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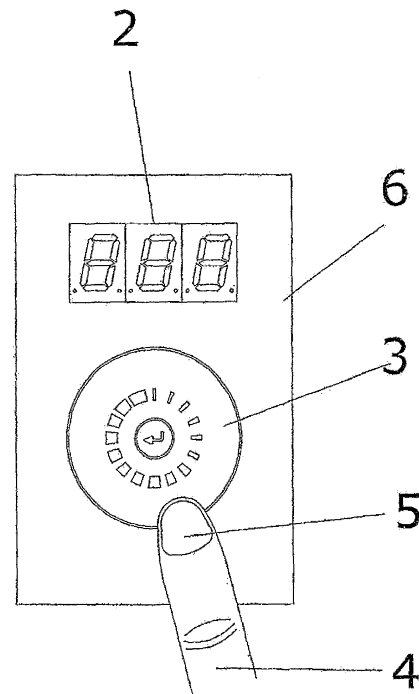
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(54) **Appliance with advanced controls, in particular a cooking oven**

(57) Electronically controlled appliance, in particular a cooking oven, comprising: selectively controllable control means working at least partially with the capacitive touch control technology, arranged on a control surface; means for displaying a plurality of working cycle parameters; control and processing means suitable to receive signals and instructions received from said processing and control means and from other sensors associated with the appliance operating devices; to process them according to one or more predefined algorithms; to send indicative signals to said display means and actuation/working instructions to the operating devices of the appliance; said command means also include a portion of said control surface, formed as a closed, preferably circular perimeter, and associated with a plurality of capacitive sensors, suitable to detect the movement of an object, typically the finger of an operator using the appliance, that moves by sliding on said closed perimeter portion, and said control means are suitable to process a value of a display signal according to a relation depending on a non-linear mode with respect to the speed of movement of said object on said portion.

Preferably, the display and programming control of the values of a selected quantity increases with a speed greater than the possible speed increase in the movement of said object, or finger, on said circular portion.



**FIG. 1**

**Description**

**[0001]** The present invention regards some improved means for setting with great precision the values of certain quantities that are selected to determine the operation of an appliance of general type.

**[0002]** The invention also regards a process for using correctly and efficiently said improved means of selection.

**[0003]** Hereafter in the present invention, and in the accompanying claims, reference will be made specifically to a cooking oven of a type preferably used in group catering, but it is understood that the invention can be applied to all types of appliances, like some types of home appliances, that must be programmed by the user by inserting specific desired values relative to a plurality of quantities or operating modes.

**[0004]** A cooking oven according to the state of the art comprises a cooking chamber, means of actuating and controlling the operating cycle, means for processing the signals received by said data control and storage means, in which are arranged selection devices, each of which is associated with a specific control variable, or control quantity as it will be referred to hereafter, which can be selected independently from among a plurality of different states or quantitative values that can be determined independently, and each combination of the distinct states of said quantities is associated with a predetermined set of machine instructions in said data storage means, suitable to operate on respective operating devices of the appliance.

**[0005]** This type of oven is provided with one or more display or viewing devices to view a plurality of said control quantities, and of the states or values respectively selected.

**[0006]** This solution is described, for example, in European Patent Application No. 06114993.6, priority 4 July 2005, to which reference is made for brevity.

**[0007]** In said document, the control devices for selecting control quantities and their respective states or values can be materially realized with various means known in the art, such as switches, commutators, linear position controls, contact and capacitive (touch control) devices, etc.

**[0008]** Although said selection control devices are easily actuated, there is the drawback that the selection of the states or values, for each single control quantity, can operate only on a discrete number of said values that are relatively distant from each other.

**[0009]** In fact, in order to be able to increase the accuracy of the control it should naturally be possible to determine for each control quantity a very large number of states or quantitative values; however, such solution implies that the passage from one value to another quantitatively very far value would require both a complicated series of control signals, with evident risks of error, and also an extended programming time, which would be clearly unwelcome in a work environment, such as the kitchen for the preparation of communal meals, a lunch bar, a restaurant, a hospital, a motorway restaurant, etc., where preparation times should be as short as possible.

**[0010]** Patent GB 2 443 296 discloses a manner of determining a value of a control quantity by acting on a control device of capacitive type, arranged in a closed and circular perimeter. This control allows the possibility that when an object, for example a finger, is placed on a definite position of said perimeter, a value is selected that corresponds bi-uniquely to that given position. Furthermore, the movement of the finger on the surface corresponding to said perimeter makes it possible to have:

- either the modification of the predetermined value,
- or a different representation of the various values shown in the different positions of said perimeter; in other words, the scale of representation of the selectable values is changed.

**[0011]** The commutation between the two previous functions takes place only when the speed of the finger moving on said perimeter exceeds a preset value.

**[0012]** In this case, too, it is evident that the drawback explained above is only attenuated, but it substantially remains, because the precision of the control depends only on what is represented by the more precise or "expanded" scale, but evidently this expansion finds a natural limit in the fact that, if wishing to represent values that are very close to each other, then the range of values between the extreme values of said scale is seriously narrowed down, as it still needs to be contained in a round angle; conversely, if wishing to operate on an expanded scale with extreme values that are rather far from each other, then evidently it is necessary to accept a reduction in the precision of control.

**[0013]** Patent WO 03/088176 discloses the use of a control of capacitive or touch control type that operates on a circular perimeter to modify the insertion of preferred values, relative to a given control quantity, in which the setting of the preset value is determined not by the position of the object, or the user's finger, on the surface that contains said circular perimeter, but only by the movement of the finger.

**[0014]** Such movement is detected in a manner independent of the initial and final position of the finger, but the extent of such movement is detected and calculated.

**[0015]** In addition, in this case too it is possible to sense, and use, both the information relative to the position of the object (finger) and to its own speed, as briefly stated in claim 13 of said document, to which reference is made for the

sake of brevity.

**[0016]** However, in this case too there still remain some of the limits of the previous case; that is, the movement of the finger, even if made at different speeds, makes it possible to carry out the programming with greater or lesser speed, but it does not make it possible in any manner to improve the precision of the control, once the type of control is defined, i.e., the correspondence between the movement of the finger, that is its "travel", and the change in the selected value of the relative quantity.

