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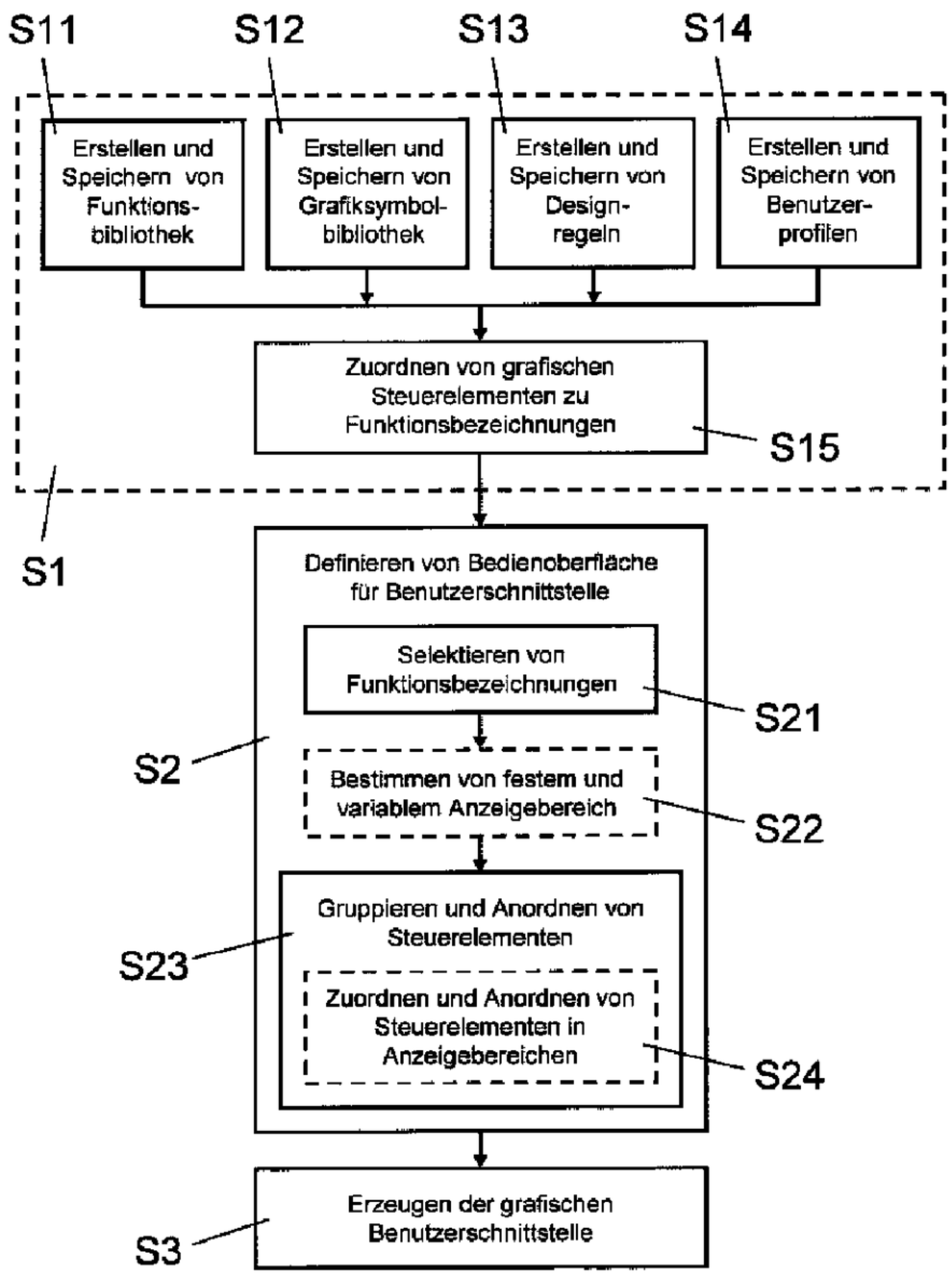

Fig. 3

(57) Abrégé/Abstract:
In order to produce a graphical user interface for operating one or more machines, a graphical symbol library having a plurality of graphical control elements is created and stored (S12). Furthermore, a function library comprising a plurality of function

CA 2803041 A1 2012/01/05

(21) 2 803 041

(13) A1

(57) Abrégé(suite)/Abstract(continued):
designations having associated classification information is created and stored (S11). Function designations are selected (S21) from the function library for a user interface, and graphical control elements from the graphical symbol library (27) are associated (S15) with the function designations. The graphical control elements are grouped and arranged (S23) in the user interface on the basis of the classification information, class-specific rules, and stored design rules. The user interface is displayed on a touch-sensitive display in accordance with the size of the display and function rights of a user. An electromechanical control element is provided for inputting a control command regardless of rights.

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[Fortsetzung auf der nächsten Seite]

(54) **Title**: USER INTERFACE SYSTEM FOR OPERATING MACHINES

(54) **Bezeichnung** : BENUTZERSCHNITTSTELLENSYSTEM ZUM BEDIENEN VON MASCHINEN

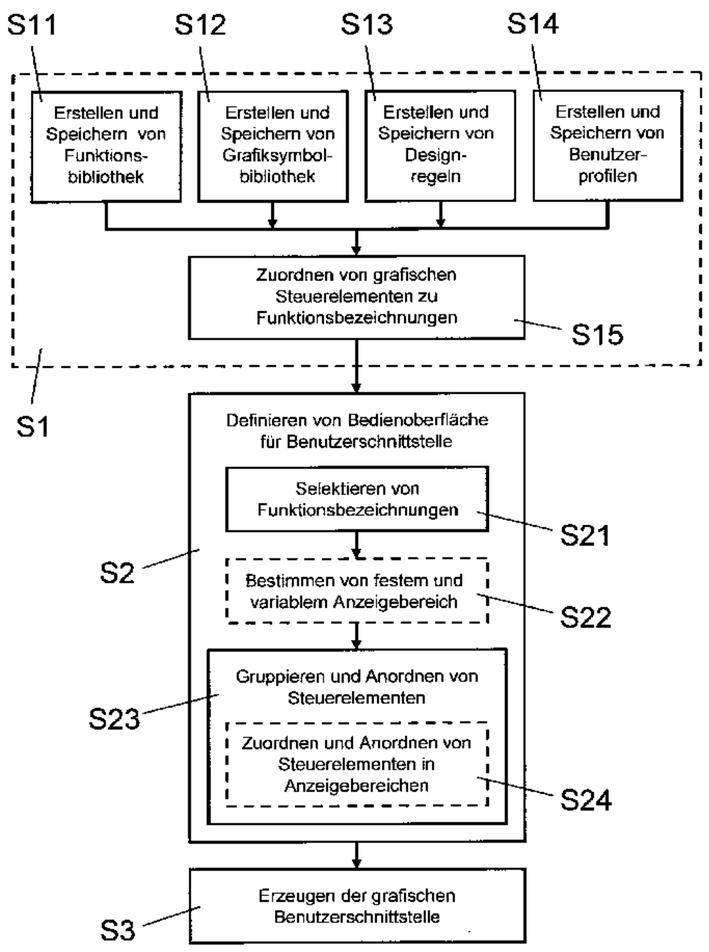

Fig. 3

S11 Creating and storing a function library
S12 Creating and storing a graphical symbol library
S13 Creating and storing design rules
S14 Creating and storing user profiles
S15 Associating graphical control elements with function designations
S2 Defining operation interface for user interface
S21 Selecting function designations
S22 Determining fixed and variable display area
S23 Grouping and arranging control elements
S24 Associating and arranging control elements in display areas
S3 Generating the graphical user interface

(57) Abstract: In order to produce a graphical user interface for operating one or more machines, a graphical symbol library having a plurality of graphical control elements is created and stored (S12). Furthermore, a function library comprising a plurality of function designations having associated classification information is created and stored (S11). Function designations are selected (S21) from the function library for a user interface, and graphical control elements from the graphical symbol library (27) are associated (S15) with the function designations. The graphical control elements are grouped and arranged (S23) in the user interface on the basis of the classification information, class-specific rules, and stored design rules. The user interface is displayed on a touch-sensitive display in accordance with the size of the display and function rights of a user. An electromechanical control element is provided for inputting a control command regardless of rights.

(57) Zusammenfassung: Zum Erzeugen einer grafischen Benutzerschnittstelle für die Bedienung von einer oder mehreren Maschinen wird eine Grafiksymbolbibliothek mit einer Vielzahl von grafischen Steuerelementen erstellt und gespeichert (S12). Überdies wird eine Funktionsbibliothek erstellt und gespeichert (S11), welche eine Vielzahl von Funktionsbezeichnungen mit zugeordneten Klassifizierungsinformationen umfasst. Aus der Funktionsbibliothek werden für eine Benutzerschnittstelle Funktionsbezeichnungen selektiert (S21) und den Funktionsbezeichnungen grafische Steuerelemente aus der Grafiksymbolbibliothek

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WO 2012/000124 A3

WO 2012/000124 A3

LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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(27) zugeordnet (S15). Die Gruppierung und Anordnung (S23) der grafischen Steuerelemente in der Benutzerschnittstelle erfolgt basierend auf den Klassifizierungsinformationen, klassenspezifischen Regeln und gespeicherten Designregeln. Die Darstellung der Benutzerschnittstelle auf einer berührungsempfindlichen Anzeige erfolgt abhängig von der Grösse der Anzeige und Funktionsberechtigungen eines Benutzers. Für eine berechtigungsunabhängige Eingabe eines Steuerbefehls ist ein elektromechanisches Steuerelement vorgesehen.

USER INTERFACE SYSTEM FOR OPERATING MACHINES

Technical Field

The present invention relates to a user interface system for operating machines. The present invention relates especially to a computer-based user interface system and a computer-implemented method for generating graphical user interfaces for operating one or more machines, especially printing machines, printed-product processing machines and installations.

Prior Art

For operating machines, user interfaces having graphical operating interfaces are becoming increasingly used which are displayed on a touch-sensitive display, i.e. on a touch-sensitive screen or "touch screen" for the output and input of data and instructions. The reason for this is not lastly because such touch-sensitive displays provide for a more flexible and cost-effective adaptation than, for example, man-machine interfaces having electromechanical operating elements such as conventional keys, keyboards or moving computer mice.

