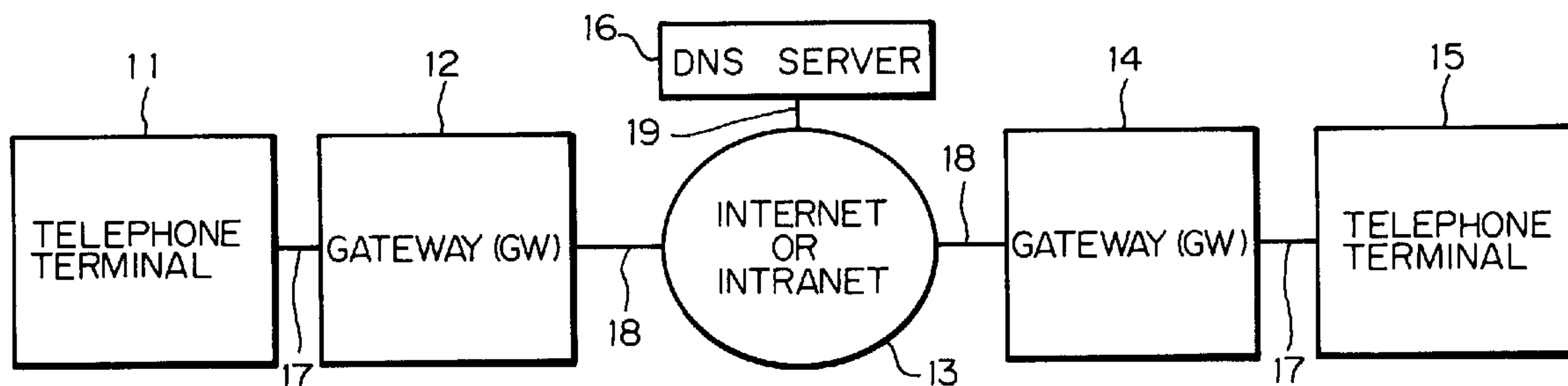




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(54) Titre : METHODE DE TRANSFERT TELEPHONIQUE POUVANT RELIER UN TERMINAL TELEPHONIQUE ET UNE ADRESSE IP DE CANAL TELEPHONIQUE AU MOMENT DE LA CONNEXION
 (54) Title: TELEPHONE COMMUNICATION METHOD CAPABLE OF RELATING A TELEPHONE TERMINAL AND A SPEECH CHANNEL IP ADDRESS AT THE TIME OF CALL CONNECTION



(57) **Abrégé/Abstract:**

A telephone communication method capable of promoting the efficient use of the limited number of IP (Internet Protocol) addresses is disclosed. When a call is originated on a first telephone terminal, a first gateway accommodating the terminal accesses a DNS (Domain Name System) server via a UDP (User Datagram Protocol) channel of Internet or Intranet. The first gateway inquires the DNS server of the IP address of a second gateway accommodating a telephone terminal to be called, using an office number assigned to the second telephone terminal as a host name. The DNS server returns the IP address of the second gateway to the first gateway via the UDP channel. In response, the first gateway selects its own IP address for speech transfer and sends a call connection request to the second gateway on a TCP (Transmission Control Protocol) channel of Internet. On receiving the request, the second gateway determines whether or not the second telephone terminal is busy, and selects the IP address for speech transfer if it is idle. The IP address selected is returned to the first gateway in the form of a response message. As a result, a connection is set up between the two telephone terminals.

ABSTRACT OF THE DISCLOSURE

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A telephone communication method capable of promoting the efficient use of the limited number of IP (Internet Protocol) addresses is disclosed. When a call is originated on a first telephone terminal, a first gateway accommodating the terminal accesses a DNS (Domain Name System) server via a UDP (User Datagram Protocol) channel of Internet or Intranet. The first gateway inquires the DNS server of the IP address of a second gateway accommodating a telephone terminal to be called, using an office number assigned to the second telephone terminal as a host name. The DNS server returns the IP address of the second gateway to the first gateway via the UDP channel. In response, the first gateway selects its own IP address for speech transfer and sends a call connection request to the second gateway on a TCP (Transmission Control Protocol) channel of Internet. On receiving the request, the second gateway determines whether or not the second telephone terminal is busy, and selects the IP address for speech transfer if it is idle. The IP address selected is returned to the first gateway in the form of a response message. As a result, a connection is set up between the two telephone terminals.

