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(54) **PORTABLE POWER SUPPLY APPARATUS
CAPABLE OF RECEIVING AC OR DC INPUT
POWER**

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(57) **ABSTRACT**

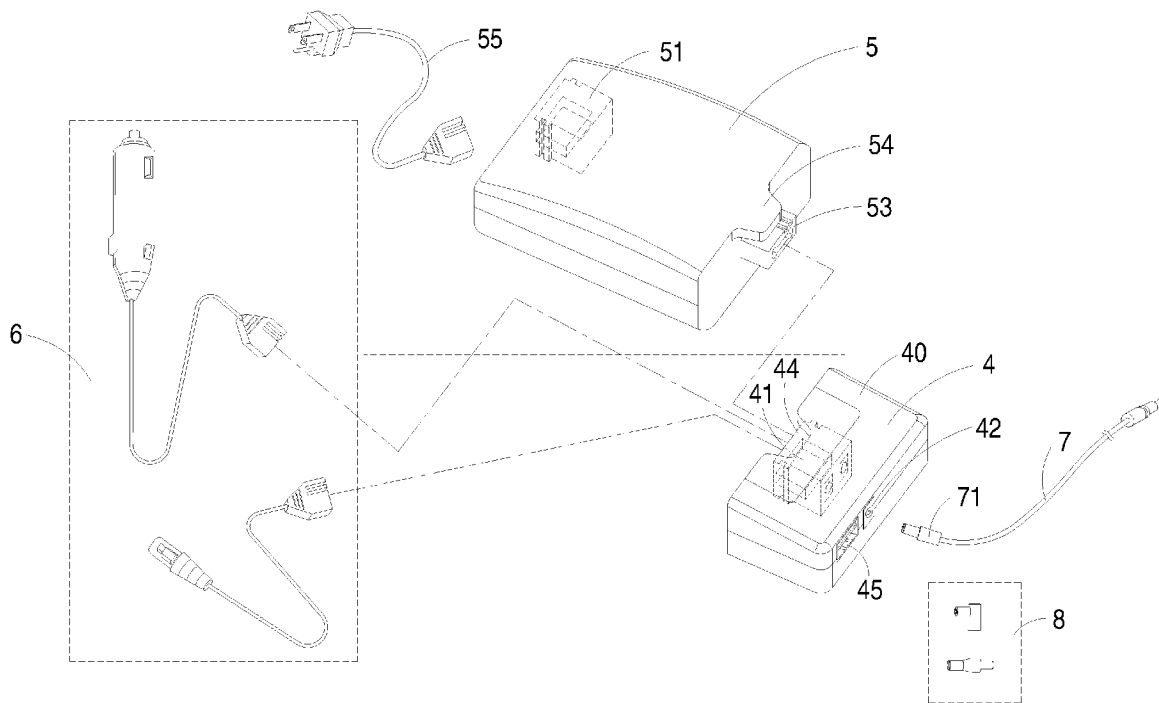
A DC-to-DC power adapter includes a first DC power input portion, a DC-to-DC power converting circuit and a first DC power output portion. The first DC power input portion is selectively connected to an AC-to-DC power adapter or a DC power connector for receiving a first input DC voltage from the AC-to-DC power adapter or a second input DC voltage from the DC power connector. The DC-to-DC power converting circuit is electrically connected to the first DC power input portion for converting the first input DC voltage or the second input DC voltage into a first DC output voltage. The first DC power output portion is electrically connected to the DC-to-DC power converting circuit for receiving and outputting the first DC output voltage.

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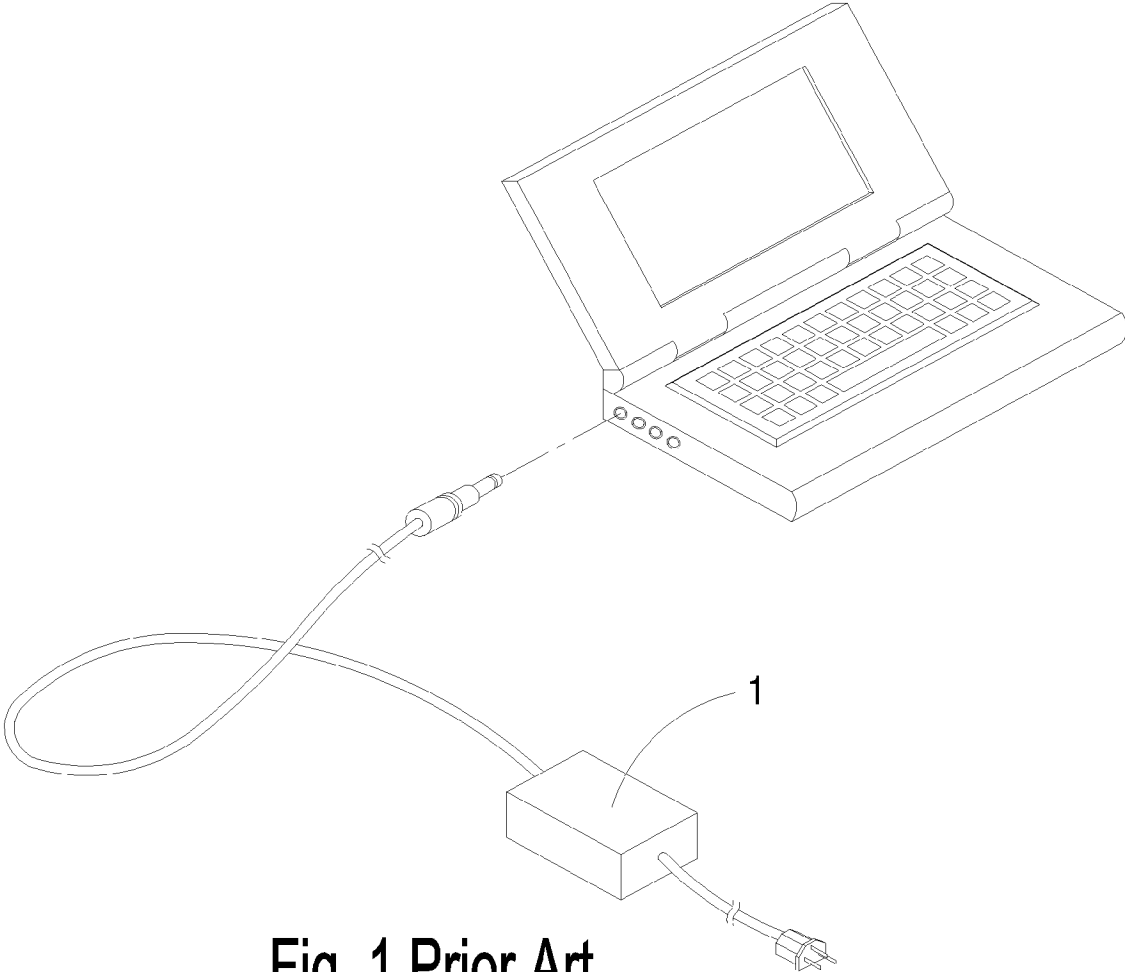