The subject matter of WO **07025396** A is a graphical user interface which consists both of a touch screen and of mechanical keys and rotary switches. A method and a device for controlling sequences of one or more machines by means of an operating unit constructed as man-machine interface is disclosed. The sequences and parameters are programmed and also changed operatively by the user at the operating interface of the operating unit, screen-supported by means of input points. The operating interface is divided over two control panels. The first control panel has a relatively large screen and, apart from displaying operating states, tables, lists etc., is mainly used also for sequence programming. The second control panel serves as a central function for operative interventions. Both control panels are designed for a data exchange in both directions.

DE **112005001152** describes a method for retrieving and displaying technical data for an industrial facility. The subject matter of DE **112005001152** is a method for transferring a user interface on a mobile computer having relatively small display and input devices to a larger terminal which is connected to an industrial facility. As soon as a user who operates, e.g. a portable PDA (personal digital assistant) approaches the large screen of the industrial facility, a wireless facility in the vicinity of the large screen recognizes a wireless facility integrated in the PDA and a connection is set up. The user can subsequently mark and select the corresponding terminal. The large screen shows, e.g., a copy of the same display as on the PDA of the user. By providing a number of entities of a graphical user interface, parameters of a special machine can be rapidly retrieved and manipulated in this manner.

The subject matter of EP **1156437** A**2** is a system and method for monitoring a printing production workflow. The system comprises workflow management software which monitors and facilitates the method steps of the workflow, namely the beginning of the order, the order inflow, the order handling, the printing production and the order completion. The workflow management software comprises an integrated object-oriented interface which visually represents the workflow and by means of which it is possible to intervene in the workflow. In addition, the software provides the functionality of creating, processing and changing composite documents as ordered collections of documents. The workflow management software provides for, e.g., cutting-out, copying, inserting, displacing actions on one page or on several pages of a document. This functionality is preferably achieved by means of pull-down menus, inserted dialog windows, option strips or symbols. In addition, the results of the actions are displayed in a visual representation of the document on the display of the workstation. Display windows are used for the intuitive visual representation of the work which must be performed at a workstation.

In DE **102008001665** A, methods for generating uniform user interfaces for controlling textile machines are described. Apart from basic application programs, additional application programs with additional functionalities are frequently implemented which, as a rule, are created by different programmers

and have user interfaces according to different operating philosophies having different appearances. This leads to a high expenditure on training for the operators and to an increased risk of operating errors. In addition, the time expended for the operation during the use of the textile machine is increased. To avoid this, the use of an independent graphical program module is proposed in DE **102008001665** A in which display elements and display routines are stored. Thus, an additional application program can be developed largely independently of the basic application program and the operator is automatically presented with a uniform appearance with a uniform operating philosophy both in the basic application area and in the additional application area. DE **102008001665** A thus supports a manufacturer of textile machine controls in the development of user interfaces which are uniform for basic applications and their additional functions.

The operation of machines in industry, especially of machines in the printing and printed-product processing industry requires user interfaces with regard to configuration, control, monitoring, maintenance and editing and representation of business and operational information for very different business areas, machine types, functions, users and user authorizations, both at the control level comprising a number of machines connected to one another and at the level of individual machines or at the station level with parts of individual machines. As a rule, proprietary user interfaces of the manufacturers of the machines are used which, overall, leads to nonuniform operating interfaces if machines and/or stations of different manufacturers and/or machine generations are used in combination. However, efficient training, utilization, development and adaptation require graphical operating interfaces which are as uniform as possible, which are not available in the prior art at present.

Furthermore, it is demanded that the operating devices for the graphical operating interfaces can be arranged or mounted cost-effectively and on or at the respective machines or machine components in the industrial environment. In this context, restrictions in dimensions often exist since various logistical, safety-related or operative boundary conditions must be met in the industrial

environment. Such boundary conditions regularly lead to the operating interfaces being limited to screen sizes of **5** to **15** inches.

Description of the Invention

It is an object of the present invention to provide a computer-based user interface system for operating machines and a computer-implemented method for generating graphical user interfaces for operating one or more machines which do not have at least some disadvantages of the known systems.

The object is achieved by the features of the independent claims. Further advantageous embodiments are also obtained from the dependent claims and the description.

Initially, the expression “operating one or more machines” also includes the most varied activities for the configuration, control, monitoring, maintenance, higher-level production planning of in each case one machine, one machine part (station) and/or one installation comprising a number of machines in in each case one or more production lines, and also comprises the retrieval, editing and representation of operational, technical and economic business information.

One embodiment of the invention is characterized by the fact that for generating graphical user interfaces for operating one or more machines, a graphical symbol library having a plurality of graphical control elements is stored, that a function library having a plurality of function designations is stored to which classification information items are in each case allocated, that function designations are selected from the function library for the user interface, that graphical control elements from the graphical symbol library are allocated to the function designations, that the graphical control elements allocated to the selected function designations are grouped and arranged in the user interface on the basis of the classification information items, and that the graphical user interface is generated for representation on a display on the basis of the graphical symbol library and the determined grouping and

arrangement of the graphical control elements. The creation and use of a graphical symbol library having graphical control elements and of a function library having classified function designations enables uniform user interfaces to be developed and generated both as stored program code before the use for the machine operation and dynamically during the operation of the machines.

In one variant of the embodiment, the classification information items comprise function groups, function subgroups, application identifiers, machine type identifiers, business area identifiers, product type identifiers, product identifiers, process identifiers and/or hierarchy stages, and the graphical control elements are grouped and arranged on the basis of class-specific rules.

In a further variant of the embodiment, the graphical control elements are additionally grouped and arranged in the user interface on the basis of stored design rules which comprise the number of graphical control elements represented simultaneously in the user interface, the number of graphical control elements arranged in a horizontal row, the number of graphical control elements arranged in a vertical column, the minimum size of graphical control elements, the permissible combinations of graphical control elements, the color combinations of adjacent graphical control elements, the color combinations of graphical control elements arranged in a horizontal row, and/or the color combinations of graphical control elements arranged in a vertical column.

In a further variant of the embodiment, the allocation of graphical control elements from the graphical symbol library to the function designations takes place in each case in dependence on the classification information items which are allocated to the relevant function designation.

A further embodiment of the invention is characterized by the fact that a computer-based user interface system for operating machines comprises a touch-sensitive display for representing a graphical operating interface and for

accepting and outputting useful data with function commands and function parameters via the operating interface, that a communication module for exchanging the useful data with one or more of the machines, and a presentation module, inserted between machines and display, for representing the operating interface on the display in dependence on system parameters are provided. The presentation module provides for a dynamic adaptation of the presentation of user interfaces to system-specific states and conditions during the operation of the machines.

In one variant of the embodiment, the presentation module is configured for representing the operating interface on the display in dependence on a defined size of the display. The size of a display is intended to be the size of the display area (and, in the case of a touch-sensitive display, as a rule, the size of the corresponding touch-sensitive input area), that is to say the screen size, e.g. the screen diagonal or the screen height and width.

In a further variant of the embodiment, the machines have different technology platforms, and the user interface system comprises an adaptation module, inserted between technology platforms and presentation module, for the platform-independent exchange of useful data between machines and operating interface.

In a preferred variant of the embodiment, the presentation module is configured for representing the operating interface on the display in dependence on authorizations of a user, logged-in or registered, with different graphical control elements and with a different arrangement of these control elements.

In a further variant of the embodiment, the user interface system comprises an electromechanical control element for the authorization-independent input of a control command.

In one variant of the embodiment, the operating interface has a number of control elements represented as graphical symbols for a direct input of control

commands, which are arranged in a permanently defined area of the display, and the operating interface has a variable area which is arranged outside the permanently defined area of the display and is provided for temporarily available control elements and for inputting and outputting useful data.

In a further variant of the embodiment, the presentation module is configured for providing, in dependence on a defined size of the display, a first part-area of the display for permanently available control elements and a second part-area of the display for temporarily available control elements.

In one variant of the embodiment, the presentation module is configured for arranging, in dependence on a defined size of the display, the second part-area of the display to be at least partially overlapping the first part-area of the display.

A further embodiment of the invention is characterized by the fact that, for generating graphical user interfaces for operating one or more machines, function designations are acquired, that hierarchy stages and graphical control elements are allocated to the function designations, that the graphical control elements are arranged in the user interface in dependence on the hierarchy stages of the allocated function designations, wherein graphical control elements of function designations having a high hierarchy stage are arranged in a permanently defined area of the user interface and graphical control elements of function designations having a low hierarchy stage are arranged in a variable area of the user interface outside the permanently defined area of the user interface, and that the graphical user interfaces are generated for representation on a display in each case with the arrangement of the graphical control elements of function designations having a high hierarchy stage in the permanently defined area of the user interface.

In one variant of the embodiment, the size of the permanently defined area of the user interface and the size of the variable area of the user interface are determined in dependence on the size of the display.

In a further variant of the embodiment, the size of the permanently defined area of the user interface and the size of the variable area of the user interface are determined in dependence on a number of authorized functions of a user.

A further embodiment of the invention is characterized by the fact that, for generating graphical user interfaces for operating one or more machines, function designations are acquired, that user identifications are acquired, that function designations are allocated to user identifications, that graphical control elements are allocated to the function designations, that user-specific arrangements of the graphical control elements are determined on the basis of the allocation of function designations to user identifications, and that the graphical user interfaces are generated for representation on a display in each case for a user on the basis of the relevant user-specific arrangement of the graphical control elements.

In one variant of the embodiment, the user-specific arrangement of the graphical control elements is determined on the basis of defined rules with color composition rules, symbol combination rules and/or design rules.

A further embodiment of the invention is characterized by the fact that a device for generating graphical user interfaces for operating one or more machines comprises a data acquisition module for accepting and storing function designations, a data memory for storing allocations of hierarchy stages and graphical control elements to the function designations and a layout module for arranging the graphical control elements in the user interface in dependence on the hierarchy stages of the associated function designations. In this context, graphical control elements of function designations having a high hierarchy stage are arranged in a permanently defined area of the user interface and graphical control elements of function designations having a low hierarchy stage are arranged in a variable area of the user interface outside the permanently defined area of the user interface. The device comprises also an interface generator for generating the graphical user interfaces for representation on a display in each case with the arrangement of the graphical

control elements of function designations having a high hierarchy stage in the permanently defined area of the user interface.

