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HOUSEHOLD APPLIANCE WITH USER INTERFACE

(57) A household appliance (1) comprises a housing (2) with an outer wall (3) forming an outer surface (4), a treatment seat (5) formed in the, or on the housing (2) and adapted to receive or support domestic products in a treatment position (6), a treatment device (7) arranged inside the housing (2), a treatment detector (8) configured to detect a value of a treatment parameter, an electronic control system (10) in signal connection with the treatment device (7) and with the treatment detector (8) and configured to command the treatment device (7) in dependency of a treatment program and in dependency of the value detected by the treatment detector (8), a user interface (11) in signal connection with the electronic control system (10), wherein the user interface (11) comprises at least one video projector (14) mounted onto the household appliance (1) at the outer wall (3) and configured to visualize treatment program parameters, by means of a process of light projecting onto a display area (15) of the outer surface (4) of the housing (2) and at least one command input sensor (16) adapted to detect a movement of the user's hand at the display area (15) and to generate a corresponding hand movement signal, wherein the electronic control system (10) processes the hand movement signal and generates a user command signal, sets the treatment program parameters in dependency of the user command signal generated, and commands the visualization by means of the video projector (14) in dependency of the user command signal generated.

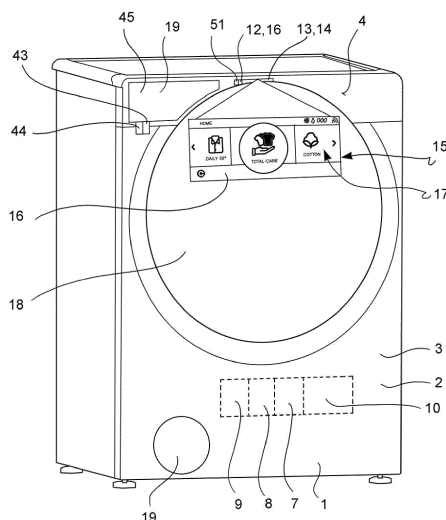


FIG. 1

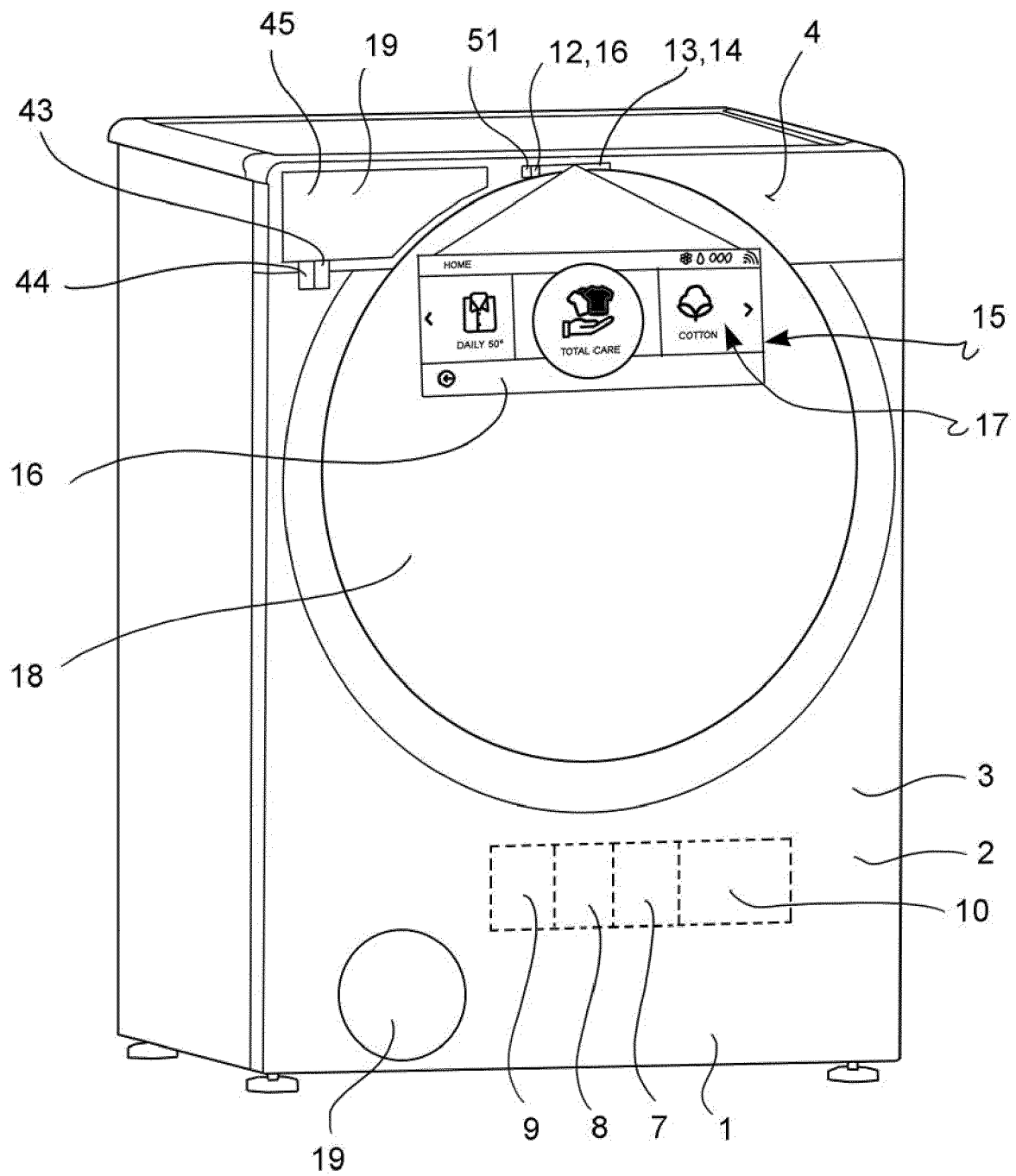


FIG. 1

Description

[0001] The present invention relates to a household appliance with a user interface for visualizing control information and for inputting commands for controlling the operation of the household appliance.

[0002] In general terms, the household appliances to which the invention relates comprise:

- a housing which delimits a treatment seat adapted to receive and/or to support one or more household products (linen, crockery, food products, furniture surfaces, fabrics) in a treatment position to subject them to a desired treatment;
- one or more treatment devices arranged inside the housing which can be actuated to perform one or more specific treatments in the treatment position;
- one or more treatment detector devices arranged inside the housing and configured to detect one or more values of the treatment parameters of the treatment to which the domestic product is subjected in the treatment position,
- optionally, one or more anomaly detectors arranged inside the housing and configured to detect one or more operating anomalies of the household appliance,
- an electronic control system arranged in the housing and in signal connection with the treatment device and with the treatment detector and configured to control the treatment device in dependency of a treatment program and in dependency of the values detected by the treatment detector,
- a user interface in signal connection with the electronic control system to allow the user to select (parameters of) a treatment program of the domestic product and for visualizing parameters of the selected and/or running treatment program.

[0003] In the household appliances of the prior art, the user interface is formed in one or more fixed positions of the housing or of the treatment seat (refrigerator) and comprises one or more buttons or knobs or capacitive touch sensors and, possibly, visual indicators, e.g. warning lights or a liquid crystal display (TFT) or OLED.

[0004] The user interfaces of the household appliances of the prior art were satisfactory at a time in which the development of strategies and treatment parameters, OSDs, communication data and electronic control went hand in hand with the development of processing apparatuses, with the evolution of the design of the household appliance housings and with the average lifetime of the appliances.

[0005] In the current state, the domestic product treatment strategies, the electronic control and data communication technology, the amount of treatment data and parameters available and potentially usable for controlling household appliances and the aesthetic design of the household appliance housings are rapidly evolving

and frequently, one either conflicts or "lags behind" the other.

[0006] A reason for dissatisfaction of known household appliances is the impossibility of providing user interfaces that are sufficiently large and extended to display large amounts of treatment control information, without spatial interference with other components of the household appliance.

[0007] A further reason for dissatisfaction with known household appliances is the conflict between the need for flat and extended housing surfaces to position a liquid crystal display (TFT) or OLED and the desire for an innovative design of the appliance with curved surfaces and with freely definable colors and surface structures.

[0008] A further reason for dissatisfaction with known household appliances is the conflict between the need to have very large openings and access doors or hatches, the relatively small outer dimensions being the same, in order to facilitate the loading of the household products in the household appliance and the need to provide, often on the same front walls of the appliance, free spaces for installing the user interface.

[0009] A further reason for dissatisfaction with known household appliances is that, today, a specific concept of user interface must be designed in close connection with a specific project of the household appliance and its exterior design, making it difficult to transfer a new concept of user interface to a preexisting household appliance, the exterior design of which one wishes to keep or to another type of household appliance having a different external shape.

[0010] Thus, it is the object of the present invention to provide a household appliance with a user interface having features such as to avoid at least some of the drawbacks of the prior art.

[0011] It is a further object of the invention to provide an appliance with a user interface having features such as to be easily adaptable to household appliances with non-continuous surfaces, e.g. in the presence of moving parts (hatch, door, detergent drawer) and/or non-planar parts, and which can be easily applied and transferred between housings with different aesthetic design, versatile with reference to display size, to the information to be visualized and to the input commands to be allowed.

[0012] These and other objects are achieved by a household appliance with a user interface according to claim 1. The dependent claims relate to advantageous and preferred embodiments.

[0013] According to an aspect of the invention, the display means of the user interface comprise at least one video projector mounted onto the household appliance at its outer wall and configured to visualize, by means of a light projecting process onto a display area of the outer surface of the housing.

[0014] The visualization by means of light projection allows to make user interfaces with a display field that is sufficiently large and extended for visualizing a large amount of treatment control information, without any spa-

tial interference with the various components which form the outer surface of the household appliance.

[0015] Visualizing by means of light projection also allows a visualization on interrupted surfaces or on surfaces consisting of areas of different structure and/or color, as well as on non-planar surfaces and thus allows an innovative aesthetic design of the household appliance with curved surfaces and with freely definable colors and surface structures.

[0016] Visualizing by means of light projection also allows very large openings and access doors or hatches in order to facilitate the loading of the domestic products to be treated, without any need to provide additional spaces devoted exclusively to visualization only, the visualization being possible, at least in part, on the same access doors (e.g. in the case of an oven, a refrigerator or a laundry or dish washing/drying machine) or even on the treatment seat (e.g. in the case of a cook top or an ironing board) if the latter forms part of the outer surface of the housing.

[0017] The video projector can be at least partially concealed by the housing and its dimensions do not depend on the size or direction of the performed light projection. This facilitates the transfer of a user interface concept between household appliances with different exterior designs.

[0018] According to a further aspect of the invention, the user command insertion means comprise at least one command input sensor adapted to detect a positioning and/or a movement of the user's hand at the display area, and the electronic control system comprises association means which:

- associate the detected hand position and/or movement with command input fields visualized by means of the video projector (e.g. buttons, knobs, virtual sliders) in the display area, and
- generate corresponding command input signal.

[0019] The electronic control system is configured to set the treatment program parameters in dependency of the generated command input signals.

[0020] Further advantageous aspects of the invention will be apparent from the following description of some embodiments provided by way of non-limiting example with reference to the accompanying figures, in which:

- figures 1 - 5 are perspective views of a washing machine according to an embodiment of the invention,
- figure 6 is a front view of a cooking oven according to an embodiment of the invention,
- figures 7a, 7b, 7c, 7d are diagrammatic section views of a detail of the user interface of the household appliance according to embodiments,
- figures 8a, 8b are section views of a detail of the housing of the household appliance at a display area according to embodiments,
- figure 8c is a front view of a detail of the housing of

the household appliance at a display area according to an embodiment,

- figure 9 is a diagrammatic view of a washing machine according to an embodiment;
- figure 10 is a diagrammatic view of a tumble dryer according to a further embodiment of the invention,
- figure 11 is a diagrammatic view of a washing and drying machine according to a further embodiment of the invention;
- figure 12 is a diagrammatic view of a dishwasher according to an embodiment;
- figure 13 is a diagrammatic view of a domestic cooking oven according to an embodiment,
- figure 14 is a diagrammatic view of the functional groups of a domestic microwave oven according to an embodiment.
- figure 15 is a diagrammatic view of the functional groups of an electric or induction cook top according to an embodiment,
- figure 16 is a diagrammatic view of the functional groups of a gas cook top according to an embodiment,
- figure 17 is a diagrammatic view of the functional groups of a refrigerator according to an embodiment,
- figure 18 is a diagrammatic view of the functional groups of a freezer according to an embodiment,
- figure 19 is a diagrammatic view of the functional groups of a vacuum cleaner according to an embodiment,
- figure 20 is a diagrammatic view of the functional groups of an ironing system according to an embodiment.

[0021] With reference to the figures, a household appliance 1 comprises:

- a housing 2 with an outer wall 3 forming an outer surface 4 of the household appliance 1,
- a treatment seat 5 adapted to receive and/or support domestic products in a treatment position 6,
- at least one treatment device 7 arranged inside the housing 2 which can be operated to perform a treatment at the treatment position 6 and subjecting the domestic product to said treatment,
- at least one treatment detector 8 arranged at least partially inside the housing 2 and configured to detect a value of a treatment parameter of the treatment performed by the treatment device 7,
- optionally, at least one anomaly detector 9 arranged at least partially inside the housing 2 and configured to detect a value indicative of an operating anomaly of the household appliance 1,
- an electronic control system 10 arranged in the housing 2 and in signal connection with the treatment device 7 and with the treatment detector 8 and configured to command the treatment device 7 in dependency of a treatment program and in dependency of the value detected by the treatment detector 8,

- a user interface 11 in signal connection with the electronic control system 10, said user interface 11 comprising:
 - command insertion means 12 for inputting commands (by a user) for selecting parameters of the treatment program and for inputting a command for executing the treatment program, and
 - display means 13 which visualize the selectable parameters of the treatment program and/or visualize treatment parameters during the execution of the treatment program.

