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(54) GARMENT CARE SYSTEM AND OPERATING METHOD

(57) Garment care system (10) comprising a base unit (20), a hand held unit (30) and a hose cord (44); the base unit (20) is adapted to provide a first driving signal (V1) which reflects an operating state of the garment care system; the hand held unit (30) comprises output means (36) for providing visual or audible output information reflecting said operating state; and a unit (38) which comprises at least one sensor (42) and/or at least one user input device (40). The hose cord (44) comprises a single communications wire (46) for carrying said first driving signal (V1) from the base unit (20) to the hand held unit (30) for driving the output means (36), and for carrying the input signal from the hand held unit (30) to the base unit (20).

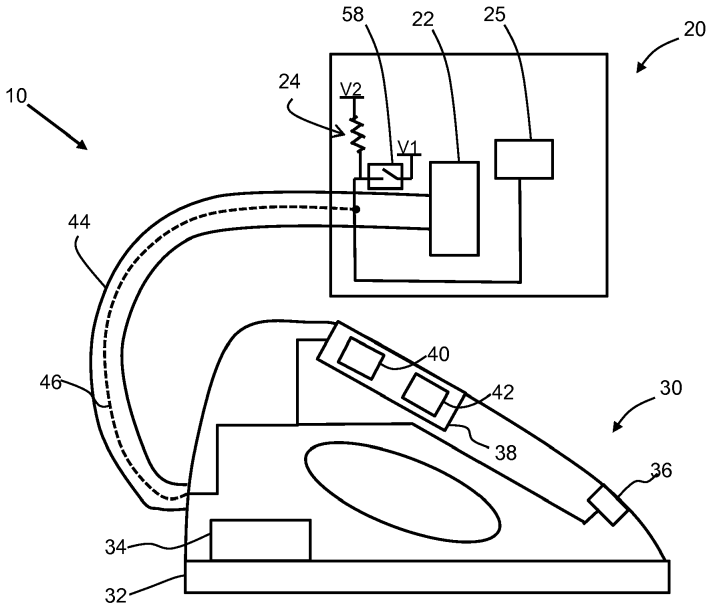

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] This invention relates to garment care systems and methods for operating such systems.

BACKGROUND OF THE INVENTION

[0002] Garment care systems for example include steam ironing systems and garment steaming systems. Steam ironing systems comprising a base unit and a hand-held iron unit connected by a hose cord are known. The base unit comprises a steam generator, and steam is provided to the iron unit when demanded by the user. The base unit functions as a pressurized steam generator.

[0003] In this known type of product architecture, the iron unit transfers a signal to the base unit reflecting that the user is requesting the generation of steam to be provided to the iron unit via the hose cord. The signal is typically transferred in an analog form on a dedicated electrical wire.

[0004] There is also a desire to transmit other signals from the iron unit to the base unit. For example, signals from sensors arranged in the iron unit may be provided to the base unit for implementing additional control functions.

[0005] There is also a desire to transmit electrical signals from the base unit to the iron unit. For example, the iron unit may have an output means such as an LED (Light Emitting Diode) or array of LEDs for providing status information to the user. This status information may for example relate to the operating state of the base unit, such as the readiness to deliver steam to the iron unit. Thus, there is a need for bidirectional signal transfer between the base unit and the iron unit.

[0006] The hose cord can only accommodate a very limited number of different electrical wires, in view of the limited cross-section of the hose cord, and also in order to keep a certain level of mechanical flexibility of the hose cord during manipulation by user. It is therefore desirable to share a communications wire for multiple control signals.

SUMMARY OF THE INVENTION

[0007] It is an object of the invention to propose an improved garment care system that avoids or mitigates above-mentioned problems.

[0008] The invention is defined by the independent claims. The dependent claims define advantageous embodiments.

[0009] To this end, there is provided a garment care system comprising a base unit, a hand held unit and a hose cord connecting the base unit and the hand held unit.

[0010] The base unit is adapted to provide a first driving signal which reflects an operating state of the garment care system.

[0011] The hand held unit comprises:

- output means for providing visual or audible output information reflecting said operating state; and
- a unit which comprises at least one sensor and/or at least one user input device, for generating an input signal having a level depending on a state of said at least one sensor and/or at least one user input device.

[0012] The hose cord comprises a single communications wire for carrying said first driving signal from the base unit to the hand held unit for driving the output means, and for carrying the input signal from the hand held unit to the base unit.

[0013] The base unit further comprises:

- a coupling means for coupling or decoupling a first driving signal to or from the communications wire, thereby to operate the output means when the first driving signal is coupled to the communications wire; and
- a controller for:

  a) measuring the signal level on the communications wire when the first driving signal is de-coupled,
  b) retrieving, from said signal level, said state of said at least one sensor and/or at least one user input device, and
  c) controlling the garment care system in dependence on said retrieved state.

[0014] This garment care system uses a single signal wire for providing a first driving signal to the hand held unit for controlling an output means (such as an LED, display and/or buzzer) and for receiving an input signal from the hand held unit, such as a user control signal or a signal from a sensor. A time division approach is used, wherein the input signal is measured at times when the output means is not operated. During those times, the signal level which is measured on the communications wire reflects the state of the at least one sensor and/or at least one user input device. During the time duration when the driving signal is coupled to the communications wire, the signal (e.g. voltage or current) on

the communications wire has a constant value, or a value fluctuating over this time duration. The coupling means may be implemented as a single transistor or relay.

[0015] Preferably, the system is further adapted to provide a DC second driving signal to the unit via a resistive means when the first driving signal is de-coupled.

[0016] The second driving signal is used to enable the sensor/user input unit of the hand held unit to operate. It may for example be generated by a DC voltage source which is connected to the communications wire through the resistive means, so that the communications wire is not held at a fixed voltage, but the voltage instead depends on a resistance of the unit.

[0017] Preferably, the DC second driving signal provided to the unit is insufficient for operating the output means, when the first driving signal is de-coupled.

[0018] This means that when the first driving signal is not connected, the output means is turned off. The second driving signal for example has an insufficient voltage (or current) to operate the output means. This is when the measurement of the input signal can take place, because the communications wire is no longer driven by the first driving signal.

[0019] Preferably, the coupling means is controlled with a periodic ON/OFF signal with frequency of at least 30Hz.

[0020] In this way, the intermittent off periods of the output means during periods used for measuring the input signal, are not visually perceptible by a user.

[0021] Preferably, each duration of not coupling the first driving signal to the communications wire is at least 0.02ms.

[0022] This range of duration, when the first driving signal is not coupled, provides sufficient time to make one measurement sample of the value on the communications wire, without taking too much time from the operation of the output means.

[0023] This means the duty cycle of the first driving signal, calculated based on periodic durations during which the first driving signal is coupled to the communications wire to drive the output means, is for example at least 90%. A large duty cycle means the operation of the output means is interrupted for relatively short durations.

[0024] Preferably, the at least one sensor for example comprises a temperature sensor and/or an orientation sensor and/or an acceleration sensor, and wherein said at least one user input device comprises at least one switch.

[0025] The user input is for example for receiving a user input command for steam control or a steam trigger. The unit may thus provide an input signal which encodes multiple sources of information, such as steam on-off commands provided by a user, and/or, for a garment care system which comprises an iron, iron orientation information provided by a movement/position sensor, such as a ball sensor or an acceleration sensor. Other signals may be provided by the unit, such as a steam delivery rate setting or, for a garment care system which comprises an iron with a soleplate, a soleplate temperature setting selected by the user.