In one variant of the embodiment, the layout module is configured for determining the size of the permanently defined area of the user interface and the size of the variable area of the user interface in dependence on the size of the display.

In a further variant of the embodiment, the layout module is configured for determining the size of the permanently defined area of the user interface and the size of the variable area of the user interface in dependence on a number of authorized functions of a user.

A further embodiment of the invention is characterized by the fact that a device for generating graphical user interfaces for operating one or more machines comprises a data acquisition module for accepting and storing function designations and user identifications, a first data memory for storing allocations of function designations to user identifications and a second data memory for storing allocations of graphical control elements to the function designations. The device comprises also a layout module for determining user-specific arrangements of the graphical control elements on the basis of the allocation of function designations to user identifications, and an interface generator for generating the graphical user interfaces for representation on a display in each case for a user on the basis of the relevant user-specific arrangement of the graphical control elements.

In a further variant of the embodiment, the layout module is configured for determining the user-specific arrangement on the basis of defined rules with color composition rules, symbol combination rules and/or design rules.

A further embodiment of the invention is characterized by the fact that a device for generating graphical user interfaces for operating one or more machines comprises a first data memory for storing a graphical symbol library having a plurality of graphical control elements and a second data memory for storing a

function library having a plurality of function designations which are in each case allocated classification information items. The device also comprises a data acquisition module for accepting selections of function designations from the function library for the user interface and a third data memory for allocating graphical control elements from the graphical symbol library to the function designations. The device is also provided with a layout module for grouping and arranging the graphical control elements, allocated to the selected function designations, in the user interface on the basis of the classification information items and comprises an interface generator for generating the graphical user interface for representation on a display on the basis of the graphical symbol library and the determined grouping and arrangement of the graphical control elements.

In one variant of the embodiment, the layout module is configured for grouping and arranging the graphical control elements in the user interface also on the basis of stored design rules.

In a further variant of the embodiment, the device also comprises an element assignment module which is configured for allocating the graphical control elements from the graphical symbol library to the function designations in each case in dependence on the classification information items which are allocated to the relevant function designation.

A further embodiment of the invention is characterized by the fact that a device for operating one or more machines comprises a touch-sensitive display with a graphical user interface which has a number of control elements represented as graphical symbols, that the control elements are allocated to functions for which a logged-in or registered user is authorized and that the device comprises an electromechanical control element for the user-independent input of a control command.

A further embodiment of the invention is characterized by the fact that a device for operating one or more machines comprises a touch-sensitive display with a graphical user interface which has a number of control elements represented

as graphical symbols, that the control elements are arranged in a permanently defined area of the display, that the graphical user interface has a variable area which is arranged outside the permanently defined area of the display and that the variable area of the display is defined in dependence on a size of the display.

Brief Description of the Drawings

In the text which follows, an embodiment of the present invention will be described with reference to an example. The example of the embodiment is illustrated by the following attached figures:

Figs. **1**, **1**a, **1**b, **1**c: show block diagrams which schematically illustrate various embodiments of user interface systems having a device for operating one or more machines.

Fig. **2**: shows a block diagram of a device for generating graphical user interfaces for operating one or more machines.

Fig. **3**: shows a flowchart of a method for generating graphical user interfaces for operating one or more machines.

Approaches for Carrying out the Invention

In figures **1**, **1**a, **1**b and **1**c, the reference symbol **1** designates a user interface system for operating one or more machines M**1** to Mn, in in each case one or more production lines, especially machines for printing systems (such as so-called rotations) and printed-product processing systems, comprising printing machines, conveyors and collection systems for collecting (in the wider sense) product collections of a number of products by carrying together, inserting or collecting (in the narrower sense), processing installations for inserting, paging, stapling, bonding, cutting, welding, and/or stacking including feeders, parcel hoists, wad feeders, winding stations and tiring machines and paper dispatch systems, digital on-demand book production system and

distribution and dispatch installations (mail room). The user interface system also relates to machine units which fulfill additional functions such as, for example, attaching adhesive tags (e.g. Memostick®) or printing in the workflow and which are here also called machines. The products are, in particular, flat, flexible printed products of different thickness but also other flat products such as, for example, data media or other attachments.

The user interface system **1** comprises at least one operating device **10** having a display **14**, preferably a touch-sensitive display **14**, for representing a graphical operating interface designated by the reference symbol **15**, or graphical user interface, respectively. The user interface system **1** comprises typically a number of operating devices **10** and displays **14** which, depending on embodiment, are arranged as independent devices with their own housing at different distances from or directly at the machines M**1**, Mn (e.g. Fig. **1**a and **1**b) or which are constructed together with one of the machines M**1**, Mn in a common housing (e.g. Fig. **1**c). The displays **14** of the operating devices **10** have different display sizes which differ from one another by a multiple, for example display sizes having a screen diagonal of **5**", **10**" or **15**", but also much larger screens, preferably having a picture aspect ratio of **16**:**9**. Touch-sensitive systems (touch screens) used can be, e.g., inductive or print-related sensor technologies which, in particular, also take into account industrial situations.

As is shown in figures **1**, **1**a, **1**b and **1**c, the user interface system **1** has a number of functional modules, especially a communication module **11**, an adaptation module **12** and a presentation module **13**. The functional modules are designed preferably as programmed software modules, which comprise computer program code for controlling one or more processors which is stored on a computer-readable data medium connected permanently or removably to the processors.

As is shown diagrammatically in Fig. **1**, the operating device **10** and the one or more machines M**1**, Mn are connected via a communication link **100**. Above the communication link **100**, a communication layer **110**, an overlying

technology layer **120** and a presentation layer **130** lying above that are arranged. Data and function call-ups are exchanged in each case over the layer boundaries.

The communication layer **110** comprises communication modules **11** for executing communication protocols for the data and signaling exchange between the operating device **10** and the machines M**1**, Mn. Depending on design, the communication link **100** is a conductorless (wireless) or conductor-connected (e.g. wired) communication interface between two computers or processors (e.g. Fig. **1**a and **1**b), for example a local area network (LAN) or system bus, or a software interface executed on a common computer or processor (e.g. between the operating device **10** and the machine M**1** in Fig. **1**c).

The technology layer comprises different technology platforms in the machines M**1**, Mn and at least one adaptation module **12** arranged between display **14** and machines M**1**, Mn, which module is constructed on a computer or processor of the operating device **10** (e.g. Fig. **1**a) and/or of one or more of the machines M**1**, Mn (e.g. Fig. **1**b and **1**c). The different technology platforms comprise, for example, different computer operating systems, applications, development platforms, software libraries (frameworks) and/or software interfaces for applications, functions, data exchange and/or signaling. The adaptation module **12** provides for an adaptation to the different technology platforms and a platform-independent exchange of useful data between the machines M**1**, Mn and the operating interface **15** of the operating device **10**.

The presentation layer **130** comprises at least one presentation module **13**, arranged between the display **14** and machines M**1**, Mn, which module is constructed on a computer or processor, respectively, of the operating device **10** (e.g. Fig. **1**a) and/or of one or more of the machines M**1**, Mn (e.g. Fig. **1**b and **1**c). The presentation module **13** is configured for representing the operating interface **15** during the operation of the machines M**1**, Mn (in real time) in dependence on current values of system parameters which relate to current system states, conditions and configurations of the user interface

system **1**, of system users and/or the machines M**1**, Mn. The presentation module **13** is especially configured for representing the operating interface **15** during the operation of the machines M**1**, Mn in dependence on the display size on the display **14**, for example, taking into consideration and applying defined design rules, classification information items, process flow structures and/or hierarchy stages which will be described later.

As is shown diagrammatically in figures **1**, **1**a, **1**b and **1**c, the operating interface **15** or user interface **15**, respectively, comprises a number of graphical control elements **153**, for example selectable and activatable knobs, function knobs, rotary knobs, riders, registers, shift registers, menus, etc., with different graphical symbols and/or letterings, the letterings in each case being produced in one of several selectable and configurable languages.

In one variant of the embodiment, the operating interface comprises a permanent area **152** and a dynamic area **151**. The permanent area **152** of the operating interface **15** has a permanent allocation and arrangement of graphical control elements **153** which are arranged, for example, in a defined area on the display **14**. The dynamic area **151** of the operating interface **15** which, for example, is also arranged in a defined area on the display **14**, in contrast, does not have a permanent but a dynamically changing allocation and arrangement of graphical control elements **153**, for example in dependence on the operating state of the machines M**1**, Mn or functions selected by the user. Depending on the variant of the embodiment and/or application, the variable area can overlap the permanent area at least partially temporarily during a defined time. The temporary and partial overlap of the part-areas is preferably linked to the size of the display **14** and limited to relatively small display versions, for example only for **5**" displays or, to a lesser extent with a great function or control element density or in the case of extensive volumes of information being output over the operating interface, also in the case of **10**" or even **15**" displays.

In one variant of the embodiment, the presentation module **13** is configured for representing the arrangement and formation of the permanent area **152** and of

the dynamic area **151** of the operating interface **15** during the operation of the machines M**1**, Mn (in real time) in dependence on the display size on the display **14**, for example taking into consideration and applying defined design rules, classification information items, process flow structures and/or hierarchy stages which will be described later.

In the case of complex systems, the dynamic area **151** can also be formed as a so-called scrolling display. Its movement can be provided to be horizontally or vertically scrolling. Because of system security, it is important that in this context the permanent area **152** displays the security-related functions in fixed manner in order to be able to access them rapidly. If in special embodiments, system-critical operating steps are also to be executed rapidly without acknowledgement dialogs, particular operating patterns can be provided (e.g. simultaneous activating of widely spaced virtual buttons with fingers of both hands or special movements on the touch-sensitive display). This is particularly necessary within the context of industrial situations since operating errors can here lead to damage or production disruptions.

The presentation module **13** is also configured for representing the operating interface **15** on the display **14** during the operation of the machines M**1**, Mn (in real time) user-specifically. The presentation module **13** is especially configured for representing the operating interface **15** in dependence on the stored authorizations of a logged-in or registered user with different graphical control elements and with different arrangement of these control elements. Even the arrangement and formation of the permanent area **152** and of the dynamic area **151** of the operating interface **15** is represented user-specifically on the display **14** in one variant. In this context, defined design rules, classification information items, process flow structures and/or hierarchy stages are again taken into consideration and applied, which will be described later.

