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AMENDED

AUSTRALIA  
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P/00/001 28/5/91  
Section 29

## PATENT REQUEST: STANDARD PATENT/PATENT OF ADDITION

We, being the person(s) identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.  
Full application details follow.

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54) Invention Title *"DIGITAL VOICE STORAGE SYSTEM FOR A  
TELECOMMUNICATION SYSTEM"*

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### ASSOCIATED PROVISIONAL APPLICATION(S) DETAILS

(60) Application Number(s) and Date(s)

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| <i>P 42 04 929.6</i>    | <i>Germany</i> | <i>DE</i>    | <i>19 February 1992</i>  |

### DIVISIONAL APPLICATION DETAILS

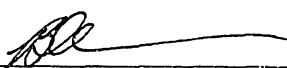
(62) Original application number:

### PARENT INVENTION DETAILS (Patent of Addition requests only)

| (61) Application Number | Patent Number |
|-------------------------|---------------|
|-------------------------|---------------|

Drawing number recommended to accompany the abstract...

*ALCATEL N.V.*

  
(Signature)

*February 25th, 1993*

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Section 29(1)  
Regulation 3.1(2)

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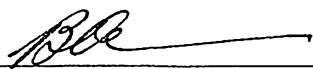
## NOTICE OF ENTITLEMENT

We, ALCA TEL N.V.  
of Strawinskylaan 341, 1077 xx Amsterdam, The Netherlands,  
being the applicant in respect of Application No.  
for an invention entitled "DIGITAL VOICE STORAGE SYSTEM FOR A  
TELECOMMUNICATION SYSTEM"

described in the accompanying specification, state the following:

1. The company nominated for the grant of the patent has entitlement from the actual inventor by mesne assignment.
2. The company nominated for the grant of the patent has entitlement from the applicant of the basic application listed on the patent request form by assignment.
3. The basic application listed on the request form is the first application made in a Convention country in respect of the invention.

ALCATEL N.V.



P.M. CONRICK

February 3rd, 1993



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**(19) AUSTRALIAN PATENT OFFICE**      **(10) Acceptance No. 663152**

- (54) Title  
**DIGITAL VOICE STORAGE SYSTEM FOR A TELECOMMUNICATION SYSTEM**
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- (56) Prior Art Documents  
**DE 3632341**  
**DE 3518737**  
**AU 542494 18423/83 H04M 1/64**
- (57) Claim

1. A digital voice storage system with random-access semiconductor memory for the storage of messages in a telecommunication system, wherein the semiconductor memory is divided into individually addressable segments, and wherein a memory control system is provided, said memory control system
- a) enters the addresses of the memory segments currently available for data storage into a directory and removes them from the directory when they are no longer available,
- b) forms from the messages being stored, one or more data blocks adapted to the size of the memory segments, stores these in available memory segments, records the address of the memory segment which is used to store the first data block of a message as the start address in a start address list, and the addresses of the memory segment used next and those of all additional memory segments used, always in the preceding memory segment, and identifies the end of a message by means of a code in the last memory segment used for this message,
- c) recalls messages to be outputted by means of the corresponding start addresses assigned to them.

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Regulation 3.2

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**ORIGINAL  
COMPLETE SPECIFICATION  
STANDARD PATENT**

Invention Title:

"DIGITAL VOICE STORAGE SYSTEM FOR A TELECOMMUNICATION  
SYSTEM"

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

This invention relates to a digital voice storage system with a random-access semiconductor memory for storage of messages in a telecommunication system.

There are already known telephone answering machines in which  
5 messages are stored on magnetic tape, either analogue or digital. With these, recording and reading takes place sequentially. Insofar as it is possible to erase individual messages, the resulting gaps are only used for storing new messages again after the whole tape has been erased.

Instead of magnetic tape, semiconductor memories are now also used,  
10 mostly DRAMs for voice storage (see e.g. article by Schartel, Ingolf: "Mein Telefon spricht mit mir" ['My telephone speaks to me'] Funkschau 13, 15-7-1990, Special pages 24-27).