[0026] The first driving signal for example relates to a soleplate temperature and/or temperature of a steam generator implemented in the base unit. The first driving signal for example conveys information about the readiness of the garment care system such as, for an ironing system, the soleplate status (off, start-up, ready) or the status of the steam generator. The user is in this way provided with status information to assist in the most efficient use of the garment care system.

[0027] When the base unit comprises a temperature sensor and/or a water level sensor, the readiness of the base unit to deliver steam to the hand held unit can be determined.

[0028] Preferably, the input signal has at least two different voltage levels for different states of said at least one sensor and/or at least one user input device, wherein the unit comprises a resistor circuit having a resistance which depends on said different states, wherein the resistance of the resistor circuit determines said at least two different voltage levels.

[0029] The input signal may thus be an analog voltage. In this way, multiple pieces of information may be encoded by a single signal and one or more of these may be an analog signal. An analog signal may for example encode a desired temperature or a desired steam delivery rate as selected by the user.

[0030] The resistance of the resistor circuit determines the analog level of the input signal. Thus, the at least one sensor and/or the at least one user input device are arranged to modify the resistance of said resistor circuit.

[0031] The resistor circuit for example comprises one or more switches which are operated by user commands and/or sensor signals, wherein the one or more switches selectively couple a respective resistance to the resistor circuit and/or shunt a respective resistance.

[0032] The switches for example may each be in parallel with a respective resistance, thereby selectively shorting the resistance. The analog input signal level then indicates which switches are activated or deactivated. The state of multiple switches may be determined, for example when those switches and their respective resistances are in a series chain. The total resistance of that series chain depends on the states of the various switches. A similar modification of the resistance of the resistor circuit may be achieved with parallel resistor-switch arrangements.

[0033] Preferably, the resistor circuit may comprise at least one variable resistor which is operated by the user commands and/or sensor signals.

[0034] The analog input signal level then indicates the variable resistor settings. Thus, a two-level signal (i.e. ON/OFF) may be generated by use of a switch or an analog multilevel signal may be generated by use of a variable resistor. These approaches may be combined.

[0035] Preferably, the base unit may comprise an RC filter coupled to the communications wire for filtering the voltage signal of said communications wire. This may be used for rejection of noise on the communications wire, and in order to make a more accurate measurement of the signal on the communications wire.

[0036] There are various possible configurations for the garment care system.

[0037] In a first example, the base unit comprises a pressurized steam generator, the hose cord comprises a steam supply cord for carrying the generated steam, and the hand held unit comprises an iron having a steam chamber for receiving steam carried by said steam supply cord. This is a steam iron with a remote source of steam.

[0038] In a second example, the base unit comprises a water supply, the hose cord comprises a water supply cord for carrying the supplied water, and the hand held unit comprises an iron having a steam chamber for receiving the water carried by said water supply cord. This is a steam iron with a remote source of water but local generation of steam.

[0039] In a third example, the base unit comprises a pressurized steam generator for generating steam, the hose cord comprises a steam supply cord for carrying the generated steam, and the hand held unit comprises a garment steamer head having a steam chamber receiving steam carried by said steam supply cord. This is a garment steamer with a remote source of steam.

[0040] In a fourth example, the base unit comprises a first steam chamber, the hose cord comprises a steam supply cord for carrying the generated steam, and the hand held unit comprises a garment steamer head having a second steam chamber for receiving steam carried by said steam supply cord. This is garment steamer with a remote source of steam.

[0041] In a fifth example, the base unit comprises a water supply, the hose cord comprises a water supply cord for carrying the supplied water, and the hand held unit comprises a garment steamer head having a steam chamber for receiving the water carried by said water supply cord. This is a garment steamer with a remote source of water and local generation of steam.

[0042] Preferably, the output means comprises a lighting unit, a LED, a speaker or a buzzer.

[0043] This type of output means allows a user to get visual and/or audible information reflecting the operating state of the garment care system.

[0044] The invention also provides a method of operating a garment care system as presented above, the method comprising the steps of:

- at the base unit, providing a first driving signal which reflects an operating state of the garment care system;
- at the hand held unit the steps of:

    i) operating an output means in said hand held unit to provide visual or audible output information reflecting said operating state; and
    ii) generating an input signal from said hand held unit having a level depending on a state of a unit arranged in said hand held unit and comprising at least one sensor and/or a state of at least one user input device,

[0045] The method comprises using a single communications wire of the hose cord for carrying said first driving signal from the base unit to the hand held unit for driving the output means, and for carrying the input signal from the hand held unit to the base unit.

[0046] The method further comprises the steps of:

- at the base unit, coupling or decoupling a first driving signal to or from the communications wire and thereby operating the output means when the first driving signal is coupled to the communications wire;
- at the base unit, measuring the signal level on the communications wire when the first driving signal is de-coupled;
- retrieving, from said signal level, said state of said at least one sensor and/or at least one user input device; and
- controlling the garment care system in dependence on said retrieved state.

[0047] This method defines the operation of the garment care system as defined above.

[0048] Preferably, the method may comprise providing a DC second driving signal to the unit via a resistive means when the first driving signal is de-coupled. The signal on the communications wire provided by the second driving signal is preferably insufficient for operating the output means, when the first driving signal is de-coupled.

[0049] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050] For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

Figure 1 shows ironing garment care system according to the invention;
Figure 2 shows a known circuit for providing two-way communication between the base unit and the iron unit, using two communications wires;
Figure 3 shows a first example of a circuit for providing two-way communication between the base unit and the iron unit using a single communications wire, according to the invention;
Figure 4 shows a timing diagram to help explain the communication method;
Figure 5 shows a second example of a circuit for providing two-way communication between the base unit and the iron unit using a single communications wire, according to the invention; and
Figure 6 shows a flow chart of a method according to the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0051] The invention will be described with reference to the Figures.

[0052] It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the apparatus, systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention. These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawings. It should be understood that the Figures are merely schematic and are not drawn to scale. It should also be understood that the same reference numerals are used throughout the Figures to indicate the same or similar parts.

[0053] Figure 1 shows a garment care system 10 according to the invention.

[0054] The garment care system 10 comprises a base unit 20, a hand held unit 30 and a hose cord 44 connecting the base unit and the hand held unit.

[0055] The base unit 20 is adapted to provide a first driving signal V1 which reflects an operating state of the garment care system.

[0056] The hand held unit 30 comprises:

- output means 36 for providing visual or audible output information reflecting said operating state; and
- a unit 38 which comprises at least one sensor 42 and/or at least one user input device 40, for generating an input signal having a level depending on a state of said at least one sensor 42 and/or at least one user input device 40.

[0057] The hose cord 44 comprises a single communications wire 46 for carrying said first driving signal V1 from the base unit 20 to the hand held unit 30 for driving the output means 36, and for carrying the input signal from the hand held unit 30 to the base unit 20.

[0058] The base unit 20 further comprises:

- a coupling means 58 for coupling or decoupling a first driving signal V1 to or from the communications wire 46, thereby to operate the output means 36 when the first driving signal V1 is coupled to the communications wire 46; and
- a controller 25 for:

    a) measuring the signal level on the communications wire 46 when the first driving signal V1 is de-coupled;
    b) retrieving, from said signal level, said state of said at least one sensor 42 and/or at least one user input device 40; and
    c) controlling the garment care system in dependence on said retrieved state.