[0022] According to an aspect of the invention, the display means 13 comprise at least one video projector 14 mounted onto the household appliance 1 at the outer wall 3 and configured to visualize, by means of a light projecting process onto a display area 15 of the outer surface 4 of the housing 2.

[0023] According to a further aspect of the invention, the user command insertion means 12 comprise at least one command input sensor 16 adapted to detect a positioning and/or a movement of the user's hand at the display area 15, and generate a corresponding hand position and/or movement signal. The electronic control system 10 and/or the user interface 19 comprises an interpretation and association module which receives and processes the hand position and/or movement signal and generates a user command signal in dependency of which the electronic control system 10 sets the treatment program parameters and/or controls the display, by means of the video projector 14.

[0024] Detailed description of the display area 15 of the outer surface 4

[0025] According to an embodiment, in the areas of the outer surface 4 provided to implement the visualization by projecting of light, the outer surface 4 is colored and treated so as to have a higher light reflectivity with respect to an area which is not intended for visualization.

[0026] According to a further embodiment, in the display area 15, the outer surface 4 may be either continuous or discontinuous, e.g. formed by parts of the appliance 1 connected to one another without mutual continuity of the outer surface and/or moving parts.

[0027] According to an embodiment, in the areas of the outer surface 4 intended for implementing the visualization by projecting light, the outer surface 4 may be planar or non-planar, e.g. curved.

[0028] According to an embodiment, the household appliance 1 comprises a door 18 for closing the treatment seat 5 during the execution of the treatment program and the display area 15 may extend at least also on the part of the outer surface 4 formed by the door 18.

[0029] According to an embodiment, the treatment seat 5 is exposed directly to the outside of the household appliance 1 and forms at least part of the outer surface 4, and the display area 15 extends at least also on the part of the outer surface 4 formed by the treatment seat 5.

[0030] According to an embodiment, the housing 2 of the appliance 1 forms an auxiliary access opening for an accessory (e.g. a detergent drawer, a bag of powder, a filter, a condensation collection drawer) of the one or more treatment devices 7, which can be closed by an auxiliary cover 19 during the execution of the treatment program, and the display area 15 can extend at least also on the part of the outer surface 4 formed by the auxiliary cover 19.

Detailed description of the video projector 14

[0031] According to an embodiment, the household appliance 1 comprises a single video projector 14.

[0032] According to a further embodiment, the household appliance 1 comprises a plurality of said video projectors 14 configured to project light onto one same display area 15 and/or onto a plurality of said display areas 15 which are distinct and at a distance or adjacent to each other.

[0033] The individual video projectors 14 may be positioned on two opposite or different sides of the display area 15 and project in opposite directions or in different directions, in order to avoid the appearance of shadows when approaching of the user's hand to the display area 15.

[0034] In the event of multiple light projections on the same display area, the video projectors 14 are configured and controlled by the electronic control system 10 so that the light wavelengths and/or the lighting frequency are compatible and do not imply destructive interferences of the projected light.

[0035] According to an embodiment, the electronic control system 10 or the video projector 14 comprises anti-distortion means configured to calculate and generate a pre-counter-distorted image to be projected, e.g. by means of rectangle-to-trapezium pre-counter-distortion, in the opposite direction with respect to an inclined projection, e.g. from rectangle to trapezium, of the image projected onto the outer surface 4 because of the light cone of the video projector 14 and of the inclination of the projection axis with respect to the outer surface 4 in the display area 15.

[0036] The pre-counter-distortion of the image occurs in dependency of the projection cone angle and of the inclination angle of the projection axis of the video projector 14 with respect to the outer surface 4 in the display area 15, so as to compensate the projection distortion. In this manner, it is possible, for example, to obtain a projected image with a rectangular or circular or oval contour, symmetrical with respect to two perpendicular symmetry axes.

[0037] According to embodiments, the one or more video projectors 14 may comprise one or more of:

- LCD video projector (liquid crystal display video projector)
- DLP video projector (micro-mirror video projector)

- LCoS video projector (Liquid Crystal on Silicon)
- D-ILA Video projector (Digital Direct Drive - Image Light Amplifier)
- SXRD video projector (Silicon X-tal Reflective Display)
- LP video projector (laser video projector), e.g. monochromatic,
- DLP video projector (Digital Light Processing)

[0038] With particular advantage, in order not to interfere with the aesthetic design of the housing 1, the one or more video projectors 14 are configured as micro or pico projectors.

[0039] According to an embodiment, the video projector 14 is positioned entirely inside the housing 2 on an inner side 20 of the outer wall 3 and performs the light projection through a window opening 21 formed in the outer wall 3. The window opening 21 may be a through opening or protected by a protective wall 22 which is transparent and/or which can be opened and closed by means of a protective cover 23 and/or by means of a shutter 24. This allows to conceal and protect the video projector 14.

[0040] According to an embodiment, the video projector 14 comprises an inner part 25 located entirely inside the housing 2, i.e. on an inner side 20 of the outer wall 3, and an outer part 26 positioned completely outside the housing 2, i.e. on an outer side of the outer wall 3, wherein the volume of the inner part 25 is greater than the volume of the outer part 26. This reduces the visual impact of the video projector on the aesthetic appearance of the household appliance.

[0041] According to an embodiment, the video projector 14 is supported in a concealable and movable manner between a rest position inside the housing 2 and a work position, in which the video projector 14 protrudes at least partially outside the housing 2.

[0042] According to an embodiment, the position and/or orientation of the video projector 14 are adjustable, e.g. by means of the electronic control system 10.

[0043] Similarly, the position of the display area 15, or in other words the position of the display, is adjustable, e.g. by means of the electronic control system 10.

[0044] The appliance 1 or the video projector may comprise a sharpness detector and/or a focal length detector, e.g. an optical sensor, and be configured for autofocus in dependency of a sharpness or focal length signal generated by the sharpness or focal length detector.

[0045] The control system 10 may also be configured to visualize, by means of the video projector 14, alarms or warnings directly at a component (e.g. door 18, auxiliary door 19, detergent drawer, filter holder) to which the alarm or warning relates, preferably in response to anomaly signals supplied by the anomaly detector 9 or in response to command insertion signals 16 supplied by the command insertion sensor 16, wherein the component or quantity to detect/monitor falls within the scope of detection of such detectors/sensors 9, 16.

[0046] The warning or alarm visualization may comprise, for example, one or more of:

- a "component displaced" warning, e.g. door open if the door 19, 19 is not properly closed or detergent drawer extracted if the detergent drawer is not fully inserted,
- a "missing component or substance" or "insert component or substance" warning, e.g. "replace filter" if a filter is missing or needs to be replaced, or "filling detergent" if a level of the treatment substance is below a minimum level.

[0047] According to a further embodiment, the user interface 19 or the video projector 14 can comprise an audio interface 51 controlled by the electronic control system 10 to emit sound alerts (e.g. sounds, voice) in addition to the visualization operations of the video projector 14 and, possibly, so as to clarify acoustically the displayed information.

[0048] The features described with reference to a video projector 14 apply to at least one, some or all of the video projectors 14 in the case of a plurality of projectors 14.

Detailed description of the command insertion sensor 16

[0049] According to an embodiment, the command insertion sensor 16 comprises a proximity or touch sensor, e.g. capacitive, applied to the outer wall 3 in the display area 15. The touch sensor may comprise a film or a support panel on which an array of conductor(s) of the capacitors is formed, e.g. arranged according to Cartesian coordinates.

[0050] According to a further embodiment, the command insertion sensor 16 comprise one or more radar interaction sensors arranged either at or near the display area 15 and configured to recognize the position and movement of the user's hand in the immediate vicinity of the display area 15, e.g. to recognize a plurality of movements of the index finger or of the index finger and thumb of the user's hand, e.g. the so-called slider dial motions, rotary dial motions, zoom motions and pan motions.

[0051] According to a further embodiment, the command insertion sensor 16 comprises one or more optical interaction sensors arranged near the display area 15 and configured to recognize the position and movement of the user's hand in the immediate vicinity of the display area 15, e.g. to recognize a plurality of movements of the index finger or of the index finger and thumb of the user's hand, e.g. the so-called slider dial motions, rotary dial motions, zoom motions and pan motions.

[0052] The optical interaction sensor may comprise, for example, a video camera and an interpretation software for interpreting the images recorded by the camera.

[0053] According to a further embodiment, the command insertion sensors 16 comprise one or more infrared light sources and corresponding optical sensors configured to recognize the position and movement of the user's hand.

er's hand in the immediate vicinity of the display area 15, e.g. to recognize a plurality of movements of the index finger or of the index finger and thumb of the user's hand, e.g. the so-called slider dial motions, rotary dial motions, zoom motions and pan motions.

[0054] According to an embodiment, the same command insertion sensor 16 is further configured to monitor and/or verify the position and/or movements (e.g. vibrations) of moving or extractable parts (door 18, auxiliary cover 19, detergent drawer) which fall within its field or scope of detection.

[0055] According to a further embodiment, the command insertion means 12 may comprise an audio sensor or microphone adapted to detect audio user commands (in particular, voice commands) and to generate a corresponding voice signal. The electronic control system 10:

- processes the voice signal and generates a corresponding user command signal,
- sets the parameters of the treatment program in dependency of the generated user command signal,
- controls the display, by means of the video projector 14, in dependency of the generated user command signal.

[0056] The features described with reference to a command insertion sensor 16 apply to at least one, some or all of the command insertion sensors 16 in the case of a plurality of said command insertion sensors.

Description of processing and interpretation of the user commands

[0057] According to an embodiment, the interpretation and association module associates, e.g. by comparison of position, the detected position and/or the movement of the hand in one or more command input fields 17 visualized by means of the video projector 14 in the display area 15, and generates the user command signal in dependency of such association.

[0058] According to a further embodiment, the interpretation and association module interprets detected single positioning (touches) of the hand or finger associated with individual visualized command input fields 17 as parameter selection movements, e.g. from a plurality of different treatment parameters, and generates the user command signal in dependency of such interpretation.

[0059] According to a further embodiment, the interpretation and association module interprets detected continual movement (sliding) of the hand or finger associated with individual visualized command input fields 17 as parameter value adjustment movements (slider dial motions) and generates the user command signal in dependency of such interpretation.

[0060] According to a yet further embodiment, the interpretation and association module interprets detected continual and relative movements (relative sliding) of

multiple detected fingers but not necessarily associated with given command input fields 17 as visualization adjustment and/or selection movements and generates the user command signal in dependency of such interpretation.

[0061] Examples of movements and adjustment and/or visualization selection commands include zooming, panning, scrolling between multiple different screens, moving in the entire display area 15, enlarging/reducing the entire display area 15.

[0062] According to an embodiment, the steps of interpreting the movements of the user's fingers may comprise steps of comparing characteristic parameters of the corresponding position and/or hand movement signals with reference parameters indicative of a plurality of pre-defined movements.

[0063] According to a further embodiment, the steps of interpreting the movements of the user's fingers may comprise steps of calculating vector paths performed by the fingers.

[0064] The electronic control system 10 performs, by means of the video projector 14, a confirmation visualization of a user's command signal generated as a function of the aforesaid hand positioning and/or movement.

[0065] According to embodiments, confirmation visualization of the user's inputted command may comprise one or more of the following:

- a visualization, possibly highlighted, of an option or of a treatment program parameter to confirm the selection of the option or parameter,
- a variation of the treatment parameter selection menu,
- a visualization of a written alert, e.g. "start of treatment program" or "interruption of treatment program" or "household appliance off",
- a change in the display characteristics.

[0066] According to an embodiment, in addition to the recognition of the position of the user's hand or finger on the display area 15 and the association of the hand or finger position with a corresponding visualized command input field 17, the one or more insertion command sensors 16 may also be configured to detect and recognize a plurality of movements of the index finger or of the index finger and thumb of the user's hand, e.g. the so-called slider dial motions, rotary or arc dial motions, as well as zoom in/out motions, video pan motions, the latter not necessarily specifically referred to a visualized command input field 17, but corresponding to the gestures of the touchscreen controls known from the touchscreen tablet computers.

[0067] According to embodiments, the command input fields 17 may be visualized as images of one or more buttons, knobs, sliders, scales of values, or simple areas or fields, all possibly identified by a corresponding symbol, which represents e.g. a treatment parameter and/or one or more selectable values of a treatment parameter,

and/or navigation command symbols for navigating between different command input menus, and/or edit or customization command symbols, such as zoom and/or brightness and/or language and/or shape of the display area 15 and/or position/displacement of the display area 15.

[0068] According to an embodiment, the electronic control system 10 of the household appliance 1 can be connected in a communication network, e.g. via Wi-Fi or using Bluetooth, with an external electronic device 52, e.g. a smart phone or tablet computer, and adapted to be controllable, e.g. configurable or upgradeable, by means of the external electronic device 52.

[0069] In this case, the electronic control system 10 can be configured, by means of the video projector 14 and the command insertion sensor 16, to mirror a user interface with a control program present on the external device 52 or on a remote server and accessible by means of the external device 52.