Semiconductor memories, in contrast to magnetic tape, can be easily read and erased partially if an appropriate addressing method is provided for the  
15 messages when they are stored. Since on the one hand the storage of voice requires a large storage capacity, and on the other hand semiconductor memories generally only provide limited storage capacity, their optimal use is desirable. To this end, for example, voice data is compressed by special procedures, as described in an article by Gfeller, Bruno, with the title: "Tritel  
20 Guardia, das Telefon mit digitalem Anrufbeantworter" ['The telephone with digital answering machine'] in ascom, Technische Mitteilungen 1/91, pages 38-40.

No mention is made in the above publications of the re-use of different-sized available, or again-available, memory regions for the storage of messages  
25 before a complete erasure of the memory.

It is an object of the present invention to provide a simple and cost-effective voice storage system, which uses the memory as effectively as possible.

According to the invention there is provided a digital voice storage  
30 system with random-access semiconductor memory for the storage of messages in a telecommunication system, wherein the semiconductor memory is divided into individually addressable segments, and wherein a memory control system is provided, said memory control system:



- a) enters the addresses of the memory segments currently available for data storage into a directory and removes them from the directory when they are no longer available,
- b) forms from the messages being stored, one or more data blocks adapted  
5 to the size of the memory segments, stores these in available memory segments, records the address of the memory segment which is used to store the first data block of a message as the start address in a start address list, and the addresses of the memory segment used next and those of all additional memory segments used, always in the preceding memory segment, and  
10 identifies the end of a message by means of a code in the last memory segment used for this message,
- c) recalls messages to be outputted by means of the corresponding start addresses assigned to them.

15 The limited-capacity memory is here used optimally with relatively little expense. Several messages with different lengths can be stored and read out, with even non-contiguous memory regions, which have become available after reading out or erasing of messages, being able to be re-used immediately for the storage of messages.

20 Preferably, faulty memory segments may be excluded from use. Because of this, even when faulty memory segments are present, the storage and read-out of messages remains free from impairments which can otherwise become audible when certain error rates are exceeded, or result in failure.

Preferably, additional input and output of text messages are provided. In  
25 this way, calls can be answered by outputting a prepared message. Instead of spoken messages, text messages transmitted by calling subscribers can also be stored and recalled.

The digital voice storage system is especially suited for use in telephone answering machines or telephones with integrated answering facilities;  
30 however, further advantageous combinations are possible with other terminals in telecommunication systems, such as, for example, fax machines.

A further preferred application for the voice storage system is that it may be allocated to several terminals for voice, text or video communication.

According to this it is, for example, appropriate with digital telephone branch exchanges (PBX) not to equip every terminal with a voice storage system, but to install a voice store which is used in common by several terminals.

Preferably, with ISDN installations for example, the numbers or names of  
5 callers in connection with the corresponding transmitted messages can be recorded. By this means, for example, the readout of messages can provide targetted access for messages of certain callers, with the aid of a list of stored caller numbers and names.

In the following, the invention will be explained in more detail with the aid  
10 of a design example and a diagram.

A digital voice storage system consists of a speech module in connection with a memory control system and a semiconductor memory 1. The speech module serves to digitise analogue signals for subsequent processing, and for their re-conversion for the recall of messages. The memory control system can  
15 be provided by means of a microprocessor, but ASICs or discrete circuits with digital logic components can also be used. The semiconductor memory 1 consists of DRAMs, but SRAMs can also be used.

The semiconductor memory is divided into n individually addressable equal-sized segments, each having a number of bytes of storage space. A  
20 directory 2 of available memory segments and a start address list 3 are provided in a reserved part of the semiconductor memory 1, or in a separate memory.

The diagram shows the contents of the memory segments of the semiconductor memory 1, the directory 2 of available memory segments and the start address list 3, after several messages have been recorded and some of  
25 them have been erased again. The memory segments 1, 2, 3, 10 ... in the semiconductor memory are free, i.e. they contain no data, or only data that can be overwritten. Such memory segments are available for the storage of further messages. For this purpose, their addresses are stored in the directory 2 of available memory segments.

