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Datasheet for the decision of 3 January 2023

Case Number: T 1455/18 - 3.5.06

Application Number: 13176269.2

Publication Number: 2738642

IPC: G06F1/32

Language of the proceedings: EN

Title of invention:
Method of sensing connection of usb device in power save mode and image forming apparatus for performing the same

Applicant:
Hewlett-Packard Development Company, L.P.

Headword:
Sensing connection of a USB device to an image forming apparatus in power-saving mode/HEWLETT-PACKARD

Relevant legal provisions:
EPC Art. 54(1), 56

Keyword:
Novelty - (no)
Inventive step - (no)

Decisions cited:

Catchword:

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Case Number: T 1455/18 - 3.5.06

D E C I S I O N
of Technical Board of Appeal 3.5.06
of 3 January 2023

Appellant: (Applicant)	Hewlett-Packard Development Company, L.P. 10300 Energy Drive Spring, TX 77389 (US)
Representative:	Appleyard Lees IP LLP 15 Clare Road Halifax HX1 2HY (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 16 January 2018 refusing European patent application No. 13176269.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	M. Müller
Members:	A. Teale
	A. Jimenez

Summary of Facts and Submissions

I. This is an appeal against the decision, dispatched with reasons on 16 January 2018, to refuse European patent application No. 13 176 269.2 on the basis that the subject-matter of claim 1 of a main and a second auxiliary request did not involve an inventive step, Article 56 EPC, in view of the following document:

D1: US 2006/0271802 A1.

The first auxiliary request, submitted in the oral proceedings before the examining division, was not admitted into the proceedings.

II. A notice of appeal against the decision in its entirety and the appeal fee were received on 8 March 2018.

III. With a statement of grounds of appeal, received on 9 April 2018, the appellant filed claims according to new main and first and second auxiliary requests. The appellant requested that a patent be granted on the basis of one of said requests and made an auxiliary request for oral proceedings.

IV. In an annex to a summons to oral proceedings the board set out its preliminary opinion on the appeal, *inter alia* as follows. The subject-matter of the independent apparatus and method claims of the main request seemed to lack novelty, Article 54(1) EPC, in view of D1. The subject-matter of the independent apparatus and method claims of the first and second auxiliary requests seemed to lack inventive step, Article 56 EPC, in view of D1 and usual design practice.

V. In response to the summons the appellant did not submit either amendments or arguments. Instead, in a letter received on 14 December 2022, the appellant withdrew its request for oral proceedings and stated that it would not attend the oral proceedings. The appellant requested a decision on the state of the file as it stood. The oral proceedings were subsequently cancelled.

VI. The application is thus being considered in the following form:

Description (all requests):
pages 1 to 10, received on 25 November 2014.

Claims (all received with the grounds of appeal):
Main request: 1 to 14.
First auxiliary request: 1 to 14.
Second auxiliary request: 1 to 11.

Drawings (all requests):
Pages 1/6 to 6/6, as originally filed.

VII. Claim 1 of the main request reads as follows:

"An image forming apparatus (100) comprising: a main controller (140) that controls overall operation of the image forming apparatus (100); a universal serial bus, USB, interface (130); a voltage change detector (120) to output a wake-up signal if a voltage change occurs on a VBUS line; a USB host controller (142) to perform data communication with a USB device connected through the USB interface; an image forming job performing unit (150) to perform an image forming job according to control by the main controller; and a voltage bus, VBUS, power supply (110) to supply power to the USB

interface through the VBUS line, the apparatus characterized in that the main controller (140) is configured to manage turning on and off each component of the image forming apparatus (100), including turning off the USB host controller (142), when the image forming apparatus (100) enters a power save mode, and in the power save mode, if the voltage change is detected on the VBUS line, the USB host controller (142) is turned on by the main controller (140)."

VIII. According to the first auxiliary request, compared to the claims of the main request, the following two features have been added to independent claims 1 and 8:

- turning off the image forming job performing unit [when the image forming apparatus enters a power save mode] and

- [in the power save mode] if a USB device is connected to the USB interface (130) [and the voltage change is detected on the VBUS line, the USB host controller (142) is turned on by the main controller (140)].

