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**MEDICAL INFORMATION MANAGEMENT SYSTEM**

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(57) Claim

1. A medical information management system for recording a patient's personal medical information onto an optical memory medium to manage the medical information, said optical memory medium being a portable card-like medium independently provided for the patient, said medical information system comprising:

write means for writing onto said memory medium any information selected from among character, image and sound information corresponding to a morbid state of the patient as the medical information in coded form so as not to be easily altered and decoded by an unauthorised access to the medium, said write means inserting at least part of data of said sound information and at least part of data of said character information between data of the image information to form composite data, so as to write the information as the composite data onto said memory medium;

read means for optically reading out the medical information written on said optical memory medium, said read means retrieving said composite data from said memory medium and reads out the sound, character and image information separately by separating the at least part of data of said sound information the at least part of data of said character information and the data of the image information from said composite data;

display means for visually presenting the character and image information of the medical information read out by said read means; and

reproduction means for audibly reproducing the sound information of the medical information read out by said read means, said optical memory medium being removably attached to said write means and read means, and said memory medium comprising data areas for storing information on the patient's name and address, for storing information on the patient's clinical record, for storing information on results of various tests performed on the patient, for storing image information representing a diagnosis on the patient and for storing sound information representing a diagnosis on the patient, respectively.

**AUSTRALIA**

**Patents Act 1990**

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ORIGINAL  
COMPLETE SPECIFICATION  
STANDARD PATENT

Invention Title:

**"Medical information management system"**

The following statement is a full description of this invention including the best method of performing it known to us:-

Medical Information Management System

The present invention generally relates to a medical information management system which records a patient's personal medical information onto an optical card for various management purposes.

Medical information management systems are popularly known, in which various character and image information such as characters, drawing, X-ray photograph and computer tomogram (so-called CT) originally entered in patients' case records (charts) as their personal medical information are optically or magnetically recorded onto recording media such as optical cards and magnetic disks. Such prior art medical information management systems are typically disclosed in Japanese Patent Laid-open Publications Nos. HEI 3-154970, 4-78959 and 4-98467.

Because the medical image information, in general, must be highly detailed and precise, recording, for example, a single X-ray photograph as a piece of image information usually requires a storage capacity of about one megabyte. In addition, in order for a doctor to obtain knowledge about or diagnose the morbid state of a

given patient, image information corresponding to at least three X-ray photographs would be necessary. This means that a medium for recording the patient's medical information must have storage capacity of more than three  
5 megabytes.

Nevertheless, the storage capacity of today's commercially available optical cards is only about three megabytes at the most, and thus, even if some form of data compression technique etc. are employed, it is very  
10 difficult or impossible for the optical cards to record thereon more than image information about two or three X-ray photographs and character information (and/or drawing information) about the patient's personal identification, clinical history, doctor's observation and the like.

15 Further, in the case of a patient having a circulatory disease, the doctor may more easily obtain knowledge of or diagnose the morbid state of the patient by listening to the patient's characteristic cardiac sounds, cardiac murmurs etc., rather than by examining the  
20 patient's X-ray photograph. However, since the prior medical information management systems only express such patient's cardiac sounds, cardiac murmurs etc. in onomatopoeic words or in schematic diagram and then record these as character and image information, it is very  
25 difficult to promptly obtain knowledge about the patient's morbid state just by examining the thus-recorded character

or image information.

It is therefore <sup>a desired feature</sup> ~~an object~~ of the present invention to provide an improved medical information management system which is capable of efficiently recording medical information corresponding to a patient's morbid state onto  
5 an optical card having limited storage capacity.

~~In order to achieve the above-mentioned object,~~ The present invention provides a medical information management system for recording a patient's personal  
10 medical information onto an optical memory medium to manage the medical information, the optical memory medium being portable and used as a private medium for the patient, the medical information system comprising a write section for writing onto the optical memory medium any  
15 information selected from among character, image and sound information corresponding to a morbid state of the patient as the medical information, a read section for optically reading out the medical information written on the card set in the attachment portion, a display section for  
20 visually presenting the character and image information of the medical information read out by the section, and a reproduction section for audibly reproducing the sound information of the medical information read out by the read section.

