



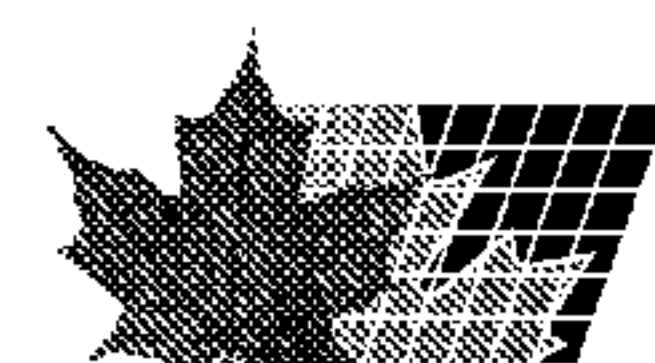
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(54) **Titre : METHODE DE FOURNITURE D'INFORMATION DE DOCUMENTATION DE MACHINES ET SYSTEMES COMPLEXES, EN PARTICULIER UNE MACHINE DE MOULAGE PAR INJECTION**
(54) **Title: METHOD FOR PROVIDING DOCUMENTATION INFORMATION OF COMPLEX MACHINES AND SYSTEMS, IN PARTICULAR AN INJECTION MOLDING MACHINE**

(57) **Abstrégé/Abstract:**

A method is disclosed for ascertaining a machine configuration and state, the machine having exchangeable components and parts. Each component is provided with a storage device storing component-specific documentation information and from which the documentation information is retrieved and stored in a first memory. Identification information is assigned to each part and is read into an identification unit. Part-specific documentation information associated with the identification information is retrieved from an external memory and stored in a second memory. The component-specific documentation information and the part-specific documentation information are combined to generate overall documentation of the machine. When a component is replaced, changed documentation information of the replacement component and replacement part are retrieved. Changed overall documentation is then automatically generated from the changed documentation information. The changed overall documentation is displayed on an output device to allow an operator to determine the changed machine configuration and state.



ABSTRACT

A method is disclosed for ascertaining a machine configuration and state, the machine having exchangeable components and parts. Each component is provided with a storage device storing component-specific documentation information and from which the documentation information is retrieved and stored in a first memory. Identification information is assigned to each part and is read into an identification unit. Part-specific documentation information associated with the identification information is retrieved from an external memory and stored in a second memory. The component-specific documentation information and the part-specific documentation information are combined to generate overall documentation of the machine. When a component is replaced, changed documentation information of the replacement component and replacement part are retrieved. Changed overall documentation is then automatically generated from the changed documentation information. The changed overall documentation is displayed on an output device to allow an operator to determine the changed machine configuration and state.

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METHOD FOR PROVIDING DOCUMENTATION INFORMATION OF COMPLEX MACHINES AND SYSTEMS, IN PARTICULAR AN INJECTION MOLDING MACHINE

The invention is directed to a method for providing documentation information of complex machines and systems, in particular an injection molding machine.

Documentation information of complex machines and systems is typically provided by the manufacturer in form of operating manuals, exploded view drawings, replacement part lists and the like, either on paper (hardcopy) or in electronic form, e.g., on a data carrier. At the time the machine/system is delivered, the manufacturer makes sure that the status of the documentation agrees with the status of the delivered machine. The customer can use the documentation from the data carrier or from the paper copy.

Disadvantageously, the manufacturer of, for example, modularly constructed machines and systems incurs significant expenses when combining the various parts of the documentation for the individual modules to assemble an overall documentation which corresponds exactly to the delivered machine. It is also disadvantageous that the desired documentation documents are typically provided to the end customer separate from the machine/system, so that the end customer incurs costs for acquiring the machine/system documentation. It is also disadvantageous that, for example, when a replacement part or replacement component is installed, the new components may be modified or improved, which is not illustrated in the original supplied documentation data. This frequently leads to an erroneous fault analysis during maintenance of the machine/system.

WO 2004/076143 discloses a plastic processing machine using components which are provided with a specific parameter for carrying out a process or method step. The component-specific parameters are supplied to a control system that controls

31254-49

the component. In this way, the processing and manufacturing processes of the entire machine can be adapted commensurate with the employed devices/components.

