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[Continued on next page]

(54) Title: DEVICE AND METHOD FOR GENERATING A VIRTUAL ANATOMIC ENVIRONMENT
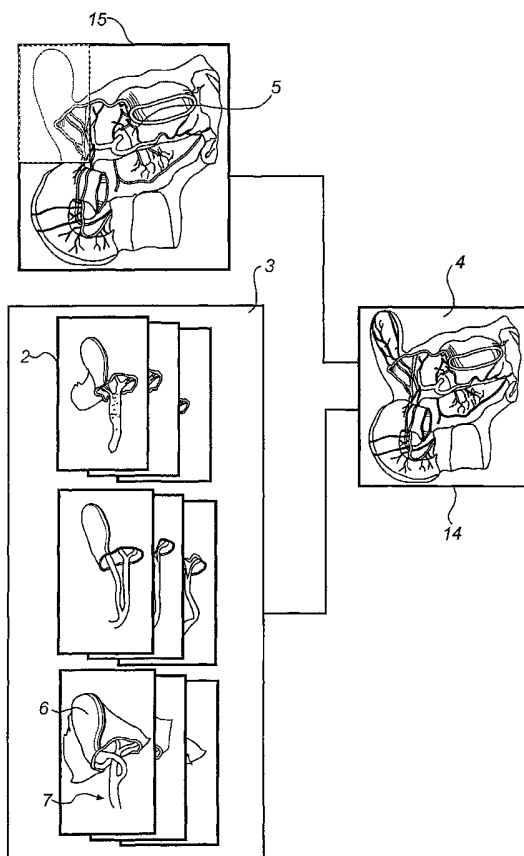
(57) Abstract: This invention relates to a method for generating a virtual anatomic environment for use in minimally invasive surgery simulation, comprising the steps of: incorporating a main virtual anatomic environment (1); selecting a local anatomic environment (2) from a predefined library (3) comprising a set of two or more simulated local anatomic environments (2); including the selected local anatomic environment (2) in said main anatomic environment (1) to form a total virtual anatomic environment (4). The invention also relates to a device for generating a virtual anatomic environment for use in minimally invasive surgery simulation, as well as a computer-based minimal-invasive surgery simulation system comprising such a device.

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DEVICE AND METHOD FOR GENERATING A VIRTUAL ANATOMIC ENVIRONMENT

Technical field of the invention

This invention relates to a method for generating a
virtual anatomic environment for use in minimally inva-
5   sive surgery simulation. The invention further relates to
such a computer-based minimal-invasive surgery simulation
system.

Background of the invention

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In modern surgery, minimal invasive techniques are
used in more and more applications. The development of
technology within this relatively new field advances
quickly, which results in great training requirements for
15   surgeons. One way of rendering the training more effec-
tive is to use computer simulations. Known techniques for
providing a credible simulation are very complicated and
expensive with respect to computer utility in the form of
processor and memory. Moreover, the result is not suffi-
20   cient to provide a realistic simulation environment. The
visual properties that the anatomy exhibits in reality
are difficult and time-consuming to recreate in a simula-
tion.
By means of modern computer engineering, it is pos-
25   sible to provide realistic training situations in a vir-
tual environment created by a computer program. In the
computer program, a three-dimensional model of the object
which the simulation concerns is provided. The user is
provided with a projection thereof which should corre-
30   spond to the picture information which in a real situa-
tion is caught by a camera. Within the field of laparo-
scopy, a camera is used to supply picture information
from the patient to the surgeon. The display screen shows

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the picture that the camera catches of the inside of, for example, the abdominal cavity. All the instruments and the anatomy with which the surgeon works are reproduced by means of the camera and the display screen. The sur-

5   geon uses the information on the display screen to control and operate his or her instruments and carry out the procedures which are required to perform the surgical operation. Since the minimal invasive techniques supply information to the surgeon by means of a display screen,

10   the three-dimensional reality is reduced to two dimensions on the display screen. The picture therefore lacks, among other things, the information as to depth that exists in reality. The surgeon has to make up for this loss of information by studying lighting conditions, colours,

15   etc.

