drive or the motor, respectively. The detection means are in particular designed for an evaluation of a drive current and/or of a drive voltage or other electrical values in the electric drive. This also allows for a good evaluation of the force transmission.

[0013] The sensor means can generally be connected to the baking oven control to have the information of any change in the force transmission, for example to indicate any malfunction in the movement device on the one hand. On the other hand, this may serve to detect a specific state or change of this state of the food to be cooked in the baking oven, which food is moved by the movement device. The food may change its viscosity, either to a higher or to a lower viscosity, which again may be detected and used to detect the state of the food in the baking oven control.

[0014] The movement device preferably comprises a vessel or a container for food in one embodiment, such as a flat pot, a baking tray or a skillet. The movement device preferably projects into the container with a stirrer or mixer, in particular from above or from a lateral side. There may be one or several stirrers or mixers, depending on the size of the vessel or container and on the kind of food that is to be cooked therein. The movement device has a kind of gearing mechanism to translate the rotating force of the flexible drive shaft of the movement means into the movement that is needed at the vessel or container or whatever holds the food.

[0015] The vessel or container preferably comprises a lid for closing the vessel or container, wherein a stirrer, a mixer or dough hooks are arranged on an underside of this lid. They are rotatable and project into the vessel or container and into the food therein. A rotary shaft for the stirrer or the dough hooks extends through the lid and is connected to a drive shaft at an upper side of the lid or comprises a coupling for connecting to such a drive shaft. The drive shaft, preferably as a flexible drive shaft, should be part of the movement device and can be mechanically connected to the coupling device in a force-transmitting manner as described initially.

[0016] In another embodiment, the movement device may comprise a flat food carrier, in particular a baking tray or a baking oven rack. The movement device may then comprise movement means such as manipulators. They are used in order to rotate or turn food having a form of large solid pieces such as, for example, pieces of meat or pieces of vegetables. This should take place in such a way that one side of the food, which has so far faced the heating device, then faces away from the heating device

so that other sides or the opposite side will be heated directly. As an alternative, the movement means may comprise ultrasonic transmitters to move food either in the form of small and even large pieces or in liquid or pasty form. Such ultrasonic transmitters may be equipped with focussing means to direct or concentrate their ultrasonic force. This may for example serve to avoid the burning of food by the food being moved or inter-mixed.

[0017] In yet another embodiment, the movement device may comprise a basket or similar container for the preparation of French fries or the like. Such a basket preferably comprises holes, openings or meshes for the heat to easily penetrate the basket and reach the food therein. The basket may in particular be closable or closable at an upper side, respectively. This allows the whole basket to be rotated, in this way moving the food therein for better and more even heating.

[0018] In another embodiment, the movement device may comprise a flat carrier in the form of a rectangular frame or tray, with at least two or three compartments or large openings. In each of these compartments or openings a food carrier can be provided, preferably in removable manner. The compartments or openings may have a standard size for any food carriers to be interchanged easily. A force-transmitting connection to a movement device for at least one of the food carriers is provided such that the movement device for this food carrier can be operated independent of the other food carriers. Additionally, at least electric energy, water or steam can be brought via the output connection to at least one of the food carriers. In one embodiment, the flat carrier has guide means for the food carriers, for example for short bearing axles of the food carriers, such that they can be rotated in each compartment or opening.

[0019] In even another embodiment, the movement device has a roasting spit for skewering food to be cooked in the form of large pieces, such as grilled chicken or turkey. The roasting spit may preferably be rotatably mounted at both its ends in the muffle, for example from the left side to the right side or from the left muffle wall to the right muffle wall. It can thereby be connected with one end to the coupling device in a force-transmitting manner, in particular is inserted therein. In this embodiment, no drive shaft is needed, the roasting spit is directly rotated with the speed of the coupling device in which it is directly inserted. In an alternative embodiment, a roasting spit or any other movement device may be rotatably mounted at only one end in the rear muffle wall, the respective coupling device then being located at this rear muffle wall. The other end may be guided or held at a carrier frame, a tray or any other vessel placed in the muffle. This other end then shall simply be held or guided and needs not to be driven.

[0020] It is possible to arrange a sensor, in particular a temperature sensor, on the vessel or on the container for food, on the flat food carrier or on the roasting spit described before. This allows for a direct temperature

measurement of the food that is being cooked. A temperature sensor may also be intended to be introduced into a piece of meat or other food which is placed on a tray to measure the core temperature of the meat. Such a sensor may have any electrical connection to the baking oven control. This electrical connection may be connected via the coupling device of the muffle, wherein the electrical connection can have connection means at the end with which it is connected to the coupling device. This electrical connection may be made when the force-transmitting connection is established with the coupling device, for example it can be automatically electrically connected to a mating electrical connection arranged on the coupling device. The coupling device can also generally be used in independent manner from usage of the rotation function, for example for an electric function or for transporting steam or water. A rotation function may then be left unused. This serves for an easy implementation of the invention in baking oven.

[0021] It is also possible to arrange at least one temperature sensor in the muffle, which temperature sensor is connected to the baking oven control. Such a connection may be in wireless manner, wherein the temperature sensor may also be arranged on the movement device or on a vessel, food carrier or roasting spit as described before. Such a temperature sensor may be basically independent from the vessel or food carrier but can be affixed to them. By means of the wireless signal transmission to the baking oven control, it need not be arranged in a specific place.

[0022] In preferred manner, at least one pressure sensor or force sensor for detecting a pressure or a force of the food against a food carrier or the like may be provided or arranged on the food carrier. Also, such a pressure sensor may be connected in either of both ways described before to the baking oven control. The pressure or force sensor may be elastically pressed against the food or at least measure any pressure or force that the food withstands. This shall serve to detect the state of meat with regard to being well done or rather raw, which can be detected how firm or how elastic the meat is.

[0023] The movement device may comprise a generator for generating current from a movement of a drive shaft extending from the coupling device to the movement device. This serves to bring electric power into the movement device or into the vessel or food carrier. In preferred manner, an electrical functional device of the movement device, such as a lighting means or a sensor, may be connected to the generator for supply with electric power. Such a sensor may be connected in wireless manner to the baking oven control by radio transmission or the like. Another alternative may be ultrasonic transmitters mentioned above, which may and need to be provided with electrical power.

[0024] In preferred manner, the at least one heating device may be designed as a tubular heating element with a resistance heating conductor. Such heating elements are well known in baking ovens and are very

reliable. An additional heating device may be provided such as for a convection oven.

[0025] In one embodiment of the invention, the baking oven has at least two separately controllable heating devices in the muffle, wherein these heating devices are arranged electrically separate and next to each other and close together on an underside of the muffle ceiling wall. The at least two heating devices may preferably be designed as tubular heating elements mentioned before, but could also be designed as alternative heating devices, for example Halogen heating elements known in the art. The muffle is divided into zones being arranged side by side, with at least as many heating devices as zones. A vertical boundary plane can be projected between two directly adjacent zones running centrally between the vertical projection of two directly adjacent heating devices. None of the adjacent zones overlap each other or the zones are separate from but directly adjacent to each other, respectively. This allows for a separate food processing or cooking, respectively, in the muffle.

