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(54) **MECHANICAL CONTROL DEVICE AND METHOD OF OPERATION**

(57) A mechanical control device (120) is provided for communicating control commands to an external device (110) by selectively reflecting light for detection by a controller (113) of the external device (110). The mechanical control device (120) comprises a plurality of reflectors (121) and a button-operated mechanism. The button-operated mechanism comprises at least one button (122) and being constructed and arranged so as to,

in response to at least one button (122) being operated by a user (13), arrange a predetermined one or more reflectors (121) into a respective enabled state in which the reflector (121) is arranged to reflect incident light and arrange any others of the reflectors (121) into a respective disabled state in which the reflector (121) is arranged to not reflect incident light.

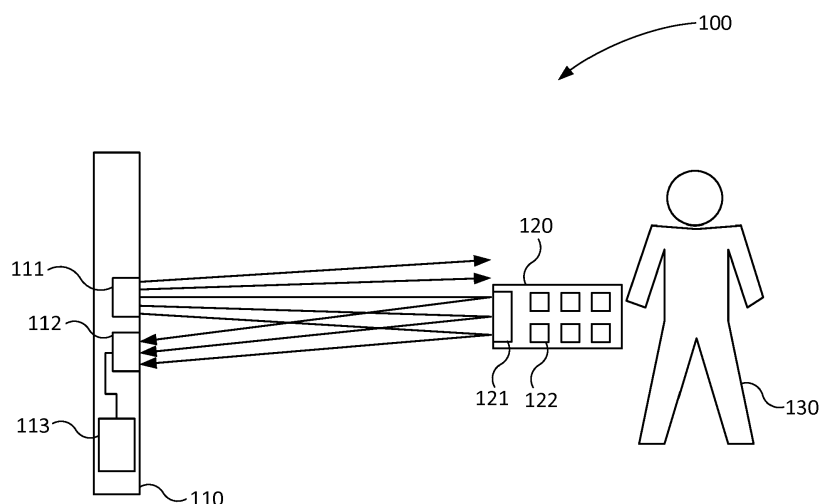


Figure 1

Description

Technical Field

[0001] The present disclosure relates to a mechanical control device for communicating control commands to an external device.

Background

[0002] A remote control device is a typically handheld device for controlling one or more external devices such as televisions, set-top boxes, games consoles, etc. Known remote control devices comprise a transmitter for transmitting control signals to an external device via, for example, a modulated infrared light output. Hence, these types of remote control device comprise internal circuitry powered by one or more internal batteries.

Summary

[0003] According to a first aspect disclosed herein, there is provided a mechanical control device for communicating control commands to an external device by selectively reflecting light for detection by a controller of the external device, the mechanical control device comprising: a plurality of reflectors, each of said reflectors being operable in either an enabled state in which said reflector is arranged to reflect light incident on the reflector or a disabled state in which said reflector is arranged to not reflect light incident on the reflector; and a button-operated mechanism for selectively causing the reflectors to transition between their enabled and disabled states, the button-operated mechanism comprising at least one button and being constructed and arranged so as to arrange a predetermined one or more of the reflectors into their respective enabled state and arrange any others of the reflectors into their respective disabled state when the at least one button is operated by a user.

[0004] In an example, the button-operated mechanism comprising two buttons, each associated with a different control command, and each being constructed and arranged so as to arrange a different predetermined set of one or more reflectors into their respective enabled state when that button is operated by a user.

[0005] In an example, the predetermined sets of reflectors comprise different numbers of reflectors.

[0006] In an example, the predetermined sets of reflectors comprise the same number of reflectors, with each set comprise different ones of the plurality of reflectors.

[0007] In an example, at least one reflector comprises a reflecting side and a non-reflecting side; and the button-operated mechanism comprises a rotating mechanism for selectively rotating the at least one reflector, the enabled state of the at least one reflector corresponding to that reflector being rotated to be in a non-reflecting position and the disabled state corresponding to that reflector

being rotated to be in a reflecting position.

[0008] In an example, the button-operated mechanism comprises a blocking mechanism for selectively blocking light incident on at least one reflector, the enabled state of the at least one reflector corresponding to the blocking mechanism not blocking light incident on that reflector and the disabled state corresponding to the blocking mechanism blocking light incident on that reflector.