25 In a most preferred embodiment of the present invention, the optical memory medium is an optical card.



The optical card is a nonvolatile memory which is very handy for carrying, has sufficiently large storage capacity (about three megabytes) and is very easy to write data thereon. For these reasons, the optical card  
5 is known as one of the most suitable recording media for recording patient's personal medical information. Thus, by using such an optical card as a recording medium, it is possible to efficiently record medical information as needed depending on a specific morbid state of the  
10 patient. Therefore, if only the patient carries the optical card bearing his or her medical information to a given doctor, the doctor, by only setting the optical card in the read section, can read the patient's medical information, can have the character and image information  
15 visually shown and also can have the sound information audibly reproduced or sounded. This allows the doctor to readily obtain knowledge about the patient's morbid state.

The doctor can easily acquire or diagnose the patient's morbid state by listening to the patient's  
20 characteristic cardiac sounds and murmurs, particularly to the cardiac murmurs if the patient has a circulatory disease. Similarly to the cardiac murmurs, the respiratory or breathing sounds are very characteristic of, i.e., very faithfully reflects a disease. Thus, it  
25 is desirable to record the respiratory sounds as sound information so that the doctor can easily obtain knowledge

about the patient's morbid state by audibly reproducing the information with the present system.

In the most preferred embodiment of the present invention, the sound information may be graphed as a visual sound waveform diagram as well as being audibly reproduced through the reproduction section. This allows the doctor to more clearly acquire the patient's morbid state both aurally and visually.

In addition, even when the patient goes to a hospital for the first time, the patient can let a doctor of the hospital readily know about his or her morbid state by only presenting the medical information bearing optical card and having it set in the read section of the system. Further, since only desired medical information depending on his or her own morbid state may be recorded on the private optical card and since it sometimes may not be necessary to record image information of a large data amount on the card, it is very often sufficient for the patient to carry only one optical card. This is far more economical than when the patient carries several optical cards.

Moreover, even in medical educational organizations, the medical information management system of the present invention can be applied as an effective means for morbid state acquisition, by reproducing the sound information recorded on the optical card.



The preferred embodiment of the present invention will be described in detail below with reference to the accompanying drawings.

In the accompanying drawings:

5        Fig. 1 is a block diagram illustrating the general structure of a medical information management system in accordance with an embodiment of the present invention;

10       Fig. 2 is a top plan view illustrating an example of an optical card for use with the medical information management system of Fig. 1;

      Fig. 3 is a diagram illustrating an example of recorded data on the optical card;

      Fig. 4 is a diagram explanatory of a display state on a display device of Fig. 1;

15       Fig. 5 is a flowchart illustrating an example of a write process carried out by the medical information management system of Fig. 1; and

20       Fig. 6 is a flowchart illustrating an example of a read process carried out by the medical information management system of Fig. 1.

      Fig. 1 is a block diagram illustrating the general structure of a medical information management system in accordance with a preferred embodiment of the present invention. This management system generally comprises  
25       an information processing device 1, an image information processing device 2, a personal computer 3, an

optical card read/write device 4 and an optical card 5 that is removably attached to or set in the optical card read/write device 4.

The sound information processing device 1 is composed of a sound information input device 11, a sound information processing board 12 and a sound information reproducing device 13.

The sound information input device 11, which includes a cardiac sound microphone 6, converts patient's cardiac sounds, cardiac murmurs or respiratory sounds into respective analog sound information signals, and then outputs the sound information to the sound processing board 12.

The sound information reproducing device 13, which may for example comprise a speaker, audibly reproduces the analog sound information signals received from the sound information processing board 12.

The image information processing device 2 is composed of an image information input device 21, an image information processing board 22 and a display device 23.

The image information input device 21, which includes a video camera or an FD camera (an electronic camera with a floppy disk drive), generates NTSC signals based on X-ray photograph information and outputs the NTSC signals to the image information processing board 22.

The image information processing board 22 converts the NTSC signals received from the image information input device 21 into digital image information and outputs the digital image information to the personal computer 3.

