ELECTRONIC APPARATUS

BACKGROUND

1. Technical Field

**[0001]@001** The present invention relates to an electronic apparatus.

2. Related Art

**[0002]@002** In the related art, a universal serial bus (USB) standard defines various types. Recently, a standard which is called the USB Type C (refer to USB Type-C Cable and Connector Specification［searched on December 28, 2015］, Internet〈URL：<http://www.usb.org/developers/usbtypec/〉>) is defined and is begun to spread.

@003

SUMMARY

**[0003]@004** In a case where an electronic apparatus corresponding to a plurality of USB standards is configured, an electronic apparatus having a plurality of sets of circuits corresponding to each standard is configured in the related art. An advantage of some aspects of the invention is to provide a technology of simplifying a configuration of a circuit.

**[0004]@005** According to one aspect of the invention, an electronic apparatus is configured to include a first connection port that is a connection port of a USB Type C; a second connection port that is a connection port of a USB other than the USB Type C; and a wire that branches off to the first connection port and the second connection port. The electronic apparatus has an exclusive structure in which, in a case where a connector is connected to one of the first connection port and the second connection port, another connector is not able to be connected to the other connection port.

**[0005]@006** That is, the electronic apparatus according to an embodiment of the invention includes a wire which is connected to an internal circuit of the electronic apparatus, branches off, and is connected to the first connection port and the second connection port, and can connect a connector to any one of the first connection port and the second connection port by using an exclusive structure. Hence, the electronic apparatus need not individually include circuits corresponding to each of the USB of the USB Type C and the USB other than the USB Type C so as to perform communication by the USB, and may include a common circuit for processing the USB of the USB Type C and the USB other than the USB Type C. For this reasons, it is possible to simplify a configuration of the circuits of the electronic apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

**[0006]** The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

**[0007]@007** Fig. 1A is an explanatory diagram illustrating a usage aspect of an electronic apparatus according to an embodiment of the invention, Fig. 1B is an explanatory view of an exclusive structure, and Fig. 1C is a diagram illustrating a configuration of a control circuit included in the electronic apparatus.

**[0008]** Fig. 2A is a diagram illustrating a configuration of a control circuit included in an electronic apparatus, and Fig. 2B, Fig. 2C, and Fig. 2D are explanatory views of an exclusive structure.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

**[0009]@008** Here, embodiments of the invention will be described according to the following order.

1. Usage Aspect of Electronic Apparatus:

1-1. Configuration of Exclusive Structure:

1-2. Configuration of USB Processing Circuit:

2. Another Embodiment:

**[0010]@009** 1. Usage Aspect of Electronic Apparatus:

Fig. 1A is an explanatory diagram illustrating a usage aspect of an electronic apparatus according to an embodiment of the invention. The electronic apparatus according to the present embodiment functions as a host. That is, a host 20 which becomes a power supply side according to a standard of the USB is an embodiment of the invention, and the host 20 is connected to a device 30 which receives power by the USB. The host 20 includes a USB processing circuit 10.

**[0011]@010** The USB processing circuit 10 processes a signal and power according to the USB, and includes a first connection port 10a and a second connection port 10b. The first connection port 10a can be connected to a connector of the USB Type C, and the second connection port 10b can be connected to a connector of USB Type A. The first connection port 10a and the second connection port 10b are open at an outer surface of the host 20, and a connector can be connected to the opening.

**[0012]@011** The device 30 is an electronic apparatus which is connected to the host 20, and includes a connection port 30a to which a connector according to a standard of either the USB Type C or the USB Type A be connected. In a case where the connection port 30a of the device 30 can be connected to a connector of the USB Type C, the connection port 30a of the device 30 and the first connection port 10a of the host 20 are connected to a cable of the USB Type C. In Fig. 1A, the cable is denoted by a solid line. In a case where the connection port 30a of the device 30 can be connected to a connector of the USB Type A, the connection port 30a of the device 30 and the second connection port 10b of the host 20 are connected to a cable of the USB Type A. In Fig. 1A, the cable is denoted by a dashed line.

