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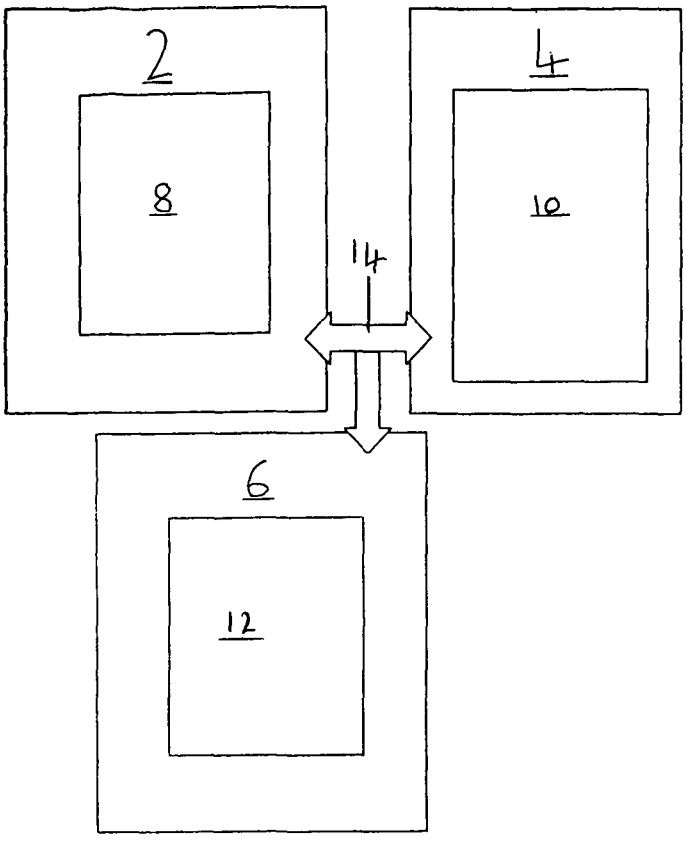
(54) Title: CONVEYING SYSTEM WITH A CENTRAL CONTROL UNIT AND AN ASSOCIATED METHOD FOR CONTROLLING IT



(57) Abstract: A central control unit of a conveying system having a memory with control data and/or configuration data for controlling the operation of a function of at least one other modular device of the conveying system. The conveying system can be an elevator system or an escalator system. These systems include the central control unit and at least one other modular device for performing a function of the system and can include more than one of these modular devices. The central control unit can store the control and/or configuration data of some or all of the modular devices. Upon installation of the modular devices or replacement of a modular device, the central control unit will automatically download the control and/or configuration data it has on its memory so that the modular device can store the data on its own memory. Such operation removes the necessity for pre-programming the modular devices before installation to the conveying system.

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CONVEYING SYSTEM WITH A CENTRAL CONTROL UNIT AND AN ASSOCIATED METHOD FOR CONTROLLING IT

Field of the Invention

The present invention is concerned with a conveying system, for example an elevator system or an escalator system, including a modular device for performing a specific function of the conveying system, a control system for such a modular device of such a conveying system and a method of providing control data to such a modular device of such a conveying system.

Background to the Invention

Elevator systems are known in which modular devices or sub-systems for performing a specific or specialised function of the elevator system are provided. The modular device may, in one form, be operative to provide the drive for the function of the elevator system. The modular device may, for example, be a door drive for opening/closing an elevator door of an elevator car of the elevator system. The modular device may also be a hoist drive for ascending/descending an elevator car of the elevator system. These drives usually include a motor.

In these known devices, each separate modular device for performing the specialised function includes a respective control unit having a memory. The control unit conventionally includes a microprocessor and the memory may be a RAM/FLASH/EEPROM or similar non-volatile memory device(s) or battery/capacitor or otherwise backed volatile memory device(s). The control unit operates to control the modular device at least partly in dependence upon control and/or configuration data stored in the memory.