5 The image information processing board 22 also converts digital image information received from the personal computer 3 into NTSC signals and outputs the NTSC signals to the display device 23. In addition, the image information processing board 22 receives digital sound  
10 information that is being provided from the personal computer 3 to the sound information processing board 12 of the sound information input device 11 and converts the input sound information into a sound waveform diagram in the form of NTSC signals. The sound waveform diagram is  
15 provided to the display device 23.

The display device 23 comprises a TV monitor such as a CRT display and visibly presents thereon the NTSC signals provided from the image information processing board 22. Namely, the image information processing board  
20 22 outputs NTSC signals based on normal image information of X-ray photograph or the like and based on a sound waveform diagram that visually represents digital sound information, and the display device 23 presents thereon visual images corresponding to such information. For the  
25 sound waveform diagram, the display device 23 presents a corresponding graph.

The personal computer 3 controls the entire operation of the medical information management system, and it basically comprises a CPU 31, internal memories (ROM and RAM) 32, peripherals and I/O interfaces. As  
5 such peripherals, this personal computer 3 includes a floppy disk drive (FDD) 33, a keyboard 34, a mouse 35, a printer 36, an external memory (e.g. hard disk), etc. Further, the sound information processing board 12 and image information processing board 22 are attached, for  
10 example, to extension slots in the personal computer 3. Accordingly, the personal computer 3 also incorporates therein software programs that are necessary for executing various processes on the sound and image information by means of the sound information processing board 12 and  
15 image information processing board 22.

The optical card read/write device 4, which is connected to the personal computer 3 as one of the peripherals thereof, writes and reads data to and from the optical card 5 under the control of the personal  
20 computer 3.

The medical information management system which, as mentioned above, comprises the sound information processing device 1, image information processing device 2, personal computer 3 and optical card read/write device  
25 4 is installed within a hospital. The optical card 5 is possessed by an individual patient and is set in the

optical card read/write device 4 such as when the patient receives medical examination by a doctor.

As typically shown in Fig. 2, the optical card 5 is a rectangular-shaped card having a size of about 85.6 mm length and about 54 mm width and has a thickness of about 0.76 mm. A predetermined area 5a on the card surface is a recording area, onto which digital data corresponding to the patient's medical information are optically recorded. The recorded digital data are then optically read out from the card when needed. Such an optical card 5 may for example be a DELA-standard card available from Drexler Inc. The optical card read/write device 4, which is designed to allow removable setting therein of the optical card 5, can optically write desired information (in this example, medical information comprising character, image, sound information etc.) onto the thus-set card 5 using light beams and read out the written information as needed.

In the case of the DELA-standard optical card, every new information is written as an addition onto unrecorded portion of the recording area (in a write-once fashion). Specific examples of the optical card read/write device 4 and optical card 5 are disclosed, for example, in Japanese Patent Laid-open Publication Nos. SHO 58-500437, 59-195327, 61-48135, 61-137245, 62-256248, 62-262239 and 62-266748, and therefore a detailed description

on these is omitted herein.

Fig. 3 illustrates an example of the medical information stored on the optical card 5. As illustrated, the recording area 5a of each optical card 5 is divided into a plurality of memory regions A - G for recording a plurality of data. On memory region A are stored control data that are indicative of the addresses and storage capacities of the individual memory regions. On memory region B, information such as the names of the hospital and doctor in charge of the patient is stored as character information. Further, on memory region C, personal information such as the patient's name and age is stored as character information. Further, on memory region D, contents of the patient's chart such as results of the doctor's questioning and diagnosis are stored as character information. Further, on memory region E, results of various tests such as urine analysis, blood type and blood pressure are stored as character information. Further, on memory region F is stored image information such as X-ray photograph and CT. Finally, on memory region G is stored sound information such as cardiac murmurs and respiratory sound detected by the above-mentioned cardiac sound microphone 6.