[0009] According to a second aspect disclosed herein, there is provided a method of communicating control commands to an external device by selectively reflecting light at a mechanical control device for detection by a controller of the external device, the method comprising: in response to at least one button being operated by a user, arranging a predetermined one or more reflectors into a respective enabled state in which the reflector is arranged to reflect light incident on the reflector and arrange any others of the reflectors into a respective disabled state in which the reflector is arranged to not reflect light incident on the reflector.

[0010] According to a third aspect disclosed herein, there is provided a system comprising a mechanical control device according to the first aspect and a light source for emitting light to be reflected by the mechanical control device.

[0011] In an example, the light source is an infrared light source.

[0012] In an example, the system comprises the external device.

[0013] In an example, the light source is comprised in the external device.

Brief Description of the Drawings

[0014] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a system in which a user controls an external device using a remote control device in accordance with examples described herein;

Figure 2 shows schematically the remote control device in more detail; and

Figures 3a-3c show schematically some examples of reflector configurations.

Detailed Description

[0015] Examples described herein relate to a mechanical control device (that is, a control device which is mechanical) for controlling an external, electronic device. The control device selectively reflects light to be detected at the external device and interpreted as a control command for controlling the external device. To do so, a user

moves the control device to be in a suitable position and orientation to reflect light towards the external device, and operates the control device to vary at least one reflective property in accordance with a desired control command. The reflective property of the control device is identifiable at the external device in light reflected from the control device and detected at the external device. By assigning reflective properties of the control device to control commands, the user is able to control the external device according to a control command by operating the control device to have a corresponding reflective property. Hence, the user is able to control the external device via the control device. The control device is purely mechanical and so does not require an electrical power source.

[0016] Figure 1 is a schematic diagram illustrating an example system 100 in accordance with aspects disclosed herein. The system 100 comprises an external device 110 and a control device 120. As will become clear from the description below, the control device 120 is operated by a user 130 in order to control the external device 120, e.g. to turn the external device 120 on or off, or to adjust one or more settings of the external device 120.

[0017] The external device 110 comprises a transmitter 111, a receiver 112 and a controller 113. In this example, the external device 110 is a television set. Other examples of external devices which can be controlled by the control device 120 include set-top boxes, DVD or Blu Ray players, games consoles, HiFi devices, home automation devices, etc. In any case, the receiver 112 is operably coupled to the controller 113 via one or more wired or wireless connections. For example, the receiver 112 may be connected to the controller 113 via a direct wired connection. Similarly, the transmitter 111 may also be operably coupled to the controller 113. In some examples, the transmitter 111 may be provided as a separate device from the external device 110 itself. In these examples, the transmitter 111 may be connected to the controller 113 via a wireless connection, such as for example a WiFi or Bluetooth connection, though a wired connection could also be used.

[0018] The transmitter 111 comprises one or more light sources constructed and arranged to generate and output light into the environment (e.g. a room in which the transmitter 111 is situated). The generated light may be infrared light which is not visible to user 130. In other examples, the light generated by the transmitter 111 may be visible light (visible to user 130). The light need not be monochromatic. For example, the transmitter 111 may output a combination of two or more wavelengths of light, and zero, one, or more of these wavelengths may fall within the visible spectrum.

[0019] The receiver 112 comprises one or more detectors for detecting light, such as photodiodes. The receiver 112 is configured to detect light having substantially the same wavelength(s) as the light output by the transmitter 111. In some examples the receiver 112 comprises a

camera for capturing an image of the environment.

[0020] The transmitter 111 and receiver 112 are arranged to avoid direct transmission of light from the transmitter 111 to the receiver 112. That is, they are arranged such that light from the transmitter 111 will only be detected at the receiver 112 if it is reflected off an object in the environment. Such an object is the control device 120.

[0021] The receiver 112 is configured to generate an output based on detected light, and provide this output to the controller 113. As mentioned above, light from the transmitter 111 can be reflected off the control device 121 for detection by the receiver 112. The output generated by the receiver 112 is indicative of at least one property of the reflected light. The controller 113 interprets the property as relating to a particular control command and controls the external device 110 accordingly. This may comprise the controller 113 accessing a data storage (not shown in Figure 1) storing a lookup table holding an association between light properties and control commands.

