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(54) Title: A CONTROL DEVICE FOR A HOME AMBIENCE SYSTEM

(57) Abstract: A control device (100) for a home ambience system (10) is provided. The control device (100) is dedicated to provide control signals for an associated sound circuit (21) of a sound system (20) and/or an associated dimmer circuit (31) of a lighting system (30). The control device (100) comprises a stationary base (102); a rotatable member (104) rotationally arranged on the stationary base (102); a rotational sensor (106) for detecting a rotational movement of the rotatable member (104) relative the stationary base (102); a controller (108) configured to determine a control signal based on the detected rotational movement of the rotatable member (104), and radio communication means (110) configured to transmit the control signal to a receiving circuit (21, 31) of said home ambience system (10).

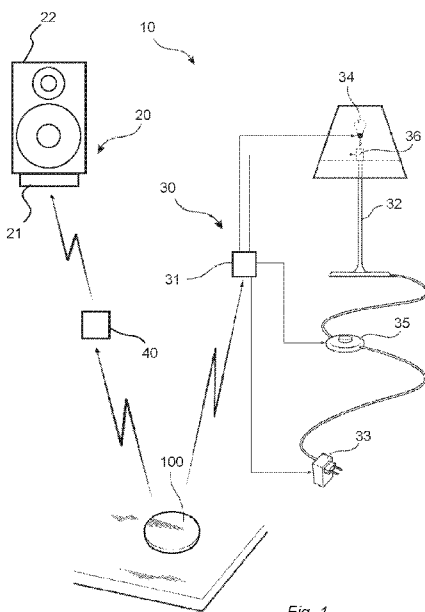


Fig. 1



AN IMPROVED CONTROL DEVICE FOR A HOME AMBIENCE SYSTEM

Technical field

The present invention relates to a control device for a home ambience system.
5 More particularly, the present invention relates to a multi-purpose wireless dimmer and a home ambience system comprising such wireless dimmer.

Background

Wireless control of lighting systems is subject to increased popularity. There
10 are several known systems wherein the lighting device, i.e. the light source, is connected to the internet either directly, by means of internet connection provided in the light source, or indirectly by providing the power line with an internet-supported switch. For these systems control is normally achieved by activating a client application on a smartphone. Upon activation a wireless connection is established between the
15 smartphone and a control device, which in accordance with the description above may be arranged within the electrical circuitry of the light source itself or as a separate switch in the power line. A user may thus control the driving power for the light source by appropriate tuning via the smartphone application in order to achieve desired dimming of the light source.

20 DE102013015284 describes an alternative system for dimming lights, wherein a cube having a magnetic sensor is configured to control dimming. When a user rotates the cube a signal representing the desired dimming based on the rotational movement is transmitted to the dimmer circuit, thus providing appropriate dimming of the light source.

25 The system taught by the above-mentioned prior art suffers from a significant drawback. As every rotation will cause a corresponding control signal for the associated light source, unintentional dimming will occur each time a user moves the cube. In view of the above there is a need for an improved control device for lighting systems.

30 Additionally, the Internet of Things is becoming increasingly popular and wireless control may advantageously be used for more than one system. There is thus a need to further improve control devices to be able to control home ambience systems,

within this specification defined as a home lighting system, a home sound system, or a combination of both.

Summary

5 An object is therefore to provide a control device for a home ambience system which solves the drawbacks of the prior art.

 In accordance with a first aspect, a control device for a home ambience system is provided. The control device (100) is dedicated to provide control signals for an associated sound circuit of a sound system and/or an associated dimmer circuit of a
10 lighting system, and the control device comprises a stationary base, a rotatable member rotationally arranged on the stationary base, a rotational sensor for detecting a rotational movement of the rotatable member relative the stationary base, a controller configured to determine a control signal based on the detected rotational movement of the rotatable member, and radio communication means configured to transmit the control signal to a
15 receiving circuit of said home ambience system.

 The stationary base may further comprise a longitudinal protrusion which supports the rotatable member; facilitated assembly and rotational support is thereby accomplished.

 The protrusion of the stationary base may comprise a spring means, thereby
20 allowing the rotatable member to be manoeuvred also in the axial direction in an improved manner as the spring means then will provide automatic return movement of the rotatable member if it is pushed down.

 The stationary base may further comprise a push sensor for detecting an axial push movement of the control device, and the controller is further configured to
25 determine the control signal based on the detected push movement. This adds control functionality to the control device. The rotational sensor may be a rotary encoder.

 The stationary base may have a planar support surface, which makes it suitable to rest on common surfaces like tables etc.

 The control device may be attachable to a wall holder using magnets arranged
30 in the wall holder and the planar support surface. Improved handling and storing of the control device is thereby provided.

The rotatable member may have a U-shaped longitudinal cross-section and a round transverse cross-section. Such disc-shape will guide the user to correct handling of the control device, thereby providing an intuitive control interface. The stationary base may have a U-shaped longitudinal cross-section and a round transverse cross-section with a smaller diameter than the rotatable member. Matching of the stationary base with the rotatable member will provide an aesthetically appealing design, as well as a very robust construction.

A diameter of the stationary base may be larger than the axial height of the control device. This further adds to the advantages listed above.

The controller may be provided with a manual input for allowing user control of the control device. Facilitated pairing may thereby be accomplished.

The manual input of the controller may e.g. be provided as a push-button.

According to a second aspect, a home ambience system is provided. The system comprises a sound source having a sound circuit connected thereto and/or a light source having a dimmer circuit connected thereto. The sound circuit and/or dimmer circuit is configured to receive control signals via radio communication, wherein the home ambience system further comprises at least one control device according to the first aspect.

According to a third aspect, a method for controlling a sound circuit of an associated sound system and/or a dimmer circuit of an associated lighting system by means of a remote control device is provided. The sound system and/or the lighting system forms part of a home ambience system, and the method is configured to perform a first mode of operation by the steps of: detecting at least one axial push movement of the control device by means of a push sensor; detecting a rotational movement of the rotatable member by means of a rotational sensor; determining a first control signal based on the detected rotational movement; and transmitting the first control signal to a receiving circuit of said home ambience system.

The method may be configured to perform a second mode of operation by the steps of detecting a sustained axial push movement of the control device by means of the push sensor and simultaneously detecting a rotational movement of the rotatable member by means of the rotational sensor; determining a second control signal based on

the detected rotational movement; and transmitting the second control signal to a receiving circuit of said home ambience system.

In an embodiment the method is configured to perform a third mode of operation by the steps of detecting a sustained axial push movement of the control
5 device by means of the push sensor; and subsequently detecting a rotational movement of the rotatable member by means of the rotational sensor; determining a third control signal based on the detected rotational movement; and transmitting the third control signal to a receiving circuit of said home ambience system.

The first mode of operation may be adapted to control the sound circuit of the
10 associated sound system, the second mode of operation is adapted to control the dimmer circuit of the associated lighting system and/or the third mode of operation is adapted to control a colour setting of the dimmer circuit of the associated lighting system.

Brief Description of the Drawings

15 In the following description reference will be made to the appended drawings, in which:

Fig. 1 is a schematic view of a home ambience system according to an embodiment;

Fig. 2 is a schematic view of details of a home ambience system according to
20 another embodiment;

Fig. 3 is a schematic view of parts of the components included in a control device according to an embodiment;

Fig. 4 is an exploded view of a control device according to an embodiment;
and

25 Figs. 5a-g are schematic views showing illustrations of different control operations according to an embodiment.

Detailed Description

The embodiments described in the following relate to a home ambience system
30 10, and in particular to a control device 100 for use with such home ambience system 10.