The hospital name, patient's disease name and blood type and results of various tests may be directly stored as character data. But, in order to save storage

capacity, it is desirable that these data are stored in encoded form, in which case the encoded data are decoded by the personal computer 3 for subsequent necessary processing. The sound information may be PCM data  
5 obtained by subjecting analog sound waveform signals to a digital PCM conversion; however, this approach will require large storage capacity, and accordingly only a limited amount of the sound information can be recorded on a single optical card 5. It should be appreciated  
10 that, in order to save the storage capacity, the sound information may of course be stored in some data-compressed form by the use of DPCM, ADPCM or any other suitable sound data compression technique.

Because of this, the embodiment attempts to minimize  
15 the required storage capacity by inserting the sound and/or character information in an invalid portion of the image information. For instance, as shown in Fig. 4, if image information generally of an elliptical shape is presented on the display device 23, the doctor only needs  
20 the valid portion 81 in order to acquire the patient's morbid state and does not need an invalid portion 82 surrounding the valid portion 81. Therefore, the sound and/or character information can be inserted in the invalid portion 82 without disturbing the valid portion 81  
25 , and thus, the storage capacity for the image information can be utilized efficiently. More

specifically, in such a case where one frame of image information data is stored in a predetermined storage area of the optical card 5, it is possible that, instead of the image information being stored in the entire frame storage area, image information representing the valid portion 81 is stored in a part of the area corresponding to the valid portion 81, and sound information and/or character information is stored in the other part of the area corresponding to the invalid portion 82.

Now, an example of a write process carried out by the personal computer 3 for writing medical information onto the optical card 5 will be described with reference to a flowchart of Fig. 5.

Step 51: Medical information (character, image and sound information) of a given patient to be recorded onto the optical card 5 is fetched: the character information is input into directly from the keyboard 34; the image information is input from the image information processing device 2 as digital image information; and the sound information is input from the sound information processing device 1 as digital sound information.

Step 52: Any data processes necessary are applied to the respective medical information input in the manner mentioned above. For example, sound components other than the patient's cardiac sounds, cardiac murmurs and respiratory sounds may be filtered out, the sound and



character information may be inserted in the invalid portion 82 of the image information as shown in Fig. 4, and/or, the image, character and sound information may be stored in a combined or composite form.

5           Step 53: The medical information as processed in step 52 above is adjusted to the recording format of the optical card.

10           Step 54: It is determined whether or not any optical card 5 is attached to or set in the optical card read/write device 4. The personal computer 3 goes to step 55 if the optical card 5 is not set, but goes to step 56 if the optical card 5 is set.

15           Step 55: Because of the negative determination in step 54 above, a message that demands setting of the optical card 5 is presented on the display device 23 or given in voice or the like.

20           Step 56: After preparation of the medical information to be written and control data indicating how to write the medical information is completed, the personal computer 3 waits for a write instruction signal to be input by operation of the keyboard 34 etc. Then, when the write instruction signal is input, the personal computer accesses the optical card read/write device 4 so as to write, onto the optical card 5, the medical  
25   information and control data that have been input previously. That is, when the write instruction signal

is input, the personal computer 3 changes the operation mode into the optical card write mode and provides the control data and medical information to the optical card read/write device 4. The optical card read/write device 4 in turn writes the medical information and control data onto the optical card 5 in accordance with the write instruction signal. Namely, this write process writes the medical information and control data as addition to an unrecorded portion of the card rather than as a rewrite to an already recorded portion of the card. However, the medical information and control data may of course be written as a rewrite to the already written portion if a rewritable recording medium is employed.

An example of a read process performed for the personal computer 3 to read out the medical information from the optical card will be described with reference to the flowchart shown in Fig. 6.

Step 61: A determination is made as to whether any optical card 5 is set in the optical card read/write device 4. The process goes to step 62 if the answer is in the negative, but it goes to step 63 if the answer is in the affirmative indicating that an optical card 5 is set in the read/write device 4.

Step 62: Because of the determination in the preceding step 61 that no optical card is set in the optical card read/write device 4, a message for demanding

setting of an optical card is given on the display device 23 or in other suitable form such as vocal sound.