[0022] The control device 120 comprises a selectively reflecting element 121 (described in more detail below with reference to Figure 2) and at least one button 122.

[0023] The at least one button 120 is mechanically coupled to the selectively reflecting element 121 such that pressing the at least one button 120 causes a reflective property of the selectively reflecting element 121 to change. For example, the selectively reflecting element 121 may reflect zero (or only a small amount of) light when the button 122 is not pressed, and may reflect a maximum amount of light when the button 122 is pressed. Hence, the user 130 is able to control the reflective properties of the selectively reflective element 121 using the at least one button 122.

[0024] In the example of Figure 1, the control device 120 comprises six buttons 122. In such cases, each button 122 is mechanically coupled to the selectively reflecting element 121 such that activation of each button 122, e.g. by pressing by the user 130, results in the selectively reflecting element 121 having a different reflective property.

[0025] Figure 2 schematically illustrates an example of the control device 120 in more detail. The selectively reflecting element 121 comprises a plurality of reflectors 121a-h. Each reflector 121 a-h is operable in either an enabled state in which the reflector 121a-h is arranged to reflect incident light or a disabled state in which the reflector 121 a-h is arranged to not reflect incident light.

[0026] For example, a reflector 121 a-h may comprise a mirror mounted on a pivot, the mirror having a reflecting surface on a first side (e.g. the obverse) and a non-reflecting surface on a second side (e.g. the reverse). In such cases, switching the reflector 121 a-h between the enable state and the disable state may comprise rotating the mirror about the pivot. The enable state corresponds to the reflecting first side facing out of the control device 120 body (into the environment), and the disable state corresponds to the non-reflecting second side facing out

of the control device body 120.

[0027] In other examples, a reflector 121 a-h may comprise a mirror for reflecting light and a movable non-reflective barrier. In such examples, switching the reflector 121 a-h between the enable state and the disable state may comprise moving the non-reflective barrier to cover or not cover the mirror (i.e. to block or not block light from reaching the mirror). The enable state corresponds to the non-reflective barrier being in a position where it allows light to reach the mirror and thereby be reflected by the mirror, and the disable state corresponds to the non-reflective barrier being in a position where it blocks light from reaching the mirror.

[0028] Only two examples of mechanisms by which the reflectors 121 may be enabled and disabled are given above, but it is appreciated that other mechanisms are possible. Additionally, the reflectors 121 of the control device 120 may be enabled by the same mechanism, or the control device 120 may have some reflectors 121 constructed and arranged to be enabled by one mechanism, and other reflectors 121 constructed and arranged to be enabled by a different mechanism. For example, it may be convenient or more cost-effective, say, for inner reflectors 121 to be enabled and disabled using one type of mechanism and for outer 121 to be enabled and disabled using another type of mechanism.

[0029] The control device 120 comprises a button-operated mechanism for selectively causing the reflectors to transition between their enabled and disabled states. The button-operated mechanism comprises at least one button and is constructed and arranged so as to arrange different sets of reflectors 121 a-h into their enabled state (and others into their disabled state) in response to each button being pressed. Figures 3a-c illustrate three examples of such combinations.

[0030] In Figure 3a, reflectors 121a-e and 121g are in their disabled state and reflectors 121f and 121h are in their enabled state.

[0031] In Figure 3b, reflectors 121a-b, 121 d, and 121f-h are in their disabled state and reflectors 121c and 121e are in their enabled state.

[0032] In Figure 3c, reflectors 121a-b and 121d-g are in their disabled state and reflectors 121c and 121h are in their enabled state.

[0033] In Figure 3d, reflectors 121a-b and 121e-g are in their disabled state and reflectors 121c-d and 121h are in their enabled state.

[0034] If the detector at the receiver 112 is able to spatially resolve all eight reflectors, it is able to distinguish the reflecting state of each individual reflector 121a-h as positioned within the control device 120. An example of a suitable detector is a camera. In such cases, the receiver 112 is able to distinguish 256 (2^8) different combinations of the eight reflectors 121 a-h. For example, such a detector is able to distinguish between all four of the examples shown in Figures 3a-d, because each example has a different set of enabled reflectors (even though some sets have the same number of enabled

reflectors). In some examples, this may be facilitated by the camera not only detecting light reflected off each individual reflector 121 a-h but also the outer edges of the control device 120 itself. Each combination may be assigned to a different control functionality, and be interpreted as such by the controller 113.