**[0017]** It would therefore be desirable, and it is the main objective of the present invention, to produce an appliance of general type, and preferably a cooking oven, provided with means suitable to eliminate the drawbacks described above.

**[0018]** This appliance must also be able to guarantee the operation in a controllable mode on a plurality of control quantities that must also be able at the same time to operate on the working cycle.

**[0019]** Further, said appliance must be able to be controlled in a simple and immediate mode, and must be made economically using the means available in the art.

**[0020]** These and other objectives are achieved by an appliance according to the accompanying claims.

**[0021]** Characteristics and advantages of the invention will be evident from the description which follows, by way of non-limiting example, with reference to the enclosed drawings, wherein:

- Fig. 1 illustrates a symbolic diagram of a simplified control panel of an appliance according to the present invention;
- Fig. 2 illustrates a graph on a Cartesian plane showing an example of the mode and operation of the control of an appliance according to the invention;
- Fig. 3 illustrates a different graph on a Cartesian plane showing with a different representation the operating time of the control of an appliance according to the invention;
- Fig. 4 is a symbolic vertical plane view of the front access door of a cooking oven, equipped with a control panel according to the invention;
- Fig. 5 illustrates an improved embodiment showing in detail an improved control panel of a cooking oven according to the invention;
- Fig. 6 illustrates a block diagram that exemplifies the manner of operation of the control panel of Fig. 5.

**[0022]** With reference to Figures 1 and 4, a food cooking oven according to the known art includes:

- an internal cooking chamber (not shown) provided with a front door 1;
- selectively controllable control means operating at least partially with the capacitive control technology, arranged on the external surface of said door 1;
- display means 2 displaying a plurality of cooking cycle parameters, located on the external surface of said door; in addition, the oven is equipped with:
- control and processing means, not shown, containing predefined algorithms and suitable:
- to receive signals and commands received from said control means, and from other sensors associated with the oven operating devices;
- to process them according to one or more predefined algorithms;
- to send indication signals to said display means, and actuation/operation signals to the functional devices of the oven.

**[0023]** According to the invention, and with particular reference to Fig. 1, said control means also include a portion 3 of the external surface of said door, formed like a closed, preferably circular perimeter with which are associated, in the area behind said portion 3, a plurality of capacitive sensors.

**[0024]** Said capacitive sensors and said control and processing means are suitable to sense the movement of an object, typically a finger 4 of an operator of said oven, that moves by sliding on said circular portion 3, and said control means are suitable to process a display signal according to a relation, with respect to the speed of movement of said finger on said portion 3, as follows:

**[0025]** Said display signal consists of a numerical value generated by said control and processing means according to the prior art, and may vary from a minimum preset value "Val.min" to a maximum preset value "Val.max".

**[0026]** Referring now to Fig. 2, a Cartesian plane is shown in which the axis of abscissas represents, on an arbitrary scale, the speed of angular or perimetric movement "V<sub>mov</sub>", and naturally in the same sense the point of contact 5 of the finger 4 on the circular portion 3.

**[0027]** On the axis of ordinates is shown, on an arbitrary scale, the speed of change "V<sub>vis</sub>" of the numerical value indicated by the display 2, which, as mentioned above, may change between a minimum value "Val.min" and a maximum preset value "Val.max".

**[0028]** According to the invention, the speed of change "V<sub>vis</sub>" of the numerical value on the display 2 does not correspond linearly with the speed of movement of the finger on said portion 3, but changes according to a relation that

changes the speed  $V_{vis}$  with an increment greater than the increment of  $V_{mov}$ .

**[0029]** In general terms, assuming that in certain circumstances the speed of the finger on the portion 3 is, for example, constant, of a value  $V(o)_{mov}$ , to which corresponds a speed of change of the display  $V(o)_{vis}$ , if now the sliding speed of the finger 4 increases to a new value

$$V(1)_{mov} = h.V(o)_{mov}, \quad \text{with } h > 1,$$

then the speed of change of display on the display 2 becomes

$V(1)_{vis} = V(o)_{vis} \cdot (h + t)$ , — shown on the Cartesian plane of Fig. 2 from point  $P(1)$

with  $t > 0$  and that can be both a constant and a variable,

(and does not become  $V(1)_{vis}(a) = h.V(o)_{vis}$ , as it would be instead if the two speeds changed in a proportional manner, as shown in the Cartesian plane itself by point  $P(o)$ , located on the straight line "C2" which represents such circumstance which, as mentioned, shows the prior art, but which does not represent the present invention).

**[0030]** In practice, and with reference to Fig. 2, the graph that represents such variation is a continually rising curve "C", showing a concavity facing upward, that is, toward the axis of the ordinates that represents the " $V_{vis}$ ", or the speed of change of the value shown in the display 2.

**[0031]** For greater clarity, this curve "C" is entirely different from the straight line "C2" which would instead be applicable if the speed of change of the representation of the value on the display 2 was exactly proportional to the speed of change of the " $V_{mov}$ ".

**[0032]** Preferably, to obtain this curve "C" with an easily programmable algorithm, and also to offer the user a direct feel of the relation between the speed of the user's own control, that is the " $V_{mov}$ ", and the speed calculated by said processing and control means, and thus represented " $V_{mov}$ " in the display 2, it has been shown advantageous to have the following relation established in said speeds:

$$V(vis) = k \cdot V(mov)^n,$$

being

- $V(vis)$  the displaying speed on the display 2,
- $K$  a constant,
- $V(mov)$  the speed of movement of the point of contact 5 of the finger 4 on the portion 3,
- and " $n$ " a number greater than 1.

**[0033]** With this embodiment the immediate result is that said curve "C" becomes a curve of perfectly parabolic type, with constants " $n$ " and " $K$ " determinable at will.

**[0034]** Naturally, many other types of said curves "C" are possible, though remaining valid the basic criterion that the speed of variation " $V_{vis}$ " is always non linear and preferably more than proportional to the speed of the command " $V_{mov}$ ".

