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(54) Title: TELECOMMUNICATIONS CABLE VENDING SYSTEM

(57) Abstract: In one example, a vending machine for dispensing customized patch cords includes: an interface programmed to accept a plurality of parameters associated with a customized patch cord; a cable manager device configured to select a cable of a desired length based upon the plurality of parameters; a connector manager device configured to select at least one connector based upon the plurality of parameters; and a dispenser manager device configured to dispense the customized patch cord from the vending machine.

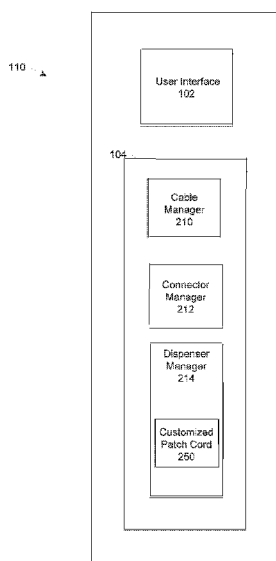


FIG. 2

Published:

- *with international search report (Art. 21(3))*
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TELECOMMUNICATIONS CABLE VENDING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is being filed on February 22, 2019 as a PCT International Patent Application and claims the benefit of U.S. Patent Application Serial No. 62/633,847, filed on February 22, 2018, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The complexities of running cables (sometimes referred to as “patch cords”) between electronic and/or fiber optic devices on a site can be significant. This complexity is increased due to the varying distances between the locations of the devices and when devices are added or moved. To accommodate these scenarios, large numbers of patch cords of varying lengths must be stocked on site or ordered, which causes delays in installations.

DESCRIPTION OF THE DRAWINGS

[0003] Figure 1 illustrates an example system for vending customized patch cords.

[0004] Figure 2 illustrates an example vending machine of the system of Figure 1.

[0005] Figure 3 illustrates an example user interface of the vending machine of Figure 2.

[0006] Figure 4 illustrates another example user interface of the vending machine of Figure 2.

[0007] Figure 5 illustrates another example user interface of the vending machine of Figure 2.

[0008] Figure 6 illustrates an example method for vending customized patch cords.

[0009] Figure 7 illustrates example physical components of the example vending machine of Figure 2.

DETAILED DESCRIPTION

[0010] The present disclosure is directed to a vending system for telecommunications equipment. In the examples provided, the telecommunications equipment includes one or more components associated with cables, such as patch cords. The vending system can be

located on the site of site and provide customized patch cords of varying types and lengths.

[0011] Referring now to Figure 1, an example vending system 100 including a vending machine 110 and a central system 108.

[0012] In this example, the vending machine 110 is located on a site 120. The site 120 can be any structure, such as a building, warehouse, data distribution center, etc., at which various electrical and/or optical devices are located and networked. See, for example, Figure 5.

[0013] The example vending machine 110 includes a user interface 102 and a dispensing unit 104.

[0014] The user interface 102 provides information to manage the configuration, sale, and dispensing of the patch cord. This can include payment (e.g., credit card reader), as well as a display or other similar interface (e.g., touchscreen) that allows a user to interact with the vending machine 110. For example, the user interface 102 can allow the user to select a telecommunications component, such as a customized patch cord, and pay for the patch cord. Additional details on example user interfaces are provided in reference to Figures 3-5 described below.

[0015] The dispensing unit 104 is configured to dispense the selected patch cord for the user. Additional details regarding the vending machine 110 are provided in reference to Figure 2 described below.

[0016] The vending machine 110 is configured to communicate through a network 106 to a central system 108. This central system 108 can monitor the performance of the vending machine 110. For example, the central system 108 can monitor the inventory of the vending machine 110 and automatically determine when replacement components are needed. The central system 108 can also determine what types of cables and/or connectors are most popular given prior sales at a particular site and modify the inventory for a given vending machine. Finally, the central system 108 can determine when the vending machine 110 malfunctions or otherwise needs to be serviced. Other configurations are possible.

[0017] Although a single vending machine 110 is shown in this example, in other embodiments, multiple vending machines can be provided at a site. The number can be dictated by the size and network requirements for a given site.

[0018] Referring now to Figure 2, the example vending machine 110 is shown in greater detail. In this example, the vending machine 110 includes the user interface 102

(see Figures 3-4) and the dispensing unit 104. The dispensing unit 104 includes a cable manager 210, a connector manager 212, and a dispenser manager 214.

[0019] The cable manager 210 manages the cable(s) stored in the vending machine 110. The cables can include both electric and/or fiber optic cables and cables of various performance specifications (e.g., CAT-5, CAT-6, and/or CAT-7, and Singlemode, OM3, OM4, and/or OM5). In one example, the cables are stored on one or more spools, and a desired length for a given cable is taken off the relevant spool when needed. In another example, cables of various lengths are stored within the cable manager 210 and selected as needed.

[0020] The connector manager 212 manages the various connectors that can be applied to the cables dispensed by the vending machine 110. For example, the connector manager 212 can include a plurality of electric connectors (e.g., RJ11, RJ45, etc.) and/or a plurality of fiber optic connectors (e.g., LC, SC, LX.5, FC, MPO, MTP, etc.). These connectors can be separate from the cable and/or be attached to the cable.