        This means that all visual information, such as instrument and anatomy, is drawn by the computer. However, many complicated processes within the field of surgery are expensive, if not impossible, to fully simulate in a

20   computer. For example, a large part of the picture information that the surgeon uses in real life, for example light effects and anatomic structures, factors such as breathing and beat of the pulse, which are present in the real situation are difficult to recreate

25   realistically in the computer. Moreover, due to different biological anatomic variations occurring in humans, it is difficult to fully simulate a situation confronting a surgeon when he is to perform an operation. Some efforts have been made to generate simulation systems providing

30   random variations of certain elements, such as the thickness of an artery, in order to provide a more realistic simulation environment. However, such random variations are not enough to fully prepare a surgeon on what to expect when performing minimal-invasive surgery.

35   Moreover, the more alterations of this type that are made during simulation, during simulation, the more computer capacity is needed, making such systems expensive. Hence, a method for providing a more realistic simulation

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viding a more realistic simulation result, at the same
time saving computer capacity, is desired, in order to
provide a realistic, cost-efficient system for minimal-
invasive surgery simulation.

Summary of the invention

Hence, an object of the present invention is to pro-
vide a method and system for use in minimally invasive
surgery simulation system, in order to generate a realis-
tic simulation environment, and which wholly or partly
solve the above-mentioned problems.

These and other objects are at least partly achieved
by a method for generating a virtual anatomic environment
for use in minimally invasive surgery simulation, com-
prising the steps of: incorporating a main virtual anat-
omic environment, selecting a local anatomic environment
from a predefined library comprising a set of two or more
simulated local anatomic environments, and including the
selected local anatomic environment in said main anatomic
environment to form a total virtual anatomic environment.
This enables a total virtual anatomic environment, in
which simulation may be performed, to be built-up by
separately modelled components. By using different build-
ing components, as stored in the library, different total
virtual anatomic environments may be generated, without
modelling the entire environment from the beginning. This
also enables that the manufacturer may have a total con-
trol over what variations are stored in the library, and
hence what total virtual anatomic environments that may
be generated, as opposed to randomise alterations of
separate components of the environment.

Preferably, said set of local anatomic environments
is arranged to represent a set of anatomic variations for
a critical internal area, occurring in living beings.
Thereby, a straight-forward method of achieving a simula-
tion system, covering anatomic variations, such as dif-

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ferent configurations of arteries and ducts around an or-
gan, or different organ shapes (and so on) is realised.

Moreover, the step of selecting a local anatomic en-
vironment from a predefined library comprising two or
more of simulated local anatomic environments suitably
further comprises the step of randomly selecting one of
the local anatomic environments in the library. Thereby,
a user of the simulation system does not know in advance
what anatomic environment will be presented to him. This
provides a realistic situation for the user, and gives
the user the opportunity to learn to tell the difference
between different anatomic environments, that may look
similar at a first glance. Preferably, the probability of
randomly selecting a certain local anatomic environment
essentially corresponds with the degree of occurrence of
that local anatomic environment in living beings, in or-
der to further provide a realistic simulation environ-
ment.

According to a preferred embodiment of the inven-
tion, the main virtual anatomic environment is arranged
to model an internal cavity of a human, such as an ab-
dominal cavity or a chest cavity, while the set of local
anatomic environments is arranged to simulate different
arrangements of arteries, veins and ducts around an organ
arranged in said internal cavity, such as a gall bladder
or a heart.

According to another embodiment, the inventive
method further comprises the step of selecting, by means
of user selection, a certain one of said local anatomic
environments from said library and including it into said
main virtual environment. This enables a user to practice
surgery in a certain selected environment, for example to
improve his or her skills on that certain environment, or
to prepare for a real surgery of a patient exhibiting a
similar environment.

The above and other objects are at least partly achieved
by a device for generating a virtual anatomic environment

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for use in minimally invasive surgery simulation, com-
prising a modelling device for providing a main virtual
anatomic environment, a library, comprising a set of two
or more predefined local anatomic environments, and means
5   for incorporating one of the local anatomic environments
of the library into the main virtual anatomic environ-
ment, together forming a total virtual anatomic environ-
ment. Such a device enables a total virtual anatomic en-
vironment, in which simulation may be performed, to be
10 built-up by separately modelled components. By using dif-
ferent building components, as stored in the library,
different total virtual anatomic environments may be gen-
erated, without modelling the entire environment from the
beginning. This also enables that the manufacturer may
15 have a total control over what variations is stored in
the library, and hence what total virtual anatomic envi-
ronments that may be generated, as opposed to randomise
alterations of separate components of the environment.
This may be advantageous from an educational point of
20 view.
        Preferably, the device further comprises a selection
device for selecting one of said local anatomic environ-
ments from said library to be included in said main anat-
omic environment, and suitably, the selection device is
25 arranged to randomly select one of said local anatomic
environments from said library to be included in said
main anatomic environment. Thereby, a user of the simula-
tion system does not know what anatomic environment will
be presented to him. This provides a realistic situation
30 for the user, and gives the user the opportunity to learn
to tell the difference between different anatomic envi-
ronments, that may look similar at a first glance. Pref-
erably, the selection device is arranged to randomly se-
lect one of said local anatomic environments in such a
35 way that the probability of choosing a certain local
anatomic environment essentially corresponds with the de-
gree of occurrence of that local anatomic environment in