[0035] In another example, if the detector at the receiver 112 is able to spatially resolve the reflectors, but not their absolute position within the control device 120, then sets of enabled reflectors comprising the same pattern but at different absolute positions within the control device 120 will not be distinguishable. For example, such a detector would be unable to distinguish between the set of enabled reflectors shown in Figure 3a and 3b, as these each comprise two enabled reflectors separated by a single disabled reflector. It would, however, be able to distinguish this from the patterns shown in Figures 3c, as the gap between the enabled reflectors is larger, and Figure 3d, as there are a different number of enabled reflectors. Though there are fewer distinguishable patterns of enabled reflectors, in this example with eight reflectors, there are still 128 distinguishable patterns. Each pattern may be assigned to a different control functionality, and be interpreted as such by the controller 113.

[0036] In another example, if the detector at the receiver 112 is not able to spatially resolve light reflected from the control device 120 (i.e. it is only capable of measuring the intensity of the light), then sets comprising the same number of enabled reflectors will not be distinguishable. An example of such a detector is a photodiode, which only measures light intensity. In such cases, the receiver 112 is not able to distinguish between, for example, the combinations of enabled reflectors shown in Figures 3a-c, as each of these comprises the same number of enabled reflectors (two) and will thus reflect substantially the same amount of light. The receiver 112 would, however, be able to distinguish between these and the combination shown in Figure 3d, as this combination has three enabled reflectors 121c-d, 121h, instead of two. Though there are fewer distinguishable patterns of enabled reflectors, in this example with eight reflectors, there are still eight distinguishable patterns. Each pattern may be assigned to a different control functionality, and be interpreted as such by the controller 113.

[0037] It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be im-

plemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

[0038] Reference is made herein to data storage for storing data. This may be provided by a single device or by plural devices. Suitable devices include for example a hard disk and non-volatile semiconductor memory.

[0039] Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into practice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

[0040] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A mechanical control device for communicating control commands to an external device by selectively reflecting light for detection by a controller of the external device, the mechanical control device comprising:

a plurality of reflectors, each of said reflectors being operable in either an enabled state in which said reflector is arranged to reflect light incident on the reflector or a disabled state in which said reflector is arranged to not reflect light incident on the reflector; and
a button-operated mechanism for selectively causing the reflectors to transition between their

enabled and disabled states, the button-operated mechanism comprising at least one button and being constructed and arranged so as to arrange a predetermined one or more of the reflectors into their respective enabled state and arrange any others of the reflectors into their respective disabled state when the at least one button is operated by a user.

2. A mechanical control device according to claim 1, the button-operated mechanism comprising two buttons, each associated with a different control command, and each being constructed and arranged so as to arrange a different predetermined set of one or more reflectors into their respective enabled state when that button is operated by a user.
3. A mechanical control device according to claim 2, wherein the predetermined sets of reflectors comprise different numbers of reflectors.
4. A mechanical control device according to claim 2, wherein the predetermined sets of reflectors comprise the same number of reflectors, with each set comprising different ones of the plurality of reflectors.
5. A mechanical control device according to any of claims 1 to 4, wherein:
 - at least one reflector comprises a reflecting side and a non-reflecting side; and
 - the button-operated mechanism comprises a rotating mechanism for selectively rotating the at least one reflector, the enabled state of the at least one reflector corresponding to that reflector being rotated to be in a non-reflecting position and the disabled state corresponding to that reflector being rotated to be in a reflecting position.
6. A mechanical control device according to any of claims 1 to 5, wherein the button-operated mechanism comprises a blocking mechanism for selectively blocking light incident on at least one reflector, the enabled state of the at least one reflector corresponding to the blocking mechanism not blocking light incident on that reflector and the disabled state corresponding to the blocking mechanism blocking light incident on that reflector.
7. A method of communicating control commands to an external device by selectively reflecting light at a mechanical control device for detection by a controller of the external device, the method comprising:
 - in response to at least one button being operated by a user, arranging a predetermined one or more reflectors into a respective enabled state in which the reflector is arranged to reflect light

incident on the reflector and arranging any others of the reflectors into a respective disabled state in which the reflector is arranged to not reflect light incident on the reflector.