[0021] In one embodiment, the connectors are provided separate from the cable that forms the patch cord. When the cable and connectors are selected, the connector manager 212 selected the relevant connectors and connects the connectors to the cable (i.e., connectorizes the cable). In the fiber optic context, this can be accomplished by automatically fusing the connector with the fiber optic cable. One example of such a system for automatically attaching a fiber optic connector to a fiber optic cable is provided in U.S. Patent No. 9,481,129, the entirety of which is hereby incorporated by reference. One or both of the connectors can be applied to the ends of the cable to form the customized patch cord.

[0022] In another embodiment, one or both of the fiber optic cables are provided as part of a short or pigtailed end. A process is used to fuse that pigtailed end to the cable to accomplish the connectorization of the customized patch cord. Such technology is provided in U.S. Patent No. 9,016,953 and U.S. Patent No. 9,720,185, the entireties of which are hereby incorporated by reference.

[0023] In yet another embodiment, one end of the cable is pre-connectorized before placement into the vending machine 110. Once the relevant cable and connector(s) are selected, that cable is cut to the desired length, and the cut end is automatically connectorized using one or more of the techniques provided above.

[0024] In a further embodiment, the selected connector(s) can simply be dispensed separately. The user can then use various techniques, such as one or more of those

provided above, to connect the connector(s) to the cable to form the customized patch cord.

[0025] Continuing to refer to Figure 2, the dispenser manager 214 collects the cable and connectors and dispenses a customized patch cord 250 to the user. In some examples, the dispenser manager 214 can include a draw with one or more walls that swing open to allow the user to access the customized patch cord 250 as part of the dispensing process. Other configurations are possible.

[0026] Referring now to Figure 3, an example user interface 300 for the user interface 102 of the vending machine 110 is shown. In this example, the user interface 300 includes information that guides the user through the configuration and purchase of the customized patch cord.

[0027] The user interface 300 includes a plurality of fields (302-316) that define the parameters of the customized patch cord. The user interacts with the user interface 300 to define these parameters. In the example shown, the parameters are selected from drop-down boxes associated with the various fields, although other input methods can be provided. Examples of these parameters include one or more of the following fields:

- site location field 302 – The user selects the specific site at which the patch cord will be used. This can be useful if the vending machine is provided at a location where multiple sites are located. The site information can impact such parameters as needed performance and costs.
- quantity needed field 304 – The user selects the number of patch cords needed.
- cable type field 306 – The user selects the cable type needed. This can include the type (e.g., electrical or fiber optic), as well as aspects associated with the cable (e.g., simplex or duplex and/or hybrid).
- cable rated performance field 308 – The user selects the desired performance of the cable (e.g., CAT-5 or CAT-6; or OM3, OM4, or OM5).
- cable length field 310 – The user selects the desired length. In one example, various systems (e.g., imperial versus metric) can be provide, along with a desired length measured in various increments, such as by foot, by inch, etc.
- first end connector type field 312 – The user selects the desired connector for the first end of the cable.
- second end connector type field 314 – The user selects the desired connector for the second end of the cable.

[0028] Other selections can also be provided. For example, another selection can allow the user to select a color for the cable and/or the connectors. In another example, the interface can allow the user to define any printing or other identification that is provided on the patch cord. For example, the user can allow pre-printed and/or customized information to be printed onto the cable and/or on a tag or sticker applied to the patch cord that identifies the site for use and/or cable and/or connector type or performance. Other configurations are possible.

[0029] A display area 320 of the user interface 300 is updated to provide a depiction of the customized patch cord as the user configures it. For example, in the user interface 300 provided, the user has selected a 6 foot duplex fiber optic cable with LC connectors. Such a patch cord is depicted in the display area 320. If the user changes the parameters selected, the display area 320 can be updated (e.g., if the user selects 9 feet instead of 6 feet, the display area 320 is updated accordingly).

[0030] Finally, a cost estimator field 322 is provided that estimates the cost of the customized patch cord based upon the parameters elected by the user. This estimate can be updated as the user selects and changes the parameters. For example, the given cost of \$3.42 can be increased if the user modifies the length from 6 feet to 9 feet. In another example, a higher performance cable will cost more than a lower performance cable. This allows the user to understand how much the customized patch cord will cost and how different parameters impact that cost.

[0031] Referring now to Figure 4, another example user interface 400 for the user interface 102 of the vending machine 110 is shown. The user interface 400 is similar to the user interface 300, except for the selection of several of the parameters is presented in a more-automated fashion.

[0032] Specifically, the user interface 400 includes a selection of first and second component type fields 402, 404. This allows a user who is less familiar with a particular component to simply name the component instead of selecting the specific cable and connectors needed. For example, if the patch cord is needed to run from device A to device B, the user can simply select the type A of device A from the dropdown for the first component type field 402 and the type B of the device B from the dropdown for the second component type field 404, and the system can automatically select the appropriate cable and connector(s) based upon the device types. The device types can be tailored to those devices on the site 120 so that the user can easily select the devices without having to have knowledge of the various technologies associated with the patch cords.

[0033] In some embodiments, the selection of the length of the cable can also be automated. For example, the user can manually input the desired length in the cable length field 310. Or, the user can select the map button 406, which loads a floorplan 500 of the site 120, as depicted in Figure 5.