[0059] In the example illustrated in Figure 1, the garment care system 10 corresponds to a steam ironing system.

[0060] The base unit 20 comprises a steam generator 22 and an output circuit 24 for providing the first driving signal V1 reflecting an operating state of the ironing system.

[0061] The hand held unit corresponds to a hand held iron (referred to as "iron" or "iron unit" in the following).

[0062] The first driving signal provided by the base is for providing status information to a user of the iron, and in particular is for operating an output means 36 of the iron unit such as a LED, an array of LEDs, a buzzer, another type of light source, or a combination of devices.

[0063] The iron unit 30 comprises a soleplate 32 and a heater 34 for heating the soleplate. The iron unit 30 comprises the output means 36 for providing visual or audible output information relating to the operating state of the ironing system.

[0064] The unit 38 provides an input signal for use by the base unit 20 in controlling, for example, the steam generator 22. The unit 38 provides an input signal which depends on user input provided at a user interface 40, for example comprising switches and/or rotary control knobs and/or slider controls, and any other type of user interface (e.g. voice control). The input signal may also depend on conditions detected by one or more sensors 42, such as a ball type

orientation sensor which can detect if the iron soleplate is in a horizontal position (i.e. in use) or in a vertical upright position (i.e. in a standby position).

[0065] The communications wire 46 and the steam hose 44 preferably form a single coupling. This provides a compact arrangement without multiple trailing wires and tubes for carrying steam. The single coupling for example further comprises a ground wire and one or more power wires. These are for example used to provide a power supply to the heating element 34 in the iron unit 30, as well as to the other circuitry of the iron unit. The single coupling for example has a length of more than 1m.

[0066] The communications wire 46 is used for the transfer of the first driving signal from the output circuit 24 of the base unit to the iron unit for operating the output means 36, and for the transfer of the input signal from the unit 38 of the iron unit to the base unit.

[0067] The base unit has a power supply arrangement for providing two driving signals V1 and V2.

[0068] The driving signals V1 and V2 may be DC voltage levels.

[0069] The symbols V1 and V2 are used to refer to the driving signals themselves, but also to the voltages of those driving signals in some of the equations below.

[0070] The two driving signals V1 and V2 may be the same voltage level and indeed they may generated as the output voltage of a single power supply, or else there may be separate power supply circuits for the two driving signals.

[0071] The first driving signal V1 is connected via a coupling means 58 to the single communications wire 46, in particular a transistor switch.

[0072] The second driving signal V2 is connected via a resistive means to the single communications wire 46.

[0073] The single communications wire 46 simplifies the steam hose design and enables it to be more flexible.

[0074] Figure 2 shows a known circuit for providing two-way communication between a base unit 20 and an iron unit 30.

[0075] The base unit comprises a power supply arrangement for providing a first driving signal V1 and a second driving signal V2.

[0076] The first driving signal V1 is provided to the output means 36, which in this example is a LED, by a first communications wire 54. To supply the first driving signal V1 to the LED, a control signal 56 is applied to the coupling means 58. This control signal 56 turns ON or OFF the coupling means 58, in the form of a transistor switch, which either couples the first driving signal V1 to the output means 36 via communications wire 54, or isolates the first driving signal V1 from the output means 36.

[0077] The second driving signal V2 is provided to the user interface 40 (shown as an on-off switch 41 in parallel with a resistor R3) and the sensor 42 through a supply resistor R4 via a second communications wire 55. The sensor is also shown as a switch 43 in parallel with a resistor R2. The voltage at node 62 depends on the resistor values R2, R3 and R4 as well as the switch states. When a switch is closed, the resistor is bypassed so the overall resistance decreases and the voltage at node 62 decreases. The four possible switch states (for the two switches) give four different voltage values at the node 62 so that each combination of switch states can be detected at node 62. The voltage at node 62 is read out from output terminal 64, which corresponds to a middle point of a RC filter. The resistors R2 and R3 have different values for this purpose.

[0078] It has been recognized that it would be desirable to have a single communications wire.

[0079] Figure 3 shows one example according to the invention of how to achieve this goal.

[0080] The same components are given the same references as in Figure 2.

[0081] The first and second driving signals V1 and V2 couple to the same single communications wire 46.

[0082] The first driving signal V1 couples directly in this example through the coupling means 58, again shown as a transistor switch, so that (ignoring the voltage drop across the transistor) the first driving signal voltage V1 is provided on the communications wire 46.

[0083] The second driving signal V2 couples to the communications wire 46 through the supply resistor R4.

[0084] When the coupling means 58 is ON, the voltage on the communications wire will be at the voltage V1.

[0085] When the coupling means is OFF, the voltage will be a resistor divider voltage depending on the voltage V2, the switch states and the resistor values of the unit 38.

[0086] The communications wire 46 connects to the two resistors R2 and R3 through a further resistor R7.

[0087] Note that the voltages V1 and V2 maybe the same (in which case there is only one actual voltage supply, which implies that resistance value of R4 must always be greater than internal resistance of coupling means 58), or different. If they are the same voltage, the voltage drop across the resistor means that the eventual voltage on the line 46 still changes when the switch 58 is turned off.

[0088] Thus, as in the example of Figure 2, the base unit makes use of a first driving signal for operating the output means 36, and a coupling means 58, again in the form of a transistor switch, for coupling or not coupling the first driving signal V1 to the communications wire 46. However, there is only a single communications wire.

[0089] Furthermore, the controller 25 (shown in Figure 1) is adapted to measure the input signal on the communications wire 46 only when the first driving signal V1 is not coupled to the communications wire. Thus, there is a time division approach: a first time period is used for driving the output means 36 and a second time period is used for measuring

the input signal generated by the unit 38.

[0090] This ironing system uses a single communications wire 46 for providing a first driving signal to the iron unit for operating the output means and for receiving an input signal from the iron unit.

[0091] The level of the input signal is measured on the communications wire 46 only at time durations when the output means 36 is not operated. During those time durations, the signal level on the communications wire 46 reflects the state of the at least one sensor 42 and/or at least one user input device 40. The signal level may be either constant if the state of at least one sensor 42 and/or at least one user input device 40 do not change, or varying if the state of at least one sensor 42 and/or at least one user input device 40 change .

[0092] The first driving signal V1 may be a constant DC voltage, for example to operate the output means 36 in the form of a LED light with a constant visual light level. An example of this situation is lighting up a green LED with a constant visual lighting, to inform user that the garment care system is ready to be used.

[0093] The first driving signal V1 may also have a voltage varying over time to provide a desired output response from the output means, for example to operate the output means 36 in the form of a LED light with a fluctuating visual light level ("e.g. blinking/pulsing/breathing effect). An example of this situation is lighting up a green LED with a changing visual lighting, to inform user that the garment care system is not ready to be used yet.

[0094] The coupling means 58 may be implemented as a single transistor.

[0095] The second driving signal V2 is such that it does not operate the output means 36. This is easily achieved for a LED by providing a second driving signal voltage V2 at or below the forward voltage of the LED (or LED arrangement). In this case, the voltage V1 may be greater than or equal to the voltage V2 (note that there is a voltage drop from V2 across the resistor R4). The same effect may be obtained based on a driving current for an output means with a current threshold rather than a voltage threshold as is the case for a LED.