Starting in Fig. 1, a home ambience system 10 is shown. The home ambience system 10 comprises a sound system 20 and a lighting system 30. The sound system 20 includes a sound source 22, such as a loudspeaker, and a sound circuit 21 configured to control operation of the sound source 22. The lighting system 30 comprises a light source 32, here illustrated as a floor standing lamp, and a dimmer circuit 31 configured to control operation of the light source 32. The home ambience system 10 also comprises a control device 100 for controlling the light source 32 and/or the sound source 22. As can be seen in Fig. 1 a gateway 40 can be arranged in the data communication path between the control device 100 and the sound circuit 21 of the sound system. The gateway 40 is particularly useful for applications where the sound circuit 21 is communicating over WiFi. In one embodiment the sound system 20 communicates via WiFi, while the lighting system 30 communicates via another radio protocol such as ZigBee. In such embodiment it is useful to have a gateway 40 between the control device 100 and the sound system 20 (i.e. the control device 100 does not communicate directly with the sound system 20 but only via the gateway 40), while the lighting system 30 may communicate directly with the control device 100 with no required use of a gateway 40.

As can be seen in Fig. 1 the lamp 32 is connected to mains power by means of a power plug 33. Power is supplied from the mains to a lighting element 34, optionally via a power switch 35. The light source 32 further comprises a dimmer circuit 31. The dimmer circuit 31, being only schematically shown, is arranged in the power path somewhere between the power supply (mains) and the lighting element 34; preferred positions include at the power plug 33, at the switch 35, at the lighting element 34, or at a socket 36 used for connecting the lighting element 34. However, other positions of the dimmer circuit 31 are also possible as long as it is capable of dimming the light source 32.

For example, the light source 32 may be a roof-hung lamp wherein the dimmer circuit 31 could be arranged at the on/off switch, normally arranged at a wall remotely of the lamp itself. The light source 32 could also be a battery-powered light source, wherein the dimmer circuit 31 could be arranged in connection with some of the electronics used to drive the light source 32. As will be evident from the following, the

lighting system 30 could in principle utilize any kind of light source 32 as long as it allows for connecting a dimmer circuit 31 to it.

The light source 12 has been described as being a lamp. However the light source 12 could just as well be a bulb with a dimmer circuit 20 integrated in the bulb.

5 As will be described in the following, the control device 100 allows for remote control of the lighting system 30, the sound system 20, or both.

In Fig. 2 another embodiment of a home ambience system 10 is shown. The home ambience system 10 comprises two light sources 32a-b, here illustrated as floor standing lamps, a sound source 22a-c, here illustrated as a set of loudspeakers and four
10 control devices 100a-d for controlling the light sources 32a-b and/or the sound source 22a-c.

Each light source 32a-b comprises an associated dimmer circuit 31 (not shown). Each dimmer circuit 31 is arranged in the power path somewhere between the power supply (mains) and the lighting element of the light sources 32a-b as described
15 with reference to Fig. 1.

A dimmer circuit 31 may be arranged as a single unit capable of controlling each of the light sources 32a-b separately or it may be arranged as two separate units in each of the light sources 32a-b controlling each individually.

The light sources 32a-b have been described as being lamps. However the light
20 sources 32a-b could just as well be bulbs with a dimmer circuit 31 integrated in the respective bulbs.

As can be seen in Fig. 2 the control devices 100a-b are capable of communicating directly with the dimmer circuit(s) 31 of the light sources 32a-b. As will be described further in the following the control devices 100a-b are for this purpose
25 provided with suitable radio communication means; the dimmer circuit 31 is also provided with a suitable radio receiver as will be further described below.

Direct communication between the control devices 100a-b and the dimmer circuit 31 is however not required; the control devices 100a-b may also communicate with the dimmer circuit 31 e.g. via the internet.

30 In a preferred embodiment the control devices 100a-b communicates with the dimmer circuit 31 using the ZigBee radio protocol. This particular radio standard will

not be described further, however it has proven to be highly advantageous for this particular home ambience system 10, e.g. due to its low power consumption and mesh network layout.

When the control devices 100a-b are activated, a control signal is generated
5 and transmitted wirelessly to the dimmer circuit 31 of the associated light sources 32a-b. Upon receiving the control signal, the dimmer circuit 31 is controlled accordingly by reducing or increasing the power supplied to the light sources 32a-b. Hence, the control devices 100a-b are remote dimmer controls for the light sources 32a-b.

In a similar manner, the sound source 22a-c comprises a sound circuit 21 (see
10 Fig. 1). The sound circuit 21 is arranged in connection with the sound source(s) 22a-c. However, other positions of the sound circuit 22 are also possible as long as it is capable of at controlling the sound being generated at the sound source 22a-c.

The sound circuit 21 may be arranged as a single unit in a master sound source unit 22a capable of controlling each of the sound source units 22a-c together or it may
15 be arranged as separate units in each of the sound source units 22a-c controlling each individually. For example, the sound source 22a-c may be a set of speakers wherein the sound circuit 21 could be configured to control the volume of music that the speakers play and the music itself, pausing, skipping and fast forwarding through songs. The sound source 22a-c could also be a built-in speaker of a television, wherein the sound
20 circuit 21 could be configured to only control the volume and optionally mute and unmute. As will be evident from the following, the sound system 20 could in principle utilize any kind of sound source 22a-c as long as it allows for connecting a remotely controlled sound circuit 21 to it.

The sound source 22a-c has so far being described as being loudspeakers.
25 However the sound source 22a-c could just as well be a sound generating chip with a sound circuit 21 integrated in the chip.

As can be seen in Fig. 2 the control devices 100c-d does not necessarily communicate directly with the sound circuit 21 of the master sound source unit 22a, but via a gateway 40. The master sound source unit 22a then communicates directly with
30 the sound circuits 21 of the other sound source units 22b-c.

The control devices 100a-b are provided with suitable radio communication means; the sound circuit 21 is also provided with a suitable radio receiver as will be further described below.

Direct communication between the control devices 100a-b and the sound
5 circuit 21 as well as between the different sound circuits 21 is, as explained earlier, not required; the communication may preferably be established via a gateway 40 being capable of receiving a ZigBee signal from the control device 100 and to forward the received control signal over WiFi to the sound circuit 21.

In a preferred embodiment the control devices 100a-b communicates with the
10 gateway 40 using the ZigBee radio protocol.

When the control devices 100c-d are activated, a control signal is generated and transmitted wirelessly to the sound circuit 21 of the associated sound source 22a-c, preferably via one or more gateways 40. Upon receiving the control signal, the sound circuit 21 is controlled accordingly by e.g. reducing or increasing the power supplied to
15 the sound generating chip of the sound source 22a-c. Hence, the control devices 100c-d are remote volume controls for the sound source 22a-c.

Looking further at Fig. 2, the first control device 100a is programmed to be associated with the first light source 32a. As can be seen in Fig. 2, the control device 100a may communicate with the associated light source 32a in different ways. A first
20 communication link may be established directly between the control device 100a and the light source 32a. However, should there be no direct communication available, for example if the control device 100a is moved to a remote location from the light source 32a such that the distance exceeds the range of the radio transmitter of the control device 100a, a second communication link may be established. In this second
25 communication link, also illustrated in Fig. 2, the control signal transmitted by the control device 100a is received by the third control device 100c, being within range of the first control device 100a. Once received, the third control device 100c will pass on, or forward, the control signal which is then received by the second control device 100b. The second control device 100b is thus within range of the third control device 100c. As
30 the second control device 100b is also within range of the light source 32a, the control signal is transmitted from the second control device 100b to the light source 32a.

The second control device 100b is also associated with the second light source 32b. As the light source 32b is within range of the second control device 100b, a direct communication link is provided between the control device 100b and the light source 32b.