[0026] In a further embodiment, means can be provided for introducing water or steam into the muffle, wherein the baking oven comprises a steam generator for this purpose. A steam generator should be arranged outside the muffle for thus generating steam that can be directed in planned manner. Also, a pump for water can be provided. Preferably the means for introducing water or steam into the muffle extend inside the coupling device in such a way that force-transmitting devices can be coupled thereto and guide the water or steam and introduce it into a vessel or container as described above. A separate steam or water line or hose may be provided inside a flexible drive shaft mentioned above.

[0027] In the method for operating a baking oven described above according to the invention may provide to derive a state, in particular a cooking state, of the food to be cooked on the basis of a force detected by sensor means or detection means during the transmission of force from the mechanical drive means to the movement device. As a result, the further cooking process is changed or adapted, in particular adapted with regard to cooking temperature and/or cooking duration. Also, any temperature measured as described above may be used in this method.

[0028] In one embodiment of the invention, the baking oven control may control the mechanical drive means according to a predetermined cooking programme or in accordance with such a programme for moving and/or processing the food by means of the movement device. The programme may preferably also define a heating or temperature profile for the food cooking. To use such a programme, in a first step A the temperature of at least one heating device may be determined by means of the baking oven control, preferably of several heating devices or of all heating devices. This may either be done by measuring this temperature or by calculation, in particular by detecting the duration and the power of the opera-

tion of all heating devices of the baking oven, with which power the heating device is operated permanently on average. Then the temperature can roughly or rather exactly be calculated on the basis of values stored in the baking oven control, for example as a look-up table.

[0029] Next the air temperature in the muffle is measured as second step B, wherein at least one discrete temperature sensor can be used for this in the muffle. Such a temperature sensor may be arranged in addition to the heating devices in the muffle, and the temperature measured by it is additionally taken into account. In preferred manner, several discrete temperature sensors can be provided and used in the muffle, wherein in each case one temperature sensor is assigned to a zone or more than one temperature sensor but fewer temperature sensors than zones are present. Then a temperature profile in the muffle can be calculated as third step C by means of the values derived from the temperature sensors, and an assignment of such a temperature profile to the zones for their heating according to this profile can be determined therefrom. In a next step, a temperature is calculated of the food to be cooked on its outside in a zone on the basis of a radiation heat flow emanating directly from the heating device and on the basis of a convection heat flow emanating from the heating device via the air. The influence of the radiation heat flow is determined on the basis of the temperature of a heating device determined as mentioned before with the aid of stored values. The influence of the convection heat flow is determined on the basis of the air temperature measured as described before. This is preferably determined by the baking oven control.

[0030] Then as fourth step D, the power of at least one heating device is determined and, if necessary, adjusted on the basis of a comparison between the predetermined temperature and the temperature calculated in step C. This serves to bring the calculated temperature close to the predetermined temperature or to match them exactly, which can preferably be carried out separately for each zone. It may preferably be made for all the heating devices that are operated.

[0031] In a further advantageous embodiment of the invention, an automatic detection of the type of the movement device may take place by the baking oven control, preferably at the coupling device. This can be done, for example, by a specific electrical coding of the movement device. Alternatively, an electrical contact to the movement device can be present at the coupling device, whereby means for identification are contained in the movement device. This may preferably be a simple computer chip, alternatively a specific electrical component such as a specific electrical resistance or a specific capacitance with unique electrical properties that allow an identification. Their specific value is then in each case precisely associated with a property or characterization of the movement device stored in a table in the baking oven control. This means that the movement device can be automatically identified when it is plugged into or

connected to the coupling device. Furthermore, the entire container, be it a vessel or a container for food or a baking tray, can be identified accordingly. Then an automatic adjustment of the control elements of the baking oven as well as preparation settings / recipes / user interface, appearance at the baking oven control etc. can take place. For this purpose, the oven can also be connected to an external database or connect itself automatically to retrieve specific information, advantageously to a database specially designed for this purpose. Advantageously an interface to the outside such as an Internet connection can be used, advantageously by a network present in the house, in particular a Wi-Fi. The baking oven control may after identification of the movement device automatically retrieve the correct and useful information for the use of this specific movement device or vessel, container or baking tray, respectively. This allows for specific adaptation to the present device. Even devices developed after the manufacturing date of the baking oven can then be used in their full functionality.

[0032] These and further features may be gathered from the claims and also from the description and the drawings, with the individual features being capable of being implemented in each case by themselves or severally in the form of sub-combinations in an embodiment of the invention and in other fields and being capable of constituting advantageous and independently patentable versions for which protection is claimed here. The subdivision of the application into individual sections and intermediate headings does not restrict the general validity of the statements made under these.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] In the following, embodiments of the invention will be described in detail with reference to the drawings. Throughout the drawings, the same elements will be denoted by the same reference numerals.

Fig. 1 an oblique view onto a baking oven according to the invention with an open door displaying the inside of the muffle,

Fig. 2 a view onto a vessel with a movement device on a lid of the vessel,

Fig. 3 a view onto the underside of the lid showing stirrers of the movement device,

Fig. 4 another embodiment of a vessel with a lid and a connection to mechanical drive means of the oven,

Fig. 5 a view onto the vessel of Fig. 4 from the front side with a lid removed displaying a grate inside the vessel that can be moved,

Fig. 6 a view into a baking oven of Fig. 1 showing a

grill spit connected to a coupling device of the mechanical drive means,

- Fig. 7 a first embodiment of a coupling device and a drive connector for it,
- Fig. 8 a second embodiment of a coupling device and a drive connector for it with an electrical connection and a steam line,
- Fig. 9 a third embodiment of a tray with three options for holding food to be cooked in a baking oven.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0034] Fig. 1 shows a baking oven 1 according to the invention having a housing 2 and a door 3 at its front side. Above the door 3, a user interface 4 is provided as a UI, this user interface having a display and control elements as is conventional. They need not be described in detail here. The user interface 4 is connected to a controller 6 having the function of a baking oven control as mentioned in the beginning. The controller 6 controls all the functions of the baking oven 1 centrally, which is any heating function on the one hand and any mechanical function according to the invention of the mechanical drive means on the other hand. The controller 6 is connected to a power supply 8 for heating devices 16 in a muffle 12. They will be described in connection with Fig. 6. Furthermore, the controller 6 is connected to a motor power supply, which is described in connection with Fig. 7.

[0035] The muffle 12 of the baking oven 1 is as is known in the art and has a left muffle wall 14a, a rear muffle wall 14b, a right muffle wall 14c, a muffle ground wall 14d and a muffle ceiling 14e. Holding rails 15 are provided at the left muffle wall 14a and the right muffle wall 14c. They serve to hold a baking tray 18 as shown in Fig. 1 or similar parts.

[0036] At the right muffle wall 14c a coupling device 20 is provided, which is for the mechanical drive means of the invention. This coupling device 20 can be taken from Figs. 6 to 8 in detail. In Fig. 1, a drive sheath 37 is connected to the coupling device 20, which is not visible here. The drive sheath 37 is flexible and is connected to a vessel 46a or its lid 47a, respectively. This will be explained in detail hereinafter with regard to Figs. 2 and 3.