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human beings, further improving the realism of the simu-
lated surgery.

According to a preferred embodiment of the inven-
tion, the main virtual anatomic environment is arranged

5   to model an internal cavity of a human, such as an ab-
dominal cavity or a chest cavity, while the set of local
anatomic environments is arranged to simulate different
arrangements of arteries, veins and ducts around an organ
arranged in said internal cavity, such as a gall bladder

10   or a heart.

Also, the above and other objects of the invention
are achieved by a computer-based minimal-invasive surgery
simulation system, comprising a device for generating a
virtual anatomic environment as described above.

15

Brief description of the drawings

The invention will hereinafter be described in
closer detail by means of presently preferred embodiments

20   thereof, with reference to the accompanying drawings.

Fig 1 is a schematic view of the basic components of
a simulation system in which the present invention may be
implemented.

Fig 2 is a block diagram of a simulation system ac-

25   cording to an embodiment of the invention.

Fig 3 is a block diagram describing the inventive
device for generating a virtual anatomic environment for
use in a minimally invasive surgery simulation system as
shown in fig 1 or 2.

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Description of preferred embodiments of the invention

Hereinafter, reference will be made in detail to a
preferred embodiment of this invention, which is illus-

35   trated in the accompanying drawings.

As stated above this invention relates to the field
of computer-based minimal-invasive surgery simulation

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systems, and a schematic drawing of the basic hard-ware
components of such a system, in which the present inven-
tion may be incorporated, is disclosed in fig 1. Such a
system essentially comprises a processing unit 10 for
5   simulating a minimal-invasive surgery situation, a surgi-
cal tool input device 11, for inputting information re-
garding movements etc of a surgical tool to be manoeuvred
by a user to the processing unit 10, and a display device
12 for displaying the simulated surgery procedure in or-
10 der to visualise the simulated surgery situation for the
user. The processing unit may, for example, comprise a
personal computer which is preferably equipped with a
graphics card having 3D-circuits. Moreover, the surgical
tool input device 11 may or may not be provided with a
15 system for tactile feedback to the user of the system.

        The processing unit 10, as disclosed in fig 1, will
hereinafter be described in closer detail with reference
to fig 2. The processing unit essentially comprises a to-
tal virtual anatomic environment modeller 14, for provid-
20 ing a model of a total virtual anatomic environment 2 to
an interaction simulation device 13. The interaction
simulation device 13 is also arranged to receive informa-
tion regarding movements etc. of the surgical tool input
device 11. Based on information from the total virtual
25 anatomic environment modeller 14 and the surgical tool
input device 11, the surgical procedure is simulated by
said interaction simulation device 13, and the resulting
simulation is outputted to the display device 12, whereby
it is displayed for a user.

30   This invention is focused on the generation of the
total virtual anatomic environment 4, generated by said
total virtual anatomic environment modeller 14. According
to the invention, the processing unit 10 further com-
prises a main virtual anatomic environment modeller 15,
35 for providing a model of a main virtual anatomic environ-
ment 1, as well as a local anatomic environment library
3, for providing a model of a local virtual anatomic en-

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vironment 2. The main virtual anatomic environment model-
ler 15 and the local anatomic environment library 3 are
both connected with the total virtual anatomic environ-
ment modeller 14.

5   The main virtual anatomic environment modeller 15 is
arranged to model and provide a model of a main virtual
anatomic environment 1 to the total virtual anatomic en-
vironment modeller 14, while the local anatomic environ-
ment library 3 is arranged to store a two or more mod-
10   elled local anatomic environments 2, and providing one of
those to the total virtual anatomic environment modeller
14. Together, the main virtual anatomic environment 1 and
the local anatomic environment 2 may form a total anat-
omic environment, in which simulation may be performed.