**[0013]@012** As such, according to the present embodiment, even in a case where the device 30 corresponds to a standard of either the USB Type A or the USB Type C, the device can be connected to the host 20. If the device 30 is connected to the host 20, the host 20 supplies power to the device 30 through the USB cable, according to the necessity, and communication is performed between the host 20 and the device 30.

**[0014]@013** 1-1. Configuration of Exclusive Structure:

Fig. 1B is a view illustrating a state where the first connection port 10a and the second connection port 10b which are open at the outer surface of the host 20 are viewed from the opening side. In Fig. 1B, a first direction is orthogonal to a second direction, and in the present embodiment, the second direction is a vertical direction of the host 20, but, of course, the second direction may be a horizontal direction or may be other directions.

**[0015]@014** In the present embodiment, in a case where connectors are connected to each of the connection port, the first connection port 10a and the second connection port 10b are formed on the outer surface of the host 20 such that the connectors are in a positional relationship of spatially overlapping each other. That is, in the present embodiment, the first connection port 10a and the second connection port 10b are in a specified positional relationship with each other, and thereby, an exclusive structure is formed in which the connector can be connected to only one of the first connection port 10a and the second connection port 10b.

**[0016]@015** Specifically, each of the first connection port 10a and the second connection port 10b has a long opening at one side thereof. Here, in the opening, a side parallel with the one side is referred to as a long side, and a direction parallel with the long side is referred to as a short side direction. In the embodiment, the long side of each of the first connection port 10a and the second connection port 10b faces the first direction, and the first connection port 10a and the second connection port 10b are at the same position in the first direction. That is, the first connection port 10a overlaps the second connection port 10b in the first direction.

**[0017]@016** Furthermore, a short side of each of the first connection port 10a and the second connection port 10b faces the second direction, and a distance L between the center of the short side direction of the first connection port 10a and the center of the short side direction of the second connection port 10b is set to a value by which, if a connector is connected to one connection port, the connector cannot be connected to the other connection port. That is, the distance L is set to a distance in which, if a connector of the USB Type A is connected to the second connection port 10b in a state where a connector of the USB Type C is connected to the first connection port 10a, the both connectors interfere with each other and thereby the connector cannot be connected to the second connection port 10b. A maximum value of the connector of the USB Type C in the short side direction is 6.5 mm, and a maximum value of the connector of the USB Type A in the short side direction is 8.0 mm, and thus, the distance L is less than 7.25 (= (8.0 + 6.5) / 2) mm.

**[0018]@017** According to the aforementioned configuration, in a case where, in a state where a connector is connected to one of the first connection port 10a and the second connection port 10b, another connector is connected to the other of the connection ports, the former connector interfere with the latter connector such that the latter connector cannot be inserted into the connection port. Hence, either a connector of the USB Type A or a connector of the USB Type C can be inserted into the host 20.

**[0019]@018** 1-2. Configuration of USB Processing Circuit:

Fig. 1C is a diagram illustrating a configuration of the USB processing circuit 10 included in the host 20 which can perform communication corresponding to the SuperSpeed standard. The USB processing circuit 10 includes a wire switching circuit 11 and wires extending from the first connection port 10a and the second connection port 10b. The wire switching circuit 11 includes a connection detecting circuit 11a and a BUS switching circuit 11b.

**[0020]@019** The connection detecting circuit 11a is connected to each of the first connection port 10a and the second connection port 10b by signal lines. The connection detecting circuit 11a can detect whether or not connectors are connected to the first connection port 10a and the second connection port 10b. In addition, the connection detecting circuit 11a is connected to the BUS switching circuit 11b by a signal line, and, in a case where the connection detecting circuit detects that a connector is connected to any one of the first connection port 10a and the second connection port 10b, the connection detecting circuit outputs information indicating the detected connection port to the BUS switching circuit 11b.