Detailed description of embodiments of the treatment devices 7

[0070] According to embodiments, the treatment devices 7 of the household appliance 1 may comprise one or more of the following:

- a hydraulic filling and emptying system 27 and/or water circulation system to wet the domestic products in the treatment position,
- a ventilation system 28 and/or air circulation for aerating the domestic products in the treatment position,
- a heating system 29 for heating the domestic products and/or for heating the water of the hydraulic system and/or for heating the air in the ventilation system,
- a dehumidification system 30 for drying the household products and/or for dehumidifying the air ventilation system 28 (e.g. by means of condensation),
- a supply system 31 for delivering one or more chemical treatment substances directly on the domestic product and/or in the water in the hydraulic system 27 and/or in the air of the ventilation system 28,
- a movement system 29a or mechanical agitation system to move the domestic product and/or the treatment seat 5, e.g. with the purpose of dehydrating by centrifugal effect or varying exposure of the domestic product to the treatment device 7 or agitation and mixing of the household product,
- a microwave generator 30a for generating microwaves in the treatment position 6,
- a steam generator 31a for generating steam in the treatment position 6,
- a generator (e.g. an induction coil) 32 of a variable electromagnetic field adapted to generate an induced electromotive force (and thus an induction heating) in electrically conductive pots in the treatment position 6,

- a gas burner 33 adapted to heat pots or dishes in the treatment position 6,
- a cooling system 34 and/or freezing system adapted to cool and/or freeze domestic products in the treatment position 6.

Detailed description of embodiments of the treatment detectors 8

[0071] According to embodiments, the treatment detectors 8 may comprise one or more of the following:

- a water pressure sensor 35,
- a water level sensor 36,
- a water temperature sensor 37,
- an air pressure sensor 38,
- a treatment seat temperature sensor 39,
- a water turbidity sensor 40,
- an electric quantity sensor 41 of an electric motor of the movement system 29 and/or mechanical agitation system,
- a presence sensor 42 of domestic products in the treatment position 6,
- a level sensor 43 or a presence sensor of a treatment chemical substance in the treatment substance delivery system,
- a position sensor 44 of movable parts of the appliance 1 (e.g. door 18, auxiliary door 19, detergent drawer 45, filter 46, filter holder 47, dust bag 48),
- a flame presence sensor 49,
- a camera 50 connected to or in the housing 2 and directed towards the treatment position 6 for monitoring the domestic product during the treatment.

[0072] According to an embodiment, the video projector 14 may visualize images detected by the video camera 50.

Detailed description of embodiments of the anomaly detectors 9

[0073] According to embodiments, the anomaly detectors 9 are also in signal connection with the electronic control system 10 and may comprise one or more temperature sensors, water presence sensors, smoke presence sensors, water absence sensors, position/presence sensors of movable or detachable parts of the household appliance (e.g. door 18, auxiliary door 19, detergent drawer 45, filter 46, the filter holder 47, dust bag 48).

[0074] According to embodiments, the electronic control system 10 controls one or more treatment devices 7 and/or controls the display means 13 also in dependency of the anomaly signals generated by anomaly detectors 9.

Detailed description of preferred embodiments of the household appliance 1

[0075] The household appliance 1 is, for example, either:

- a washing machine 1.1 (**figures 1-5, 9, 11**),
- a tumble dryer 1.2 (**figure 10**),
- a clothes washing and drying machine 1.3 (**figure 11**),
- a dishwasher 1.4 (**figure 12**),
- a domestic cooking oven 1.5 (**figure 13**),
- a microwave oven 1.6 (**figure 14**),
- a gas cook top 1.7 (**figure 16**) and/or a resistive cook top 1.8 (**figure 15**), and/or an inductive cook top 1.9 (**figure 15**),
- a refrigerator 1.10 (**figure 17**),
- a freezer 1.10 (**figure 18**),
- a vacuum cleaner 1.11 (**figure 19**),
- an ironing apparatus 1.12 (**figure 20**).

[0076] According to embodiments, the household products which are treated by means of the household appliance 1 may comprise one or more of either:

- linen to be washed and/or dried and/or ironed,
- dishes to be washed,
- food products to be heated and/or cooked and/or defrosted and/or frozen and/or cooled,
- furniture surfaces to be dusted and/or washed,
- fabrics to be ironed or sewn.

[0077] The washing machine 1.1 (**figure 1-5, 9, 11**) comprises a laundry basket or drum which forms the treatment seat 5 and which can be closed by means of a door 18, as well as a hydraulic system 27, a water heating system 29, a dispensing system 31 and a moving system 29a.

[0078] The tumble dryer 1.2 (**figure 10**) comprises a laundry basket or drum which forms the treatment seat 5 and which can be closed by a door 18, as well as a ventilation system 28, an air heating system 29, a dehumidification system 30 and an actuating/moving system 29a.

[0079] The washing and drying machine 1.3 (**figure 11**) comprises a laundry basket or drum which forms the treatment seat 5 and which can be closed by a door 18, as well as a hydraulic system 27, a water heating system 29, a dispensing system 31, movement system 29a, a ventilation system 28, an air heating system 29 and a dehumidification system 30.

[0080] The dishwasher 1.4 (**figure 12**) comprises a housing cavity which forms the treatment seat 5 and which can be closed by a door 18, as well as a hydraulic system 27, a water heating system 29, a dispensing system 31 and, optionally, a dehumidification system 30.

[0081] The domestic cooking oven 1.5 (**figure 13**) comprises a cooking cavity which forms the treatment

seat 5 and which can be closed by a door 18, as well as a ventilation system 28, a heating system 29 for heating the food products, optionally a movement system 29a (e.g. for turning grilled meat), optionally a steam generator 31a for generating steam in the treatment position 6, optionally a gas burner 33 adapted to heat dishes in the treatment position 6.

[0082] The microwave oven 1.6 (**figure 14**) comprises a cooking cavity which forms the treatment seat 5 and which can be closed by a door 18, as well as a microwave generator 30a for generating microwaves in the treatment position 6, a movement system 29a and optionally a ventilation system 28.

[0083] The resistive cook top 1.8 (**figure 15**) comprises a pot supporting structure which forms the treatment seat 5, as well as a resistive heating system 29 for heating pots or dishes in the treatment position 6.

[0084] The inductive cook top 1.9 (**figure 15**) comprises a pot supporting structure which forms the treatment seat 5, as well as a generator (e.g. induction coil) 32 of a variable electromagnetic field in the treatment position 6.

[0085] The gas cook top 1.7 (**figure 16**) comprises a pot supporting structure which forms the treatment seat 5, as well as a gas burner 33 adapted to heat pots or dishes in the treatment position 6.

[0086] The refrigerator 1.10 (**figure 17**) comprises a refrigeration cavity which forms the treatment seat 5 and which can be closed by a door 18, as well as a cooling system 34 and/or freezing system adapted to cool and/or freeze domestic products in the treatment position 6 and, optionally, a ventilation system 28 and/or air circulation system for aerating the domestic products in the treatment position 6.

[0087] The freezer 1.11 (**figure 18**) comprises a freezing cavity which forms the treatment seat 5 and which can be closed by a door 18, as well as a freezing system 34 adapted to freeze the domestic products in the treatment position 6.

[0088] The vacuum cleaner 1.12 (**figure 19**) comprises a suction mouth for a furnishing surface which forms the treatment seat 5, as well as a ventilation system 28, in particular a suction system, of air from the furniture surface in the treatment position 6 and, optionally, a movement system 29a or mechanical agitation system to move the treatment seat 5.

[0089] The ironing apparatus 1.13 (**figure 20**) comprises a heatable plate which forms the treatment seat 5, as well as a heating system 29 for heating the heatable plate and a steam generator 31a for generating steam in the treatment position 6.

[0090] Each of the household appliances 1, 1.1 ... 1.12 described in greater detail may selectively comprise one or more treatment detectors 8 and selectively one or more anomaly detectors 9, together with their signal connections to the electronic control system 10, described above and not repeated here for the sake of brevity.

[0091] Obviously, those skilled in art may make further

changes and variations to the household appliance 1 according to the present invention, all contained within the scope of protection of the invention as defined in the following claims, in order to meet contingent needs and specifications.

Claims

1. A household appliance (1) comprising:

- a housing (2) with an outer wall (3) forming an outer surface (4) of the household appliance (1),
- a treatment seat (5) formed in or at the housing (2) and adapted to accommodate or support domestic products in a treatment position (6),
- at least one treatment device (7) arranged inside the housing (2) and actuable for carrying out a treatment at the treatment position (6) and subjecting the domestic product to said treatment,
- at least one treatment detector (8) arranged at least partially inside the housing (2) and configured to detect a value of a treatment parameter of the treatment performed by the treatment device (7).
- optionally, at least one anomaly detector (9) arranged at least partially inside the housing (2) and configured to detect a magnitude indicative of an operating anomaly of the household appliance (1),
- an electronic control system (10) arranged in the housing (2) and in signal connection with the treatment device (7) and with the treatment detector (8) and configured to control the treatment device (7) according to a treatment program and according to the value detected by the treatment detector (8),
- a user interface (11) in signal connection with the electronic control system (10), said user interface (11) comprising:

- command insertion means (12) for inputting commands for selecting the parameters of the treatment program and for inputting a command for executing the treatment program, and
- display means (13) which visualize the selectable parameters of the treatment program and visualize the treatment parameters during the execution of the program,

characterized in that the display means (13) comprise at least one video projector (14) mounted to the household appliance (1) at the outer wall (3) and configured to visualize, by means of a light projection process, onto a display area (15) of the outer surface (4) of the housing (2),

and **in that** the command insertion means (12) comprise at least one command input sensor (16) adapted to detect a movement of the user's hand at the display area (15) and to generate a corresponding hand movement signal, wherein the electronic control system (10):

- processes the hand movement signal and generates a user command signal,
- sets the treatment program parameters according to the generated user command signal,
- commands the display by means of the video projector (14) according to the generated user command signal.

2. A household appliance (1) according to claim 1, wherein the command input sensor (16) comprises one or more proximity or touch sensors applied to the outer wall (3) in the display area (15).

3. A household appliance (1) according to claim 1, wherein the command input sensor (16) comprises one or more radar interaction sensors arranged at or close to the display area (15) and configured to recognize the position and movement of the user's hand in the immediate vicinity of the display area (15).

4. A household appliance (1) according to claim 1, wherein the command input sensor (16) comprises one or more infrared interaction sensors arranged at or close to the display area (15) and configured to recognize the position and movement of the user's hand in the immediate vicinity of the display area (15).

5. A household appliance (1) according to claim 1, wherein the command input sensor (16) comprises a video camera and software for interpreting the images recorded by the video camera.

6. A household appliance (1) according to any one of the preceding claims, wherein the same command input sensor (16) is further configured to monitor the position or movements of movable parts (18, 19) of the household appliance (1) arranged in the detection field thereof.

7. A household appliance (1) according to any one of the preceding claims, wherein the electronic control system (10) associates the detected hand movement with the position of one or more command input fields (17) displayed by the video projector (14) in the display area (15), and generates said user command signal in dependency of said association.

8. A household appliance (1) according to claim 7, wherein the electronic control system (10) interprets:

- individual positionings of the finger that have been detected and associated with individual command input fields (17) as parameter selection movements,
 - continuous movements of the finger that have been detected and associated with a series of command input fields (17) adjacent to one another as movements for setting parameter values,
 - continuous and relative movements of several fingers, detected in the display area (15) but not associated with certain command input fields (17), as movements for setting the display.
9. A household appliance (1) according to claim 7 or 8, wherein the electronic control system (10) interprets the movements of the user's fingers in the display area (15) by comparing characteristic parameters of the corresponding hand movement signals with the indicative reference parameters for a plurality of preset movements.
10. A household appliance (1) according to one of claims 7 to 9, wherein the electronic control system (10) interprets the movements of the user's fingers in the display area (15) by calculating vector paths performed by the user's fingers.
11. A household appliance (1) according to one of the preceding claims, wherein the electronic control system (10) performs, by means of the video projector (14), a confirmation visualization of the generated user command signal.
12. A household appliance (1) according to claim 7, wherein the command input fields (17) are displayed as:
- areas delimited and identified by a symbol representing a treatment parameter, and/or
 - one or more selectable values of a treatment parameter and/or
 - command symbols for navigating between different command entering menus, and/or
 - symbols of the commands for customizing the projected display.
13. A household appliance (1) according to any one of the preceding claims, wherein the command insertion means (12) comprise a microphone adapted to detect voice user commands and to generate a corresponding voice signal, wherein the electronic control system (10):
- processes the voice signal and generates a corresponding user command signal,
 - sets the treatment program parameters according to the generated user command signal,
- commands the display by means of the video projector (14) according to the generated user command signal.
14. A household appliance (1) according to any one of the preceding claims, wherein the electronic control system (10) may be connected in wireless communication to an external electronic device (52), in particular a smartphone or a tablet, and is adapted to be controllable and configurable by means of the external electronic device (52).
15. A household appliance (1) according to claim 14, wherein the electronic control system (10) is configured to mirror, by means of the video projector (14) and the command input sensor (16), a user interface of a control program present on the external device (52) or on a remote server and accessible by means of the external device (52).