5 The third control device 100c is associated with a gateway 40 being within range of the sound source 22a-c. A fourth control device 100d is also associated with the gateway 40, i.e. indirectly associated with the sound source 22a-c. Hence, a single light source 32 or sound source 22 may be associated with one or more control devices 100, as well as one control device 100 may be associated with one or more light sources
10 32 or sound sources 22 or a combination of both. The fourth control device 100d is shown to communicate with its associated sound source 22a-c either directly, or via a gateway 40 provided to transmit communication signals, i.e. control signals, between the different network components i.e. control devices 100 and circuits 21, 31.

 All of the above-mentioned communication links are available by means of the
15 ZigBee protocol. Other radio communication protocols, providing one or more of the above-mentioned communication links, may also be used for the embodiments described herein. To further explain the use of gateways 40, these are either operating as routers or extenders of the communication signals, but also as signal converters transforming a control signal of a first radio protocol to a control signal of a second
20 radio protocol, and vice versa. To illustrate this functionality an example is given for which the control device 100 is programmed to communicate only over a specific radio protocol, such as ZigBee. If a dimmer circuit 31 is programmed to communicate over the same radio protocol control signals can be communicated directly between the control device 100 and the dimmer circuit 31, or perhaps via a gateway 40 thus acting as
25 a router. If a sound circuit 21 is programmed to communicate over another radio protocol, such as WiFi, the control device 100 can not communicate directly but the gateway 40 is needed to interpret the control signal of the first radio protocol, and to convert it to the second radio protocol before forwarding the converted signal to the sound circuit.

30 In Fig. 3 an embodiment of a control device 100 is shown in further detail, although schematically only. The control device 100 has the stationary base 102, which

is configured to enclose various electronic components. A power supply 150, such as a Lithium-Ion battery or the like, is provided and being electrically connected to a controller 108. The controller 108, being configured to determine a control signal based on various data input, is configured to control a radio communication unit 110 for
5 transmitting said control signal to an associated dimmer circuit 31 and/or sound circuit 21. The radio communication unit 110, forming radio communication means, is also powered by the power supply 150.

While the controller 108 transmits its output, i.e. the control signal, to the radio communication unit 110 it receives input from at least one sensor 106. In the shown
10 embodiment there is a first sensor 106 being a rotational sensor, receiving power from the power supply 150. The rotational sensor 106 is configured to measure, and thus to detect, a rotational movement of a rotatable member 104 (see Fig. 4) of the control device 100 relative the stationary base 102. Preferably, the rotational sensor 106 is configured to detect and measure the rotational movement around an axis being parallel
15 with a normal of the control device 100. The rotational sensor 106, which preferably is in the form of a rotary encoder, transmits its output, i.e. the measured rotational movement, to the controller 108.

The second sensor 114 is a sensor being configured to detect a push movement in the axial, or normal, direction. The push movement sensor 114 is also being powered
20 by the power supply 150. The push sensor 114 is configured to detect and measure a push movement of the control device 100, preferably an axial movement of the rotatable member 104 relative the stationary base 102. As for the rotational sensor 104, the push movement sensor 114 transmits its output signal to the controller 108.

Except for the digital inputs, the controller 108 preferably also has a further
25 input channel in the form of a push button 140 or the like. The button 140 is preferably hidden during normal operation. This may be achieved by arranging the push button 140 on the underside of the control device 100, and made accessible only by inserting a sharp object through a small hole provided in the housing stationary base 102. The button 140 may control various functions of the control device 100, such as pairing with
30 dimmer circuits 31 and sound circuits 21 or resetting the control device 100. In one example, depressing of the button 140 while also within a predetermined time pressing

a similar button on an associated receiving circuit 21, 31 will pair the control device 100 to that particular circuit 21, 31. Further pairing may be allowed, such that a subsequent pairing operation with another circuit 21, 31 will add the new circuit 21, 31 to the one already being paired. A LED indicator (not shown) may also be provided for indicating when pairing is successful. In such manner the control device 100 may be paired with a plurality of circuits 21, 31. Resetting may e.g. be achieved by depressing the button 140 for a certain time, such as e.g. 10 seconds or more. Upon resetting, the control device 100 may delete any added pairing(s), such that the control device 100 returns to a pre-set state. Preferably, the pre-set state corresponds to the state of the control device 100 prior to any user-initiated additional pairings.

Fig. 4 shows an exploded schematic view of a control device 100. The control device 100 has a stationary base 102 enclosing various electronic components on a printed circuit board assembly (PCBA) 160.

In addition to the components mentioned above, a planar support surface 116 of the stationary base 102 is provided with a magnet 118 used to attach the control device 100 to dedicated supports, such as a wall holder 130.

In Fig. 4, the stationary base 102 is shown having a hollow, tapered disc-like shape, wherein a lower surface attaches to the planar support surface 116 using fastening means 162 such as screws, nails, plugs or an adhesive. There may be a sheet gasket 164 between the stationary base 102 and the planar support surface 116. The stationary base 102 can thus be said to comprise a cylinder extending upwards from the support surface 116. The cross-section of the cylinder is preferably smaller than the cross-section of the rotatable member 104, which in turn is preferably smaller than the support surface 116 such that the control device 100 exhibits a tapered shape. The tapered shape of the control device 100 is particularly advantageous by the fact that gripping and handling is facilitated, since the fingers of a user may easily grab the periphery of the control device 100 without actually touching the underlying table or support structure 116. This is preferred since only the rotation of the rotatable member 104 relative to the stationary base 102 is measured. Other shapes of the stationary base 102 are of course possible and intended to be within the scope of the attached claims.

The rotatable member 104 is in the form of a lid and has a U-shaped longitudinal cross-section and a round transverse cross-section, however other shapes are within the scope of the attached claims. It lays on top of the stationary base 102 supported either by the top of the stationary base 102 or a support piece 166 arranged
5 between the stationary base 102 and the rotatable member 104. The support piece 166 is fastened to the rotatable member 104 using a bayonet mount with a seal ring 168 between the layers, however other connections may be used. The rotatable member 104 preferably rests atop the stationary base 102 so that it may rotate with little to no frictional resistance. This may be achieved using many different methods known to the
10 skilled person. In the embodiment shown in Fig. 4, the rotatable member 104 is attached to a protrusion 112 extending axially from the stationary base 102.

This embodiment allows for unhindered rotational movement of the rotatable member 104 and allows for the use of a simple, cheap and reliable rotational sensor 106.

The axial protrusion 112 may further comprise a spring means 113 such as a
15 compression spring, a coiled spring or a sheet of rubber. This allows the rotatable member 104 to be longitudinally pushed towards the stationary base 102. This push may be registered by the push sensor 114 and used to control different functions of the home ambience system 10.

The rotary encoder 106 is preferably included in the PCBA 160 which further
20 comprises the other electronic equipment as described with reference to Fig. 3. The PCBA 160 is attached to the stationary base 102 using fastening means such as screws, nails, plugs or an adhesive. There may be a sheet gasket 169 to support it on the support piece 166.

As can be seen in Fig. 4, the magnet 118 is preferably arranged close to the
25 support surface 116. The magnet 118 is attached to the support surface 116 using fastening means, which preferably is an adhesive in this embodiment. A magnetic shield (not shown) may be provided between the magnet 118 and the electronic equipment in order to reduce radio signal interference. Hence, the components of the control device 100 may be arranged in a layer structure, wherein the electronic components are stacked
30 above the magnet 181.

A wall holder 130 may also be provided, adapted to removably attach the control device 100 to a wall. The wall holder 130 is attached to the wall using fastening means such as such as screws, nails, plugs or an adhesive. The wall holder 130 comprises a magnet 132, arranged to connect with the corresponding magnet 118 in the control device 100. The wall holder 130 is configured to receive and hold the control device 100 in a secure manner using the magnetic force of the two magnets 118, 132, while still being easily detachable from the wall holder 130.