**[0021]@020** The BUS switching circuit 11b is connected to each of the first connection port 10a and the second connection port 10b, and a signal processing circuit 22 included in the host 20 by signal lines. The BUS switching circuit 11b includes a switch which switches a connection between a signal line extending from the signal processing circuit 22 and any one of signal lines extending from the first connection port 10a and the second connection port 10b, and controls the switch on the basis of an output signal of the connection detecting circuit 11a.

**[0022]@021** That is, in a case where the output signal of the connection detecting circuit 11a indicates that a connector is connected to the first connection port 10a, the BUS switching circuit 11b controls the switch such that the first connection port 10a is connected to the signal processing circuit 22. In addition, in a case where the output signal of the connection detecting circuit 11a indicates that a connector is connected to the second connection port 10b, the BUS switching circuit 11b controls the switch such that the second connection port 10b is connected to the signal processing circuit 22. The connection detecting circuit 11a may be configured to become one piece with the wire switching circuit 11, or may be configured as a separated unit.

**[0023]@022** The signal processing circuit 22 performs communication based on the standards of the USB Type C and the USB Type A. In a case where the device 30 is connected to the first connection port 10a or the second connection port 10b through a cable, communication can be performed between a connection port connected to a connector and the signal processing circuit 22 by controlling the switch of the BUS switching circuit 11b.

**[0024]@023** Meanwhile, the host 20 includes a power supply circuit 21. The power supply circuit 21 generates power of a voltage defined in the USB standard. The power supply circuit 21 includes a power line extending toward the USB processing circuit 10, and the power line branches off and is connected to the first connection port 10a and the second connection port 10b. Hence, power that is generated by the power supply circuit 21 is supplied to the device 30 through a connector connected to the first connection port 10a or the second connection port 10b.

**[0025]@024** According to the aforementioned configuration, the device 30 can be driven by receiving power from the host 20, and USB communication can be performed by the host 20 and the device 30. In the present embodiment in which wires are switched by the wire switching circuit 11, one of the first connection port 10a and the second connection port 10b is connected to a communication line connected to the signal processing circuit 22, the other is not connected to the communication line. For this reason, leakage or the like of a signal from a communication line through which communication is performed to a communication line through which communication is not performed is reduced. Hence, it is possible to transmit a signal whose frequency is high and frequency loss cannot be neglected, for example, a signal according to the SuperSpeed standard.

**[0026]@025** Furthermore, in the present embodiment, an exclusive structure is formed in the host 20, and thus, a connector can be connected to any one of the first connection port 10a and the second connection port 10b. Hence, the host 20 performs communication according to the USB standard, and thus, the host does not need to individually include a circuit for corresponding to each of the USB Type C and USB Type A, and the power supply circuit 21 and the signal processing circuit 22 which are common in each standard may be included. For this reason, it is possible to simplify a configuration of a circuit of an electronic apparatus.

**[0027]@026** 2. Another Embodiment:

The aforementioned embodiment is an example for realizing the invention, and, as long as a configuration is provided in which, if a connector is connected to one of connection ports of the USB of different standards, a connector cannot be connected to other connection ports, various other embodiments can be employed. For example, an electronic apparatus according to the invention may function as a host according to the USB standard, or may function as a device.

**[0028]@027** In addition, in the aforementioned embodiment, the USB processing circuit 10 includes the wire switching circuit 11, but, if a signal in which influence of high frequency loss due to branching of a signal that is transmitted cannot be neglected, for example, a signal of the High Speed standard is used, the wire switching circuit 11 can be omitted. Fig. 2A illustrates a configuration of a USB processing circuit 100 configured by omitting the wire switching circuit 11 from the USB processing circuit 10 illustrated in Fig. 1C. In the configuration illustrated in Fig. 2A, configuration elements to which the same symbols or reference numerals as illustrated in Fig. 1C are attached have the same configuration as illustrated in Fig. 1C.

**[0029]@028** The USB processing circuit 100 according to the present embodiment does not need the wire switching circuit 11, and includes a power line which extends from the power supply circuit 21 and branches off to the first connection port 10a and the second connection port 10b, and a signal line which extends from a signal processing circuit 220 and branches off to the first connection port 10a and the second connection port 10b.