Fig. 1 Prior Art

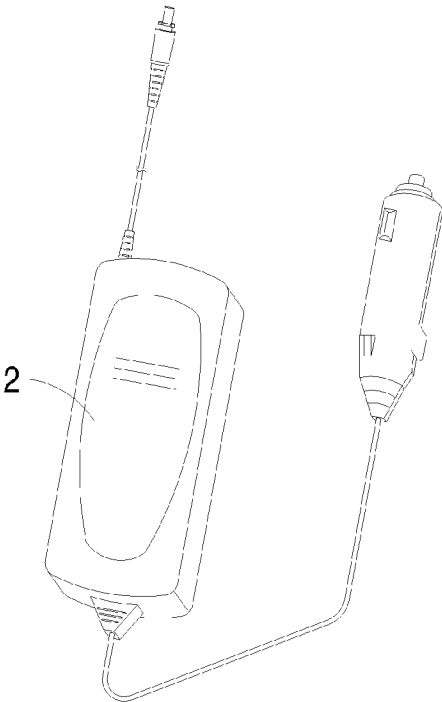


Fig. 2(a) Prior Art

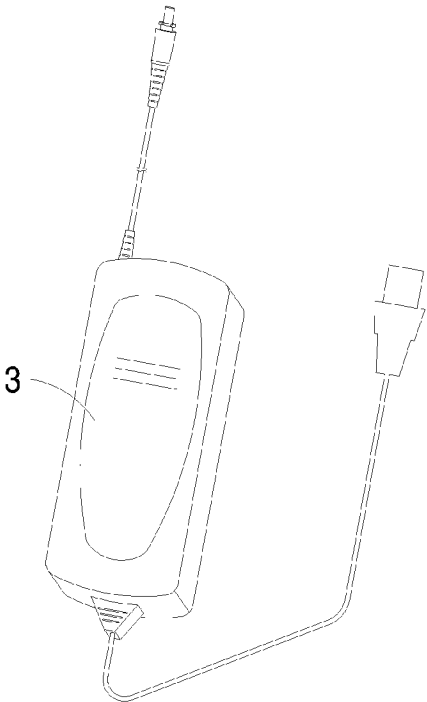


Fig. 2(b) Prior Art

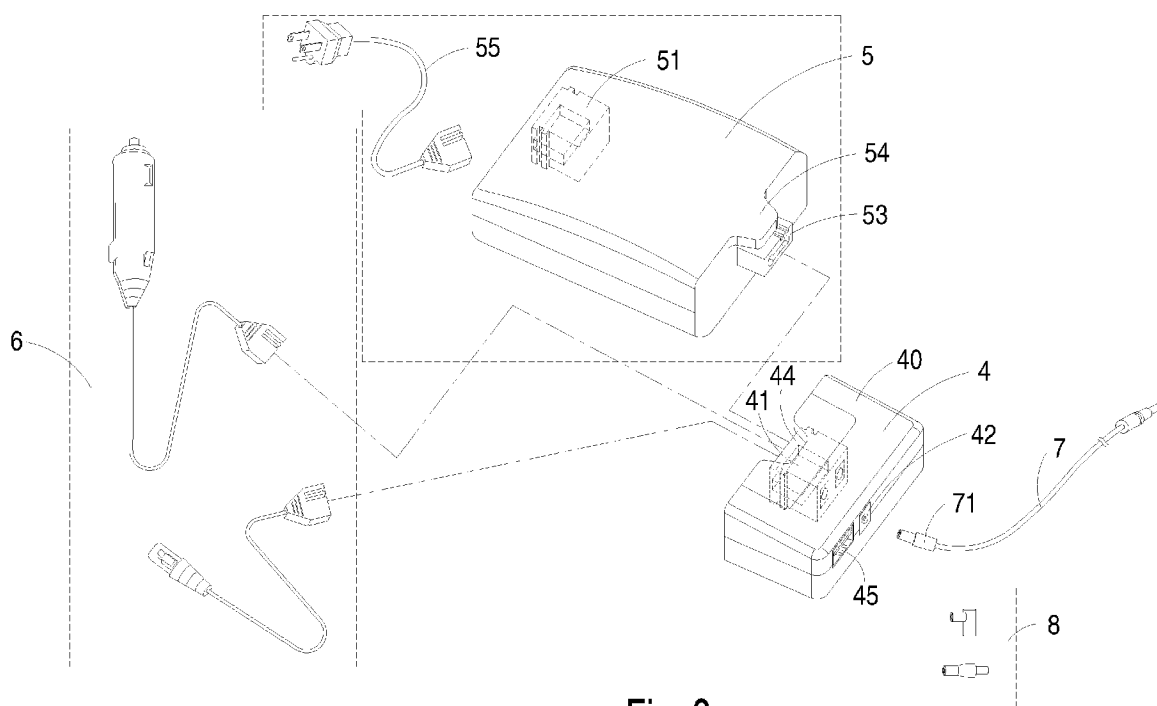