Step 63: When medical information to be read out is specified by the user's operation of the keyboard 34 or mouse 35, the personal computer 3 changes the operation mode into the optical card read mode and then provides the optical card read/write device 4 with a read instruction signal corresponding to the medical information to be read out. In response to the read instruction signal, the read/write device 4 reads out the control data from the optical card 5 and then reads out medical information in accordance with the read instruction signal.

Step 64: Any data processes necessary are applied to the medical information read out from the optical card 5. For example, the character, sound and image information may be extracted out from the medical information that has been so far stored in synthesized form as shown in Fig. 4.

Step 65: If the medical information processed in the preceding step 64 is the sound information, the sound information is provided to the sound information processing device 1; if the medical information processed in the preceding step 64 is the character or image information, the character or image information is provided to the image information processing device 2.

Thus, the sound information processing device 1 sounds or audibly reproduces the provided sound information. On the other hand, the image information processing device 2 visually shows the provided character or image information on the display device 23. If both of the character and image information are provided to the image information processing device 2, the character information may be shown with the image information in a superimposed manner. Further, if the medical information processed in the preceding step 64 is the sound information and if it is desired to show a corresponding sound waveform diagram on the display 23 with the sound information audibly reproduced, image information on the waveform diagram is provided to the image information processing device 13. In this case, the sound waveform diagram can be stored as image information in the optical card 5; however, in order to save the storage capacity of the card 5, it is more preferable that sound information is temporarily stored in data buffer memory to thereby prepare a sound waveform diagram and then the sound waveform diagram is displayed while sound corresponding to the sound information stored in the buffer memory is audibly reproduced.

According to the embodiment so far described, the optical cards of the write-once-type are employed such that any data, once written, will not disappear, i.e.,

any previously written information will not be erased by overwriting, as opposed to magnetic recording media typically represented by cassette tapes. In addition, the optical cards are not affected by magnetism, static  
5 electricity, radiation etc. and therefore have better data storage capability than other types of recording media. Further, even when the optical cards have been soiled, they can readily be used again by wiping their surfaces.

In addition, as opposed to tape-shape recording  
10 media with which a considerable long time is taken to retrieve desired data therefrom, the optical cards allow direct and quick access to desired data in conjunction with the personal computer. For example, names of recorded data may be shown on the display screen of the  
15 personal computer so that, in response to the user's selection of a desired data name shown on the screen, the corresponding recorded sound information can be quickly read out for the audible and/or visual reproduction.

The optical cards are generally of a credit card  
20 size and therefore can be attached to the patients' charts or the like so as to be easily filed in a desired place. Furthermore, the optical cards are very handy for carrying, and thus if the patient goes to a doctor of another hospital or the like, the patient can have his or  
25 her clinical history readily acquired by only presenting the optical card.

Moreover, because data are stored on the optical cards in coded form and thus are difficult to be altered or decoded by any unauthorized person, the optical cards can provide reliable protection of patients' privacy and  
5 also can provide superior data safety.

Moreover, because the optical cards can record not only sound information but also image and character information, they provide easy communication and storage of various kinds of information independently.

10 Although the above embodiment has been described in connection with such a case where cardiac sounds and murmurs detected by a cardiac sound microphone are recorded and reproduced, pulse wave detected by a pulse wave detector, electrocardiogram waveform detected by an  
15 electrocardiograph, cardiac echo diagram detected by an ultrasonic cardiac diagnosis device, cardiac tomogram etc. may be recorded as image signals for being graphed as waveform diagram. Moreover, the cardiac sound microphone may be replaced by an electrostethophone utilizing the  
20 Doppler effect.

As apparent from the foregoing, the present invention permits recording of medical information corresponding to a patient's morbid state to be efficiently recorded onto an optical card that has a  
25 limited storage capacity.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A medical information management system for recording a patient's personal medical information onto an optical memory medium to manage the medical information, said optical memory medium being a portable card-like medium independently provided for the patient, said medical information system comprising:

write means for writing onto said memory medium any information selected from among character, image and sound information corresponding to a morbid state of the patient as the medical information in coded form so as not to be easily altered and decoded by an unauthorised access to the medium, said write means inserting at least part of data of said sound information and at least part of data of said character information between data of the image information to form composite data, so as to write the information as the composite data onto said memory medium;

