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GB 1493487 A JP 550146336 A

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(54) Abstract Title: **Detachable contactless operating means rotatable about an axis parallel to a front face of a domestic appliance**

(57) A domestic appliance (10, fig 1) eg. for cooking, has an operating means 13 rotatable about an axis 11 substantially parallel to a front face 12 of the appliance on which it is mounted. The means 13 may be ellipsoidal, and be carried on a shaft 20 in a removable mounting 19 which is detachable from a recess (28, fig 5) in the front face for cleaning. The mounting 19 is retained by detents engaging leaf springs 27, 27' and magnets (14, fig 3). Magnet tracks 22,23 and magnetic sensors (30,31, fig 5) produce a signal for incrementing or decrementing values in a computer (29, fig 2). The means 13 and push buttons (16,16', fig 5) are used to navigate menus on a display (17, fig 1) and to set values. Other embodiments of the contactless sensing have angularly and axially offset magnets (fig 7) or a spiral arrangement of iron cores 33 which vary inductance of a coil (34, fig 8). The means 13 may be a track ball or roller.

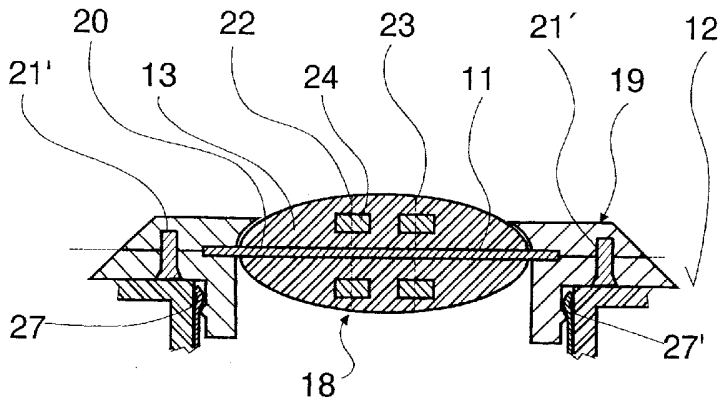

Fig. 4

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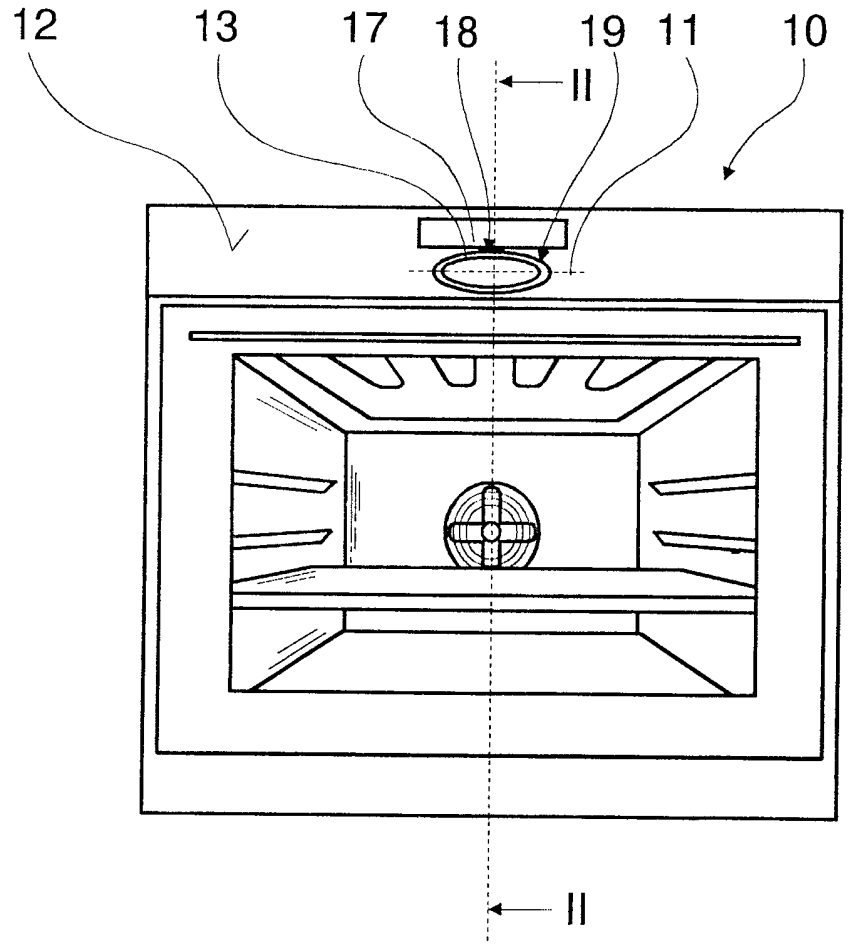