1 TELEPHONE COMMUNICATION METHOD CAPABLE OF RELATING
A TELEPHONE TERMINAL AND A SPEECH CHANNEL IP ADDRESS
AT THE TIME OF CALL CONNECTION

5

BACKGROUND OF THE INVENTION

Field of the Invention

10 The present invention relates to a telephone communication
method for a communication system allowing a plurality of
telephone terminals to communicate via Internet or Intranet
(Private IP (Internet Protocol) Network).

Description of the Background Art

15 Speech communication systems implemented by Internet
include an IRC (Internet Relay Chat) server system referred to as
Internetphone. A conventional telephone communication system
using the IRC server system accommodates a number of gateways
capable of accessing Internet. Telephone terminals are connected to
20 each of the gateways via respective subscriber lines so as to allow
conversation to be held therebetween. A number server is
connected to Internet and assigns a particular IP (Internet Protocol)
address to the telephone number of each telephone terminal for a
control purpose.

25

Before a telephone connection, a gateway requests entry
registration for a telephone service of the number server. In

1 response to the request, the number server assigns a particular IP
address to each telephone accommodated in the gateway. Assume
that after the assignment of the IP addresses one of the telephone
terminals accommodated in the gateway sends a call request meant
5 for another telephone terminal to the gateway. Then, the gateway
inquires the number server of an IP address assigned to the
telephone to be called. In response, the number server searches for
the above IP address and sends it to the gateway. The gateway
having received the IP address sends a call connection request to a
10 gateway accommodating the telephone terminal designated by the
IP address. As a result, the call is terminated at the telephone
terminal to be called. The called telephone terminal sends an
answer representative of the call connection to the gateway
accommodating the calling telephone terminal via the gateway
15 accommodating the called telephone terminal. Consequently, the
calling terminal and called terminal are connected together and
allowed to communicate with each other.

The conventional telephone communication procedure
20 described above has the following problems left unsolved. First,
while a particular IP address must be assigned to each telephone
terminal, communication will become difficult in the future because
the number of IP addresses is limited and short throughout the
world. Second, the communication system inhibits communication
25 from being held on telephone terminals other than those registered
at the number server, so that it is not available for emergency calls.

1 SUMMARY OF THE INVENTION

 It is therefore an object of the present invention to provide a telephone communication method allowing a plurality of telephone terminals to share a single IP address and thereby promoting the efficient use of the limited number of IP addresses.

 It is another object of the present invention to provide a telephone communication method implementing a telephone communication system available even for emergency calls.

 A telephone communication method of the present invention is applicable to a network system including a plurality of gateways given respective IP addresses corresponding to the addresses of Internet, which includes a control line having a first and a second channel and a speech line having a first and a second channel, for holding communication with each other via Internet on the basis of the IP addresses, and a plurality of telephone terminals given respective telephone numbers for holding communication with each other via the gateways on the basis of the telephone numbers. The method begins with the step of preparing a name server connectable to the gateways via Internet for managing the names of the gateways, IP addresses respectively corresponding to the names, and office numbers respectively assigned to the gateways.

 When a first telephone terminal outputs a connection request meant for a second telephone terminal, a first gateway accommodating the first telephone terminal is caused to access the

1 name server via the first channel of the control line in response to a
call originated on the first telephone terminal, and inquire the name
server of the IP address of the second gateway by using the name
corresponding to the office number assigned to the second gateway.
5 The name server sends the IP address of the second gateway to the
first gateway on the first channel of the control line. The first
gateway selects the IP address of the speech line connected thereto
and sends a call connection request to the second gateway on the
second channel of the control line. The second gateway determines
10 whether or not the second telephone terminal is busy, selects, if the
second telephone terminal is idle, the IP address of the speech line,
and returns the IP address selected to the first gateway, thereby
setting up a connection between the first telephone terminal and
the second telephone terminal. The first gateway transfers a
15 speech signal received from the first telephone terminal to the
second gateway on the speech line, and causes the second gateway
to send the speech signal to the second telephone terminal.

