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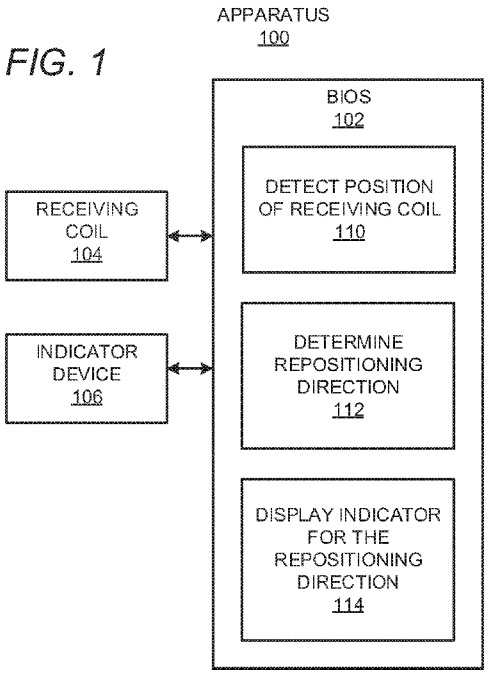


FIG. 1

(57) Abstract: An example apparatus may include a receiving coil, an indicator device, and a basic input/output system (BIOS). The BIOS may determine a position of the receiving coil relative to a charger transmitting coil. Based on a determination that the receiving coil is misaligned with the charger transmitting coil, the BIOS may determine a repositioning direction to which the apparatus is to be repositioned to bring the receiving coil into alignment with the charger transmitting coil. The BIOS may cause the indicator device to display an indicator corresponding to the determined repositioning direction.

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# INDICATORS TO REPOSITION RECEIVING COILS

## BACKGROUND

**[0001]** Electronic devices, including computing devices, may be charged using a wireless charger. The electronic devices may be positioned near the wireless charger to enable wireless charging.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0002]** Features of the present disclosure are illustrated by way of example and not limited in the following figure(s), in which like numerals indicate like elements, in which:

**[0003]** FIG. 1 depicts a block diagram of an example apparatus that may detect a position of a receiving coil relative to a charger transmitting coil;

**[0004]** FIG. 2 shows a block diagram of an example system that may include the example apparatus depicted in FIG. 1;

**[0005]** FIG. 3A shows a diagram of an example receiving coil having an indicator coil and an example charger transmitting coil;

**[0006]** FIG. 3B shows a diagram illustrating determination of a repositioning direction of the receiving coil based on a relative position of the charger transmitting coil to an indicator coil of the receiving coil;

**[0007]** FIG. 3C shows a diagram of an example charger transmitting coil having an indicator coil and an example receiving coil;

**[0008]** FIG. 4 shows a flow diagram of an example method for detecting a position of a receiving coil and displaying an indicator for a repositioning direction of the receiving coil; and

**[0009]** FIG. 5 depicts a block diagram of an example non-transitory computer-readable medium that may have stored thereon computer-readable instructions for activating a keyboard light to indicate a repositioning direction based on a determined repositioning direction.

## DETAILED DESCRIPTION

**[0010]** Electronic devices, such as personal computers, may be made up of many hardware devices, including displays, cameras, a mouse or mouse-like glide and click pads, keyboards, LED lights, and/or the like. In some examples, the electronic devices may be wirelessly charged and include components of a wireless charging system.

**[0011]** A concern associated with wireless charging for some electronic devices may be that alignment of the electronic device to a wireless charger may be difficult. Generally, wireless charging may be implemented for portable devices, and in particular, for smaller devices such as mobile phones. However, implementation of this technology for larger electronic devices, such as notebook computers, may present additional challenges. For instance, the larger footprint of a notebook computer may obstruct the wireless charger from being viewable and may thus make it difficult to align the notebook computer to a relatively smaller charger coil of the wireless charger.

**[0012]** Disclosed herein are apparatuses, systems, methods, and computer-readable media that may detect a position of an electronic device with respect to a wireless charger and provide indications to guide alignment of the electronic device to the wireless charger, or vice versa. In some examples, indications to guide alignment of the electronic device and/or the wireless charging device may be in the form of an on-screen dialog on a display, for instance, based on operating system (OS) control (e.g., system ON) or based on a basic Basic Input/Output System (BIOS) control (e.g., when the electronic device is in a SLEEP or an OFF state). In some examples, indications to guide alignment of the electronic device may be provided by indicator devices that BIOS

may control. The indicator devices may be outside of the control of the OS, such as light emitting diodes (LEDs), backlit keys of a keyboard, and/or the like.

**[0013]** As used herein, a BIOS refers to hardware or hardware and instructions to initialize, control, or operate a computing device prior to execution of an OS. Instructions included within a BIOS may be software, firmware, microcode, or other programming that defines or controls functionality or operation of a BIOS. In one example, a BIOS may be implemented using instructions, such as platform firmware of a computing device, executable by a processor. A BIOS may operate or execute prior to the execution of the OS of a computing device. A BIOS may initialize, control, or operate components such as hardware components of a computing device and may load or bootup the OS of computing device.

**[0014]** In some examples, a BIOS may provide or establish an interface between hardware devices or platform firmware of the computing device and an OS of the computing device, via which the OS of the computing device may control or operate hardware devices or platform firmware of the computing device. In some examples, a BIOS may implement the Unified Extensible Firmware Interface (UEFI) specification or another specification or standard for initializing, controlling, or operating a computing device.

**[0015]** In some examples, keyboard lights, such as backlit keyboard lights, may be used as indicators for wireless charger placement/alignment. In this regard, the BIOS may be implemented to control the keyboard lights, which may avoid certain problems in providing screen status when using other hardware devices, such as OS requirements for an application when using a display screen. By using indicator devices such as a keyboard light, the indication or guidance for alignment may be implemented within BIOS control.

**[0016]** In some examples, the apparatus may include a receiving coil, an indicator device, and a BIOS. The BIOS may determine a position of the receiving coil relative to a charger transmitting coil, and based on a determination that the receiving coil is misaligned with the charger transmitting coil, the BIOS may determine a direction to reposition the receiving coil relative to the charger

transmitting coil. In some examples, the BIOS may cause the indicator device to display an indicator corresponding to the determined direction to reposition the receiving coil.