Fig. 3

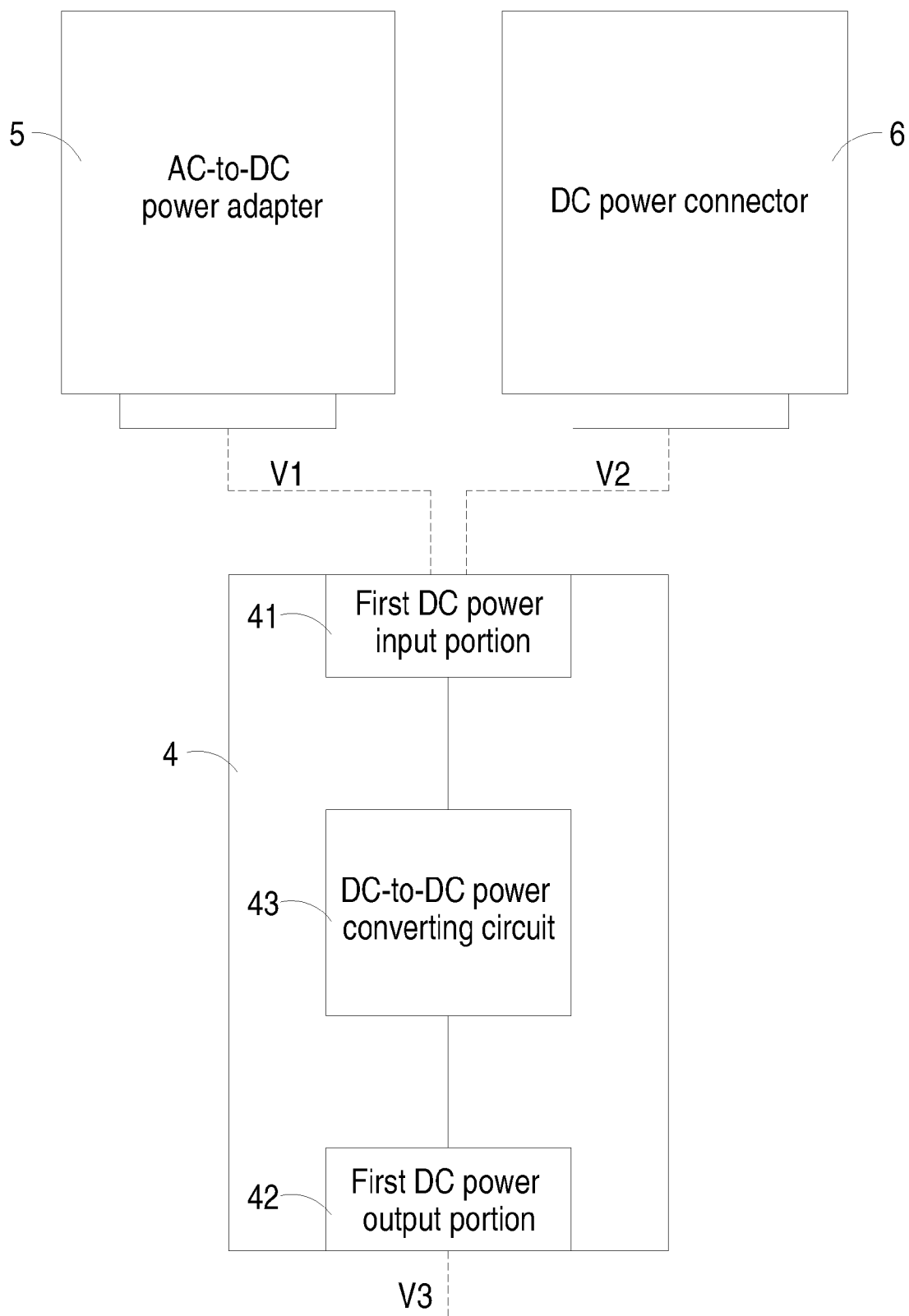


Fig. 4

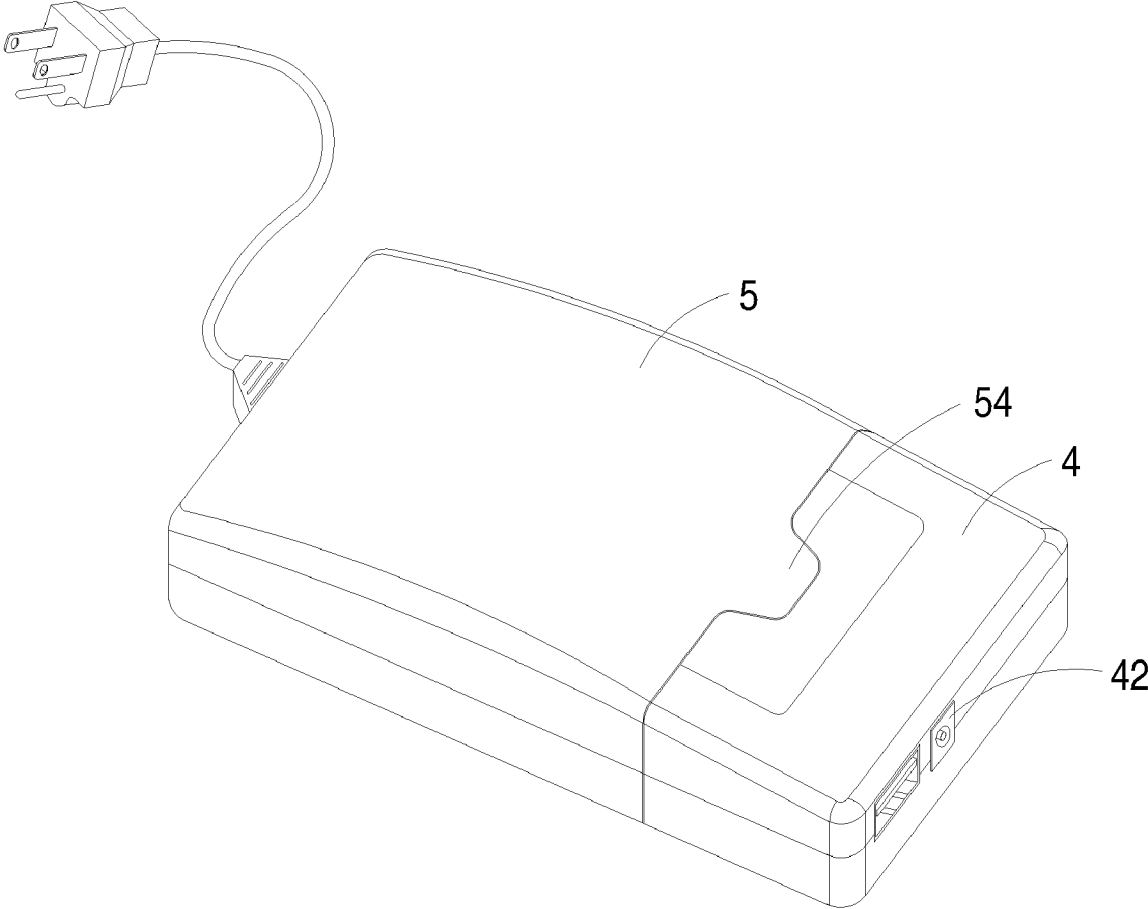


Fig. 5

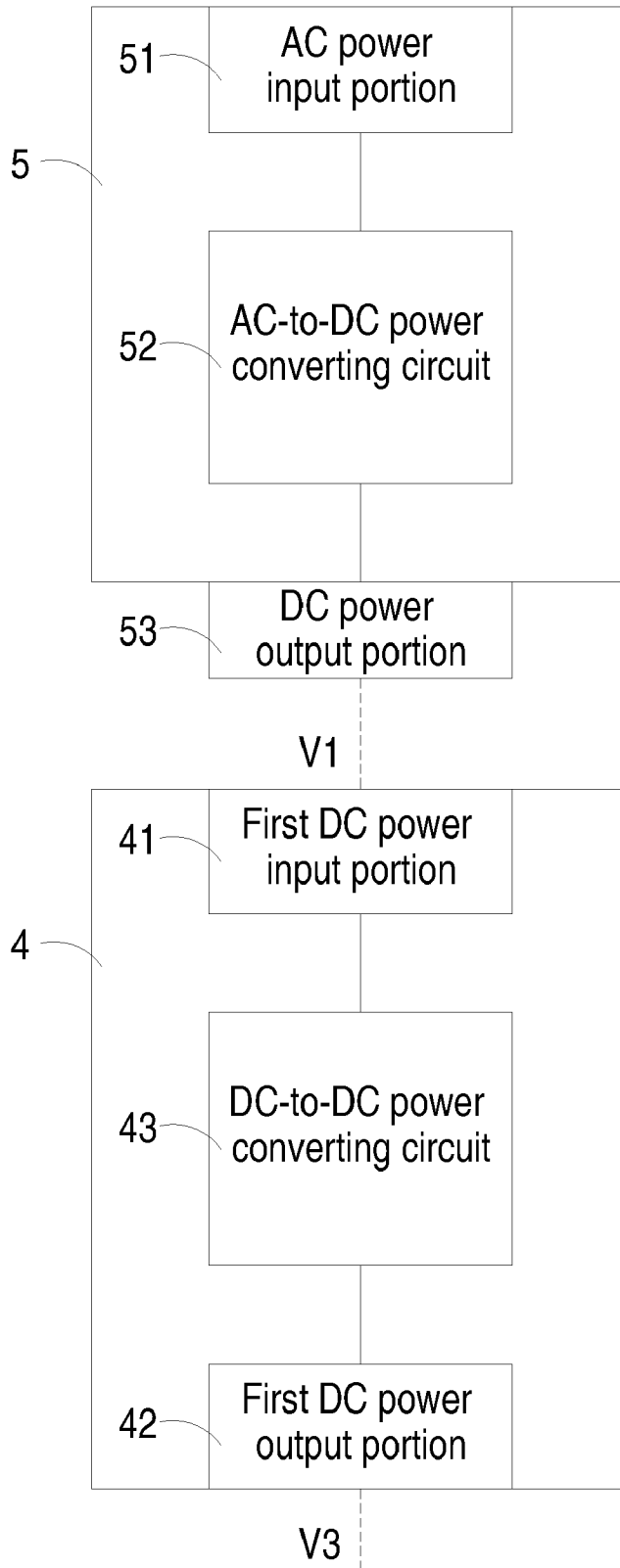


Fig. 6