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8. A system comprising a mechanical control device according to any of claims 1 to 6 and a light source for emitting light to be reflected by the mechanical control device.

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9. A system according to claim 8, wherein the light source is an infrared light source.

10. A system according to claim 8 or claim 9, comprising the external device.

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11. A system according to claim 10, wherein the light source is comprised in the external device.

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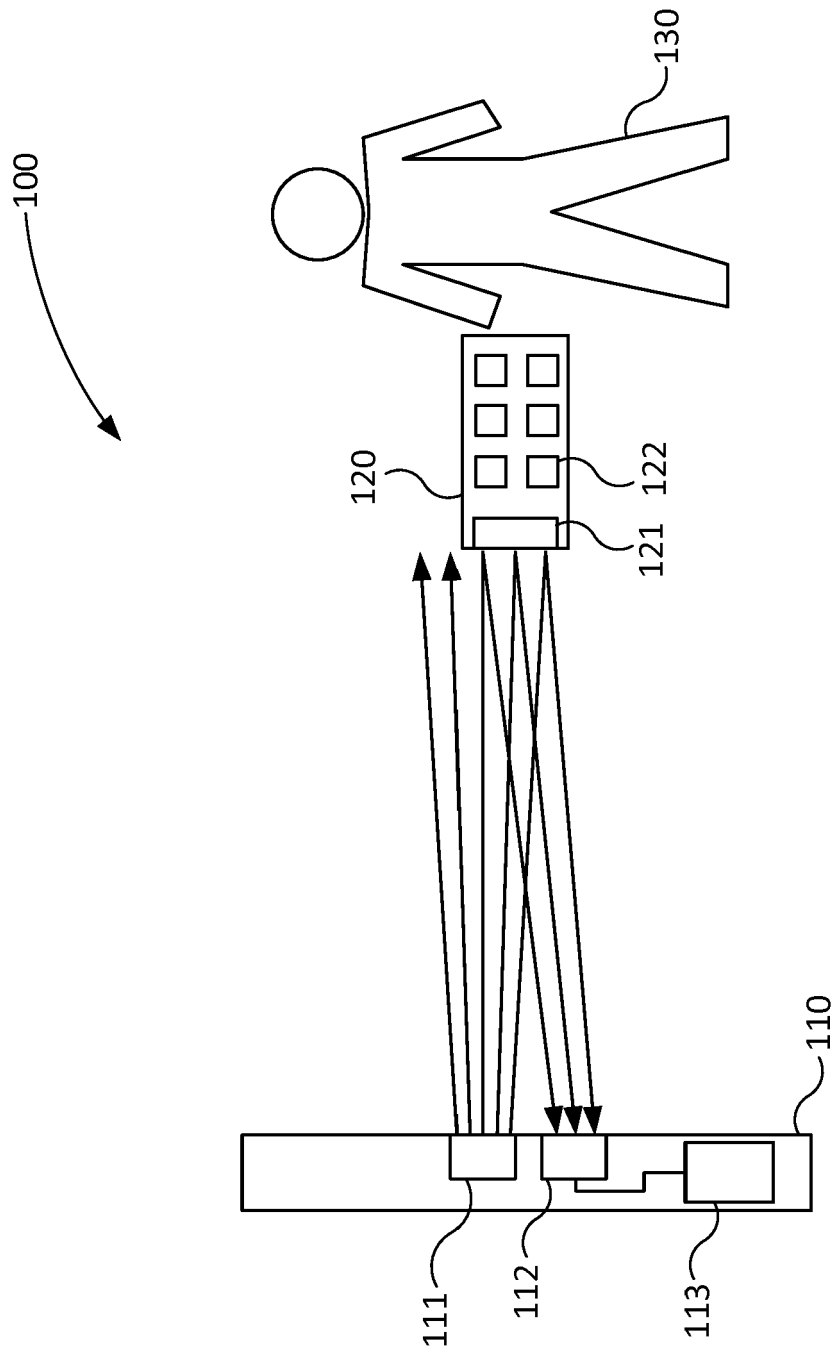