[0096] In both cases, it means that when the first driving signal V1 is not coupled to the communication wire 46, the output means 36 is turned off. This is actually during this time duration that the measurement of the input signal can take place, because the communications wire is no longer held at the first driving signal voltage (or delivering a first driving signal current).

[0097] The coupling means 58 is controlled with a periodic control signal 56 for example with frequency of at least 30Hz. This range of frequency is in particular beneficial in case the output means corresponds to a lighting element, such as a LED, because the intermittent off periods used for measuring the input signal are not visually perceptible by a user.

[0098] Each period of not coupling the first driving signal V1 to the communications wire is designed to allow the input signal to stabilize and be measured, for example with a duration of at least 0.02ms. Preferably, the measurement on the communications wire 46 made by the controller 25 is made as a single measurement in the middle of this duration of not coupling the first driving signal V1.

[0099] The duty cycle of the control signal 56, during which the first driving signal is coupled to the communications wire to drive the output means 38, is high, for example at least 90%, so that the brief interruptions of not operating the output means are not perceptible.

[0100] Figures 2 and 3 also show a separate ground wire GND, and there will also typically be one or more power wires, such as live and neutral wires. Thus, there may be four wires in total.

[0101] Figures 2 and 3 show an example in which there is a user interface 40 and a sensor 42.

[0102] The user interface is for example for receiving a user input command for steam control, such as binary information (for example, steam or no steam). One or more (mechanical) switch may be used to provide such binary information.

[0103] However, analog information may be provided such as a desired steam temperature, a desired steam flow rate, etc. One or more variable resistors may be used to provide such analog information. The analog information level is indicated by the value of the variable resistors settings.

[0104] Same as in the example of switches, the resistor values are such that the corresponding combined resistance conveys a unique combination of settings, for example an on/off switch reflecting two operating states (for example steam / no steam). Ultimately the input signal that is measured at node 62 is always an analog voltage level.

[0105] The first driving signal reflects an operating state of the garment care system, for example relates to the soleplate temperature and/or steam temperature, and in particular may convey readiness information of the iron unit such as the soleplate status (off, start-up, ready), or the status of the steam generator 22. The base unit for example may sense the temperature and/or water level of the steam generator to determine the status of the steam generator.

[0106] The operating state of the garment care system, can for example be materialized by the output means 36 as a visual light (e.g. LED) and/or a sound (e.g. buzzer/speaker).

[0107] The output means 36 may be used to provide information for multiple operating states of the garment care system, as explained in the following examples..

[0108] Some examples are now presented for an output means 36 in the form of an LED. The system status and corresponding LED status may be:

Garment care system Powered OFF: LED is OFF;
Garment care system in a start-up phase (for example the first two minutes after switching ON the garment care system): LED turns ON and varying light intensity to create a with blinking/pulsing/breathing visual effect;
Garment care system ready: LED is ON constantly;
Garment care system in automatic shutdown mode (for example after five minutes of no movement by user): LED with varying light intensity to create a blinking/pulsing/breathing visual effect.

[0109] The LED may thus be controlled to be ON or OFF or blinking/pulsing/breathing at any time and the status of the switch or switches 41 can still be detected during the off periods.

[0110] The resistors R2, R3, R4 and R7 are used to form a resistor divider network for sensing the switching status of the switches 41, 43.

[0111] For turning off the output means 36 of the iron, the control signal 56 is pulled high to de-couple the coupling means 58 (i.e. turn off the transistor). To prevent output means 36 being operated during this de-coupling time duration, for the example of an LED, the resistors R2, R3, R4, R7 and the voltage V2 should meet the following condition:

$$\frac{R2+R3+R7}{R4+R2+R3+R7} \bullet V2 < V_{F(LED)} \qquad (1)$$

$V_{F(LED)}$ is the LED forward voltage.

[0112] While the LED is in the OFF condition, the signal level at the output node 62 can then be measured from output terminal 64 to derive the switch(s) status any time by the control unit 25 in the base unit.

[0113] For turning on the output means 36 of the iron unit, the control signal 56 is pulled low to form a coupling of the first driving signal V1 with communications wire 4658 (i.e. turn on the transistor).

[0114] In order to measure the status of the switches 41/43, the control signal 56 is pulled high to periodically de-couple (i.e. periodically turn off the transistor, because it is a p-type transistor in this example) the driving signal V1 from the communications wire 46, as shown in Figure 4.

[0115] The measurement of the signal level on the communication wire 46 takes place during the time durations where the transistor is turned off. Those time durations are illustrated with a crossed-hatched pattern.

[0116] The voltage on terminal 64 is determined by the status of the switches after the coupling means 58 has de-coupled the first driving signal V1 from the communications wire 46, i.e. the transistor has been turned off. The switch status can be thus detected by the control unit 25 in the base unit.

[0117] When a continuous visual lighting of the LED 36 is desired (from user's visual perspectives), because the LED is always operated intermittently by the first driving signal, in order to prevent the LED 36 blinking, the frequency of the control signal 56 is preferably higher than 30Hz.

[0118] The duty cycle of the control signal 56 and the time duration the first driving signal V1 is de-coupled from the communications wire 46 depend on the overall garment care system design, such as the length of communication wire 46, component selection, analog to digital converter sample and conversion times by the controller 25, etc.

[0119] As an example, a 100Hz frequency of the control signal 56 may be used with a 0.1ms time duration where the first driving signal V1 is de-coupled from the communications wire 46. This gives a duty cycle of LED switching of 99% (=9.9ms/10ms). The duty cycle is preferably more than 90% and the detecting time (the transistor off time) is preferably at least 0.02ms.

[0120] The design is typically used for long wires (>Im or even >1.5m). Parasitic parameters, such as inductance and capacitance, prevent the signal at terminal 64 dropping immediately, so there is a stabilization time allowed.

[0121] With reference to the components in Figure 3, R1 is used for controlling the LED current and light output intensity. The LED current can be calculated, when the coupling means 58 couples the first driving signal V1 to the communications wire 46 (i.e. the transistor 58 is turned on) as follows:

$$I_{LED} = \frac{V1 - V_{F(LED)}}{R1} \qquad (2)$$

[0122] During this time duration, the voltage on the terminal 64 is V1.

[0123] When the coupling means 58 de-couples the first driving signal V1 from communications wire 46(i.e. the transistor is turned off), the voltage on the single communications wire is given by:

$$\frac{R2+R3+R7}{R4+R2+R3+R7} \bullet V2 \tag{3}$$

[0124] Thus, during the OFF time of the transistor, the LED current is given by:

$$I_{LED} = \frac{\frac{R2+R3+R7}{R4+R2+R3+R7} \bullet V2 - V_{F(LED)}}{R1} \tag{4}$$

[0125] Thus, to ensure that the LED is OFF when the coupling means 58 de-couples the first driving signal V1 from the communications wire 46, the following condition must be met:

$$\frac{R2+R3+R7}{R4+R2+R3+R7} \bullet V2 < V_{F(LED)} \tag{5}$$

[0126] $V_{F(LED)}$ is typically in the range 1 Volt to 4 Volts or even higher.