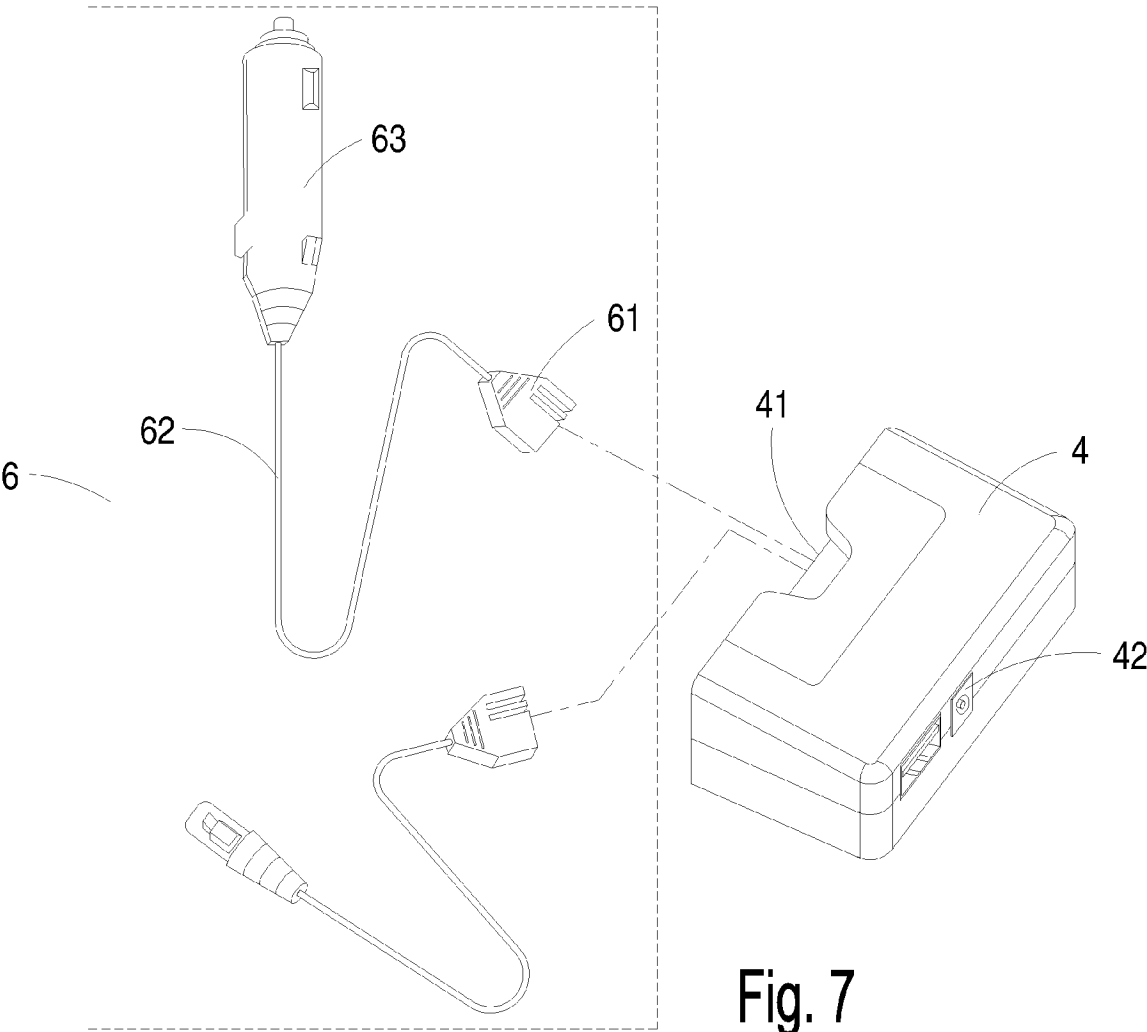


Fig. 7

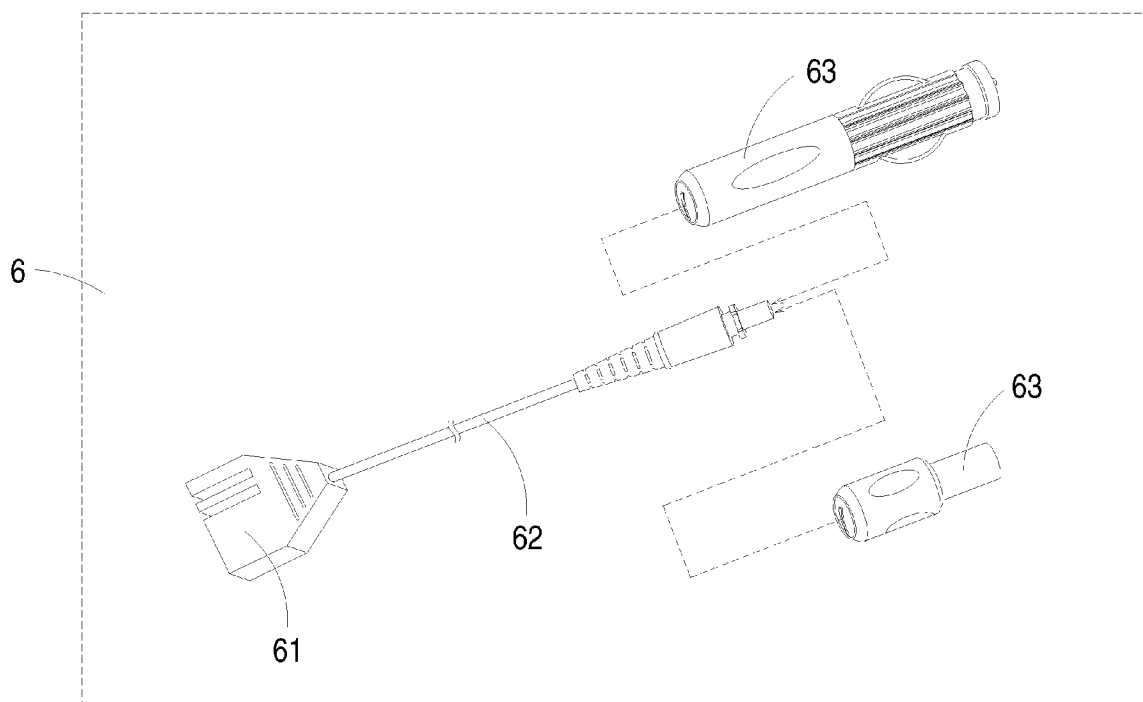


Fig. 8

**PORTABLE POWER SUPPLY APPARATUS
CAPABLE OF RECEIVING AC OR DC INPUT
POWER**

FIELD OF THE INVENTION

[0001] The present invention relates to a portable power supply apparatus, and more particularly to a portable power supply apparatus capable of receiving AC or DC input power.