**[0017]** Reference is made to FIGS. 1, 2, and 3A to 3C. FIG. 1 shows a block diagram of an example apparatus 100 that may detect a position of a receiving coil relative to a charger transmitting coil. FIG. 2 shows a block diagram of an example system 200 that may include the example apparatus 100 depicted in FIG. 1. FIG. 3A shows a diagram of an example receiving coil 104 having an indicator coil 206 and an example charger transmitting coil 204, and FIG. 3B shows a diagram illustrating determination of a repositioning direction of the receiving coil 104 based on a relative position of the charger transmitting coil 204 to an indicator coil 206 of the receiving coil 104. FIG. 3C shows a diagram of an example charger transmitting coil 204 having an indicator coil 304 and an example receiving coil 104. It should be understood that the apparatus 100 depicted in FIG. 1, the system 200 depicted in FIG. 2, and/or the features depicted in FIGS. 3A to 3C may include additional features and that some of the features described herein may be removed and/or modified without departing from the scopes of the apparatus 100 and/or the system 200.

**[0018]** The apparatus 100 may include a BIOS 102, a receiving coil 104, and an indicator device 106. The apparatus 100 may be a portable device, including a laptop computer, a tablet computer, a smartphone, an electronic device such as Internet of Things (IoT) device, and/or the like. The BIOS 102 may include a processor such as a semiconductor-based microprocessor, a central processing unit (CPU), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), and/or other hardware device. In some examples, the apparatus 100 may include multiple processors and/or cores without departing from a scope of the apparatus. In this regard, references to a single processor as well as to a single memory may be understood to additionally or alternatively pertain to multiple processors and multiple memories.

**[0019]** In some examples, the BIOS 102 may enable various features and functions on the indicator device 106. In this regard, the BIOS 102 may generally be defined as hardware or hardware and a set of instructions that may provide

low-level control for the indicator device 106 in and/or attached to the apparatus 100. In some examples, the instructions may be stored in a memory (not shown) of the apparatus 100. The memory may be, for example, a non-volatile memory such as, Read-Only Memory (ROM), flash memory, solid state drive, Random-Access memory (RAM), an Electrically Erasable Programmable Read-Only Memory (EEPROM), a storage device, an optical disc, or the like. By way of example, the memory may be non-volatile random-access memory (NVRAM).

**[0020]** The receiving coil 104 may be, for example, a component of a wireless charging system, such as the system 200 depicted in FIG. 2, and may wirelessly couple to a charger transmitting coil, such as the charger transmitting coil 204 depicted in FIG. 2, for wireless power transmission. Wireless charging, also referred to as inductive charging, is a type of wireless power transfer that uses electromagnetic induction to charge portable electronic devices. The charger transmitting coil in the wireless charger may transfer energy to the receiving coil 104 by inductive coupling. In this regard, the efficiency of energy transfer may be dependent on alignment of the receiving coil 104 to the charger transmitting coil 204. In some examples, the apparatus 100 may include an indicator device 106 to guide alignment of the receiving coil 104.

**[0021]** The indicator device 106 may be a hardware component installed in the apparatus 100 and may output an indication. For instance, the indicator device 106 may include a display screen, indicator lights such as LEDs, backlit keyboards, audio output devices, haptic devices, and/or the like. In some examples, the indicator device 106 may be integrated in a single housing of the apparatus 100, or in some examples, the indicator device 106 may be connected externally to the housing.

**[0022]** As shown in FIG. 1, the BIOS 102 may perform various operations 110-114 to display an indicator to guide repositioning of the receiving coil 104. The operations 110-114 may be hardware logic blocks that the BIOS 102 or a processor may execute. In other examples, the operations 110-114 may be computer-readable instructions, e.g., non-transitory computer-readable instructions. In other examples, the apparatus 100 may include a combination of

instructions and hardware logic blocks to implement or execute functions corresponding to the operations 110-114.

**[0023]** In some examples, the BIOS 102 may execute the operation 110 to detect a position of the receiving coil 104 relative to a charger transmitting coil, such as the charger transmitting coil 204 as depicted in FIG. 2. In some examples, the BIOS 102 may cause the receiving coil 104 to sense a magnitude of a magnetic flux emitted from the charger transmitting coil 204 to determine the positon of the receiving coil 104 and determine whether the receiving coil 104 is misaligned with the charger transmitting coil 204.

**[0024]** For instance, the charger transmitting coil 204 may be implemented to output a magnetic flux having a known magnitude. In this regard, when the receiving coil 104 is misaligned with the charger transmitting coil 204, the sensed magnetic flux at the receiving coil 104 may be less than the known magnitude of the magnetic flux. As such, the BIOS 102 may determine that the receiving coil 104 is misaligned with the charger transmitting coil 204 based on the detected position of the receiving coil 104 relative to the charger transmitting coil 204.

**[0025]** The BIOS 102 may execute the operation 112 to, based on the determination that the receiving coil 104 is misaligned with the charger transmitting coil 204, determine a repositioning direction to which the apparatus 100 is to be repositioned to bring the receiving coil 104 into alignment with the charger transmitting coil 204.

**[0026]** In some examples, the BIOS 102 may determine the position of the receiving coil 104 using an indicator coil 206. In this regard, the apparatus 100 may include the indicator coil 206 positioned adjacent to the receiving coil 104 to detect the position of the receiving coil 104 relative to the charger transmitting coil 204.

**[0027]** Referring to FIG. 3A, the indicator coil 206 may be positioned adjacent to the receiving coil 104, and in some examples, multiple indicator coils 206 may be disposed adjacent to the receiving coil 104. By way of particular example, the indicator coils 206 may be positioned around an outer circumference of the receiving coil 104, as depicted in FIG. 3A, and alternatively

or additionally, the indicator coils 206 may be positioned adjacent an inside edge of the receiving coil within the opening at the center of the receiving coil 104, and/or the like. The relative position of each of the indicator coils 206 to the receiving coil 104 may be stored so that the BIOS 102 may derive a position of the receiving coil 104 with respect to the charger transmitting coil 204 using the known location of one or more of the indicator coils 206.

