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(54) **METHOD OF AUTOMATICALLY ASSESSING THE TYPE OF DETERGENT IN USE IN A DISHWASHING MACHINE**

(57) The present disclosure relates to a method of automatically assessing the type of detergent (TD1, TD2, TD3) in use in a dishwashing machine (1) having optical

means (8) and a user interface (9) for varying the cleaning parameters of a washing program (P) according to the type of detergent that has been detected.

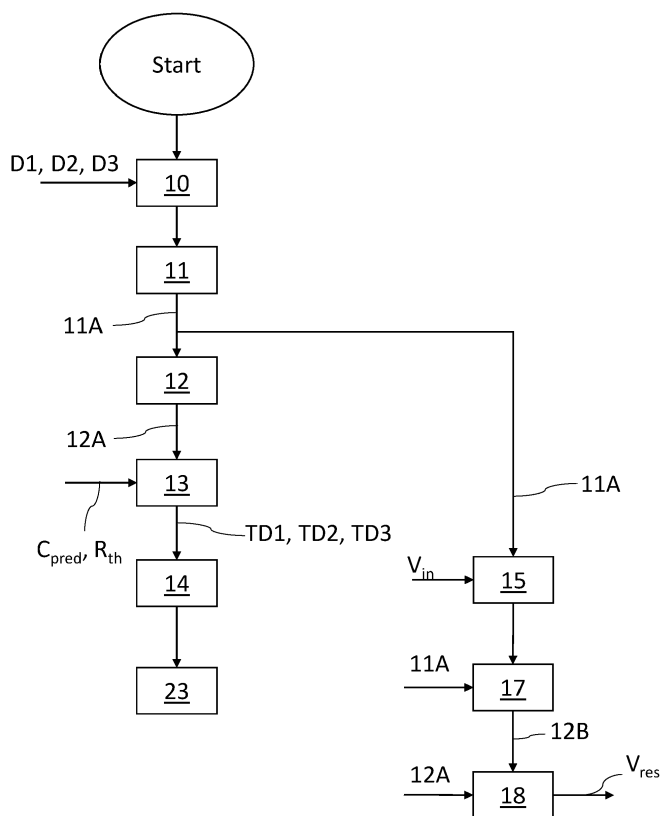


Fig. 1

Description

Field of The Invention

[0001] The present disclosure relates to a method of automatically assessing the type of detergent in use in a dishwashing machine, as defined in the preamble of claim 1.

[0002] The present disclosure also relates to a dishwashing machine configured to carry out the method of automatically assessing the type of detergent in use in a dishwashing machine, as defined in the preamble of claim 9.

[0003] The present disclosure further relates to a system composed of a dishwashing machine and a user-handheld portable device configured to carry out the method of automatically assessing the type of detergent in use in a dishwashing machine, as defined in the preamble of claim 12.

Discussion of the related art

[0004] Dishwashing machines are known in the art, which are equipped with optical devices such as still cameras, video cameras or camcorders, located in a fixed or moving position relative to the washing chamber to check the dishware load or degree of cleaning.

[0005] For example, WO2016008699 and US 2012/0138092 disclose such dishwashing machines.

[0006] The operation of such dishwashing machine requires dishware to be loaded in then washing area by the user and a detergent to be used for washing.

[0007] This detergent is usually placed in a dispenser having a suitable door that can be automatically opened once the user has closed the door of the dishwashing machine and has started the selected washing program.

[0008] Currently available detergents include:

- powder detergent;
- liquid detergent;
- gel detergent;
- tabs;
- rinse aid, to assist dishware drying.

[0009] Dishwashing machines are known in the art, which are equipped with a sensor and can identify by a sensor whether the detergent in the dispenser is solid or liquid. US 2011/0030729 discloses an example of such dishwashing machine.

Problem of the prior art

[0010] The aforementioned detergent types have different chemico-physical properties different with chemical agents and varying solubilities.

[0011] Nevertheless, current dishwashing programs which include, for example, the steps of loading water, heating, intensity and duration of the washing and drying

cycles, are calibrated by assuming that a detergent having average characteristics is used.

[0012] Therefore, the potential of a specific detergent is not fully exploited by the washing programs of a dishwashing machine.

[0013] Failure to identify the type of detergent entails less than optimal dishware cleaning, as well as increased consumption to carry out the washing program. Increased consumption has a strong impact, in terms of both power and water use.

SUMMARY OF THE INVENTION

[0014] The object of the present invention is to provide a method, a dishwashing machine and a system for automatically assessing the type of detergent in use in a dishwashing machine, to avoid the above described prior art problems.

[0015] This object is fulfilled by a method, a dishwashing machine and a system for automatically assessing the saturation level of a dish rack of a dishwashing machine as defined in the following claims 1, 9 and 12, respectively.

Advantages of the Invention

[0016] One embodiment of the present invention provides a method and a corresponding dishwashing machine as well as a system composed of a dishwashing machine and a user-handheld portable device that can be used to:

- increase washing effectiveness;
- optimize drying effectiveness;
- reduce the consumption of salt for regenerating the resins used to reduce the degree of hardness (in French degrees) of the incoming water;
- reduce the consumption of rinse aid for dishware drying;
- ensure proper detergent dissolution.

BRIEF DETAILS OF THE DRAWINGS

[0017] The characteristics and advantages of the present disclosure will appear from the following detailed description of a possible practical embodiment, illustrated as a nonlimiting example in the set of drawings, in which:

- Figure 1 shows a flowchart of the method of the present invention;
- Figure 2 shows a front perspective view of a built-in dishwashing machine with the omission of the finishing panels, which is configured to carry out the method of Figure 1;
- Figure 3 shows a rear perspective view of the dishwashing machine of Figure 2 with the omission of some of its parts and the dishware;

- Figures 4A, 4B and 4C shows a sectional view of the dispenser, with tab, powder, liquid/gel detergents contained therein respectively;
- Figure 5 shows a flowchart of the system of the present invention;

DETAILED DESCRIPTION

[0018] Even when this is not expressly stated, the individual features as described with reference to the particular embodiments shall be intended as auxiliary to and/or interchangeable with other features described with reference to other exemplary embodiments.