30 The memory segments 4, 5, 6, 7, 9 ... in the semiconductor memory 1 contain data. This consists of a data block representing part of a previously stored message and the address of that memory segment which contains the next data block of this message. For example, memory segment 4 contains a

data block of message 0. The next data block of this message is located in memory segment 11, whose address is also contained in memory segment 4. The start address list 3 contains the addresses of those memory segments which contain the first-recorded data block of a message. With the use of these  
 5 start addresses, the individual messages can be read out.

The message 0, divided into five data blocks, was stored in the memory segments 4, 11, 12, 13, 21.

The start address list 3 therefore points to memory segment 4 as the start address. The first data block of message 0, stored in memory segment 4, is read  
 10 out first. Following this, the next data block, whose address 11 is held in the previous memory segment 4, is read out from memory segment 11. This is followed by the data blocks from the memory segments 12, 13 and 21, which are likewise linked together because of the address of the next memory segment always being stored in the corresponding previous memory segment. After the  
 15 last data block has been read out, in this case from the memory segment 21, the readout of message 0 is terminated by a code, which, in place of the address of a following memory segment, here marks the end of the message.

The recording of a message takes place as follows:

20 The recording of, for example, a message 4 begins in memory segment 1, the first free memory segment which is entered in the directory of available memory segments. This address is simultaneously entered as start address for message 4 into the start address list. As soon as a quantity of data equal to a data block has been stored from this message, the storage process is continued  
 25 in memory segment 2. This is the next one of the available memory segments entered in the directory 2. In a similar way, further storage takes place into the next memory segments, corresponding to their order in the directory 2 of available memory segments. The address of each following memory segment is also stored in the previous memory segment, the address of memory segment 2 thus being entered into memory segment 1. Similarly, the address of memory  
 30 segment 3 is entered into memory segment 2. The addresses of the memory segments being used during the recording are erased from the directory 2 of available memory segments, in this case the addresses of memory segments 1,



2, 3. In the last memory segment 10 used for storing the message 4, the code for end-of-message is stored instead of the address for a following memory segment. The length of a message can either be predetermined in advance, e.g. by allocating a predetermined speech duration, or it can remain unlimited. In the latter case, the end of of a message is identified by the ensuing absence of speech, which causes the storage of the end code into the voice memory. Such an end code can also be provided in the case of a predetermined speech duration being set for each message which, however, was not fully utilised. In this way, the possibility exists to use the unused storage space for other messages.

When erasing a stored message, the addresses of the memory segments that were occupied by the data blocks of this message are entered again into the directory 2 of available memory segments. The start address of the message is erased from the start address list 3. In the case of erasing the message 2 shown in Diagram 1, the memory segments 5, 6, 7 would be entered into the directory 2 for available memory segments, and the start address of memory segment 5 would be erased from the start address list 3.

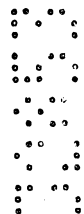
In Diagram 1 the segments 8, 17, 18 are not contained in the directory 2, but are also not used for storing a message. Such a case arises when, during the initialisation of the system, the memory segments 8, 17, 18 are recognised as being faulty, are therefore not entered into the directory, and are thus excluded from further use.

In a voice store of, for example, an answering device, the stored messages are generally outputted in the order of their input. For this purpose, the start addresses stored in the start address list 3 are processed in sequence. This can, for example, be achieved by the repeated operation of a recall key. Another possibility consists of entering a series of numbers, which are associated with the stored messages according to their order of occurrence and are stored in the memory together with the corresponding start address of the message, and which, when entered, initiate the output of the message stored at the associated start address.

If the voice storage system is used in a communication system in which,

for example, subscribers' numbers or names are transmitted as part of the signalling information, these can be stored with the start addresses of the individual messages, instead of message numbers. The individual messages can then be recalled via the stored subscriber numbers or subscriber names. For this purpose, a list of the stored subscriber numbers or names can be shown on a display of a terminal.

If, instead of spoken messages, text messages are stored, this can be achieved in the same way as described earlier for spoken messages. For outputting such messages, a display built into the terminal is suitable, or a data display terminal coupled to the voice storage system, or a printer.