**[0030]@029** Furthermore, the signal processing circuit 220 is connected to the first connection port 10a by the signal line (may be connected to the second connection port 10b), and can detect whether or not a connector is connected to the first connection port 10a. According to the aforementioned configuration, output power of the power supply circuit 21 is supplied to the device 30 through a connector or a cable connected to the first connection port 10a or the second connection port 10b. In addition, the signal processing circuit 220 can communication with the device 30 through the connector or the cable connected to the first connection port 10a or the second connection port 10b.

**[0031]@030** In the aforementioned configuration, the power supply circuit 21 and the signal processing circuit 220 which are common in each standard of the USB Type C and USB Type A may also be included. For this reason, it is possible to simplify a configuration of a circuit of an electronic apparatus.

**[0032]@031** Furthermore, a first connection port may be a connection port of the USB Type C. Hence, a shape or a terminal of an insertion portion of a connector may be disposed such that a connector of the USB Type C is connected and thereby communication can be performed (power may be able to be received).

**[0033]@032** A second connection port may be a connection port of the USB other than the USB Type C. Hence, a shape or a terminal of an insertion portion of the connector may be disposed such that a connector of a USB standard other than the USB Type C is connected, and thereby, communication can be performed (power may be able to be received). For example, the USB Type A or B, the mini-USB Type A, B or AB, micro-USB Type A, B, or AB, or the like can be used as the USB standard other than the USB Type C.

**[0034]@033** A wire may branch off to a first connection port and a second connection port. That is, a wire which extends from a circuit included in an electronic apparatus to the first connection port and the second connection port is included, and the wire branches off to be connected to the first connection port and the second connection port. In addition, each of the first connection port and the second connection port is connected to a circuit included in an electronic apparatus.

**[0035]@034** The wire may be used for various purposes, and may be one or both of a signal line and a power line. Branching of the wire may be performed by various circuits, may be performed by simple branching which divides the wire, and may be performed by a wire switching circuit which switches connection of wires by using a switch or the like.

**[0036]@035** The wire can be formed by a configuration or the like that includes, for example, a communication line connected to a first connection port, a communication line connected to a second connection port, and a wire switching circuit which connects a communication line of an electronic apparatus to any one of the respective communication lines in a switchable manner. In a configuration in which the wires are switched by the wire switching circuit, a state where any one of the first connection port and the second connection port is connected to the communication line of the electronic apparatus and the other is not connector thereto can be realized. For this reasons, it is preferable that a configuration for transmitting a signal whose frequency is high and frequency loss cannot be neglected, for example, a signal according to the SuperSpeed standard be provided.

**[0037]@036** Of course, the wire switching circuit may include other circuits, for example, a redriver (repeater) circuit which shapes a waveform of a signal, or a connection detecting circuit which detects that a connector is connected to at least one of the first connection port and the second connection port. If the latter is used, it is possible to easily switch wires of signals on the basis of the detected results.

**[0038]@037** In a case where a connector is connected to one of the first connection port and the second connection port, the exclusive structure may be a structure in which a connector cannot be connected to the other. That is, a electronic apparatus structurally has a configuration in which the USB of the USB Type C and the USB other than the USB Type C cannot be used at the same time. Such a configuration may have a configuration in which various configurations can be employed, and in a case where simultaneous use of the first connection port and the second connection port is attempted, a connector interferes with other connectors or a structure around the connection port and thereby the simultaneous use cannot be done, and one connection port can be selectively used.

**[0039]@038** For example, in a case where connectors are respectively connected to the first connection port and the second connection port, an exclusive structure may be formed in which each connection port is configured such that the connectors are in a positional relationship of spatially overlapping each other. That is, in a case where, in a state where a connector is connected to one connection port, another connector is connected to the other connection port, a configuration may be performed in which the former connector interfere with the latter connector such that the latter connector cannot be inserted into the connection port.