[0019] Referring to the accompanying figures 2 and 3, numeral 1 designates a dishwashing machine, e.g. of built-in type, located in a kitchen cabinet, the finishing panels being omitted for better illustration of the internal volumes.

[0020] This dishwashing machine 1 comprises a washing area 2 and a door 3 adapted to be closely associated with the washing area 2.

[0021] The dishwashing machine 1 identifies a base 1A, usually designed to accommodate the mechanisms/devices required to carry out the specific operations of the machine 1.

[0022] The washing area 2 defines the volume in which the dishware S is arranged.

[0023] Namely, the washing area 2 is defined by a plurality of walls, such as the base wall 2A, the side walls 2B and 2C, the ceiling 2D and the bottom wall 2E and identifies an upper portion 2' and a lower portion 2".

[0024] The terms upper/lower shall be intended to be related to a proper installation and operation condition of the dishwashing machine 1. Here, the term upper designates the portion that is farther from the base 1A, and the term lower designates the portion that is closer to the base 1A.

[0025] The door 3 can be manually operated by the user and/or be power-assisted and has the purpose of hermetically closing the washing area 2 to avoid leakage of washing liquids while the cleaning program is being executed.

[0026] As used hereinbelow, the term dishware S, is intended to designate, for instance a dish, a piece of cutlery, a glass, a pot, etc.

[0027] The impellers 5 are well known in the art and will not be further described herein. It shall be simply noted that one or preferably two impellers may be located in the washing area. Namely, the first impeller is located in the lower area 2' proximate to the base 1A and the other is located in the upper area 2", preferably in the lower portion of the upper area.

[0028] A dish rack 21 is situated in the lower area 2' and/or the upper area 2", and has the purpose to accommodate the dishware S, in a manner that is known in the art and will not be further described herein.

[0029] As used herein the term dish rack is intended to designate any device and/or accessory that assists

dishware positioning, and is adapted to support the dishware S.

[0030] Such rack and/or accessories should be compatible with the size of the washing area 2 of the dishwashing machine 1.

[0031] The dishwashing machine 1 comprises a dispenser 6 whose shape defines a volume adapted to accommodate the products or detergents D1, D2, D3 required to clean the objects, namely the dishware S.

[0032] For example, these detergents, also referring to Figures 4A, 4B and 4C, may be in tab form D1 (Figure 4A), in powder form D2 (Figure 4B), or in liquid/gel form D3 (Figure 4C).

[0033] The dispenser 6 may comprise one or more compartments, each designed to receive a particular washing product.

[0034] In one aspect, the dispenser 6 comprises a door 7 which is configured to move between a closed position and a position allowing free access to the internal volume of the dispenser 6.

[0035] For example, when the door 7 is in the closed position, products are prevented from coming out of their respective compartments, whereas when the door 7 is in the open position, such washing products are allowed to come out, once the door 3 is in its closed position and a washing program P for washing dishware S has been selected.

[0036] In other words, the door 7 is moved between the closed position and the open position by being mechanically and/or electrically controlled by the control unit 4, once the door 3 of the dishwashing machine 1 has been closed.

[0037] In one aspect, also referring to Figure 4, the dispenser 6 is placed on the door 3, and particularly on the side facing the washing area 2, at a predetermined height. More particularly, the dispenser 6 is housed within the thickness of the door 3.

[0038] The dishwashing machine 1 comprises a control unit 4, e.g. situated within the thickness of the door 3, which has a motherboard with the usual electrical and electronic devices located thereon, including a CPU, a number of I/O ports for receiving and transmitting data, a memory bank, a portion whereof being designed to permanently store at least one cleaning program P.

[0039] The cleaning program P results from one or a combination of more than one of the following parameters:

- washing time
- washing pump pressure;
- temperature during the washing and drying steps;
- use of a water softening system.

[0040] The program P may also encompass other parameters, not described herein for simplicity.

[0041] The control unit 4 is a unit configured to control and supervise the operating functions of the dishwashing machine 1.

[0042] In one embodiment of the present invention, the memory of the control unit 4 is designed to also permanently store a database in which the detergents D1, D2, D3 and the dispenser volume are identified by appropriate parameters.

[0043] The detergents D1, D2, D3 are advantageously identified in the database by one or more digital parameters that can represent:

- the contour, in case of a tab detergent D1,
- roughness, in case of a powder detergent D2, or a liquid/gel detergent D3, as compared with a roughness threshold value.

[0044] The volume of the dispenser 6 is also advantageously identified in the database, through an initial capacity value.

[0045] In order to execute the selected cleaning program, the dishwashing machine 1 comprises a pump, for example arranged in the base 1A, which is adapted to be connected, in a manner that is known to a skilled person and will not be described herein, to a water mains supply.

[0046] This pump is controlled by the control unit 4 and has the purpose to convey water into the impellers 5 arranged in the washing area.

[0047] The dishwashing machine 1 comprises one or more optical devices 8 that can acquire digital images of the washing area 2.

[0048] In one aspect, the optical devices 8 are arranged with their optical system facing the dispenser 6.

[0049] Namely, each wall 2A, 2B, 2C, 2D and/or 2E of the washing area 2 can accommodate one or more of the aforementioned optical devices 8 in its thickness,

[0050] A housing 2F for each optical device 8 is provided for this purpose.

[0051] The housing 2F defines a volume adapted to accommodate its respective optical device and a light-transparent covering panel 8A preferably covers the optical system of the optical device.

[0052] This covering panel 8A is made, for example, of glass or plastic or materials having similar technical properties.

[0053] The covering panel 8A is preferably arranged substantially flush with or slightly projecting out of the surface of the wall 2A, 2B, 2C, 2D or 2E.

[0054] Particularly referring to Figure 4A, the housing 2F is formed, for instance, in the thickness of the ceiling 2D of the dishwashing machine 1 (and likewise in Figures 4B and 4C). All the electrical and electronic parts required for the operation of the optical device 8 are accommodated in this housing 2F. This arrangement is advantageous as it allows the optical device 8 to frame the detergent D1, D2, D3 as soon as the door 7 of the dispenser 6 is opened and prior to the release of the detergent into the washing area 2.