**[0028]** For instance, by way of particular example and for purposes of illustration, FIG. 3B shows a diagram illustrating a process of determining the repositioning direction of the receiving coil 104 using the known locations of the indicator coils 206. The BIOS 102 may detect a presence of the charger transmitting coil 204 near the receiving coil 104, for instance, based on a detected magnitude of the magnetic flux at the receiving coil 104 from the charger transmitting coil 204. In some instances, the indicator coils 206 may also be used to detect the presence of the charger transmitting coil 204.

**[0029]** As the apparatus 100 is moved toward a charging apparatus 202 and the presence of the charger transmitting coil 204 is detected, the BIOS 102 may cause the indicator coils 206 to be pinged to sense for energy from the magnetic field emitted from the charger transmitting coil 204. In some examples, the BIOS 102 may sequentially ping the indicator coils 206 around the circumference of the receiving coil 104, or alternatively or additionally, the BIOS 102 may ping the indicator coils 206 in a predetermined pattern, and/or the like.

**[0030]** By way of particular example, the BIOS 102 may determine that energy is detected at an indicator coil 206. In this regard, the magnetic flux from the charger transmitting coil 204 may be focused near the center of the charger transmitting coil 204, and as the indicator coil 206 is moved within the magnetic flux, the BIOS 102 may determine that the indicator coil 206 is currently detecting energy, and identify the position of the indicator coil 206 as being aligned with the charger transmitting coil 204.

**[0031]** In some examples, the BIOS 102 may identify a pair of indicator coils, such as the first indicator coil 206-1 and the second indicator coil 206-2 as depicted in FIG. 3B, as being energized, and the BIOS 102 may use the positions

of both the first indicator coil 206-1 and the second indicator coil 206-2 to determine the relative position of the receiving coil 104 to the charger transmitting coil 204. In this regard, the BIOS 102 may determine a repositioning direction, as depicted by the arrow 302 in FIG. 3B, to which the apparatus 100 is to be repositioned to bring the receiving coil 104 into alignment with the charger transmitting coil 204. It should be understood that the BIOS 102 may determine the repositioning direction 302 based on a single indicator coil 206, and a greater or fewer number of indicator coils 206 may be installed around the receiving coil 104 without departing from a scope of the present disclosure. In some examples, the BIOS 102 may determine that the receiving coil 104 is aligned with the charger transmitting coil 204 when the detected magnitude of magnetic flux at the receiving coil 104 is at a predetermined level and/or when none of the indicator coils 206 are determined to be energized or to be energized below a certain level.

**[0032]** The BIOS 102 may execute the operation 114 to cause the indicator device 106 to display an indicator corresponding to the determined repositioning direction 302. In some examples, the indicator device 106 may be a display and the indicator, which may include textual and/or graphical information to guide the alignment, may be displayed on the display. In some examples, the BIOS 102 may identify a graphical indicator corresponding to the determined repositioning direction 302 from a list of graphical indicators, and may display the identified graphical indicator on the display. In some examples, the graphical indicators may be stored in a table, and referenced to a corresponding indicator coil 206 or pairs of indicator coils 206.

**[0033]** In some examples, the indicator device 106 may be a keyboard having a lighted keyboard key 210. By way of particular example, the BIOS 102 may activate a first lighted keyboard key based on the determined repositioning direction 302 being a first direction, may activate a second lighted keyboard key based on the determined repositioning direction 302 being a second direction, and so forth. For instance, the first lighted keyboard key may be positioned in a first location relative to a reference key, such as left of the reference key, and the second lighted keyboard key may be positioned in a second location relative to the reference key, such as right of the reference key. In this regard, the first lighted

keyboard key may be activated when the receiving coil 104 is detected to be positioned left of the charger transmitting coil 204 and the second lighted keyboard key may be activated when the receiving coil 104 is detected to be positioned right of the charger transmitting coil 204.

**[0034]** In some examples, the BIOS 102 may change a color of the activated lighted keyboard key 210 based on a relative degree of misalignment of the receiving coil 104 to the charger transmitting coil 204. By way of particular example and for purposes of illustration, the first lighted keyboard key may be illuminated to be yellow when the relative degree of misalignment is within a first range (e.g., moderate misalignment), and the first lighted keyboard key may be illuminated to be red when the relative degree of misalignment is within a second range greater than the first range (e.g., severe misalignment). In this example, a lighted keyboard key 210 may be illuminated to be green when the receiving coil 104 is aligned with the charger transmitting coil 204. In some examples, the degree of misalignment may be represented by a relative distance of a lighted keyboard key 210 to the reference key.

**[0035]** In this regard, when the receiving coil 104 is aligned to the charger transmitting coil 204, the BIOS 102 may cause the charger transmitting coil 204 to fully power the receiving coil 104. In some examples, the apparatus 100 and the charging apparatus 202 may communicate though in-band communication means, such as through signals sent over the coils, or may communicate over out-of-band communication means, such as various wireless communication protocols. As shown in FIG. 2, the charging apparatus 202 may include a controller 208.

**[0036]** In some examples, indicator coils 304 may be disposed adjacent to the charger transmitting coil 204. As depicted in FIG. 3C, an indicator coil 304 may be positioned adjacent to the charger transmitting coil 204, and used to detect a presence of the receiving coil 104. In this regard, the controller 208 in the charging apparatus 202 may detect a presence of the receiving coil 104 relative to the charger transmitting coil 204 using the indicator coil 304. In some examples, the controller 208 may, based on the detected presence of the

receiving coil 104, determine a status of the indicator coil 304, in which the status may correspond to whether the indicator coil 304 detects the receiving coil 104.

**[0037]** In some examples, the controller 208 may determine a relative position of the receiving coil 104 to the charger transmitting coil 204 based on the determined status of the indicator coil 304. By way of particular example, the indicator coil 304 may include a first indicator coil 304-1 disposed adjacent to the charger transmitting coil 204 and a second indicator coil 304-2 disposed adjacent to the charger transmitting coil 204 at a different location than the first indicator coil 304-1. The controller 208 may cause the charger transmitting coil 204 to periodically scan for the presence of the receiving coil 104 near the charger transmitting coil 204 by energizing each indicator coil 304 to scan for the receiving coil 104. The controller 208 may identify an energized indicator coil 304 or a pair of energized indicator coils, for instance the first indicator coil 304-1 and the second indicator coil 304-2, as receiving energy from the receiving coil 104. The controller 208 may determine the relative position of the receiving coil 104 to the charger transmitting coil 204 based on the identified energized indicator coil or the pair of energized indicator coils among, for instance, the first indicator coil 304-1 and the second indicator coil 304-2.