The data stored in the memory will be function specific and installation specific data required to properly control the modular device. In particular, the data will include installation specific data or configuration data. Configuration data allows the operation of the elevator to be tailored to take into account the requirements imposed by the users and purchasers of an elevator system and also to take into account the system's installation environment. Configuration data can vary from one elevator installation to another.

For example, a memory of a door control unit may store configuration data such as velocity profile data for opening and closing of a door of the elevator, door type, door device, door reversal devices, continuous door open times, etc., while a memory of a car drive control unit may include such configuration data as drive speed, drive type, etc.. Other configuration data may include number of floors, distance between floors, allowed landing floors, etc..

Conventionally, some of the various modular devices of the elevator system are provided by a specialist manufacturer. These are delivered first to a supplier factory (which is the factory contracted to supply the elevator system) in order to install the control and/or configuration data. This may involve opening of each of the packages, linking (in an academic sense) the product to a particular elevator system installation and installing the appropriate data in the memory of each of the modular devices. The control data installation may or may not require the product to be built into the elevator system at the factory. It could, for example, only involve powering of the device and installing the data or insertion of a pre-programmed memory. The process of having to pre-program the various modules increases the time taken for, and complexity of, installing an elevator system.

Further, during maintenance or upgrading of a particular modular device of the elevator, after installation, the data will need to be re-entered. This can be done on site by entering the data into a RAM/FLASH/EEPROM or similar non-volatile memory device(s) or battery/capacitor or otherwise backed volatile memory device(s), or replacement of the memory with an entirely new memory. This data entry requires access to the modular device and usually requires removal of a cover of the modular device. Access to certain modular devices can be particularly troublesome. For example, entry to an elevator shaft may be necessary.

Furthermore, in the conventional system, a maintenance engineer is required to read-out data for each modular device for further maintenance reference. This reference data may later be used for re-entering the data during replacement of the modular device.

One such known prior art system is shown in Figure 1. Reference numerals 2, 4 and 6 represent, respectively an operational command sub-system operating as a central command unit, a drive sub-system for ascending/descending the elevator car and a door sub-system for opening/closing the elevator doors. Reference numeral 8 represents the control and/or configuration data specific to the system, which the operational command sub-system 2 uses

to perform the central control. The data 8 includes the number of floors, drive type, door type and fixtures. The operational command sub-system 2 uses the communication link 14 to provide control signals for controlling operation of the elevator system to the various other sub-systems. The drive sub-system 4 also includes its own data 10, such as the number of floors, the speed, the drive type, the direction and the machine. The door sub-system 6 is also provided with its own data 12, such as door type, door speed, door width and direction.

The state of the art for other conveying systems, such as escalators, suffers from similar problems.

Statement of the Invention

The present invention solves the above mentioned problems with the prior art by providing a central control unit as defined in claim 1. In particular, this central control unit comprises a memory having stored on it the control data for controlling the operation of a function of at least one other modular device.

The characterising feature of claim 1 solves the above problems by providing a central memory location which stores the control and/or configuration data for control of at least one other modular device of the system. This permits the entry of data into just the central memory and permits subsequent transfer to the modular device. Thus, the problem of having to enter control data and/or configuration data into each modular device during installation or maintenance is overcome.

The present invention also provides a conveying system directed to this solution. The conveying system comprises at least one modular device for performing a conveying function in dependence on control data, the above central control unit and a communication means between the two.

A conveying system is used in the present disclosure to include, for example, passenger conveyors such as elevator systems, escalator systems and passenger conveyors and also conveyors for goods.

The present invention further provides a method of providing control data to a modular device. The method is also directed to the above solution. The method includes the step of transmitting control data to the modular device from the central control unit.

Preferably, the modular device includes its own memory to allow download of the control data from the central control unit.

According to a preferred embodiment of the invention, the central control unit is also for controlling the performance of a function of the conveying system and its own control data is also stored in the central memory. Alternatively, the central control unit could be a central control means which does not perform a function of the conveying system other than storing and providing the data.

In preferred forms, the conveying system includes a plurality of control devices, each one for controlling a modular device and each one having its own memory having stored thereon a suitable set of control data.