BACKGROUND OF THE INVENTION

[0002] Recently, the general trends in designing portable electronic devices are toward small size, light weightness and easy portability. The portable electronic devices such as mobile phones, personal digital assistants (PDAs), digital still cameras, digital video cameras or notebook computers have built-in batteries. If no external power supply apparatus is provided to power the portable electronic device, the built-in battery is usually employed as the main power source. As shown in FIG. 1, if the power supplied from the battery is insufficient, the users may simply insert the plug of an AC-to-DC power adapter **1** into an AC wall outlet commonly found in most homes or offices so as to receive an AC voltage. The AC voltage is then converted into a DC power to be used for the portable electronic device and/or charge the built-in battery. Similarly, as shown in FIGS. 2(a) and 2(b), in a case that the user is in an automobile or airplane where only DC input power is available, the users may insert the plug of a DC-to-DC power adapter **2** or **3** into a standard automobile lighter socket or a standard airplane power socket. By means of the DC-to-DC adapter **2** or **3**, a regulated DC output voltage is provided for powering the portable electronic device.

[0003] Although these power adapters can provide regulated DC voltages and recharging capabilities, there are still some drawbacks. For example, the users need to carry two separate adapters to provide power to each portable electronic device. In addition, the voltages required for different portable electronic devices are different. If two or more portable electronic devices selected from mobile phones, personal digital assistants (PDAs), digital still cameras, digital video cameras or notebook computers are carried at a time, the users are forced to carry more than one power adapter. Under this circumstance, the volume and the overall weight of the baggage are increased.

[0004] As previously described, the AC-to-DC power adapter **1** may be used to receive the AC voltage, the DC-to-DC power adapter **2** may be used in the automobile to receive the DC voltage, and the DC-to-DC power adapter **3** may be used in the airplane to receive the DC voltage. Since the plug for receiving the AC or DC voltage is usually attached onto the main body of the power adapter, these power adapters are disadvantageous for portability and storage.

[0005] Therefore, there is a need of providing a portable power supply apparatus capable of providing power to several mobile devices of varying power requirements regardless of whether the input power is AC or DC.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a portable power supply apparatus capable of receiving AC or DC input power by selectively coupling a common DC input portion of a DC-to-DC power adapter with a DC power output portion of an AC-to-DC power adapter or a DC power connector, so that the portable power supply apparatus of the present invention can be used in many instances where the AC power or the DC power is available.

[0007] Another object of the present invention provides a portable power supply apparatus having reduced cost, overall volume and/or weight for portability and storage.

[0008] Another object of the present invention provides a portable power supply apparatus capable of providing regulated DC output voltages for powering portable electronic devices depending on the kinds of portable electronic devices being powered.

[0009] In accordance with an aspect of the present invention, there is provided a DC-to-DC power adapter. The DC-to-DC power adapter includes a first DC power input portion, a DC-to-DC power converting circuit and a first DC power output portion. The first DC power input portion is selectively connected to an AC-to-DC power adapter or a DC power connector for receiving a first input DC voltage from the AC-to-DC power adapter or a second input DC voltage from the DC power connector. The DC-to-DC power converting circuit is electrically connected to the first DC power input portion for converting the first input DC voltage or the second input DC voltage into a first DC output voltage. The first DC power output portion is electrically connected to the DC-to-DC power converting circuit for receiving and outputting the first DC output voltage.

[0010] In accordance with another aspect of the present invention, there is provided a portable power supply apparatus. The portable power supply apparatus includes an AC-to-DC power adapter, a DC power connector and a DC-to-DC power adapter. The AC-to-DC power adapter is employed for receiving AC power. The DC power connector is employed for receiving DC power. The DC-to-DC power adapter includes a first DC power input portion, a DC-to-DC power converting circuit and a first DC power output portion. The first DC power input portion is selectively connected to the AC-to-DC power adapter or the DC power connector for receiving a first input DC voltage from the AC-to-DC power adapter or a second input DC voltage from the DC power connector. The DC-to-DC power converting circuit is electrically connected to the first DC power input portion for converting the first input DC voltage or the second input DC voltage into a first DC output voltage. The first DC power output portion is electrically connected to the DC-to-DC power converting circuit for receiving and outputting the first DC output voltage.

[0011] The above contents of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a schematic perspective view of a conventional AC-to-DC power adapter to be used in a notebook computer;

[0013] FIGS. 2(a) and 2(b) are schematic perspective views illustrating two conventional DC-to-DC power adapters to be used in an automobile and an airplane, respectively;

[0014] FIG. 3 is a schematic outward view of a portable power supply apparatus according to a preferred embodiment of the present invention;

[0015] FIG. 4 is a schematic circuit block diagram of the portable power supply apparatus of FIG. 3;

[0016] FIG. 5 is a schematic assembled view illustrating the combination of the AC-to-DC power adapter and the DC-to-DC power adapter;

[0017] FIG. 6 is a schematic circuit block diagram of the portable power supply apparatus of FIG. 5;

[0018] FIG. 7 is a schematic perspective view illustrating the combination of the DC power connector and the DC-to-DC power adapter; and

[0019] FIG. 8 schematically illustrates a variant of the DC power connector.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0020] The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only. It is not intended to be exhaustive or to be limited to the precise form disclosed.

[0021] Please refer to FIGS. 3 and 4. FIG. 3 is a schematic outward view of a portable power supply apparatus according to a preferred embodiment of the present invention is illustrated. FIG. 4 is a schematic circuit block diagram of the portable power supply apparatus. The portable power supply apparatus principally includes a DC-to-DC power adapter 4, an AC-to-DC power adapter 5 and a DC power connector 6. The DC-to-DC power adapter 4 includes a main body 40, a first DC power input portion 41, a first DC power output portion 42 and a DC-to-DC power converting circuit 43. The DC-to-DC power converting circuit 43 is mounted on a circuit board (not shown), which is included within the main body 40. The first DC power input portion 41 is selectively connected to the AC-to-DC power adapter 5 or the DC power connector 6 in order to receive a first input DC voltage V1 from the AC-to-DC power adapter 5 or a second input DC voltage V2 from the DC power connector 6. An exemplary first DC power input portion 41 is a power socket. The DC-to-DC power converting circuit 43 is electrically connected to the first DC power input portion 41 for converting the first input DC voltage V1 or the second input DC voltage V2 into a first DC output voltage V3. The first DC power output portion 42 is electrically connected to the DC-to-DC power converting circuit 43 for outputting the first DC output voltage V3.