The claims defining the invention are as follows:

1. A digital voice storage system with random-access semiconductor memory for the storage of messages in a telecommunication system, wherein the semiconductor memory is divided into individually addressable segments,

5 and wherein a memory control system is provided, said memory control system:

a) enters the addresses of the memory segments currently available for data storage into a directory and removes them from the directory when they are no longer available,

b) forms from the messages being stored, one or more data blocks adapted to the size of the memory segments, stores these in available memory segments, records the address of the memory segment which is used to store the first data block of a message as the start address in a start address list, and the addresses of the memory segment used next and those of all additional memory segments used, always in the preceding memory segment, and  
10 identifies the end of a message by means of a code in the last memory segment used for this message,

c) recalls messages to be outputted by means of the corresponding start addresses assigned to them.

2. A digital voice storage system as claimed in claim 1, wherein the memory control system detects permanent faults in the individual memory segments and erases the addresses of faulty memory segments from the directory of available memory segments.  
20

3. A digital voice storage system as claimed in claims 1 or 2, wherein the voice storage system additionally processes text data and for this purpose is connected to at least one text input and one text output device.  
25

4. A digital voice storage system as claimed in any one of claims 1 to 3, wherein said storage system forms a part of a terminal for voice, text or video communication.

5. A digital voice storage system as claimed in any one of claims 1 to 3, wherein said storage system is allocated to several terminals for voice, text or video communication.  
30

6. A digital voice storage system as claimed in any one of the preceding claims, wherein the voice storage system is capable of accepting signalling information associated with a call and to store this together with a transmitted

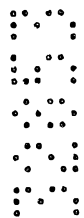


message, and wherein, using this signalling information, access can be obtained to the messages which have been stored together with this signalling information.

7. A digital voice storage system substantially as herein described, with  
5 reference to the accompanying diagram.

DATED THIS FIRST DAY OF FEBRUARY 1993

ALCATEL N. V.



## ABSTRACT

This invention relates to a digital voice storage system with a random-access semiconductor memory for storage of messages in a telecommunications system.

The large storage capacity needed when storing speech requires an optimal utilisation of limited available storage locations. To achieve this, according to the invention, the semiconductor memory is divided into individually addressable memory segments. By means of a memory control system, messages are divided into data blocks and stored in memory segments which are listed in a directory of available memory segments. Known faulty memory segments are excluded from use. Data blocks forming part of a message are located by means of a start address for the corresponding first data block, and by follow-on addresses, stored in each used memory segment, which identify the corresponding next memory segment. A simplified access to particular messages can, for example, be achieved via telephone numbers. The voice storage system is particularly advantageous in terminals such as telephone answering machines.

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Diagram 1

Memory Segments of Semiconductor Memory 1

| Memory Segment |                        | Address of next<br>Memory Segment |
|----------------|------------------------|-----------------------------------|
| 1              | free                   |                                   |
| 2              | free                   |                                   |
| 3              | free                   |                                   |
| 4              | datablock of message 0 | 11                                |
| 5              | datablock of message 2 | 6                                 |
| 6              | datablock of message 2 | 7                                 |
| 7              | datablock of message 2 | E                                 |
| 8              | faulty                 |                                   |
| 9              | datablock of message 1 | E                                 |
| 10             | free                   |                                   |
| 11             | datablock of message 0 | 12                                |
| 12             | datablock of message 0 | 13                                |
| 13             | datablock of message 0 | 21                                |
| 14             | free                   |                                   |
| 15             | free                   |                                   |
| 16             | datablock of message 3 | X                                 |
| 17             | faulty                 |                                   |
| 18             | faulty                 |                                   |
| 19             | datablock of message 1 | 20                                |
| 20             | datablock of message 1 | 9                                 |
| 21             | datablock of message 0 | E                                 |
| 22             | free                   |                                   |
| ..             | ..                     |                                   |
| ..             | ..                     |                                   |
| x              | ..                     |                                   |
| ..             | ..                     |                                   |
| ..             | ..                     |                                   |
| n              | ..                     |                                   |

Directory 2 of Available  
Memory Segments

Start Address List 3  
Message      Start Address

|    |   |    |
|----|---|----|
| 1  | 0 | 4  |
| 2  | 1 | 19 |
| 3  | 2 | 5  |
| 10 | 3 | 16 |
| 14 |   |    |
| 15 |   |    |
| 22 |   |    |
| .. |   |    |
| .. |   | .. |