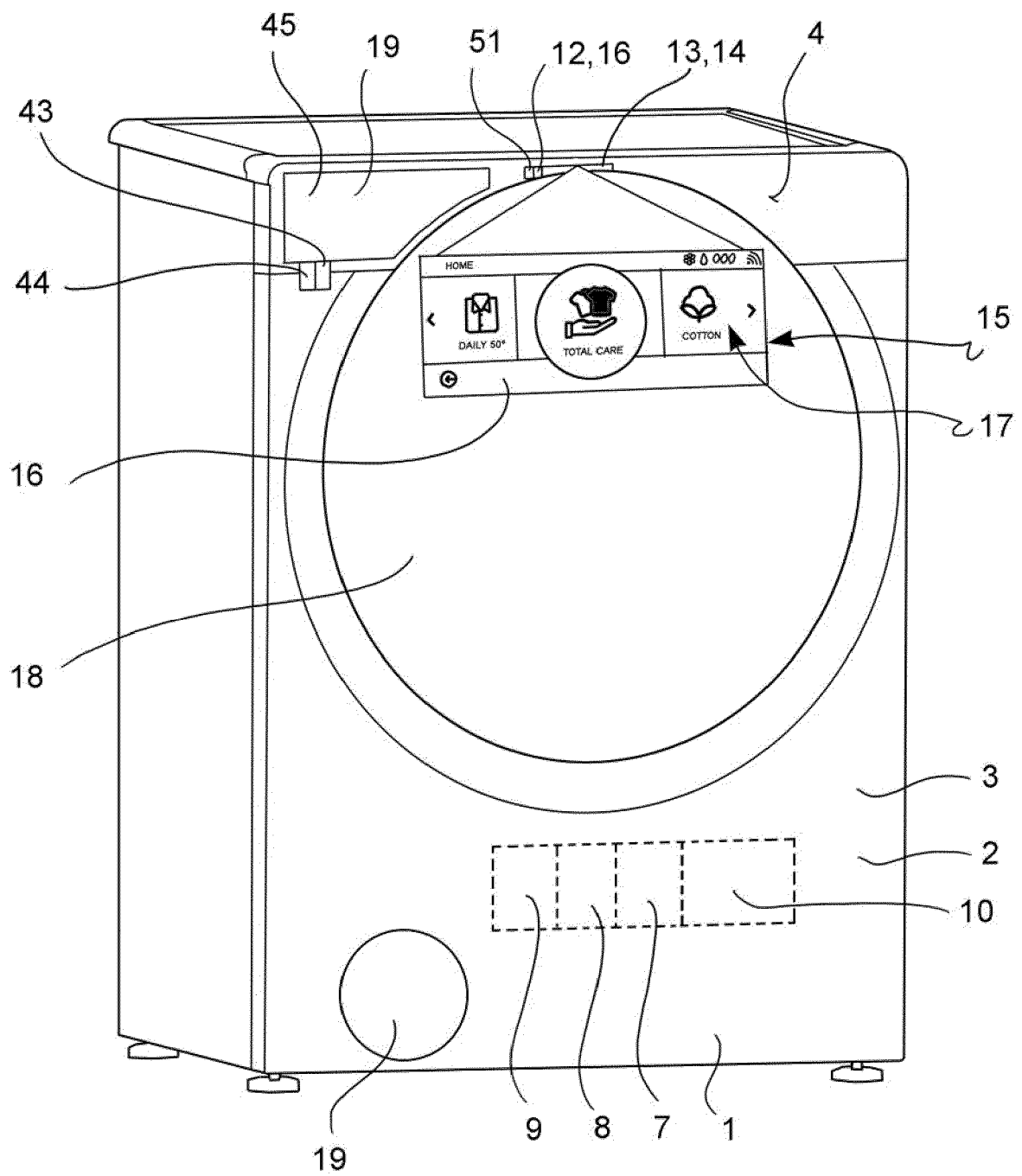


FIG. 1

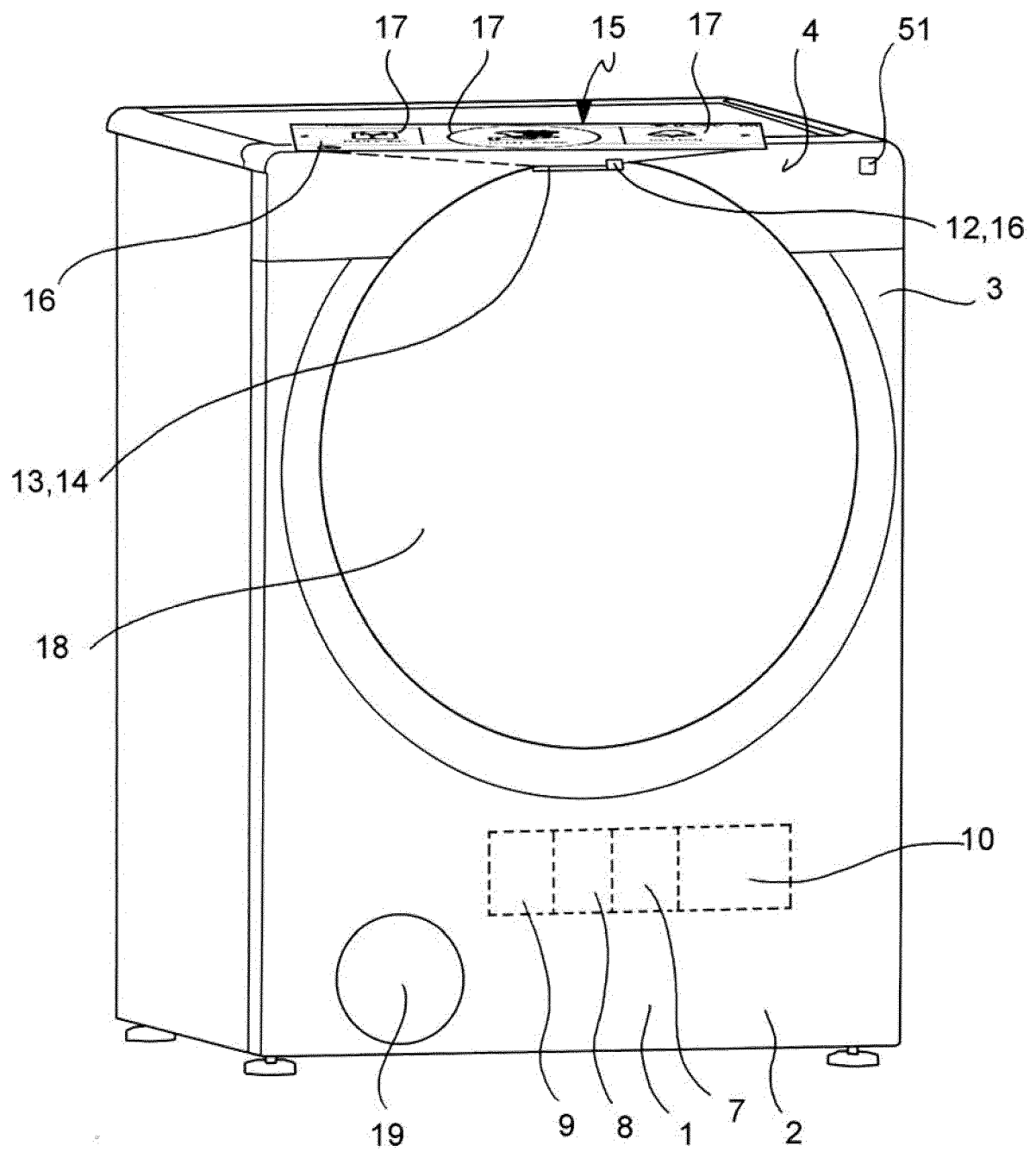


FIG. 2

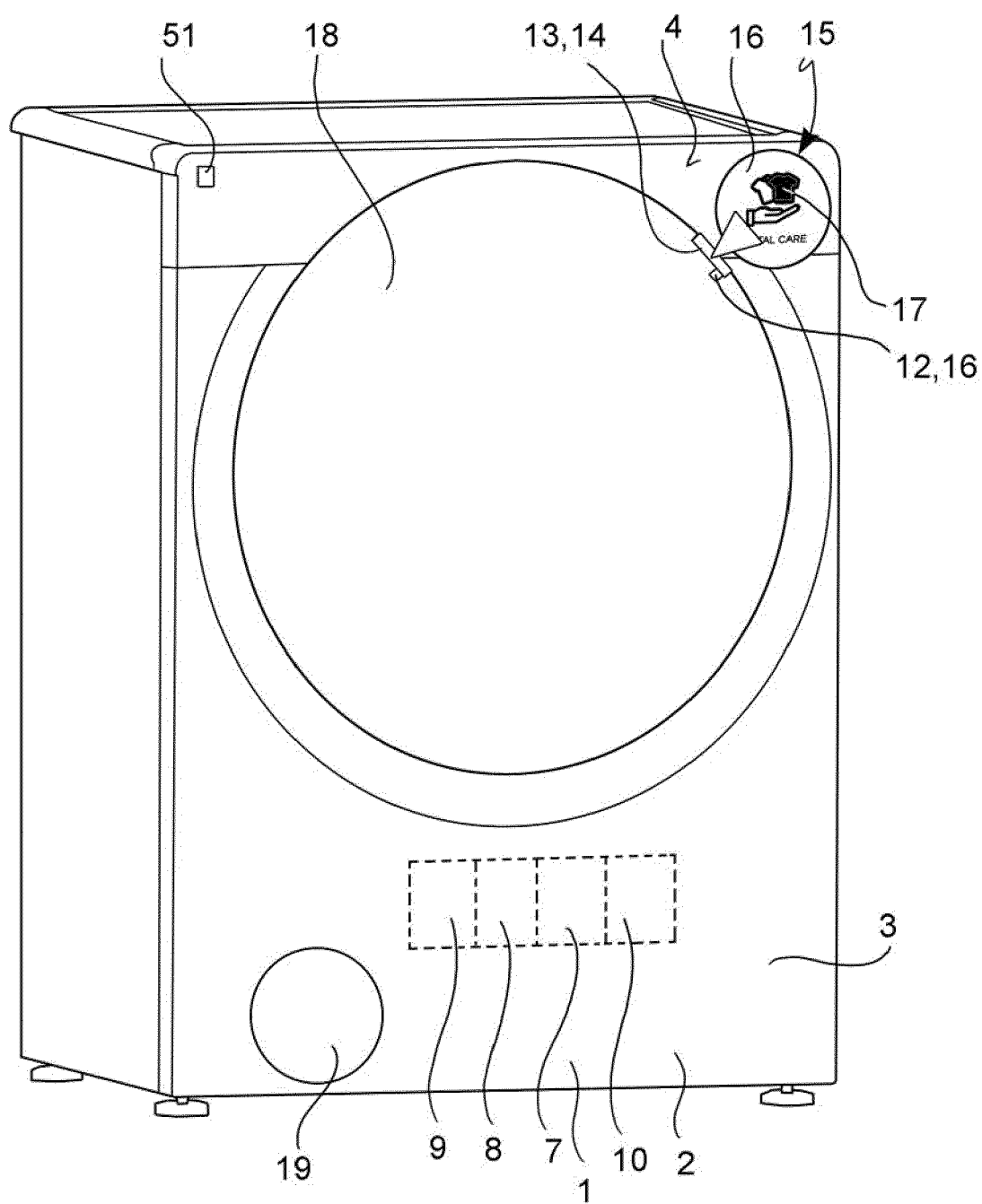


FIG. 3

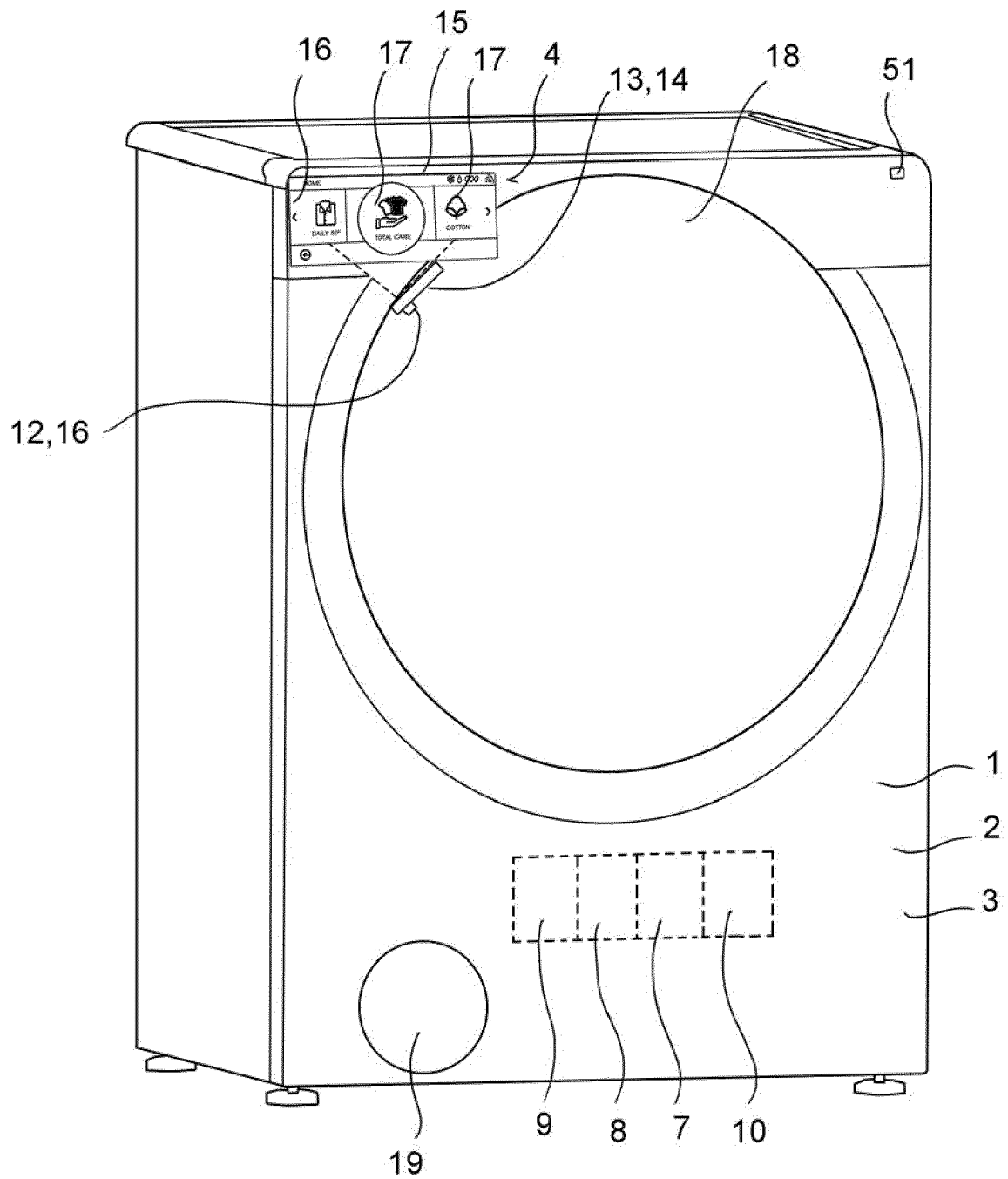


FIG. 4