[0055] For example, still referring to Figure 4A, it may be appreciated that the optical device 8 has a field of

view 8B, allowing acquisition of images of the dishware S that falls within such field of view.

[0056] The purpose of the optical devices 8 in the dishwashing machine 1 is to acquire still and/or sequential two-dimensional digital images at predetermined acquiring speeds, usually in the visible range of the electromagnetic spectrum, such as a single frame, or a burst of images, or a seamless stream of images of the area of the dispenser 6.

[0057] Namely, the optical devices 8 acquire images of the detergent D1, D2, D3, once the door 7 of the dispenser 6 has been opened. As the door 7 is opened, the detergent D1, D2, D3 is released from the dispenser 6. It shall be noted that the aforementioned optical devices 8 preferably image the detergent D1, D2, D3 when it has not been entirely released yet.

[0058] These optical devices 8 are in signal communication with the control unit 4 via the I/O ports of the latter to send the acquired data to the control unit 4.

[0059] The optical devices 8 are embodied, for example, by a still camera and/or a video camera. These devices are known in the art and will not be described in further detail herein.

[0060] Nevertheless, it shall be noted that the still camera and/or the video camera as used in the dishwashing machine 1 preferably can acquire images with image acquiring times of less than one tenth of a second, and comply with the technical specifications for operation with water, i.e. the still camera and/or the video camera comply with the standard IP x(1-8).

[0061] Instead of or in addition to these technical specifications, the housing 2F in which the optical devices 8 are placed, is configured to be watertight, e.g. using sealing techniques.

[0062] The dishwashing machine 1 comprises a user interface 9, i.e. the control and monitoring interface through which the user may control and manage the operation and functions of the dishwashing machine.

[0063] For this purpose, the user interface 9 is in signal communication with the control unit 4 via the I/O ports of the latter to receive the data processed by the CPU of the control unit.

[0064] In one embodiment, the user interface 9 is a screen 23 which is integrated in the dishwashing machine 1 to be visible by a user during normal operation and/or with the addition of a buzzer (not shown).

[0065] In one aspect, referring to figures 2 and 2, the user interface 9 is integrated in the door 3 with such an orientation that the screen faces out of the washing area 2.

[0066] It shall be noted that the screen 23 of the user interface 9 is configured to display light indications, text messages and/or single or continuous images. Namely, the images displayed on screen may be the images of the washing area 2 and the objects therein provided acquired by the optical devices 8.

[0067] Particularly, the screen may be a touch (i.e. touch sensitive) screen.

[0068] In another embodiment, the user interface 9 comprises one or more analog buttons and/or a combination of analog/digital controls and/or a combination of analog/digital controls and a screen, the latter being, for instance, a touchscreen.

[0069] The buzzer of the user interface 9 has the purpose of providing acoustic warnings of any situations or operating conditions to the user.

[0070] In one embodiment, the dishwashing machine 1 comprises a radio transmitting/receiving apparatus, which is configured to provide signal communication with a wired and/or wireless network. For instance, the wireless network may be an Internet protocol-based network that uses a WI-FI connection or a Bluetooth-based WPAN (Wireless Personal Area Network).

[0071] In this case, the user interface 9 also comprises a portable device (i.e. a device that can be carried and held in a user's hand) 22 such as a smartphone, a tablet, a PC or similar instruments.

[0072] In other words, the user interface 9 comprises both the usual control interface of the dishwashing machine 1 and the screen of a portable device 22.

[0073] Particularly, the portable device 22 has its own radio transmitting/receiving apparatus, which is configured to establish a signal communication with the radio transmitting/receiving apparatus of the dishwashing machine 1.

[0074] In one aspect, the portable device 22 is not only able to communicate with the control unit 4 of the dishwashing machine 1, but also to connect through the Internet network, for example via a GSM infrastructure, to one or more remote servers 24 to carry out storage, saving and/or data processing operations on the images that have been acquired by the optical devices 8.

[0075] In other words, the portable device 22 is adapted to connect either directly with the dishwashing machine 1 and with the Internet network via the GSM infrastructure. Thus, a system 25 is provided which comprises the dishwashing machine 1, the portable device 22 which are in signal communication with each other via the GSM network, a WI-FI connection and/or a WPAN.

[0076] It shall be noted that the screen of the portable device 22 is configured to display light indications, text messages and/or images acquired by the optical devices 8.

[0077] In one embodiment of the present invention, if the user interface 9 also includes the portable device 22, then the database in which the contours of the dishware S are identified through appropriate parameters may be stored at least partially, preferably entirely, in the memory of the portable device 22, in a mass storage of the server and/or be distributed in the memories of the dishwashing machine 1, the portable device 22 and the server 23.

[0078] In one aspect, the control unit 4 is in signal communication with the user interface 9 (provided either as the screen of the dishwashing machine 1 or as a screen of the portable device) to notify through the user interface 9 the type of detergent that has been detected and/or the

changes made to one or more of said cleaning parameters of the cleaning program P.

[0079] As used herein the term changes made to one or more of said cleaning parameters of the cleaning program P is intended to designate any change to the parameters of the program parameters P as a result of the identification of the type of detergent.

[0080] Referring now to Figure 1, the method of automatically assessing the type of detergent in use in the dishwashing machine 1 comprises a step 10 of providing a detergent D1, D2, D3 in the dispenser 6, with the user placing the detergent he/she has selected in the compartment of the dispenser 6.

[0081] Once the door 7 of the dispenser 6 has been moved to the closed position, the program P has been selected through the interface 9 and the door 3 of the dishwashing machine 1 has been moved to the closed position, the method comprises the step 11 of acquiring a first digital image 11A representative of the detergent D1, D2, D3.

[0082] It shall be noted that the method steps as described hereinbelow, i.e. the steps of acquiring and processing may be carried out either directly by the CPU of the control unit 4 or more preferably by the CPU of the portable user device via the Internet connection with the CPU of remote servers for analysis and data processing.

[0083] This acquisition step 11 is carried out through the optical device/s 8 located in the washing area 2.