**[0035]** This invention can also be explained with Fig. 3, which shows the relation between said " $V_{mov}$ " shown in abscissa, and the time " $T_{vis}$ " shown in ordinate, where said " $T_{vis}$ " indicates in an arbitrary scale the time taken by the display 2 to pass from displaying the minimum value of the speed of display to the relative maximum value.

**[0036]** From Figure 3 it is evident that the greater said speed " $V_{mov}$ " is, the smaller is the time used to pass between the extreme values of the relative scale, and that said relation is not a hyperbolic relation, as it would logically be if there were a perfect correspondence between the two speeds described above, but it is instead a relation that is strongly declining with the increasing speed " $V_{mov}$ ", as shown in the relative curve "S".

**[0037]** Hence, one of the main advantages of the invention becomes evident; in fact, if wishing to set very quickly, but also very precisely, a selected value of a certain characteristic quantity of the operation of the appliance (for example, time, temperature, etc.) on the display 2, it will be sufficient to:

- start to move the finger on the circular portion 3 at fast speed, or at the maximum speed that allows the operator to follow the variation of the value on the display 2, and thus the approaching of the selected value;
- lower that speed greatly, so as to make the values near said selected value appear at the due slow rate;
- finally, that selected value is determined exactly on the display by progressively adjusting the movement of the finger with due slowness and precision.

**[0038]** At this point it will simply be necessary to select and send the preselected value to said control and processing means through a suitable known command.

**[0039]** It is also important here to stress one of the main advantages of the invention: in fact, again with reference to Fig. 3, a field is indicated at the bottom, shown by "A", wherein a fast speed of change of display is obtained with a low precision, and a field at the top "B" in which, on the contrary, a low speed of change of display is used, combined however with a high precision in both the display and in the relative control.

**[0040]** A useful application and the relative improvements of the invention described above are shown with reference to Figures 4 and 5.

**[0041]** In fact, in a type of oven that utilizes the invention the figures show that on the door 1 there is an external area 6 in which various items are shown. First of all it should be noted that said area 6 is in fact just an area, and that it does not necessarily have to be drawn or delimited by specific elements or with particular graphics.

**[0042]** In said area 6, shown in detail on Fig. 4, are shown,

- the individual viewers or displays 10, 11, 12 and 13,
- the separate control buttons, preferably of capacitive contact (touch control) type 14, 15, 16 and 17,
- a further sequencing control 18, which will be better explained below,
- a further confirm button 19.

**[0043]** According to the present improvement, the oven of the present invention is provided with programming control devices, and/or devices displaying the values of the following quantities:

- time to end of cooking cycle, with the control button 14,
- temperature within the food, with the control button 15,
- temperature inside the cooking chamber, with the control button 16,
- temperature difference between the two previous temperatures, with control button 17,
- degree of moisture inside the temperature chamber,
- a parameter correlated with the speed of the air inside the cooking chamber,
- other physical quantities normally used in cooking ovens.

**[0044]** As shown, the two control buttons 14 and 15 are associated with a single display 10, whereas the control buttons 16 and 17 are associated with the display 11.

**[0045]** This enables the user to immediately monitor the progress of the selected cooking cycle; in fact, it is pointed out that two different types of cooking cycles are principally used and available:

- the first type is the classic so-called "time-based" cooking mode; in this mode, the user selects the button 14 that determines the cooking time. With this type of setting of the cooking cycle it is immediately possible to check the condition of the food being cooked, checking on the display 11 the corresponding temperature values in the cooking chamber and the relative differential with respect to the internal temperature of the food being cooked by selecting the respective buttons 16 and 17;
- the second type of cooking cycle is the so-called cooking "based on the temperature of the food"; with this cooking mode, the user selects the button 15 that measures the temperature inside the food being cooked. With this type of setting of the cooking cycle it is immediately possible to check the cooking condition of the food in the oven, checking on the display 11 the corresponding temperature values both inside the cooking chamber and in the interior (the heart) of the food being cooked by selecting the respective buttons 16 and 17.

**[0046]** To program said oven, the user proceeds as follows:

To insert a particular selected value for a particular one of said quantities, it will be sufficient in fact, after having activated or touched the relative button, that is, one button from 14 to 17, to touch said portion 3 with a finger, and move the finger on it with a rotational movement until the numerical value that the user decides to select appears on the respective display 10 or 11.

**[0047]** The type of reading, combined with the relative control mode has been explained above, and thus it will not be discussed further.

**[0048]** In addition, with the selection of one of said controls from 14 to 17, a precise instruction is also transmitted at the same time to said processing and control means to activate that or those functions of the oven, or the relative operating devices, that bring the oven itself to reach and maintain the selected value for the newly inserted quantity; in fact, to end this programming phase, the command is completed and ended by acting, preferably again by capacitive

contact, on the areola 19 centred in said portion of surface 3 and that corresponds to the confirm button, or operating instruction send button (corresponding, for example, to the "enter" button).

[0049] With reference in particular to Fig. 5, there is a third display 12, to which is associated a respective touch control device 20; by selecting the latter, the user can adjust the level of moisture introduced through the usual touch control device on said superficial portion 3, and at the same time monitor the value set on the relative said third display 12.

[0050] Naturally, in this moisture value selection function too, the type of adjustment on said circular portion 3 is the same as the general procedure exemplified and discussed above.

[0051] With reference to Fig. 6, and again to Fig. 5, it can be seen that the control panel has a fourth display window, indicated with No. 13, and another single and independent control device indicated by No. 18, marked also with letter "M", for "MENU".

[0052] Said control device 18 makes it possible to modify in cascade, according to a universally used well-known selection model (as for example in the insertion of a selection command for subsequent steps in a computer application program), both the kind of food that is subjected to cooking and, for the kind of food selected, the specific type of food.