read means for optically reading out the medical information written on said optical memory medium, said read means retrieving said composite data from said memory medium and reads out the sound, character and image information separately by separating the at least part of data of said sound information, the at least part of data of said character information and the data of the image information from said composite data:

display means for visually presenting the character and image information of the medical information read out by said read means; and

reproduction means for audibly reproducing the sound information of the medical information read out by said read means, said optical memory medium being removably attached to said write means and read means, and said memory medium comprising data areas for storing information on the patient's name and address, for storing information on the patient's clinical record, for storing information on results of various tests performed on the patient, for storing image information representing a diagnosis on the patient and for storing sound information representing a diagnosis on the patient, respectively.

2. A medical information management system as defined in claim 1 wherein said write means writes the at least part of the sound information onto a predetermined part of a storage area of said memory medium provided for storing one frame of the image information data, said predetermined part



of the storage area being a part where no substantially valid image information is stored.

3. A medical information management system as defined in claim 2 wherein said predetermined part of the storage area substantially corresponds to a peripheral portion of the frame.
4. A medical information management system as defined in claim 1 wherein said display means includes printer means.
5. A medical information management system as defined in claim 1 wherein said display means presents a visual sound waveform diagram corresponding to the sound information reproduced by said reproduction means.
6. A medical information management system as defined in claim 1 wherein said optical memory medium is an optical card.
7. A medical information management system as defined in claim 1 wherein said sound information represents any of the patient's cardiac sound and cardiac murmur.
8. A medical information management system as defined in claim 1 wherein said sound information represents the patient's breathing sound.
9. A medical information management system substantially as described with reference to the drawings.

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## Abstract

A medical information management system records patient's medical information onto an optical card (5) for management purposes. For each patient, any suitable information selected from among character, image and sound information is recorded onto the optical card (5) as medical information corresponding to the patient's morbid state. A read section (3, 4) optically reads out the medical information written on the optical card. A display section (23) visually presents the character and image information contained in the medical information that is read out by the read section. A reproduction section (13) audibly reproduces the sound information contained in the medical information that is also read out by the read section. Thus, a doctor can easily acquire or diagnose the patient's morbid state by listening to the patient's characteristic cardiac sounds, cardiac murmurs and breathing sounds, particularly to the cardiac murmurs if the patient has some circulatory disease. By also displaying the sound information as a sound waveform diagram at the same time, more accurate acquisition of the morbid state can be achieved.

(Figure 1)