As can be seen in figures **1**, **1**a, **1**b and **1**c, the operating device **10** is also provided with an electromechanical control element **16** which provides for a user- and authorization-independent and temporally undelayed input of a

control command or of a control value, for example for triggering an emergency or stop function when the display **14** and/or the graphical operating interface is disrupted, for example a switch or pushbutton and/or a rotary or sliding regulator.

In Fig. **2**, the reference symbol **2** designates a device for generating graphical user interfaces with operating interfaces **15** for operating one or more machines M**1**, Mn. The device **2** comprises one or more operatable computers **20** having one or more processors, a display **21** for representing a preferably graphical user interface **22** and data, and operating elements **200** for inputting data and commands.

As is shown diagrammatically in Fig. **2**, the device **2** also comprises a number of functional modules, particularly a data acquisition module **23**, a layout module **24**, an element assignment module **240** and an interface generator **25**. The functional modules are preferably constructed as programmed software modules which comprise computer program code for controlling one or more processors, which is stored on a computer-readable data medium connected permanently or removably to the device **2**. The device **2** also comprises a number of data memories with a function library **26**, a graphical symbol library **27**, a user database **28** and a rule database **29**. The function library **26** comprises data memories with function designations of defined functions, an allocation of hierarchy stages to the function designations **261**, an allocation of classification information items to the function designations **262** and an allocation of graphical control elements to the function designations **263**. The user database **28** comprises data memories with user profiles which comprises user identifications and associated authorizations, particularly authorizations for the various functions. In one variant of the embodiment, the function designations are also allocated process flow structures or process identifiers, respectively.

In the sections following, the functionality and possible step sequences for a method for generating graphical user interfaces for operating one or more machines are explained with reference to Fig. **3**.

In figure **3**, the reference symbol S**1** designates a block with preparatory steps for the generating graphical user interfaces **15**.

In step S**11**, a function library **26** is created and stored by means of the data acquisition module **23**. The data acquisition module **23** accepts function designations of defined functions for configuring, controlling, monitoring and maintaining the machines M**1**, Mn via the graphical user interface **22** and stores them in the function library **26**. The functions comprise, for example, read and write operations for setting or reading control and parameter values of the machines M**1**, Mn during a configuration and/or operating phase, and control commands for switching on, starting, stopping and switching off the machines M**1**, Mn. The data acquisition module **23** also enables the functions or their function designations, respectively, to be grouped and to be organized preferably hierarchically and/or in accordance with process flow structures. For this purpose, classification information items are acquired with function groups, function subgroups, application identifiers, machine type identifiers, business area identifiers, product type identifiers, product identifiers, process identifiers and hierarchy stages and are allocated to the function designations. On the basis of this, an allocation of hierarchy stages to function designations **261** and an allocation of classification information items to function designations **262** is created and stored in the function library **26**. Thus, functions for various types of functions, applications, machine types, business areas, production processes/sequences and product types can be distinguished and ordered hierarchically, for example in tree and/or menu structures.

In step S**12**, a graphical symbol library **27** is created and stored by means of the data acquisition module **23**. The data acquisition module **23** accepts via the graphical user interface **22** graphical symbols (including photographic images, e.g. images of printed products, machines M**1**, Mn or machine parts) for control elements and input panels/input masks in the form of file names and/or collective file names and on the basis of these creates and stores a graphical symbol library **27**. The graphical symbol library **27** comprises, for

example, control element designations allocated to graphical control elements with various graphical symbols (pattern, image content) in in each case different size, coloring and/or various file formats for the efficient support of various technology platforms, applications, display sizes and/or resolutions.

In step S**13**, a rule database **29** is created and stored by means of the data acquisition module **23**. The data acquisition module **23** accepts via the graphical user interface **22** design rules with color composition rules and symbol combination rules and stores these in the rule database **29**. The design rules define, for example, the number of graphical control elements simultaneously displayable in the user interface or operating interface **15**, respectively, the number of graphical control elements arranged in a horizontal row, the number of graphical control elements arranged in a vertical column, the minimum size of graphical control elements, the permissible combinations of graphical control elements, the permissible and/or preferred color combinations of adjacent graphical control elements, the color combinations of graphical control elements arranged in a horizontal row and/or the color combinations of graphical control elements arranged in a vertical column. In one variant of the embodiment, the design rules are class-specific, i.e. dependent on the classification information items of the function designations, size-specific, i.e. dependent on the size of the display **14**, and hierarchy-dependent, i.e. dependent on the hierarchy stage of the function designation allocated to the control element **153**.

In step S**14**, user profiles are acquired by means of the data acquisition module **23** and stored in a user database **28**. The data acquisition module **23** accepts user identifications and allocated authorizations for functions or function designations, respectively, via the graphical user interface **22** and, on the basis of these, creates corresponding user profiles with function authorizations in the user database **28**.

In step S**15**, graphical control elements from the graphical symbol library **27** are allocated to the function designations in the function library **26**. The allocation is carried out by means of the data acquisition module **23** via the

graphical user interface **22** and/or by the element assignment module **240** automatically on the basis of the classification information items which are allocated to the relevant function designations. The allocation of graphical control elements, possibly including various graphically represented input panels and input masks, to function designations **263** is stored in the function library **26**.

In step S**2**, the operating interface **15** for the user interface **15** is defined.

In step S**21**, functions and possibly input panels and input masks for the operating interface **15** are defined by means of the data acquisition module **23**. The data acquisition module **23** accepts selections of functions or function designations, respectively, (and possibly input panels/input masks) from the function library **26**, which should be available in the operating interface **15**, via the graphical user interface **22**. In one variant, various language-specific translation modules are allocated to the input panels/input masks, which enable users to input voice commands in various languages.

In the optional step S**22**, a first part-area is defined as permanently defined display area **151** and a second part-area is defined as variable for the operating interface **15** in the display **14** by means of the data acquisition module **23**. The data acquisition module **23** accepts corresponding coordinates and/or size information via the graphical user interface **22**. In one variant of the embodiment, the permanent and variable display areas are determined by the layout module **24**. The layout module **24** determines, for example, the size of the permanently defined area and the size of the variable area in dependence on the size of the display **14** and/or in dependence on the (maximum) number of authorized functions of the users.

In step S**23**, the control elements **153** are grouped and arranged in the user interface or operating interface **15**, respectively, by the layout module **24**. The choice of the control elements **153** is determined by the selection of the functions in step S**21** and the allocation of graphical control elements to function designations **263**. The layout module **24** determines the grouping and

arrangement of the graphical control elements **153** in the operating interface **15** on the basis of the stored design rules of the rule database **29** including the color composition rules and symbol combination rules and on the basis of the classification information items and/or hierarchy stages which are allocated to the function designations in the function library **26**. The layout module **24** determines user-specific arrangements of the graphical control elements **153** on the basis of the allocation of function designations to user identifications in the stored user profiles of the user database **28**.

In the optional step S**24**, the control elements **153** are grouped, allocated and arranged to the permanent and variable display areas **151**, **152** of the operating interface **15** by the layout module **24**. The layout module **24** determines the grouping and arrangement of the graphical control elements **153** in the operating interface **15** in dependence on the hierarchy stages, which are allocated to the selected function designations, graphical control elements **153** of function designations having a high hierarchy stage being arranged in the permanently defined display area **151** and graphical control elements of function designations having a low hierarchy stage being arranged in the variable display area **152** of the operating interface **15**.

In step S**3**, the interface generator **25** generates the graphical user interface or operating interface **15**, respectively, for representation on the display **14** on the basis of the defined grouping and arrangement of the control elements **153**.

When using portable operating devices, especially in the industrial environment, such as in the case of complex printing and print processing installations, it is particularly necessary also for safety-related requirements that the allocation of operating device **10** and machine(s) M**1**, Mn is not interrupted or dissolved (in disruptive instances). Within the context of step **2**, it is therefore preferably possible to specify, in the permanent or variable display area **151**, **152**, not only operating elements of a machine **M1** but additionally also a signal area or direct access for at least one second machine Mn. In this manner, it is possible to draw the attention of the user to urgent operating steps on one (or more) further machines **M1** to Mn directly on

the portable operating device. The user interface system according to the invention can thus be used operationally reliably particularly in the case of small screen sizes. The user is enabled by such a direct access (especially emphasized or represented function designation) preferably in a special display area to immediately switch to a different machine or a different machine unit. It is particularly in the case of complex processing installations such as, for example, in the case of a plurality of feeding devices for a collecting device that it is desirable if the operating personnel is enabled, in spite of small operating devices, to clearly operate a number or a plurality of machines **M1** to Mn by means of an intelligent adaptation of the operating interface **15**. Since in the case of such small operating interfaces, the operating functions cannot be simultaneously represented for a number of or even all machines **M1**, Mn, the dynamic display adaptation by means of a direct access function can guarantee disruption-proof operation of complex installation areas. The (wireless or wired) communication link **100** described above between operating device **10** and machines **M1** to Mn provides for the dynamic intelligent switch-over of the display **14** described. For this purpose, it is advantageous in the case of special arrangements to equip the communication layer **110** or technology layer **120**, respectively, in the case of a predetermined group or in the case of all machines **M1** to Mn with an additional logic module **132**, **132**' which can undertake interrupt calls to one or more operating devices **10** via the communication link **100**. Such an interrupt call thereupon triggers the adaptation of the operating interface **15** described before. The logic module **132**, **132**' can be constructed as hardware or as software. A special area is preferably reserved for such interrupt calls on the user interface **15**, but at least an area for a direct access (virtual button, warning dialog or the like).

In one variant of the embodiment, the device **2** for generating the graphical user interface or operating interface **15**, respectively, is constructed as independent (stand-alone) system which, in a first phase, generates and stores executable computer code which is executed at a later time, in a second phase, on a computer or processor of the operating device **10** and/or the machines **M1**, Mn in order to generate the graphical user interface or

operating interface **15**, respectively, on the display **14**. In further variants of the embodiment, at least certain functional modules, functions and/or data memories of the device **2**, for example the layout module **24**, the interface generator **25**, the function library **26**, the graphical symbol library **27**, the user database **28** and the rule database **29** are formed as part of the presentation module **13** in order to define, to generate and correspondingly represent on the display **14** the operating interface **15** dynamically in real time. In particular, this provides for the dynamic adaptation of the operating interface **15** and its part-areas to different display sizes and user authorizations, taking into consideration and applying the defined design rules.