WO 0204186 A1 discloses an injection molding system with a standardized interface
5 section which can be effectively connected with a corresponding interface section of more than one mold. Data flows and/or media flows can be transmitted via the interface section.

DE 197 44 443 C1 discloses a method and a device for identifying screws employed in extruders or metering units. This method is intended to prevent that forbidden
10 parameters are used with a built-in reversing screw which may possibly destroy the screw.

It is an object of some embodiments of the invention to provide a method for providing documentation information in a complex machine/system, in particular an injection molding machine, which ensures that the user of the machine always has an
15 available up-to-date documentation information that is correct for the particular machine.

According to an aspect of the invention, there is provided a method of ascertaining a configuration and a state of a machine, wherein the machine comprises a plurality of exchangeable machine components and parts, said method comprising the steps of:
20 providing each of the machine components with a dedicated storage device arranged on the machine component that stores documentation information specific for the machine component; assigning an individual identification information to each of the machine parts; accessing the storage device of each machine component to retrieve the component-specific documentation information; storing the component-specific
25 documentation information in a first documentation memory; reading the identification information of each machine part into an identification unit; accessing with the identification unit an external memory to retrieve documentation information associated with the identification information of each machine part; storing the

31254-49

retrieved part-specific documentation information in a second documentation memory; combining the component-specific documentation information from the first documentation memory and the retrieved part-specific documentation information from the second documentation memory to generate an overall documentation of the machine; upon exchange of a machine component with a replacement machine component, reading into the first documentation memory changed component-specific documentation information of a replacement machine component stored in the dedicated storage device arranged on the replacement machine component, and reading with the identification unit at least the part-specific documentation information of the replacement part from the external data memory into the second documentation memory, automatically generating from changed documentation information in the first and second documentation memory a changed overall documentation, and displaying at least the changed overall documentation on an output device to allow an operator to determine the changed machine configuration and machine state and to intervene in operation and maintenance of the machine.

According to another aspect of the invention, there is provided a method of ascertaining a configuration and a state of a machine, wherein the machine comprises a plurality of exchangeable machine components and parts, the method comprising the steps of: providing each of the machine components with component-specific identification information and each of the machine parts with part-specific identification information; reading the component-specific identification information and the part-specific identification information from the respective machine component or the respective machine part, or both, into an identification unit; reading with the identification unit component-specific and part-specific documentation information from an external data memory into an overall documentation memory; automatically generating from the component-specific and part-specific documentation information an overall documentation of the system; upon exchange of a machine component with a replacement machine component, reading into the identification unit changed component-specific identification information of a replacement machine component, and reading with the identification unit changed

31254-49

component-specific and part-specific documentation information of the replacement part from the external data memory into the overall documentation memory, automatically generating from the changed documentation information a changed overall documentation, and displaying at least the changed overall documentation on
5 an output device to allow an operator to determine the changed machine configuration and machine state and to intervene in operation and maintenance of the machine.

In the following, a differentiation is made between the terms "components" and "parts" of complex systems. The term "component" applies herein to a system module
10 constructed of several individual parts and has a readable memory unit, e.g., a chip or a hard disk, on which component-specific documentation information is saved. Advantageously, a component has an interface adapted to connect the component to a central documentation memory of the system.

31254-49

In the following, the term "part" applies to a small system module or a small individual part, which is not adapted to be equipped with a memory unit, e.g., a chip or a hard disk. According to the invention, small components of this type or individual parts are provided with identification information, for example in form of a barcode, by which the "part" can be unambiguously identified.

Advantageous with the method of an embodiment of the invention is that documentation information of components is read from the memory unit of the components into a first documentation memory and the identification information of the parts is read by an identification unit, wherein documentation data of the parts are recalled from an external data memory with the help of the identification unit and these documentation data are read into a second documentation memory. In this way, an overall documentation of the complex system can be easily generated by combining the contents of the two documentation memories, which is then provided on an output device to the user.

It is particularly advantageous that after exchange of a component or as a part documentation, information or portion of the identification information used for recalling the documentation information of the parts is always combined so as to provide an overall documentation of the complex system, which is device-specific and up-to-date. In this way, changed and updated overall documentation can be provided to the user even after, for example, a component has been exchanged for a modified and updated replacement component.