The control means of the modular device(s) may also include a status flag, which indicates whether the control data is still to be downloaded. The status information can be transferred to the central control means over the communication means. This allows the second control means to determine whether control data is needed or not.

The memories may be of a type which do not lose their stored content when power from a main power source is lost, such as EEPROMs, FLASH, FRAM or similar or even battery or capacitor backed volatile memory devices.

The modular device of the system may preferably include a driving device. In other preferred forms, the modular device is a door opening/closing device or an elevator car ascending/descending device.

Further advantageous embodiments are defined in the dependent claims and are also set out in the below detailed description of the invention.

Preferred embodiments of the invention will now be described by way of example only with reference to the drawings. In the following, an elevator system is described. However, it is envisaged that the present invention is also applicable to other conveying systems, such as an escalator system or other passenger conveyors.

Brief description of the drawings

Figure 1 shows a prior art elevator system.

Figure 2 shows an elevator system according to the present invention.

Detailed description of the invention

An overview of the system according to the present invention is shown in Figure 2. As can be seen, the operational command sub-system 2 includes a plurality of sets of control data 8, 10, 12, which are for use by the operational command sub-system 2, the drive sub-system 4 and the door sub-system 6, respectively. In the illustrated embodiment, the sub-systems 2, 4 and 6 perform a function of the elevator system in dependence on its respective set of data 8, 10 and 12.

The sub-systems are preferably provided with a respective memory. The operational command sub-system's memory, will store the control data for its own operation and also for controlling the operation of the sub-systems 4 and 6. The operational command sub-system 2 will communicate the set of data 10 to the drive sub-system 4 and will communicate the set of data 12 to the door sub-system 6. This communication is preferably over the main communication link 14. The sub-systems 4 and 6 will download to their memories their respective data 10, 12 sent to them, which they need for performing their function. The drive sub-system 4 is also shown to have stored on its memory the control data 8 for the operational command sub-system 2. This provides a back-up of the operational sub-system data.

Thus, the present invention proposes to have a central memory device for storing control data and/or configuration data specific to the elevator installation, for each sub-system or modular device of the elevator system. The central memory will be accessed by a central controller of the elevator system and the data sent to the various modular devices of the elevator system at

the appropriate time. The sub-systems of the elevator system could include a door sub-system, a load-weighing sub-system, an elevator car drive sub-system, a rescue sub-system or any other sub-system for performing a specific function of the elevator system.

Each sub-system will include its own memory device and control circuitry. Each sub-system will operate, in performing its respective function, under the control of its own control circuitry. The control circuitry needs the data stored in the memory in order to provide proper control of the sub-system.

The data stored in the central memory is sent to the respective sub-systems for storing in their respective memories, by the central controller. This means that the control data needs only be entered into the central location and can then be transferred to the respective sub-systems automatically. Entry of control data into every sub-system is not necessary.

The memory of the central control unit and each sub-system control unit may be an EEPROM or other non-volatile memory, such as FLASH, FRAM or similar memory. The memories can also include volatile memory devices with an internal back-up energy supply in case of a loss of the main power supply, e. g. battery or capacitor backed volatile memories.

The control data can be sent over an internal communication link of the elevator system, which may also be used for sending control signals between the various sub-systems of the elevator system. For example, the communication link may also be used for instructing each of the various sub-systems with a command to perform a certain action. The sub-systems will then respond to the command signal by carrying out the action and using the data stored in its memory to do so. The use of a communication link already required for other purposes is advantageous as no further communication link is needed and no special adaptation of the control circuitry of each of the modular devices is needed to provide additional communication ports. It is envisaged, however, that a dedicated communication means could be provided instead.

The central controller sends the appropriate data to each sub-system over the communication link. The central controller will have the data for each sub-system on its memory.