[0053] For example, with reference to Fig. 6, if wishing to cook a bass (fish), it is necessary to:

- first select the control device 18, "MENU";
- then select the word "FISH" by operating on the portion 3, which in this case works like a sequencer in successive choices; through it, the following come up in succession:
- first, all the kinds of food memorized in said processing and control means,
- and in the next step, the types of food memorized and corresponding to each kind memorized;
- then the user must confirm the choice made by pressing the confirm control 19, preferably of touch control type, in the centre of the portion 3;
- then select, by operating again on the portion 3, the word "bass";
- then, to complete the procedure, confirm the choice made and send this final information by operating again, by contact, on the same confirm control device 19.

[0054] Naturally, each of said selections can be read in the display 13.

[0055] It will be seen here too that, with the previous selection procedure, the control on the capacitive control portion 3 operates as a sequencer, in the sense that it makes it possible to have a fast scroll in a succession of commands and subcommands, which, once chosen, are selected and confirmed with the activation of said confirm command 19.

[0056] Essentially, this setting procedure in successive phases can in part be assimilated to the procedure disclosed in the European patent No. 06114993.6.

[0057] Further, it is pointed out that among the settings that can be programmed with said portion 3 there is also the "WASHING" command; this naturally makes it possible to transmit to said processing and control means the instruction to activate a particular operating cycle, which does not correspond to any cooking cycle but to an automatic washing cycle, that the oven itself is capable of carrying out based on devices included in it, and with known procedures.

[0058] A further improvement consists of the fact that said external area 6, which contains and delimits the control panel including the displays and the control devices, is substantially only a region limited by the area of the external surface of the whole door 1.

[0059] This region is made up of a single plate of glass or of a transparent material, and inside said area 6 that is a region delimited in said plate, are formed and arranged, with known methods, said displays 10-13 and said control devices 14-18, as well as said portion 3 that functions as a control and selection (scrolling) device.

[0060] In practice, all said devices appear simply as suitable graphic designs located on the front or on the back part of said plate of glass or of transparent material, and they can be activated as capacitive (touch control) controls of known type.

[0061] This gives the favourable result that the external surface of said plate is not interrupted by any projecting or recessed element but remains completely smooth, flat and free of any discontinuity.

[0062] This situation thus improves not only the aesthetic appearance, but also makes it very easy to clean said external surface, and naturally it facilitates its construction, and at the same time it lowers its cost of production.

[0063] Obviously, every appliance that meets the following claims falls within the scope of protection of the present patent, even if it incorporates embodiments and functionalities that are different and/or incremental with respect to the same claims.

## Claims

1. Electronically controlled appliance, comprising:

- command means which are selectively controllable and working at least partially as capacitive touch control, arranged on a control surface,
- means or displays able of showing a plurality of working cycle parameters,
- control and processing means able:
  - of receiving signals and commands received from said command means, and from further sensors associated to the operating devices of said appliance,
  - of processing them according to one or more pre-defined algorithms,
  - and of sending indicative signals to said displays and to actuating/working devices of said appliance, **characterized in that** said command means do include also a portion (3) of said control surface,
  - that said surface portion (3) is shaped as a closed, and preferably circular, perimeter,
  - that in the back region of said portion (3) a plurality of (preferably capacitive) sensors is arranged,
  - that said (preferably capacitive) sensors and said command and processing means are able of detecting the motion of an object, typically an user finger (4), which moves sliding on said portion (3),
  - that said control means are able of producing a value of a visualization signal according to a relationship depending in a not-linear mode with respect to the moving speed of said object (4) on said portion (3).

2. Oven for cooking food, according to claim 1, and comprising

- an inner cooking chamber provided with a front door (1),
- command means which are selectively controllable and working at least partially as (preferably capacitive) touch control, arranged on the outer surface of said door (1),
- means or displays able of showing a plurality of working cycle parameters, placed on the outer surface of said door,
- control and processing means able:
  - of receiving signals and commands received from said command means, and from further sensors associated to the operating devices of said oven,
  - of processing them according to one or more pre-defined algorithms,
  - and of sending indicative signals to said displays and to actuating/working devices of said oven, **characterized in that** said command means do include also a portion (3) of said door,
  - that said surface portion (3) is shaped as a closed, and preferably circular, perimeter,
  - that in the back region of said portion (3) a plurality of (preferably capacitive) sensors is arranged,
  - that said sensors and said command and processing means are able of detecting the motion of an object, typically an user finger (4), which moves sliding on said portion (3)
  - that said control means are able of producing a value of a visualization signal according to a relationship depending in a not-linear mode with respect to the moving speed of said object (4) on said portion (3).

3. Oven according to claim 2, **characterized in that** said relationship, depending in a not-linear mode on the moving speed of said object (4) on said portion (3) is such that, in a Cartesian plane (Fig. 2), it shows a convexity toward the y- ordinate orientation , which represent the changing rate of the visualization value (V.vis) so that said rate is being increased, with respect to an initial reference, in a larger amount of the moving speed (Vmov) increase, with respect to the corresponding initial speed reference of said object (4).

4. Oven according to claim 2, **characterized in that** said relationship, depending in a not-linear mode on the moving speed of said object (4) on said portion (3), is of the type:

$$V(vis)=k \cdot V(mov)^n,$$

where:

- V(vis) is the visualization changing rate,
- K is a constant,
- V(mov) is the moving speed of said object over said portion (3),
- "n" is a number greater than 1.

5. Oven according to claim 3 or 4, **characterized in** being provided with at least a display (2) able of showing a feature processed and produced by said processing and control means, or by suitable sensors associated to said oven,

and **in that**, on said display, a value can be selectively showed of at least one of the following features:

- time to cycle-ending,
- temperature detected by a probe detecting the inner temperature of the food,
- temperature inside said cooking chamber,
- temperature difference between the temperature detected by said probe and the temperature inside said cooking chamber,
- moisture inside said chamber.

**6.** Oven according to claim 5, **characterized in that** it is provided with at least two distinct displays (10, 11), wherein a first display (10) is able of representing in a selectively controllable way the remaining time-period to the cooking cycle-ending, or the probe temperature, and the second display (11) is able of representing in a selectively controllable way the temperature inside the cooking chamber, or the temperature difference between the probe temperature and the chamber inner temperature.