[0034] In Figure 5, a floorplan 500 of the site 120 is provided on the user interface 102 once the user selects the map button 406. The floorplan 500 depicts the location one or more of the electrical and/or fiber optic component on the site 500. In this example, the site 120 includes rooms 502, 504 with racks 510, 512, 514, 516, 518, 520, 522, 524, 526, 528 positioned therein. The positions of these items is provided so that the user can easily identify the needed connection(s) between the racks holding the devices.

[0035] In this example, the user has selected (e.g., using a finger or other input device) the rack 510 and the race 512. The user interface 102 indicates the connection 530 between the racks and automatically calculates the necessary cable length. This length can be auto-populated into the cable length field 310.

[0036] An example method 600 for preparing a customized patch cord is shown in Figure 6. While the operations of the method 600 are presented in a particularly order, the operations can be rearranged and performed in other orders. Further, some of the operations (e.g., 608, 610) are optional.

[0037] At operation 602, the vending machine receives the selection of the cable for the customized patch cord. Next, at operation 604, the vending machine obtains the cable at the desired length. If the cable is provided on a spool, the desired length of cable is spooled out, and the cable is cut. If the cables are simply provided at different lengths, the cable of the desired length is selected.

[0038] Next, at operation 606 of the method 600, the vending machine receives the selection of the connector(s) for the customized patch cord. Next, at optional operation 608, the vending machine connectorizes the cable using the connector(s), as described previously. Alternatively, this step can be skipped in the connector(s) are dispensed separately from the cable.

[0039] Next, at optional operation 610, payment for the customized patch cord is received. This can be accomplished in various ways. For example, the vending machine can accept cash and/or credit card. In another example, payment can be made by previous arrangement, such as through credit provided by the vending machine operator and/or patch cord manufacturer. Payment may not be needed in all instances. For example,

payment may not be required when the vending machine is owned by the same owner as the site.

[0040] In other examples, the costs charged for the customized patch cord can vary. For example, the costs can be modified based upon the site into which the patch cord will be installed and/or based upon the purchasers. For example, if the purchaser has a pre-established relationship, the purchaser could receive a preferred (e.g., lower) price. Further, the price could decrease based upon the number of customized patch cords purchased. Other configurations are possible.

[0041] Finally, at operation 612 of the method 600, the customized patch cord is dispensed.

[0042] In an alternative embodiment, the customized patch cord(s) can be ordered prior to the user interfacing with the vending machine. For example, an application can be provided on a smartphone that allows the user to define the parameters needed for the customized patch cord(s). For example, the application can provide interfaces similar to those shown in Figures 3-5 that allow the user to define the customized patch cord and also optionally pay for the customized patch cord.

[0043] In this example, the user can thereupon visit the vending machine, authenticate him/herself (e.g., using a pin provided by the application or a technology like NFC), and then obtain the customized patch cord from the vending machine. The vending machine could pre-make the customized patch cord so the customized patch cord is ready when the user visits the vending machine and/or the vending machine can make the customized patch cord after the user authenticates at the vending machine.

[0044] Although the examples provided herein show a vending machine that is positioned on a premises, other embodiments are possible. For example, in alternative embodiments, the functions of the vending machine can be provided in a mobile station that can be transported as needed to various positions on a premises and/or multiple different premises. For example, the vending machine can be configured to be positioned in a mobile container that can be transported (e.g., by a tractor-trailer) as needed. The mobile container can be configured to be positioned outside (or inside) a structure at the premises and allow the user to enter the container, define the patch cord needed, and vend the patch cord. Other configurations are possible.

[0045] There are various possible advantages associated with the systems and method described herein. For example, the ability to obtain a customized patch cord on site minimizes waste associated with using patch cords of the wrong type or length and/or the

wait associated with ordering such patch cords. Further, being able to quickly obtain a patch cord of the correct length assists in cable management associated with the excess length of incorrect patch cords. Finally, the ability to customize the patch cord on site minimizes the need for the site owner to maintain a large inventory of different patch cords.

[0046] As illustrated in the example of Figure 7, the vending machine 110 includes at least one central processing unit (“CPU”) 702, also referred to as a processor, a system memory 708, and a system bus 722 that couples the system memory 708 to the CPU 702. The system memory 708 includes a random access memory (“RAM”) 710 and a read-only memory (“ROM”) 712. A basic input/output system that contains the basic routines that help to transfer information between components within the vending machine 110, such as during startup, is stored in the ROM 712. The vending machine 110 further includes a mass storage device 714. The mass storage device 714 is able to store software instructions and data. Some or all of the components of the vending machine 110 can also be included in the central system 108 and other computing devices described herein.

[0047] The mass storage device 714 is connected to the CPU 702 through a mass storage controller (not shown) connected to the system bus 722. The mass storage device 714 and its associated computer-readable data storage media provide non-volatile, non-transitory storage for the vending machine 110. Although the description of computer-readable data storage media contained herein refers to a mass storage device, such as a hard disk or solid state disk, it should be appreciated by those skilled in the art that computer-readable data storage media can be any available non-transitory, physical device or article of manufacture from which the central display station can read data and/or instructions.

[0048] Computer-readable data storage media include volatile and non-volatile, removable and non-removable media implemented in any method or technology for storage of information such as computer-readable software instructions, data structures, program modules or other data. Example types of computer-readable data storage media include, but are not limited to, RAM, ROM, EPROM, EEPROM, flash memory or other solid state memory technology, CD-ROMs, digital versatile discs (“DVDs”), other optical storage media, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the vending machine 110.