The central controller is, in the illustrated embodiment, an operational command sub-system 2 of the elevator system to direct proper operation of the elevator system as a whole, that is, provide commands for carrying out a specific action, receiving responses from other sub-systems and reacting thereto. The operational command sub-system 2 is, thus, for supervising control of the other sub-systems. For example the central control could also be operative to receive a hall call signal and provide a dispatch signal to an elevator car, possibly, in a multiple elevator system, also including the step of deciding which elevator should be dispatched. These signals may be sent over the communication link that is also used to transmit the data. Alternatively, the central controller may be a dedicated device for providing the data to each sub-system.

In order to establish when to send the parameters, each sub-system may include status information of some kind indicating whether or not the data has yet been installed. The sub-system may include a "not programmed" flag for example. The status information could be stored in the memory device of each controller of each sub-system. The controller of a particular sub-system could send the status information to the central controller, e.g. the operational command sub-system, upon initial connection of the device to the elevator system or upon initial powering of the sub-system and the central controller will respond by sending the control data. Alternatively, the central controller could interrogate each control device, rather passively waiting for the data to be sent, upon initial powering of the elevator system as a whole.

The content of the central memory may comprise an array for each set of data for each sub-system and an associated unique identifier. The unique identifier is useful to associate the array of data with the appropriate sub-system. For example, the central controller could be processing an instruction to send data to a door subsystem and the instruction will include an identifier for the door sub-system, which can be related to the identifier associated with the appropriate array of data. The arrays of data in the memory are searchable by the unique identifier so that the appropriate data can be retrieved. A respective unique identifier could be stored in the memory of each sub-system and sent with the status information as described above.

Connection of a sub-system involves the physical integration of the sub-system into the elevator system, an electrical connection of the sub-system so that power can be provided and

also a communications connection to the communication link so that control and/or configuration data and operation data can be sent or received.

In a new installation, each sub-system will require the data to be downloaded after connection to the elevator system. The data will need to be set-up in the supplier factory or on-site, but only in the central memory, not in the memory of each sub-system. The default configuration for the memory of each new sub-system will be for the "not programmed" flag to be set true so that data is automatically downloaded to a new sub-system. The sending of the data may be in response to the initial powering of each respective sub-system or the data may be sent in response to the initial powering of the system in its entirety, after each sub-system is compiled and the whole system is installed.

The central control unit may include a comparing algorithm, which checks the data it has for a modular device with the data the modular device has. If the comparison shows up an inconsistency, then the data of the modular device is replaced or updated with the data from the central control unit.

The present invention allows one, some or all of the modular devices of a new installation to be produced in a location different from the elevator system supplier factory and sent directly to the installation site. There is no need to deliver the product to the installation site via the elevator system supplier factory to allow data to be installed.

The present invention is also applicable when a sub-system is being replaced in an existing system for any reason. The sub-system will only need to be connected to the elevator system and powered on for the control data to be automatically downloaded from the central memory. There will be no need for an engineer to install or enter all of the control data into the sub-system and there is no need for making or using of read-outs of control data. Further, access to the sub-system before installing it for the purposes of programming control data, e.g. by removing covers, is not necessary. Thus, the sub-system can be delivered directly to the site without having to be programmed at the elevator system supplier factory and without having to be programmed by an engineer on site.

The central memory of the elevator system may not be the only memory device of a sub-system storing control data for other sub-systems. The reason for this is that there is a

possibility that the central memory device or the central controller of the central sub-system could fail. The data for all of the sub-systems of the elevator system could then be lost. This would require re-entering of all the data into the central sub-system, which would be an arduous task. In order to avoid such a situation at least one other sub-system could include the data for the central sub-system, all of the data for each other sub-system of the elevator system and its own control data.

In another envisaged embodiment, the central control unit of at least two groups of elevators could be in communication with each other and could each have the data of at least one other group of the groups of elevators stored on it. This provides a useful back-up of the data, which can be transferred to the memory of the other central control unit for recovery purposes.

While the preferred embodiment of the invention has been described with respect to an elevator system, the present invention is applicable to other conveying systems, such as an escalator system.

Claims

1. A central control unit of a conveying system, comprising:
a memory having stored on it control data and/or configuration data for controlling the operation of a function of at least one other modular device.

2. The central control unit of claim 1, wherein the memory has stored on it respective control and/or configuration data for controlling the operation of a plurality of modular devices.