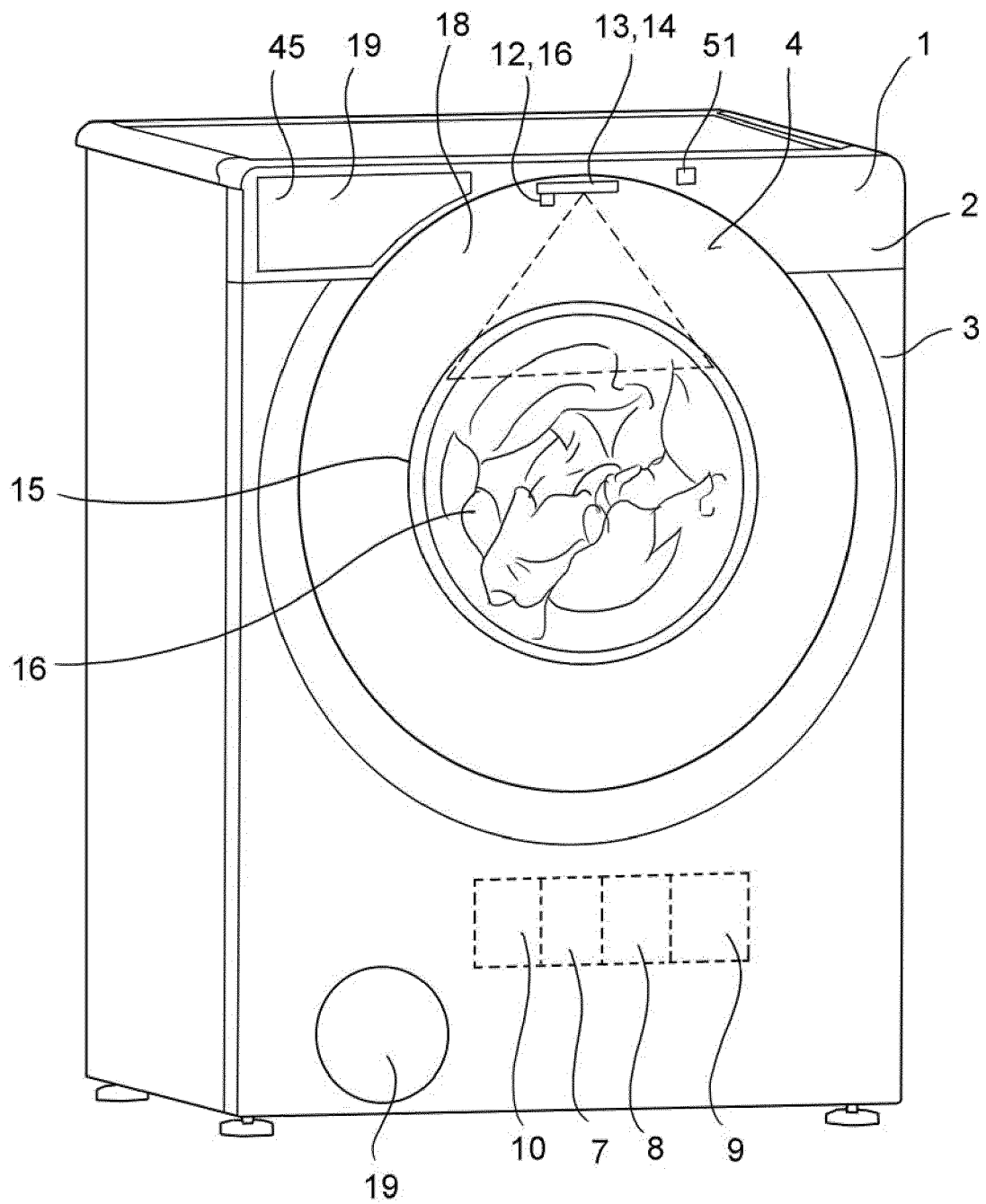


FIG. 5

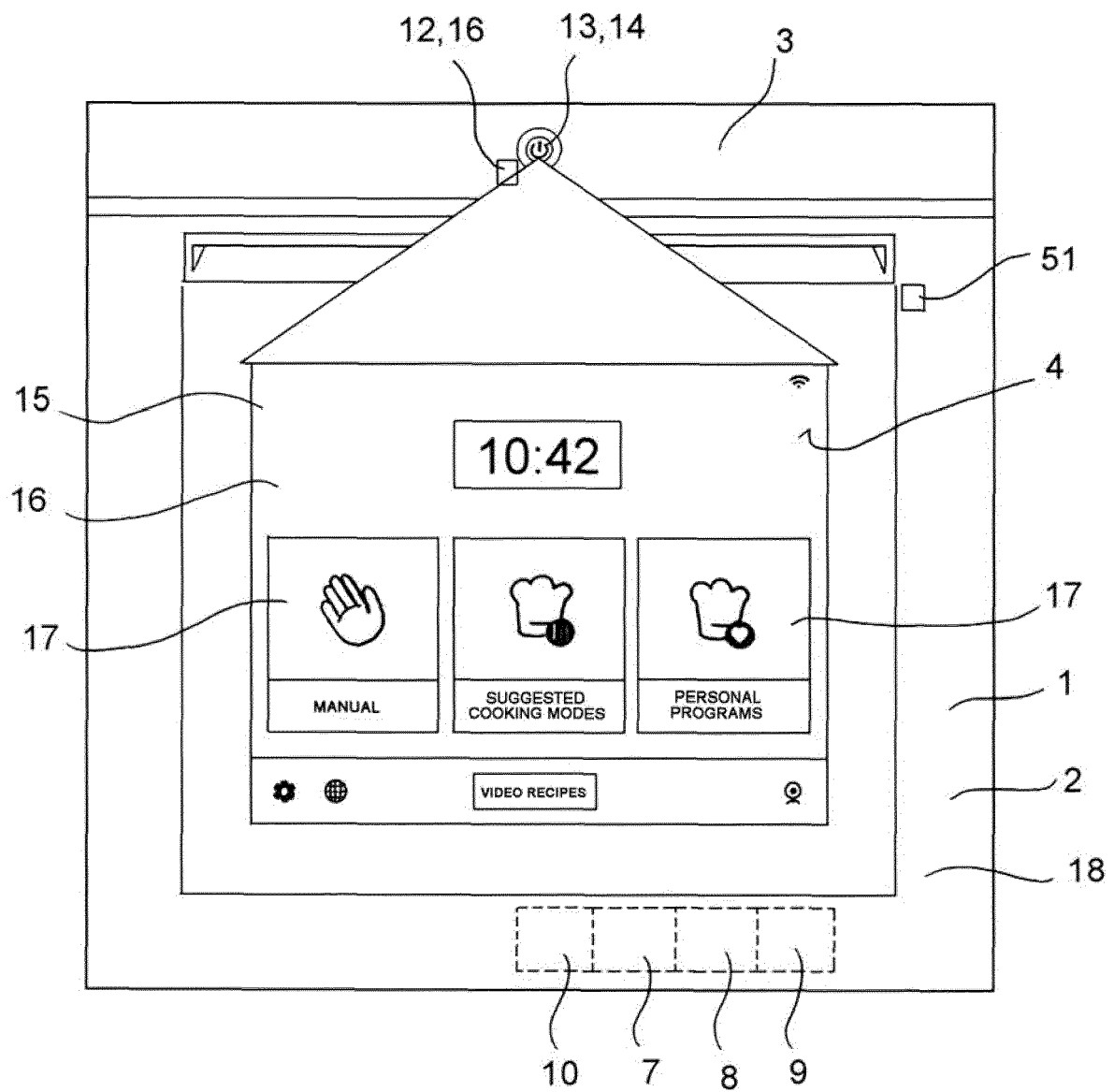


FIG. 6

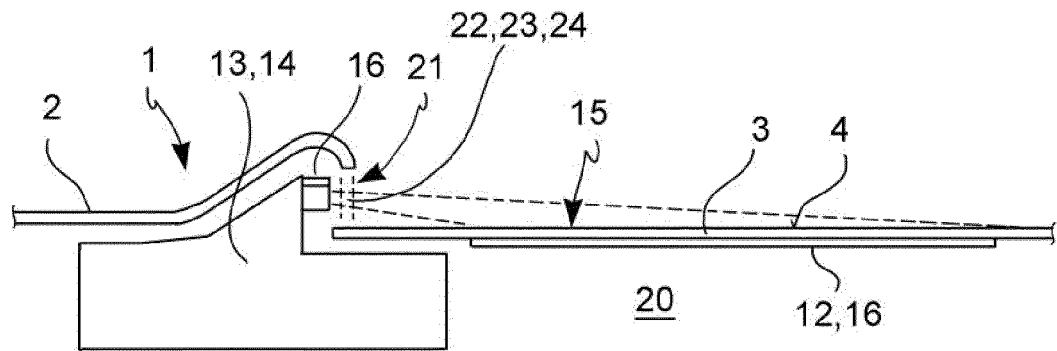


FIG. 7A

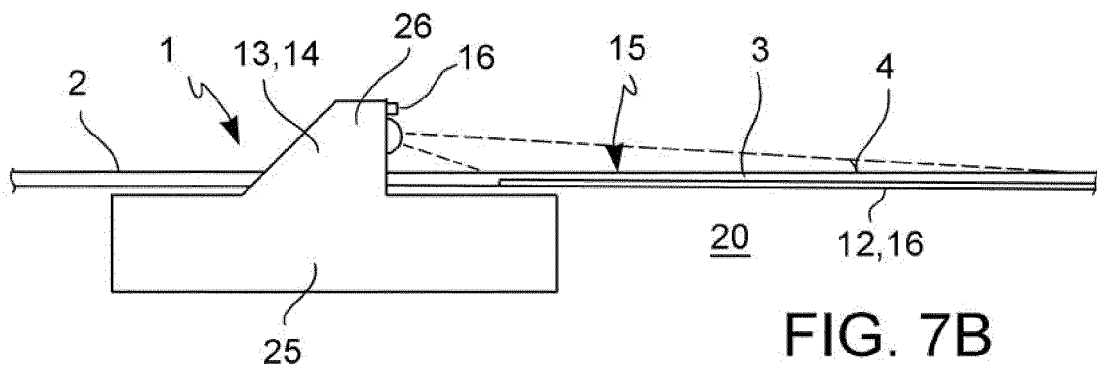


FIG. 7B