**7.** Oven according to claim 5 or 6, **characterized in that** it is provided with controllable selection means (14, 15, 16, 17), preferably capacitive touch control means, able of setting one of the following features:

- time to cycle-ending,
- temperature detected by a probe detecting the inner temperature of the food,
- temperature inside said cooking chamber,
- temperature difference between the temperature detected by said probe and the temperature inside said cooking chamber.

**8.** Oven according to claim 7, **characterized in that** the motion of said object (4) over said portion (3) determines the value change represented on one of said displays (10, 11) and associated to the respective selected feature (time-period, temperature etc.).

**9.** Oven according to claim 8, **characterized in that** it is provided with a confirmation command (19) able of sending to said processing and control means the information that the previous programming step has been completed.

**10.** Oven according to claim 9, **characterized in that** it is provided with sequencing means able of allowing the showing of a plurality of different categories of food, which are selectively and independently selectable, and, for each of said category, a respective food specific type, said showing being implemented in a dedicated display (13), and a confirmation device which is actionable from the outside, and preferably is said confirmation command (19), by which it is instructed to said processing and control means which, among said food categories and specific types, is selected as actual cooking food to be cooked.

**11.** Oven according to any of the previous claims, **characterized in that** it is provided with a third display (12) able of showing the humidity level detected inside said cooking chamber, and a respective command means (20) able of control said humidity level.

**12.** Oven according to any of the previous claims, **characterized in that**

- all said command and display devices and means, and said portion (3), are included inside a delimited area (6) of the outer surface of said door (1),
- and **in that** said outer surface is implemented by a single glass or transparent, flat, smooth material plate, with no irregularities oriented outwards.



