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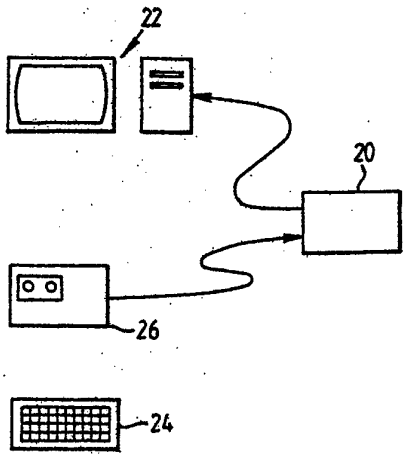
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(57) Abstract

A teaching or presentation aid is used with a personal computer (22) the keyboard (24) of which is disconnected. An audio playback device (26) such as a cassette recorder has its output connected through a decoder (20), the output of which is connected to the keyboard input of the computer (22). Keystrokes are recorded on the tape in the playback device in the form of dual tone multiple frequency codes, and the decoder (20) converts these two ASCII codes to instruct the computer. Sound recorded on the tape is also replayed, by the recorder (26) or by a separate loudspeaker. Thus, as the tape is played, a commentary is heard and simultaneously the computer is operated in synchronism with the commentary to provide an appropriate display. The tape is previously prepared and can be edited as desired.



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TEACHING AID

The present invention relates to a system for providing control over a computer simultaneously with reproduction of an audio signal, comprising, for example, instructions or guidance on computer operation.

Over the last few years, use of computers, and in particular, personal computers, has become very widespread in all areas of life. Consequently, there are now many computer users who have very little specialist training. They, along with users of specialist systems which require particular knowledge or background information, must try to learn how to use new systems and programs as best they can.

One method of teaching users of new systems is to send them to seminars and presentations at which the operation of new systems and software can be explained to them. The disadvantage of this method of teaching is that students may retain little of what they are told and if, subsequently, they encounter problems, they have no way of resolving them other than to turn to the other main teaching aid in this field, the written manual. In practice, most users learn how to operate new software or equipment from written instruction manuals and guides. Unfortunately, experience shows that many of these are badly written and unclear and that understanding them is not straightforward.

We have appreciated that it would be desirable to provide a teaching aid which combines the advantages of the two teaching methods referred to above.

One such teaching system involves the use of a recorded training session, the recording including both an audio track and signals for operating a computer independently of the student or trainee. A system of this kind is described in US Patent No. 4 637 797 (Whitney et al). However, the apparatus described in the US patent is complex and requires special software to enable it to operate.

The present invention aims to provide a teaching aid which is simple, easy to operate and which involves the use of conventional audio equipment.

In accordance with the invention there is provided a

decoder for use with an audio playback device, the decoder having an input for connection to the output of the playback device; means for detecting encoded signals in a signal input from the playback device and for converting the encoded signals from an encoded form to keystroke signals suitable for input to the keyboard input of a computer; and an output for connection to the keyboard input of a computer so that the converted control signals can be applied thereto.

Preferably, the encoded signals are in the form of dual tone multiple frequency ('DTMF') tones.

Using such a decoder it is possible to provide, from a suitable recording, an audible commentary or guide with simultaneous, automatic operation of the listener's computer to demonstrate what is being described. Because the decoder plugs directly into the keyboard input of the computer there is no need for additional software or hardware within the computer to enable the computer to recognise and act on the keystroke signals.

In a further aspect the invention provides recording apparatus comprising an input for receiving an audio signal and means for recording the said audio signal on a recording medium; and an encoder having an input for receiving keystroke signals generated by a keyboard device for a computer and means for converting the said signals into dual tone multiple frequency (DTMF) signals capable of being recorded by the audio signal recording means; the encoder having an output for connection to an input of the said recording means, so that the audio signals and converted keystoke signals can be recorded together on the recording medium.

The invention also provides an audio recording comprising a recording medium having recorded thereon signals representing a sound track and encoded signals derived from keystroke signals generated by a keyboard device for a computer so that, when the recording is played back, the encoded signals can, after decoding, be applied to the keyboard input of a computer to operate it simultaneously with reproduction of the sound track.

The invention also provides a method for making such an audio recording in which keystroke signals generated by a keyboard device for a computer are converted into DTMF tones

capable of being recorded by audio signal recording means; and the DTMF tones are recorded on a recording medium together with signals representing a sound track.

It is preferred that the DTMF tones are recorded on a separate track to the audio signal but this is not essential; the tones form quite "musical" sequences and are unlikely to prove offensive or unduly distracting to the listener.

Furthermore, the invention provides a method of operating a computer, the method comprising replaying such an audio recording by means of an audio playback device, detecting encoded keystroke signals recorded on the recording medium of the audio recording and converting the encoded signals to keystroke signals for a computer, and applying the converted signals to the keyboard input of a computer to operate it.