[0037] The vessel 46a is placed on the baking tray 18. On its left side, another vessel 46b with food 54b in the form of a chicken is placed. Inside the vessel 46a any food to be cooked in a baking oven 11 can be provided, for example vegetables, alternatively a sauce.

[0038] Beneath the baking tray 18, another vessel 46c is provided, which is similar to a baking tray but with larger height. French fries 55c as food are provided on this relatively flat vessel 46c.

[0039] Fig. 2 shows the vessel 46a in more detail, having the lid 47a. On the lid 47a, a movement device

49a is provided, having a connection 50a, to which connection 50a the flexible drive sheath 37 is connected. Such a connection may be fixed, such that it cannot be disconnected. Alternatively, and preferably, it can be designed in a form similar to the coupling device 20 at the right muffle wall 14c, which will be explained later.

[0040] Fig. 3 shows the underside of the lid 47a with the movement device 49a. From this movement device 49a, two stirrer shafts 52a are protruding, which in use protrude roughly vertically downwards when in use. Close to the end of the stirrer shafts 52a, stirrers 53a are provided. In the situation of Fig. 2, the stirrer shafts 52a and, in particular, the stirrers 53a reach way into the vessel 46a and can serve for example to stir any food cooked therein such as liquids, for example sauces or the like, or vegetables such as potatoes or the like. Inside the movement device 49, a gear device is provided which is not shown, but which transforms any rotating movement of a flexible drive shaft inside the drive sheath 37 to affect a rotation of the stirrers 53a. They can rotate in the same direction or in opposite directions. There could also be more stirrers or only one single stirrer. In another alternative, the stirrers are not designed for a rotating movement, but for a translating movement such as pushing or shoving any food first to one side of the vessel 46a, and then to the other side. The movement device 49 will then transform a rotating movement or force, respectively, into a translation force.

[0041] As will be explained later, the flexible drive sheath 37 does not move in itself, and so, although it is flexible, no moving parts are visible in the muffle 12. This also means that no movable parts are exposed to grease or any other side effects in a baking oven muffle 12.

[0042] Fig. 4 shows another embodiment of a vessel 46d, which basically is similar to the one of Figs. 2 and 3. The vessel 46d has a connection 50d at one end face such that it is directly provided in the vessel 46d and not in its lid 47d. Fig. 5 shows the vessel 46d of Fig. 4 in a view onto the front side with the lid 47d being partly removed. Inside the vessel 46d, a grate 44 is provided. This grate 44 can be movable, for which purpose a flexible drive sheath 37 is connected to the connection 50d at the backside. The movement device 49d in this case effects the grate 54d to move sideways in a movement resembling an oscillation, such that any food placed on it such as small potatoes or the like will be stirred, similar as to Fig. 3. This embodiment shows that the movement device 49d need not absolutely be provided only at a lid 47d but can also be provided in the vessel 46d itself. Other options for the vessel 46d will be explained in detail with connection to Fig. 8, where steam can be conducted through the drive sheath 47, such that vegetables in the vessel 46d cannot only be moved or stirred, respectively, but they can also be cooked similar as with a steamer.

[0043] Fig. 6 shows the baking oven 1 of Fig. 1 in a front view. It can easily be seen that the muffle 12 has a rear wall 14b and a muffle ceiling 14e. Beneath this muffle

ceiling 14e, three heating devices 16a, 16b and 16c are provided. They are powered by the power supply 8 being controlled by the controller 6, such that any combination of the heating devices 16a to 16c can be operated, preferably also with individual and/or different average powers.

[0044] In the right muffle wall 14c, a coupling device 20 is provided in which in this case a grill spit 48 is inserted. The left end of the grill spit 48 is inserted in a rotating bearing in the left muffle wall 14a, where no drive or the like is provided. The coupling device 20 with the mechanical drive means connected to it is also controlled by the controller 6 to rotate the grill spit 48 in defined manner, for example slowly and continuously. In this case, as such a rotatable grill spit is known in the art, temperature sensor means are provided on the grill spit 48 which are in an area inside of the chickens 55 to be grilled. These temperature sensors are electrically connected to the controller 6 via an internal electrical connection inside the grill spit 48, which is not shown here, but explained later on in detail with regard to Fig. 8. Other than the embodiment of Figs. 1 to 5, the grill spit 48 is not flexible, but rigid, such as is conventional and even necessary for a grill spit to carry the weight of the chickens 55. The temperature sensors at the grill spit 48 inside the chickens 55 serve to be able to prepare them with a correct or pre-defined core temperature. If such a temperature sensor is provided on the grill spit 48, no other temperature sensor needs to be installed in the baking oven 1 and inserted inside the chickens 55. This could also pose a problem in that the chickens 55 should continuously be rotated, which poses significant problems with a conventional connecting cable or the like of a conventional temperature sensor.

[0045] As an alternative or in addition to the stirrers 53 on the stirrer shaft 52 in Fig. 3, the movement device 59a could be provided with a kind of generator inside it. This generator would also be turned in the same manner, but faster than the stirrer shaft 52a. It can generate electricity in the vessel 46a or its lid 47a, respectively. This electricity could be used to operate and evaluate temperature sensors on the lid 47a reaching down into any food in the vessel 46a. The temperature information could be transmitted in wireless manner to a receiver on the controller 6. This serves to have an easy way to retrieve temperature information about the food inside the vessel 46a without the need to have long wires that need to be temperature-resistant or the like. This could be useful in a case where no electrical connection or jack is provided at the coupling device.

[0046] In Fig. 7, on the left side a simple version of a coupling device 20 is shown. The coupling device 20 is driven by a drive motor 21, which is shown very schematically. The drive motor 21 is powered by a motor power supply 22, which is connected to the controller 6 in a manner similar as the power supply 8.

[0047] A force sensor 24 is provided on a drive shaft from the drive motor 21 to the coupling device 20. This force sensor can externally sense any force or torque,

respectively, exerted from the drive motor 21 onto the coupling device 20 and thus sensing any force or torque needed at the movement device 49 and any stirrers 53 or the like. The force sensor 24 is also connected to the controller 6 for its evaluation. As an alternative to such an external force sensor 24, the controller 6 can monitor and analyze the current that the motor power supply 22 provides to the drive motor 21. This may also serve to evaluate whether any problems are present in the movement device 49.

[0048] In the rotating coupling device 20, a coupling receptor 27 is provided, for example with a hexagonal shape. This could also be in square or triangle form for a good transfer of mechanical torque.

[0049] On the upper left of the coupling device 20, a relatively small centering hole 29a is provided. A larger centering hole 29b is provided on the opposite side to the lower right side of the coupling device 20.

[0050] On the right side of Fig. 7, a drive connector 32 is provided having a protruding profile part 33 with an outer shape in hexagonal manner corresponding to the coupling receptor 27. A ratchet mechanism can be provided to hold the profile part 33 inside the coupling receptor 27 against inadvertent removal. Furthermore, an upper relatively small centering protrusion 36a is provided to fit into the centering hole 29a. A larger centering protrusion 36b is provided in the lower region to fit into the lower centering hole 29b. This serves to hold the drive connector 32 in position and against any rotation, while the profile part 33 is rotating together with the coupling receptor 27.