[0022] Please refer to FIG. 3 again. The DC-to-DC power adapter 4 includes a first connecting part 44, and the AC-to-DC power adapter 5 includes a second connecting part 54. In this embodiment, the first connecting part 44 is a recess structure and the second connecting part 54 is a protrusion structure. Alternatively, the first connecting part 44 is a protrusion structure and the second connecting part 54 is a recess structure. Alternatively, the first connecting part 44 and the second connecting part 54 may be gliding track and gliding channel, respectively. When the first connecting part 44 is engaged with the second connecting part 54, the AC-to-DC power adapter 5 is securely attached onto the DC-to-DC power adapter 4 to result in the portable power supply apparatus of FIG. 5.

[0023] In some embodiments, the first connecting part 44 of the DC-to-DC power adapter 4 and the second connecting part 54 of the AC-to-DC power adapter 5 may be dispensed with. Under this circumstance, the AC-to-DC power adapter 5 is attached onto the DC-to-DC power adapter 4 by coupling the DC power output portion 53 of the AC-to-DC power adapter 5 with the first DC power input portion 41 of the DC-to-DC power adapter 4. After the AC-to-DC power adapter 5 is combined with the DC-to-DC power adapter 4, the AC voltage received from the portable power supply apparatus may be converted into a regulated DC output voltage for powering a portable electronic device (not shown).

[0024] FIG. 6 is a circuit block diagram illustrating the combination of the AC-to-DC power adapter 5 and the DC-to-

DC power adapter 4. As shown in FIG. 5 and FIG. 6, the AC-to-DC power adapter 5 includes an AC power input portion 51, an AC-to-DC power converting circuit 52 and the DC power output portion 53. An exemplary AC power input portion 51 is a power socket coupled with a detachable power cable 55. The AC-to-DC power converting circuit 52 is electrically interconnected between the AC power input portion 51 and the DC power output portion 53 for converting an AC voltage into the first input DC voltage V1. The DC power output portion 53 is electrically connected to the first DC power input portion 41 of the DC-to-DC power adapter 4 so as to transmit the first input DC voltage V1 to the first DC power input portion 41 of the DC-to-DC power adapter 4.

[0025] FIG. 7 is a circuit block diagram illustrating the combination of the DC power connector 6 and the DC-to-DC power adapter 4. After the DC power connector 6 is electrically connected to the DC-to-DC power adapter 4, the DC voltage received from the portable power supply apparatus may be converted into a regulated DC output voltage for powering a portable electronic device (not shown). In some embodiments, the DC power connector 6 is an automobile DC power connector or an airplane DC power connector. The DC power connector 6 includes a first plug 61, a power cable 62 and a second plug 63. The first plug 61 may be electrically connected to the first DC power input portion 41 of the DC-to-DC power adapter 4. The power cable 62 is electrically interconnected between the first plug 61 and the second plug 63. In a case that the DC power connector 6 is an automobile DC power connector, the second plug 63 may be plugged into a standard automobile lighter socket. In another case that the DC power connector 6 is an airplane DC power connector, the second plug 63 may be plugged into a standard airplane power socket. After the DC power connector 6 is combined with the DC-to-DC power adapter 4, the DC voltage received from the portable power supply apparatus may be converted into a regulated DC output voltage for powering a portable electronic device (not shown).

[0026] Referring to FIG. 8, a variant of the DC power connector 6 is illustrated. In this embodiment, the DC power connector 6 includes a first plug 61, a power cable 62 and a second plug 63, wherein the second plug 63 is detachably connected to the power cable 62. Likewise, the first plug 61 may be electrically connected to the first DC power input portion 41 of the DC-to-DC power adapter 4. The power cable 62 is electrically interconnected between the first plug 61 and the second plug 63. Via a connecting mechanism (not shown), the second plug 63 will be detachably coupled to the power cable 62. An example of the second plug 63 includes an automobile DC power plug or an airplane DC power plug to be inserted into a standard automobile lighter socket or a standard airplane power socket. After the DC power connector 6 is combined with the DC-to-DC power adapter 4, the DC voltage received from the portable power supply apparatus may be converted into a regulated DC output voltage for powering a portable electronic device (not shown).

[0027] Please refer to FIG. 3 again. After a plug 71 of a power cable 7 is electrically connected to the first DC power output portion 42 of the DC-to-DC power adapter 4, the regulated DC voltage may be transmitted to a portable electronic device (not shown) through the power cable 7. Moreover, according to the specification of the first DC power output portion 42 of the DC-to-DC power adapter 4, the plug 71 is variable. Alternatively, the first DC power output portion 42 of the DC-to-DC power adapter 4 can be electrically connected to a portable electronic device through one of multiple DC plugs 8, wherein the magnitude of the first DC output voltage V3 is adjustable by the DC-to-DC power con-

verting circuit **43** according to the type of the DC plug **8** coupled to the first DC power output portion **42** of the DC-to-DC power adapter **4**. As a consequence, the magnitude of the first DC output voltage **V3** may be adjusted according to the types of the DC plugs **8**. In this embodiment, the DC-to-DC power converting circuit **43** is programmable to provide a regulated DC output voltage depending on the kind of portable electronic device being powered.

[0028] Please refer to FIG. **3** again. In some embodiment, the DC-to-DC power adapter **4** further includes at least a second DC power output portion **45**. An exemplary second DC power output portion **45** is a USB connecting port. Via the second DC power output portion **45**, the regulated DC voltage may be transmitted to a portable electronic device through a USB bus. Alternatively, the DC-to-DC power adapter **4** may include at least one second DC input portion (not shown) for receiving DC voltages from other DC power suppliers or power sources.