It will be appreciated that the teaching aid system described is simple and easy to manufacture whilst providing better training assistance for computer users. Because the system records and uses keystrokes rather than data or operating information provided by the computer itself the system is compatible with a very wide range of personal computers, most of which use standard keyboards.

Embodiments of the invention will now be described in detail, by way of example, with reference to the drawings, in which:

Figure 1 shows schematically recording using an encoder forming part of a system in accordance with the invention;

Figure 2 is a schematic illustration of playback using a decoder forming part of a system in accordance with the invention;

Figure 3 is a circuit diagram of one form of decoder for use in the system of the invention;

Figure 4 shows schematically an arrangement allowing editing of the recording;

Figure 5 shows schematically an alternative arrangement allowing editing of the recording; and

Figure 6 shows use of the system to achieve control of a remote computer.

In broad terms, the system of the invention includes an encoder associated with an audio recorder and a decoder associated with an audio playback device, for example, a loudspeaker. The encoder acts to capture control signals from an input device associated with a computer and to convert them to a form in which they can be recorded on audio tape. The decoder acts to identify the recorded control signals on the audio tape and to convert them to a form in which they can be recognised and acted on temporally by the computer.

The encoder and decoder elements of the system are used in two separate operations; recording - which may typically take place in an educational or training establishment or in a commercial undertaking with a view to producing recordings for sale or hire; and playback, where the student uses the recording in place of, for example, a printed manual.

Recording is illustrated schematically in Figure 1. The encoder 10 referred to above is connected between the demonstrator's computer 12 and an input device 14, in this case, a keyboard. The input device might equally be a mouse, a touch screen or other known devices for inputting control signals to a computer. The encoder 10 is also connected to the input socket of an audio recorder 16. Also connected to the audio recorder input is a microphone 18.

The keyboard 14 is coupled by means of a keyboard splitter arrangement (not shown) so that its output signals drive the computer and, at the same time are converted by the encoder 10. The encoder 10 accepts the signals from the keyboard 14 and converts them to a form capable of recordal on an audio tape. In a preferred embodiment, the encoder 10 converts the signals to DTMF (dual tone multiple frequency) tones. In a preferred form of this coding system, each character of the keyboard is represented by two tones. This permits the full PC and ASCII character sets to be encoded. Alternative coding systems or tone formats can be implemented, for example, one tone per character and use of the ALT NUMBER ALT sequence to generate ASCII characters. Such systems are, however, better suited to implementations using a reduced character set.

During recording, it is envisaged that the tutor or demonstrator will deliver his commentary via the microphone 18

to the audio recorder 16. At the same time keystroke operations during the course of the demonstrations are converted by the encoder 10 to DTMF tones and recorded with the audio signal from the microphone 18.

The tones from the encoder 10 can be recorded onto any suitable audio recording medium, for example, a cassette tape or optical disc. Due to the high integrity and reliability of the encoding technique adopted, special audio equipment is not necessary; simple portable audio units such as personal cassette systems and dictation machines can be used.

During playback, shown in Figure 2, a decoder 20 is connected to the keyboard input or RS232 socket of the student's computer 22. An audio playback device 26, for example, a cassette player is connected to the decoder input. As the recording is played back the audio signal is reproduced in the usual way through the loudspeaker of the playback device or through headphones, if the user prefers. At the same time, the DTMF codes are converted by the decoder 20 to control signals recognisable to the computer 22. These control signals mimic keystrokes of the computer keyboard or other input device and cause the computer to operate in the same manner as actual keystrokes. Thus, as the commentary embodied in the audio signal progresses, the computer 22 acts under the control signals from the decoder 20 so as to demonstrate on the computer monitor or display what is being described. During playback, the computer keyboard 24 is not used and can be disconnected. This is, in fact, to be preferred since additional keystrokes input by the student deliberately or inadvertently may disrupt the sequence of keystroke signals from the decoder 20.

One form of decoder 20 is illustrated in the circuit diagram of Figure 3.

Referring to Figure 3, the signals which arrive from the audio cassette player 26 are in two forms: the left channel carries the narrative and the right channel contains the encoded keyboard data. These two channels are mixed together via IC8b, with the option of the tones from the right channel either being added at an attenuation of 6dB using R27 and R28 or being completely absent; the choice is determined by the position of switch SW3.

On leaving the mixer circuit, the resulting signal is

fed to two identical audio amplifier devices, IC7a and IC7b. These amplify and filter the signal before being passed to the headphone socket CONN6A/B. The volume of the signal may be adjusted using VR1.

As well as being optionally mixed with the narrative, the encoded data is also passed along two other routes: to the tone decoder and to the level sensing circuit.

The tone encoder is formed around IC9, with the gain of its input stage being set by R17 and R18 to a factor of approximately three times. The time constant formed by the combination of R19 and C9 enables the device to reject tones which are either:

a) too short in duration, or

b) too close to one another.