Advantageously, based on the overall documentation of the complex system formed in this manner and by providing an interface, in particular a remote query interface, the manufacturer of the complex system can now easily interrogate the up-to-date configuration of the components and parts of the complex system and assist the operator of the complex system, e.g., the injection molding machines, with the operation and/or the repair with additional information. This eliminates the

risk that the operator of the complex system and the manufacturer of this system base their decisions on different states of the system.

According to another method of the invention, both the components and the parts only include identification information which is read by an identification unit of the complex system. In this modification of the method of the invention, the entire documentation is read from an external data memory based on the identification information of the identification unit and read into a documentation memory of the complex system, thereby forming an overall documentation of the complex system. In this modification of the method of the invention, it is particularly advantageous that there is not necessarily a differentiation between components and parts and that the design complexity of components is minimized, because only the identification information needs to be attached to the component which can be implemented, for example, by a barcode sticker.

Examples of the invention will now be described in more detail with reference to the drawings.

FIG. 1 shows schematically in form of a block diagram a first embodiment of the method of the invention; and

FIG. 2 shows in form of a block diagram a second embodiment of the method of the invention.

FIG. 1 shows a first embodiment of the method of the invention. A complex system 1, e.g., an injection molding machine, includes a first documentation memory 2, a second documentation memory 3, and an identification unit 4. Also provided is an output device 5 adapted to output documentation information of an overall documentation GD of the complex system 1. The overall documentation GD is composed of information of the first documentation

memory 2 and the second documentation memory 3. The first documentation memory 2 is operatively connected with the components A, B, ... N, wherein the components A, B, ... N include memory units, e.g., chips or hard disks, on which documentation information relating to the respective component A, B, ... N is stored.

Smaller modules or smaller parts of the machine, in the following referred to as "parts" a, b, ... n, of the complex system 1 include identification information, e.g., in form of a barcode sticker or other types of identification information and are operatively connected with the identification unit 4. The identification unit 4 can read the identification information of the parts a, b, ... n and access an external data memory 6 where up-to-date documentation information relating to the parts a, b, ... n and specific for each part is stored. The external data memory may be, for example, a data carrier supplied with a subscription, for example a CD or a DVD. The required documentation information for the "parts" can also be stored in a database accessible on an intranet or on the Internet. Based on the identification information, the up-to-date part-specific documentation information is read from the external data memory 6 into the second documentation memory 3. As a result, up-to-date component-specific documentation information for all components of the complex system is available in the first documentation memory 2. Updated part-specific documentation information is available in this documentation memory 3 for all parts a, b, ... n.

An overall documentation GD is formed from this totality of documentation information of all relevant components and parts of the complex system. A user of the complex system, for example the injection molding machine, can access the information of the overall documentation GD via an output device 5.

Advantageously, the overall documentation GD includes an interface 7, for example a remote query interface, which can be used by the manufacturer of a

complex system to access the system-specific overall documentation at the operator of a complex system, for example, for supporting maintenance and service functionality. In this way, the operator can receive effective optimized and machine-specific support from the manufacturer.

A second embodiment of the method of the invention is illustrated in FIG. 2. Unlike with the method depicted in FIG. 1, all components A, B, ... N and all parts a, b, ... n only include identification information and are connected with the identification unit 4 of the complex system 1. The complete documentation information of all components and parts is provided in the external data memory 6, with the identification unit calling the part-specific and component-specific documentation information from the external data memory based on the identification of the components and parts, and reading this documentation information into an overall documentation memory GDS. The overall documentation GD in the overall documentation memory GDS is in turn connected with an output device 6, so that the user of the complex system 1 is provided with an up-to-date, machine-specific system documentation.

Advantageously, with this embodiment of the method of the invention the overall documentation information can also be provided to the manufacturer of the complex system via an interface 7, in particular a remote query interface, so as to optimize and improve, as already mentioned above, the customer service from the manufacturer.

In the following, an exemplary exchange of a component or a part is described for both embodiments of the method of the invention depicted in FIG. 1 and FIG. 2.