**[0038]** In some examples, the controller 208 may send a signal to the receiving coil 104 that is associated with the determined relative position of the receiving coil 104 with respect to the charger transmitting coil 204. In these examples, the signal may cause the BIOS 102 associated with the receiving coil 104 to display an indicator corresponding to an alignment direction of the receiving coil 104 based on the determined relative position of the receiving coil 104 to the charger transmitting coil 204.

**[0039]** In some examples, the controller 208 may send the signal to the BIOS 102 and the BIOS 102 may identify a graphical indicator based on the determined relative position of the receiving coil 104 to the charger transmitting coil 204 as identified in the signal. The BIOS 102 may also display the identified graphical indicator on a display. By way of particular example and for purposes of illustration, the graphical indicator may be an arrow, text, and/or the like, to

guide the movement of the apparatus 100 and the receiving coil 104 to align with the charger transmitting coil 204 of the charging apparatus 202.

**[0040]** In some examples, the controller 208 may send the signal to the apparatus 100, which may cause the BIOS 102 to activate a keyboard light, such as the lighted keyboard keys 210 as depicted in FIG. 2, corresponding to a direction in which the receiving coil 104 is to be repositioned with respect to the charger transmitting coil 204. In this regard, the BIOS 102 may activate a different keyboard light based on a movement of the receiving coil 104 relative to the charger transmitting coil 204. In some examples, the BIOS 102 may change a color of the activated keyboard light. In these examples, the color of the activated keyboard light may be based on a relative degree of alignment of the receiving coil 104 to the charger transmitting coil 204 as discussed herein.

**[0041]** In some examples, the controller 208 may cause the charger transmitting coil 204 to fully power the receiving coil 104 when the receiving coil 104 is determined to be aligned with the charger transmitting coil 204. In some examples, the controller 208 may prevent the charger transmitting coil 204 from applying full power to the receiving coil 104 when the receiving coil 104 is determined to be misaligned to the charger transmitting coil 204.

**[0042]** Various manners in which a processor implemented on the apparatus 100 may operate are discussed in greater detail with respect to the method 400 depicted in FIG. 4. FIG. 4 depicts a flow diagram of an example method 400 for detecting a position of a receiving coil 104 and displaying an indicator for a repositioning direction of the receiving coil 104. It should be understood that the method 400 depicted in FIG. 4 may include additional operations and that some of the operations described therein may be removed and/or modified without departing from the scope of the method 400. The description of the method 400 is made with reference to the features depicted in FIGS. 1, 2, and 3A to 3C for purposes of illustration.

**[0043]** At block 402, the processor may determine a presence of the receiving coil 104 near the charger transmitting coil 204, or alternatively or additionally, the processor may determine a presence of the charger transmitting

coil 204 near the receiving coil 104. At block 404, based on a determination that the receiving coil 104 is near the charger transmitting coil 204, the processor may activate an indicator coil 206 to determine whether the charger transmitting coil 204 is near the indicator coil 206. In this regard, where there are multiple indicator coils 206 disposed around the receiving coil 104, the processor may sequentially activate the indicator coils 206 to detect the presence of the charger transmitting coil 204. Based on a determination at block 404 that the receiving coil is not detected at any indicator coil 206, the processor may continue to detect a presence of the receiving coil 104, at block 402.

**[0044]** At block 406, based on an identification of an indicator coil 206 that has detected the charger transmitting coil 204, the processor may determine an alignment direction of the receiving coil 104 with respect to the charger transmitting coil 204. In this regard, the processor may determine the alignment direction based on a position of the indicator coil 206 that is identified to be positioned near the charger transmitting coil 204.

**[0045]** At block 408, the processor may display an indicator for the alignment direction. In some examples, the processor may display a graphical indicator, text, and/or the like to guide alignment of the receiving coil 104. In some examples, the processor may activate a lighted keyboard key 210 corresponding to the alignment direction to guide alignment of the receiving coil 104.

**[0046]** By way of particular example and for purposes of illustration, a designated key on the keyboard may represent the target, for instance, the charger transmitting coil 204. In this instance, in a case where the alignment direction is to move the receiving coil 104 to the right, a lighted keyboard key 210 to the left of the designated key may be activated, indicating to the user that the receiving coil 104 is currently misaligned to the left of the charger transmitting coil 204. In some examples, the processor may change a color of the activated lighted keyboard key 210 to reflect a relative degree of alignment of the receiving coil 104 to the charger transmitting coil 204.

**[0047]** Some or all of the operations set forth in the method 400 may be included as utilities, programs, or subprograms, in any desired computer

accessible medium. In addition, the method 400 may be embodied by computer programs, which may exist in a variety of forms both active and inactive. For example, they may exist as machine readable instructions, including source code, object code, executable code or other formats. Any of the above may be embodied on a non-transitory computer readable storage medium.

**[0048]** Examples of non-transitory computer readable storage media include computer system RAM, ROM, EPROM, EEPROM, and magnetic or optical disks or tapes. It is therefore to be understood that any electronic device capable of executing the above-described functions may perform those functions enumerated above.

**[0049]** Turning now to FIG. 5, there is shown a block diagram of a non-transitory computer readable medium 500 that may have stored thereon machine readable instructions for activating a keyboard light to indicate a repositioning direction based on a determined repositioning direction. It should be understood that the computer readable medium 500 depicted in FIG. 5 may include additional instructions and that some of the instructions described herein may be removed and/or modified without departing from the scope of the computer readable medium 500 disclosed herein. The computer readable medium 500 may be a non-transitory computer readable medium. The term "non-transitory" does not encompass transitory propagating signals.

**[0050]** The computer readable medium 500 may have stored thereon machine readable instructions 502-508 that a processor disposed in apparatus 100 or apparatus 202 may execute. The computer readable medium 500 may be an electronic, magnetic, optical, or other physical storage device that contains or stores executable instructions. The computer readable medium 500 may be, for example, Random Access memory (RAM), an Electrically Erasable Programmable Read-Only Memory (EEPROM), a storage device, an optical disc, and the like.