The output from the tone encoder takes two forms. Pin 15, Std output is taken to a high level when a tone-pair is correctly decoded. The binary representation of the tones is presented on outputs Q1 to Q4 (pins 11 to 14 respectively).

The outputs from the tone decoder are fed into a standard microprocessor configuration, based around ICS 1 to 3. The microprocessor operates at a speed of 16MHz, governed by crystal XTAL2. The initial power-on reset pulse width is determined by the time-constant formed by R22 and C27. IC2 latches the lower eight address bits from the multiplexed lines AD0 to AD7, before passing them to the EPROM device, IC3. No external RAM has been provided, since there is sufficient capacity within the microprocessor.

Resistors R23 and R24 pull the port lines P3.6 and P3.7 to +5 volts. These lines in turn are connected to the optional RS232 port, IC11. If an RS232 configured device is to be connected to the unit, instead of to the PC socket, CONN4a, then this may be achieved by pulling either of these lines to ground, thus alerting the microprocessor.

IC8a acts as an inverting amplifier, increasing the level of the tones before being passed into the two comparators, IC8c/d. The low-pass filter formed around R12 and C7 is to ensure that the comparators only operate on the average signal level and ignore spaces between tones.

The two potential dividers formed around the networks R13/14 and R15/16 set the upper and lower level thresholds

between which the incoming tones should lie. The outputs from the comparators are fed into the microprocessor via its port pins P1.5 and P1.6. The software recognises the status indicated by the comparators and in turn drives the two colour light emitting diodes LED1, via the driver transistors TR1 and TR2.

Decoded data is converted into scan-codes by the microprocessor and is transmitted to the computer via the buffering circuit IC4 and IC5. This circuit also allows for data to be sent from the computer to the QPC unit. The type of computer to which the QPC may be connected to is governed by the setting of switch SW2, which is read at power-on.

Both the recording and playback sequences described above are direct, that is to say, the recording and/or playback take place at the same location as the demonstrator's/student's computer, respectively. It will be appreciated, however, that the recording may be subject to editing and that the DTMF signals may be transmitted via a telephone or other communication line from one location to another.

Figures 4 and 5 show more elaborate ways in which keyboard data can be stored and edited before being recorded or transmitted.

In Figure 4, the output control signal from the keyboard 14 is connected to the encoder 10 by means of a switch A. When this switch is closed, both the computer 12 and the encoder 10 receive the keyboard output. The computer 12 receives and processes the keyboard output in the usual way, while the encoder 10 converts the serial data stream from the key depressions at the keyboard 14 into a two digit hexadecimal code which is output by the encoder 10 as two DTMF tones, exactly as described in relation to Figure 1.

The tones output by the encoder 10 are transmitted through the audio recorder 16 to a decoder 30 similar to the decoder 20 of Figure 2. After decoding, these tones are transmitted to an editing station 32, usually another personal computer (pc) which sees the tones in their decoded form as keyboard entry or RS232 data. Using suitable software, the editing station 32 stores the keystroke signals onto disc.

The editing station software allows the keystroke data to be retrieved and edited as required. For example, the

time interval between keystrokes and/or data can be adjusted to optimise the subsequent recorded presentation. Once editing is complete, both encoder and decoder switches are moved to position B so that keystroke signals and/or data output from the editing station 32 via RS232 printer port of bus I/O are transmitted to the encoder 10 and recorded as DTMF tones on a suitable recording medium at the audio recorder 16. Typically, speech and/or music is added at the same time.

In the arrangement of Figure 5, the output from the keyboard 14 is fed via a keyboard splitter 13 to both the computer 12 and, with the switch in position A, to the editing station 32. The computer 12 processes the keyboard output in the usual way whilst the editing station receives and stores the data. The encoder 10 receives the data as a pair of hexadecimal digits from the editing station 32 and converts these to a pair of DTMF tones which may optionally be recorded at this time. If the data is to be edited, then, with the switch in position B, the editing station keyboard 34 is used as normal, allowing the data to be retrieved, edited and, in its revised form, stored on disc. When the data has been optimised, the editing station 32 sends it to the encoder 10 which then converts it to DTMF tones for recordal at audio recorder 16.

Figure 6 shows how the system may be implemented to achieve control of a remote pc via a transmission medium such as, for example, telephone, cable, radio, infrared, ultrasonic or other means by which audio signals can be transmitted. In this mode of operation, the keystrokes or data may be pre-recorded and edited as described in relation to Figures 1, 4 and 5 or sent via a remote computer 10, either from storage discs or by means of live keyboard input. In either case, the data is transmitted by means of suitable data transmission means 60.