[0049] According to various embodiments, the vending machine 110 may operate in a networked environment using logical connections to remote network devices through the network 106, such as a wireless network, the Internet, or another type of network. The vending machine 110 may connect to the network 106 through a network interface unit 704 connected to the system bus 722. It should be appreciated that the network interface unit 704 may also be utilized to connect to other types of networks and remote computing systems. The vending machine 110 also includes an input/output controller 706 for receiving and processing input from a number of other devices, including a touch user interface display screen, or another type of input device. Similarly, the input/output controller 706 may provide output to a touch user interface display screen or other type of output device.

[0050] As mentioned briefly above, the mass storage device 714 and the RAM 710 of the vending machine 110 can store software instructions and data. The software instructions include an operating system 718 suitable for controlling the operation of the vending machine 110. The mass storage device 714 and/or the RAM 710 also store software instructions and software applications 716, that when executed by the CPU 702, cause the vending machine 110 to provide the functionality discussed in this document. For example, the mass storage device 714 and/or the RAM 710 can store software instructions that, when executed by the CPU 702, cause the vending machine 110 to display received data allowing for the selection and dispensing of a customized patch cord.

[0051] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A vending machine for dispensing customized patch cords, the vending machine comprising:
 - an interface programmed to accept a plurality of parameters associated with a customized patch cord;
 - a cable manager device configured to select a cable of a desired length based upon the plurality of parameters;
 - a connector manager device configured to select at least one connector based upon the plurality of parameters; and
 - a dispenser manager device configured to dispense the customized patch cord from the vending machine.
2. The vending machine of claim 1, wherein the interface is further programmed to allow a user to select a length and a performance for the cable.
3. The vending machine of claim 1, wherein the cable is an electric cable or a fiber optic cable.
4. The vending machine of claim 1, wherein the interface is further programmed to allow a user to select a type of the at least one connector.
5. The vending machine of claim 1, wherein the connector manager device is further configured to automatically attach the at least one connector to the cable.
6. A vending system for dispensing customized patch cords, comprising:
 - a vending machine, the vending machine including:
 - a user interface programmed to accept a plurality of parameters associated with a customized patch cord;
 - a cable manager device configured to select a cable of a desired length based upon the plurality of parameters;
 - a connector manager device configured to select at least one connector based upon the plurality of parameters; and

a dispenser manager device configured to dispense the customized patch cord from the vending machine.

7. The vending system of claim 6, wherein the user interface is further programmed to allow a user to select a length and performance for the cable.

8. The vending system of claim 6, wherein the cable is an electrical cable or a fiber optic cable.

9. The vending system of claim 6, wherein the user interface is further programmed to allow a user to select a type of the at least one connector.

10. The vending system of claim 6, wherein the connector manager device is further configured to automatically attach the at least one connector to the cable.

11. The vending system of claim 6, further comprising a central system, wherein the central system is programmed to remotely monitor performance of the vending machine.

12. The vending system of claim 11, wherein the vending machine is programmed to communicate with the central system to report performance characteristics to the central system.

13. A method for dispensing a customized patch cord from a vending machine, comprising:

- receiving, by a computing device, a selection of a cable length;
- causing, by the vending machine, a cable of the cable length to be selected;
- receiving, by the computing device, a selection of a connector type;
- causing, by the vending machine, at least one connector of the connector type to be selected; and
- dispensing, by the vending machine, the customized patch cord including the cable and the at least one connector.

14. The method of claim 13, further comprising receiving, by the computing device, a performance characteristic associated with the cable.

15. The method of claim 13, further comprising receiving, by the computing device, payment for the customized patch cord.
16. The method of claim 13, further comprising automatically connecting the at least one connector to the cable.
17. The method of claim 13, further comprising providing, by the computing device, a floorplan to allow for selection of the cable length.
18. The method of claim 17, further comprising allowing, by the computing device, for the selection of two components on the floorplan to identify the cable length.
19. The method of claim 13, further comprising providing, by the computing device, a user interface including a depiction of the customized patch cord as the cable length and the connector type are selected.
20. The method of claim 13, further comprising providing, by the computing device, a user interface including a cost estimate for the customized patch cord.