Also, a telephone communication method of the present
20 invention is applicable to a network system including a plurality of
gateways given respective IP addresses corresponding to the
addresses of Internet, which includes a control line having a first
and a second channel and a speech line having a first and a second
channel, for holding communication with each other via Internet on
25 the basis of the IP addresses, a plurality of switching systems given
respective office numbers for holding communication with each
other via the gateways on the basis of the office numbers, and a

1 plurality of telephone terminals given respective telephone
numbers for holding communication with each other via the
gateways and switching systems on the basis of the telephone
numbers. The method begins with the step of preparing a name
5 server connected to the gateways via Internet for managing office
numbers and names respectively given to the switching systems
and IP addresses assigned to the gateways to which the switching
systems are respectively connected. Subscriber data tables each is
stored in a respective one of the gateways and has a division field
10 storing division data showing whether an apparatus accommodated
in the respective gateway is the telephone terminal or the switching
system, and an office number field storing an office number
assigned to the gateway and an office number assigned to the
switching system accommodated in the gateway.

15

When a first telephone terminal outputs a connection request
meant for a second telephone terminal, a first gateway
accommodating the first telephone terminal accesses the name
server via the first channel of the control line in response to a call
20 originated on the first telephone terminal and a call originated on a
first switching system accommodating the first telephone terminal,
and inquire the name server of the IP address of a second gateway
accommodating a second switching system accommodating the
second telephone terminal by using the name corresponding to the
25 office number assigned to the second switching system. The name
server sends the IP address of the second gateway to the first
gateway on the first channel of the control line. The first gateway

1 selects the IP address of the speech line connected thereto and
sends a connection request to the second gateway on the second
channel of the control line. The second gateway searches division
data of the subscriber data and searches for, if the division data is
5 representative of a switching system, the line of a switching system
at which the office number of the second switching system and the
office number included in the subscriber data coincide. The second
gateway having detected the line of the switching system
determines whether or not the line of the switching system is busy,
10 selects, if the line is idle, the IP address of the speech line, and
return the IP address selected to the first gateway, thereby setting
up a connection between the first switching system and the second
switching system and therefore between the first telephone
terminal and the second telephone terminal. The first gateway
15 transfers a speech signal received from the first telephone terminal
via the first switching system to the second gateway via the speech
line, and then the second gateway sends the speech signal to the
second telephone terminal via the second switching system.

20 BRIEF DESCRIPTION OF THE DRAWINGS

The objects and features of the present invention will become
more apparent from the consideration of the following detailed
description taken in conjunction with the accompanying drawings in
which:

25 FIG. 1 is a block diagram schematically showing a telephone
communication system to which a telephone communication method
embodying the present invention is applied;

1 FIG. 2 is a block diagram schematically showing a specific
configuration of a gateway included in the embodiment shown in
FIG. 1;

5 FIG. 3 is a block diagram schematically showing a specific
configuration of a central controller included in the gateway of FIG.
2;

 FIG. 4 shows a specific format of number conversion
information stored in a DNS (Domain Name System) server also
included in the embodiment of FIG. 1;

10 FIG. 5 is a view useful for understanding channels included in
Internet and used by the embodiment of FIG. 1;

 FIG. 6 is a chart representative of a specific communication
sequence available with the embodiment of FIG. 1;

15 FIG. 7 is a block diagram similar to FIG. 1, schematically
showing a telephone communication system to which an alternative
embodiment of the present invention is applied;

 FIG. 8 is a view similar to FIG. 4, showing a specific number
conversion information particular to the embodiment shown in FIG.
7;

20 FIG. 9 shows a specific format of subscriber data also
particular to the embodiment shown in FIG. 7; and

 FIG. 10 is a chart demonstrating a specific communication
sequence available with the embodiment shown in FIG. 7.