[0084] For this purpose, the control unit 4 supervises the acquisition step by controlling the optical device/s 8.

[0085] It shall be noted that the acquired image 11A preferably comprises a burst of images and hence more than a single frame. The burst of images is advantageous because, once the door 7 of the dispenser 6 has been moved from the closed position to the open position, the detergent D1, D2, D3, is moved by gravity from the dispenser 6 to the washing area 2. Therefore, by acquiring multiple images 11A by the optical device/s 8 multiple frames 11A that depict the detergent D1, D2, D3 are obtained.

[0086] In one aspect, the preferred number of frames that make up the burst of images 11A is equal to or greater than three, preferably equal to four, five or six.

[0087] Particularly, the image 11a is acquired when the door 7 of the dispenser 6 moves from the closed position to the open position.

[0088] In other words, the acquisition step 11 is carried out during the time interval between the time at which the door 7 is opened and the time at which the detergent D1, D2, D3 is released into the washing area 2 of the dishwashing machine 1.

[0089] For example, the time interval in which the optical device 8 must acquire the image 11A is equal to or smaller than one second.

[0090] The method comprises a step 12 of digitally processing the first acquired image 11A to obtain a first processed image 12A, in which such first processed image 12a identifies either:

- at least a partial contour Cpar the detergent D1, D2, D3 or
- a roughness value Racq of the detergent D1, D2, D3.

[0091] In other words, the control unit 4 and/or the user-held portable device are used to start a process in which the first image 11A is processed to identify at least a portion of the contour Cpar of the detergent or the roughness value Racq of the detergent.

[0092] Particularly, the at least a portion of the contour Cpar is identified in case of a tab detergent D1 or a powder detergent D2, whereas the roughness Racq is identified in case of a powder detergent D2, or a liquid/gel detergent D3, as described below.

[0093] The method comprises a step 13 of comparing the at least a portion of the contour with a predetermined contour Cpred or comparing the roughness value with a roughness threshold value Rth to define a type TD of detergent.

[0094] Namely, the comparison step 13 may be implemented, for instance, by comparing the various portions of detergent that have been imaged with the contours of the tabs or the roughness values that have been previously stored in a database residing in the memory of the control unit 4 or in the memory of the user-held portable device or in a server remote from both the dishwashing machine 1 and the user handheld portable device.

[0095] Namely, the contours of the tabs 5 and/or the roughness value are known to the manufacturer of the dishwashing machine 1 and can be stored beforehand and directly compared with those in the first processed image 12A.

[0096] This comparison step 13 will result in the definition of the type of detergent TD1, TD2, TD3, i.e. The recognition of a tab, powder or liquid/gel detergent, respectively.

[0097] As a result of the comparison step 13 the method comprises a step 14 of changing one or more of the cleaning parameters of the cleaning program P according to the type of detergent.

[0098] Namely, the cleaning parameters of the cleaning program P that can be changed according to the type of detergent that has been detected are one or a combination of more than one of the following parameters:

- washing time
- washing pump pressure;
- temperature during the washing and drying steps;
- use of a water softening system.

[0099] By way of example, for a so-called "quick" cycle, i.e. a cycle in which the detergent is released during the washing step when both the washing pump and the heating resistor are operating, the parameters of the cleaning program P that can be changed vary according to whether a liquid detergent D2/D3 or a tab detergent D1 has been recognized.

[0100] In the case of a liquid detergent D2/D3, the pro-

gram P operates the washing pump and the heating resistor for a first predetermined time interval, e.g. a few minutes, and then continues with the washing operation for a second time interval, that is longer than the first time interval. The next rinsing step includes a washing and heating step whose duration is equal to a third time interval, shorter than the first time interval.

[0101] In the case of a liquid detergent D1, the program P operates the washing pump and the heating resistor for a first time interval and then continues with the washing operation only for a second time interval, that is shorter than the first time interval. The next rinsing step includes a washing and heating step whose duration is equal to a third time interval, that is shorter than the first and second time intervals. By changing the washing cycle, the same performance and the complete dissolution of the tab are ensured.

[0102] Still referring to Figure 1, in the method, the comparison step 13, when comparing the at least a portion of the acquired contour Cpar with a predetermined contour Cpred, comprises a step of checking such said at least a portion of the acquired contour Cpar is analogous to the predetermined contour Cpred, to thereby determine the type of detergent TD1, such as a detergent tablet, i.e. a tab D1.

[0103] As used herein, the term analogous is intended to designate the case in which the portion of the acquired contour Cpar is comparable or similar, within a predetermined percent deviation, with the tab contour that has been previously stored. For example, if the comparison results in deviation of 10% or less between the acquired portion of the contour Cpar and the stored contour Cpred, then the acquired portion of the contour Cpar will be identified as belonging to a previously stored contour. Otherwise, the acquired image 11A is repeatedly processed until the type of detergent is determined or identified as a detergent with average characteristics (i.e. with average chemico-physical properties).

[0104] Still referring to Figure 1, in the method, the comparison step 13, in case of comparison between the acquired roughness value Racq with a threshold roughness value Rth, comprises the step of assessing whether such acquired roughness value Racq is:

- higher than the threshold value Rth to thereby determine that the type of detergent TD2 is powder, i.e. the detergent D2, or
- lower than the threshold value for Rth to thereby determine the type of detergent TD3 as a liquid/gel, i.e. the detergent D3.

[0105] For example, also referring to Figure 4C, it shall be noted that the step of comparing the threshold value Rth with the acquired value Racq is carried out by assessing the deviation between the two imaginary lines, even when the door 7 has been opened.

[0106] In one aspect, the method can detect whether there is a detergent D1, D2 or D3 in the dispenser 6.

[0107] For this purpose, the method comprises a step 15 of providing a first capacity value V_{in} for the dispenser 6, said first value identifying the volume of the dispenser when it is empty.

[0108] The method comprises a step of processing 17 the first captured image 11a to generate a second processed image 12B that defines a second capacity value for the dispenser 6, i.e. the value identifying the volume of the dispenser 6 when there is a detergent D1, D2 or D3 therein.