IX. According to the second auxiliary request, compared to the claims of the previous request, three features have been added to claims 1 and 8:

- [the main controller comprises] a general purpose input/output, GPIO, (141) to manage an input and output of a signal, and a power save mode manager (146);
- the power save mode manager (146) comprises a micro kernel executed by a program stored in a

read only memory included in the main controller (140) and

- [in the power save mode, the power save mode manager (146) turns on the USB host controller (142)] when a wake-up signal is received from the voltage change detector (120) through the GPIO (141) if a USB device is connected to the USB interface (130) [and the voltage change is detected on the VBUS line].

Reasons for the Decision

1. The admissibility of the appeal

In view of the facts set out at points I to III above, the appeal fulfills the admissibility requirements under the EPC and is consequently admissible.

2. A summary of the invention

2.1 The application relates to saving power in an image forming apparatus, for instance a printer or scanner (see [3, 28]), by putting the apparatus in a "standby" (also called "low power" and "power save") mode if it is inactive for a certain period of time; see [3] and [29].

2.2 When the apparatus is in the standby state, meaning that certain parts of it are turned off to conserve power, the question arises of how to detect the connection of a USB device, meaning that the apparatus should "wake up" again, whilst minimising the power consumed in the standby state; see [6]. Conventionally, such apparatuses can act as either a USB host or USB device, the invention concerning the apparatus

configured as a USB host controller; see [4] to [5]. It is known to periodically turn on the USB host controller to check whether a USB device has been connected, but this approach has the drawback that the USB host controller has an undesirably high power consumption in the standby mode.

2.3 The invention concerns an alternative solution to this problem in which the USB host controller is turned off in the standby mode and only woken up when a detector circuit monitoring the USB VBUS power line detects that a USB device has been connected to the apparatus.

2.4 Figure 1 illustrates an apparatus controlled by a "main controller" (140) comprising the USB host controller (142). A "voltage change detector" (120) monitors the voltage of the power line (VBUS) to the USB bus interface (130) to which USB devices can be detected. In the "standby" mode the apparatus controller (140) turns off the power to the USB host controller (142) and the "image forming job performing unit", i.e. the printer and scanner parts; see [32-35]. When the detector (120) detects a change, in particular a drop (see [25], last line), in the bus voltage, caused by connecting a USB device to the USB interface (130), the detector sends a "wake-up" signal to the main apparatus controller (140) causing everything to "wake up" again; see [24-26]. Figure 6 illustrates the steps of a corresponding method.

2.5 Figure 2 (see claims 2 to 4) illustrates an example of a voltage change detector (120) comprising a comparator (121) which senses the potential difference across a current-sensing resistor R1 in series with the USB interface (130). The board understands the output of the comparator to have two states - high and low -

since it is fed to a GPIO (General Purpose Input Output) interface of the main apparatus controller (140); see figure 5; 144, and [45]. The board understands a GPIO interface to be digital. According to paragraph [40], the current-sensing resistor R1 can be realised as a "poly switch" (understood by the board to be a type of temperature-sensitive resistor), figure 7 listing suitable devices, or a switching transistor, figure 8 setting out the characteristics of a suitable FET (Field Effect Transistor) device.

2.6 According to figure 5 (see [45]), the main controller (140) comprises a power save mode manager (146) which, according to paragraph [46], lines 32 to 34, may be "a micro kernel that may be executed by a program stored in a read only memory (ROM) included in the main controller 140." In this context, the board understands a micro kernel to be a small operating system. The power save mode manager is said to always be on, since it does not consume much power.

3. The board's understanding of the invention

3.1 A key issue to be decided in this case is which components of the apparatus are turned on and off when the device transitions between the normal operating mode and the standby ("power save") mode. The board understands claim 1 of all requests to require that at least the USB host controller is turned off in "power save" mode. Claim 1 of both auxiliary requests further requires that the "image forming job performing unit" also be turned off.

3.2 According to figure 6, only the USB host controller is turned off (step S601) when entering standby mode and on again (S607) when leaving standby mode; see

[30,48-51]. In a more detailed embodiment, the power save mode manager (146) in the main controller (140) (see figure 5) turns the USB host controller off when the apparatus enters a power save mode and on again if a wake-up signal is received through the GPIO interface; see [13]. The claims of the main request are understood to be directed to this embodiment.