**[0051]** The processor may fetch, decode, and execute the instructions 502 to determine a position of a receiving coil 104 relative to a charger transmitting coil 204. The processor may fetch, decode, and execute the instructions 504 to

determine a repositioning direction to which a computing device, such as the apparatus 100 as depicted in FIGS. 1 and 2, is to be repositioned to bring the receiving coil 104 into alignment with the charger transmitting coil 204. In this regard, the processor may determine the repositioning direction based on a determination that the receiving coil 104 is misaligned with the charger transmitting coil 204.

**[0052]** The processor may fetch, decode, and execute the instructions 506 to activate a keyboard light, such as the lighted keyboard key 210 as depicted in FIG. 2, to indicate the determined repositioning direction to reposition the receiving coil 104 to be in alignment with the charger transmitting coil 204.

**[0053]** In some examples, the processor may cause a BIOS, such as the BIOS 102 as depicted in FIG. 2, of the computing device to change a color of the activated keyboard light based on a relative degree of alignment of the receiving coil 104 with respect to the charger transmitting coil 204. In some examples, the processor may cause the BIOS 102 of the computing device to receive a detected signal from an indicator coil 206 and to detect the position of the receiving coil 104 relative to the charger transmitting coil 204 from the detected signal.

What is claimed is:

1. An apparatus comprising:

a receiving coil;

an indicator device; and

a basic input/output system (BIOS);

wherein the BIOS is to:

determine a position of the receiving coil relative to a charger transmitting coil;

based on a determination that the receiving coil is misaligned with the charger transmitting coil, determine a repositioning direction to which the apparatus is to be repositioned to bring the receiving coil into alignment with the charger transmitting coil; and

cause the indicator device to display an indicator corresponding to the determined repositioning direction.

2. The apparatus of claim 1, further comprising:

a first indicator coil and a second indicator coil positioned adjacent to the receiving coil,

wherein the BIOS is to detect the position of the receiving coil relative to the charger transmitting coil based on a detected position of the charger transmitting coil with respect to the first indicator coil and/or the second indicator coil.

3. The apparatus of claim 1, wherein the indicator device includes a display, and the BIOS is to:

identify a graphical indicator among graphical indicators corresponding to the determined repositioning direction; and

display the identified graphical indicator on the display.

4. The apparatus of claim 1, wherein the indicator device includes a keyboard, the keyboard having a first lighted keyboard key disposed in a first location and a second lighted keyboard key disposed in a second location

different than the first location,

wherein the BIOS is to:

activate the first lighted keyboard key based on the determined repositioning direction being a first direction; and

activate the second lighted keyboard key based on the determined repositioning direction being a second direction.

5. The apparatus of claim 1, wherein the indicator device includes a keyboard having a lighted keyboard key, wherein the BIOS is to:

activate the lighted keyboard key based on the determined position of the receiving coil relative to the charger transmitting coil; and

change a color of the activated lighted keyboard key based on a relative degree of misalignment of the receiving coil to the charger transmitting coil.

6. The apparatus of claim 1, wherein the BIOS is to cause the charger transmitting coil to fully power the receiving coil when the receiving coil is aligned with the charger transmitting coil.

7. An apparatus comprising:

a transmitting coil;

an indicator coil disposed adjacent to the transmitting coil; and

a controller to:

detect a presence of a receiving coil relative to the transmitting coil;

based on the detected presence of the receiving coil, determine a status of the indicator coil, wherein the status corresponds to whether the indicator coil detects the receiving coil;

determine a relative position of the receiving coil to the transmitting coil based on the determined status of the indicator coil; and

send a signal to the receiving coil associated with the determined relative position of the receiving coil to the transmitting coil, the signal to cause a basic input/output system (BIOS) associated with the receiving coil to display an indicator corresponding to an alignment direction of the

receiving coil based on the determined relative position of the receiving coil to the transmitting coil.

8. The apparatus of claim 7, wherein the indicator coil includes a first indicator coil disposed adjacent to the transmitting coil and a second indicator coil disposed adjacent to the transmitting coil at a different location than the first indicator coil, wherein the controller is to:

cause the transmitting coil to periodically scan for the presence of the receiving coil near the transmitting coil;

identify an energized indicator coil or a pair of energized indicator coils among the first indicator coil and the second indicator coil having energy received from the receiving coil; and

determine the relative position of the receiving coil to the transmitting coil based on the identified energized indicator coil or the pair of energized indicator coils among the first indicator coil and the second indicator.

9. The apparatus of claim 7, wherein the controller is to send the signal to:

cause the BIOS to identify a graphical indicator based on the determined relative position of the receiving coil to the transmitting coil; and

cause the BIOS to display the identified graphical indicator on a display.

10. The apparatus of claim 7, wherein the controller is to send the signal to cause the BIOS to:

activate a first keyboard light that corresponds to a direction in which the receiving coil is to be repositioned with respect to the transmitting coil.

11. The apparatus of claim 10, wherein the controller is to send the signal to cause the BIOS to:

activate a second keyboard light based on a movement of the receiving coil relative to the transmitting coil; and

change a color of the second keyboard light relative to the first keyboard light, the color being based on a relative degree of alignment of the receiving coil

to the transmitting coil.

12. The apparatus of claim 7, wherein the controller is to:

cause the transmitting coil to fully power the receiving coil when the receiving coil is aligned with the transmitting coil.

13. A non-transitory computer readable medium on which is stored machine readable instructions that when executed cause a processor of a computing device to:

determine a position of a receiving coil relative to a charger transmitting coil;

based on a determination that the receiving coil is misaligned with the charger transmitting coil, determine a repositioning direction to which the computing device is to be repositioned to bring the receiving coil into alignment with the charger transmitting coil; and

activate a keyboard light to indicate the determined repositioning direction to reposition the receiving coil to be in alignment with the charger transmitting coil.

14. The non-transitory computer readable medium of claim 13, wherein the instructions are further to cause the processor to:

cause a basic input/output system (BIOS) of the computing device to change a color of the activated keyboard light based on a relative degree of alignment of the receiving coil with the charger transmitting coil.