Finally, it should be noted that, although computer program code has been allocated to specific functional modules in the description and the execution of steps was represented in a particular order, the expert will understand that the computer program code can be differently structured and the order of at least certain steps can be changed without deviating from the subject matter under protection. In addition, the expert will also understand that the functional modules listed can be constructed completely or at least partially with hardware components in various variants of the embodiment.

Patent Claims

1. A computer-implemented method for generating a graphical user interface (**15**) for operating one or more machines (M**1**, Mn), comprising:

storing (S**12**) of a graphical symbol library (**27**) having a plurality of graphical control elements (**153**),

storing (S**11**) of a function library (**26**) having a plurality of function designations to which classification information items are in each case allocated,

selecting (S**21**) of function designations from the function library (**26**) for the user interface (**15**),

allocating of graphical control elements (**153**) from the graphical symbol library (**27**) to the function designations,

determining of grouping and arrangement of the graphical control elements (**153**) allocated to the selected function designations in the user interface (**15**) on the basis of the classification information items, and

generating of the graphical user interface (**15**) for representation on a display (**14**) on the basis of the graphical symbol library (**27**) and the determined grouping and arrangement of the graphical control elements (**153**).

2. The method as claimed in claim **1**, characterized in that the classification information items comprise at least one of: function groups, function subgroups, application identifier, machine type identifier, business area identifier, product type identifier, product identifier and hierarchy stage, and in that the grouping and arrangement of the graphical control elements (**153**) takes place on the basis of class-specific rules.

3. The method as claimed in one of claims **1** or **2**, characterized in that the grouping and arrangement of the graphical control elements (**153**) in the user interface (**15**) also takes place on the basis of stored design rules which define at least one of: number of graphical control elements (**153**) represented simultaneously in the user interface (**15**), number of graphical control elements (**153**) arranged in a horizontal row, number of graphical control elements (**153**) arranged in a vertical column, minimum size of graphical control elements (**153**), permissible combinations of graphical control elements (**153**), color combinations of adjacent graphical control elements (**153**), color combinations of graphical control elements (**153**) arranged in a horizontal row, and color combinations of graphical control elements (**153**) arranged in a vertical column.

4. The method as claimed in one of claims **1** to **3**, characterized in that the allocation of graphical control elements (**153**) from the graphical symbol library (**27**) to the function designations takes place in each case in dependence on the classification information items which are allocated to the relevant function designation.

5. The method as claimed in one of claims **1** to **4**, characterized by acquiring the function designations, allocating (S**15**) of hierarchy stages and graphical control elements (**153**) to the function designations, arranging (S**23**) the graphical control elements (**153**) in the user interface (**15**) in dependence on the hierarchy stages of the allocated function designations, wherein graphical control elements (**153**) of function designations having a high hierarchy stage are arranged in a permanently defined area (**152**) of the user interface (**15**) and graphical control elements (**153**) of function designations having a low hierarchy stage are arranged in a variable area (**151**) of the user interface (**15**) outside the permanently defined area of the user interface (**15**), and generating (S**3**) of the graphical user interfaces (**15**) for representation on the display (**14**) in each case with the arrangement of the graphical control elements (**153**) of function designations having a high hierarchy stage in the permanently defined area of the user interface (**15**).

6. The method as claimed in claim **5**, characterized in that the size of the permanently defined area (**152**) of the user interface (**15**) and the size of the variable area (**151**) of the user interface (**15**) are determined in dependence on the size of the display (**14**).

7. The method as claimed in one of claims **5** or **6**, characterized in that the size of the permanently defined area (**152**) of the user interface (**15**) and the size of the variable area (**151**) of the user interface (**15**) are determined in dependence on a number of authorized functions of a user.

8. The method as claimed in one of claims **1** to **7**, characterized by acquiring the function designations, acquiring user identifications, allocating function designations to user identifications, allocating (S**15**) of graphical control elements (**153**) to the function designations, determining of user-specific arrangements of the graphical control elements (**153**) on the basis of the allocation of function designations to user identifications, and generating (S**3**) of the graphical user interfaces (**15**) for representation on the display (**14**) in each case for a user on the basis of the relevant user-specific arrangement of the graphical control elements (**153**).

9. The method as claimed in claim **8**, characterized in that the user-specific arrangement of the graphical control elements (**153**) is determined on the basis of defined rules with at least one of: color composition rules, symbol combination rules and design rules.

10. A device (**2**) for generating a graphical user interface (**15**) for operating one or more machines (M**1**, Mn), comprising:

a first data memory for storing a graphical symbol library (**27**) having a plurality of graphical control elements (**153**),

a second data memory for storing a function library (**26**) having a plurality of function designations to which classification information items are allocated in each case,

a data acquisition module (**23**) for accepting selections of function designations from the function library (**26**) for the user interface (**15**),

a third data memory for allocating graphical control elements (**153**) from the graphical symbol library (**27**) to the function designations,

a layout module (**24**) for grouping and arranging the graphical control elements (**153**), allocated to the selected function designations, in the user interface (**15**) on the basis of the classification information items, and

an interface generator (**25**) for generating the graphical user interface (**15**) for representation on a display (**14**) on the basis of the graphical symbol library (**27**) and the determined grouping and arrangement of the graphical control elements (**153**).

11. The device (**2**) as claimed in claim **10**, characterized in that the classification information items comprise at least one of: function groups, function subgroups, application identifier, machine type identifier, business area identifier, product type identifier, product identifier and hierarchy stage, and in that the grouping and arrangement of the graphical control elements (**153**) takes place on the basis of class-specific rules.

12. The device (**2**) as claimed in one of claims **10** or **11**, characterized in that the layout module (**24**) is configured for grouping and arranging the graphical control elements (**153**) in the user interface (**15**) also on the basis of stored design rules which define at least one of: number of graphical control elements (**153**) represented simultaneously in the user interface (**15**), number of graphical control elements (**153**) arranged in a horizontal row, number of graphical control elements (**153**) arranged in a vertical column, permissible combinations of graphical control elements (**153**), color combinations of adjacent graphical control elements (**153**), color combinations of graphical control elements (**153**) arranged in a horizontal row, and color combinations of graphical control elements (**153**) arranged in a vertical column.

13. The device (**2**) as claimed in one of claims **10** to **12**, characterized by an element assignment module (**240**) which is configured for allocating the graphical control elements (**153**) from the graphical symbol library (**27**) to the function designations in each case in dependence on the classification information items which are allocated to the relevant function designation.

14. The device (**2**) as claimed in one of claims **10** to **13**, characterized in that the data acquisition module (**23**) is configured for accepting and storing the function designations, in that the device (**2**) comprises a further data memory for storing allocations (**263**) of hierarchy stages and graphical control elements (**153**) to the function designations, in that the layout module (**24**) is configured for arranging the graphical control elements (**153**) in the user interface (**15**) in dependence on the hierarchy stages of the allocated function designations, wherein graphical control elements (**153**) of function designations having a high hierarchy stage are arranged in a permanently defined area (**152**) of the user interface (**15**) and graphical control elements (**153**) of function designations having a low hierarchy stage are arranged in a variable area (**151**) of the user interface (**15**) outside the permanently defined area (**152**) of the user interface (**15**), and in that the interface generator (**25**) is configured for generating the graphical user interfaces (**15**) for representation on the display (**14**) in each case with the arrangement of the graphical control elements (**153**) of function designations having a high hierarchy stage in the permanently defined area of the user interface (**15**).

15. The device (**2**) as claimed in claim **14**, characterized in that the layout module (**24**) is configured for determining the size of the permanently defined area of the user interface (**15**) and the size of the variable area of the user interface (**15**) in dependence on the size of the display (**14**).

16. The device (**2**) as claimed in one of claims **14** or **15**, characterized in that the layout module (**24**) is configured for determining the size of the permanently defined area of the user interface (**15**) and the size of the variable

area of the user interface (**15**) in dependence on a number of authorized functions of a user.

17. The device (**2**) as claimed in one of claims **10** to **16**, characterized in that the data acquisition module (**23**) is configured for accepting and storing function designations and user identifications, in that the device (**2**) comprises further data memories for storing allocations of function designations to user identifications and allocations (**263**) of graphical control elements (**153**) to the function designations, in that the layout module (**24**) is configured for determining user-specific arrangements of the graphical control elements (**153**) on the basis of the allocation of function designations to user identifications, and in that the interface generator (**25**) is configured for generating the graphical user interfaces (**15**) for representation on the display (**14**) in each case for a user on the basis of the relevant user-specific arrangement of the graphical control elements (**153**).

18. The device (**2**) as claimed in claim **17**, characterized in that the layout module (**24**) is configured for determining the user-specific arrangement on the basis of defined rules with at least one of: color composition rules, symbol combination rules and design rules.

19. A computer-based user interface system (**1**) for operating machines (M**1**, Mn), comprising:

a touch-sensitive display (**14**) for representing a graphical operating interface (**15**) and for accepting and outputting useful data with function commands and function parameters via the operating interface (**15**),

a communication module (**11**) for exchanging the useful data with one or more of the machines (M**1**, Mn),

a presentation module (**13**), inserted between machines (M**1**, Mn) and display (**14**), for representing the operating interface (**15**) on the display (**14**) in dependence on system parameters.

20. The user interface system (**1**) as claimed in claim **19**, characterized in that the presentation module (**13**) is configured for representing the operating interface (**15**) on the display (**14**) in dependence on a defined size of the display (**14**).

21. The user interface system (**1**) as claimed in one of claims **19** or **20**, characterized in that the machines (M**1**, Mn) have different technology platforms, and in that the user interface system (**1**) comprises an adaptation module (**12**), inserted between technology platforms and presentation module (**13**), for the platform-independent exchange of useful data between machines (M**1**, Mn) and operating interface (**15**).

22. The user interface system (**1**) as claimed in one of claims **19** to **21**, characterized in that the presentation module (**13**) is configured for representing the operating interface (**15**) on the display (**14**) in dependence on authorizations of a logged-in user with different graphical control elements (**153**) and with a different arrangement of these control elements (**153**).