The system described above can, thus, provide a simple and effective interface which controls a personal computer by means of audio playback, either directly or through a suitable transmission medium. The encoder/decoder can easily be connected into a pc by inexperienced or non-technical users and is used in conjunction with familiar consumer equipment such as personal stereo cassette players, telephones and radios.

As mentioned above, keystroke data generated by the demonstrator can be edited to optimise subsequent presentations

to students and trainees by synchronising keystrokes with an audio track including, for example, speech and music.

Whilst the system has been described in connection with training, it will be appreciated that it is suitable for a wide range of other applications, for example, advertising, demonstrations, point-of-sale displays, remote information points and the like. When used in the context of training, it permits the provision of software training and presentations in different languages and without modifying in any way the original software.

Furthermore, replication of the recorded presentation can be achieved using standard industry and consumer techniques.

For clarity, it is stated that, for the purpose of this specification, the term "sound track" is intended to mean an audio track capable of having sound recorded on it, irrespective of whether any sound is actually recorded. Similarly, the term "audio signal" is to be taken to include a signal which consists wholly or partially of signals representing silences.

CLAIMS

1. A decoder for use with an audio playback device, the decoder having an input for connection to the output of the playback device; means for detecting encoded signals in a signal input from the playback device and for converting the encoded signals from an encoded form to keystroke signals suitable for input to the keyboard input of a computer; and an output for connection to the keyboard input of a computer so that the keystroke signals can be applied thereto.

2. Apparatus according to claim 1 comprising a further output for connection to the input of a sound reproduction device so that unconverted signals from the decoder input can be applied thereto.

3. Apparatus according to claim 1 or 2 in which the input to the decoder is capable of connection to a communication link so that it can be connected to receive an input signal from a playback device at a remote location.

4. Apparatus according to any preceding claim in which the encoded control signals are in the form of dual tone multiple frequency ('DTMF') tones.

5. Apparatus according to any preceding claim in which the means for converting the encoded control signals acts to convert them to hexadecimal form.

6. Recording apparatus comprising an input for receiving an audio signal and means for recording the said audio signal on a recording medium; and an encoder having an input for receiving keystroke signals generated by a keyboard device for a computer and means for converting the said signals into dual tone multiple frequency (DTMF) signals capable of being recorded by the audio signal recording means; the encoder having an output for connection to an input of the said recording means, so that the audio signals and converted control signals can be recorded together on the recording medium.

7. Apparatus according to claim 5 or 6 including editing means comprising means for storing the keystroke signals and processor means for editing the stored signals.

8. Apparatus according to claim 7 in which the keystroke signals are input to the editing means prior to conversion to DTMF tones, the editing means having an output for connection to the input of the encoder.

9. An audio recording comprising a recording medium having recorded thereon signals representing a sound track and encoded signals derived from keystroke signals generated by a keyboard device for a computer so that, when the recording is played back, the encoded signals can, after decoding, be applied to the keyboard input of a computer to operate it simultaneously with reproduction of the sound track.

10. An audio recording according to claim 9, in which the encoded signals are in the form of DTMF tones.

11. A method for making an audio recording according to claim 10 in which keystroke signals generated by an input keyboard device for a computer are converted into an encoded form capable of being recorded by audio signal recording means; and the encoded signals are recorded on a recording medium together with signals representing a sound track.

12. A method according to claim 11 in which the keystroke signals generated by the keyboard device are applied to the input of an encoder having an output connected to the input of audio signal recording means, the audio signal recording means receiving an audio signal representing the sound track simultaneously with the encoded signals from the encoder output for recordal.

13. A method according to claim 11 or 12 in which the keystroke signals converted into DTMF tones.

14. A method according to any of claims 11 to 13 in which the keystroke signals are stored and the stored signals edited

prior to recordal.

15. A method according to claim 14 in which the keystroke signals are stored and edited before being converted to a form capable of recordal by audio signal recording means.

16. A method of operating a computer, the method comprising replaying an audio recording in accordance with claim 9 by means of an audio playback device, detecting encoded keystroke signals recorded on the recording medium of the audio recording and converting the encoded signals to keystroke signals for a computer, and applying the converted signals to the keyboard input of a computer to operate it.

17. A method according to claim 16 in which the encoded keystroke signals are in the form of DTMF tones.

18. A method according to claim 16 or 17 in which the encoded keystroke signals are converted to hexadecimal form.

19. A method according to any of claims 16 to 18 in which the audio playback device is at a location remote from the computer, the unconverted signals being transmitted by means of a communications link between the locations.