15. The non-transitory computer readable medium of claim 13, wherein the instructions are further to cause the processor to:

cause a basic input/output system (BIOS) of the computing device to receive a detected signal from an indicator coil and to detect the position of the receiving coil relative to the charger transmitting coil from the detected signal.

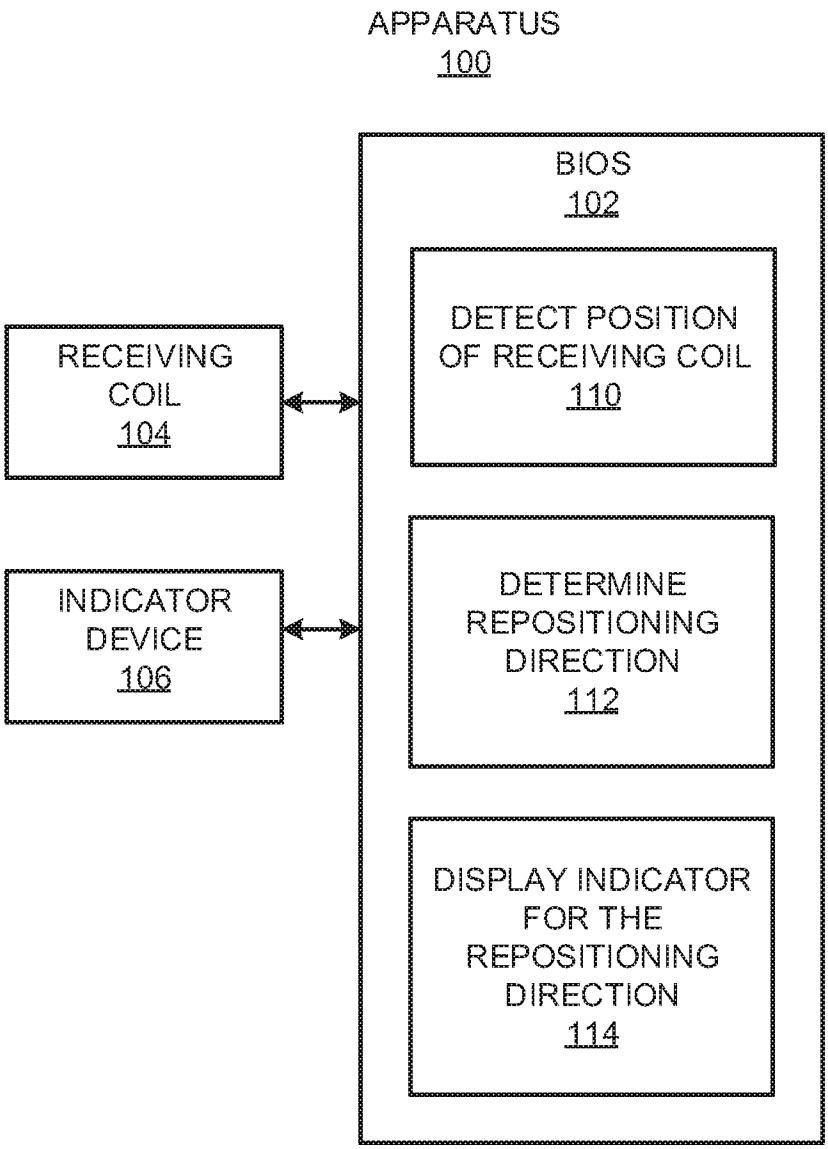
APPARATUS
100
BIOS
102
DETECT POSITION OF RECEIVING COIL
110
RECEIVING COIL
104
INDICATOR DEVICE
106
DETERMINE REPOSITIONING DIRECTION
112
DISPLAY INDICATOR FOR THE REPOSITIONING DIRECTION
114

FIG. 1

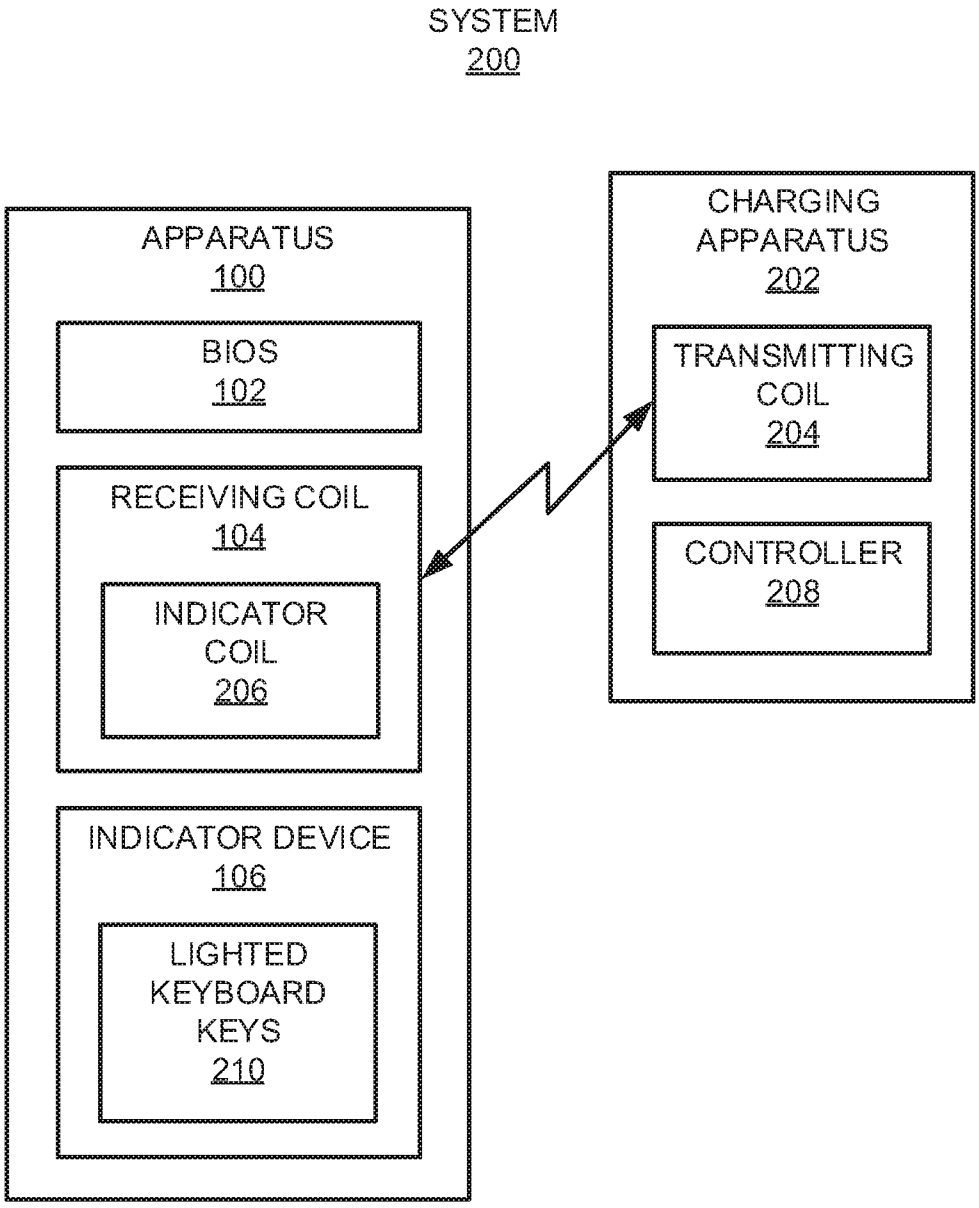
SYSTEM
200
APPARATUS
100
BIOS
102
RECEIVING COIL
104
INDICATOR
COIL
206
INDICATOR DEVICE
106
LIGHTED
KEYBOARD
KEYS
210
CHARGING
APPARATUS
202
TRANSMITTING
COIL
204
CONTROLLER
208