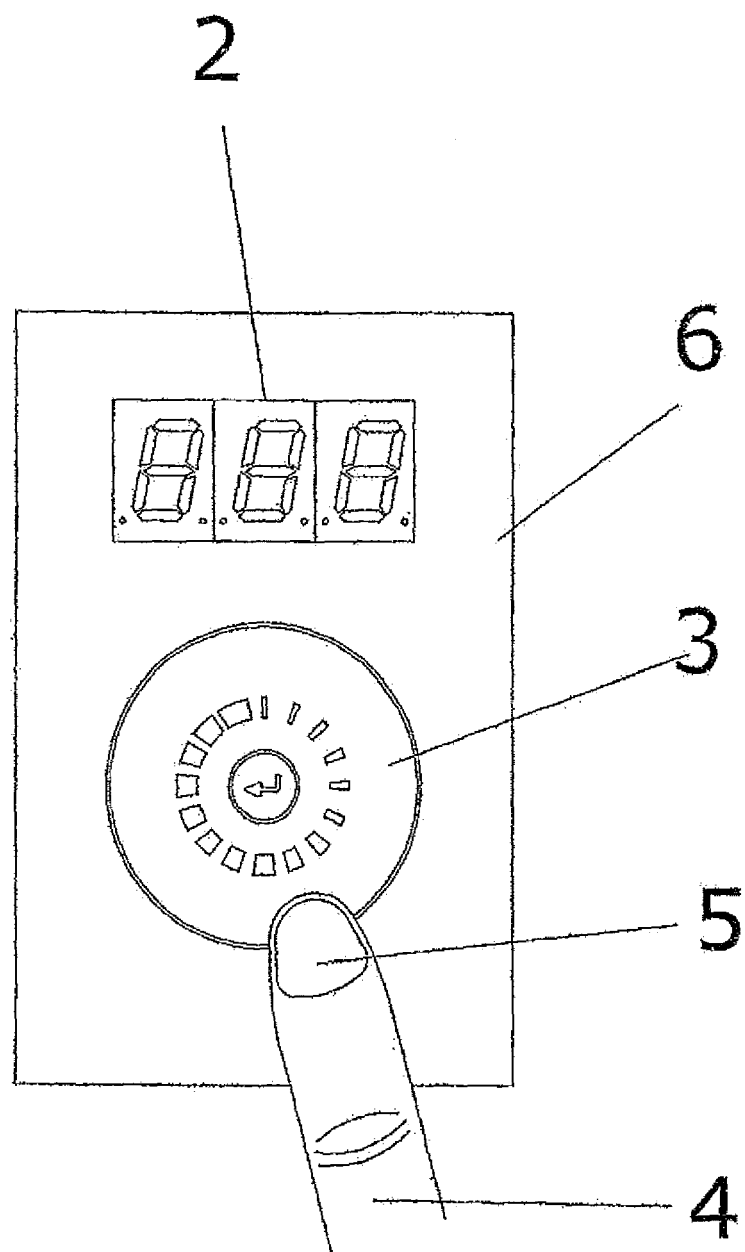


FIG.1

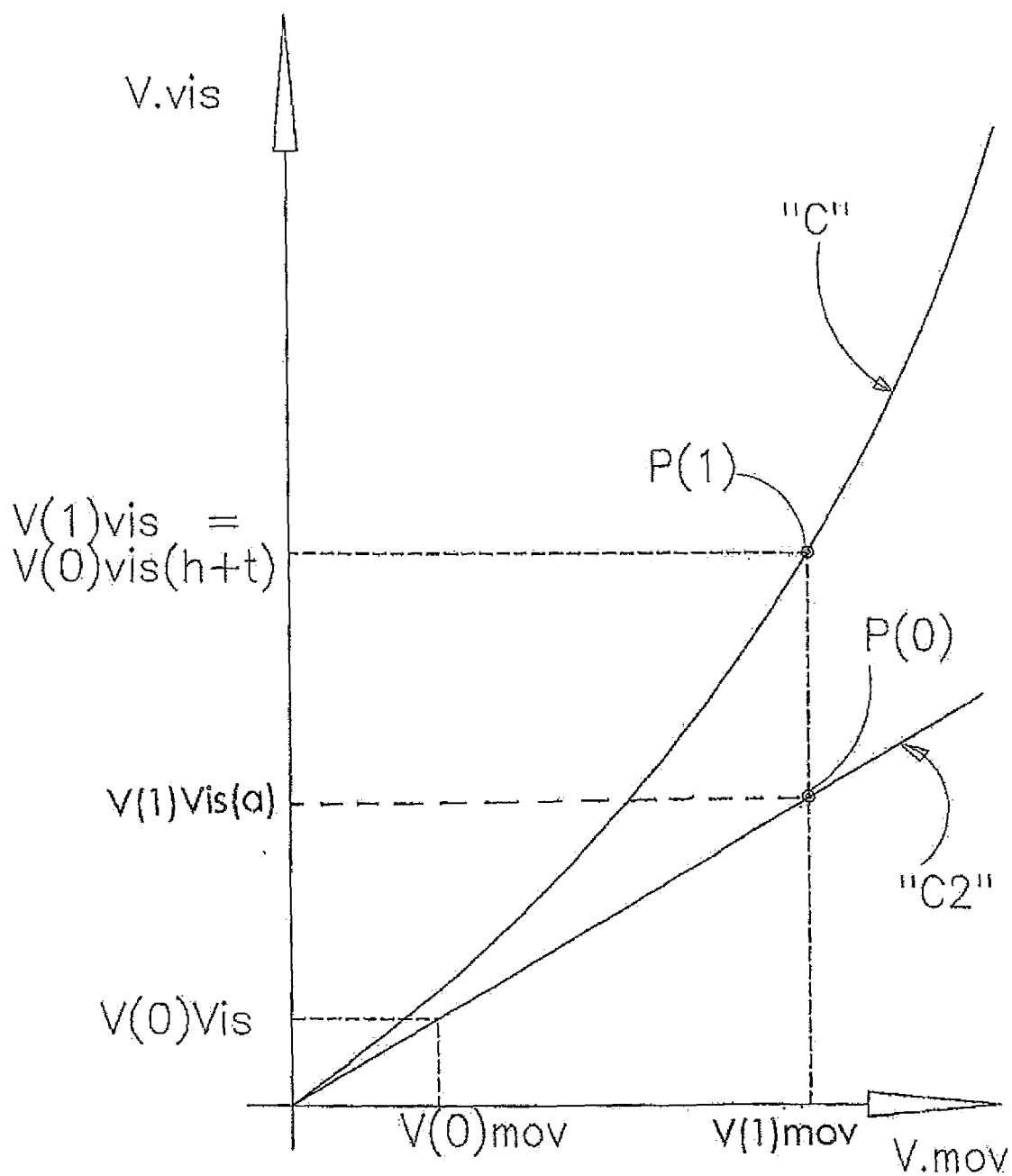


FIG.2

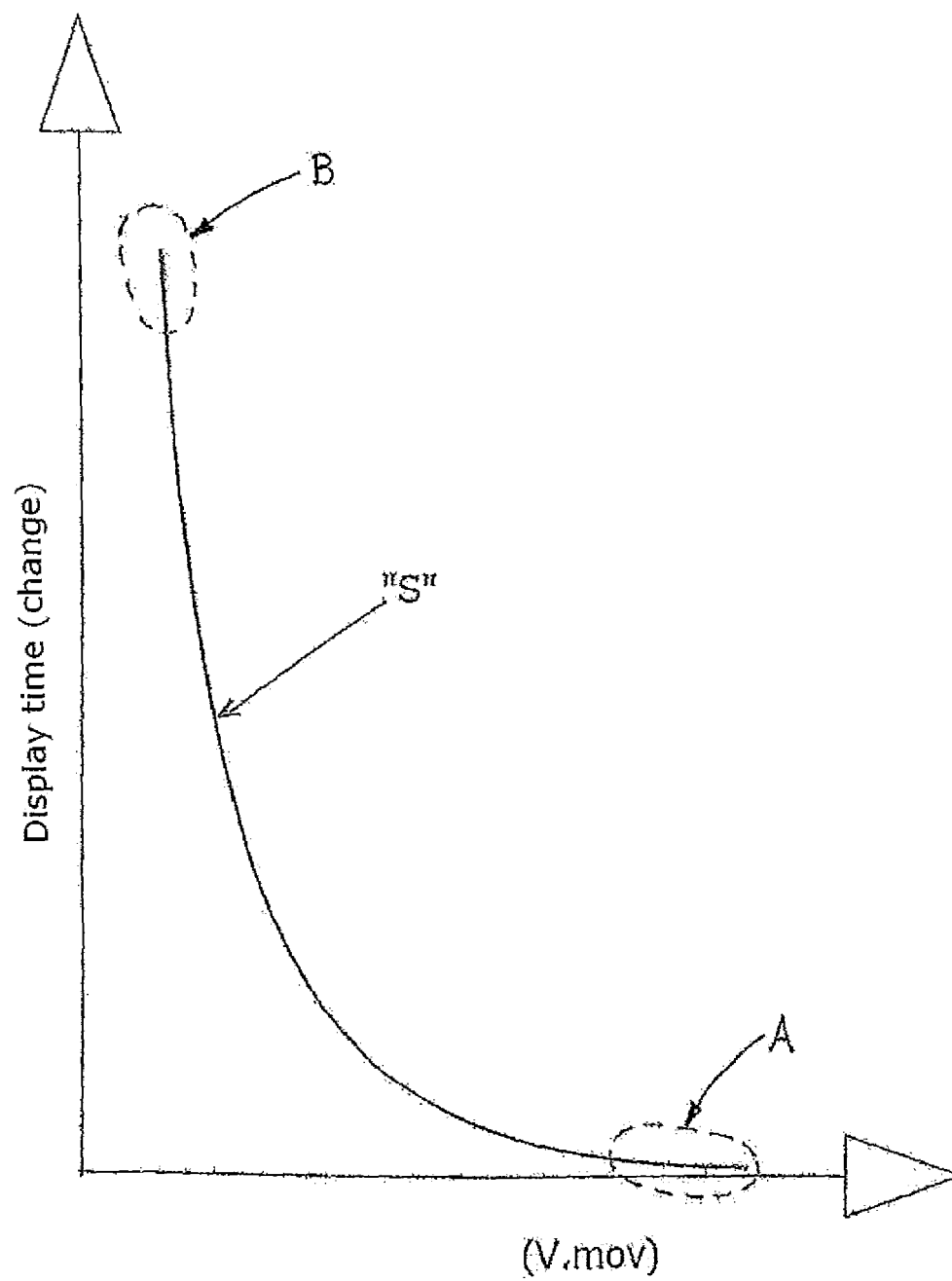