[0109] The method includes a step of comparing (18) the first processed image 12A with the second processed image 12B to determine a residual capacity value V_{res} identifying the free volume of the dispenser 6.

[0110] Namely, in the method, if this comparison step 18 results in a residual capacity value V_{res} that is greater than 60% based on the first capacity value V_{in} , then there is no detergent in the dispenser 6.

[0111] It shall be noted that the result of the comparison step 18 may be combined with the processing step 12 to combine the information that can be obtained from the processed image 12A with the residual capacity value V_{res} to thereby obtain a higher degree of reliability in the identification of the type of detergent TD1, TD2, TD3.

[0112] The method comprises a step 23 of notifying the type of detergent TD1, TD2, TD3 and/or the changes made to one or more of the parameters of the cleaning program P, through the user interface 9, to promptly inform the user of the changes that have been made.

[0113] As mentioned above, the method and the dishwashing machine 1 allow a change of the operating state of the machine to be notified through the user interface 9, allowing actions to be taken to restore the proper installation conditions of the object. This will reduce the need to wash part of the dishware and/or repeat the washing cycle, leading the water, detergent and power consumption.

[0114] Those skilled in the art will obviously appreciate that a number of changes and variants as described above may be made to fulfill particular requirements, without departure from the scope of the invention, as defined in the following claims.

Claims

1. A method of automatically assessing the type of detergent in use in a dishwashing machine (1), said dishwashing machine (1) comprising a dispenser (6) with one door (7) configured to move between a closed position and an open position, and being designed to implement a cleaning program (P) defined by a plurality of cleaning parameters, said method comprising the step of

- providing a detergent (D1, D2, D3) in said dispenser (6);
- said method being **characterized in that it**

comprises the steps of:

- acquiring (11) a first digital image (11A) representative of said detergent (D1, D2, D3) when said door (7) moves from said closed position to said open position;
- digitally processing (12) said first acquired image (11A) to obtain a first processed image (12A); wherein said first processed image (12A) defines either a contour portion (Cpar) or a roughness value (Racq) of said detergent (D1, D2, D3),
- comparing (13) said at least one contour portion (Cpar) with a predetermined contour (Cpred) or comparing said roughness value (Racq) with a roughness threshold value (Rth) to determine a type of detergent (TD1, TD2, TD3);
- changing (14) one or more of said cleaning parameters of said cleaning program (P) according to said type of detergent (TD1, TD2, TD3).

2. A method as claimed in claim 1, wherein said step of comparing (13) said at least one a contour portion (Cpar) with a predetermined contour (Cpred) comprises a step (15) of checking whether said at least a partial contour (Cpar) is similar to said predetermined contour (Cpred), to determine the type of detergent such as a detergent tablet.

3. A method as claimed in claim 1, wherein said step of comparing (13) said roughness value (Racq) with a roughness threshold value (Rth) comprises the step of assessing whether said roughness value (Racq) is higher than said roughness threshold value (Rth) to determine the type of detergent as a powder.

4. A method as claimed in claim 1, wherein said step of comparing (13) said roughness value (Racq) with a roughness threshold value (Rth) comprises the step of assessing whether said roughness value (Racq) is lower than said threshold value (Rth) to determine the type of detergent as a liquid.

5. A method as claimed in any of the preceding claims, comprising a step (15) of providing a first capacity value (V_{in}) for said dispenser (6), said first value identifying the volume of said dispenser when it is empty; and wherein:

- processing (17) said first image (11A) to generate a second processed image (12B) that defines a second capacity value for said dispenser, said second capacity value identifying the volume of said dispenser with said detergent therein;
- comparing (18) said first processed image

- (12A) with said second processed image (12B) to determine a residual capacity value (Vres) identifying the free volume of said dispenser.
6. A method as claimed in claim 5 wherein, if said residual capacity value (Vres) is higher than said first capacity value (Vin) by 60%, said detergent type corresponds to an empty dispenser. 5
7. A method as claimed in any of the preceding claims, wherein said cleaning parameters of said cleaning program (P) are one or a combination of more than one of the following parameters: 10
- washing time 15
 - washing pump pressure;
 - temperature during the washing and drying steps;
 - use of a water softening system. 20
8. A method as claimed in any of the preceding claims, wherein said dishwasher (1) comprises a user interface (9), the method comprising the step of indicating said detergent type and/or the changes made to one or more of said cleaning parameters of said cleaning program via said user interface (9). 25
9. A dishwashing machine (1) comprising a washing area (2) and a door (3) designed to be associated with said washing area to close it, a control unit (4) having a memory with a cleaning program (P) stored therein, a pump adapted to be connected to a water mains supply connection to withdraw water from the mains, one or more impellers (5) in fluid communication with such pump, a dispenser (6) having a door (7) configured to move between a closed position and an open position, one or more resistive means to change the temperature of water from the mains, one or more optical devices (8) that can acquire digital images (11, 16) of said dispenser and a user interface (9), said one or more optical devices (8) and user interface (9) being in signal communication with said control unit (4), **characterized in that** it comprises a program residing in another portion of said memory, which is configured to carry out the steps as claimed in any of the preceding claims 1 to 8. 30 35 40 45
10. A dishwashing machine as claimed in claim 9, wherein said user interface (9) is a screen integrated in said dishwashing machine, said screen (23) being configured to display said detergent type (TD1, TD2) and/or the changes made to one or more of said cleaning parameters of said cleaning program through warning lights, texts and/or images. 50
11. A dishwashing machine as claimed in claim 9, wherein said dishwashing machine comprises a radio transmitting apparatus and said user interface 55
- (9) is a portable device having its own radio transmitting apparatus configured to establish a signal communication with said radio transmitting apparatus of said dishwashing machine to thereby receive data representative of said detergent type (TD1, TD2, TD3) and/or the changes to one or more of said cleaning parameters of said cleaning program through warning lights, messages and/or images.
12. A system for automatically assessing the type of detergent in use in a dishwashing machine (1), comprising:
- a dishwashing machine comprising a washing area (2) and a door (3) designed to be associated with said washing area (2) to close it, a control unit (4) having a memory with a cleaning program stored therein, a pump adapted to be connected to a water mains supply connection to withdraw water from the mains, one or more impellers (5) in fluid communication with such pump, a dispenser (6) having a door configured to move between a closed position to an open position, one or more resistive means for changing the temperature of water from the mains, one or more optical devices (8) that can acquire digital images of said dispenser and a user interface (9), said one or more optical devices (8) and user interface (9) being in signal communication with said control unit (4) as well as said pump, and a transmitting/receiving radio apparatus;
 - a portable device (22) designed to be handheld by a user, having its own radio transmitting/receiving apparatus configured to establish a signal communication with said radio transmitting/receiving apparatus of said dishwashing machine, a screen configured to display warning lights, messages and/or images and a memory,
- characterized in that it comprises** a program residing in a portion of said memory of the user-handheld portable device (22), said program being configured to carry out the steps as claimed in any of the preceding claims 1 to 9, for said detergent type (TD1, TD2, TD3) and/or the changes made to one or more of said cleaning parameters of said cleaning program to be displayed on said interface (9) and/or said screen of said user-handheld portable device through warning lights, texts and/or images.