15   The term "local virtual anatomic environment" as
used herein shall be understood as a 3-D model of a local
internal area of a living being, that is critical during
the surgery procedure that is to be simulated. For exam-
ple, the local virtual anatomic environment may comprise
20   a and organ 6, such as a gall bladder or a heart and the
veins, arteries and ducts 7 surrounding the organ 6. How-
ever, the invention may be used for simulation of virtu-
ally any internal area, and hence, the invention is not
limited to the above examples.

25   The term "local virtual anatomic environment li-
brary" as used herein shall be understood as a library
containing two or more local virtual anatomic environ-
ments as defined above, said environments forming a set
of environments. The set of environments may for example
30   comprise a plurality of environments each modelling a
biological variation in the selected local internal area.
As an example, environmental models of different configu-
rations of the veins, arteries and ducts surrounding the
gall bladder, that are present in human beings may be
35   stored in the library, as is disclosed in fig 3. In the
present example, in order to cover the biological variety
to an extent of approximately 99% of all humans, the set

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should contain about 16 different local virtual anatomic
environments. Another example, for which the invention
may be used, is different configurations of veins, arter-
ies and ducts surrounding the heart.

5   The term "main virtual anatomic environment" as used
herein shall be understood as a 3-D model of an internal
area of a living being, essentially surrounding the local
internal area described above. An example of such an in-
ternal area is the abdominal cavity (for the example with
10   a gall bladder) or the chest cavity (for the example with
the heart). The components included in the local virtual
anatomic environment are excluded in the main virtual
anatomic environment. For example, if the local virtual
anatomic environment contains the gall bladder and the
15   surrounding arteries and ducts, the main virtual anatomic
environment does not include those components, but only
connecting arteries, and ducts and so on. Alternatively,
the local virtual anatomic environment may only comprise
the arteries and ducts surrounding the gall bladder,
20   while the gall bladder itself is included in the main
virtual anatomic environment.

        The device further comprises a selection device 9,
for selecting one of the local anatomic environments 2
25   stored in the local anatomic environment library 3. This
selection device may be realised in various different
ways.
        According to a first example, the selection device
9may be provided with an input device (not shown), so
30   that a user actively may select what local anatomic envi-
ronment should be selected and included into the main
virtual anatomic environment. This may for example be re-
alised through a computer input interface, using a mouse
or the like. The above enables training in a user-
35   selected environment, for improving the user's skills re-
garding a certain biological variation, as defined by the
selected local anatomic environment 2. Thereby, a user

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(surgeon) may train on a surgery procedure of a patient, exhibiting a certain biological variation, before per-forming the surgery. Moreover, the user may specifically train on procedures in local anatomic environments which
5   they are less familiar with, thereby improving the over-all quality of the surgery training.

According to a second example, the selection device 9 may be arranged as a random selection device, for ran-domly selecting one of the local anatomic environments 2,
10   stored in the local anatomic environment library 3. This provides a realistic training situation, since, in most cases, a surgeon is not aware of what biological varia-tion a patient exhibits until the surgery procedure has started. It is then of great importance to quickly be
15   able to recognize the different biological variations, in order to perform a correct procedure. Hence, a selection device according to this example facilitates such train-ing. In order to further enhance the realism of the sur-gical training, the selection device 9 may be arranged to
20   randomly select one of the local anatomic environments 2, as described above, whereby the random selection is such that the probability of selecting a certain local anat-omic environment essentially corresponds with the degree of occurrence of that local anatomic environment in human
25   beings. This may for example be realised by means of pro-viding each local anatomic environment 2 of the library 3 with a weight, corresponding to the occurrence of the biological variation being represented by the local anat-omic environment 2 in question.
30   As stated above, the 3-D model of the main virtual anatomic environment 1 and the 3-D model of the selected local anatomic environment 2 is transmitted to the total virtual anatomic environment modeller 14, in which the local anatomic environment 2 is positioned in its desired
35   position in the main virtual anatomic environment 1, to-gether forming a total virtual anatomic environment.

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The total anatomic environment, as modelled by the total anatomic environment modeller 14, is thereafter transmitted to the interaction simulation device 13, in which the total anatomic environment is used for perform-
5   ing the simulation, and the interaction with the inputted movements and actions of the surgical tool. Thereafter, the simulation result is transmitted to and displayed by the display device 12.