Fig. 1

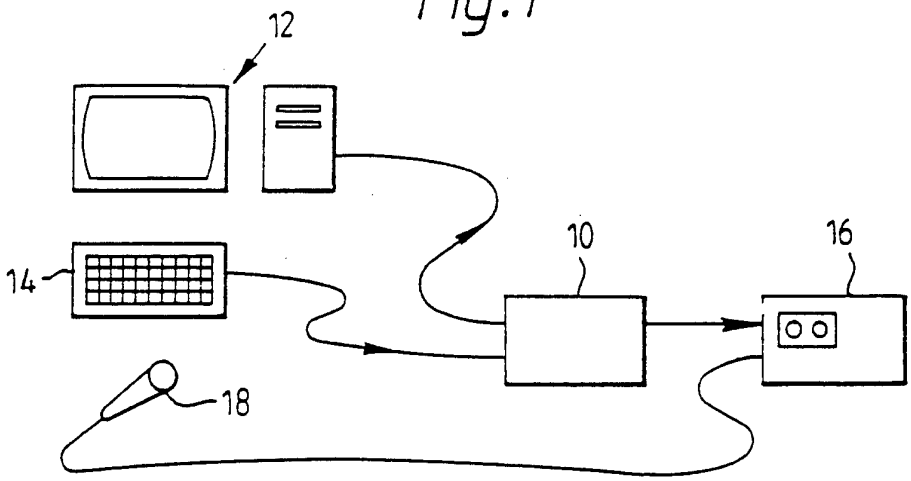
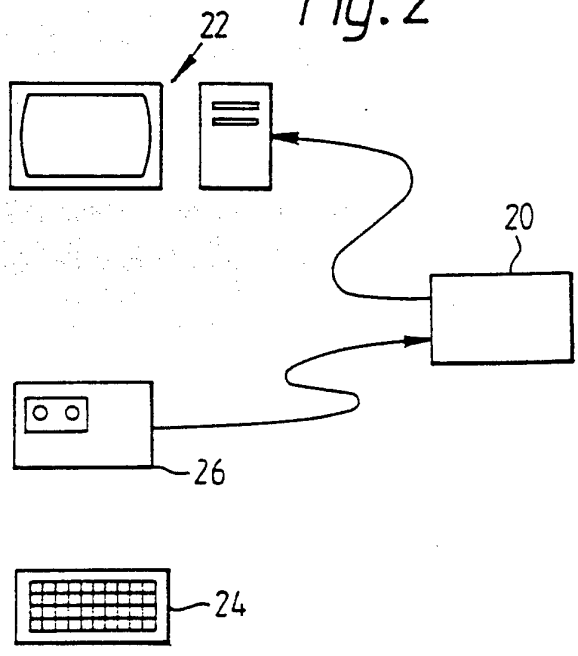