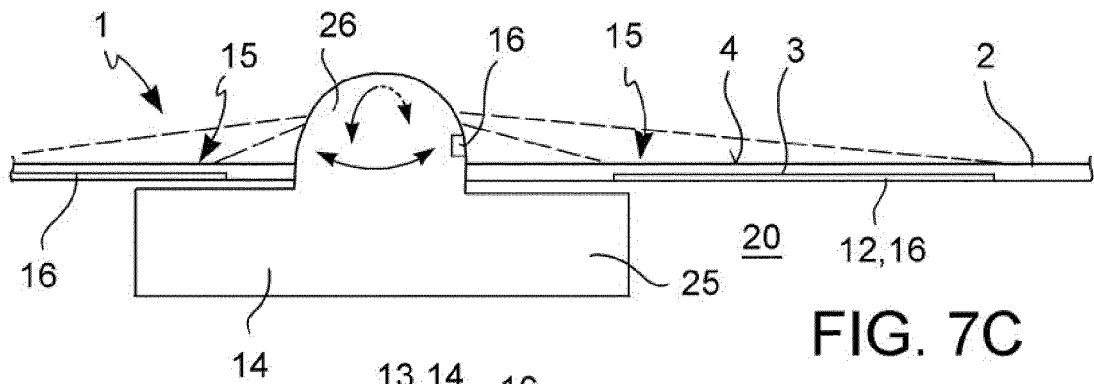


FIG. 7C

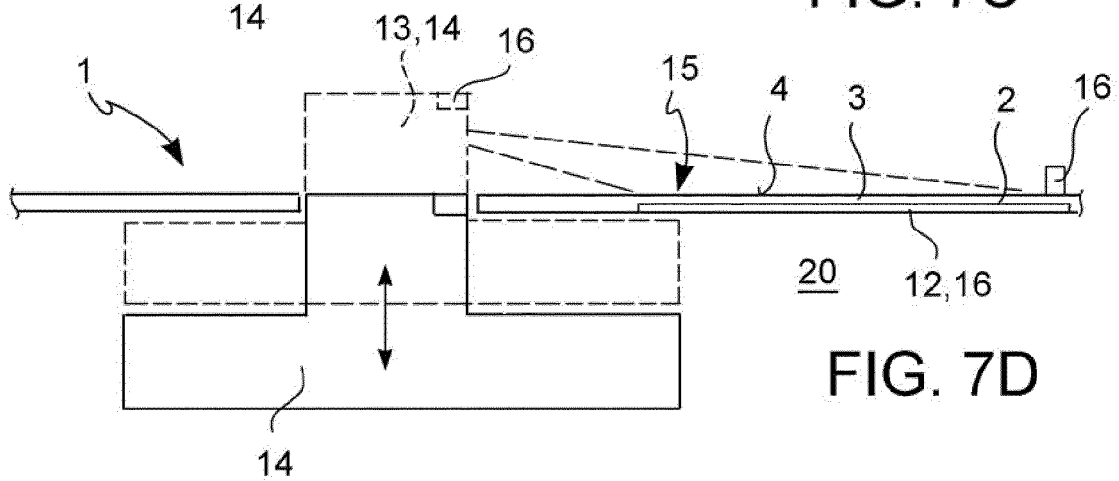
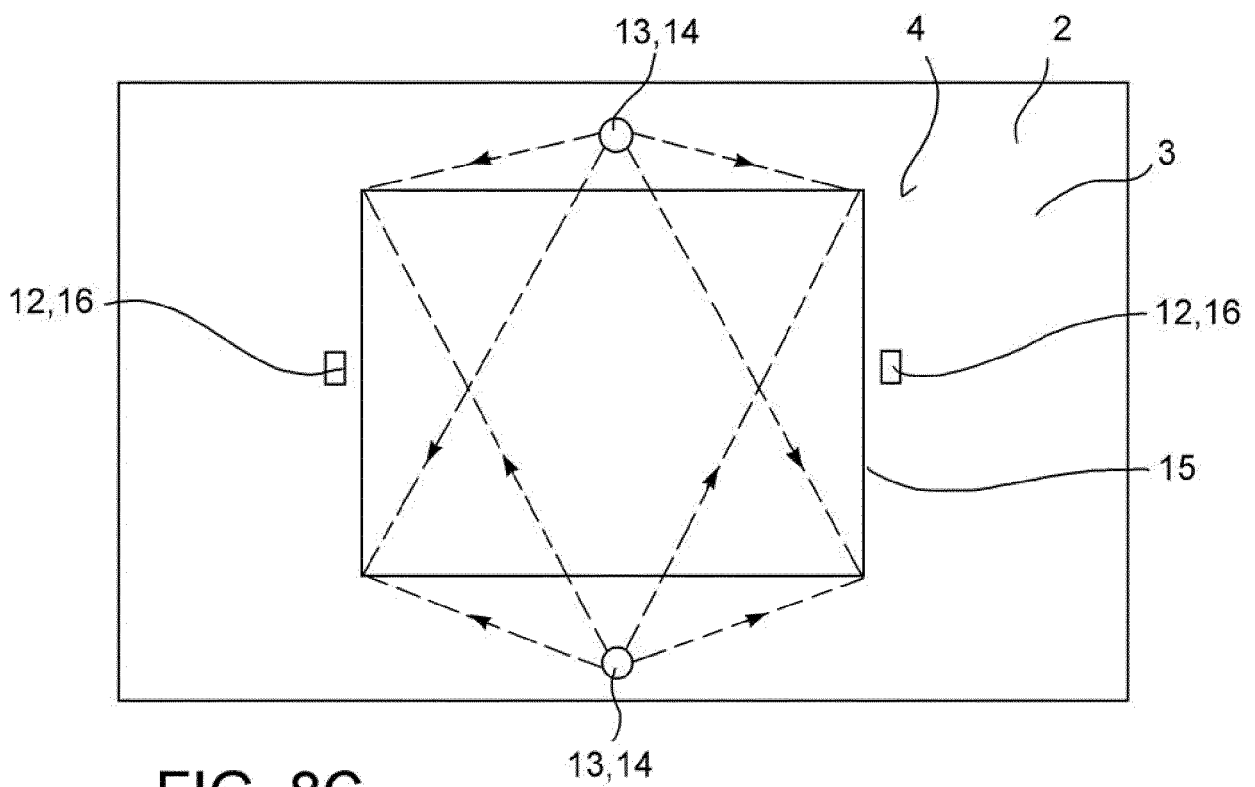
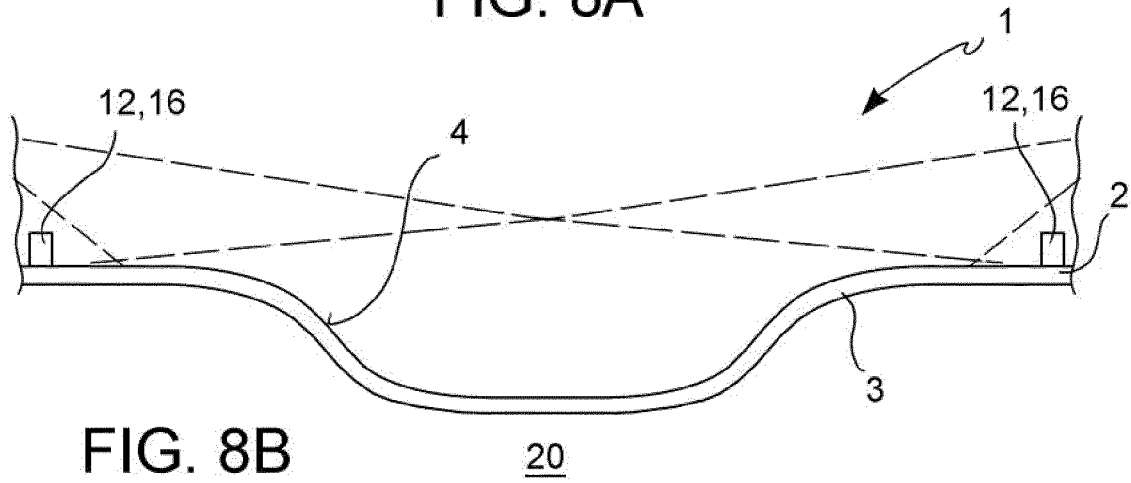
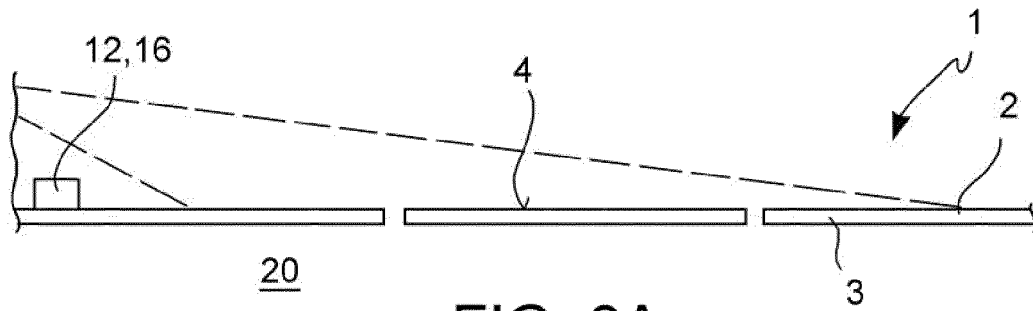