Fig. 1

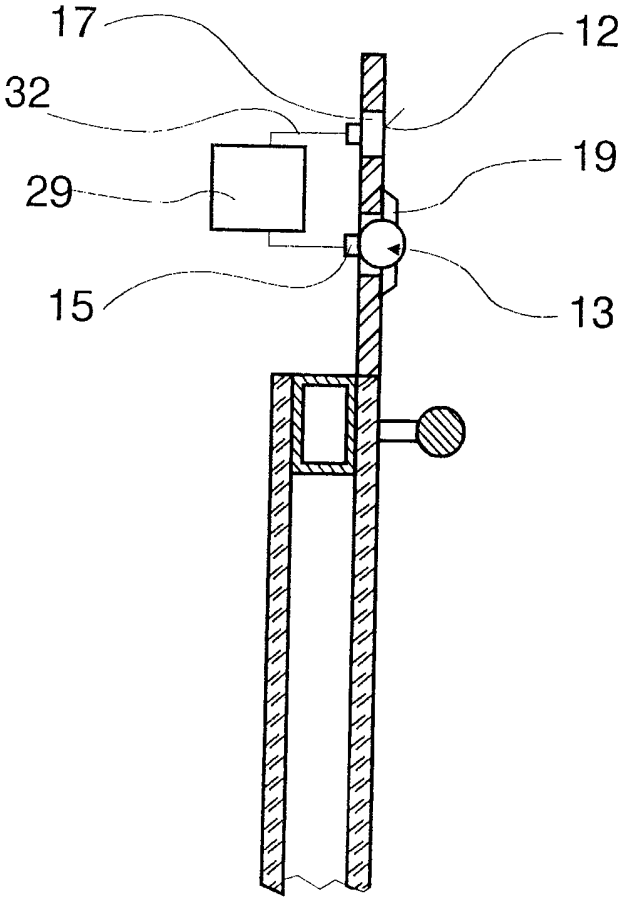

Fig. 2

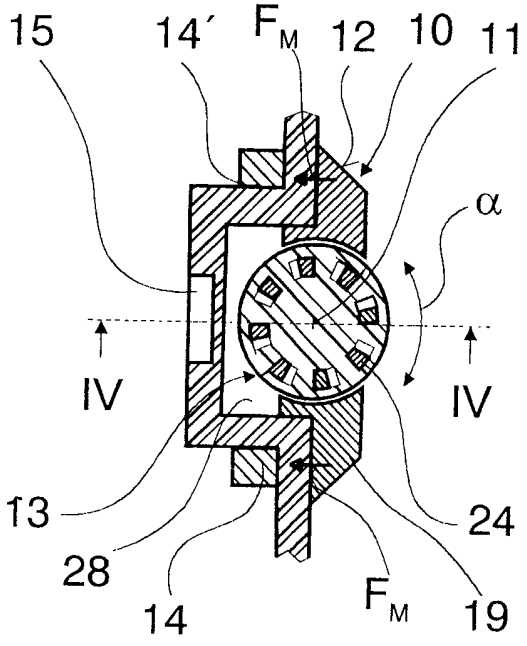

Fig. 3

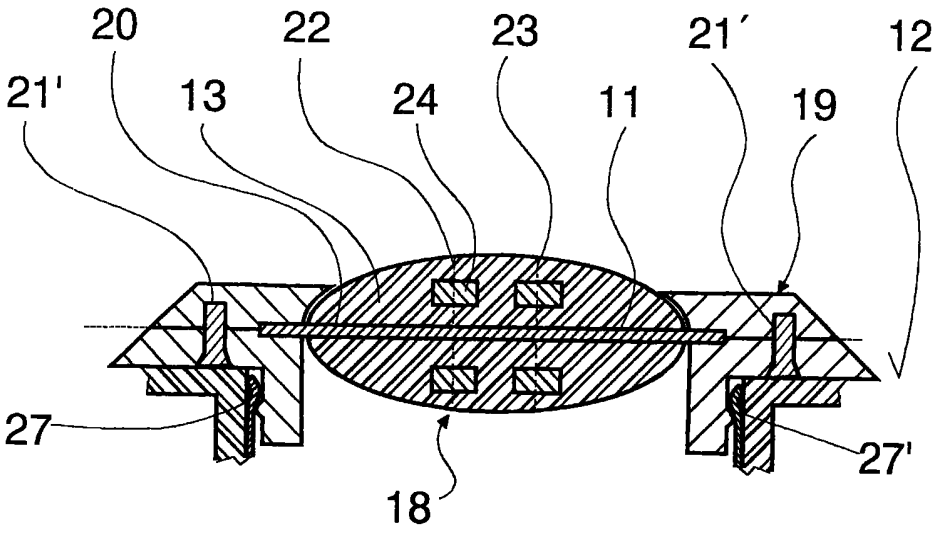

Fig. 4

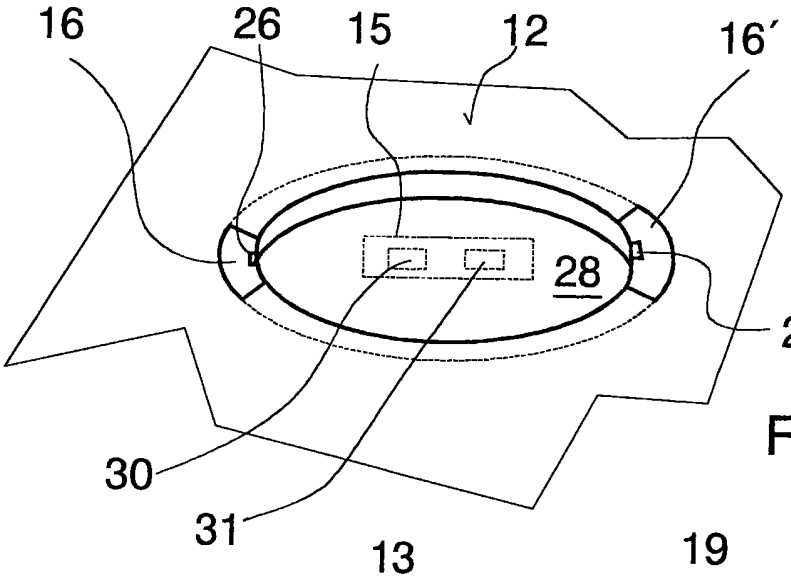

Fig. 5

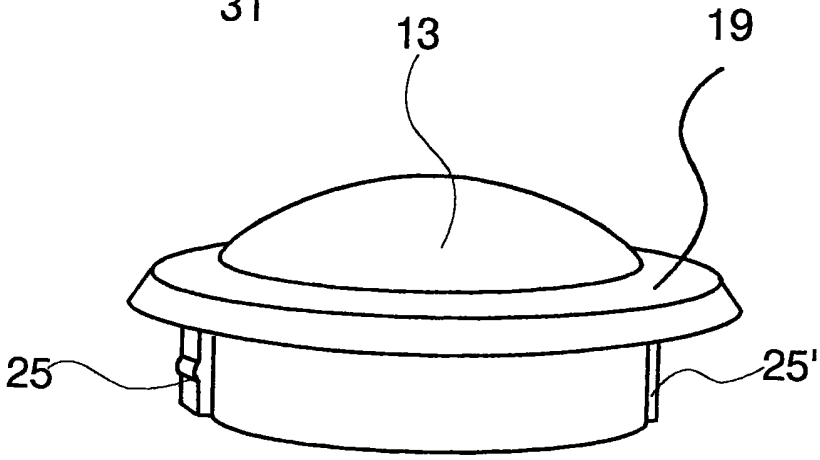

Fig.6

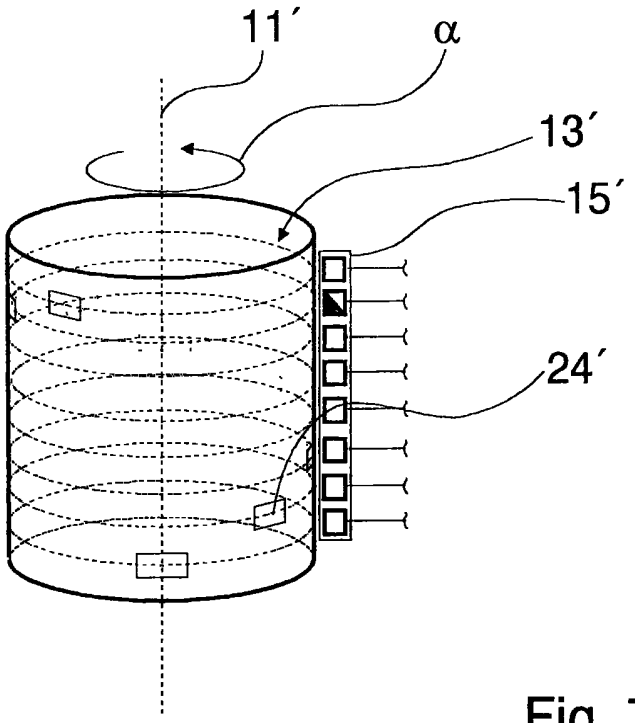

Fig. 7

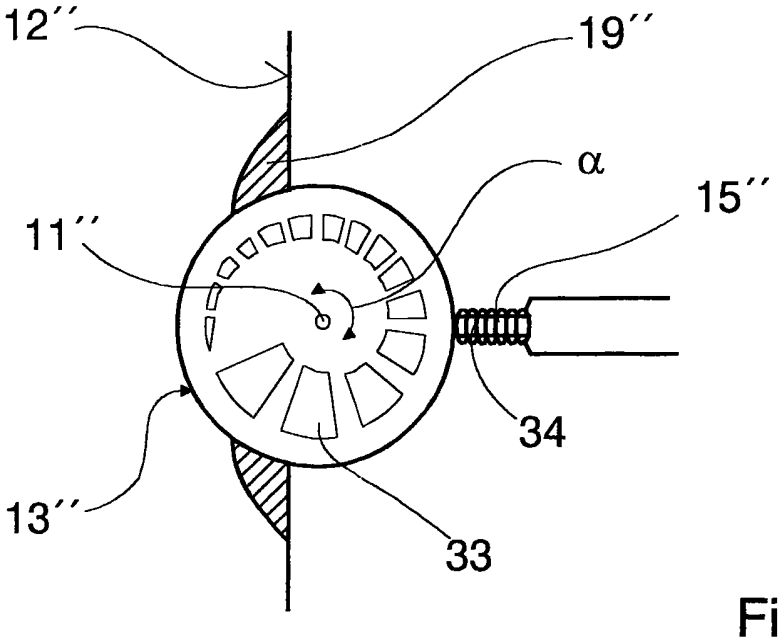

Fig. 8

OPERATING MEANS IN A DOMESTIC APPLIANCE

The present invention relates to a domestic appliance provided with operating means.

Domestic operating appliances with rotatably mounted operating means are known. The operating means is usually connected by way of a shaft, which is coupled with the operating means and extends perpendicularly to an appliance front face, via the front face with a potentiometer, or other rotational movement transmitter, for sensing a setting and/or movement of the operating means. In addition, domestic appliance operating means are known in which the operating means is detachably connected with the shaft and detachably fastened to the appliance front by way of the shaft acting as a mounting device. In that case the operating means is usually plugged or screwed onto the shaft.

There is a need for a domestic appliance operating means which facilitates cleaning and/or has improved characteristics with regard to operation and/or safety.

According to a first aspect of the present invention there is provided domestic appliance operating means, particularly for a cooking appliance, mounted at the appliance front to be rotatable about at least one axis of rotation, wherein the axis of rotation extends at least substantially parallel to the appliance front.