23. The user interface system (**1**) as claimed in one of claims **19** to **22**, characterized by an electromechanical control element (**16**) for the authorization-independent input of a control command.

24. The user interface system (**1**) as claimed in one of claims **19** to **23**, characterized in that the operating interface (**15**) has a number of control elements (**153**) represented as graphical symbols for a direct input of control commands, which are arranged in a permanently defined area (**152**) of the display (**14**), and in that the operating interface (**15**) has a variable area (**151**) which is arranged outside the permanently defined area (**152**) of the display (**14**) and is provided for temporarily available control elements (**153**) and for inputting and outputting useful data.

25. The user interface system (**1**) as claimed in one of claims **19** to **24**, characterized in that the presentation module (**13**) is configured for providing,

in dependence on a defined size of the display (**14**), a first part-area of the display (**14**) for permanently available control elements (**153**) and a second part-area of the display (**14**) for temporarily available control elements (**153**).

26. The user interface system (**1**) as claimed in claim **25**, characterized in that the presentation module (**13**) is configured for arranging, in dependence on a defined size of the display (**14**), the second part-area of the display (**14**) to be at least partially overlapping the first part-area of the display (**14**).

27. The user interface system (**1**) as claimed in one of claims **19** to **26**, characterized in that the operating interface (**15**) has a number of control elements (**153**) represented as graphical symbols (**153**), in that the control elements (**153**) are allocated to functions for which a logged-in user is authorized and in that the user interface system (**1**) comprises an electromechanical control element (**16**) for the user-independent input of a control command.

28. The user interface system (**1**) as claimed in one of claims **19** to **27**, characterized in that the operating interface (**15**) has a number of control elements (**153**) represented as graphical symbols (**153**), in that the control elements (**153**) are arranged in a permanently defined area (**152**) of the display (**14**), in that the operating interface (**15**) has a variable area (**151**) which is arranged outside the permanently defined area (**152**) of the display (**14**), and in that the variable area (**151**) of the display (**14**) is defined in dependence on a size of the display (**14**).