FIG. 7D



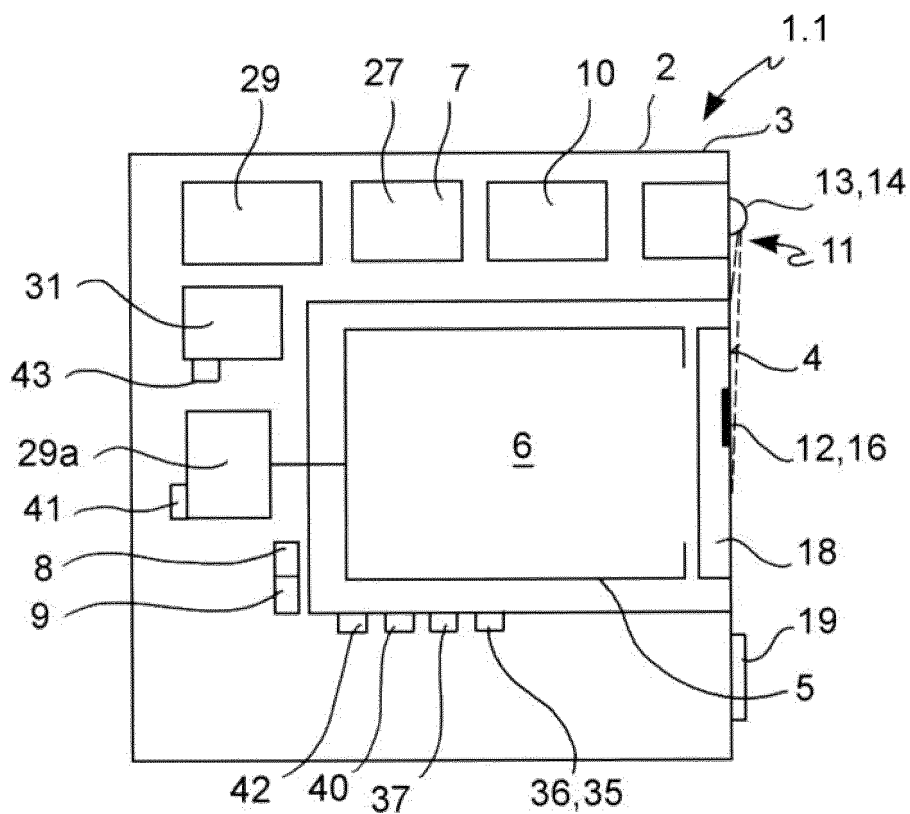


FIG. 9

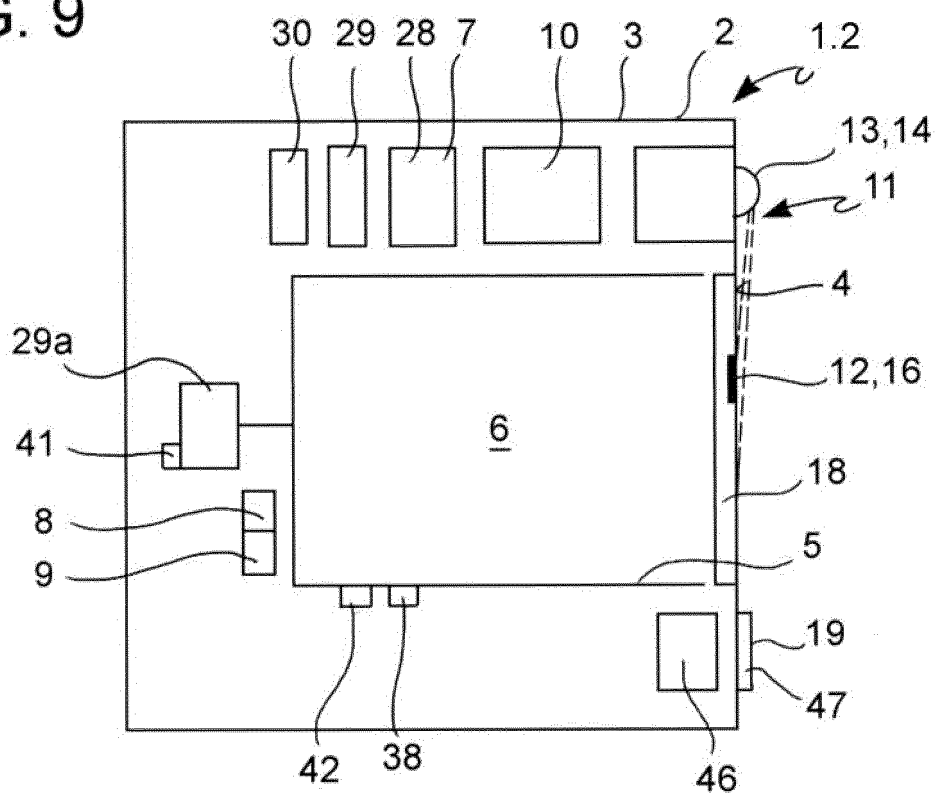


FIG. 10

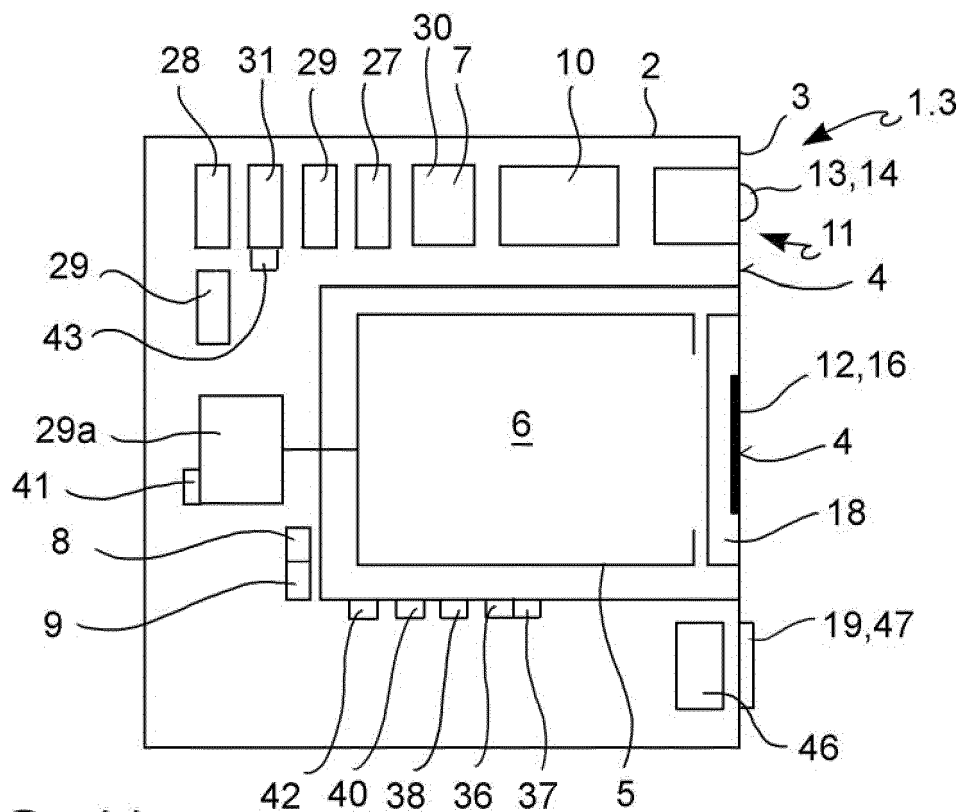


FIG. 11

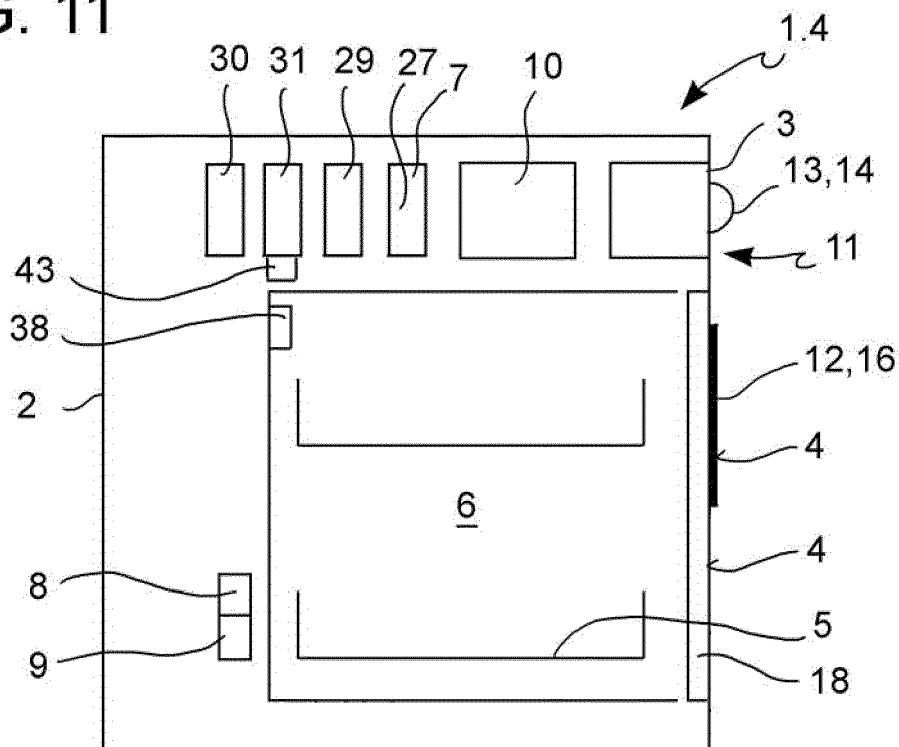


FIG. 12

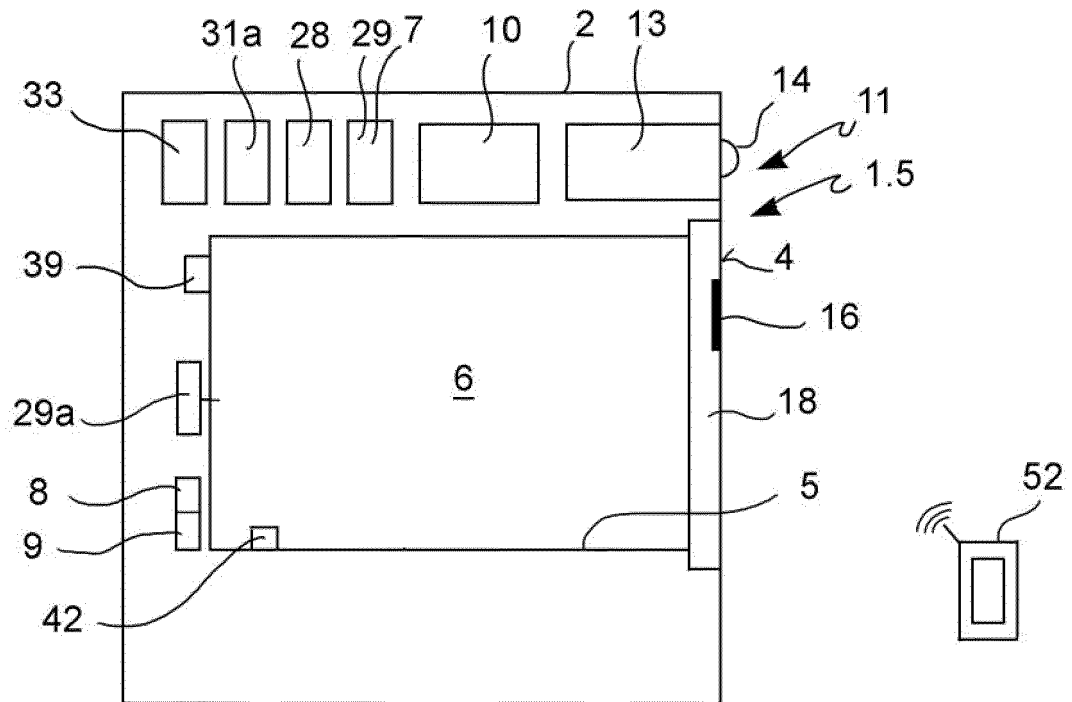


FIG. 13

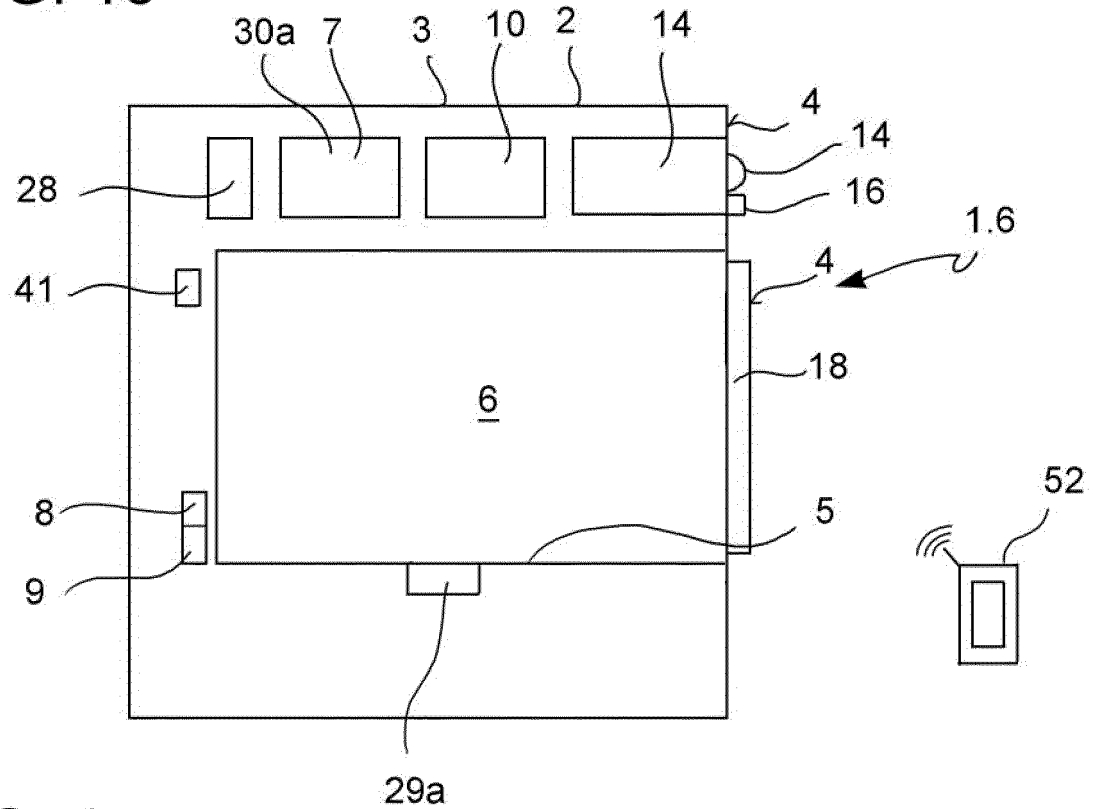


FIG. 14

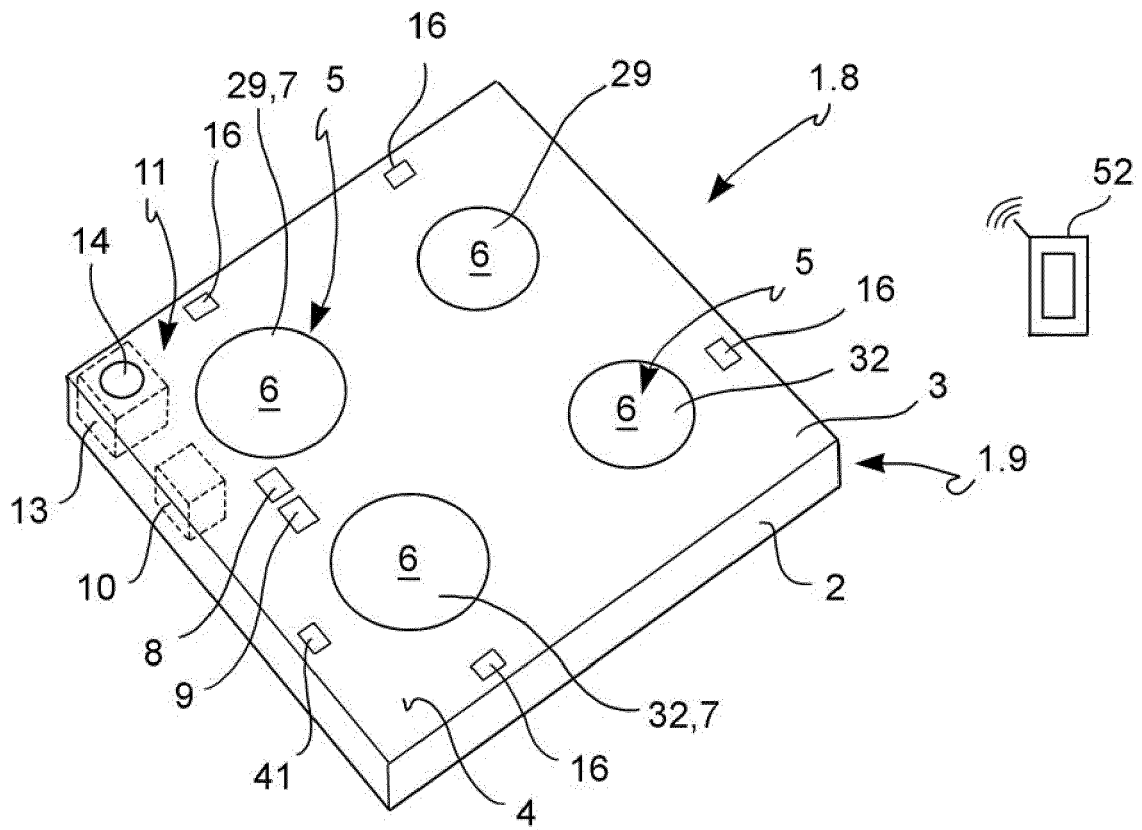


FIG. 15

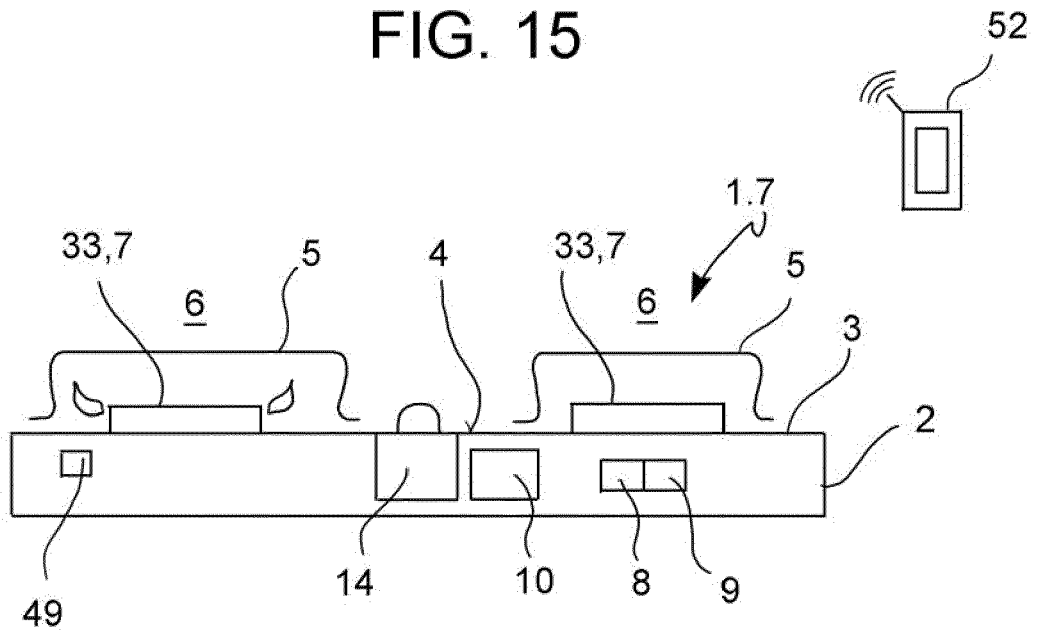


FIG. 16

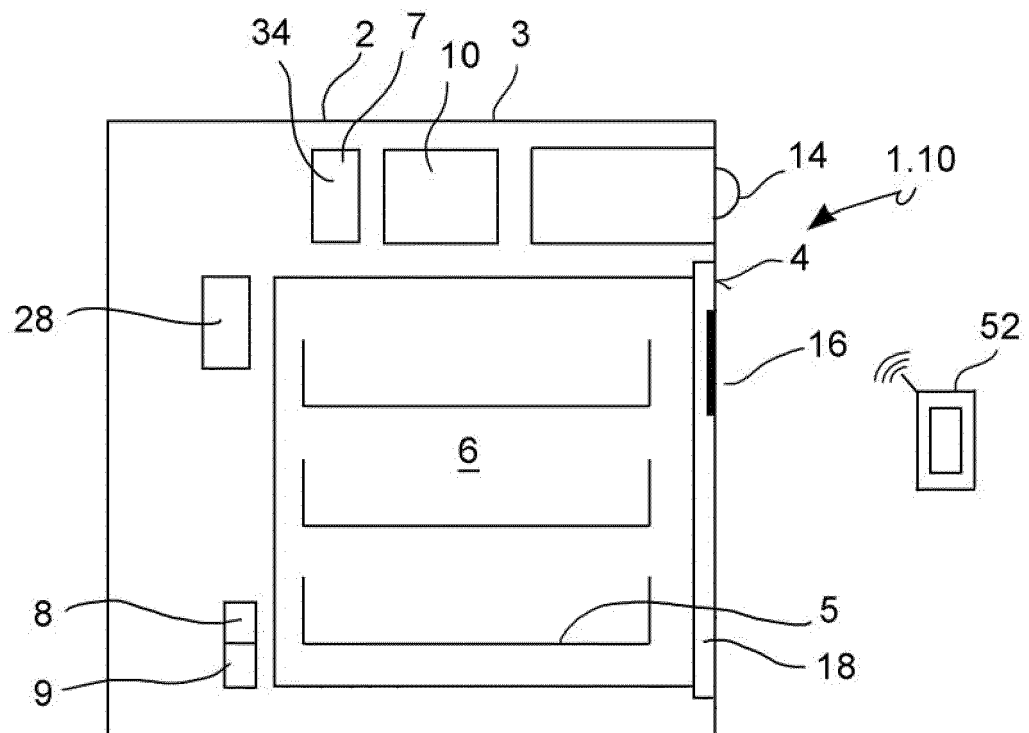


FIG. 17

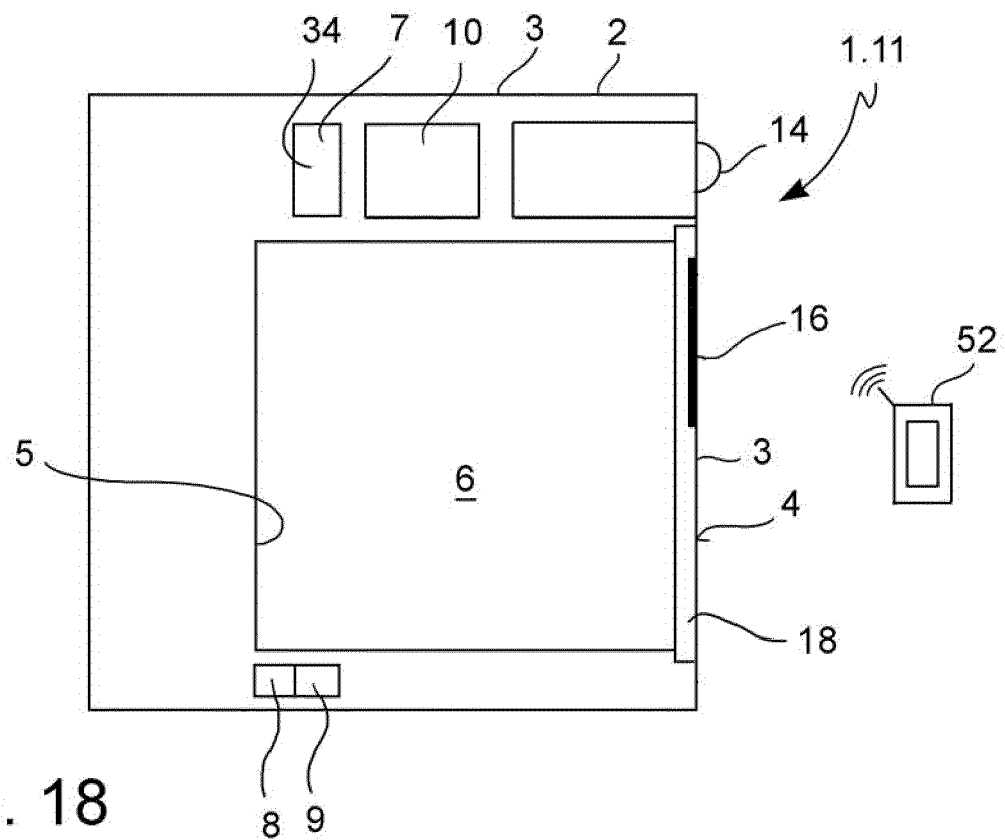


FIG. 18

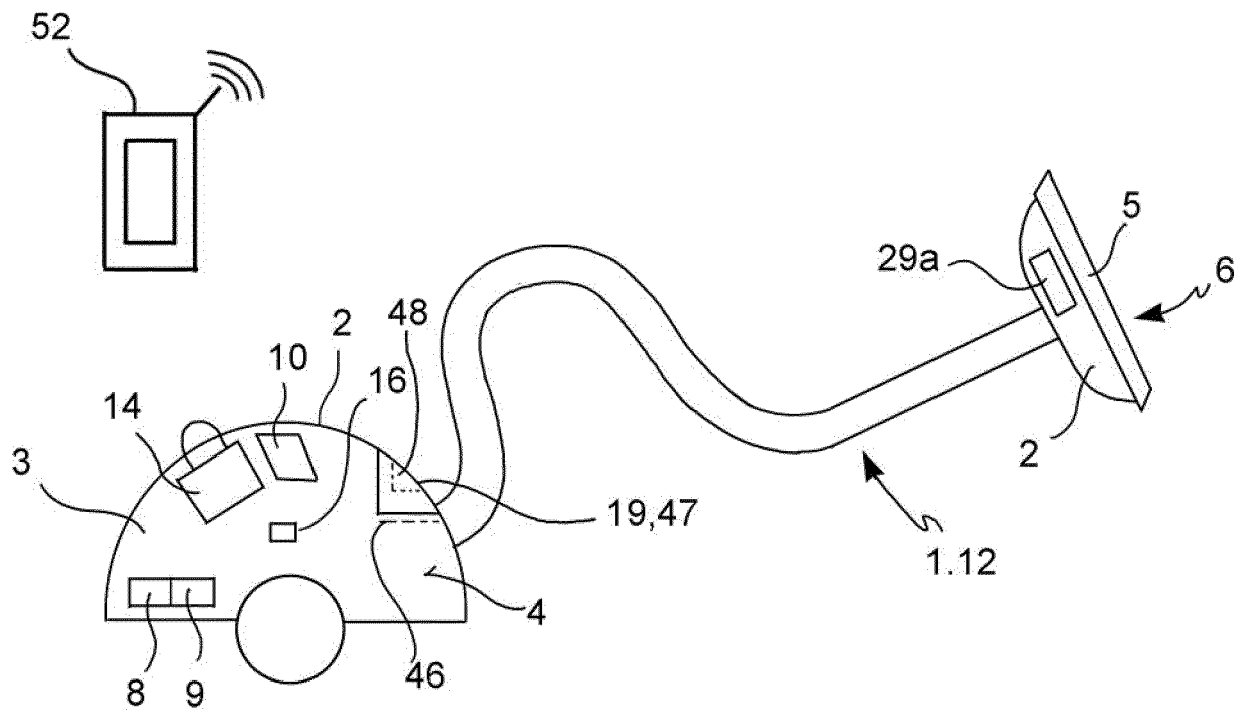


FIG. 19

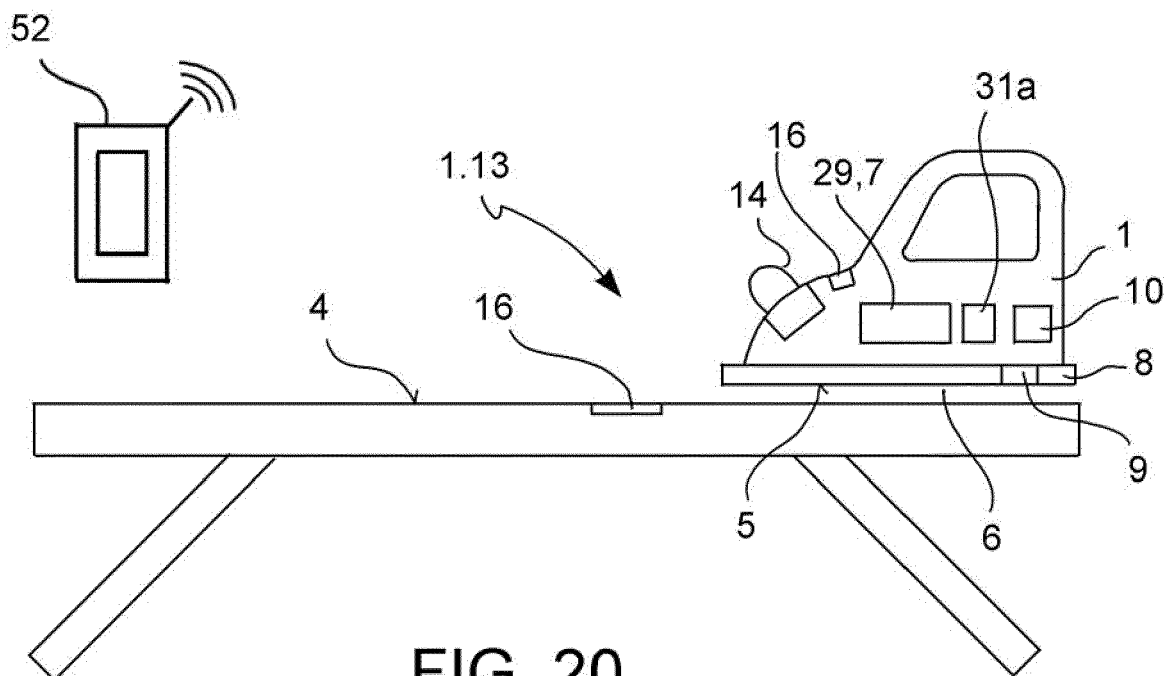


FIG. 20



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 16 3751

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2012/327201 A1 (KAPPLER JERROD AARON [US] ET AL) 27 December 2012 (2012-12-27) * paragraph [0007] - paragraph [0009] * * paragraph [0019] - paragraph [0028]; figures 1-3 *	1,3-5,7, 9,11,12 2,6,8, 10,13-15	INV. D06F39/00 ADD. D06F58/28 F24C7/08 F25D29/00
X A	DE 10 2012 106181 A1 (MIELE & CIE [DE]) 16 January 2014 (2014-01-16) * paragraph [0001] - paragraph [0002] * * paragraph [0006] * * paragraph [0027] - paragraph [0035]; figures 1, 2, 3a, 3b *	1,2,7,9 3-6,8, 10-15	
X A	US 2010/182136 A1 (PRYOR TIMOTHY [CA]) 22 July 2010 (2010-07-22) * paragraph [0071] - paragraph [0111]; figures 1a, 1b, 1c, 1d, 2a, 2b, 2c *	1,2,5, 11-14 3,4, 6-10,15	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F F24C F25D G03B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 June 2019	Examiner Sabatucci, Arianna
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 19 16 3751

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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11-06-2019

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012327201 A1	27-12-2012	NONE	
DE 102012106181 A1	16-01-2014	NONE	
US 2010182136 A1	22-07-2010	AU 2010249515 A1	19-01-2012
		CN 102498442 A	13-06-2012
		EP 2433188 A2	28-03-2012
		JP 2012527847 A	08-11-2012
		KR 20120011892 A	08-02-2012
		US 2010182136 A1	22-07-2010
		US 2010231506 A1	16-09-2010
		WO 2010135478 A2	25-11-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82