3.3 The description also discloses the main controller (140) turning off the USB host controller and the "image forming job performing unit" (150) when the apparatus enters a power save mode and turning the USB host controller on again when it receives a "wake-up" signal from the voltage change detector (120); see [9, 34]. The claims of the auxiliary requests are understood to be directed to this embodiment.

3.4 During examination proceedings there was much debate concerning the meaning of the sentence at the beginning of paragraph [46] of the description: "The power save mode manager 146 may manage turning off **each** component of the image forming apparatus in a power save mode" (emphasis by the board), the expression "each component" appearing in claim 1 of all requests, although it was not used in the original claims. In the context of the application, the board does not understand "each component" literally as disclosing turning off every individual component of the image forming means, since at least one case exists in which the skilled person would understand that a component is not turned off in the standby state, namely the VBUS power supply (110); see figure 1. Turning this off would namely defeat the object of detecting the connection of a USB device. Hence the board understands the expression "each component" to only relate to those components which are explicitly mentioned in the

application as individually being turned off in the standby state. These are: the "image forming job performing unit" (150) (see [28, 32]), "sub-components performing control operations in the main controller" (see [28]) and a USB hub (160) (see figure 4 and [43-44]). As turning off these components is disclosed separately, the board understands it to be implicit that these options concern power control at an individual component level. It is also disclosed that the USB host controller and the "image forming job performing unit" (150) are turned off together but that only the USB host controller is turned on again when a "wake-up" signal is received; see [9, 34]. This implies individual power control of the USB host controller.

3.5 In view of the above, the board construes the expression "each component" as "at least one component" in the case of the main request and "at least two" in the case of the auxiliary requests. Put another way, in the context of each claim, the board regards the expression "each component" as having no limitative effect in any of the requests.

3.6 As explained below, on this construction of the claims, the subject-matter of the independent apparatus and method claims of the main request is anticipated by D1.

4. Clarity, Article 84 EPC

Despite its comments in the annex to the summons to oral proceedings, the board finds that the claims are sufficiently clear for the assessment of inventive step.

5. Document D1 (US 2006/0271802 A1)

5.1 The decision assesses inventive step starting from D1. The board agrees that this is a suitable starting point. According to its abstract and figure 1, D1 concerns a printing apparatus having a "normal operating" mode in which printing can occur and an "energy-saving" mode in which power consumption is reduced by cutting off power to the USB host interface (160) and an "energy-saving block" (101), comprising the system LSI (Large Scale Integrated circuit; see [37]) and a ROM (Read Only Memory)(103). As can be seen in figure 1, power is not entirely cut off from the USB host interface in the energy-saving mode, since a resistor (173), understood by the board to be a current-sensing resistor (see figure 4; steps S402-S493 and [61-63]), bypasses the FET (Field Effect Transistor) switch (172) between the 5V power supply (170) and the USB host interface; see [45-46]. The system LSI contains the microprocessor that controls the printer; see [54, 67]. When a USB device is connected to the USB host interface, the microprocessor shifts the apparatus from an energy-saving to a normal-operating state. The connection of an external USB device to the apparatus is detected by a first voltage monitoring section (174) sensing a voltage drop in the USB power supply line, see [12-13 and 44].

5.2 As shown in figure 1, power is always provided to the power control section, but can be turned off by a FET switch (171) to the energy-saving block (101) comprising the system LSI; see [40-42]. The board understands the system LSI to comprise a USB host controller, termed the "USB control section" in [42], which is turned off when the energy-saving block is turned off. When the first voltage monitoring section

(174) senses the connection of a USB device at the USB interface (160), it sends a "returning signal" via line 214 to the power control section (120).