[0051] The profile part 33 is provided in a connector housing 35a but can rotate inside it. The connector housing 35 continues into a drive sheath 37 having a specific length. The drive sheath 37 is in this case flexible, as has been described before with regard to Figs. 1 to 3. It has an inner channel 38, in which a flexible drive shaft 34 connected to the profile part 32 can rotate. Such a construction of a flexible drive shaft 34 being rotatable in a drive sheath 37 being also flexible is known in the art, for which reason it is not explained in lengthy detail here. Both can be made from metal, preferably in a spiral form. The provision of the connector housing 35a serves to better handle a connection, in particular if additional functionalities such as an electrical connection are provided.

[0052] In the case of the grill spit 48 of Fig. 6, the flexible drive sheath 37 will be replaced by a metal pipe being rather rigid. It can be connected in one piece to a profile part corresponding to the profile part 33 such that the grill spit 48 can be in one single part that rotates as one part. The centering holes 29a and 29b are not needed.

[0053] In Fig. 8, another example of a coupling device 120 with a drive connector 132 is shown. The coupling device 120 again has two centering holes 129a and 129b being juxtaposed of a central coupling receptor 127. Above the coupling receptor 127, four power jacks 130 are provided. They can be connected inside or behind the

right muffle wall 14c, either for signal transmission or for the transmission of electrical power. Further jacks as electrical contacts may be provided at the coupling device 120 for its identification at the coupling receptor 127 and a controller 6 of the baking oven. This may serve for the controller 6 to adapt any automated programs or parameters of the operation of the movement device of the coupling device 120, on the one hand, or of the heating operation of the baking oven on the other hand. The baking oven of Fig. 1 or its controller 6 may be provided with an outside data connection, preferably via Wi-Fi, to an external database, preferably via the internet.

[0054] As a general alternative embodiment, the complete connection could be arranged in fully concentric manner, such that for example the mechanical connection can have a hexagonal shape protruding into the cavity or into the muffle wall. In case a mechanical connection is needed a hexagonal spit can be connected as shown in Figs. 7 and 8. In case an additional steam connection is needed, the mechanical connection has to be hollow so that steam can flow concentrically through the mechanical connection into the respective vessel, preferably through a pipe or the like.

[0055] In case an additional electrical connection is needed, the inner wall of the mechanical connection with the hexagonal shape can have electrical contacts e. g. in circumferential direction (like a TRS connector) for the electrical connection. This is an alternative to the embodiment of Figs. 7 and 8 being not concentric.

[0056] On the lower left side of the coupling receptor 127, a steam jack 131 is provided. Steam generated in the baking oven 1 or in a respective steam generator can be let out of the steam jack 131.

[0057] A corresponding drive connector 132 basically is as the one of Fig. 7 with a protruding profile part 33 corresponding to the coupling receptor 127. Two centering protrusions 136a and 136b are provided with the same function as described before. The profile part 133 is connected to a flexible drive shaft 134 inside a flexible drive sheath 137, which again is connected to the connector housing 135 as in Fig. 7.

[0058] While the flexible drive shaft 134 is provided concentrically inside the flexible drive sheath 137, cables or wires 141 are integrated in the flexible drive sheath 137 being connected to power plugs 140. They serve to be plugged into the power jacks 130. They can transmit electrical signals, for example from a temperature sensor in a vessel according to Figs. 2 to 5, alternatively in an embodiment of a grill spit from an integrated temperature sensor. The cables 141 could also transmit power to any electrical device at a cooking vessel or a baking tray, which should be a temperature-resistant device.

[0059] A steam coupling 142 is also shown protruding in a similar manner as the power plugs 140. This steam coupling 142 connects into the steam jack 131. It is connected to a steam hose 133 being integrated into the flexible drive sheath 137. The steam hose 143 can

lead to any steam outlet at some place of the flexible drive sheath 137, preferably in the vessel 46d according to Fig. 5.

[0060] In Fig. 9 another embodiment of the invention is shown as a tray 218 with three rectangular openings of the same size for holding various containers for food to be cooked in a baking oven. The tray 218 can have the outer shape and size of a regular baking tray similar to the baking tray 18 in Fig. 1 for being held in the holding rails 15. Along the front side, three guide parts 219a, 219b and 219c are provided having U-shape. They can simply be welded to the upper side of the tray 218 along its front edge. Corresponding guide parts 219'a, 219'b and 219'c are provided along its rear edge. They serve to hold and guide short axle pieces such as of a grill cage 257 being placed in the leftmost rectangular opening. The profile part 233a of the rear short axle piece of the grill cage 257 is held in the guide parts 219'a and protrudes over the rear edge to be inserted into a coupling receptor such as shown in Figs. 7 and 8.

[0061] In the central rectangular opening, a vessel 246b being closed with a lid 247b is held, preferably by being supported on the rim of the central rectangular opening. At a rear side of the lid 247b a steam coupling 242b is provided, in this case running through the guide part 219'b. So, it may fit into a corresponding coupling receptor with a steam jack in the rear muffle wall such as in Fig. 8. This serves to introduce steam into the vessel 246b according to a given program, for example to prepare fish or vegetables as in a steam cooker.

[0062] In the right rectangular opening, an open vessel 246c is placed, also being supported on the rim of the rectangular opening. For this vessel 246c only a temperature sensor 258 is provided, which could be introduced into any food being cooked in this open vessel 246c, for example a casserole, into which the temperature sensor 258 is immersed. It serves to measure and potentially control the temperature in the casserole by regulating the heat in the baking oven correspondingly. The temperature sensor 258 has a cable 241 leading to an electrical plug 240c that can be plugged into a power jack in the rear muffle wall such as in Fig. 8. This serves to connect the temperature sensor 258 to a controller of the baking oven as described before.

[0063] In the rear muffle wall, at each location of the rear guide parts 219'a, 219'b and 219'c corresponding coupling devices are preferably provided. More preferably, they are all identical with options for mechanical force transmission as well as steam coupling and electric connection. In this manner, in each of the openings of the tray 218 the vessels may be interchanged such that each vessel may be used anywhere in the manner as described before.