Now turning to Figs. 5a-g, the operation of the control device 100 and the entire home ambience system 10 will be described. Before the control device 100 may control the circuits 21, 31 of the sound sources 22 and light sources 32 pairing is required. This may be performed according to various pairing schemes. If the circuits 21, 31 (either integrated with the sound sources 22 and light sources 32 or provided as a separate component) are provided separately from the control device 100 a user may pair the control device 100 with the associated circuits 21, 31, e.g. using the button 140 described above. In other embodiments, the control device 100 is paired with an associated circuit 21, 31 already during manufacturing, such that one control device 100 is dedicated to a specific circuit 21, 31. Once pairing is completed the control device 100 is allowed to control the home ambience system 10. For proper functionality, the control device 100 should be located within a certain distance from the sound sources 22 and/or light sources 32. The distance is normally set by the range of the radio communication means 110, although the range may be increased by a mesh network in accordance with the ZigBee protocol.

In Figs. 5a-g, a home ambience system 10 ready for operation is shown. This means that the control device 100 is paired to one or more circuit(s) 21, 31 of a sound source 22 and/or a light source 32, and that the source(s) 22, 32 is/are turned on and ready to receive commands.

Figs. 5a-d show a control device 100 connected to a sound source 22 and Figs. 5e-g show a control device 100 connected to a light source 32. These may be the same control device 100 connected to devices in the same home ambience system 10, and may also be separate control devices 100 in the same home ambience system 10 or several different home ambience systems 10.

The control device 100 may have up to three different modes of control for controlling different circuits 21, 31 of the same home ambience system 10.

Different modes of control may also be used to control different settings of the same circuit 21, 31. For example, the default setting of the dimmer circuit 31 may
5 control the light intensity, however an alternative colour setting may be used to control the colour of the light. The colour setting varies the light intensity of different sets of coloured LEDs to achieve a controllable colour variation in the resulting collective light produced, without affecting the intensity of the light produced. Alternatively, the sound circuit 21 may use different settings for volume control, music control and play control.
10 For example, the volume setting may control the volume played from the sound source 22, the music setting may control what sound is played and in what order and the play setting may control the speed of the played sound as well as pausing and resuming said sound.

A first mode comprises detecting push impulses and rotational movement
15 independently of one another, which is used to control the sound circuit 21 in the embodiment shown in Figs. 5a-d.

A second mode comprises detecting a sustained push and a rotational movement simultaneously, which is used to control the light intensity setting of the dimmer circuit 31 in the embodiment shown in Fig. 5e.

20 A third mode comprises detecting a sustained push and subsequently a rotational movement, which is used to control the colour setting of the dimmer circuit 31 in the embodiment shown in Figs. 5f-g.

An alternative third mode comprises detecting a sustained push and as a response cycling between different further modes, e.g. switching between controlling
25 the sound circuit 21, the light intensity setting of the dimmer circuit 31 and the colour setting of the dimmer circuit 31 for each sustained push. After the desired circuit 21, 31 or setting is reached, a subsequent rotational movement will control the specific circuit 21, 31 or setting. This may advantageously be used if more than three different settings of different circuits 21, 31 of the same home ambience system 10 are to be controlled
30 independently.

The different modes of control may of course control any other combination of the different circuits 21, 31 and/or settings within the scope of the attached claims.

When pausing and resuming of the sound is desired, e.g. pausing music that is playing from the sound source 22 a user simply pushes the rotatable member 104
5 downwards towards the stationary base 102, slightly compressing the control device 100 longitudinally as shown in Fig. 5a. The push sensor 114 will sense the push. Once the sensor 114 has transmitted its data to the controller 108, the controller 108 determines the control signal for the sound circuit 21.

When control of the volume of the sound from the sound source 22 is desired, e.g. raising the volume of the sound, a user simply grabs the control device 100 and
10 rotates the rotatable member 104 in a direction corresponding to volume increase, shown as clockwise in Fig. 5b. The rotational sensor 106 will sense the movement and immediately measure movement characteristics such as rotational speed (i.e. angular velocity), rotational direction, rotational acceleration or deceleration, start and stop
15 position, etc. Once the sensor 106 has transmitted its data to the controller 108, the controller determines the control signal for the sound circuit 21.

The control device 100 may further be adapted to register double and triple pushes. These are defined as several push impulses in quick succession within a short time interval. When skipping of the sound is desired, e.g. skipping back to the
20 previously played song, a user simply pushes the rotatable member 104 downwards three times in quick succession as shown in Fig. 5d. The push sensor 114 will sense the pushes. Once the sensor 114 has transmitted its data to the controller 108, the controller determines the control signal for the sound circuit 21.

Alternative uses of the different inputs within a mode of control is also
25 possible. For example, a single push impulse in the first mode may be used to indicate a switch between mute and unmute of a sound source 22, the rotational movement may control fast forward and backward controls and the double and triple pushes may indicate a volume decrease and increase, respectively.

When dimming of the light source 32 is desired, in this case for increasing the
30 emitted light, a user simply grabs the control device 100, pushes the rotatable member 104 downwards while also starting a rotating movement of the rotatable member 104 in

a direction corresponding to light increase, shown as clockwise in Fig. 5e. The push sensor 114 will sense the push and the rotational sensor 106 will sense the movement and immediately measure movement characteristics such as rotational speed (i.e. angular velocity), rotational direction, rotational acceleration or deceleration, start and stop position, etc. Once the sensors 106, 114 have transmitted their respective data to the controller 108, the controller the control signal for the dimmer circuit 31.

When changing of the colour of the light source 32, if the light source 32 has this functionality, a user simply pushes on the rotatable member 104 a predetermined amount of time, shown as 3 seconds in Fig. 5f. Within a predetermined amount of time after this prolonged push has been registered by the push sensor 114, if then a rotational movement is detected by the rotational sensor 106, it will sense the movement and immediately measure movement characteristics such as rotational speed (i.e. angular velocity), rotational direction, rotational acceleration or deceleration, start and stop position, etc. Once the sensors 106, 114 have transmitted their respective data to the controller 108, the controller determines the control signal for the dimmer circuit 31.

The control signal may be determined in various ways. For example, only the start and stop position of the rotational movement is relevant for determining the control signal. In such an embodiment, the rotational movement is preferably mapped relative the dimmer or sound voltage output such that a preset rotational movement corresponds to 100% dimmer or sound action. In one specific embodiment, a rotational movement of 90° corresponds to a dimmer action from 0-100%, or from 100-0% in power output depending on the rotational direction. This means that if a user turns the control device 100 a quarter of a full turn, depending on the rotational direction the light source 32 will change from its current dimmer state to either maximum light intensity, or to minimum light intensity. Should the user instead choose to turn the control device 100 only a portion of a quarter of a turn, the resulting dimming action will be a corresponding percentage. As the described embodiment may in some cases result in a rotational movement not resulting in a dimming action (if the performed rotational movement is an angular distance being less than a movement corresponding to the current dimming setting), other embodiments may be considered.

In one embodiment, preventing the situation addressed above, the relationship between dimmer action and rotational movement is dynamic. Such an embodiment may be realized by programming the controller 108 to map a specific rotational movement, such as a 90° turn, corresponds to the dimming action from the current dimming setting to maximum or minimum light intensity. This means that if the current dimmer setting is at 40% power output, a 90° turn will result in a change from 40-100%, or from 40-0% depending on the rotational direction.

The above embodiments thus require only the start and stop positions of the rotational movement, or more properly the angular distance covered by the rotational movement.