5.3 Figure 2 illustrates the generation of the control voltage (210) for the two FET switches (171,172) by means of an OR gate (122) and a flip-flop (123), a bistable circuit. The board understands that the FET switches can be turned on by one or more of three different signals, which set the flip-flop, and turned off again by a signal (209) from the system LSI (105), termed the "power-supply interrupting" signal in paragraph [49], which, if the printer has been idle for a predetermined time (see [54]), resets the flip flop, returning the apparatus to the energy-saving mode; see [49-50]. The first of said three signals for putting the apparatus into the normal operation mode comes from a second "voltage monitoring section" (121) which detects that the printer power supply is on, understood by the board to be a "Power On Reset" signal; see [52] and figure 3; step S302. The second signal is the "return signal" from the first voltage monitoring section (174), and the third signal comes from an "energy-saving" key, which the user can press to "wake up" the apparatus; see figure 3, steps S311, S312 and [72].

5.4 Figure 3 illustrates the steps of the mode switching process, the loops around steps S305/S306 and S310/S311 corresponding to the two flip-flop (123) states, i.e. the "normal" and "energy-saving" apparatus modes.

5.5 The appellant has argued that the power control section (120) in D1 cannot be considered as a "main controller" in the claims, since in D1 the power control section is not an overall general controller and only controls

power; see FET switches 171 and 172. In D1 it is the system LSI (105) that controls overall apparatus operation; see [42]. The board regards the perimeter of the "main controller" in the claim as being arbitrary. The perimeter in D1 can, for example, include the combination of the system LSI (105) and the power control section (120). On this interpretation, D1 does indeed disclose a "main controller" in the sense of the claims.

5.6 The appellant has argued that the skilled person would not understand D1 to disclose the main controller turning itself off. The board notes that, on the above understanding of the "main controller", in D1 part of the main controller (the power control section (120)) does indeed turn the other part, the energy-saving block (101), off. However, as the claims are not limited to the main controller turning itself off, this point is not decisive.

5.7 The appellant has also argued that D1 does not disclose each component of the apparatus being turned off when entering a standby mode. In D1 only the energy-saving block (101) and the USB host interface (160) were turned off; see [45-46]. In contrast to the claims, the two components could only be turned off together. As explained above, the board finds that the claims do not exclude two components being turned off together.

5.8 The appellant has also argued that D1 does not disclose the USB host controller being "woken up" in response to a change of voltage being detected on the VBUS line. The board takes the view that this feature is known from D1, since the system LSI (105) is understood to comprise a USB host controller, and this is woken up when the voltage monitoring section (174) detects a

drop in the VBUS voltage due to the resistor (173) when a USB device is connected; see figure 3; steps S311-S312 and S303-S305.

5.9 Hence, in the terms of claim 1 of the main request, D1 discloses an image forming apparatus (printer 100) comprising: a main controller (LSI 105, power control section 120) that controls overall operation of the image forming apparatus (100); a universal serial bus, USB, interface (160); a voltage change detector (174) to output a wake-up signal if a voltage change occurs on a VBUS line; a USB host controller (in LSI) to perform data communication with a USB device connected through the USB interface; an image forming job performing unit (printer engine 180) to perform an image forming job according to control by the main controller; and a voltage bus, VBUS, power supply (170) to supply power to the USB interface (160) through the VBUS line (203), the apparatus characterized in that the main controller (105, 120) is configured to manage turning on and off "each component" (understood as "at least one component") of the image forming apparatus (100), including turning off the USB host controller (LSI 105), when the image forming apparatus (100) enters a power save mode, and in the power save mode, if the voltage change is detected on the VBUS line, the USB host controller is turned on by the main controller (see return signal 214 to power control section 120).

6. Novelty, Article 54 EPC, and inventive step, Article 56 EPC

6.1 The main request

6.1.1 According to the reasons for the appealed decision, the subject-matter of claim 1 of the then main request

differed from the disclosure of D1 in that the main controller was configured to manage turning on and off each component of the image forming apparatus, i.e. instead of some components being switched on and off (the case in D1), each component was switched on and off. The difference features had the technical effect that, as every component was switched off, more components than in D1 were switched off during power save mode, thus reducing power consumption.