Claims

1. A baking oven comprising:

- a muffle with muffle walls, an access opening to the muffle and a closure for closing the access opening,
- at least one heating device for the muffle, preferably the heating device being arranged on an inner side of the muffle or on the inside on a muffle wall
- a power supply for the heating device,
- a baking oven control which is connected to the power supply for controlling the heating device and for evaluating the functional state thereof,

characterised in that

- the baking oven has mechanical drive means which have an electric drive and an output connection,
 - the output connection has a coupling device for force-transmitting mechanical or magnetic connection to a movement device in the muffle, the coupling device being accessible at least from the muffle or projecting into the muffle,
 - the baking oven control is connected to the mechanical drive means or to the electrical drive for controlling the same.
2. Baking oven according to claim 1, **characterised in that** the coupling device is arranged on a muffle side wall or on a muffle rear wall and/or the coupling device is designed to operate magnetically for power transmission.
 3. Baking oven according to claim 1 or 2, **characterised in that** the movement device is selected from the following group: stirrer, mixing device, turning device, comminuting device.
 4. Baking oven according to one of the preceding claims, **characterised in that** sensor means for detecting a magnitude of a force transmission from the mechanical drive means to the movement device are provided, preferably directly on the mechanical drive means, wherein in particular the sensor means are connected to the baking oven control.
 5. Baking oven according to one of the claims 1 to 3, **characterised in that** detection means for detecting a magnitude of a force transmission from the mechanical drive means to the movement device are integrated into the electric drive, preferably integrated into a motor power supply for the electric drive, wherein in particular the detection means are designed for an evaluation of a drive current of the electric drive and are connected to the baking oven control.
 6. Baking oven according to one of the preceding claims, **characterised in that** the movement device

comprises a vessel or container for food, wherein the movement device with a stirrer or mixer projects into the container, preferably from above.

7. Baking oven according to claim 6, **characterised in that** the vessel or container comprises a lid for closing the vessel or container, wherein a stirrer or dough hooks are arranged on an underside of the lid, which are rotatable and which project into the vessel or container, and wherein preferably a rotary shaft for the stirrer or the dough hooks extends through the lid and is connected to a drive shaft at an upper side of the lid or comprises a coupling for connecting a drive shaft, wherein the drive shaft is part of the movement device and is mechanically connectable to the coupling device in a force-transmitting manner.
8. Baking oven according to one of the claims 1 to 5, **characterised in that** the movement device comprises a flat food carrier, in particular a baking tray or a baking oven rack, wherein the movement device comprises movement means, in particular manipulators, preferably in order to rotate food in the form of large solid pieces such as, for example, pieces of meat or pieces of vegetables, in particular in such a way that a side of the food, which has so far faced the heating device, then faces away from the heating device.
9. Baking oven according to one of the claims 1 to 5, **characterised in that** the movement device comprises a flat carrier in the form of a rectangular frame, with at least two compartments, wherein in each compartment a food carrier is provided and wherein a force-transmitting mechanical or magnetic connection to a movement device for at least one food carrier is provided such that the movement device for this food carrier can be operated independent of another, wherein preferably at least electric energy or water or steam can be brought via the output connection to at least one food carrier.
10. Baking oven according to one of the claims 1 to 5, **characterised in that** the movement device has a roasting spit for skewering food to be cooked in the form of large pieces, wherein the roasting spit is preferably rotatably mounted at both its ends in the muffle and is thereby connected with one end to the coupling device in a force-transmitting manner, in particular is inserted therein.
11. Baking oven according to one of the preceding claims, **characterised in that** a sensor, in particular a temperature sensor, is arranged on the vessel or on the container for food according to claim 7, on the flat food carrier according to claim 8 or on the roasting spit according to claim 10, which sensor has an electrical connection, which can be connected to

the coupling device of the muffle, the electrical connection preferably having connection means at this end which, when the force-transmitting connection is established with the coupling device, can be automatically electrically connected to a mating electrical connection arranged on the coupling device.

12. Baking oven according to one of the claims 1 to 10, **characterised in that** at least one temperature sensor is arranged in the muffle, which is connected to the baking oven control, in particular is connected in wireless manner, wherein preferably the temperature sensor is arranged on the movement device or on a vessel, food carrier or roasting spit according to one of the claims 6 to 10.
13. Baking oven according to one of the preceding claims, **characterised in that** the movement device comprises a generator for generating electric current from a movement of a drive shaft extending from the coupling device to the movement device, preferably an electrical functional device of the movement device, such as a lighting means or a sensor, being connected to the generator for electric current supply, preferably a sensor being connected wirelessly to the baking oven control.
14. Baking oven according to one of the preceding claims, **characterised in that** the baking oven has at least two separately controllable heating devices in the muffle, wherein:
 - the heating devices are arranged electrically separately next to each other and close together on a muffle ceiling wall of the muffle,
 - the muffle is divided into zones arranged side by side, with at least as many heating devices as zones and a vertical boundary plane between two directly adjacent zones running centrally between the vertical projection of two directly adjacent heating devices,
 - none of the adjacent zones overlap each other or the zones are separate from but directly adjacent to each other,wherein preferably the at least two heating devices are designed as tubular heating elements with a resistance heating conductor.
15. Baking oven according to one of the preceding claims, **characterized in that** means are provided for introducing water or steam into the muffle, the baking oven comprising a steam generator arranged outside the muffle for generating steam, preferably the means for introducing water or steam into the muffle extending inside the coupling device in such a way that power-transmitting devices coupled thereto guide the water or steam and introduce it into a

vessel according to claim 6 or 7 or 10.

16. Method for operating a baking oven according to one of the preceding claims, **characterised in that** a state, in particular a cooking state, of the food to be cooked is derived on the basis of a force detected by sensor means or detection means during the transmission of force from the mechanical drive means to the movement device, and as a result the further cooking process is changed, in particular adapted with regard to cooking temperature and/or cooking duration.
17. Method according to claim 16, **characterised in that** the baking oven control controls the mechanical drive means according to a predetermined cooking programme for moving and/or processing the food by means of the movement device.
18. Method according to claim 16 or 17 for operating a baking oven according to claim 14, **characterized by the steps:**

A determining the temperature of at least one heating device by means of the baking oven control, preferably several heating devices or all heating devices, in particular by detecting the duration and the power of the operation of all heating devices of the baking oven, with which the heating device is operated permanently on average, the temperature being calculated on the basis of stored values,

B measuring an air temperature in the muffle, at least one discrete temperature sensor being used for this in the muffle, which is arranged in addition to the heating devices in the muffle and the measured temperature of which is additionally taken into account, preferably several discrete temperature sensors being used in the muffle, wherein in each case one temperature sensor is assigned to a zone or more than one temperature sensor but fewer temperature sensors than zones are present, wherein a temperature profile in the muffle is calculated by means of the temperature sensors and an assignment of the temperature profile to the zones is determined therefrom,

C calculating a temperature of the food to be cooked on its outside in a zone on the basis of a radiation heat flow emanating directly from the heating device and on the basis of a convection heat flow emanating from the heating device via the air, the influence of the radiation heat flow being determined on the basis of the temperature of a heating device determined in step A with the aid of stored values, the influence of the convection heat flow being determined on the basis of the air temperature measured in step B,

preferably being determined by the baking oven control,

D determining and, if necessary, adjusting the power of at least one heating device, preferably all the heating devices being operated, on the basis of a comparison between the predetermined temperature and the temperature calculated in step C, in order to bring the calculated temperature close to the predetermined temperature, this preferably being carried out separately for each zone.

19. Method for operating a baking oven according to one of the claims 1 to 15, **characterized by** an automatic detection of the type of the movement device by the baking oven control, preferably at the coupling device by a specific electrical coding of the movement device and an electrical contact to the movement device, wherein means for identification of the movement device or the entire container are contained in the movement device, wherein the movement device is automatically identified when it is plugged into or connected to the coupling device to adapt preparation settings / recipes / a user interface of the baking oven, appearance at the baking oven control, wherein preferably the baking oven connects to an external database to retrieve specific information for the use of this specific movement device or container.