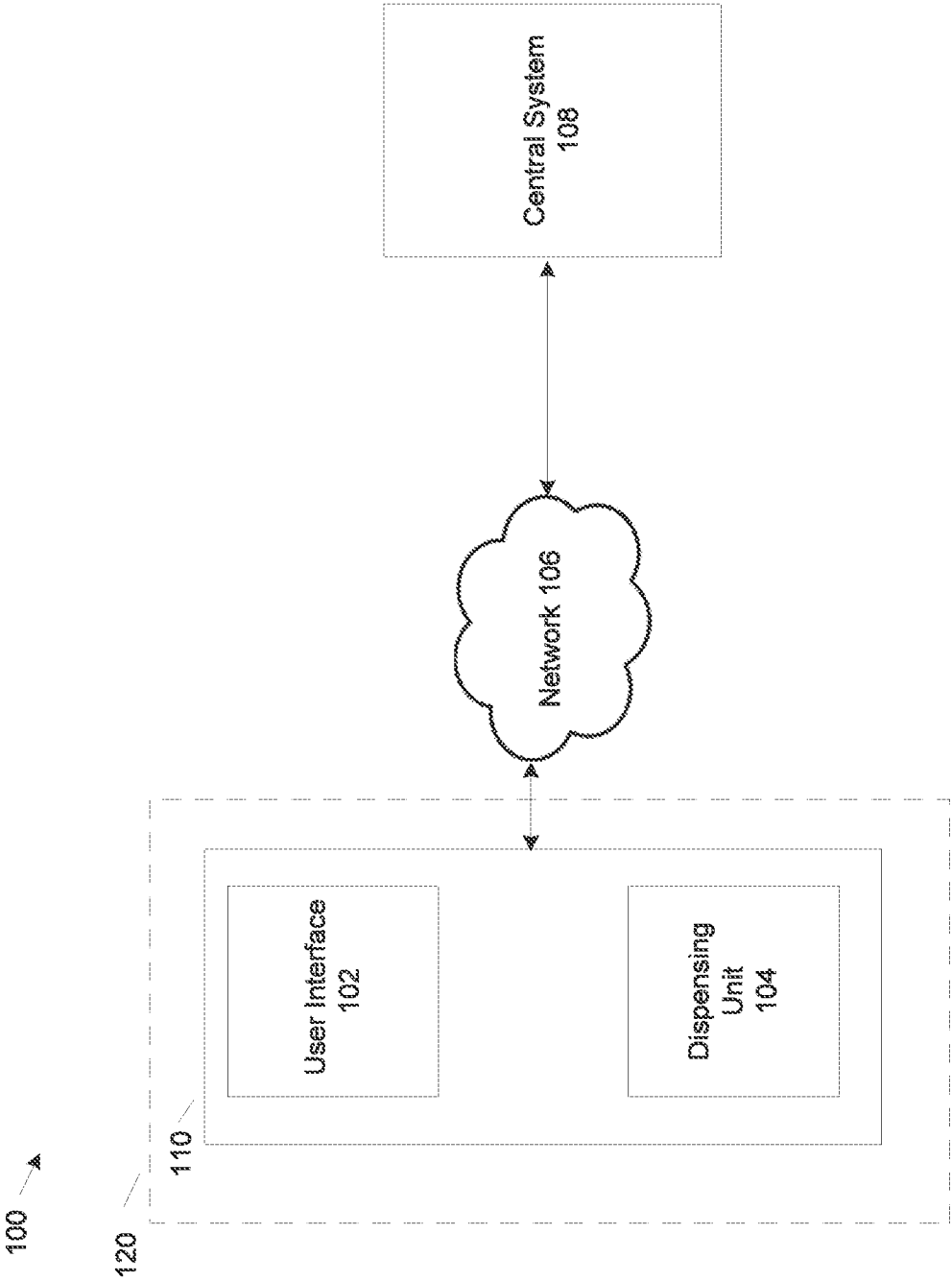


FIG. 1

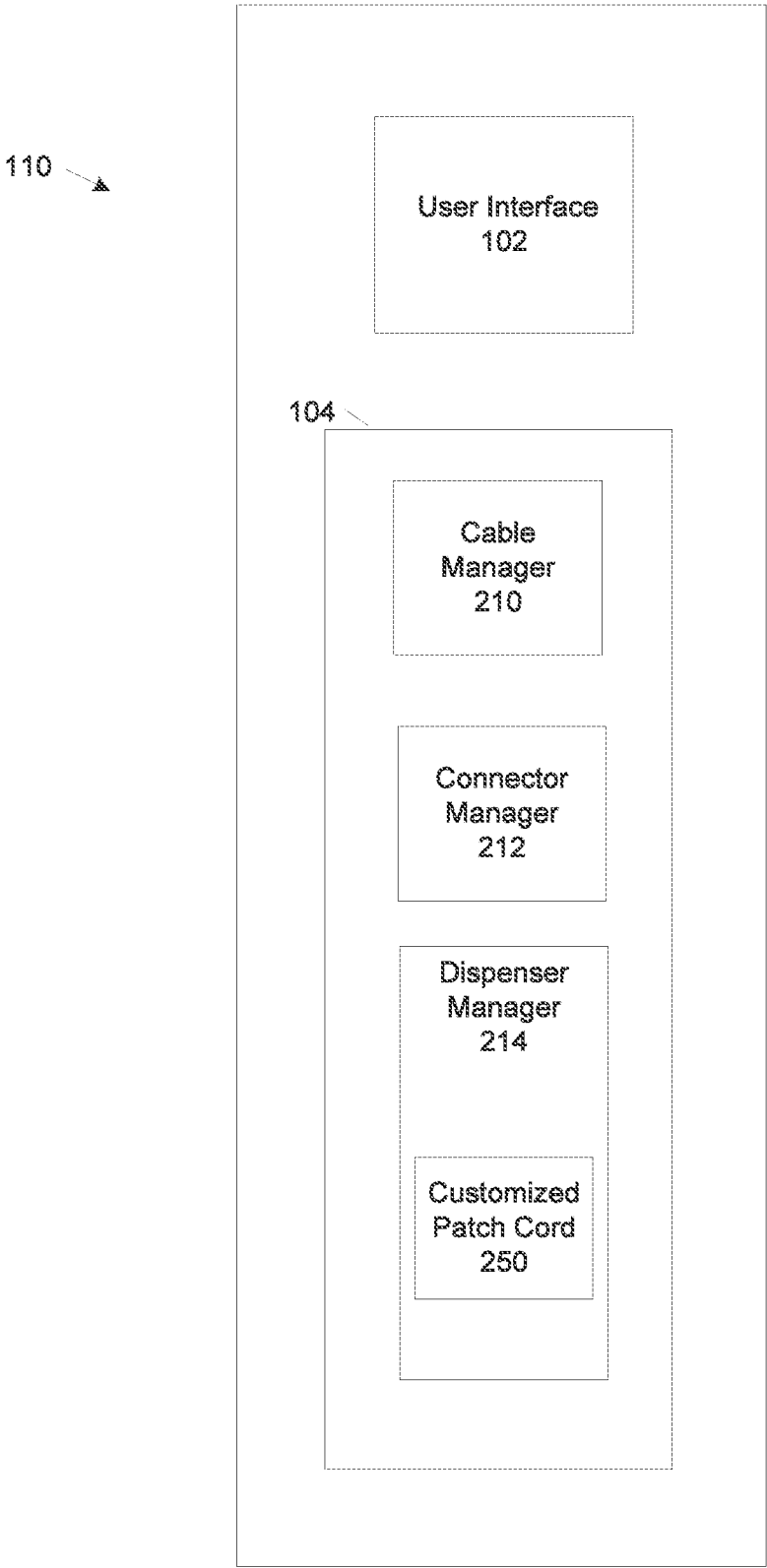


FIG. 2

FIG. 3

300 

302  Site location:

304  Quantity needed:

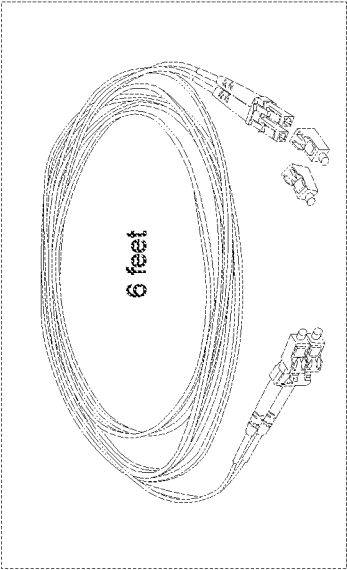
306  Cable type:

308  Cable rated performance:

310  Cable length:

312  First end connector type:

314  Second end connector type:

320 

322  Cost estimate: \$3.42 (each, as configured)

FIG. 4

300 

302  Site location:

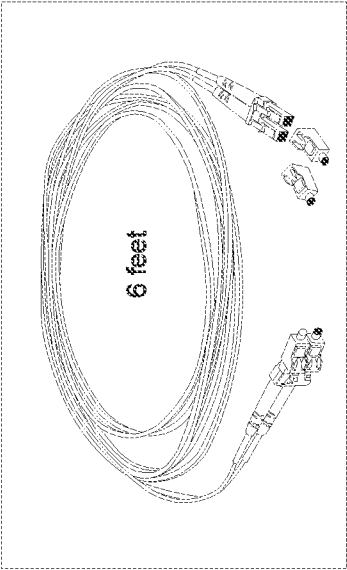
304  Quantity needed:

402  First component type:

404  Second component type:

310  Cable length: 6 feet

406  MAP

320 

322  Cost estimate: \$3.42 (each, as configured)

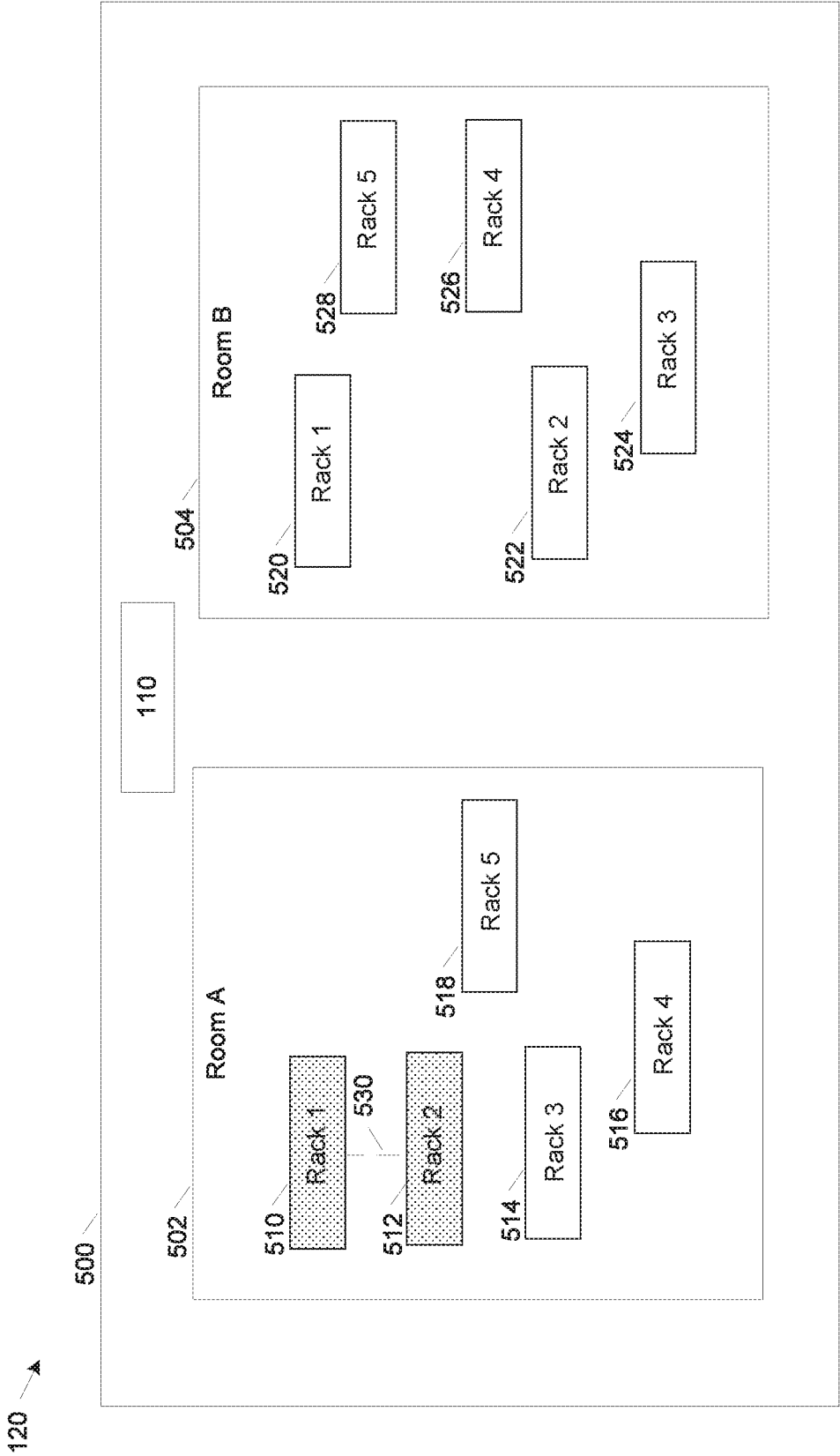


FIG. 5

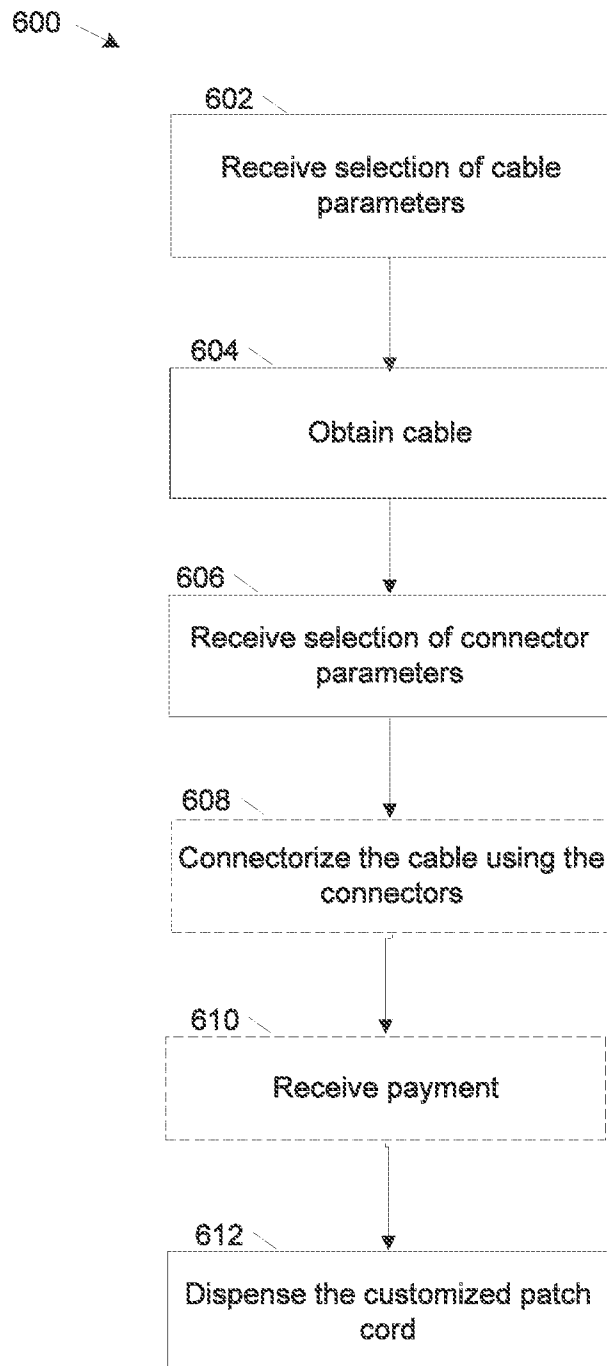


FIG. 6

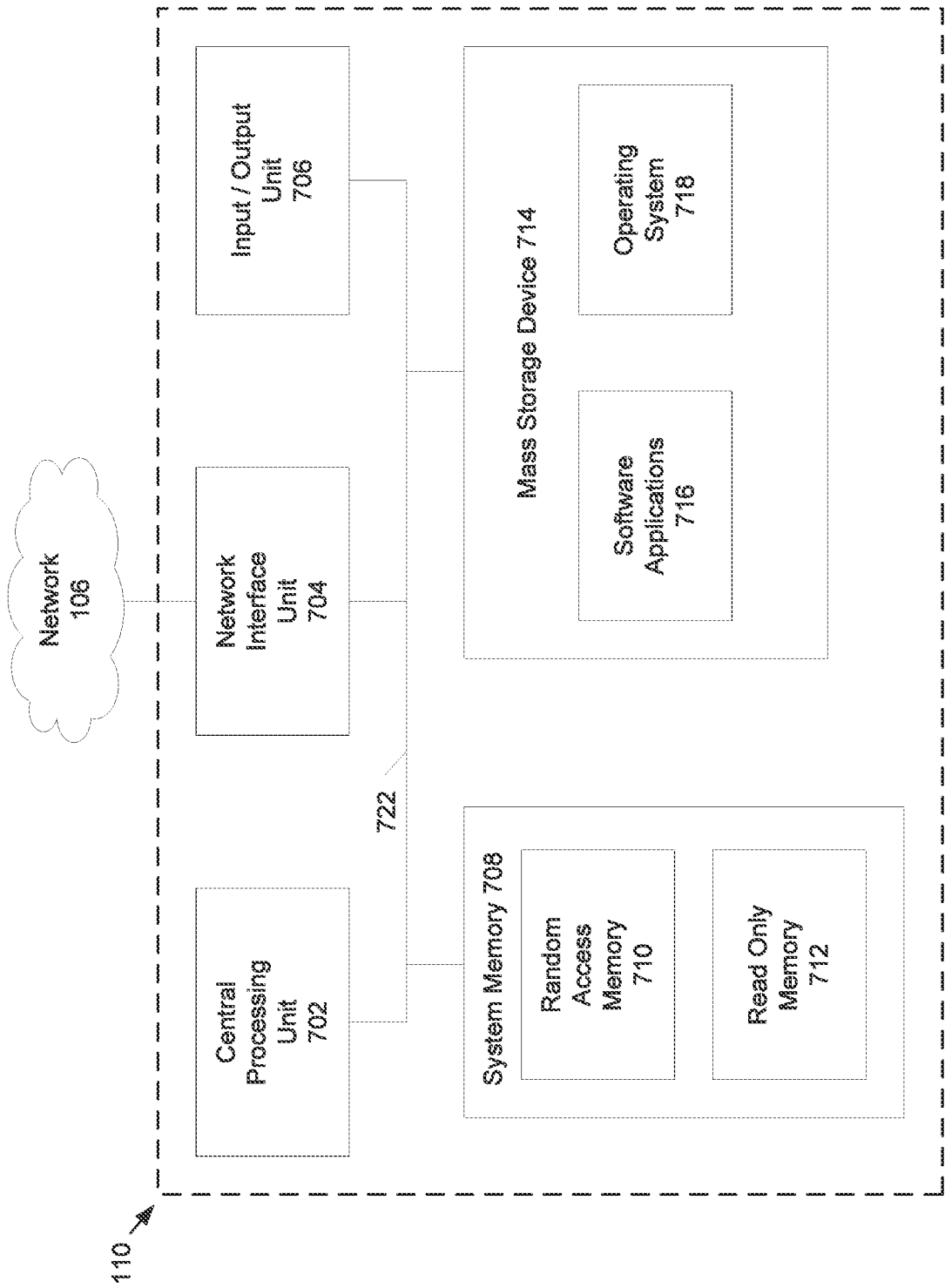


FIG. 7

A. CLASSIFICATION OF SUBJECT MATTER**G07F 17/00(2006.01)i, G06Q 30/06(2012.01)i, G06Q 20/18(2012.01)i, G02B 6/10(2006.01)i**

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)

G07F 17/00; G06F 15/177; G06F 17/50; G06Q 99/00; G07F 9/00; G09F 3/10; H01R 43/00; H01R 43/01; G06Q 30/06; G06Q 20/18; G02B 6/10

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: vending machine, customized patch cords, interface, dispenser, parameter, cable, connector, length, type

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012-0029885 A1 (STEVEN FELDMAN et al.) 02 February 2012 See paragraphs [0017]–[0036] and figures 2–6.	1–20
Y	US 2016-0180632 A1 (ALEJANDRO SANTANA et al.) 23 June 2016 See paragraphs [0040]–[0052] and figures 1A–2, 4.	1–20