Consequently, the axis of rotation can be advantageously recessed in the appliance front and a convenient operation of the operating means is possible in the case of complete or at least almost complete integration of a grip surface of the operating means into the appliance front. It may be possible to dispense with regions of the operating means protruding from the appliance front. Cleaning characteristics of the appliance front and of the operating means can thereby be improved

High demands on cleaning characteristics are placed on domestic appliance operating devices particularly when provided for operating an appliance, especially a cooking appliance, for example a baking oven, microwave oven, cooking hob or a comparable cooking appliance, which in certain circumstances may be operated by dirty hands.

If the axis of rotation extends horizontally, operating convenience can be improved by providing intuitive operation. If, for example, the appliance is operated in a mode in which

a temperature is settable by way of the operating means, the setting action can be arranged so that a movement in upward direction of a hand of the user resting on the operating means leads to an increase in temperature and a movement of the hand in downward direction leads to a lowering of the temperature. The same applies when the user selects by way of the operating means an entry from a list with entries arranged vertically one above the other

In a more complicated embodiment, the operating means can be rotatable about several axes of rotation, for example in the manner of a track ball.

Additional advantages with respect to cleaning properties, particularly of a region disposed behind the operating means, can be achieved if the operating means is detachably fastened to the appliance front. The operating means can be cleaned separately when it has been soiled by, for example, contact with dirty fingers In addition it can be arranged for the appliance to be deactivated when the operating means is detached so that a dangerous and/or unauthorised actuation of the appliance, for example by children, can be avoided.

In a further aspect of the invention there is provided a domestic appliance operating device, particularly for a cooking appliance, with a detachably fastened operating means and with a mounting device for mounting the operating means at an appliance front.

Preferably, the mounting device mounts the operating means at the appliance front at least partly by a magnetic force. A fastening arrangement which can be detached and re-attached in particularly simple manner can thereby be achieved. Gaps and/or detent grooves of a detent connection can advantageously be avoided, whereby an at least substantially smooth surface, which assists cleaning, is achievable. In that case the operating means in itself, or a sub-unit which surrounds the operating means, can be detachably fastened to the appliance front. The magnetic force can mount the operating means or the sub-unit entirely or in conjunction with a detent and/or clamping connection.

In a further aspect of the invention there is provided a domestic appliance with operating means and with mounting means capable of causing deactivation of at least one function of the appliance when the operating means is detached from the appliance. It can thereby be avoided that functions which may obstruct cleaning of the appliance and/or lead to risk

are active when the operating means is detached and possibly remain active even without the operating means. Advantages with respect to safety of the appliance, particularly during cleaning of the appliance, can thereby be achieved.

In a further aspect of the invention there is provided a domestic appliance operating device particularly for a cooking appliance, comprising operating means fastened to an appliance front and a sensor unit for sensing a setting and/or movement of the operating means

Preferably, the sensor provides contact-free detection of the setting and/or movement of the operating means. In that case an inductive, capacitive, optical or other form of contact-free sensing of the setting and/or movement of the operating means is conceivable. A physical connection between the sensor unit and the operating means can be avoided, whereby convenient detaching of the operating means can be made possible without a mechanical and/or electrical connection of the operating means to the sensor unit having to be disrupted and without parts, especially movable parts, of the sensor protruding from a surface, which is to be cleaned, when the operating means is detached.

In that case a sensor acting, in a manner which is particularly advantageous with respect to cleaning properties, by way of a smooth surface which is easy to clean can be achieved if the sensor serves to detect a magnetic field, for example through an induction voltage or through a Hall voltage. For that purpose the sensor can detect the setting and/or movement of the operating means by an absolute value of an inductance or incrementally through a detection of voltage pulses produced by permanent magnets arranged in the operating means In addition, a magnetic field produced by the operating means or by permanent magnets incorporated in the operating means can be directionally dependent and thereby codes a setting. Moreover, the operating means could have the function of an armature of a dynamo and the sensor unit could sense the current generated during rotation of the actuating means or a power produced by that rotation.