FIG. 2

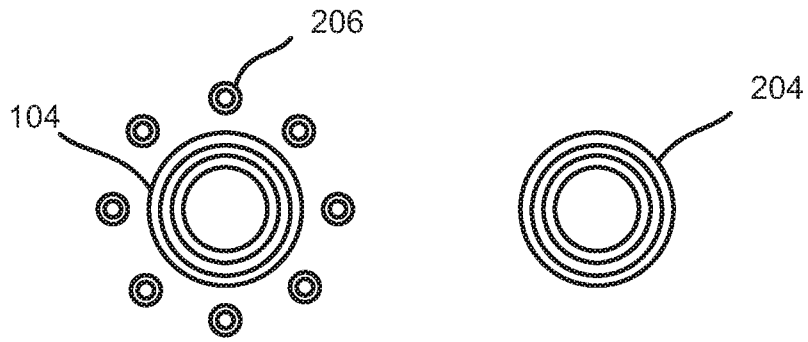


FIG. 3A

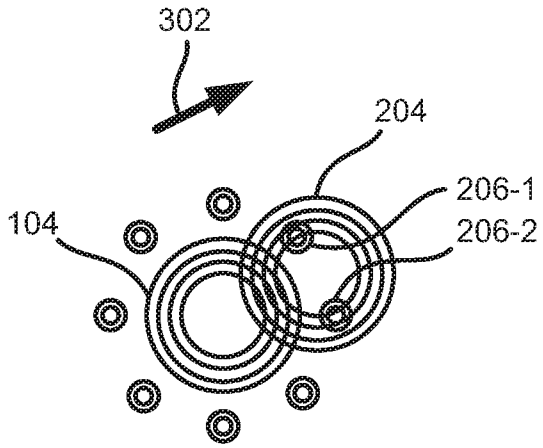


FIG. 3B

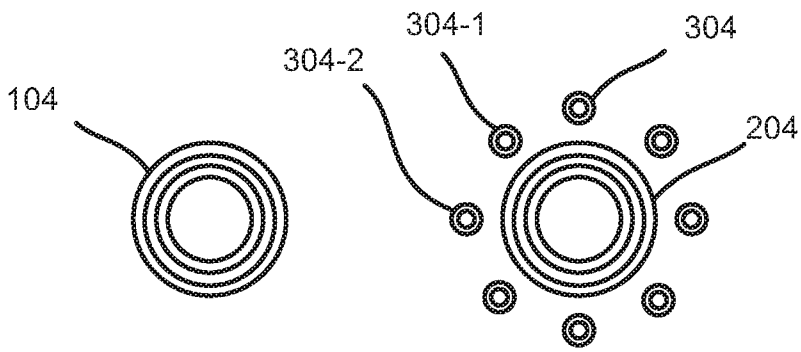


FIG. 3C

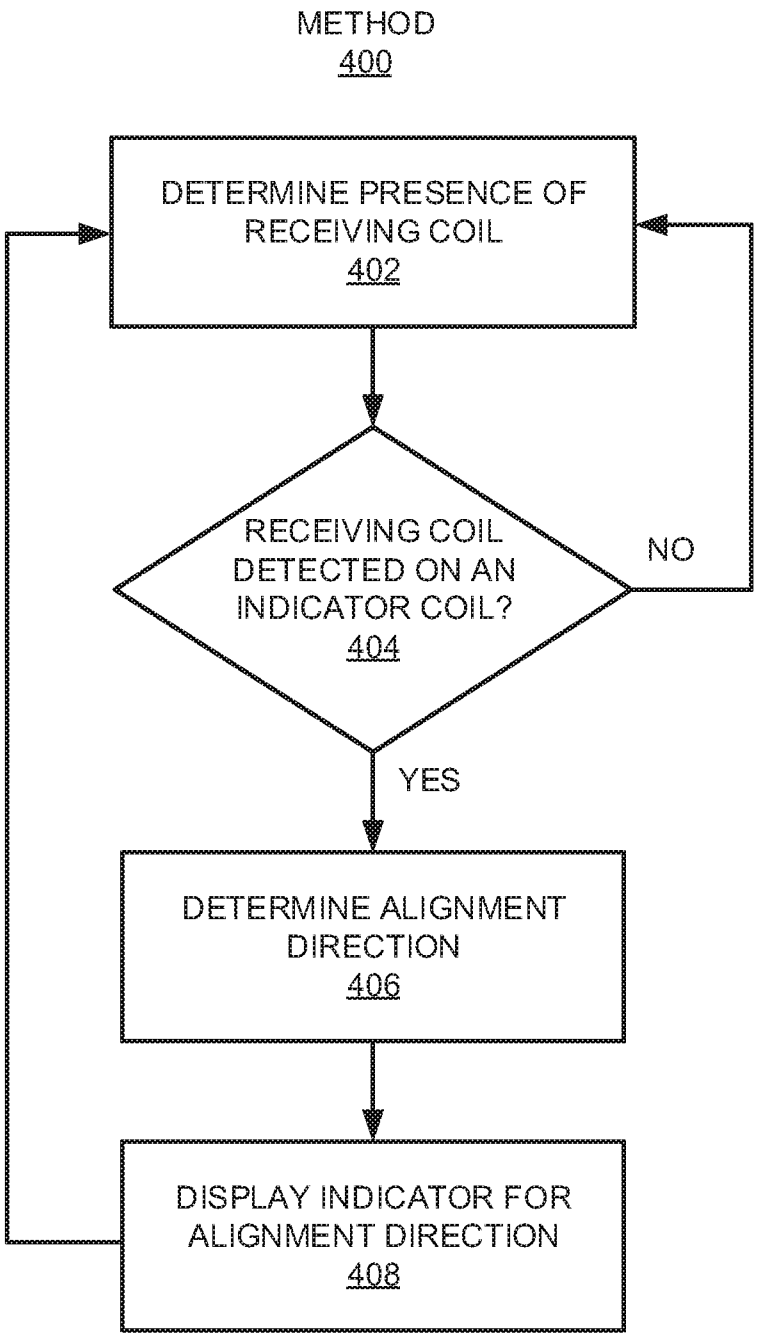
METHOD
400
DETERMINE PRESENCE OF RECEIVING COIL
402
RECEIVING COIL DETECTED ON AN INDICATOR COIL?
404
NO
YES
DETERMINE ALIGNMENT DIRECTION
406
DISPLAY INDICATOR FOR ALIGNMENT DIRECTION
408

FIG. 4

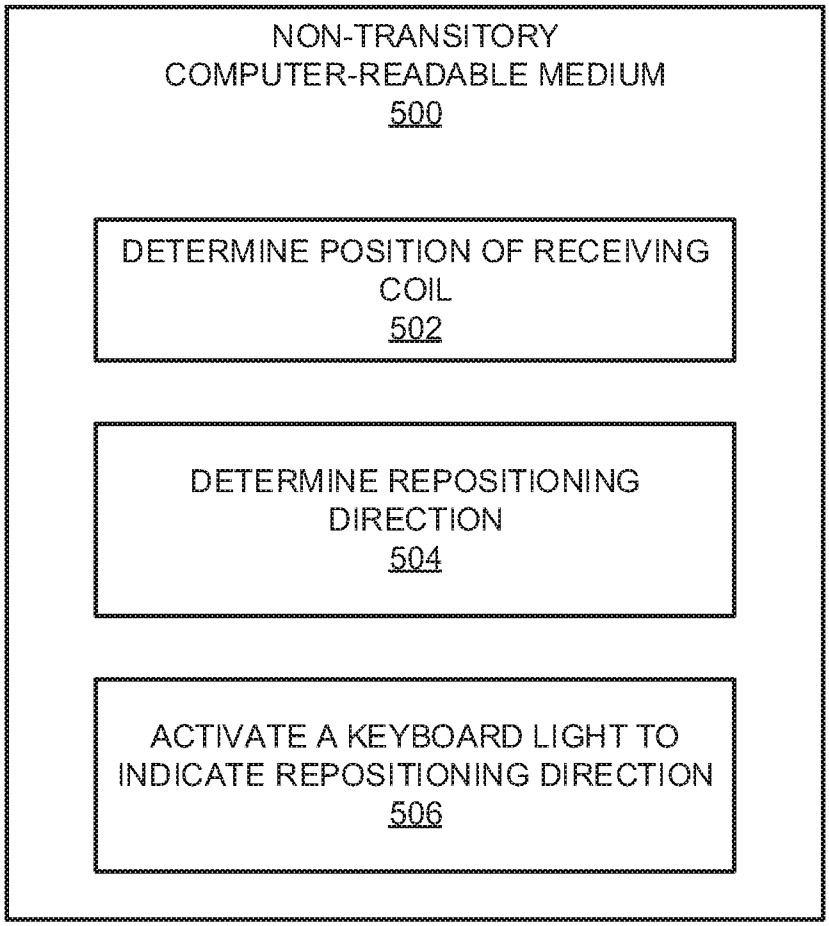
NON-TRANSITORY
COMPUTER-READABLE MEDIUM
500
DETERMINE POSITION OF RECEIVING COIL
502
DETERMINE REPOSITIONING DIRECTION
504
ACTIVATE A KEYBOARD LIGHT TO INDICATE REPOSITIONING DIRECTION
506

FIG. 5

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/US 2020/043066

A. CLASSIFICATION OF SUBJECT MATTER

***H02J 50/90*** *(2016.01)*
***H02J 50/40*** *(2016.01)*
***G01B 7/004*** *(2006.01)*

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)

H02J 50/00, 50/40, 50/90, G01B 7/00, 7/004

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

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

PatSearch (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>Y | US 10072947 B1 (GOOGLE LLC) 11.09.2018,<br>col. 8, line 52 - col. 10, line 67, col. 11, lines 11-30, claim 1 | 13<br>1-12, 14, 15 |
| Y | US 2017/0163076 A1 (SAMSUNG ELECTRONICS CO. LTD.) 08.06.2017,<br>paragraph [0100] | 1-12, 14, 15 |
| A | US 2018/0287413 A1 (LG INNOTEK CO., LTD.) 04.10.2018 | 1-15 |
| A | US 2016/0210616 A1 (SAMSUNG ELECTRONICS CO. LTD.) 21.07.2016 | 1-15 |

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

"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

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 02 September 2020 (02.09.2020) | 10 September 2020 (10.09.2020) |

| Name and mailing address of the ISA/RU: | Authorized officer |
|---|---|
| Federal Institute of Industrial Property,<br>Berezhkovskaya nab., 30-1, Moscow, G-59,<br>GSP-3, Russia, 125993<br>Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37 | V. Volodin<br><br>Telephone No. 8(495)531-64-81 |