Y	US 2005-0288946 A1 (RONALD J. VOGEL et al.) 29 December 2005 See paragraphs [0027]–[0037], claim 1 and figure 1.	17–18
A	US 2007-0245255 A1 (RICHARD G. GALGANO) 18 October 2007 See paragraphs [0035]–[0078] and figures 3–24.	1–20
A	JP 05-234655 A (HITACHI TELECOM TECHNOL LTD.) 10 September 1993 See paragraphs [0073]–[0094] and figure 1.	1–20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2019/019142

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012-0029885 A1	02/02/2012	CN 101326525 A EP 1958106 A2 TW 200809559 A US 2007-0136031 A1 US 2012-0029886 A1 US 8069016 B2 WO 2007-067679 A2 WO 2007-067679 A3	17/12/2008 20/08/2008 16/02/2008 14/06/2007 02/02/2012 29/11/2011 14/06/2007 26/07/2007
US 2016-0180632 A1	23/06/2016	None	
US 2005-0288946 A1	29/12/2005	US 2006-0004543 A1 US 7324911 B2 US 7366630 B2	05/01/2006 29/01/2008 29/04/2008
US 2007-0245255 A1	18/10/2007	US 7945549 B2	17/05/2011
JP 05-234655 A	10/09/1993	JP 3008378 B2	14/02/2000