If the appliance is provided with at least one pushbutton activatable by way of the operating means, the functionality of the operating means may be able to be enhanced. In that case the pushbutton can trigger a switching signal by pressure in a direction, which is perpendicular to a direction of rotation of the operating means and particularly also perpendicular to the appliance front, on a surface of the operating means. It could be the case that an inadvertent rotation of the operating means leads to an undesired setting of

the appliance. In that case it may be advantageous if activation of the appliance requires actuation of the pushbutton, the actuation of which is produced by pressure on a mounting unit of the operating device.

A particularly convenient operation of the appliance can be achieved if the operating means comprises a roller. A rotational direction of the operating means can be visually suggested by a form of the operating means which is elongate in the direction of its rotational axis

An optical report about the settings undertaken at the appliance by means of the operating means can be provided if the operating device comprises a communications interface for controlling an optical means for visualisation of a state of the appliance. If the optical means is arranged separately from the operating means, for example as a display, operation of the appliance without the necessity of eye contact with the operating means can be achieved. The optical means can be controllable by way of the communications interface not only directly, but also indirectly, for example via computer unit or control and/or regulating unit of the appliance.

Embodiments of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a schematic perspective front view of a cooking appliance with an operating device mounted at an appliance front face to be rotatable about a horizontal axis of rotation;

Fig. 2 is a vertical section, to enlarged scale through the appliance front face of Fig. 1, showing the operating device and an associated display;

Fig. 3 is a detail of Figure 2, to further enlarged scale, showing the operating device;

Fig. 4 is a horizontal section through the operating device;

Fig. 5 is a perspective view of part of the appliance front face with the operating device detached,

Fig. 6 is a perspective view of the operating device by itself, i.e. after being detached;

Fig. 7 is a schematic perspective view of a magnetic sensing system incorporated in an operating device of an alternative embodiment of the appliance; and

Fig. 8 is a schematic sectional view of a magnetic sensing system incorporated in an operating device of yet another embodiment of the appliance.

Referring now to the drawings, there is shown a domestic appliance which has the form of a cooking unit 10 with different cooking functions, inter alia a grilling function, a microwave function, a top heat function and a lower heat function. The appliance has a front face 12 which consists of a door in a lower region and a panel, which is arranged above the door and aligned with the plane of the door and into which a removable operating unit 18 is let. The operating unit 18 comprises the operating means 13 and a mounting device 19. The operating means comprises a rotatable ellipsoidal body, the longer axis of which is coincident with a horizontal axis 11 of rotation extending parallel to the front face 12. The body is made substantially of plastics material. The length of the operating means 13 substantially corresponds with the width of a human hand. Operating convenience can be enhanced if the longitudinal diameter is between 4 and 12 centimetres. A shaft 20 is incorporated in the operating means 13 to extend along the axis 11 of rotation and projects beyond the body at both ends by approximately 1 centimetre. The protruding ends of the shaft 20 are rotatably mounted in corresponding recesses of the mounting unit 19, wherein the recesses exert on the shaft 20 a frictional resistance settable by way of screws 21, 21' Two sets of eight magnets 24 spaced in circumferential direction by 45° are arranged on, respectively, two circumferential tracks 22 and 23 and are displaced relative to one another about the axis 11, in particular so that the magnets 24 on the track 22 are displaced by approximately 10° relative to the magnets on the second track 23

The mounting device 19 is constructed as a stainless steel part which is elliptical in plan view and which has a flanged insert portion able to be pushed perpendicularly to the front face 12 into an elliptical mating recess 28 in the front face (Fig. 5) and detached therefrom In the region of the ellipse ends the insert portion has rails 25 and 25' which can be pushed into complementary grooves 26 and 26' at the ends of the recess 28. Arranged

centrally on each of the rails 25 and 25' is a respective protrusion which on pushing of the operating unit 18 into the recess 28 detents with a perspective leaf spring 27 or 27' (Fig. 4) at the inner side of the groove 26 and 26'. A cover portion of the mounting device 19 serves to overlap an edge of the recess 28 at the front face 12, in particular by approximately 1 cm. The insert portion and the cover portion of the mounting means 19 are connected together by the screws 21 and 21' and together form, at a side facing the operating means 13, an inner surface which in shape conforms with the outer surface of the rotatable body of the operating means 13.