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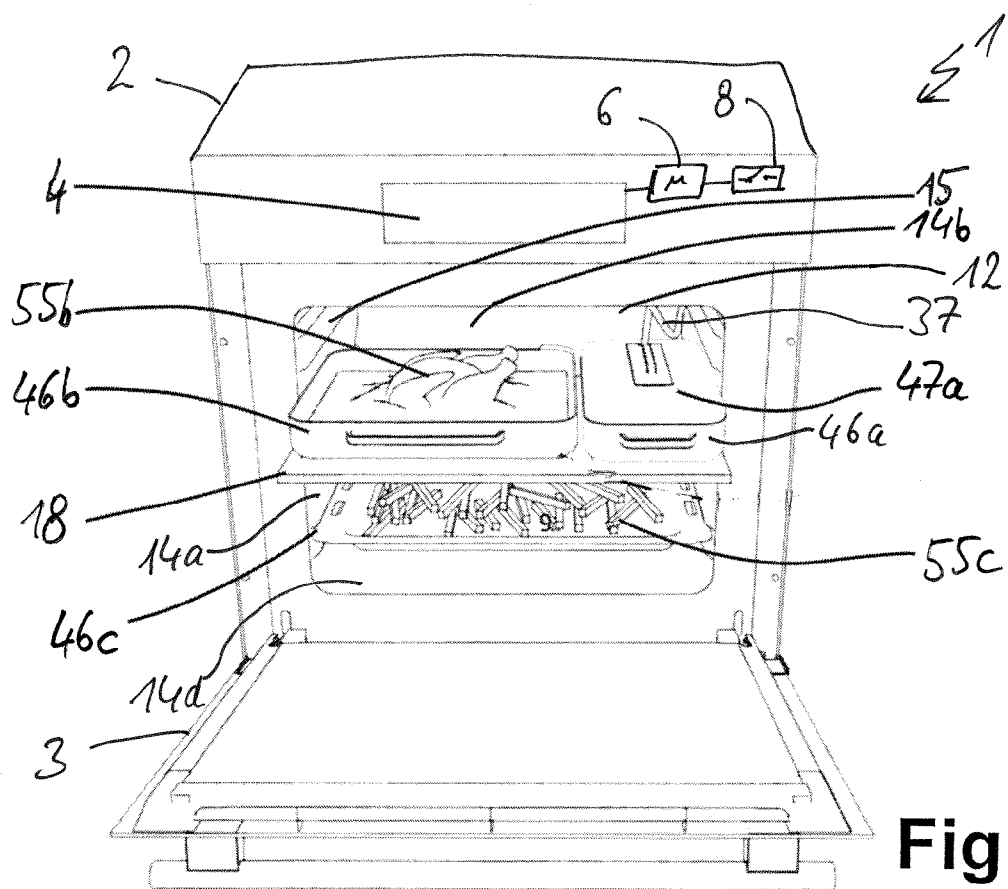