When a component A, B, ... N is exchanged for a replacement component A', B', ... N' according to the method of FIG. 1, documentation information is read from the storage unit of the replacement component A', B', ... N' into the

documentation memory 2 after the replacement component A', B', ... N' has been installed. In this way, the documentation memory 2 is updated so as to reflect the potentially changed documentation information resulting from the installation of the replacement component A', B', ... N'.

If a part a, b, ... n is exchanged for a replacement part a', b', ... n', then the type of the replacement part is determined with the identification unit 4 after the replacement part a', b', ... n' has been installed. Thereafter, documentation information about this replacement part a', b', ... n' is recalled from the external data memory 6 and read into the second documentation memory 3. As a result, the documentation memory 3 is also updated to reflect the parts actually installed in the complex system 1. After the documentation memory 2 or the documentation memory 3 or both documentation memories 2, 3 have been updated, an up-to-date overall documentation GD specific for this machine is generated from the documentation information of both documentation memories 2, 3, and this overall documentation GD is provided to the output device 5.

In the embodiment according to FIG. 2 of the method of the invention, after a component A, B, ... N or a part a, b, ... n has been exchanged with a replacement component A', B', ... N' or a replacement part a', b', ... n', this replacement component or part is identified by the identification unit 4. Thereafter, the documentation information corresponding to the replacement component A', B', ... N' or the replacement part a', b', ... n' is recalled from the external data memory 6 and read into the overall documentation GD. As a result, the overall documentation GD is updated machine-specific following the installation of a replacement component A', B', ... N' or a replacement part a', b', ... n'.

The overall documentation GD can be integrated, for example, with a machine controller, wherein the machine controller is electronically connected with the components and capable of evaluating a documentation or the technical data of

the components/parts and optionally display the evaluated technical data of the components/parts on the display screen. The components/parts can be connected with the documentation memories and/or the identification unit and/or the machine controller, for example, via cable, wireless, optical links, magnetism, etc.

Advantageously, the machine controller and/or the overall documentation GD can administer and update itself automatically, so that the documentation is automatically updated, in particular during a subsequent components/parts exchange.

Advantageously, updated documentation is always available on the complex system and need not be centrally administered and/or provided. An exemplary component is a hydraulic pump of an injection molding machine with control electronics that includes a memory unit, in which exploded views, replacement part lists, technical data such as characteristic curves, limit values, etc., are stored. The electronics/memory unit is connected via a bus system with the supervisory machine controller of the complex system, e.g., the injection molding machine, which can recall, process and visualize these data.

In the electronics or the memory unit of, for example, a pressure sensor, additional values for permissible load cycles, for example a maximum value, are stored by the manufacturer and the sensor counts the number of load cycles observed during operation. This makes possible a load- and cycle-dependent service life forecast, and a forecast of the failure probability. This facilitates preventive maintenance.

Additional data that can be stored in the memory unit of a component or in the external memory for components and/or parts are, for example:

Limit values (maximum/minimum values), logs of characteristic curves in the operating state, wear data, service life data, maintenance interval, manufacturing data, permissible and actual control deviations, etc.

It will be understood that the method of the invention according to FIG. 1 and FIG. 2 can be used to integrate additional peripheral devices, for example an injection molding tool, handling units for workpieces and the like, conveyor belts, annealing units, heating cabinets, or tool change systems.

The invention also makes it possible to store, update and document in the injection molding tool, for example, wiring diagrams, operating instructions, settings, process parameters, maintenance information, etc.

With the invention, the documentation advantageously matches at any time machine-specific and up-to-date the corresponding machine or system configuration. This enables in a simple manner so-called plug-and-play service and plug-and-play updating of the documentation. This is a prerequisite for a reliable remote diagnostic, for example, via the remote query interface, via a PC connection for the manufacturer. This provides for both the manufacturer and the operator reliable end-to-end documentation as well as time and cost savings for generating the documentation. In addition, the operator can correctly and machine-specifically implement support measures communicated by the manufacturer.