FIG.3

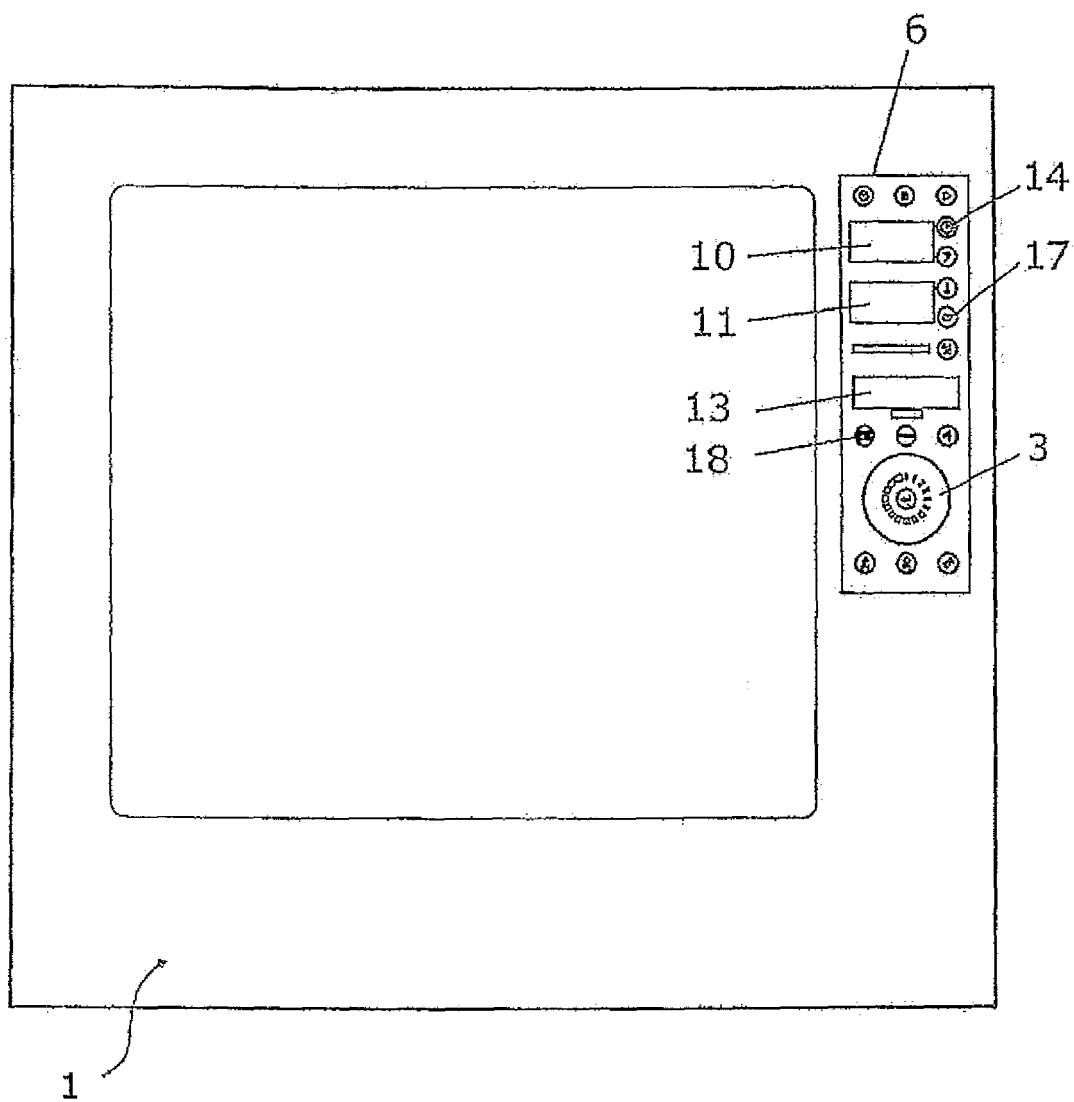


FIG.4

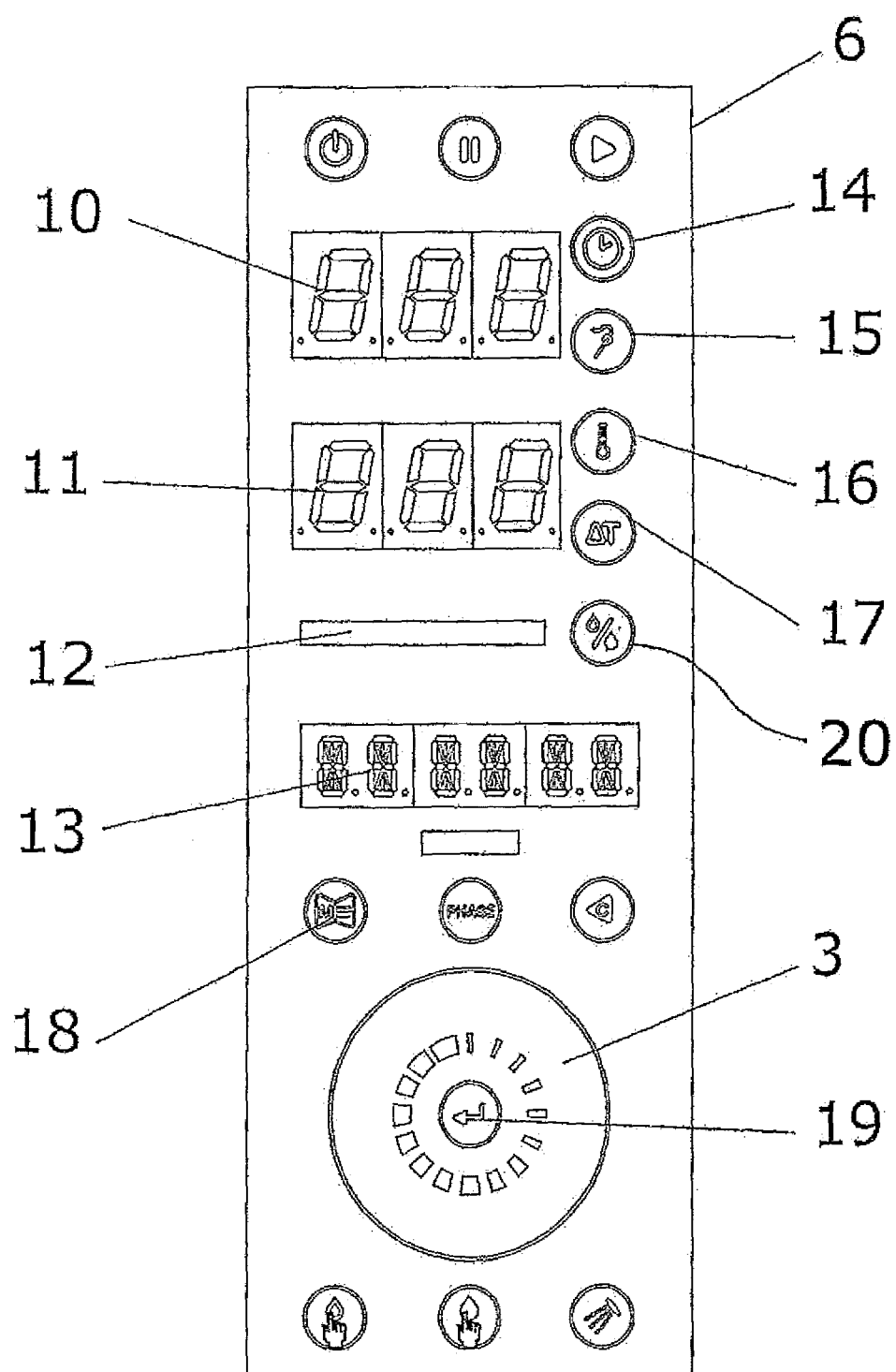


FIG. 5