Fig.1

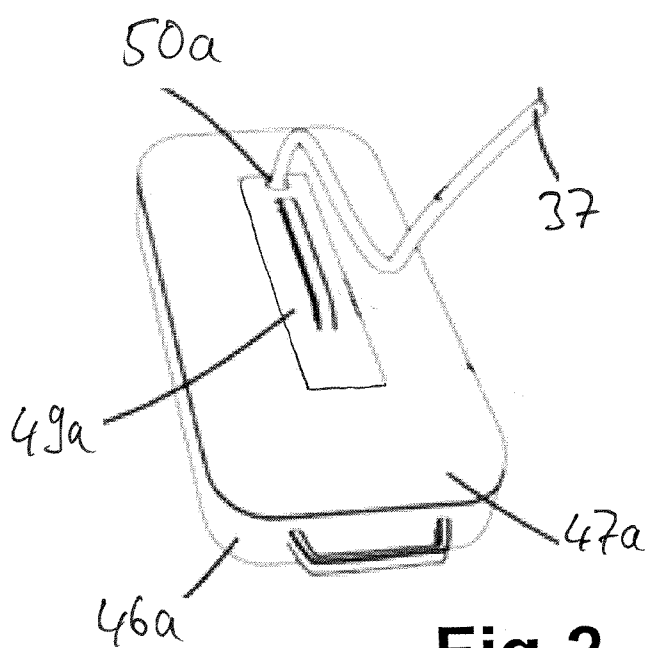


Fig.2

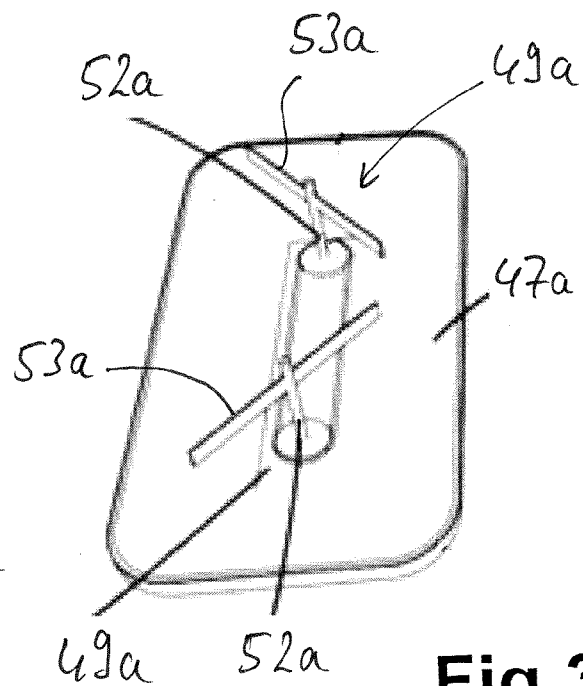
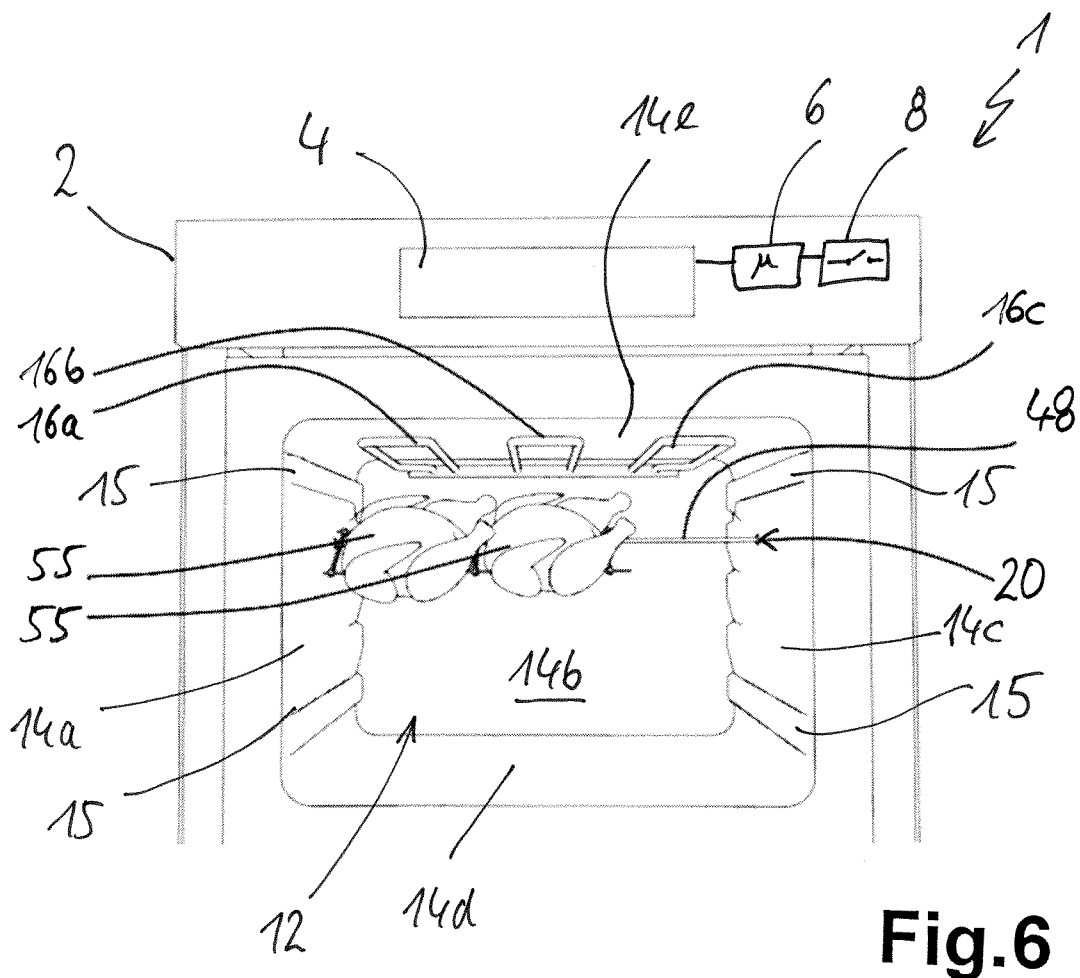
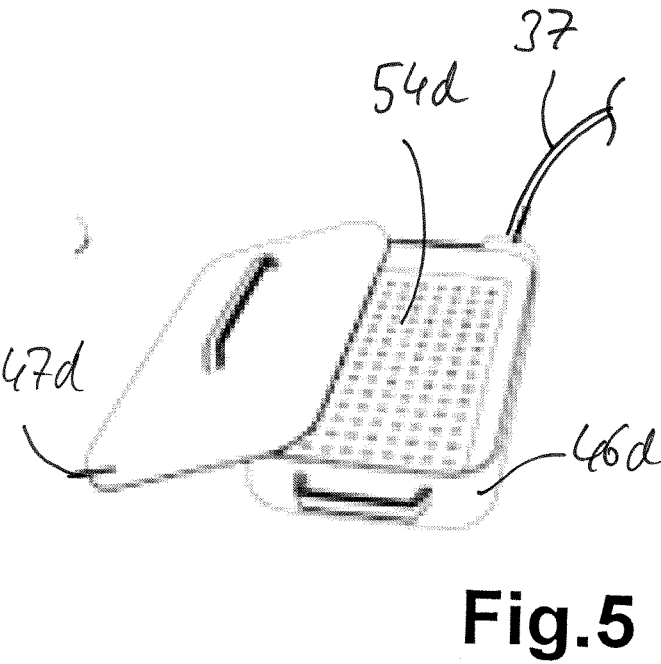
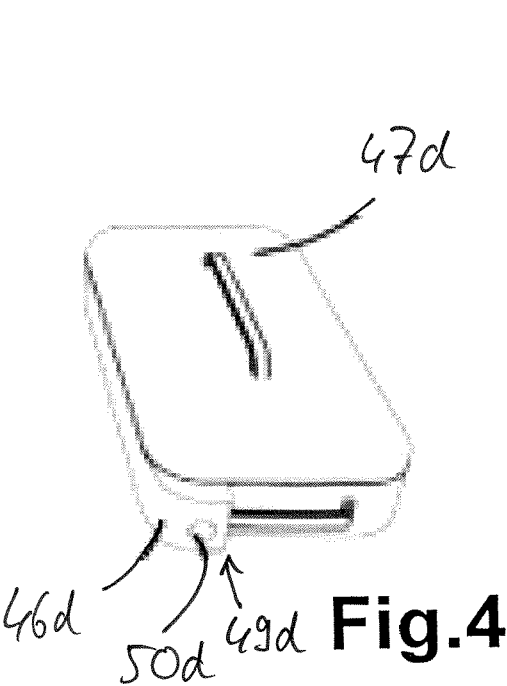
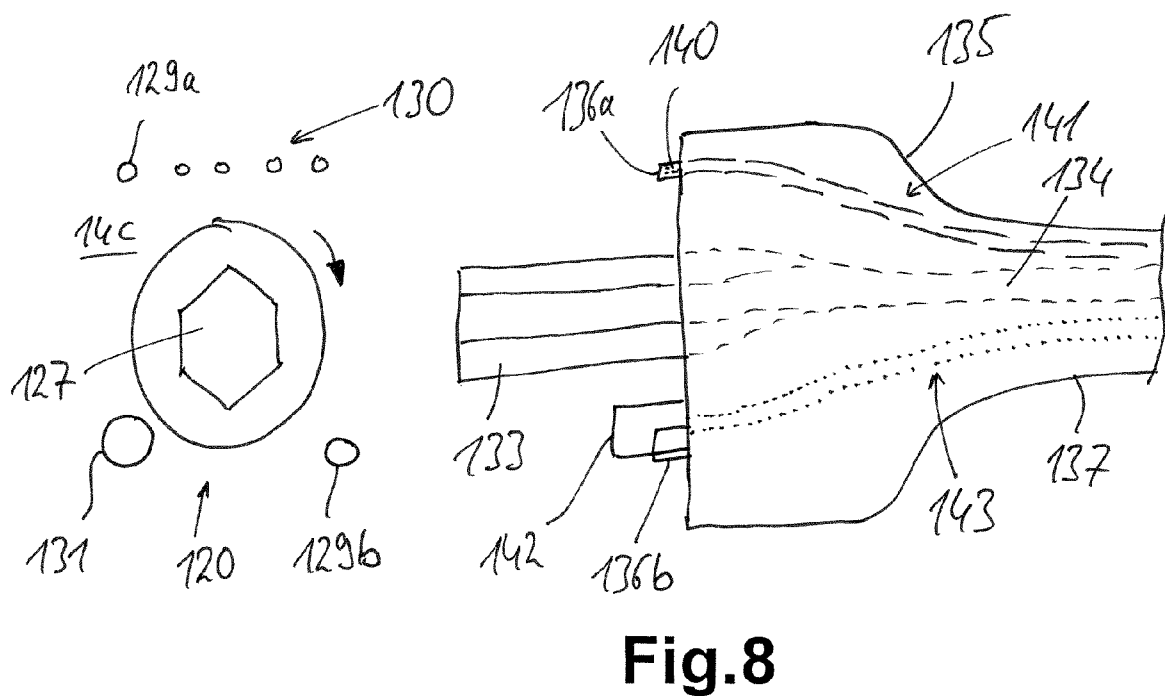
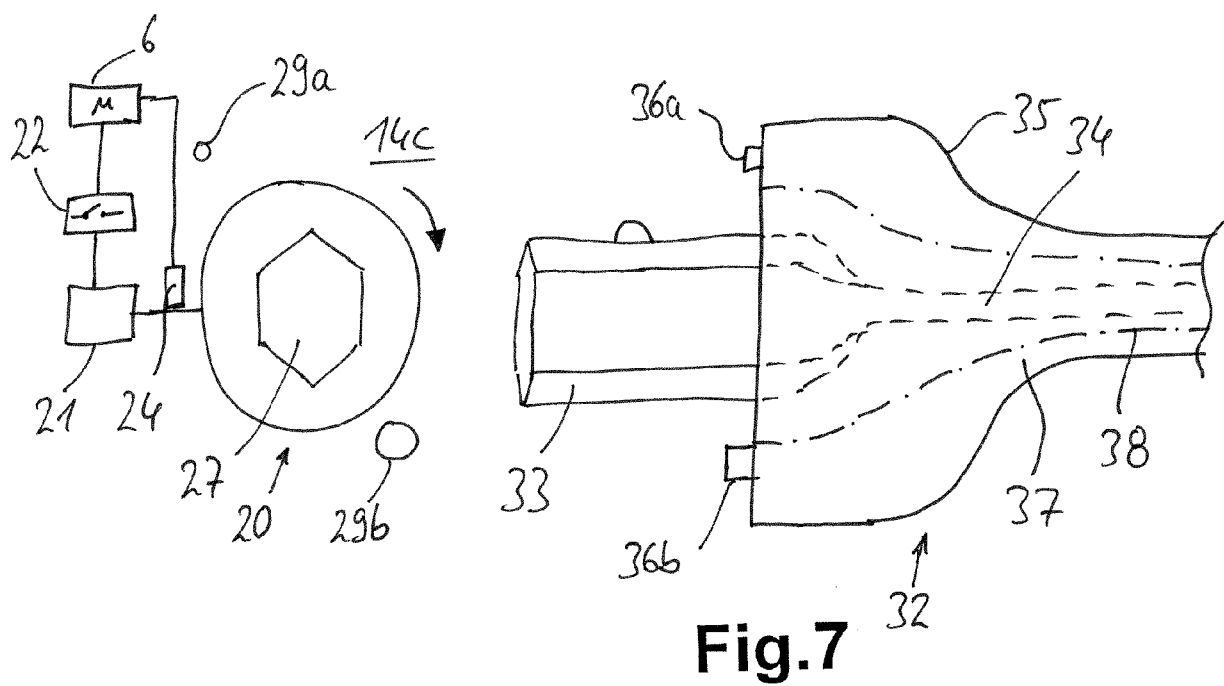