[0127] The voltage on the single communications 46 wire (V_{COMM_IN}) at node 62 depends on the switch states in the following way:

Switch 41 open and switch 43 open:

$$V_{COMM\_IN} = \frac{R2+R3+R7}{R4+R2+R3+R7} \bullet V2 \tag{6}$$

Switch 41 closed and switch 43 open:

$$V_{COMM\_IN} = \frac{R2+R7}{R4+R2+R7} \bullet V2 \tag{7}$$

Switch 41 open and switch 43 closed:

$$V_{COMM\_IN} = \frac{R3+R7}{R4+R3+R7} \bullet V2 \tag{8}$$

Switch 41 closed and switch 43 closed:

$$V_{COMM\_IN} = \frac{R7}{R4+R7} \bullet V2 \tag{9}$$

[0128] This means that the input signal has at least two different voltage levels for different states of the at least one sensor (42) and/or at least one user input device (40). The the unit (38) comprises a resistor circuit (R2, R3, R7) having a resistance which depends on said different states. The resistance of the resistor circuit determines said at least two different voltage levels, as described above.

[0129] By way of example only, let assume V1=5.0V, V2=5.0V, $V_{F(LED)}$=2.8~3.8V, R1=330Ω, R2=9.09kQ, R3=5.11kQ, R4=46.4kQ, R6=47kQ, R7=3.74kQ.

[0130] The AC power supply connection included in the hose cord 44 may cause noise in the signal of the communications wire 46 from the iron unit to the base unit. In order to limit this noise, a RC filter can be added in the circuit of Figure 3.

[0131] Figure 5 shows a modification in which an RC filter 80 is provided at the output terminal 64 to filter the noise. By way of example R5=1kΩ, C1=1nF.

[0132] The equivalent resistance of the input signal is for example less than 5 kQ, and considering a maximum capacitor size of InF in the noise filter, 3RC=15μs as a suitable stabilization time for the input signal (to give -95% accuracy), and another 5μs for signal sampling and measuring.

[0133] Only one example of an electrical circuit has been given to illustrate the invention (with a modification to include an RC filter). However, other circuits are of course equally possible. The invention may be based on voltage driving or current driving, and voltage sensing or current sensing.

[0134] Formulated differently, the invention avoids interference to the measured input signal on the communication wire 46 by ensuring this measurement takes place only during time durations that the output means is not operated and thereby not affecting the input signal itself. This may be achieved with various circuit designs.

[0135] The output means may be perceived by the user as continuously operational, or else there may be a deliberate blinking/pulsing/breathing effect to convey information to the user. There are operating modes of the garment care system during which, when the output means 36 is operated (i.e. providing information to the user), the state of the at least one sensor 42 and/or at least one user input device 40 is desired to be sensed.

[0136] For example, there are the following situations:

a) The output means 36 may be operated continuously (e.g. a LED emitting light continuously, from a user visual perspective i.e. blinking above a frequency so that the blinking is not visible for a human) to indicate to the user that the garment care system is ready to be used. In this situation, there is a need to retrieve the information that the user has actuated the steam trigger (for example via switch 41) so that the base and the hand held device generates accordingly the necessary steam.

b) The output means 36 may be operated intermittently (i.e. blinking/pulsing/breathing of a LED, from the user visual perspective, by V1 being a periodic ON/OFF signal, the ON durations defining durations where LED is visually ON, the OFF duration defining durations where LED is visually OFF) to indicate to the user that the garment care system has entered a specific operating state, such as an auto steam mode (i.e. the garment care system generates steam from its soleplate without user action). In this situation, there is a need to retrieve the information that user will actuate the steam trigger (for example actuating the switch 41 at least two times within a certain period of time, sometimes referred to as "double-tap"), which is interpreted by the base as a command to exit the auto steaming mode.

c) The output means may be operated continuously (e.g. a LED emitting light continuously, from a user visual perspective i.e. blinking above a frequency so that the blinking is not visible for a human) to indicate user that the garment care system is used in a by-default mode. In this situation, there is a need to retrieve the information on whether the garment care system (in particular the iron unit) is moving or not. For this, the state of sensor 42 is retrieved according to the invention. For example, the sensor 42 is an acceleration sensor, and if the same state of sensor 42 is retrieved continuously during more than a certain duration threshold, this is interpreted by the base unit as the garment care system being in a no-moving state. In that case, the base may decide to operate the output means 36 differently, such as intermittently (i.e. blinking of a LED, from user perspective, by V1 being a periodic ON/OFF signal) to alert the user on possible risks of damaging garments of even a start of fire. Optionally, the base could decide to have the garment care system enter into a stand-by mode.

[0137] Figure 6 shows a flow chart of a method according to the invention.

[0138] The method comprises:

- in step 90, at the base unit, providing a first driving signal which reflects an operating state of the garment care system;
- at the hand held unit (30):

  i) in step 92, operating an output means by said first driving signal, to provide visual or audible output information reflecting said operating state,

  ii) in step 94, generating an input signal from said hand held unit 30 having a level depending on the state of a unit 38 arranged in said hand held unit 30 and comprising at least one sensor 42 and/or at least one user input device 40.

[0139] The method comprises using a single communications wire of the hose cord for carrying the first driving signal from the base unit to the hand held unit for driving the output means, and for carrying the input signal from the hand held unit to the base unit.

[0140] The method further comprises the steps of:

- coupling or decoupling a first driving signal to or from the communications wire and thereby operating the output means when the first driving signal is coupled to the communications wire. The coupling phase is shown as step 92a and the non-coupling phase is shown as step 94a;

- in step 94b, at the base unit, measuring the signal level on the communications wire when the first driving signal is de-coupled;
- in step 94c, retrieving, from said signal level, said state of said at least one sensor and/or at least one user input device; and
- in step 96, controlling the garment care system in dependence on said retrieved state.

[0141] The steps maybe performed in different orders. For example, the output phases 92, 92a and the input phases 94, 94a, 94b, 94c may be in either order, or indeed follow a cyclic sequence, with alternation between the coupling of step 92a and the non-coupling of step 94a.

[0142] Preferably, the method also comprises a step of providing a DC second driving signal V2 to the unit (such as unit 38 described above) via a resistive means (such as resistance R4 described above) when the first driving signal V1 is de-coupled.

[0143] Preferably, as described above, the signal on the communications wire 46 provided by the second driving signal is insufficient for operating the output means 36, when the first driving signal V1 is de-coupled.

[0144] Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A garment care system (10) comprising a base unit (20), a hand held unit (30) and a hose cord (44) connecting the base unit and the hand held unit,
wherein the base unit (20) is adapted to provide a first driving signal (V1) which reflects an operating state of the garment care system;
wherein the hand held unit (30) comprises:

output means (36) for providing visual or audible output information reflecting said operating state; and
a unit (38) which comprises at least one sensor (42) and/or at least one user input device (40), for generating an input signal having a level depending on a state of said at least one sensor (42) and/or at least one user input device (40),

wherein the hose cord (44) comprises a single communications wire (46) for carrying said first driving signal (V1) from the base unit (20) to the hand held unit (30) for driving the output means (36), and for carrying the input signal from the hand held unit (30) to the base unit (20),
wherein the base unit (20) further comprises:

a coupling means (58) for coupling or decoupling the first driving signal (V1) to or from the communications wire (46), thereby to operate the output means (36) when the first driving signal (V1) is coupled to the communications wire (46); and
a controller (25) for:

a) measuring the signal level on the communications wire (46) when the first driving signal (V1) is de-coupled;
b) retrieving, from said signal level, said state of said at least one sensor (42) and/or at least one user input device (40); and
c) controlling the garment care system in dependence on said retrieved state.