6.1.2 Claim 1 set out the following components of the image forming apparatus: the main controller, the USB interface, the voltage change detector, the USB host controller, the image forming job performing unit and the voltage bus power supply. Thus switching off each component included switching off the voltage change detector and the main controller itself. If these components were switched off, then the apparatus could not return from power save mode on its own initiative. If the main controller were switched off, it could no longer switch itself back on. If the voltage change detector switched off, it could not compare voltage levels and, therefore, could not detect voltage changes triggering power mode related actions. Hence switching off all components reduced power consumption at the cost of lost functionality. This trade-off would have been known to the skilled person who would have known only to switch off those components which were dispensable. Hence the subject-matter of claim 1 did not involve an inventive step over D1.

6.1.3 The examining division did not accept the applicant's argument that the term in claim 1 "each" should be understood to mean "individually", since claim 1 was not limited to some components remaining on whilst others were turned off and covered the case of every

component being turned off. The examining division also did not accept the argument that the main controller in D1 was part of the system LSI (105), since the power control section (120) in D1 could be regarded as the main controller. The argument that, in contrast to D1 (see [57]), in claim 1 components were turned on and off in the low power mode was also not accepted, since the beginning and end of a mode could be arbitrarily set, so that in D1 modules 101 and 160 could also be considered to be powered up in the low power mode.

6.1.4 Present claim 1 differs from that of the main request in the decision in that it is now also specified that turning off each component in the power save mode includes "turning off the USB host controller (142)". The expression "is in a power save mode" has been amended to "enters a power save mode". Also the following passage has been added at the end: "in the power save mode, if the voltage change is detected on the VBUS line, the USB host controller (142) is turned on by the main controller (140)".

6.1.5 In the light of the board's construction of the claims and its appreciation of the disclosure of D1, set out above, the board finds that the subject-matter of claim 1 is known from D1 and consequently lacks novelty, Article 54(1,2) EPC.

6.2 The first auxiliary request

6.2.1 Compared to that of the main request, claim 1 has been restricted to not only the USB host controller being turned off in the "power save" mode, but also the "image forming job performing unit (150)".

6.2.2 The appellant has argued that D1 does not disclose the main controller turning each component of the apparatus, in particular the printer engine, off in a power save mode. The characterising features over D1 had the technical effect of improving power saving in an image forming apparatus, so that the objective technical problem was to modify the apparatus/method of D1 to improve power saving. Turning off both components provided an enhanced power save mode in which the image forming job performing unit could remain off, thus saving power, but the USB host controller was on and enabled the apparatus to usefully perform functions. Neither D1, not any other document on file, provided a hint in the claimed direction.

6.2.3 Whilst the board agrees with the applicant that it is not directly and unambiguously derivable from D1 that the printer engine 180 (see figure 1) is turned off in the "power save" mode, as figure 1 does not show the printer engine 180 having its own separate power supply, the skilled person constructing a printer according to D1 and "filling in the gaps" in its disclosure would have decided to power the printer engine from the energy saving block as a matter of usual design, the result being that the USB host controller and image forming job performing unit would turn off together in the energy-saving mode. Claim 1 does not exclude the printer engine turning on again with the energy-saving block.

6.2.4 Hence the additional feature is unable to lend inventive step, Article 56 EPC, to claim 1 in view of D1 and usual design practice.

6.3 The second auxiliary request

6.3.1 According to the decision, claim 1 of the then second auxiliary request, compared to that of the main request, additionally set out that the main controller comprised:

A) a general purpose input/output, GPIO (141) to manage an input and output of a signal;

B) a power save mode manager (146) to manage the turning on and off function;

C) wherein the power save mode manager turns off the USB host controller (142) when the image forming apparatus enters a power save mode, and

D) turns on the USB host controller when a wake-up signal is received from the voltage change detector through the GPIO.

None of the additional features could lend inventive step to claim 1. Although feature "A" was not disclosed by D1, GPIO interfaces were common general knowledge and a usual design choice for the skilled person. Feature "B" merely defined a sub-module of the main controller performing the same function as had previously been associated with the main controller, so that feature "B" had no limiting effect. Feature "C" was known from the power control section (120) (fig. 1) in D1 which turned off the energy saving block (101) (including the USB host controller: par. [42]) using a FET switch (171) when the apparatus entered the power-saving mode (par. [45] and fig. 1). Feature "D" was also known from D1, as analogously the power control section (120) turns on power (par. [45]) on receiving

the signal (214) from the voltage monitoring section (174) (par. [44]); see also fig. 3, modules S303-S305. Hence claim 1 lacked inventive step in view of D1.