31254-49

CLAIMS:

1. A method of ascertaining a configuration and a state of a machine, wherein the machine comprises a plurality of exchangeable machine components and parts, said method comprising the steps of:

5 providing each of the machine components with a dedicated storage device arranged on the machine component that stores documentation information specific for the machine component;

assigning an individual identification information to each of the machine parts;

10 accessing the storage device of each machine component to retrieve the component-specific documentation information;

storing the component-specific documentation information in a first documentation memory;

15 reading the identification information of each machine part into an identification unit;

accessing with the identification unit an external memory to retrieve documentation information associated with the identification information of each machine part;

20 storing the retrieved part-specific documentation information in a second documentation memory;

combining the component-specific documentation information from the first documentation memory and the retrieved part-specific documentation information from the second documentation memory to generate an overall documentation of the machine;

31254-49

upon exchange of a machine component with a replacement machine component, reading into the first documentation memory changed component-specific documentation information of a replacement machine component stored in the dedicated storage device arranged on the replacement machine component, and
 5 reading with the identification unit at least the part-specific documentation information of the replacement part from the external data memory into the second documentation memory,

automatically generating from changed documentation information in the first and second documentation memory a changed overall documentation, and

10 displaying at least the changed overall documentation on an output device to allow an operator to determine the changed machine configuration and machine state and to intervene in operation and maintenance of the machine.

2. The method of claim 1, wherein the external data memory is provided on the Internet, on an intranet or on a data carrier, a CD-ROM, a DVD-ROM, or a
 15 combination thereof.

3. The method of claim 1, wherein at least one of the component-specific documentation information and the part-specific identification information is encoded.

4. The method of claim 3, wherein the identification information is encoded as a barcode.

20 5. The method of claim 1, further comprising the step of providing the overall documentation to a manufacturer of the machine via an interface.

6. The method of claim 5, wherein the interface comprises a remote query interface.

7. The method of claim 1, wherein the documentation information of the
 25 components comprises an exploded view drawing, a replacement part list, technical

31254-49

data, characteristic curves, limit values relating to a load, data about a maximally permissible load cycle of a component, or a combination thereof.

8. The method of claim 1, wherein the documentation information includes at least one of data logs of the operating state, wear values, data relating to the service life, data relating to maintenance intervals, manufacturing data, and information about permissible and historic control deviations.

9. The method of claim 1, wherein the documentation information includes wiring diagrams, operating information, information about settings, process parameters or maintenance information for at least one of the components and the parts.

10. The method of claim 1, wherein the documentation information is provided in different languages or in a combination of languages.

11. A method of ascertaining a configuration and a state of a machine, wherein the machine comprises a plurality of exchangeable machine components and parts, the method comprising the steps of:

providing each of the machine components with component-specific identification information and each of the machine parts with part-specific identification information;

reading the component-specific identification information and the part-specific identification information from the respective machine component or the respective machine part, or both, into an identification unit;

reading with the identification unit component-specific and part-specific documentation information from an external data memory into an overall documentation memory;

automatically generating from the component-specific and part-specific documentation information an overall documentation of the system;

31254-49

upon exchange of a machine component with a replacement machine component, reading into the identification unit changed component-specific identification information of a replacement machine component, and reading with the identification unit changed component-specific and part-specific documentation information of the replacement part from the external data memory into the overall documentation memory,

automatically generating from the changed documentation information a changed overall documentation, and

displaying at least the changed overall documentation on an output device to allow an operator to determine the changed machine configuration and machine state and to intervene in operation and maintenance of the machine.

12. The method of claim 11, wherein the external data memory is provided on the Internet, on an intranet or on a data carrier, a CD-ROM, a DVD-ROM, or a combination thereof.

15 13. The method of claim 11, wherein at least one of the component-specific identification information and the part-specific identification information is encoded.

14. The method of claim 13, wherein the identification information is encoded as a barcode.

15. The method of claim 11, further comprising the step of providing the overall documentation to a manufacturer of the machine via an interface.

16. The method of claim 15, wherein the interface comprises a remote query interface.

17. The method of claim 15, wherein the component-specific documentation information comprises an exploded view drawing, a replacement part list, technical data, characteristic curves, limit values relating to a load, data about a maximally permissible load cycle of a component, or a combination thereof.