Many modifications, improvements and variations of
10   the above described embodiments of the invention are ob-vious for the man skilled in the art, and such modifica-tions, improvements and variations are intended to form a part of the disclosure, and are also intended to fall within the scope and spirit of this invention as defined
15   by the appended claims. Hence, the above description of preferred embodiments is only given by way of example, and the invention is only to be limited to what is stated in the following claims, taking any equivalents into ac-count.

20   For example, it shall be noted that the incorpora-tion of the local virtual anatomic environment 2 into the main virtual anatomic environment may alternatively take place directly in the interaction simulation device 13, hence excluding the total virtual anatomic environment
25   modeller 14 as a separate component.

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CLAIMS

1.   A method for generating a virtual anatomic environment for use in minimally invasive surgery simulation, comprising the steps of:
-incorporating a main virtual anatomic environment (1),
-selecting a local anatomic environment (2) from a predefined library (3) comprising a set of two or more simulated local anatomic environments (2),
-including the selected local anatomic environment (2) in said main anatomic environment (1) to form a total virtual anatomic environment (4).

2.   A method according to claim 1, wherein said set of local anatomic environments (2) is arranged to represent a set of anatomic variations for a critical internal area, occurring in living beings.

3.   A method according to claim 1 or 2, wherein the step of selecting a local anatomic environment (2) from a predefined library (3) comprising two or more of simulated local anatomic environments (2) further comprises the step of randomly selecting one of the local anatomic environments (2) in the library (3).

4.   A method according to claim 3, wherein the probability of randomly selecting a certain local anatomic environment (2) essentially corresponds with the degree of occurrence of that local anatomic environment in living beings.

5.   A method according to any one of the preceding claims, wherein the main virtual anatomic environment (1) is arranged to model an internal cavity (5) of a human, such as an abdominal cavity or a chest cavity, while the set of local anatomic environments is arranged to simulate different arrangements of arteries, veins and ducts

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(7) around an organ (6) arranged in said internal cavity
(5), such as a gall bladder or a heart.

6.   A method according to any one of the claims 1-2
or 5, further comprising the step of:
-selecting, by means of user selection, a certain one of
said local anatomic environments (2) from said library
(3) and including it into said main virtual environment
(1).

7.   A device for generating a virtual anatomic en-
vironment for use in minimally invasive surgery simula-
tion, comprising:
-a modelling device (15) for providing a main virtual
anatomic environment (1),
-a library (3), comprising a set of two or more prede-
fined local anatomic environments (2),
-means for incorporating one of the local anatomic envi-
ronments (2) of the library (3) into the main virtual
anatomic environment (1), together forming a total vir-
tual anatomic environment (4).

8.   A device according to claim 7, further compris-
ing:
-a selection device (9) for selecting one of said local
anatomic environments (2) from said library (3) to be in-
cluded in said main anatomic environment.

9.   A device according to claim 8, wherein:
-the selection device (9) is arranged to randomly select
one of said local anatomic environments (2) from said li-
brary (3) to be included in said main anatomic environ-
ment.

10.   A device according to claim 9, wherein:
-the selection device (9) is arranged to randomly select
one of said local anatomic environments (2) in such a way

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that the probability of selecting a certain local anat-
omic environment (2) essentially corresponds with the de-
gree of occurrence of that local anatomic environment in
human beings.

11.   A device according to any one of the claims 7-
10, wherein the main virtual anatomic environment (1) is
arranged to model an internal cavity (5) of a human, such
as an abdominal cavity or a chest cavity, while the set
of local anatomic environments (2) is arranged to simu-
late different arrangements of arteries, veins and ducts
(7) around an organ (6) arranged in said internal cavity
(5), such as a gall bladder or a heart.