6.3.2 Compared to claim 1 in the decision, claim 1 has been amended to now also specify that turning off each component in the power save mode includes "turning off the USB host controller (142) and turning off the image forming job performing unit (150)". The expression "is in a power save mode" has been amended to "enters a power save mode". Also the following passage has been inserted before the last paragraph: "wherein the power save mode manager (146) comprises a micro kernel executed by a program stored in a read only memory included in the main controller (140) and maintains an[d] on state in the power save mode". In the last paragraph it is now also specified that a wake-up signal is generated "if a USB device is connected to the USB interface (130) and the voltage change is detected on the VBUS line".

6.3.3 The appellant has argued that the difference features over D1 have the technical effect of improving power savings in an image forming apparatus. Thus the objective technical problem was to modify the apparatus known from D1 to improve power saving. D1 only disclosed two modes: "normal", in which the entire apparatus was on, and "energy-saving", in which the energy-saving block and USB host controller were turned off, rendering the apparatus non-operational. The invention provided a third, "enhanced" power-saving mode in which only the USB host controller was turned on. D1 provided no hint at such a "third option", which, in the context of D1, would require independent control of the two FET switches 171 and 172, currently controlled by a common line from the power control

section 210, to independently control the energy-saving block 101 and the USB host interface 160, respectively. In D1 it would not make sense to only turn on the USB host controller since, without the energy-saving block 101, it would be unable to function properly. The difference functions over D1 were not disclosed by any of the other documents on file.

6.3.4 According to the appellant, claim 1 has been amended to take up the features of original claims 5 (GPIO/power save mode manager) and 6 (micro kernel), none of these features being known from D1. The use of a micro kernel in the power save mode manager resulted in a low power consumption, so that the power save mode manager could always be left on. The GPIO interface resulted in a more efficient design than in D1. As with the previous requests, the characterising features over D1 had the technical effect of improving power saving in an image forming apparatus, so that the objective technical problem was to modify the apparatus of D1 to improve power saving. Neither D1, not any other document on file, provided a hint in the claimed direction. Indeed D1 taught away from the invention in disclosing a power control section (120) which was separate from the main controller/system LSI 105. Moreover the power control section turned off the energy-saving block (see FET switch 171), thus turning off the system LSI (105) in the energy-saving mode. Hence the separation was necessary.

6.3.5 The board does not understand claim 1 as excluding the image forming job performing unit being turned on with the USB host controller when the apparatus leaves the power save mode. Hence the board does not interpret claim 1 as setting out an intermediate "enhanced" power-saving mode.

6.3.6 The board takes the view, based on the construction of the "main controller" set out above, that the subject-matter of claim 1 differs from the disclosure of D1 in the following three features:

a. the main controller comprises a general purpose input/output (GPIO) interface (difference "A" in the decision);

b. the image forming job performing unit is turned off with the USB host controller and

c. the power save mode manager in the main controller comprises a micro kernel.

6.3.7 The three difference features address different problems, so that their contributions to inventive step must be assessed separately. Difference "a" concerns interfacing the voltage change detector with the main controller, difference "b" concerns saving power and feature "c" concerns the realisation of the power save mode manager.

6.3.8 Given that in D1 the signal (214) between the voltage monitoring circuit (174) and the power control section (120) is digital (binary) (see figure 2), the use of a GPIO interface at this location would have been a usual design choice for the skilled person. Hence feature "a" is unable to lend inventive step to the claim.

6.3.9 Feature "b" is also unable to lend inventive step to the claim for the same reasons as are set out above for the first auxiliary request.

6.3.10 Turning to feature "c", the skilled person constructing the printer according to D1, in particular the power control section (120), which remains on in the power-saving mode, would have used a micro kernel, a small operating system, as a usual design choice, so that feature "c" is also unable to lend inventive step to the claim.

6.3.11 Hence the subject-matter of claim 1 does not involve an inventive step, Article 56 EPC, in view of D1 and usual design practice.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

L. Stridde M. Müller

Decision electronically authenticated