Fig. 2



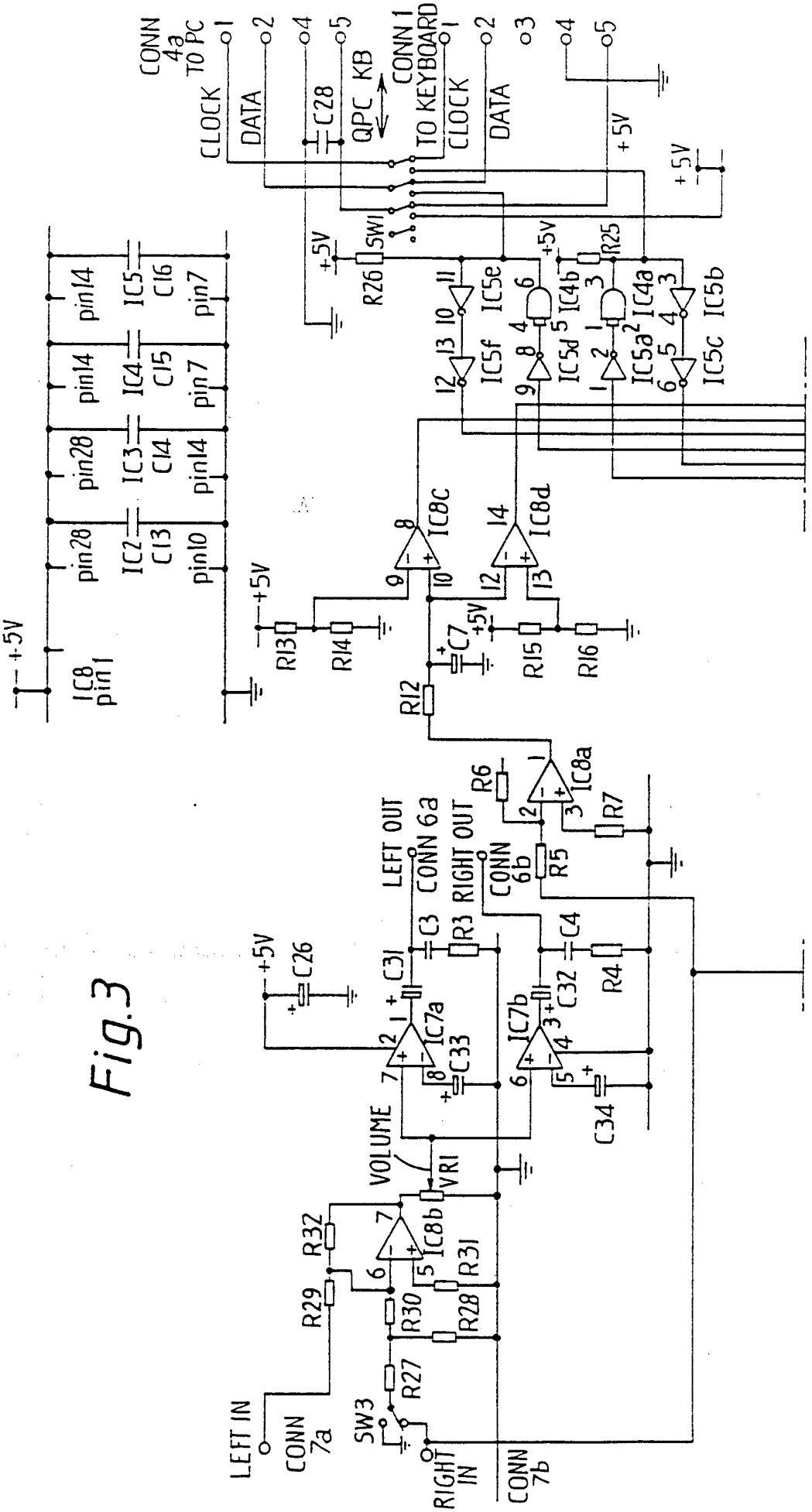

CONN 4a TO PC
CLOCK
DATA
C28
QPC KB
CONN 1 TO KEYBOARD
CLOCK
DATA
+5V
SW1
R26
R25
IC5e
IC5f
IC5d
IC4b
IC4a
IC5a
IC5b
IC5c
IC8c
IC8d
IC8a
IC8b
IC7a
IC7b
IC8 pin1
pin28
pin14
pin10
IC2
IC3
IC4
IC5
C13
C14
C15
C16
pin7
R13
R14
R15
R16
C7
R12
R6
R7
R5
R3
R4
C3
C4
C31
C32
C33
C34
C26
LEFT OUT CONN 6a
RIGHT OUT CONN 6b
VOLUME
VR1
R32
R31
R30
R29
R28
R27
SW3
LEFT IN CONN 7a
RIGHT IN CONN 7b