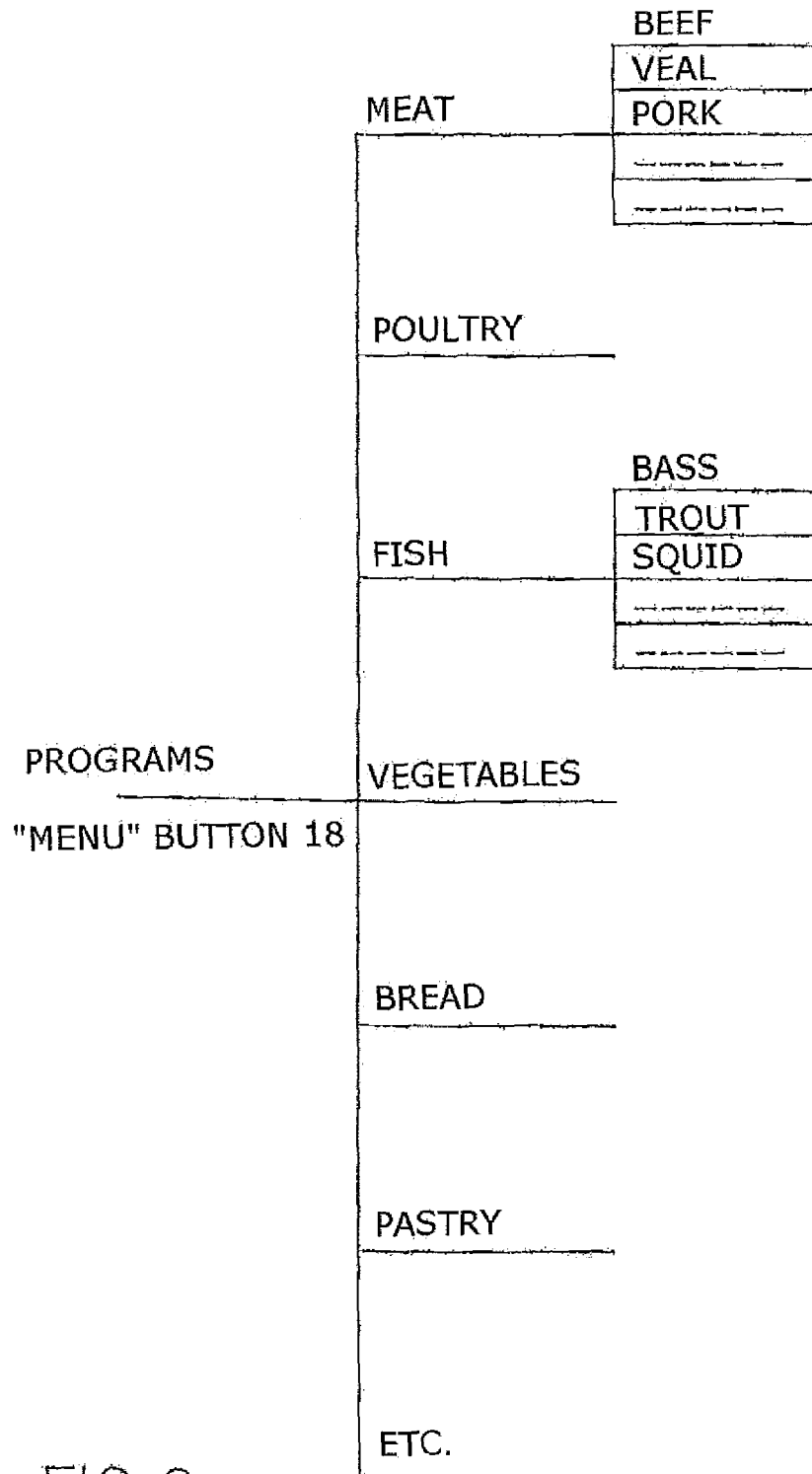


FIG.6

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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