2. A garment care system as claimed in claim 1, wherein the base unit is further adapted to provide a DC second driving signal (V2) to the unit (38) via a resistive means (R4) when the first driving signal (V1) is de-coupled.

3. A garment care system as claimed in claim 2, wherein the DC second driving signal (V2) provided to the unit (38) is insufficient for operating the output means (36), when the first driving signal (V1) is de-coupled.

4. A garment care system as claimed in any one of claims 1 to 3, wherein the coupling means (58) is controlled with a periodic ON/OFF signal (56) having a frequency of at least 30Hz.

5. A garment care system as claimed in any one of claims 1 to 4, wherein each duration of not coupling the first driving signal to the communications wire (46) is at least 0.02ms.

6. A garment care system as claimed in any one of claims 1 to 5, wherein said at least one sensor (42) comprises a temperature sensor and/or an orientation sensor and/or an acceleration sensor, and wherein said at least one user input device (40) comprises at least one switch (41).

7. A garment care system as claimed in any one of claims 1 to 6, wherein the input signal has at least two different voltage levels for different states of said at least one sensor (42) and/or at least one user input device (40), wherein the unit (38) comprises a resistor circuit (R2, R3, R7) having a resistance which depends on said different states, wherein the resistance of the resistor circuit determines said at least two different voltage levels.

8. A garment care system as claimed in claim 7, wherein said at least one sensor (42) and/or at least one user input device (40) are arranged to modify the resistance of said resistor circuit (R2, R3, R7).

9. A garment care system as claimed in claim 8, wherein the resistor circuit comprises at least one variable resistor which is operated by the user commands and/or sensor signals.

10. A garment care system as claimed in any one of claims 1 to 9, wherein the base unit (20) comprises an RC filter (80) coupled to the communications wire (46) for filtering the voltage signal of said communications wire (46).

11. A garment care system as claimed in any one of claims 1 to 10, wherein:

- the base unit (20) comprises a pressurized steam generator, the hose cord comprises a steam supply cord for carrying the generated steam, and the hand held unit comprises an iron having a steam chamber for receiving steam carried by said steam supply cord; or
- the base unit (20) comprises a water supply, the hose cord comprises a water supply cord for carrying the supplied water, and the hand held unit comprises an iron having a steam chamber for receiving the water carried by said water supply cord, or
- the base unit (20) comprises a pressurized steam generator for generating steam, the hose cord comprises a steam supply cord for carrying the generated steam, and the hand held unit comprises a garment steamer head having a steam chamber receiving steam carried by said steam supply cord, or
- the base unit (20) comprises a first steam chamber, the hose cord comprises a steam supply cord for carrying the generated steam, and the hand held unit comprises a garment steamer head having a second steam chamber for receiving steam carried by said steam supply cord; or
- the base unit (20) comprises a water supply, the hose cord comprises a water supply cord for carrying the supplied water, and the hand held unit comprises a garment steamer head having a steam chamber for receiving the water carried by said water supply cord.

12. A garment care system as claimed in claim 11, wherein the output means (36) comprises a lighting unit, a LED, a speaker or a buzzer.

13. A method of operating a garment care system comprising a base unit (20), a hand held unit (30) and a hose cord (44) connecting the base unit and the hand held unit, the hose cord (44) comprising a single communications wire (46), the method comprising the steps of:

at the base unit, providing (90) a first driving signal (V1) which reflects an operating state of the garment care system;
at the hand held unit (30), the steps of:

operating (92) an output means in said hand held unit (30) by said first driving signal, to provide visual or audible output information reflecting said operating state; and
generating (94) an input signal from said hand held unit (30) having a level depending on a state of a unit (38) arranged in said hand held unit (30) and comprising at least one sensor (42) and/or a state of at least one user input device (40),

wherein the method comprises using said single communications wire (46) for carrying said first driving signal from the base unit (20) to the hand held unit (30) for driving the output means (36), and for carrying the input

signal from the hand held unit (30) to the base unit (20),
wherein the method further comprises the steps of:

at the base unit, coupling (92a) or decoupling (94a) the first driving signal (V1) to or from the communications wire (46) and thereby operating the output means (36) when the first driving signal is coupled to the communications wire;
at the base unit, measuring (94b) the signal level on the communications wire when the first driving signal is de-coupled;
retrieving (94c), from said signal level, said state of said at least one sensor (42) and/or at least one user input device (40); and
controlling (96) the garment care system in dependence on said retrieved state.

14. A method as claimed in claimed 13, further comprising a step of providing a DC second driving signal (V2) to the unit (38) via a resistive means (R4) when the first driving signal (V1) is de-coupled.

15. A method as claimed in any one of claims 13 or 14, wherein the signal on the communications wire (46) provided by the second driving signal is insufficient for operating the output means (36), when the first driving signal (V1) is de-coupled.