12.   A computer-based minimal-invasive surgery simu-
lation system, comprising a device for generating a vir-
tual anatomic environment as described in any one of the
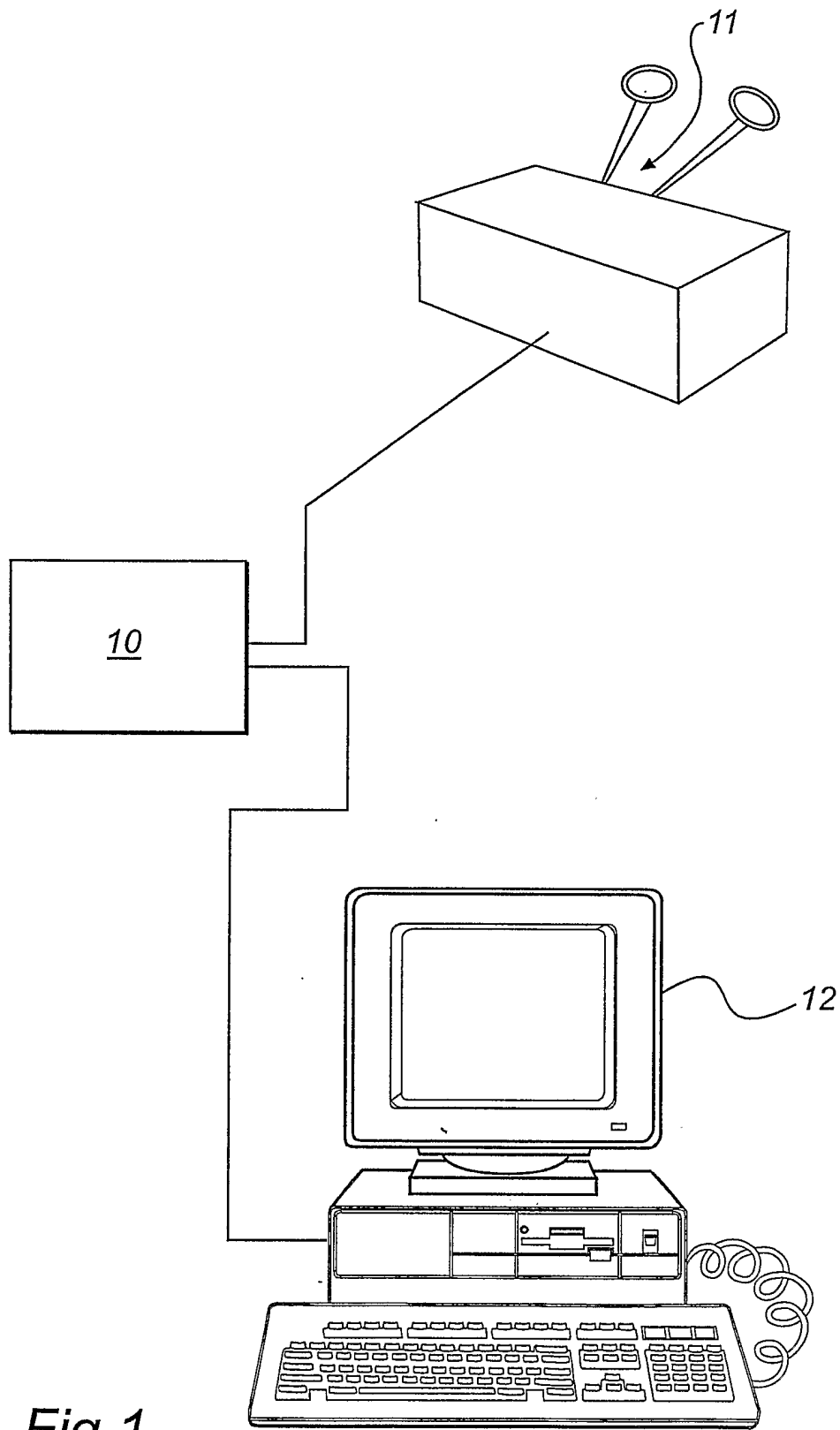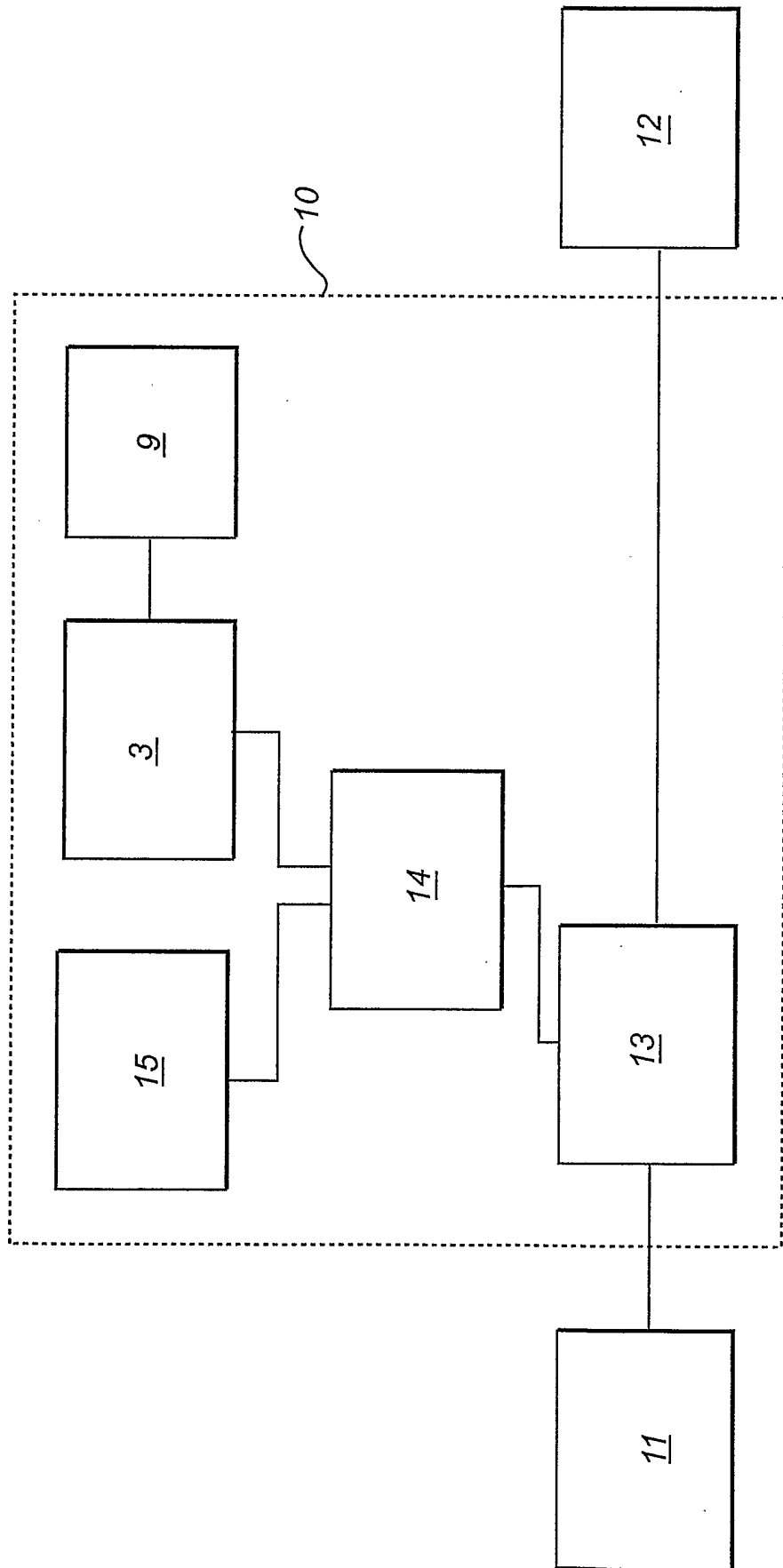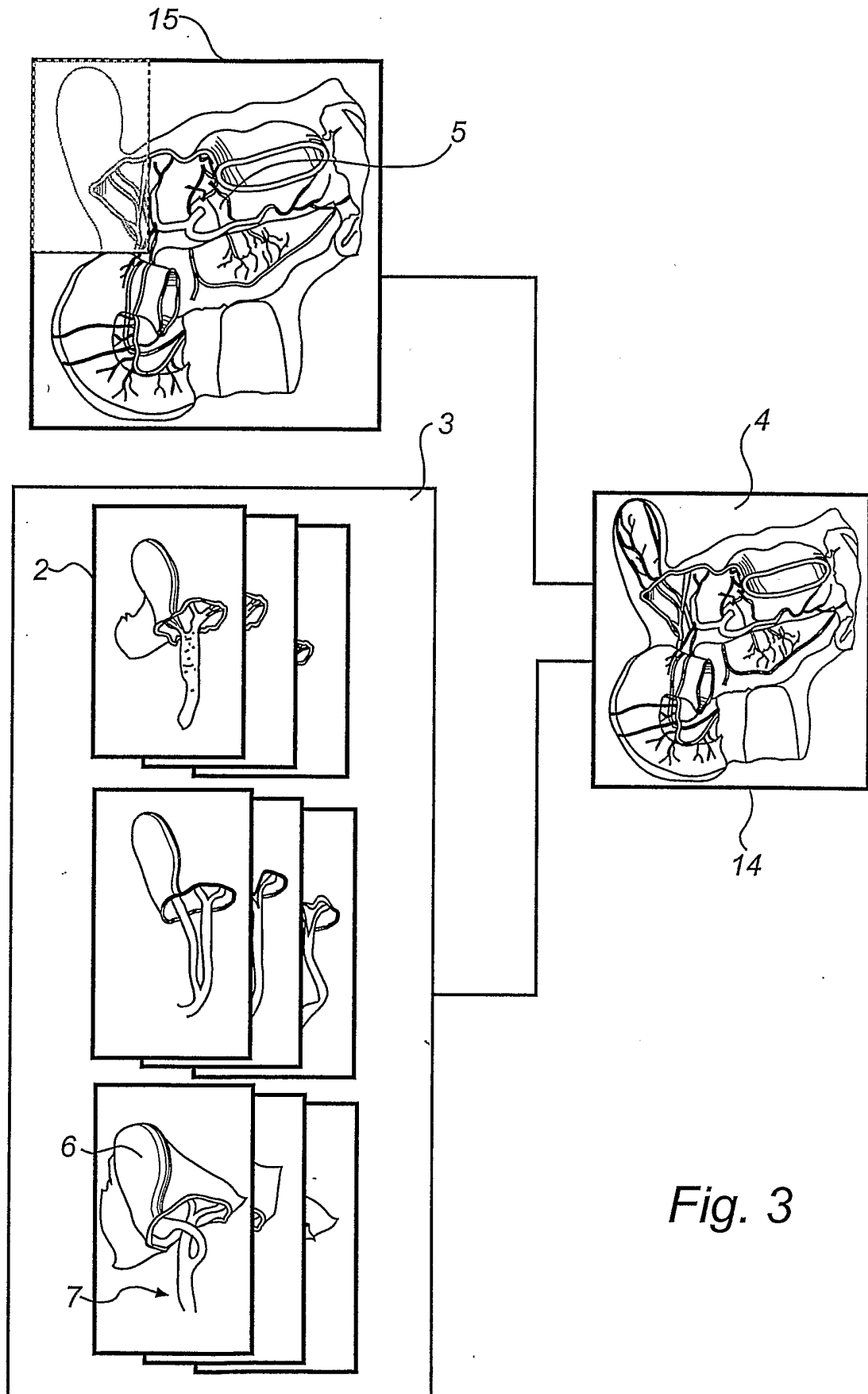claims 7-12.