In a yet further embodiment, additional rotational movement characteristics are determined and used for controlling the dimmer circuit of the light source 32. Such characteristics may e.g. be rotational speed, or rotational acceleration or deceleration. Examples of such controls may include that the dimmer action corresponding to the angular distance is dependent of the rotational speed. Giving only a few examples, a preset angular distance, such as 90°, may represent a dimming action to 0% or 100% from the current dimmer setting only if the rotational speed is above a predetermined threshold. The threshold may be set to 90°/s, whereby the resulting dimmer action will be less if the rotational speed is below the threshold. Should the rotational speed be half of the threshold, i.e. 45°/s, the dimming action may result in a far less dimming action even if the maximum angular distance is applied. This allows for fine tuning of the light intensity, as the user may choose to turn the control device 100 slowly in order to reduce the maximum allowable change in light intensity. The speed relationship may be divided in several steps, whereby a full movement using fast rotational speed may correspond to a change to max or min, a full movement using a medium rotational speed may correspond to a change towards max or min by a factor of e.g. 0.5, and a full movement using a slow rotational speed may correspond to a change towards max or min by a factor of e.g. 0.2.

In a yet further embodiment the relationship between rotational movement and the corresponding dimmer action is progressive. This means that for a predefined full movement, such as 90°, the initial angular distance will correspond to a greater or lesser

change of dimmer setting than the final angular distance. If e.g. the full movement is set to 90°, corresponding to a change to 0% or 100% light intensity depending on the rotational direction, the initial 45° rotational movement may correspond to a change of ± 10% while the final 45° correspond to the remaining 90% change. The opposite control is also applicable, such that the initial 45° rotational movement may correspond to a change of ± 90% while the final 45° correspond to the remaining 10% change.

The control device 100 may e.g. be programmed such that a clockwise rotation corresponds to light intensity decrease, while a counter-clockwise rotation corresponds to light intensity increase.

According to one embodiment, which may be combined with any one of the schemes for determining the control signal mentioned above, the relationship between the rotational pattern of the control device 100 and the corresponding dimmer action is split into two sub-schemes. A first scheme is applied if the rotational speed is above a predetermined threshold value, while a second scheme is applied if the rotational speed is equal to, or below, the predetermined threshold value.

The first scheme may be programmed such that full dimming action is requested independently of the exact rotational distance. Hence, if the rotational speed is determined to be sufficiently high such that the predetermined threshold value is exceeded, immediate “full on” or “full off” is controlled. The second scheme, which is applied if the rotational speed is sufficiently low, may be any one of the control schemes mentioned above.

The control device 100 may transmit control signals to the dimmer circuit 31 in different ways. According to one embodiment the control signal is determined once the user has performed the entire rotational movement. Hence, the controller 108 receives all input and determines the corresponding control signal before the control signal is transmitted.

In other embodiments a plurality of control signals are transmitted during the rotational movement. For example, once the rotational direction is determined the controller 108 may command a control signal requiring slow start of dimming. As the rotational direction is known, the control signal includes information if the light intensity should be increased or decreased. As soon as the rotational movement is

finished the controller may determine the remaining properties of the intended dimmer action, i.e. the desired light intensity level. The desired light intensity level may be determined according to any of the control schemes described above, and may be determined based on angular distance, rotational speed, etc.

- 5 The above embodiments have been discussed with regards to controlling light intensity, however as is apparent for the skilled person it may apply to volume or colour control *mutatis mutandis*.

 Determining the control signal for a push movement is simpler as there are fewer variables to consider. In one embodiment the distance of the push movement
10 needs to exceed a predetermined threshold to be accepted. In another embodiment the push movement duration needs to be within a predetermined range of time. This range is especially important to consider when combining the first and third modes of control, so as to not allow unintended activations of the wrong type. For example, a range of .1 to 1 seconds may constitute a push impulse, a range of 3 to 5 seconds may constitute a
15 change to the third mode of control and any other durations are to be ignored. In a third embodiment, a combination of the distance and duration of the push may be used to determine the control signal for a push movement.

 Determining the rotational and push movement of the rotatable member 104 requires the electronics of the control device 100 to be turned on. As the control device
20 100 however is used only for short times a limited number of times each day, it may be desirable to allow for a sleep mode in order to save power and increase battery life time. Other options are of course also possible, such as allowing for power charging of the battery 150.

 Instead of a traditional on/off button on the control device 100, a switch may
25 be provided which turns on the electronics when activated. The switch may be formed in various ways. For example, two electrodes provided at the periphery of the control device 100 may be separated, but bridged when a user grips the control device 100. For this the position of the electrodes may be indicated in either shape or colour for directing the user to use that particular grip. Once the electrodes are bridged a relay may
30 be closed for powering the sensors 106, 114, the controller 108, and the radio

communication unit 110 such that control is allowed. The relay may be provided with a timer for automatically shutting off the electronics after a predetermined period of time.

The description above thus discloses a control device 100 for a home ambience system 10 which is improved in relation to the prior art. Although the present invention
5 has been described above with reference to specific embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the invention is limited only by the accompanying claims.

CLAIMS

1. A control device (100) for a home ambience system (10), the control device (100) being dedicated to provide control signals for an associated sound circuit (21) of a sound system (20) and/or an associated dimmer circuit (31) of a lighting system (30), the control device (100) comprising:
- a stationary base (102);
 - a rotatable member (104) rotationally arranged on the stationary base (102);
 - a rotational sensor (106) for detecting a rotational movement of the rotatable member (104) relative the stationary base (102);
 - a controller (108) configured to determine a control signal based on the detected rotational movement of the rotatable member (104), and
 - radio communication means (110) configured to transmit the control signal to a receiving circuit (21, 31) of said home ambience system (10).
2. The control device (100) according claim 1, wherein the stationary base (102) further comprises a longitudinal protrusion (112) which supports the rotatable member (104).
3. The control device (100) according to claim 2, wherein the protrusion (112) of the stationary base (102) further comprises a spring means (113).
4. The control device (100) according to any one of the previous claims, wherein the stationary base (102) further comprises a push sensor (114) for detecting a axial push movement of the control device (100), and wherein the controller (108) is further configured to determine the control signal based on the detected push movement.
5. The control device (100) according to any one of the previous claims, wherein the rotational sensor (106) is a rotary encoder.

6. The control device (100) according to any one of the previous claims, wherein the stationary base (102) has a planar support surface (116).

5 7. The control device (100) according to claim 6, wherein the control device (100) is attachable to a wall holder (130) using magnets (132, 118) arranged in the wall holder (130) and the planar support surface (116).

8. The control device (100) according to any one of the previous claims,
10 wherein the rotatable member (104) has a U-shaped longitudinal cross-section and a round transverse cross-section.

9. The control device (100) according to claim 8, wherein the stationary base
15 (102) has a U-shaped longitudinal cross-section and a round transverse cross-section with a smaller diameter than the rotatable member (104).

10. The control device (100) according to any one of the previous claims, wherein a diameter of the stationary base (102) is larger than the axial height of the control device (100).

20

11. The control device (100) according to any one of the previous claims, wherein the controller (108) is provided with a manual input (140) for allowing user control of the control device (100).

25 12. The control device (100) according to claim 11, wherein the manual input (140) of the controller (108) is provided as a push-button.

13. A home ambience system (10), comprising a sound source (22) having a sound circuit (21) connected thereto and/or a light source (32) having a dimmer circuit
30 (31) connected thereto, the sound circuit (21) and/or dimmer circuit (31) being configured to receive control signals via radio communication, wherein the home

ambience system (10) further comprises at least one control device (100) according to any one of the preceding claims.

14. A method for controlling a sound circuit (21) of an associated sound
5 system (20) and/or a dimmer circuit (31) of an associated lighting system (20) by means of a remote control device (100), the sound system (20) and/or the lighting system (30) forming part of a home ambience system (10), the method performing a first mode of operation by the steps of:

detecting at least one axial push movement of the control device (100) by
10 means of a push sensor (114);

detecting a rotational movement of the rotatable member (104) by means of a rotational sensor (106);

determining a first control signal based on the detected rotational movement;
and

15 transmitting the first control signal to a receiving circuit (21, 31) of said home ambience system (10).