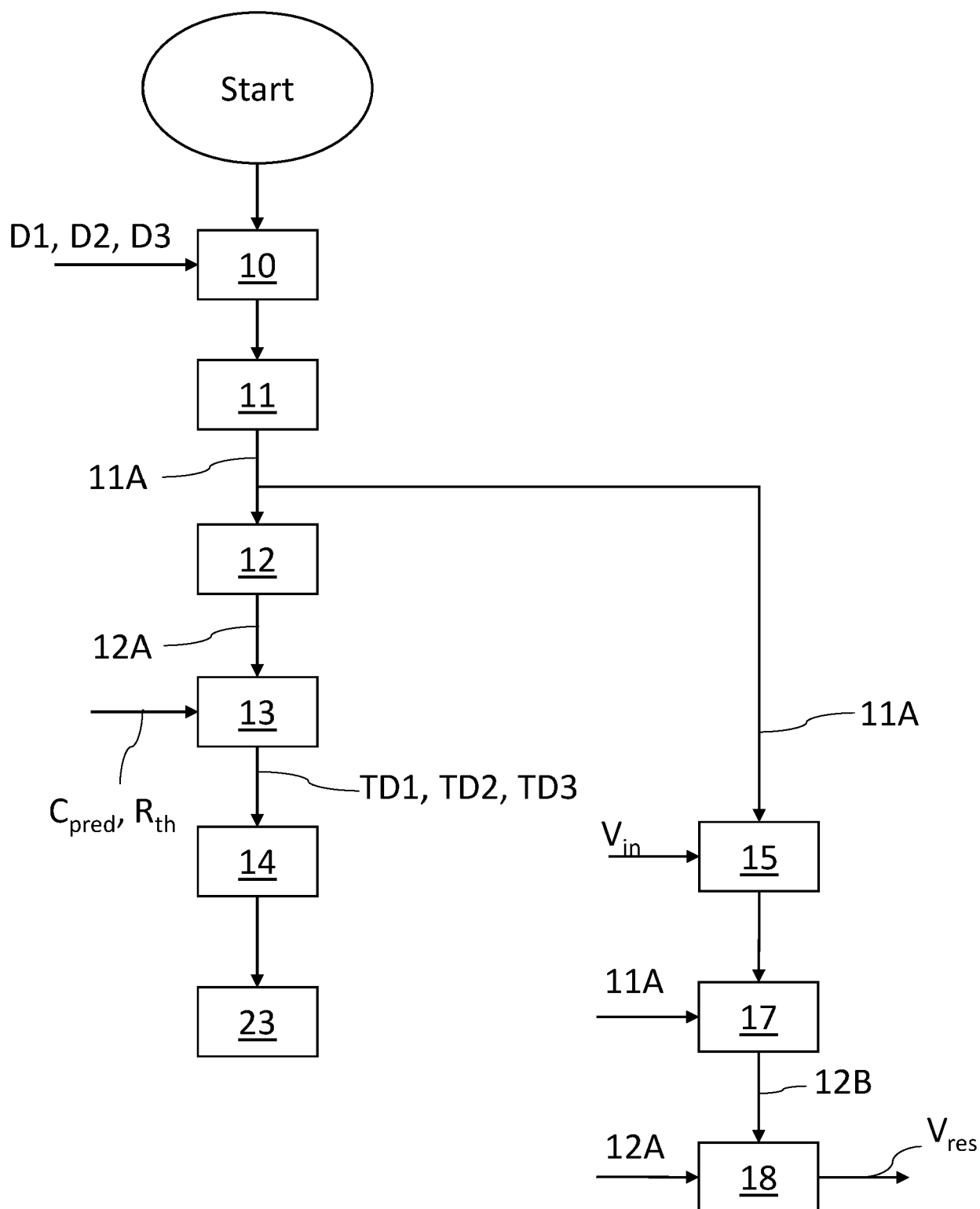


Fig. 1

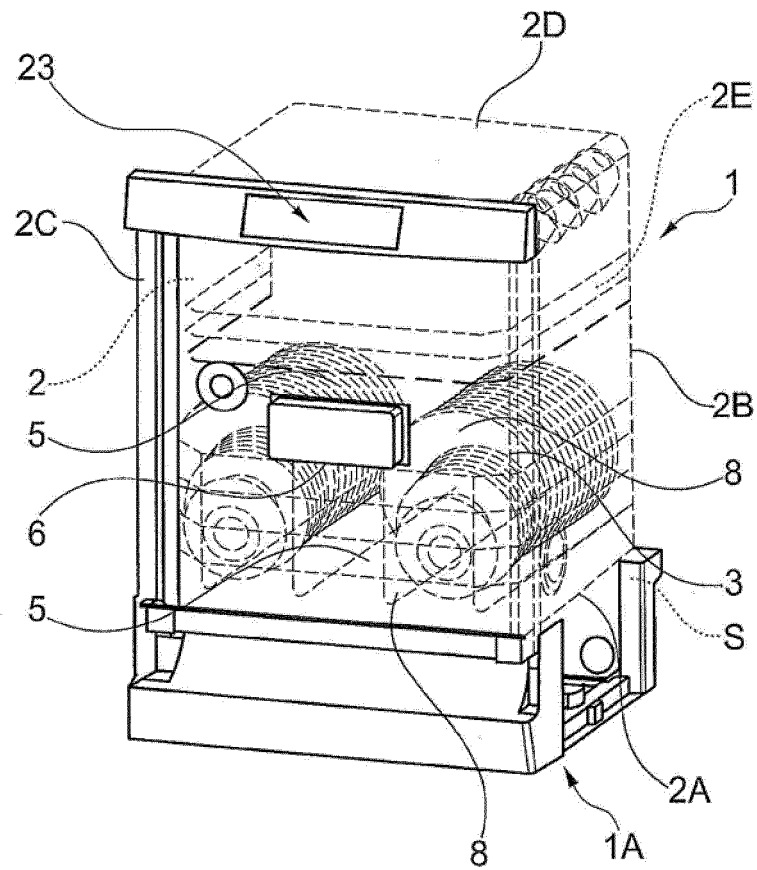


Fig. 2

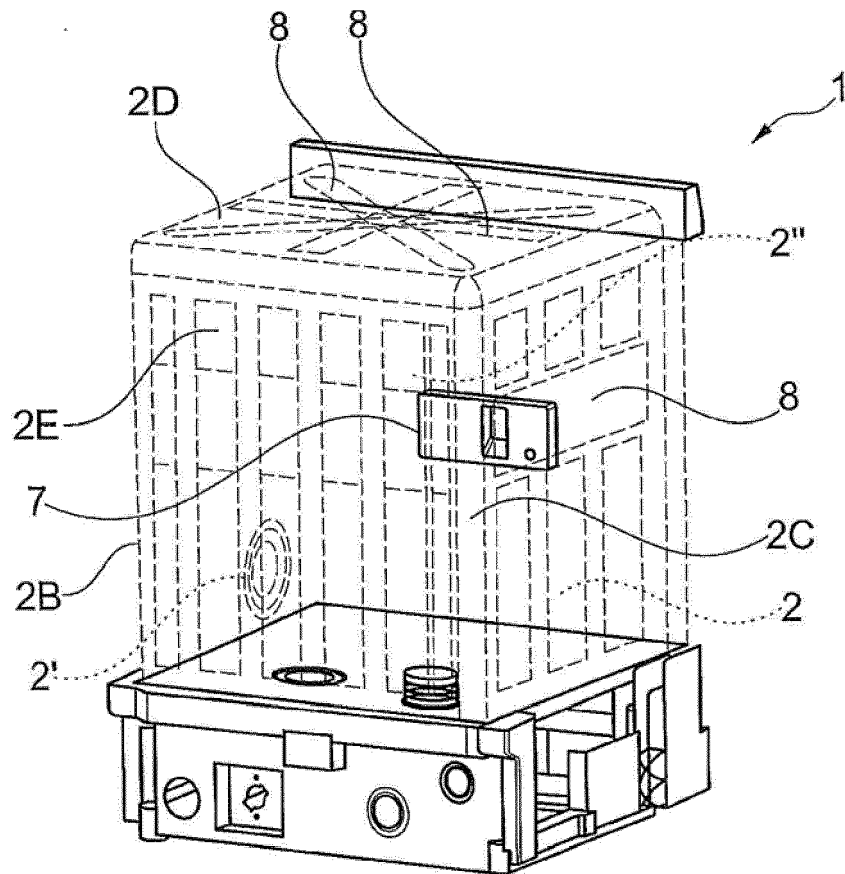


Fig. 3

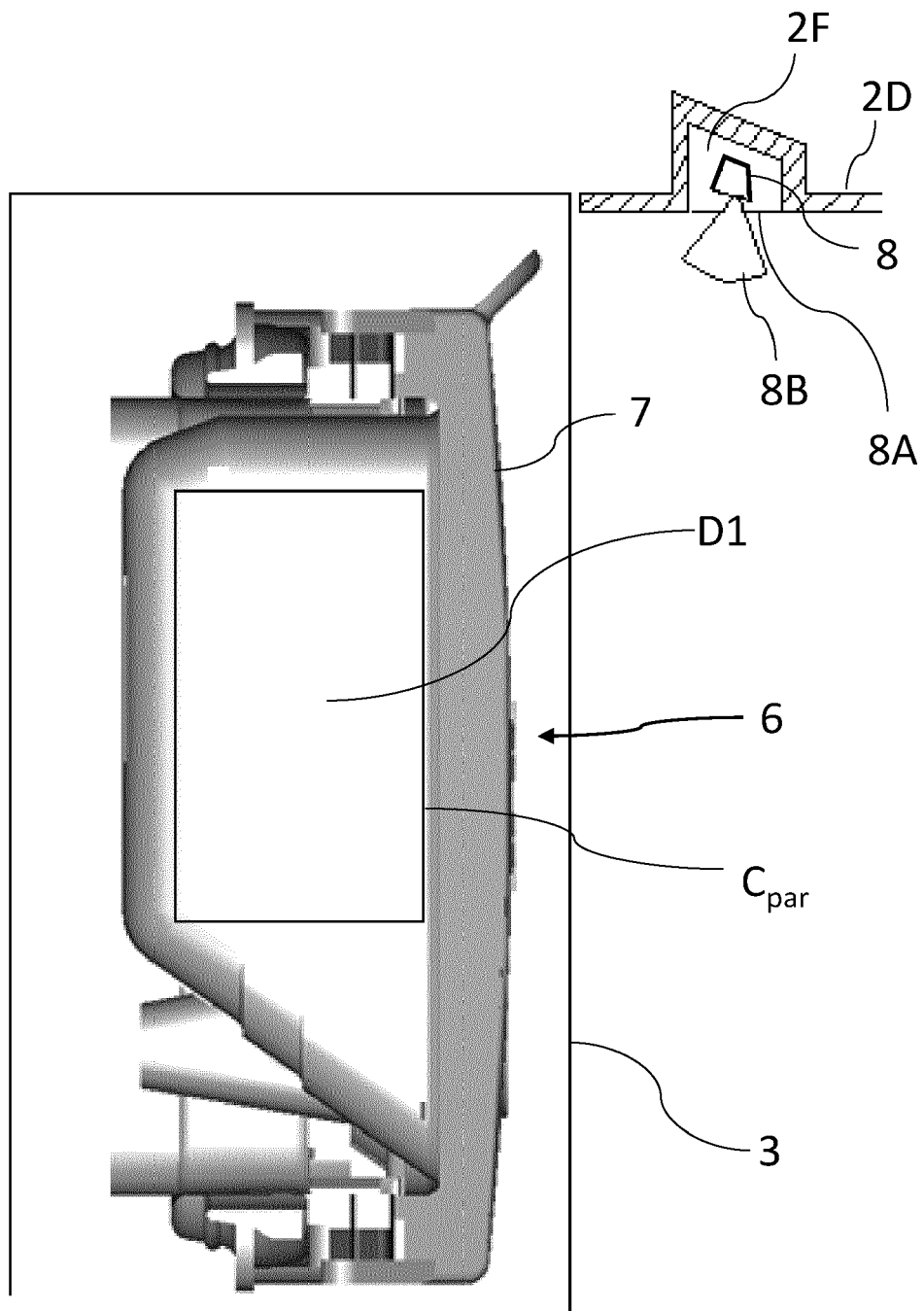


Fig. 4A