31254-49

18. The method of claim 15, wherein the component-specific and part-specific documentation information includes at least one of data logs of the operating state, wear values, data relating to the service life, data relating to maintenance intervals, manufacturing data, and information about permissible and historic control
5 deviations.

19. The method of claim 11, wherein the component-specific and part-specific documentation information includes wiring diagrams, operating information, information about settings, process parameters or maintenance information for at least one of the components and the parts.

10 20. The method of claim 11, wherein the component-specific and part-specific documentation information is provided in different languages or in a combination of languages.

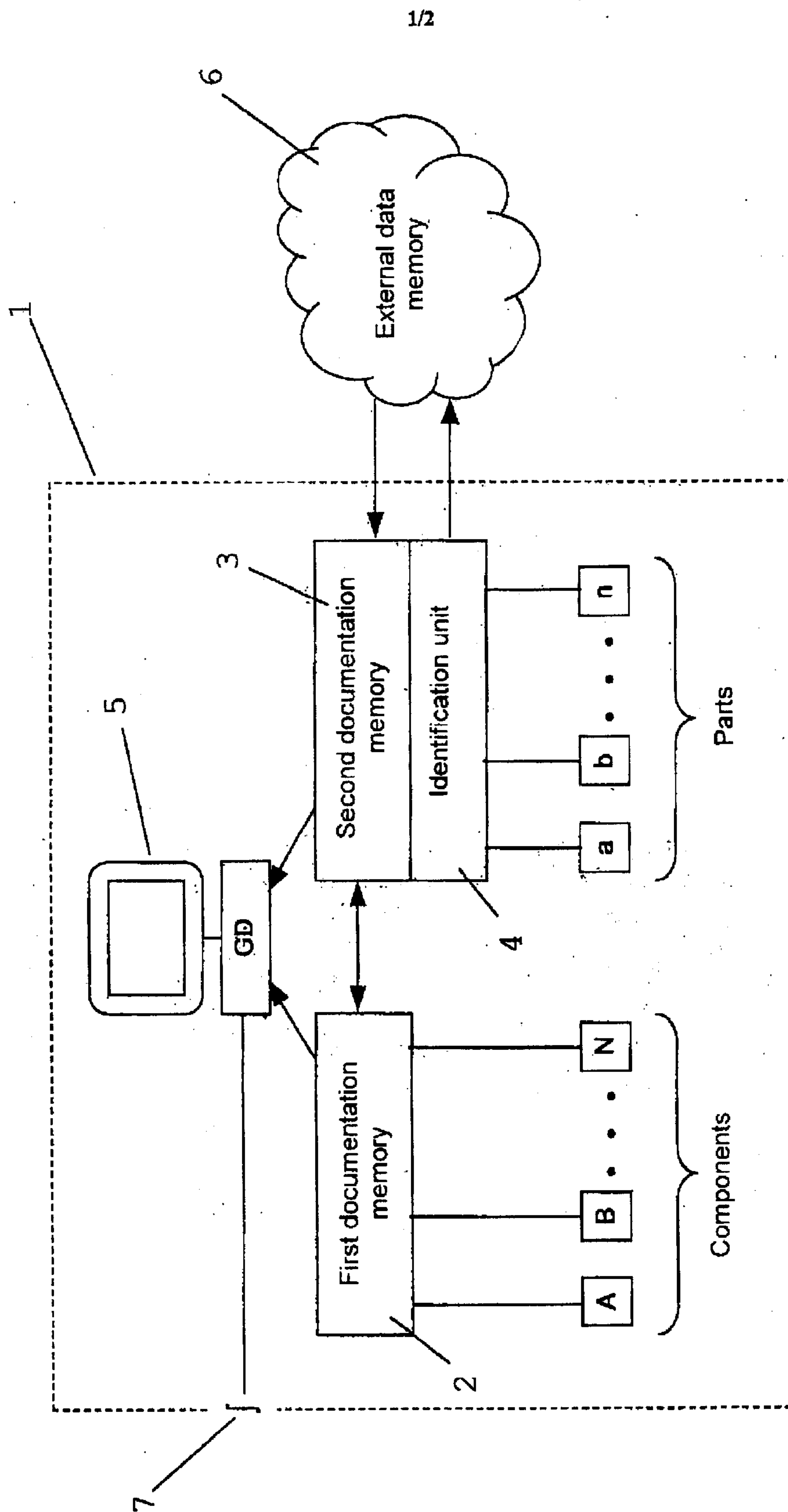


Fig. 1

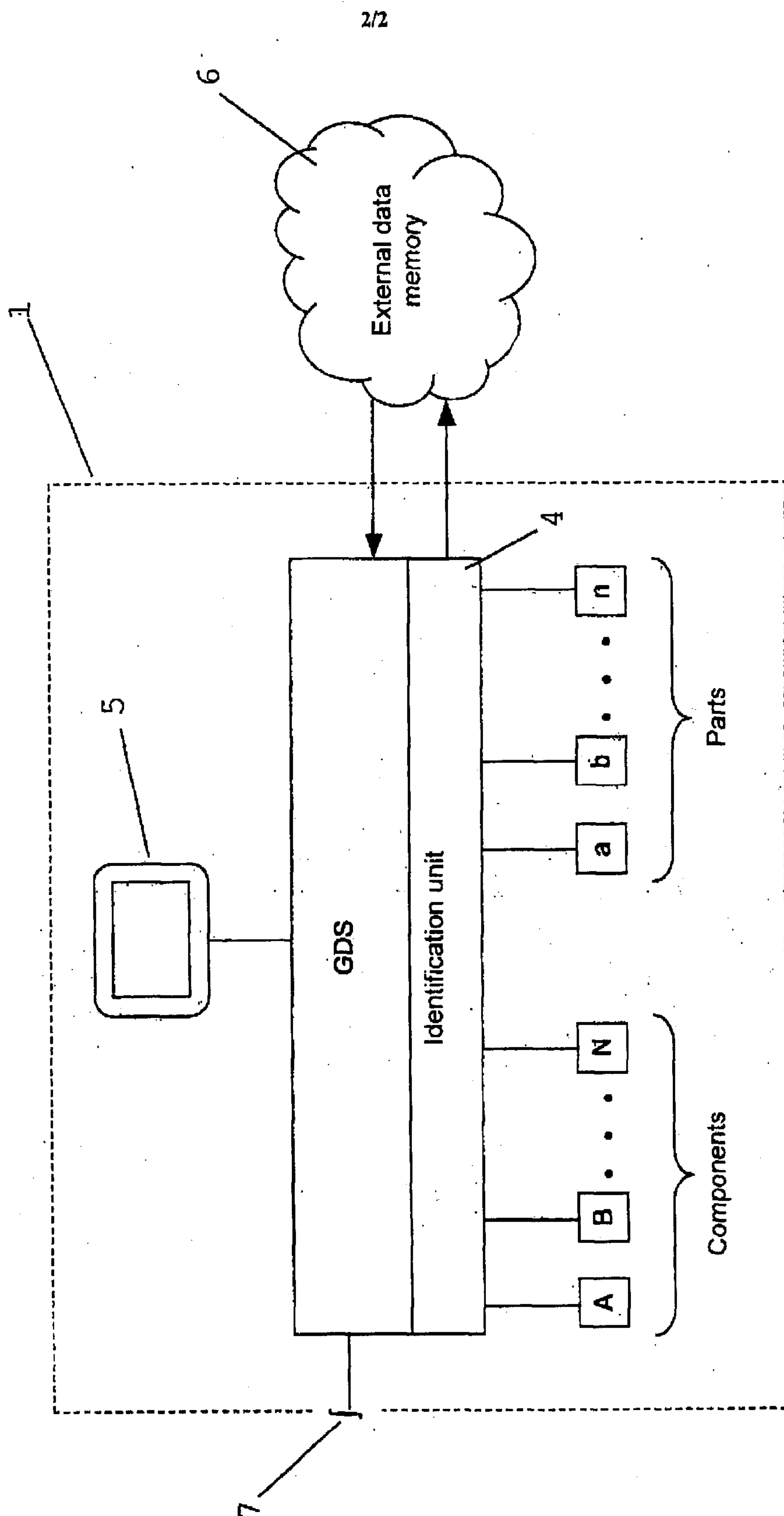


Fig. 2