15. The method according to claim 14, performing a second mode of operation by the steps of:

20 detecting a sustained axial push movement of the control device (100) by means of the push sensor (114) and simultaneously detecting a rotational movement of the rotatable member (104) by means of the rotational sensor (106);

determining a second control signal based on the detected rotational movement; and

25 transmitting the second control signal to a receiving circuit (21, 31) of said home ambience system (10).

16. The method according to claim 14 or 15, performing a third mode of operation by the steps of:

30 detecting a sustained axial push movement of the control device (100) by means of the push sensor (114); and subsequently

detecting a rotational movement of the rotatable member (104) by means of the rotational sensor (106);

determining a third control signal based on the detected rotational movement;

and

5 transmitting the third control signal to a receiving circuit (21, 31) of said home ambience system (10).

17. The method according to any one of the claims 14 to 16, wherein the first mode of operation is adapted to control the sound circuit (21) of the associated sound
10 system (20), the second mode of operation is adapted to control the dimmer circuit (31) of the associated lighting system (30) and/or the third mode of operation is adapted to control a colour setting of the dimmer circuit (31) of the associated lighting system (30).

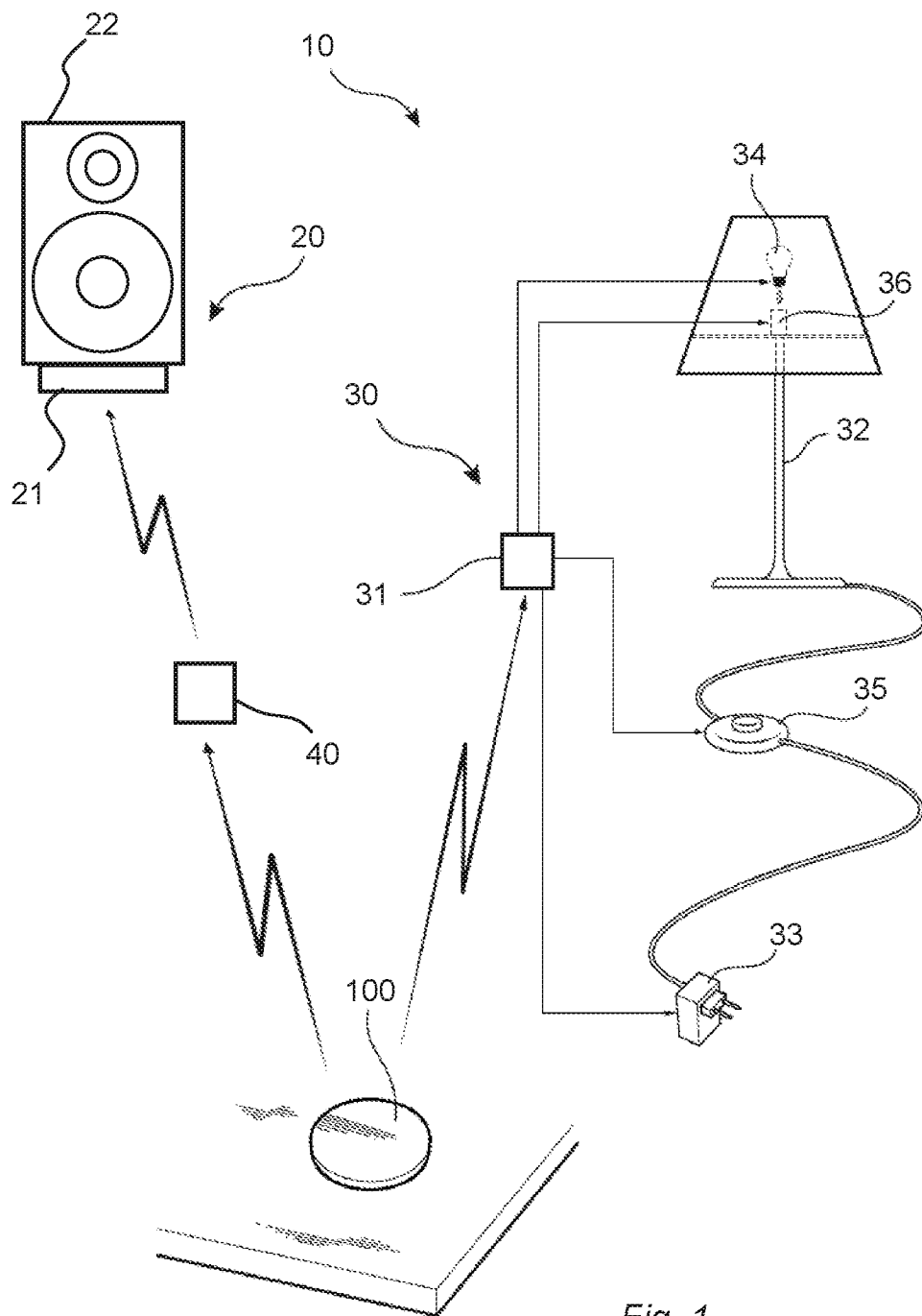


Fig. 1

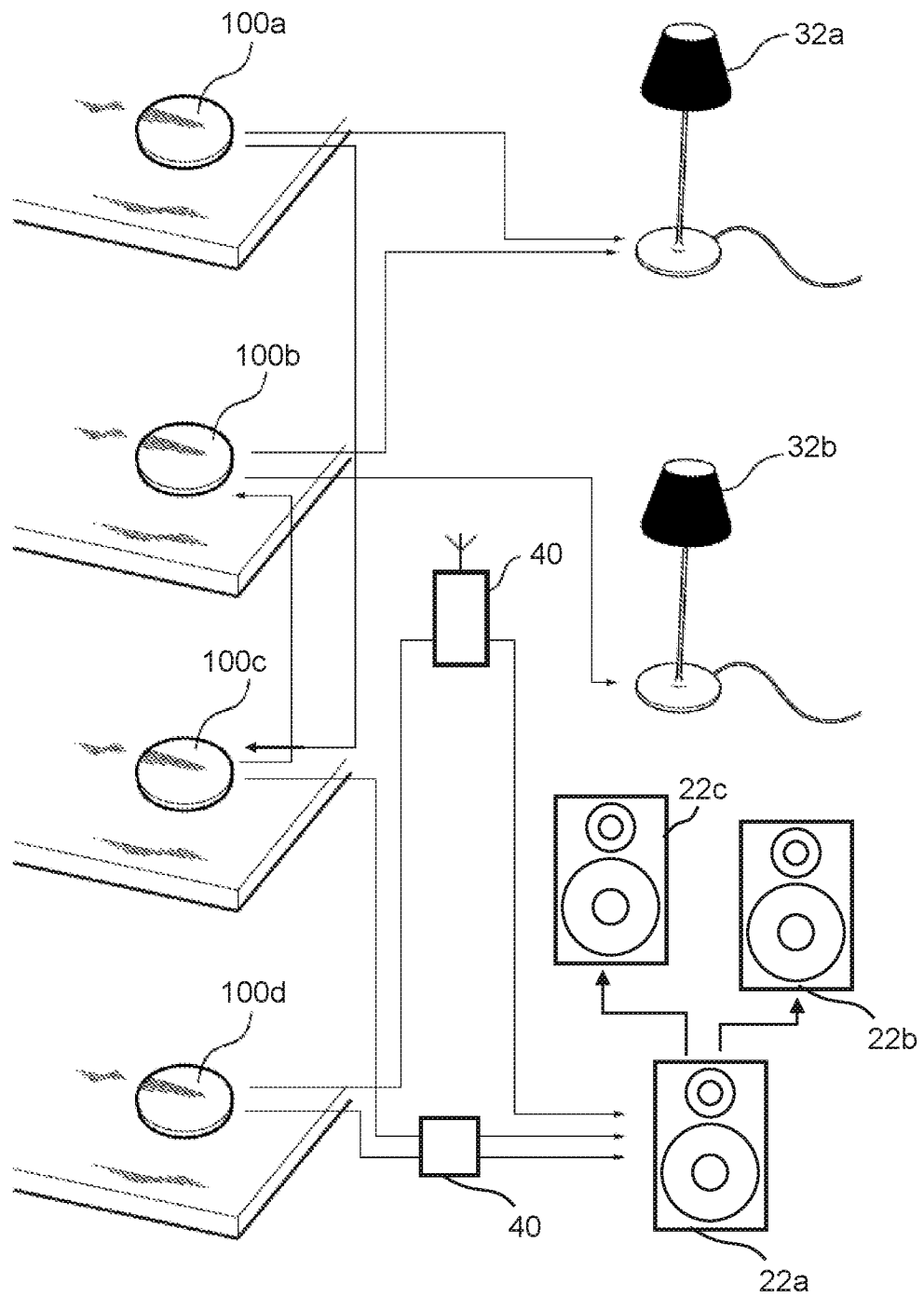


Fig. 2

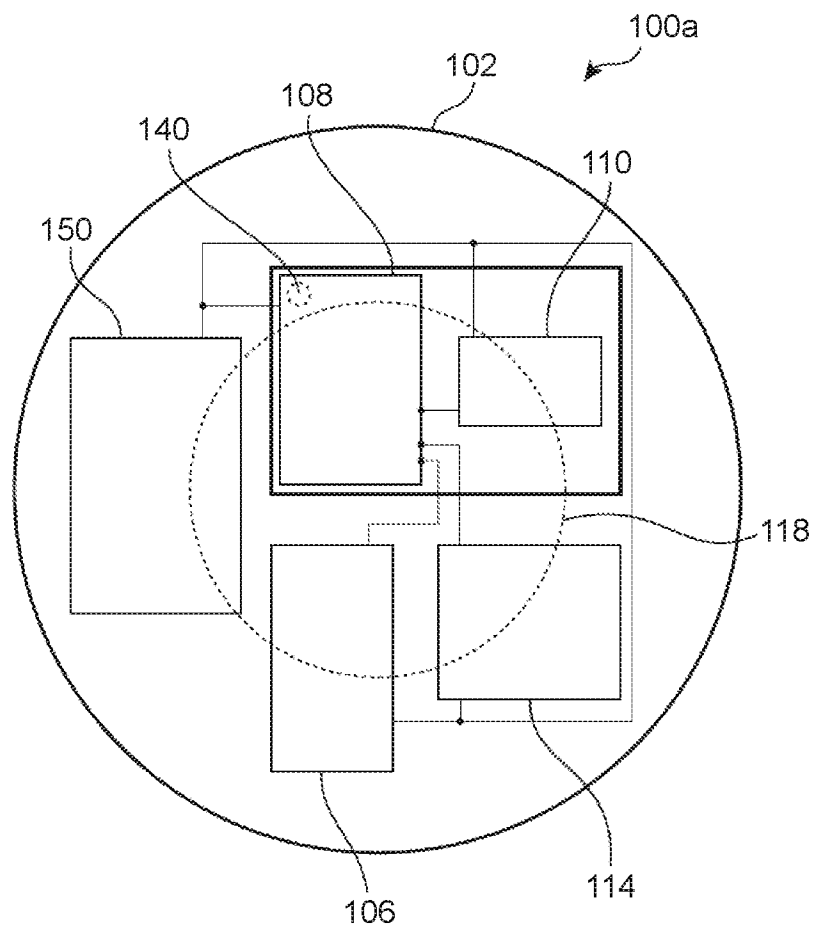


Fig. 3

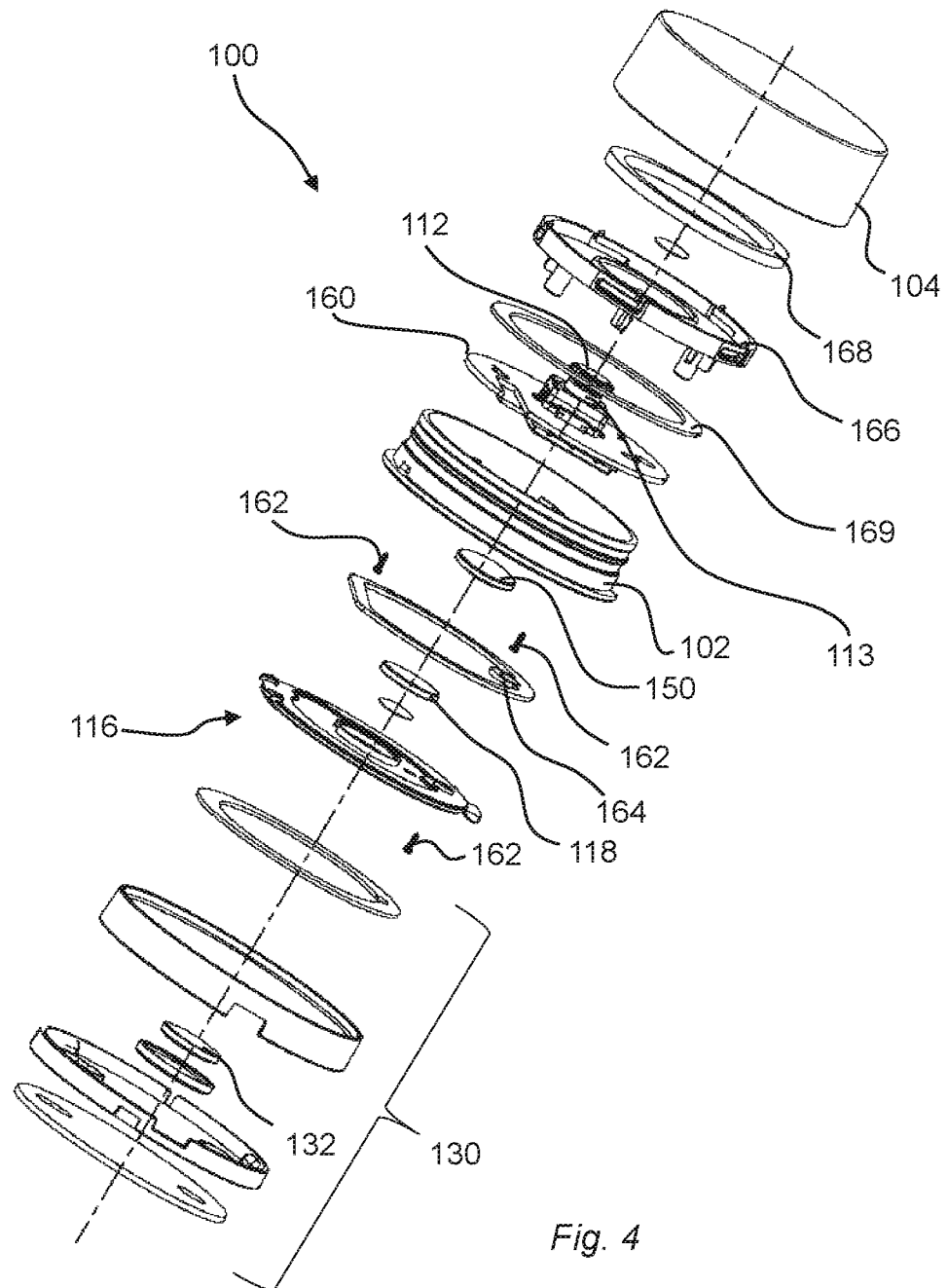
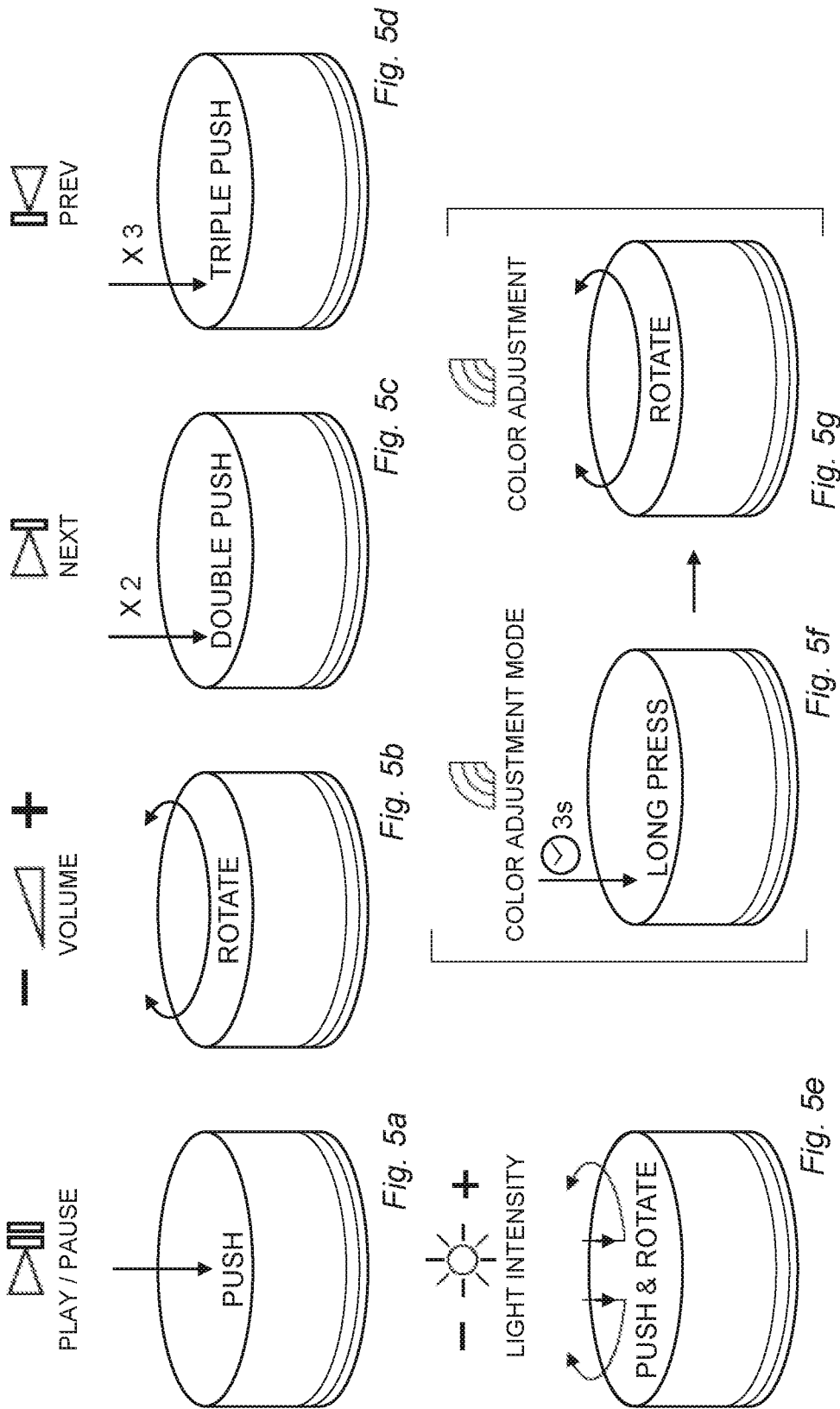