Respective pressure sensors in the form of pushbuttons 16 and 16' and activatable by pressure on the operating means 13 or on the mounting device 19 are arranged in the region of the ends of the recess 28 in the door plane so as to be overlapped by the mounting means 19. The pushbuttons 16 and 16' are connected by a communications line with a computer unit 29 in an interior space of the appliance 10 (Fig. 2), which computer unit can process signals of the pushbuttons. Arranged in the region of an outer edge of the recess 28 and behind the door plane are permanent magnets 14 which form part of mounting means for the operating means 13 and which assist the detent connection in that they exert a magnetic force F_M on the ferromagnetic mounting device 19 and thereby mount the operating means 13 at the front face 12 at least partly by the magnetic force F_M. The magnetic force F_M and a detent force have to be overcome in order to detach of the operating means 13 from the front face 12.

The springs 27 and 27' are flexed by insertion of the operating unit 18 and thereby respectively close electrical contacts. On release of the operating unit 18 the contacts automatically open by the forces of the springs 27 and 27'. If one of the contacts is opened, all heating functions of the appliance 10 are deactivated by an electronic circuit, whereby a risk of burning in the case of released operating unit 18 can at least be reduced and also heating in the case of released operating unit 18 is prevented

A sensor unit 15 provided for the purpose of sensing a setting α or a movement $\alpha' = d\alpha/dt$ of the rotatable body of the unit 18 is arranged at an underside of the recess 28 which goes back the furthest behind the door plane. For that purpose the sensor unit 15 comprises two magnetic field sensors 30 and 31 respectively arranged in the region of the circumferential tracks 22 and 23. When the operating means 13 is rotated about the axis 11 the magnets 24 move past the sensors 30 and 31 and induce therein a Hall voltage in

pulses, which are communicated by way of the communications interface to the computer unit 29. The computer unit 29 ascertains from the succession of pulses in time a rotational direction of the operating means 13. With each detected pulse the computer unit 29 can increment or decrement a magnitude, which is dependent on the operating mode and stored in a memory unit of the computer unit 29, by a predetermined amount in dependence on the rotational direction

The computer unit 29 is connected by way of a data cable 32 with an optical means 17 which has the form of a display and on which the computer unit 29 can give to a user a report about operating settings that have been undertaken. In a rest state the optical means 17 does not illustrate any data. A program, with the help of which the appliance 10 is actuable in the manner described in the following, can, for example, be installed on the computer unit 29. When the user presses on the operating unit 18, the computer unit 29 receives a switching signal from the pushbuttons 16 and 16' and changes from a readiness mode to a selection mode, in which the computer unit 29 illustrates a menu on the optical means 17. The menu consists of several lines which are vertically arranged one above the other and which each denote a respective operating mode of the appliance 10, wherein always one line is characterised by an optical emphasis. If the user rotates the operating means 13 upwardly or so that the surface of the operating means facing the user moves upwardly, the computer unit 29 receives a pair of pulses from the magnetic field sensors 30 and 31. On receipt of each pulse pair the emphasis moves upwardly by one line. If the user rotates the operating means 13 downwardly, the computer unit 29 correspondingly moves the emphasis downwardly The optical means 17 is thereby controllable by the operating means 13 via the communications interface. If the menu line desired by the user is emphasised, the user can then select this by a renewed pressure on the operating means 13 or on the mounting device 19, whereby the computer unit 29 switches into the operating mode associated with that corresponding line. If the user has, for example, selected a line representing 'upper heat' the user can then, through rotation of the operating means 13, set a temperature and confirm by a renewed pressing. The computer unit 29 then gives control signals for heating an upper heating device of the appliance 10 until attainment of the set temperature in a cooking space. In addition, the user can preselect a cooking time. Further sub-menus for selection and/or setting of other operating magnitudes are, of course, also possible

Fig. 7 shows an operating means 13' of an alternative embodiment, a sensor unit 15' of

which can sense an absolute rotational position or setting α of the operating means 13' For this purpose the operating means 13' has a plurality of magnets which are individually offset relative to one another not only in circumferential direction, but also in axial direction. For each axial position of a magnet the sensor unit 15' has a respective magnetic field sensor which responds when in a given setting α of the operating means 13' the corresponding magnet faces in the direction of the sensor. The setting α of the operating means 13' can thereby be ascertained from the response behaviour of the sensor unit 15'.