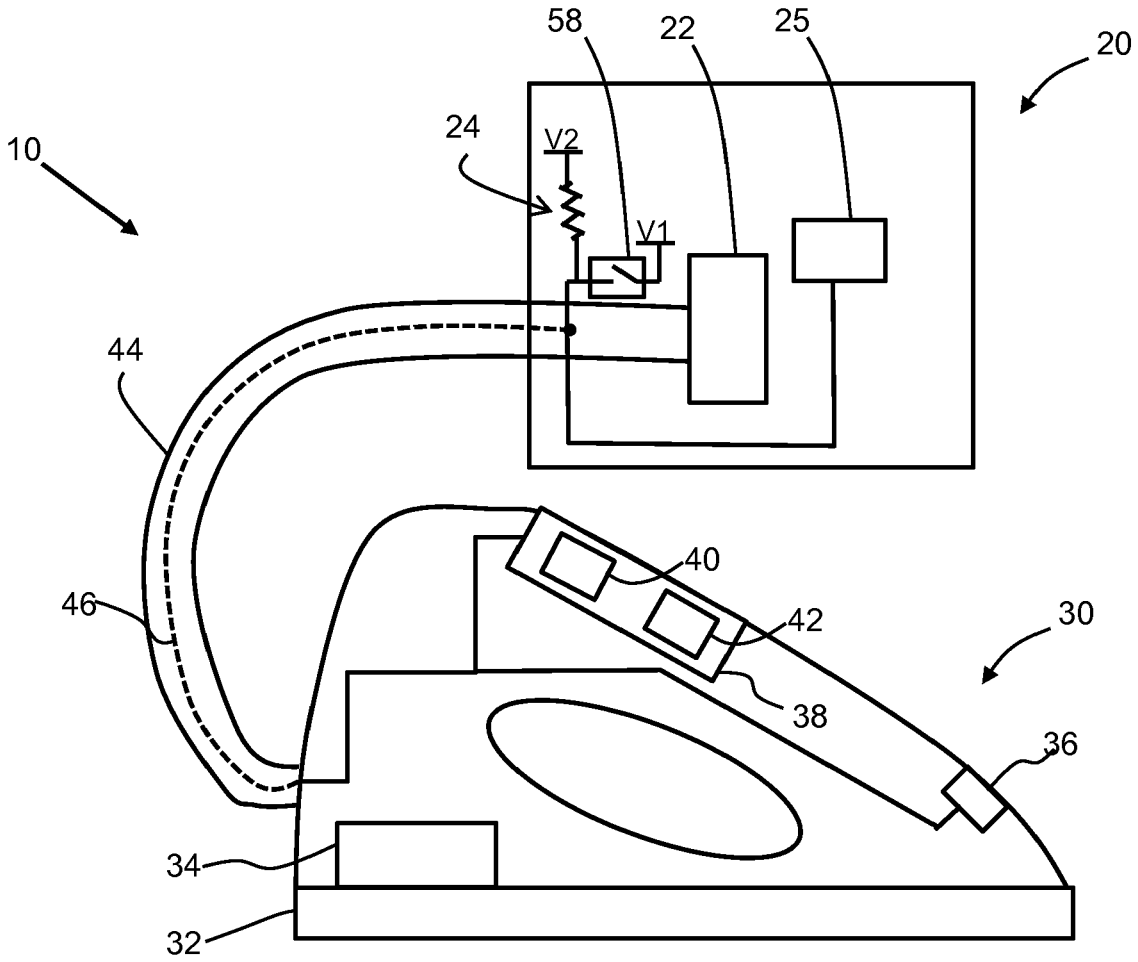


FIG. 1

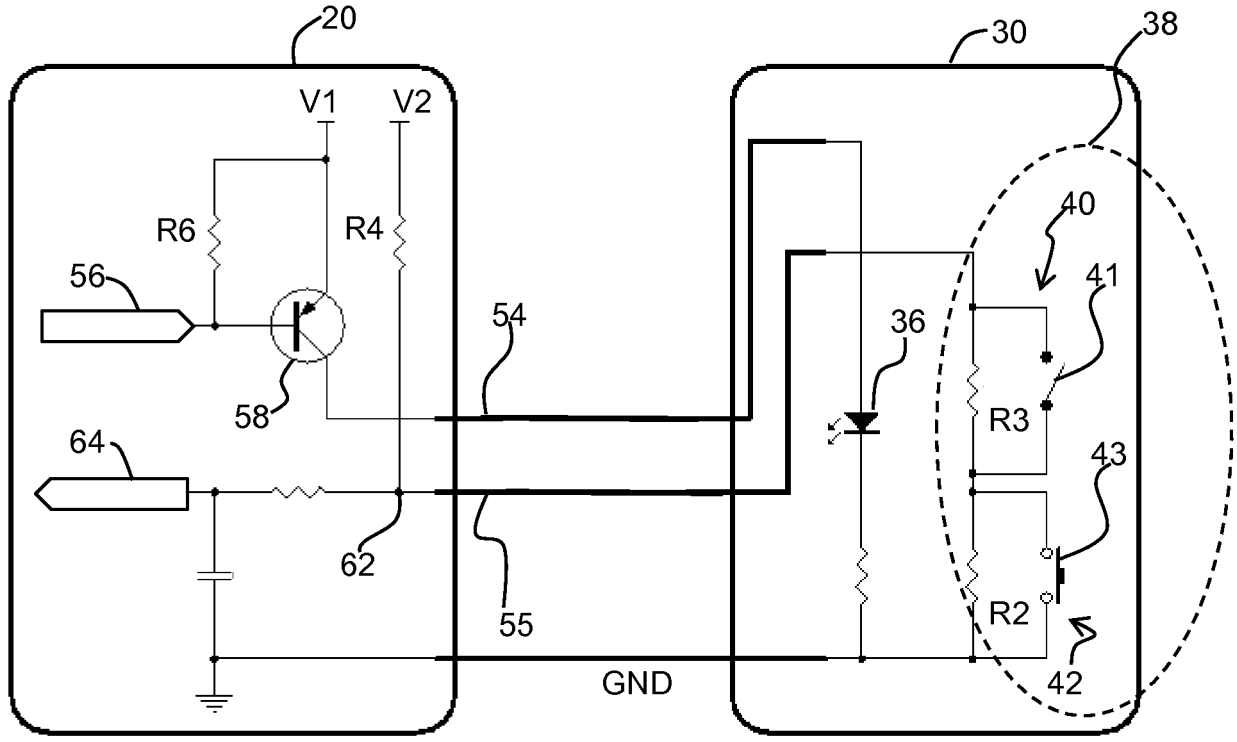

20
30
38
V1
V2
R6
R4
56
54
40
41
36
58
R3
64
43
62
55
R2
GND
42

FIG. 2

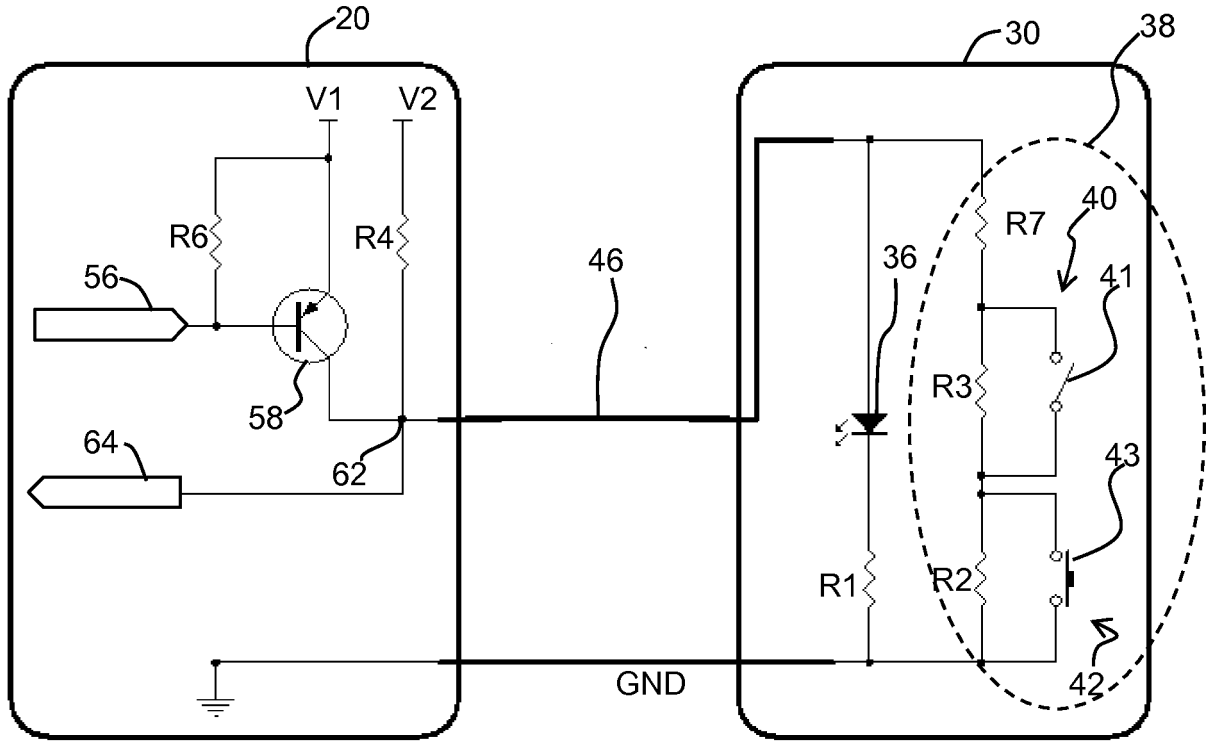

20
30
38
V1
V2
R6
R4
R7
40
56
46
36
41
R3
58
64
43
62
R1
R2
GND
42

FIG. 3

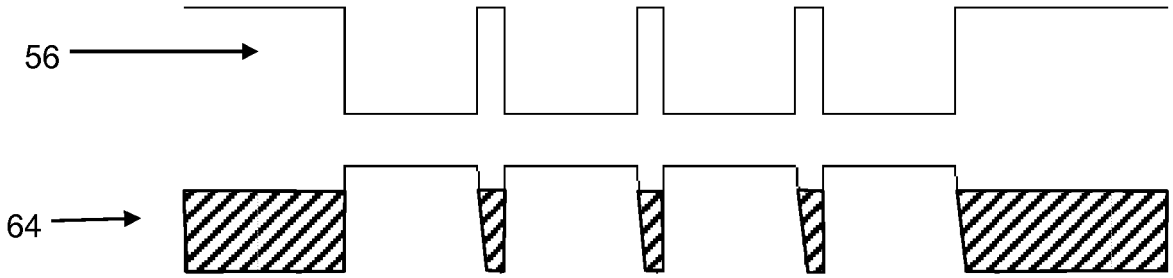
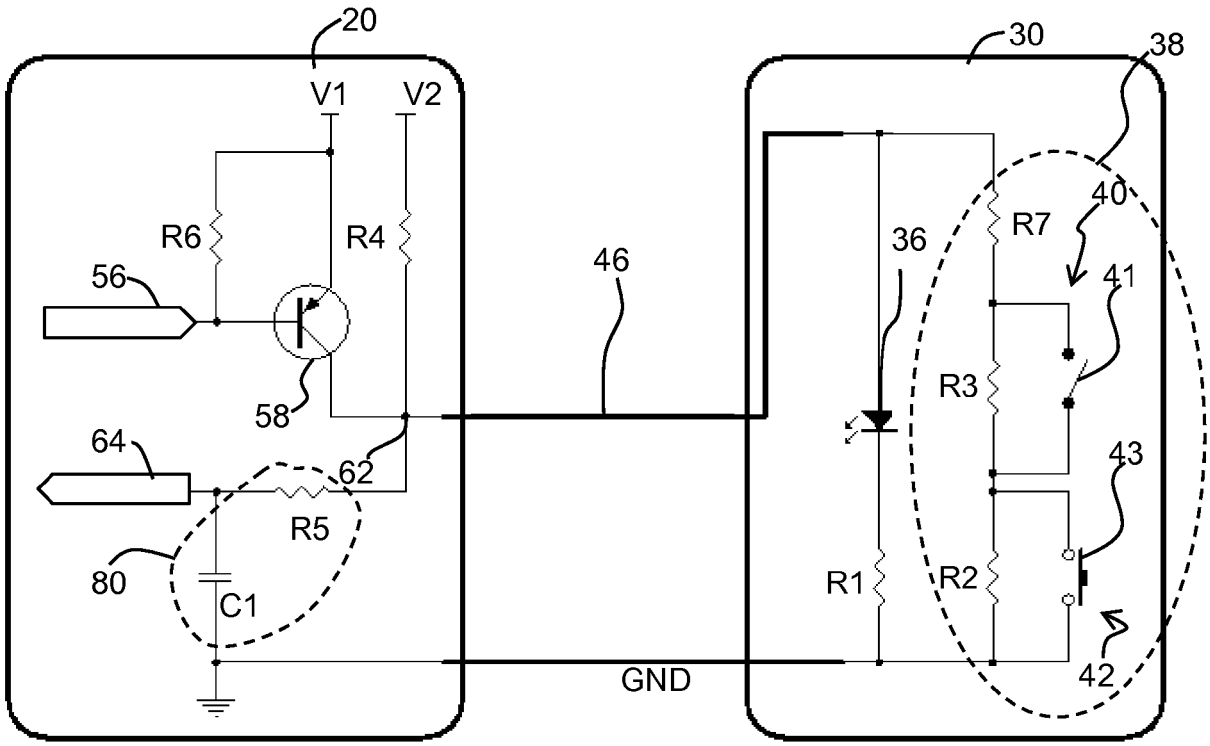

56
64