Fig.3





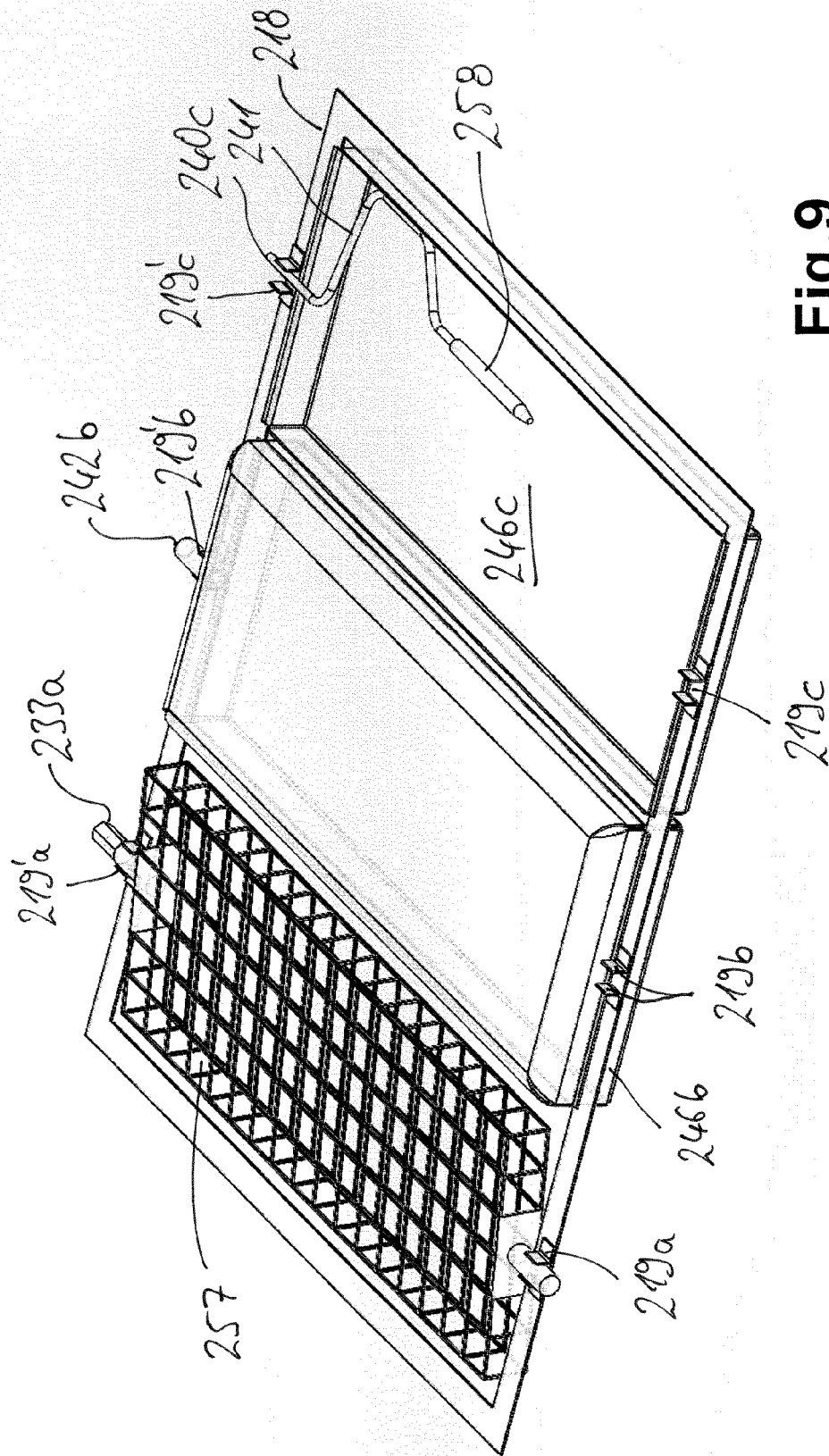


Fig. 9



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Place of search

The Hague

Date of completion of the search

4 March 2024

Examiner

Fest, Gilles

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