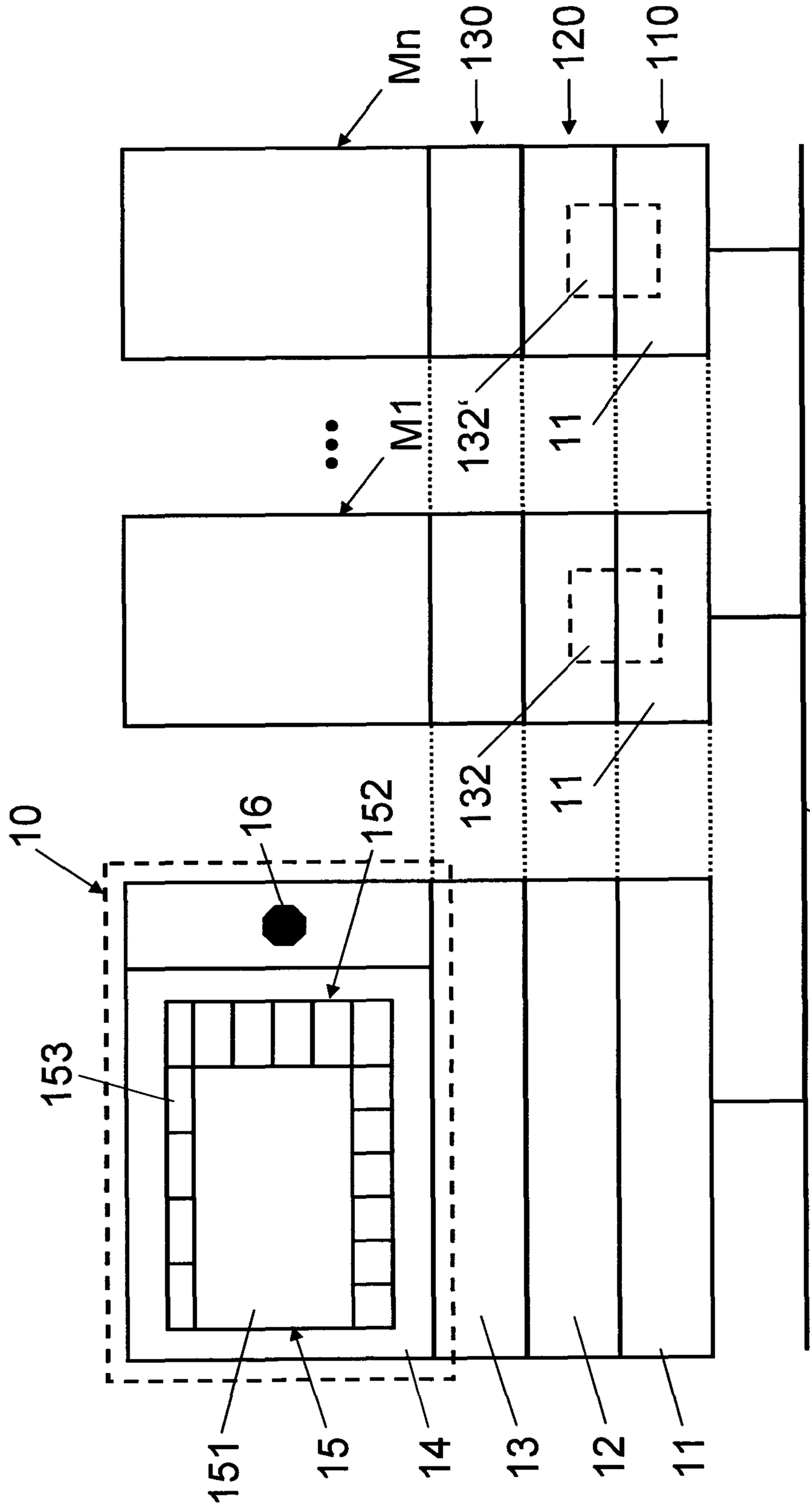

Mn
130
120
110
M1
132'
11
M2
132
11
10
16
152
153
100
151
15
14
13
12
11
1

Fig. 1

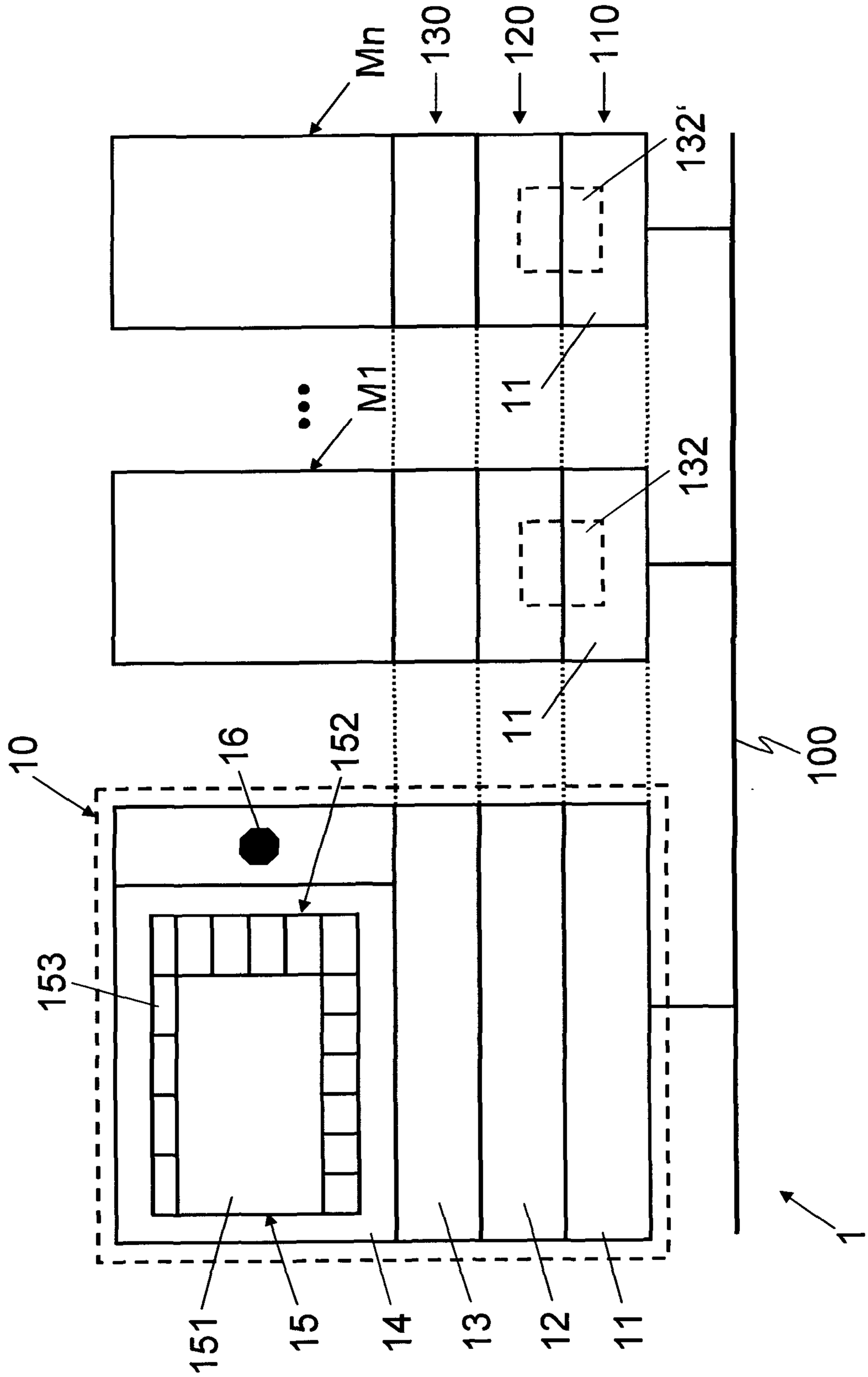


Fig. 1a

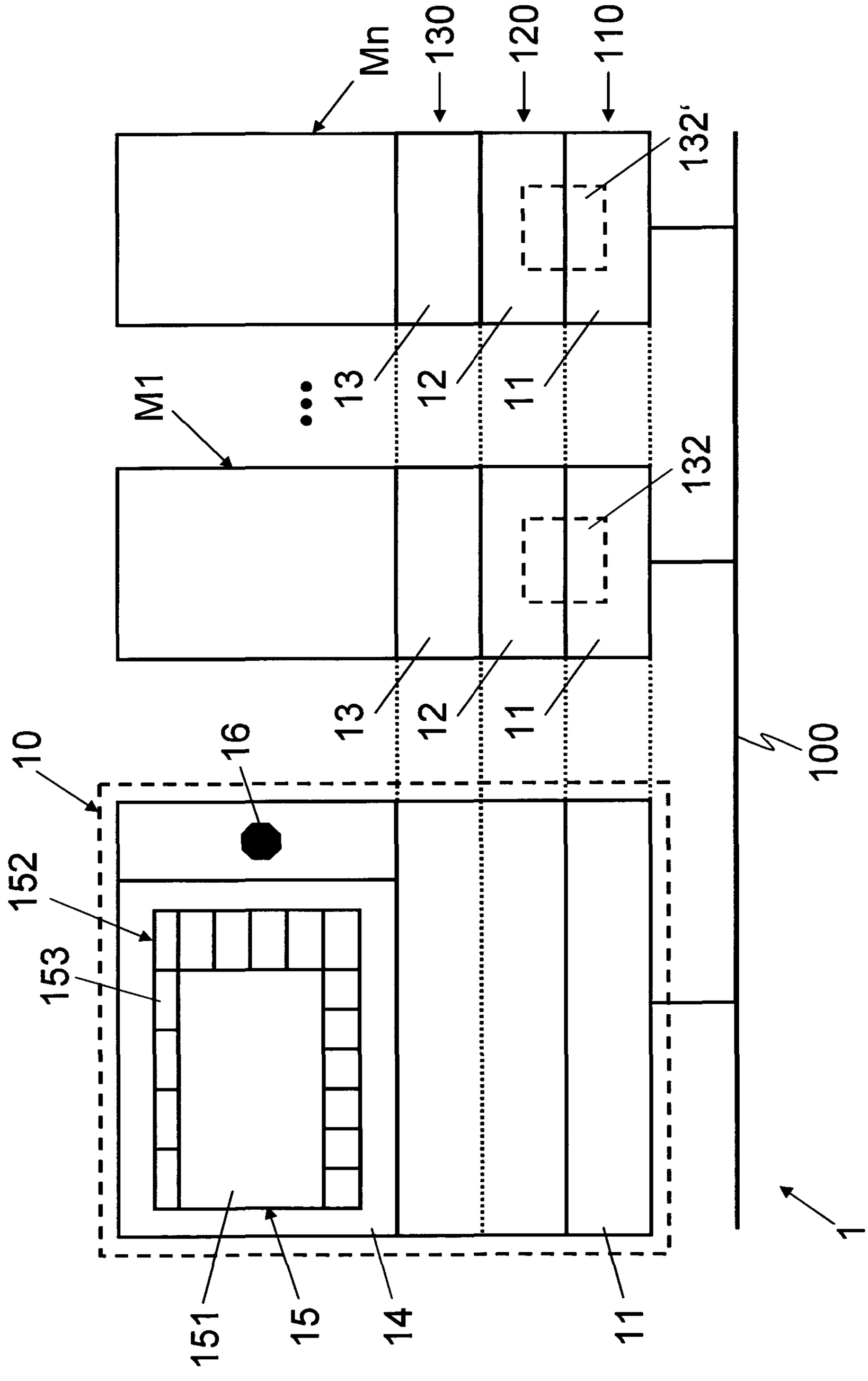


Fig. 1b

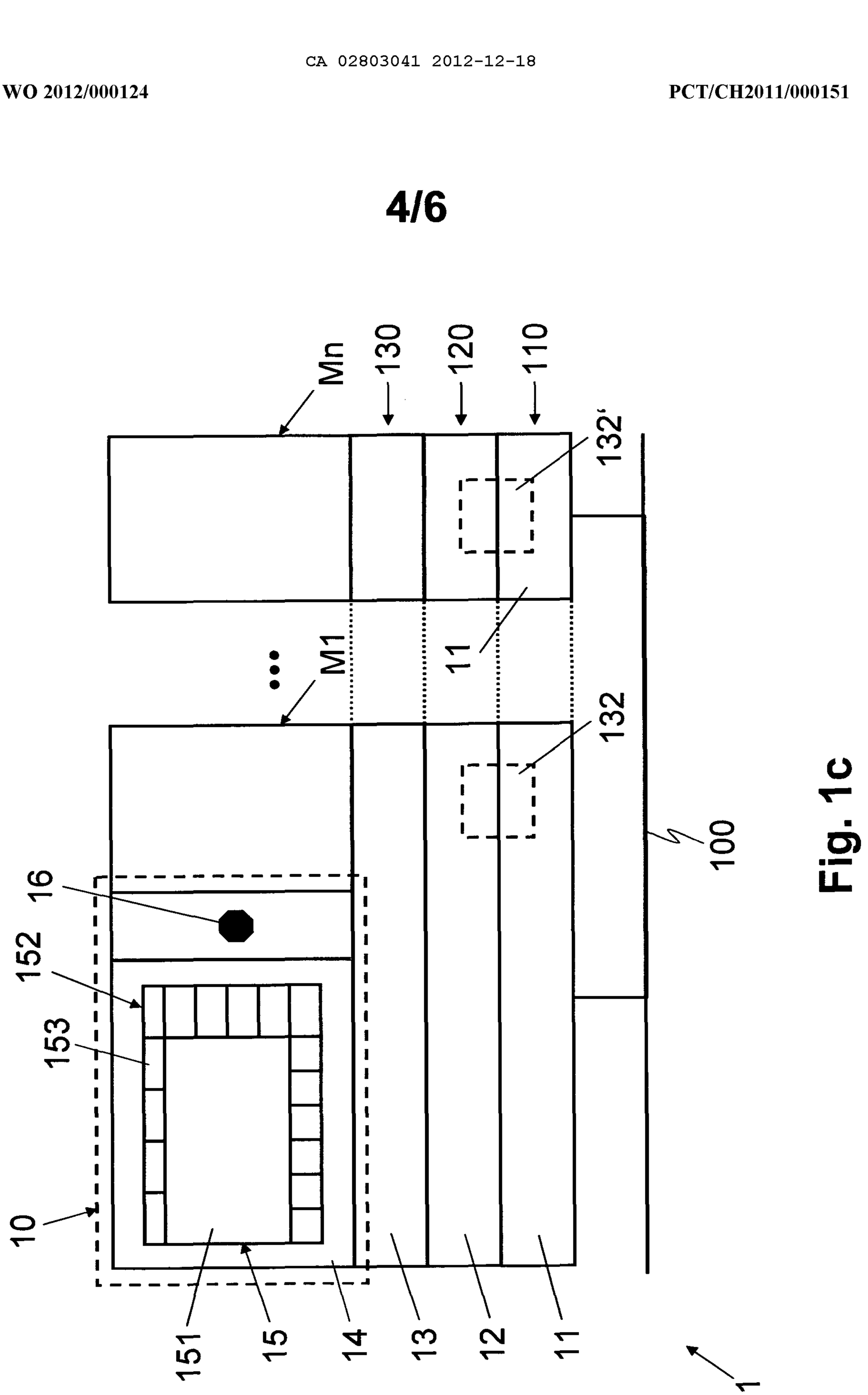


Fig. 1c

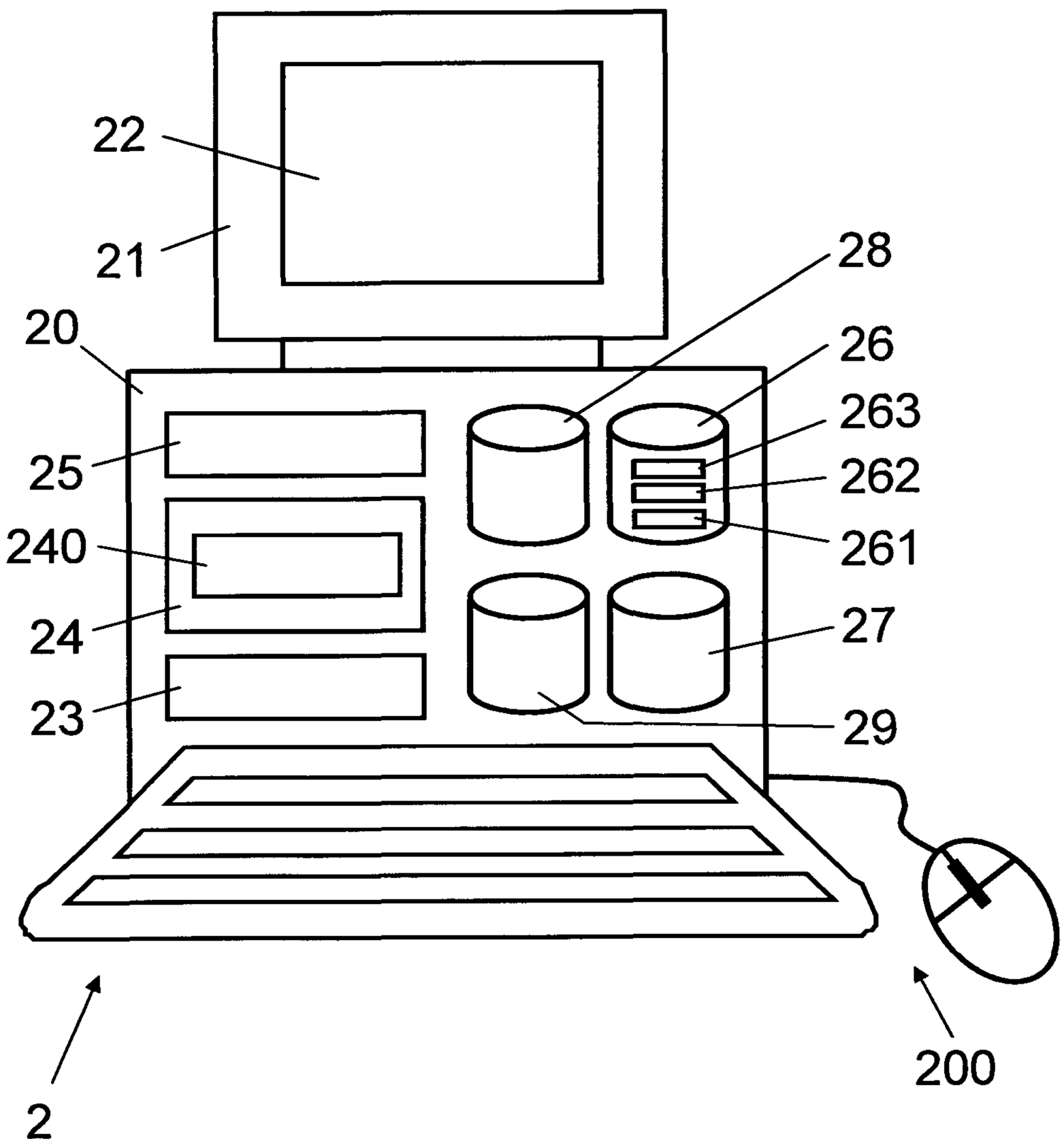


Fig. 2

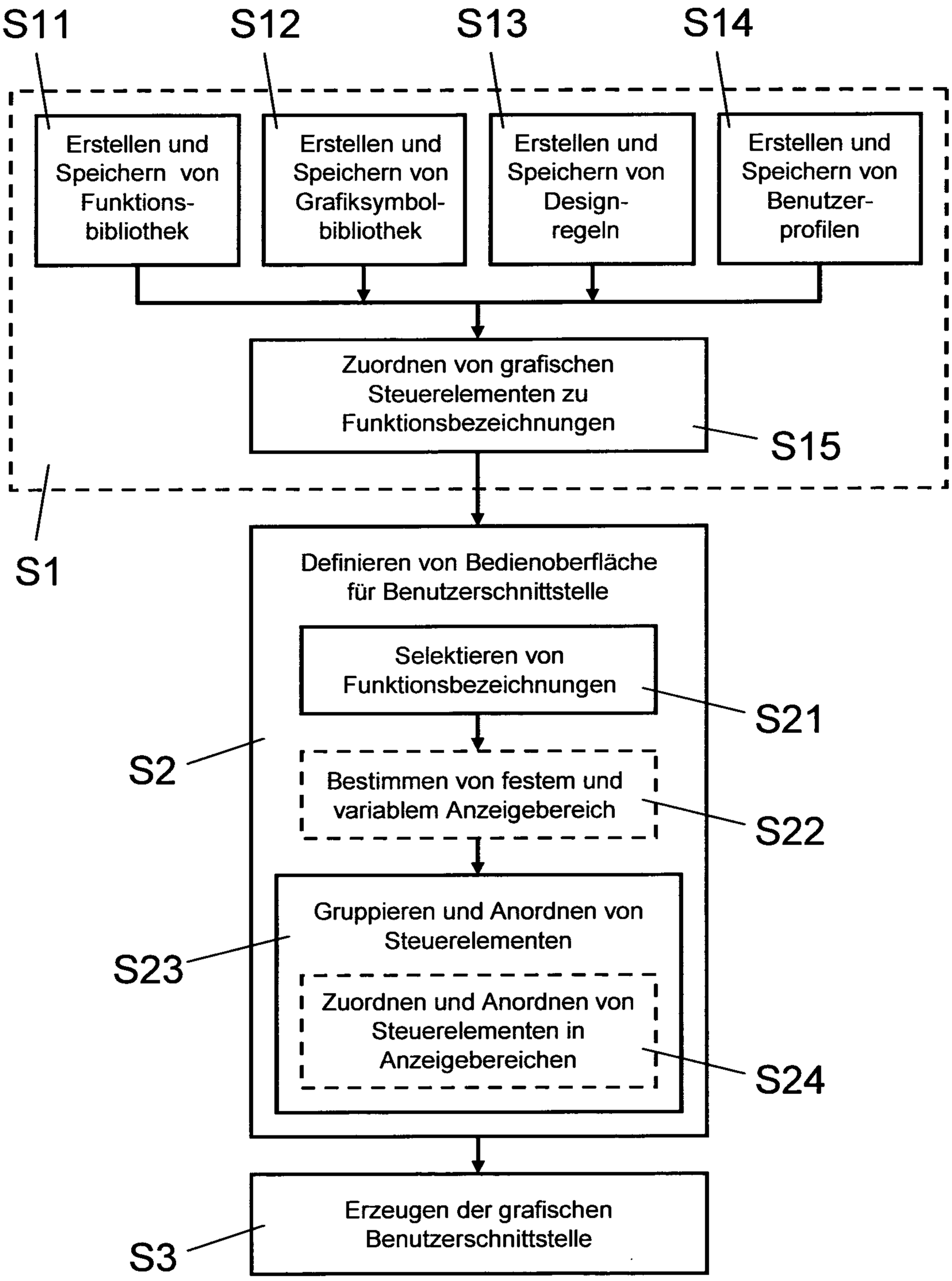
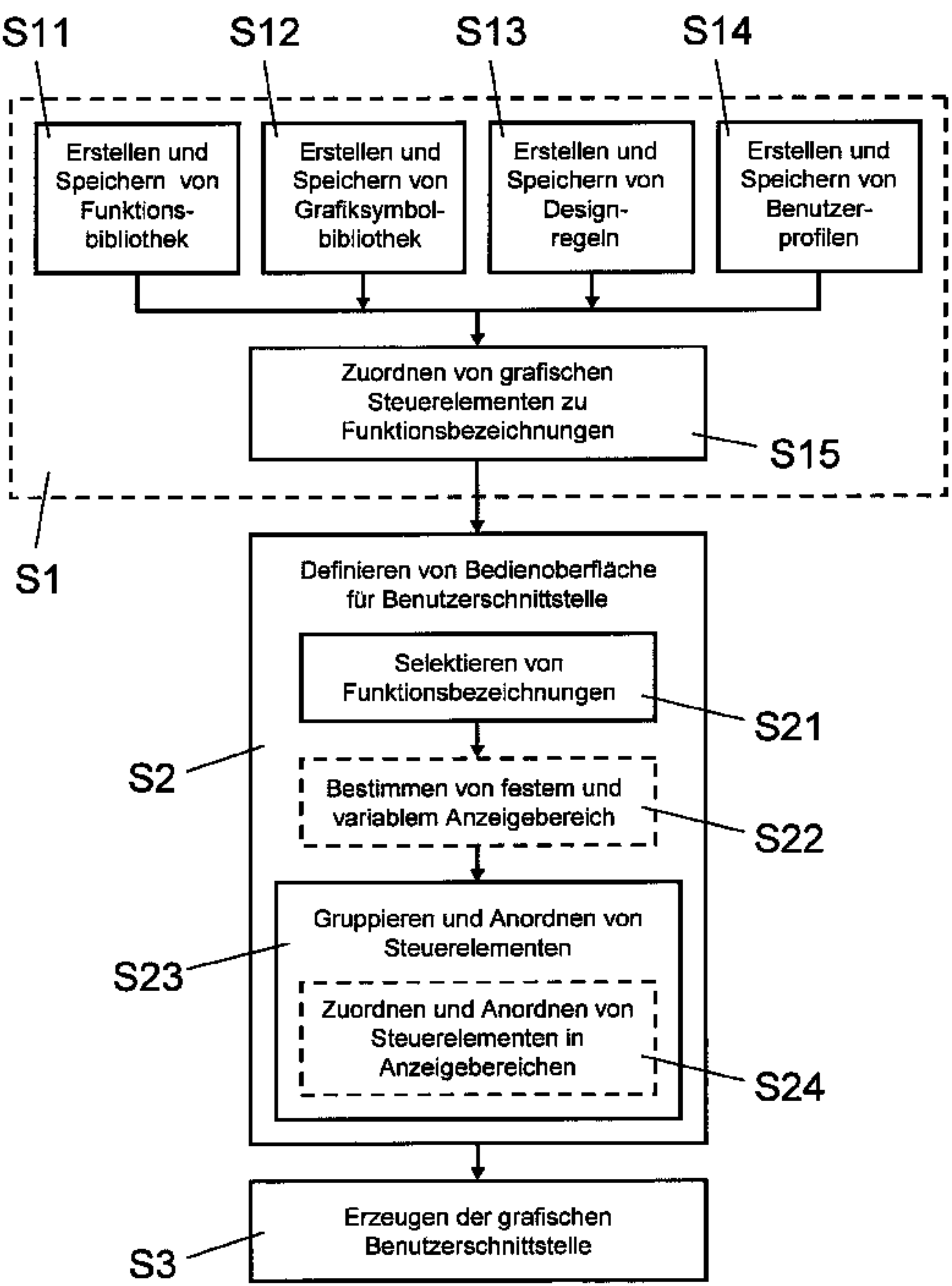

S11
S12
S13
S14
Erstellen und Speichern von Funktions-bibliothek
Erstellen und Speichern von Grafiksymbol-bibliothek
Erstellen und Speichern von Design-regeln
Erstellen und Speichern von Benutzer-profilen
Zuordnen von grafischen Steuerelementen zu Funktionsbezeichnungen
S15
S1
Definieren von Bedienoberfläche für Benutzerschnittstelle
Selektieren von Funktionsbezeichnungen
S21
S2
Bestimmen von festem und variablem Anzeigebereich
S22
Gruppieren und Anordnen von Steuerelementen
S23
Zuordnen und Anordnen von Steuerelementen in Anzeigebereichen
S24
Erzeugen der grafischen Benutzerschnittstelle
S3

Fig. 3


S11
S12
S13
S14
Erstellen und Speichern von Funktions-bibliothek
Erstellen und Speichern von Grafiksymbol-bibliothek
Erstellen und Speichern von Design-regeln
Erstellen und Speichern von Benutzer-profilen
Zuordnen von grafischen Steuerelementen zu Funktionsbezeichnungen
S15
S1
Definieren von Bedienoberfläche für Benutzerschnittstelle
Selektieren von Funktionsbezeichnungen
S21
S2
Bestimmen von festem und variablem Anzeigebereich
S22
Gruppieren und Anordnen von Steuerelementen
S23
Zuordnen und Anordnen von Steuerelementen in Anzeigebereichen
S24
Erzeugen der grafischen Benutzerschnittstelle
S3

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