Fig.3

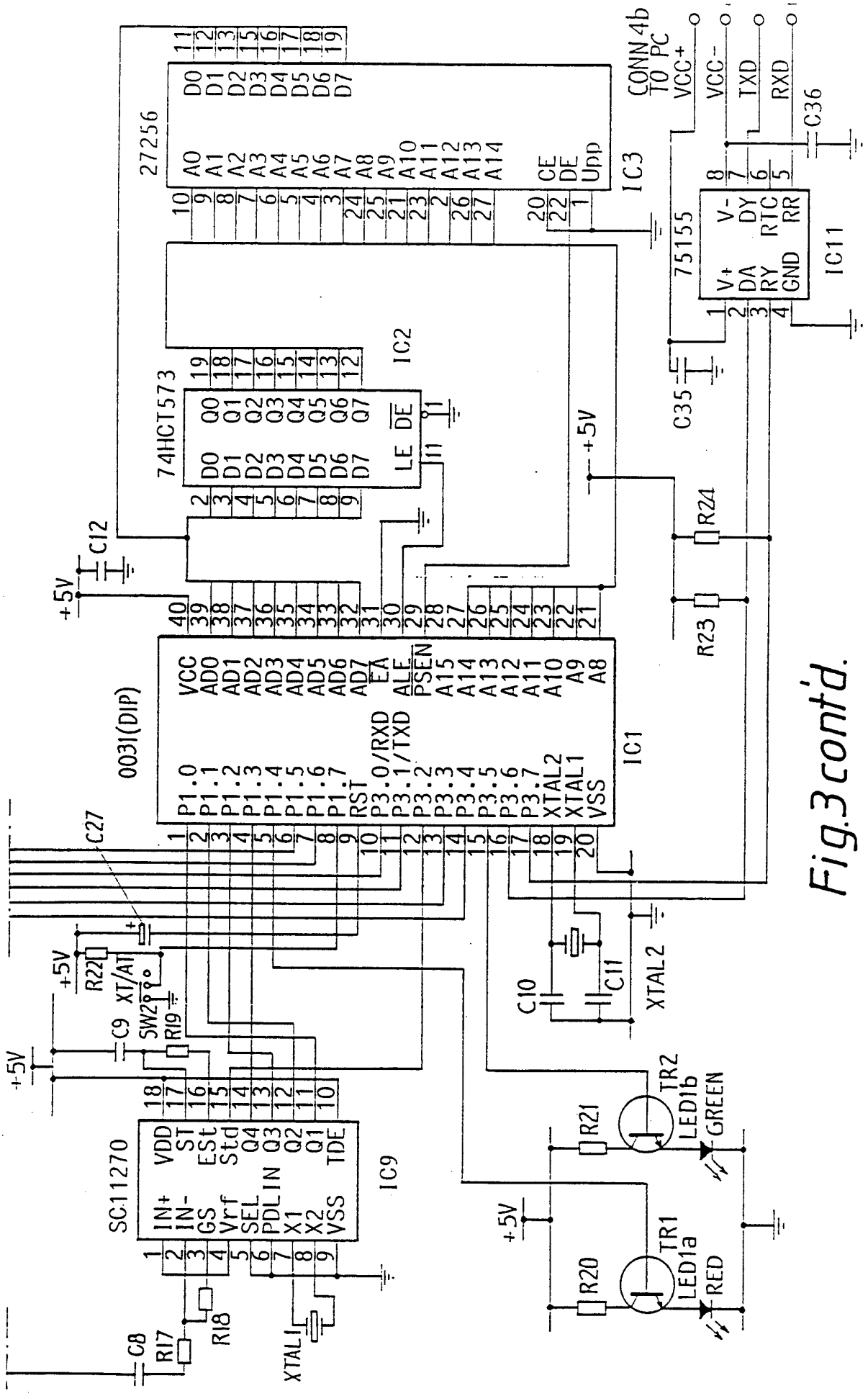

CONN4b
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RXD
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IC3
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75155
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+5V
R24
R23
003I(DIP)
IC1
C27
R22
XT/AT
SW2
C9
R19
C10
C11
XTAL2
SC11270
IC9
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LED1a
RED
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R17
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XTAL1

Fig.3 cont'd.