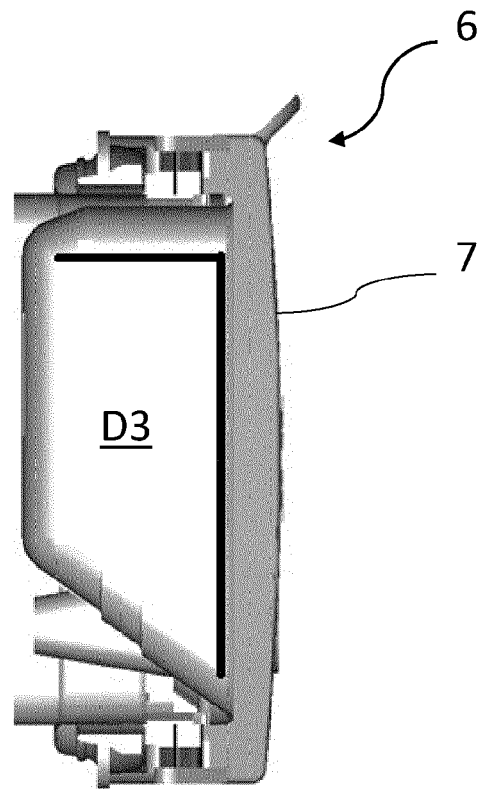


Fig. 4B

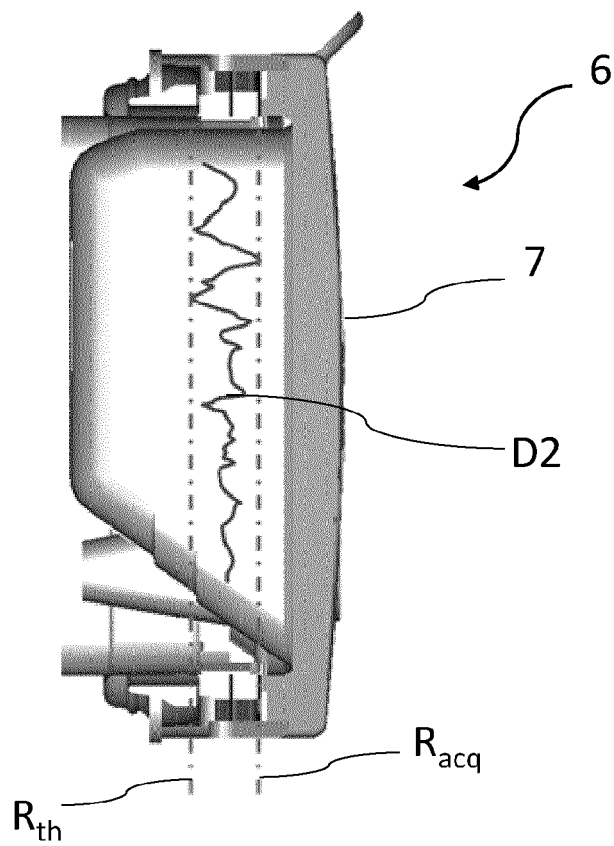


Fig. 4C

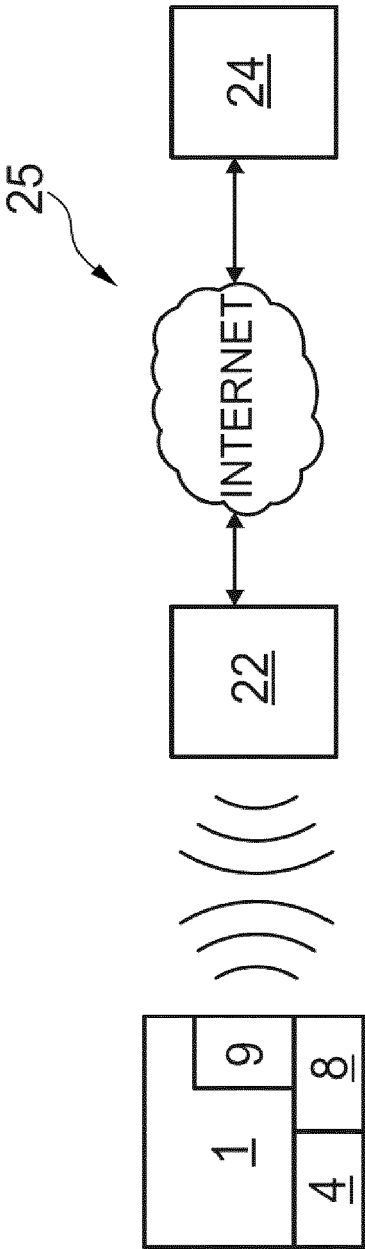


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 18 20 1770

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			A47L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 December 2018	Examiner Beckman, Anja
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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