[0029] From the above description, the portable power supply apparatus is capable of receiving AC or DC input power by selectively coupling a common DC input portion of a DC-to-DC power adapter with a DC power output portion of an AC-to-DC power adapter or a DC power connector. As a consequence, the portable power supply apparatus of the present invention can be used in many instances where the AC power or the DC power is available. In addition, since the functions of many conventional power supply apparatuses are integrated into the portable power supply apparatus of the present invention, the present portable power supply apparatus is very cost-effective and has reduced overall volume and/or weight for portability and storage. Moreover, the portable power supply apparatus of the present invention may provide regulated DC output voltages for powering portable electronic devices depending on the kinds of portable electronic devices being powered.

[0030] While the invention has been described in terms of what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention needs not be limited to the disclosed embodiment. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures.

What is claimed is:

1. A DC-to-DC power adapter comprising:
 - a first DC power input portion selectively connected to an AC-to-DC power adapter or a DC power connector for receiving a first input DC voltage from said AC-to-DC power adapter or a second input DC voltage from said DC power connector;
 - a DC-to-DC power converting circuit electrically connected to said first DC power input portion for converting said first input DC voltage or said second input DC voltage into a first DC output voltage; and
 - a first DC power output portion electrically connected to said DC-to-DC power converting circuit for receiving and outputting said first DC output voltage.
2. The DC-to-DC power adapter according to claim **1** wherein said DC-to-DC power adapter further includes a first connecting part, and said AC-to-DC power adapter further includes a second connecting part, wherein said AC-to-DC power adapter is securely attached onto said DC-to-DC power adapter after said first connecting part is engaged with said second connecting part.

3. The DC-to-DC power adapter according to claim **2** wherein said AC-to-DC power adapter further includes an AC power input portion, an AC-to-DC power converting circuit and a DC power output portion, wherein said AC-to-DC power converting circuit is electrically interconnected between said AC power input portion and said DC power output portion.

4. The DC-to-DC power adapter according to claim **3** wherein said DC power output portion of said AC-to-DC power adapter is electrically connected to said first DC power input portion of said DC-to-DC power adapter when said first connecting part is engaged with said second connecting part.

5. The DC-to-DC power adapter according to claim **1** wherein said DC power connector is an automobile DC power connector or an airplane DC power connector.

6. The DC-to-DC power adapter according to claim **1** wherein said DC power connector includes:
 - a first plug electrically connected to said first DC power input portion of said DC-to-DC power adapter;
 - a second plug for receiving a DC power; and
 - a power cable electrically interconnected between said first plug and said second plug.

7. The DC-to-DC power adapter according to claim **6** wherein said second plug is detachably coupled to said power cable.

8. The DC-to-DC power adapter according to claim **1** wherein said first DC power output portion of said DC-to-DC power adapter is electrically connected to a portable electronic device through another power cable.

9. The DC-to-DC power adapter according to claim **1** wherein said first DC power output portion of said DC-to-DC power adapter is electrically connected to a portable electronic device through one of multiple DC plugs, wherein the magnitude of said first DC output voltage is adjusted by said DC-to-DC power converting circuit according to the type of said DC plug coupled to said first DC power output portion of said DC-to-DC power adapter.

10. The DC-to-DC power adapter according to claim **1** further comprising a second DC power output portion, wherein said second DC power output portion includes a USB connecting port.

11. A portable power supply apparatus comprising:
 - an AC-to-DC power adapter for receiving AC power;
 - a DC power connector for receiving DC power; and
 - a DC-to-DC power adapter including a first DC power input portion, a DC-to-DC power converting circuit and a first DC power output portion, wherein said first DC power input portion is selectively connected to said AC-to-DC power adapter or said DC power connector for receiving a first input DC voltage from said AC-to-DC power adapter or a second input DC voltage from said DC power connector, said DC-to-DC power converting circuit is electrically connected to said first DC power input portion for converting said first input DC voltage or said second input DC voltage into a first DC output voltage, and said first DC power output portion is electrically connected to said DC-to-DC power converting circuit for receiving and outputting said first DC output voltage.

12. The portable power supply apparatus according to claim **11** wherein said DC-to-DC power adapter further includes a first connecting part, and said AC-to-DC power adapter further includes a second connecting part, wherein said AC-to-DC power adapter is securely attached onto said

DC-to-DC power adapter after said first connecting part is engaged with said second connecting part.

13. The portable power supply apparatus according to claim 12 wherein said AC-to-DC power adapter further includes an AC power input portion, an AC-to-DC power converting circuit and a DC power output portion, wherein said AC-to-DC power converting circuit is electrically interconnected between said AC power input portion and said DC power output portion.

14. The portable power supply apparatus according to claim 13 wherein said DC power output portion of said AC-to-DC power adapter is electrically connected to said first DC power input portion of DC-to-DC power adapter when said first connecting part is engaged with said second connecting part.

15. The portable power supply apparatus according to claim 11 wherein said DC power connector is an automobile DC power connector or an airplane DC power connector.

16. The portable power supply apparatus according to claim 11 wherein said DC power connector includes:

- a first plug electrically connected to said first DC power input portion of DC-to-DC power adapter;
- a second plug for receiving said DC power; and

a power cable electrically interconnected between said first plug and said second plug.

17. The portable power supply apparatus according to claim 16 wherein said second plug is detachably coupled to said power cable.

18. The portable power supply apparatus according to claim 11 wherein said first DC power output portion of said DC-to-DC power adapter is electrically connected to a portable electronic device through another power cable.

19. The portable power supply apparatus according to claim 11 wherein said first DC power output portion of said DC-to-DC power adapter is electrically connected to a portable electronic device through one of multiple DC plugs, wherein the magnitude of said first DC output voltage is adjusted by said DC-to-DC power converting circuit according to the type of said DC plug coupled to said first DC power output portion of said DC-to-DC power adapter.

20. The portable power supply apparatus according to claim 11 wherein said DC-to-DC power adapter further comprises a second DC power output portion, wherein said second DC power output portion includes a USB connecting port.

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