**[0040]@039** The exclusive structure can be specified by, for example, analyzing a size of the connector, or the like in advance. That is, a shape or a size of a connector is approximately determined by the USB standard (USB Type C or others). Hence, when shapes or sizes of connectors according to each standard are specified by statistics or the like in advance, each connection port may by formed such that, in a case where a connector is connected to the second connection port, the connector is positioned on an inner side of the periphery of a connector, in a case where the connector is connected to the first connection port.

**[0041]@040** Such a configuration can be realized by a configuration in which, for example, a long side of each of the first connection port and the second connection port faces a first direction, the first connection port and the second connection port are in the same position in the first direction, and a distance between the center of a short side direction of the first connection port and the center of a short side direction of the second connection port is less than 7.25 mm in a second direction orthogonal to the first direction.

**[0042]@041** That is, if each connection port is disposed such that connectors interfere with each other in two directions orthogonal to each other, the first connection port and the second connection port can be disposed in a positional relationship in which the connectors spatially overlap each other. Hence, if the first connection port and the second connection port overlap each other at least partially in the first direction, the first connection port and the second connection port can be disposed such that connectors interfere with each other in the first direction.

**[0043]@042** In addition, if the first connection port and the second connection port are configured such that a distance between the centers of the short side directions thereof in the second direction is less than a specified distance, the first connection port and the second connection port can be disposed such that the connectors also interfere with each other in the second direction by adjusting the specified distance. The specified distance can be adjusted on the basis of a size of the connector, but the distance can be set to be less than, for example, 7.25 mm. That is, a maximum value of a connector of the USB Type C in a short side direction is 6.5 mm and a maximum value of a connector of the USB Type A in a short side direction is 8.0 mm, and thus, it is necessary to set a distance between the centers of the short side directions of the first connection port and the second connection port to be less than 7.25 (= (8.0 + 6.5) / 2) mm so as to make the connectors interfere with each other.

**[0044]@043** Various values can be employed as values less than 7.25 mm, and, for example, a value at which almost all the connectors statistically interfere with each other may be selected. Here, the first connection port and the second connection port are configured to be in the same position in the first direction that long sides of the first connection port and the second connection port face, but, of course, the first connection port and the second connection port may be configured to be in the same position in a direction that a short side faces, and a configuration may be provided in which a distance between the centers in the long side direction is less than a specified distance in a direction that the long sides face.

**[0045]@044** Furthermore, a hole of the first connection port and a hole of the second connection port may be configured to be connected to each other. Fig. 2B is a diagram illustrating the configuration example. Fig. 2B is a view illustrating a state where the connection port which is formed on an outer surface of an electronic apparatus that functions as a host is viewed. An opening of the first connection port 10a and an opening of the second connection port 10b which are illustrated in the same figure are connected to each other. The configuration can be realized by simply connecting the connection ports, and thus, the configuration can be realized without performing a layout such as adjusting positions of the first connection port 10a and the second connection port 10b by considering a size or the like of a connector to be connected to the first connection port 10a or the second connection port 10b. Hence, in a case where a connector is connected to one of the first connection port and the second connection port, it is possible to easily realize an exclusive structure by which a connector cannot be connected to the other connection port.

**[0046]@045** In the exclusive structure which is configured such that, in a case where simultaneous use of the first connection port and the second connection port is attempted, a connector interferes with other connectors or a structure around the connection port, and thereby, the simultaneous use cannot be done, and one connection port can be selectively used, for example, a configuration can be employed in which the exclusive structure can be formed by a shutter that selectively blocks one of the first connection port and second connection port. That is, in a case where one of the first connection port and the second connection port is blocked by a shutter, a configuration may be provided in which the other connection port can be connected to a connector without being blocked by the shutter.

**[0047]@046** Figs. 2C and 2D are views illustrating the configuration example. Each of the figure illustrates a state where a connection port which is formed on an outer surface of an electronic apparatus that functions as a host is viewed. In the example illustrated in the figures, a recess portion P is formed on an outer surface of the electronic apparatus, and the first connection port 10a and the second connection port 10b are formed on an inner wall of the recess portion P. In the present embodiment, the first connection port 10a and the second connection port 10b are formed at a position of 1/4 of a length from one end of the recess portion P in a long side direction and at a position of 3/4 of a length from the one end.