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2019/050726

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G01C, G01P, G05G, H01H, H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20160007431 A1 (BOSUA PHILIP ANTHONY ET AL), 7 January 2016 (2016-01-07); paragraphs [0018]-[0019], [0022], [0026]-[0028], [0041]-[0042], [0062]-[0067], [0070]; figures 1-7,9-12-13 --	1-17
X	US 9565742 B2 (SWATSKY MATTHEW J ET AL), 7 February 2017 (2017-02-07); abstract; column 9, line 53 - column 11, line 59; column 12, line 8 - line 49; column 13, line 10 - line 59; figures 1-4,6 --	1-17
A	US 20180192197 A1 (KEMMERER JASON), 5 July 2018 (2018-07-05); paragraphs [0020], [0030]-[0038] --	14-17

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
03-10-2019

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INTERNATIONAL SEARCH REPORT

 International application No.
 PCT/SE2019/050726

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 204046795 U (XU MINJIE), 24 December 2014 (2014-12-24); abstract; figures 2-3 --	1-17
A	WO 2017078604 A1 (INTER IKEA SYS BV ET AL), 11 May 2017 (2017-05-11); abstract; figures --	1-17
A	EP 3291248 A1 (MAD TECHNIKS GMBH), 7 March 2018 (2018-03-07); abstract; figures 1a-b,3a-5b --	1-17
A	US 20150233595 A1 (FADELL ANTHONY MICHAEL ET AL), 20 August 2015 (2015-08-20); abstract; figures --	1-17
A	US 4131033 A (WRIGHT NORMAN Z ET AL), 26 December 1978 (1978-12-26); abstract; figures; claims --	14-17
A	Programmable WIFI Control Knob Retrieved on the Internet: https://hackaday.io/project/8118-programmable-wifi-control-knob Dated by WayBack Machine: https://web.archive.org/web/20170118124654/https://hackaday.io/project/8118-programmable-wifi-control-knob ; whole document -- -----	1-17

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International Patent Classification (IPC)

G05G 1/08 (2006.01)

G05G 1/10 (2006.01)

H01H 19/14 (2006.01)

H05B 37/02 (2006.01)

G01C 19/00 (2013.01)

G01P 15/00 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2019/050726

US	20160007431 A1	07/01/2016	US	20190059146 A1	21/02/2019
			US	10129965 B2	13/11/2018
			US	20170231072 A1	10/08/2017
			US	9338864 B2	10/05/2016
			WO	2016007520 A1	14/01/2016
US	9565742 B2	07/02/2017	US	20190037674 A1	31/01/2019
			US	20190006130 A1	03/01/2019
			US	10147560 B2	04/12/2018
			US	10104750 B2	16/10/2018
			US	20170103859 A1	13/04/2017
			US	20170071049 A1	09/03/2017
			US	9538619 B2	03/01/2017
			US	20140117871 A1	01/05/2014
			US	20140117859 A1	01/05/2014
US	20180192197 A1	05/07/2018	NONE		
CN	204046795 U	24/12/2014	NONE		
WO	2017078604 A1	11/05/2017	DE	212016000224 U1	06/06/2018
			SE	539633 C2	24/10/2017
			SE	1551437 A1	07/05/2017
EP	3291248 A1	07/03/2018	EP	3507813 A1	10/07/2019
			US	20190198202 A1	27/06/2019
			WO	2018041991 A1	08/03/2018
US	20150233595 A1	20/08/2015	US	20190155232 A1	23/05/2019
			US	10241482 B2	26/03/2019
			US	20180129174 A1	10/05/2018
			US	9766606 B2	19/09/2017
			US	20150005953 A1	01/01/2015
			US	20140222220 A1	07/08/2014
			US	20140005837 A1	02/01/2014
			US	20130046397 A1	21/02/2013
			US	20120239207 A1	20/09/2012
			US	20120130547 A1	24/05/2012
			US	9026232 B2	05/05/2015
			US	8868219 B2	21/10/2014
			US	8706270 B2	22/04/2014
			US	8489243 B2	16/07/2013
			US	8280536 B1	02/10/2012
			US	8195313 B1	05/06/2012
US	4131033 A	26/12/1978	NONE		