3. The central control unit of claim 1 or 2, comprising a transmission device, said central control unit operative to transmit the or the respective data to the or the respective modular device with the transmission device.

4. The central control unit of claim 3, said central control unit responsive to the receipt of a status signal to transmit the or the respective data with the transmission device; said status signal indicating whether or not a modular device needs data to be downloaded.

5. The central control unit of claim 3 or 4, said central control unit to transmit operational commands to the or each at least one other modular device with said transmission device.

6. The central control unit of any preceding claim, wherein the memory of the central control unit is of the type which does not lose its stored content when a loss of power occurs.

7. The central control unit of claim 6, said memory being a non-volatile memory(ies) or battery/capacitor backed or otherwise backed volatile memory device(s).

8. The central control unit of any preceding claim, wherein data stored in the memory is associated with an identifier in the memory to identify the modular device it provides data for.

9. The central control unit of any preceding claim, said memory having stored on it central control and/or configuration data, said central control unit for controlling a function of the passenger conveying system in dependence on the central data.

10. The central control unit of any preceding claim, said configuration data being specific to the conveying system.

11. A conveying system, comprising:

at least one modular device to perform an elevator function in dependence on control and/or configuration data;

a central control unit according to any preceding claim; and

a communication means between the or each at least one modular device and the central control unit, said communication means for communicating the data from the central control unit to the or each at least one modular device.

12. The system of claim 11, wherein the or each modular device comprises a memory and a control unit, said control unit to control the modular device in dependence on data stored in the memory.

13. The system of claim 11 or 12, comprising a plurality of said modular devices, each device comprising a respective control unit and a respective memory having stored on it respective control and/or configuration data, each control unit to control its modular device in dependence upon the data stored in its memory.

14. The system of claim 12 or 13, wherein the memory of the or each modular device is of the type which does not lose its stored content when a loss of power occurs.

15. The system of claim 14, said memory being a non-volatile memory.

16. The system any of claims 11 to 15, the memory of the central control unit having stored on it central control and/or configuration data, said central control unit for controlling a function of the system in dependence on the central data and wherein the memory of at least one other modular device has the central data stored on it.

17. The system of any of claims 11 to 16, wherein said communication means comprises a main control link of the elevator system connected to transfer system control signals from the central control unit.

18. The system of any of claims 11 to 17, wherein the or each at least one modular device comprises a status flag indicating whether or not data needs to be downloaded and a transmission device for transmitting the status information to said central control unit.

19. The system according to any of claims 11 to 18, wherein the at least one modular device comprises a driving means for providing a mechanical driving of a particular function of the system.

20. The system of claim 19, said driving means comprising a motor.

21. The system of any of claims 11 to 20 being an elevator system.

22. The system of any of claims 11 to 20 being an escalator system.

23. The system according to claim 21, wherein said at least one modular device comprises a door device for performing opening/closing of an elevator door.

24. The elevator system according to claim 21 or 23, wherein said at least one modular device comprises a hoist device for performing ascending/descending of an elevator car.

25. A method of providing control and/or configuration data to a modular device for performing a function of a conveying system in dependence on the data, said method comprising:

transmitting the data stored on a memory of a central control unit to the modular device.

26. The method of claim 25, wherein said transmitting step comprises downloading the data stored on the memory of the central control unit to a memory of the modular device.

27. The method of claim 25 or 26, comprising storing the transmitted data on a memory of the modular device.

28. The method of claim 25, 26 or 27, comprising connecting said modular device to a communication means in communication with a second control means, said second control

means to control the modular device in dependence on data stored on a memory of the modular device.

29. The method of claim 28, comprising the central control unit detecting the connection of said modular device, said transmission of the data being in response to said connection.

30. The method of claim 29, said detection of the connection of the modular device comprising the modular device transmitting status information indicating whether or not data is needed.