Figure 1

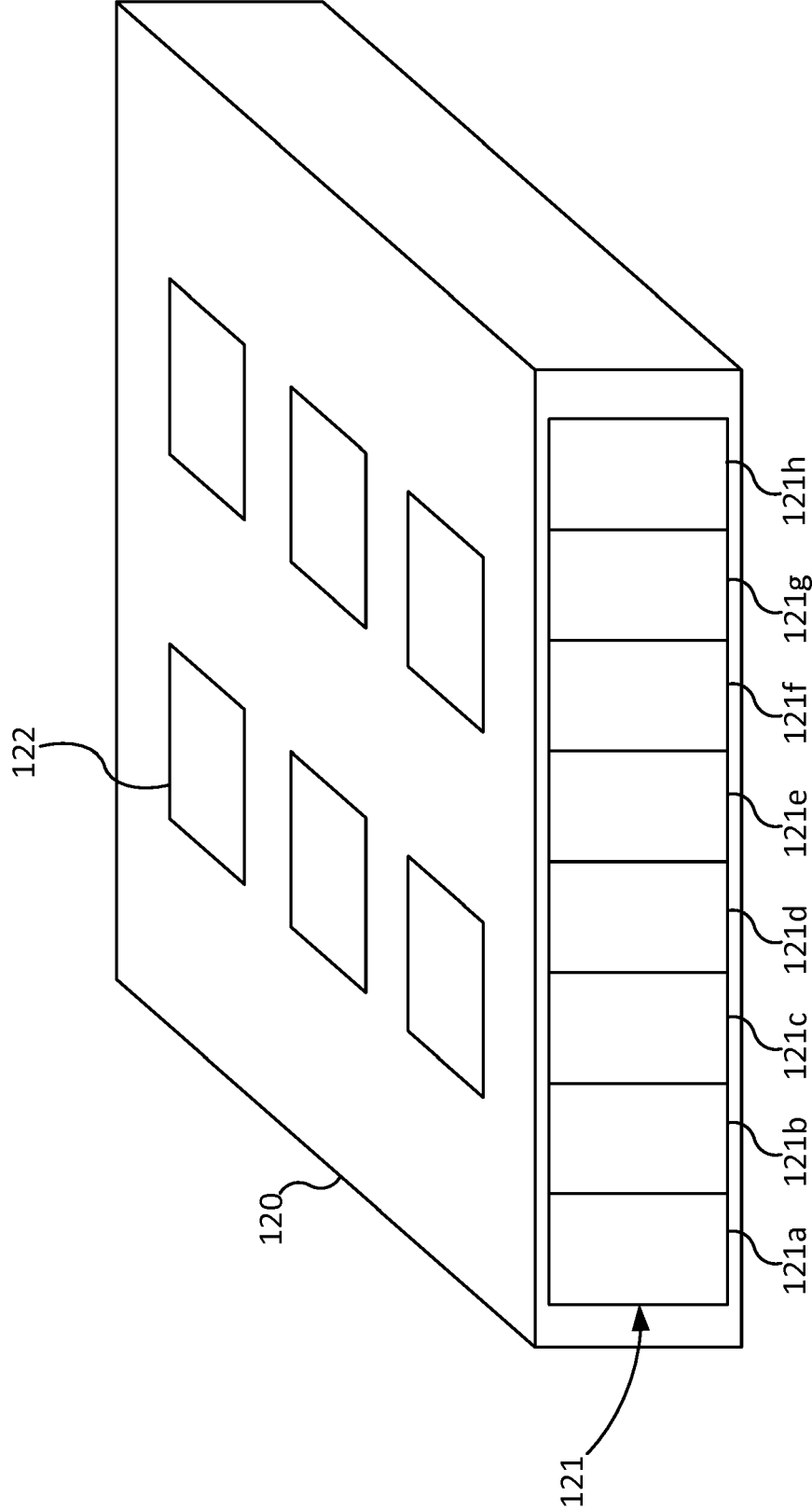


Figure 2

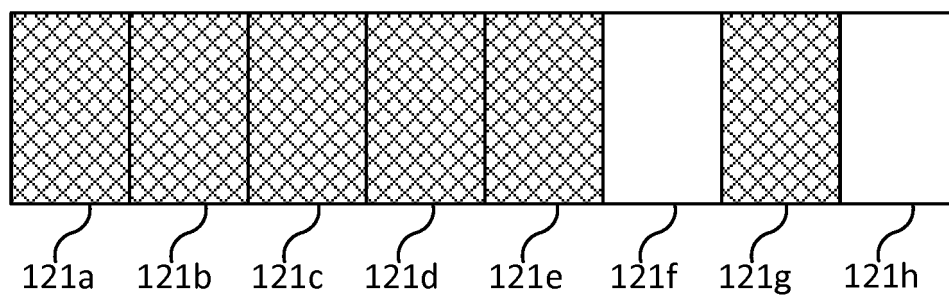


Figure 3a

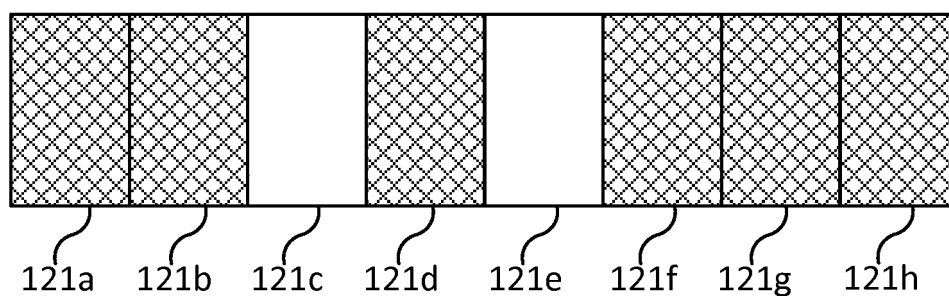


Figure 3b

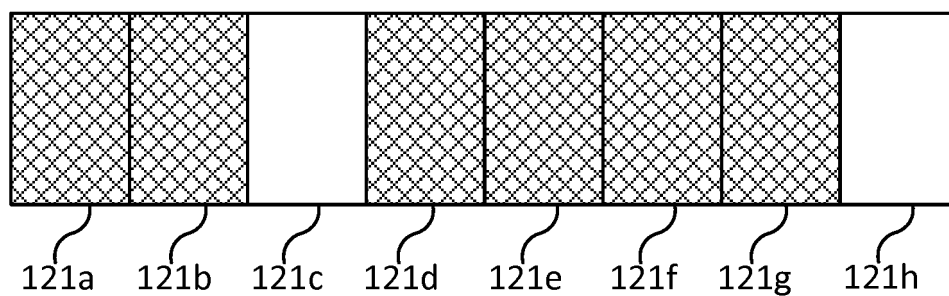


Figure 3c

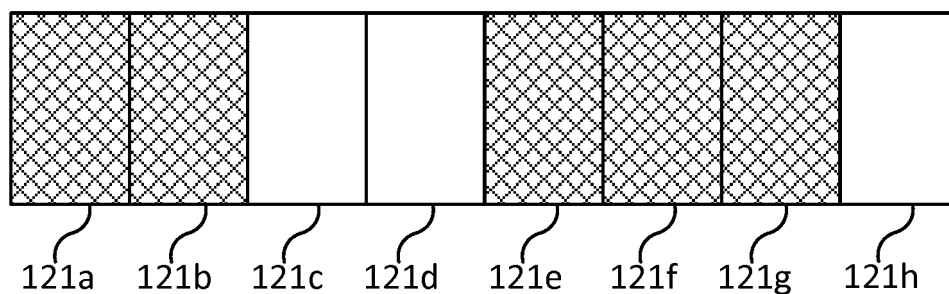


Figure 3d



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 20 1440

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X	WO 96/16385 A1 (TENORIO CAMPA JUAN MANUEL [ES]; KIM SIN TAI MYUNG [ES]; ALEJO TREVIJAN) 30 May 1996 (1996-05-30) * page 2, line 15 - page 3, line 19 * * page 6, line 20 - page 9, line 24 *	1-11	
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 May 2018	Examiner Baas, Gert-Jan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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08-05-2018

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