FIG. 4


20
V1
V2
R6
R4
56
58
64
62
R5
80
C1
46
30
38
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36
R7
41
R3
43
R1
R2
42
GND

FIG. 5

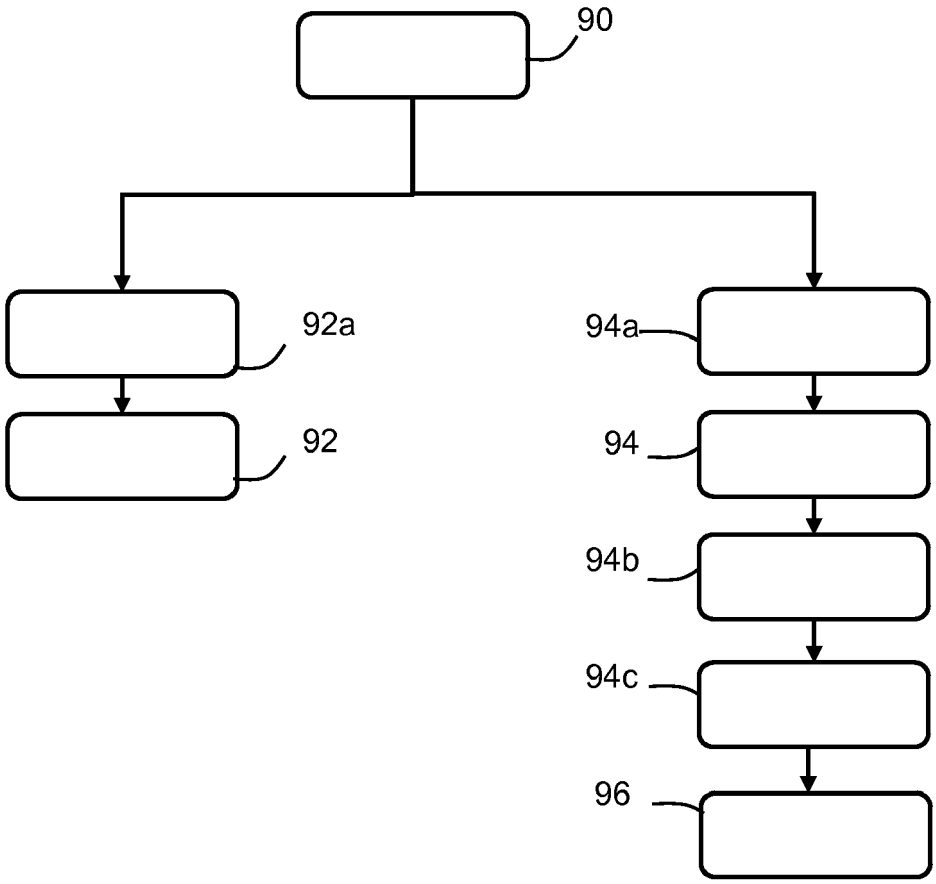

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 3031

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 April 2019	Bermejo, Marco

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