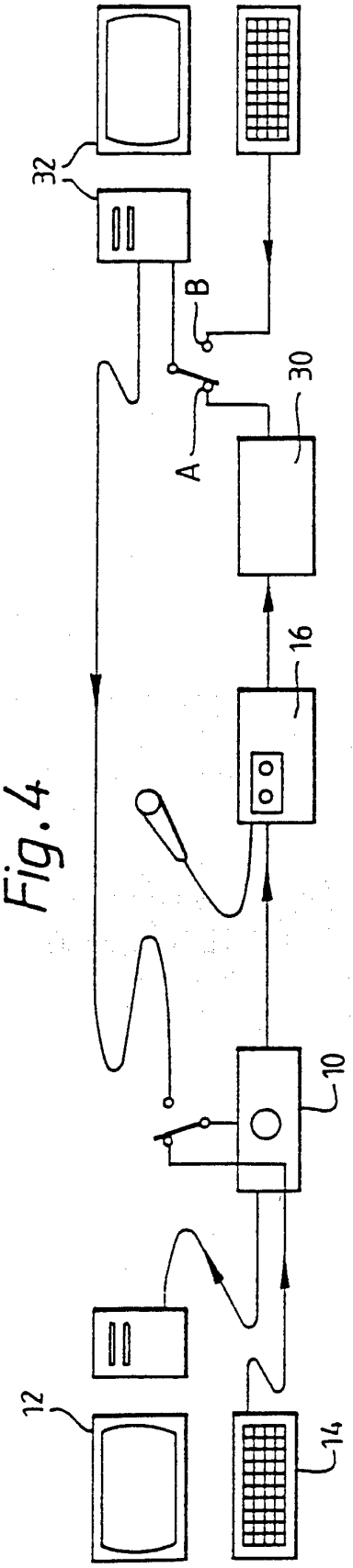


Fig. 4

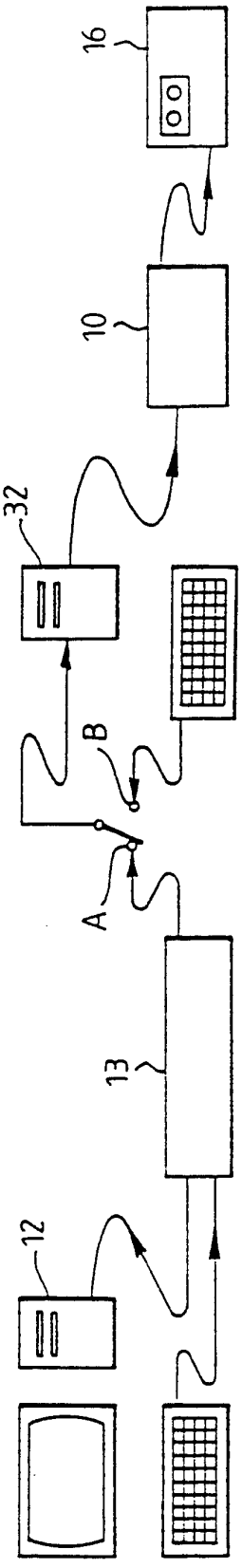
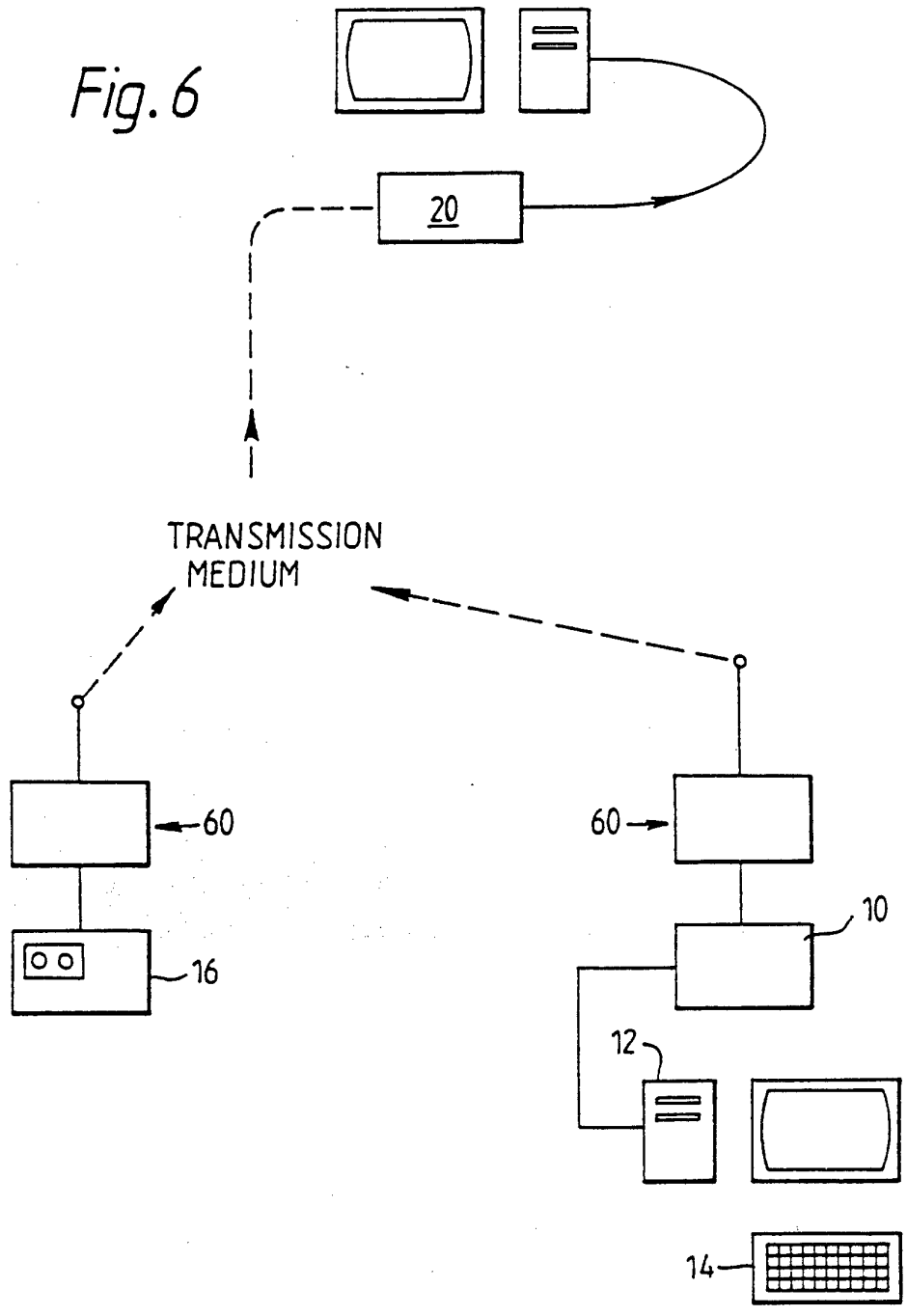


Fig. 5

Fig. 6



INTERNATIONAL SEARCH REPORT

Inter nal A cation No
PCT/GB 93/01971

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 G09B19/00 G09B5/04 G11B20/10

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)
IPC 5 G09B G11B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR,A,2 648 926 (SARL A2PI ET HERBST,PEZER;FR) 28 December 1990 see page 6, line 27 - page 9, line 21; claims 1-9; figures 1,2	1,2,5,6, 9,11,12, 16,18
X	EP,A,0 162 967 (NIXDORF COMPUTER AG) 4 December 1985 see page 2, line 4 - page 12, line 6; claims 1-12; figures 1,2	1-6, 9-13, 16-19
X	WO,A,90 02402 (SAFIER,RICHARD L. ET AL.;US) 8 March 1990 see the whole document	1,2,4,6, 7,9,10

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13 January 1994	03. 02. 94

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INTERNATIONAL SEARCH REPORT

Inter nal A cation No
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