Fig. 8 in turn shows a further alternative operating means 13" with an iron core 33 which is arranged around an axis 11" of rotation of the rotatable body of the operating means 13 and spirally widens in circumferential direction and which is divided in circumferential direction into a plurality of segments which are not conductively interconnected. A sensor unit 15' comprises a coil 34, which can be acted on by alternating current, with an iron core which in operation magnetises the respective segment of the core 23 lying closest to the coil 34 The inductance of the coil 34 thereby depends on the size of the corresponding segment and thus on the setting α which can be detected by the sensor unit 15" or by a computer unit, which is connected with the sensor unit 15", from the inductance of the coil 34

CLAIMS

1. A domestic appliance provided with operating means mounted at a front face of the appliance to be rotatable about at least one axis of rotation, the at least one axis extending substantially parallel to the front face.

2. An appliance as claimed in claim 1, wherein the axis extends substantially horizontally.

3. An appliance as claimed in claim 1 or claim 2, wherein the operating means is detachably fastened to the front face.

4. A domestic appliance provided with operating means and with mounting means detachably mounting the operating means at a front face of the appliance at least partly by magnetic force.

5. An appliance as claimed in claim 4, wherein the operating means is rotatable about an axis of rotation extending substantially parallel to the front face.

6. A domestic appliance provided with operating means and with mounting means detachably mounting the operating means at a front face of the appliance, the mounting means causing deactivation of at least one function of the appliance when the operating means is detached.

7 An appliance as claimed in claim 6, wherein the operating means is rotatable about an axis of rotation extending substantially parallel to the front face.

8. An appliance as claimed in claim 6 or claim 7, the mounting means causing deactivation of at least one function of the appliance when the operating means is detached.

9. A domestic appliance provided with operating means mounted at a front face of the appliance and with a sensor unit for contactless sensing of at least one of a setting of the operating means and movement of the operating means.

10 An appliance as claimed in claim 9, wherein the operating means is rotatable about an axis of rotation extending substantially parallel to the front face.

11 An appliance as claimed in claim 9 or claim 10, wherein the operating means is detachably mounted at the front face by mounting means.

12. An appliance as claimed in claim 11, wherein the mounting means detachably mounts the operating means at least partly by magnetic force.

13. An appliance as claimed in claim 11 or claim 12, the mounting means causing deactivation of at least one function of the appliance when the operating means is detached.

14. An appliance as claimed in any one of claims 9 to 13, wherein the sensor unit is operable to detect a magnetic field.

15. An appliance as claimed in any one of the preceding claims, wherein the appliance is provided with at least one pushbutton for activating the operating means.

16. An appliance as claimed in any one of the preceding claims, wherein the operating means comprises a roller.

17 An appliance as claimed in any one of the preceding claims, wherein the appliance is further provided with a communications interface communicating with the operating means for controlling optical means for optically indicating a state of the appliance.

18. An appliance as claimed in any one of the preceding claims, wherein the operating means comprises an ellipsoidal body.

19. An appliance as claimed in claim 18, wherein the body incorporates a plurality of magnets selectively co-operable with magnetic field detecting means of the appliance to cause generation of signals each indicative of a respective rotational setting of the body.

20. An appliance as claimed in claim 19, wherein the appliance is provided with

evaluating means to evaluate successive signals to determine a direction of rotation of the body.

21. An appliance as claimed in any one of the preceding claims, wherein the operating means is partly embedded in the front face.

22 An appliance as claimed in any one of the preceding claims, wherein the appliance is a cooking appliance.

Application No:	GB0502043.3	**Examiner:**	Terence Newhouse
Claims searched:	1 at least	**Date of search:**	25 May 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1,2,15,16 ,21,22	GB1493487 A MATSUSHITA, see page 2 lines 107-122 and figs noting operating means 9
X	1,2,16,21 ,22	JP55146336 A TOKYO SHIBAURA, see also entry in Patent Abstracts of Japan and figs noting operating means 21,22

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

F2Y; F4W; U1S

Worldwide search of patent documents classified in the following areas of the IPC^{07}

A47L; D06F; F24C; F25D; G06F; H05B

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI, TXTE