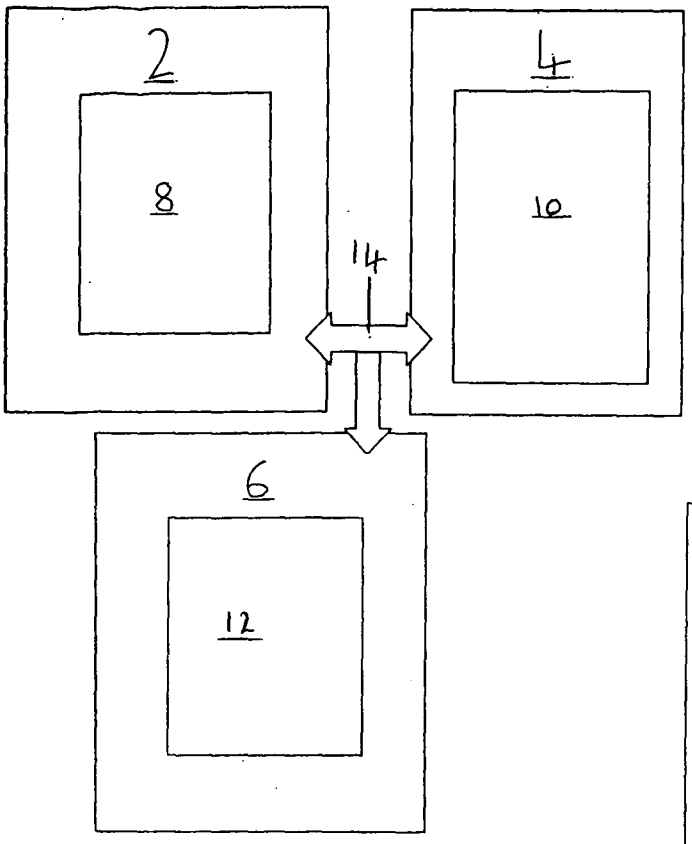

Fig. 1

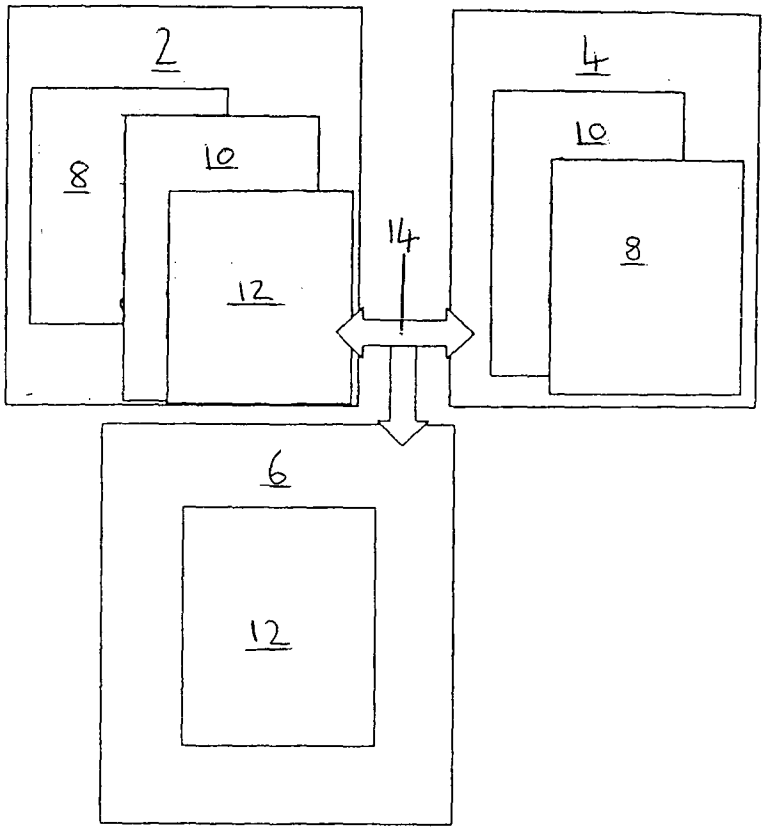

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B66B1/00

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)
B66B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 May 2007	16/05/2007

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/004245

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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