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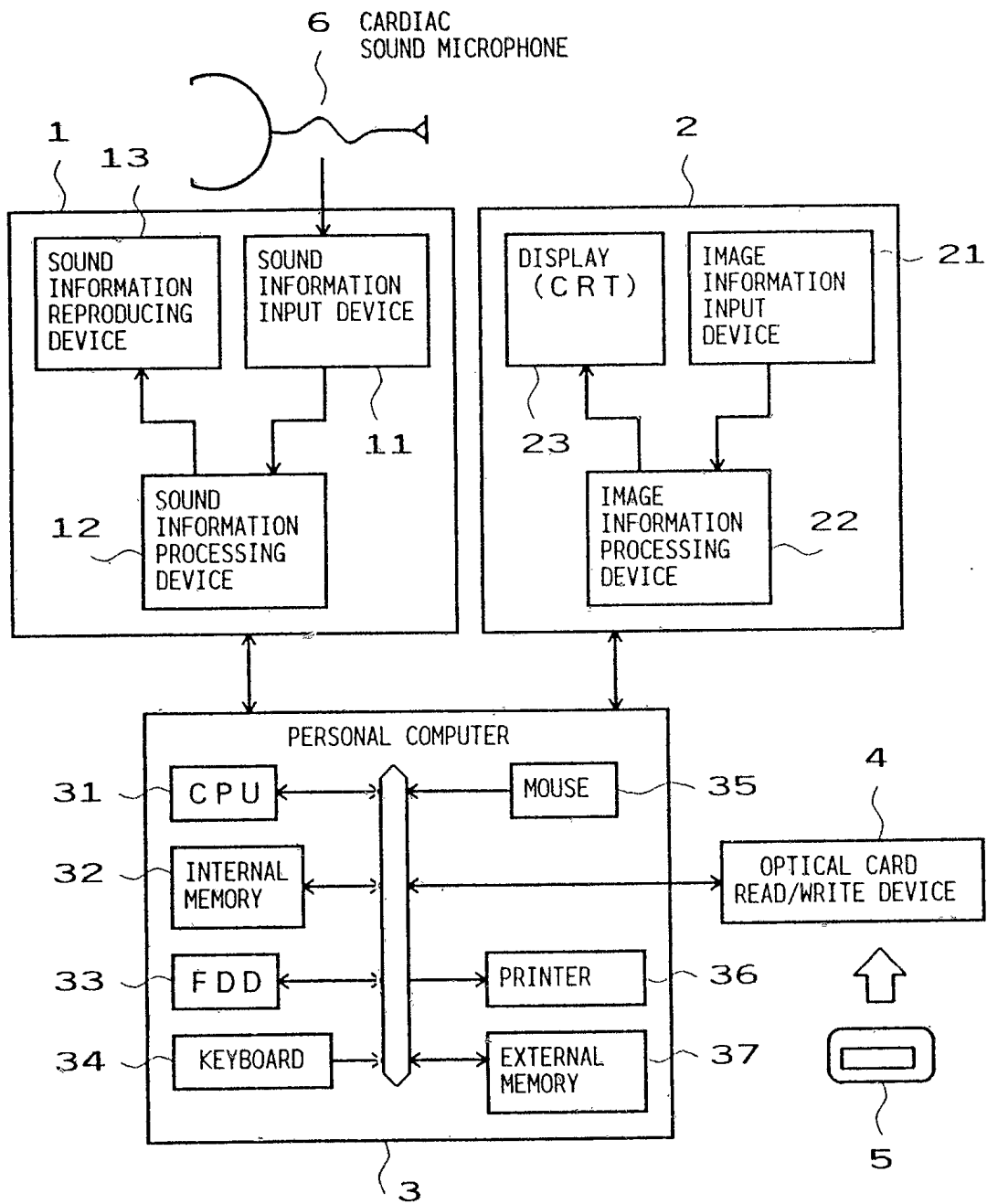
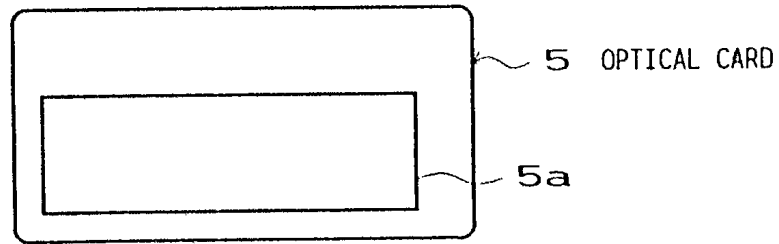


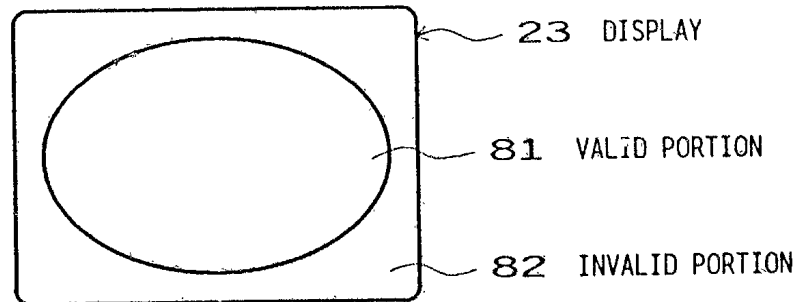
FIG. 1



F I G. 2

A	CONTROL DATA
B	NAMES OF HOSPITAL & DOCTOR
C	PATIENT'S NAME & ADDRESS
D	CONTENTS OF CHART
E	VARIOUS TEST RESULTS
F	IMAGE INFORMATION
G	SOUND INFORMATION

F I G. 3



F I G. 4