**[0048]@047** In addition, a groove C having a predetermined depth in a direction perpendicular to a side wall W is formed on the side wall W of the recess portion P. A shutter S with a thickness slightly smaller than a width of the groove C is fitted on the groove C. The shutter S has a length of approximately half the length of the recess portion P in a long side direction. Hence, by sliding the shutter S in the long side direction, one of the first connection port 10a and the second connection port 10b can be blocked, and the other connection port is not blocked. According to the configuration, it is possible to simply form a configuration in which a configuration in which, in a case where a connector is connected to one connection port, another connector cannot be connected to the other connection port.

**[0049]@048** The shutter may be able to block or open each connection port, and a configuration may be provided in which, in a case where a connector is connected to the block connection port to be used, at least the shutter and the connector interfere with each other, and thereby, another connector cannot be connected to the connection port. The shutter may be able to move forward or backward to block or open the connection port, and various shutters such as a rotary type shutter can be employed in addition to the slide type shutter illustrated in Figs. 2C and 2D.

**[0050]@049** In addition, connection detection of the second connection port 10b may not be performed. Specifically, in a case where an output signal of the connection detecting circuit 11a indicates that a connector is connected to the first connection port 10a, the BUS switching circuit 11b controls the switch such that the first connection port 10a is connected to the signal processing circuit 22. In addition, in a case where the output signal of the connection detecting circuit 11a indicates that the connector is not connected to the first connection port 10a, the BUS switching circuit 11b controls the switch such that the second connection port 10b is connected to the signal processing circuit 22.

**[0051]@050** Furthermore, as described above, a technology in which, if a connector is connected to one of connection ports of the USB according to different standards, another connector cannot be connected to the other connection port, can also be realized as a method.

What is claimed is:

1. An electronic apparatus comprising:

a first connection port that is a connection port of a USB Type C;

a second connection port that is a connection port of a USB other than the USB Type C; and

a wire that branches off to the first connection port and the second connection port,

wherein the electronic apparatus has an exclusive structure in which, in a case where a connector is connected to one of the first connection port and the second connection port, another connector is not able to be connected to the other connection port.

2. The electronic apparatus according to Claim 1, wherein, in a case where connectors are connected to each of the first connection port and the second connection port, the exclusive structure has a positional relationship in which the connectors spatially overlap each other.

3. The electronic apparatus according to Claim 2, wherein a long side of each of the first connection port and the second connection port faces a first direction, the first connection port and the second connection port are in the same position in the first direction, and a distance between a center of a short side direction of the first connection port and a center of a short side direction of the second connection port is less than 7.25 mm in a second direction orthogonal to the first direction.

4. The electronic apparatus according to Claim 2, wherein a hole of the first connection port is connected to a hole of the second connection port.

5. The electronic apparatus according to Claim 1, wherein the exclusive structure is a shutter that selectively blocks one of the first connection port and the second connection port.

6. The electronic apparatus according to Claim 1, wherein the wire includes,

a communication line that is connected to the first connection port and another communication line that is connected to the second connection port; and

a wire switching circuit that connects a communication line of the electronic apparatus to any one of the respective communication lines in a switchable manner.

7. The electronic apparatus according to Claim 6, further comprising:

a connection detecting circuit that detects whether or not a connector is connected to the first connection port,

wherein the wire switching circuit switches a connection between a communication line that is connected to a connection port to which a connector is connected and a communication line of the electronic apparatus.

ABSTRACT

An electronic apparatus is configured to include a first connection port that is a connection port of a USB Type C; a second connection port that is a connection port of a USB other than the USB Type C; and a wire that branches off to the first connection port and the second connection port. The electronic apparatus has an exclusive structure in which, in a case where a connector is connected to one of the first connection port and the second connection port, another connector is not able to be connected to the other connection port.