Fig.1

Fig. 2

Fig. 3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G09B 23/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G09B

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5771181 A (R.S. MOORE ET AL), 23 June 1998 (23.06.98), column 3, line 16 - line 24	1-12
Y	US 6336812 B1 (C.M. COOPER ET AL), 8 January 2002 (08.01.02), whole document	1-12
Y	WO 9628800 A1 (HIGH TECHSPLANATIONS, INC.), 19 Sept 1996 (19.09.96), page 3, paragraph 3	3,4,6,8-10
A	WO 0178039 A2 (SIMBIONICS LTD.), 18 October 2001 (18.10.01), page 20, line 1 - line 7	

☐ Further documents are listed in the continuation of Box C.   ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 December 2003	0 9 -12- 2003

Name and mailing address of the ISA/	Authorized officer
Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Erik Miliander/MN Telephone No. + 46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/09/03

International application No.

PCT/SE 03/01514

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5771181 A	23/06/98	AU	4520196 A	03/07/96
		WO	9618942 A	20/06/96
US 6336812 B1	08/01/02	AU	755575 B	19/12/02
		AU	8117498 A	04/01/99
		CN	1260896 T	19/07/00
		DE	69804793 D,T	14/08/02
		DK	990227 T	01/07/02
		EP	0990227 A,B	05/04/00
		SE	0990227 T3	
		ES	2175728 T	16/11/02
		GB	9712987 D	00/00/00
		HK	1023832 A	00/00/00
		HU	0002657 A	28/12/00
		JP	2002511156 T	09/04/02
		WO	9858358 A	23/12/98
WO 9628800 A1	19/09/96	AU	5025396 A	02/10/96
		CA	2144505 A	11/09/96
WO 0178039 A2	18/10/01	AU	5060101 A	23/10/01
		EP	1275098 A	15/01/03
		US	2003091967 A	15/05/03