25 DESCRIPTION OF THE PREFERRED EMBODIMENTS

 Referring to FIG. 1 of the drawings, a telephone
communication system implemented by a telephone communication

1 method embodying the present invention includes gateways (GW)
12 and 14 connected to Internet or Intranet 13 by respective
connection lines 18 so as to access it, as needed. It should be noted
that, for simplicity in FIG. 1 the two gateways 12 and 14 are representative of a
5 number of gateways included in the communication system for
simplicity. The gateways 12 and 14 respectively accommodate
telephone terminals 11 and 15 connected thereto by subscriber
lines 17. In FIG. 1, the two telephone terminals 11 and 15 each is
representative of a number of telephone terminals connected to the
10 gateway 12 or 14. That is, the illustrative embodiment is, of course,
applicable to a telephone communication system including other
gateways and other telephone terminals.

The gateway 12 converts an analog speech signal received
15 from the telephone terminal 11 to a corresponding digital signal or
converts a digital signal received via Internet or Intranet 13 to a
corresponding analog signal and delivers the analog signal to the
terminal 11. In addition, the gateway 12 executes various kinds of
control over connections to occur via Internet or Intranet 13. The
20 gateway 14 has exactly the same functions as the gateway 12
except that it deals with the telephone terminal 14. The gateways
12 and 14 may have an identical configuration as will be described
later with reference to FIG. 2.

25 A DNS server or similar name server 16 is also connected to
Internet or Intranet 13. The DNS server 16 has an address
mapping function for managing correspondence between host

1 names assigned to various hosts including the telephone terminals
11 and 15, gateways 12 and 14 and computers, not shown, and IP
addresses. For this purpose, the DNS server 16 includes a memory,
not shown, storing data representative of correspondence between
5 the host names and the IP addresses in the form of a table

FIG. 2 shows a specific configuration of the gateway 12 or 14.
The following description will concentrate mainly on the gateway
12. As shown, the gateway 12 or 14 includes a terminal
10 accommodating circuit (Analog Peripheral Interface or APIF) 122.
A group of lines including the lines to which the telephone terminal
11 or 15 is connected are connected to the input ports of the
terminal accommodating circuit 122. The circuit 122 interfaces the
group of lines 121 and the gateway 12 or 14. The circuit 122 has
15 its output ports 129 connected to the input ports of a switch (SW)
123. The switch 123 selects one of the lines 121 at a time and
connects it to its output port 130 which is connected to a voice
compression controller (VCC) 124. The voice compression controller
124 compresses a speech signal and then delivers it to a line 131
20 connected to Internet or Intranet 13, or reproduces a speech signal
from a signal received from another gateway, as needed. The
connection line 131 connected to the voice compression controller
124 is exclusively assigned to digital speech signals to be
interchanged via Internet or Intranet 13.

25

The gateway 12 further includes a LAN (Local Area Network)
controller (LACM) 125 for sending various control signals particular

1 to Internet or Intranet 13 to Internet or Intranet 13. Specifically, a
control line 132 is connected to the LAN controller 125 in order to
allow control information to be sent via Internet or Intranet 13.
The gateway 12 or 14 additionally includes a central controller 126
5 for controlling call connections, and a memory 127 for storing
number conversion information, which will be described, under the
control of the central controller 126. The terminal accommodating
circuit 122, switch 123, speech compression controller 124, LAN
controller 125, central controller 126 and memory 127 are
10 interconnected by a bus 128, as illustrated.

FIG. 3 shows a specific configuration of the central controller
126 for implementing the gateway control function. As shown, the
central controller 126 includes a call control (CPC) 1261 for
15 processing call connections between a source apparatus and a
destination apparatus, e.g., between the gateways 12 and 14 and
therefore between the telephone terminals 11 and 15. Line
controls (CCC) 1262 are connected to the call control 1261, as
illustrated. The line controls 1262 execute the line-by-line access
20 of the gateway 12 or 14 to the DNS server 16 and commands voice
compression and control over a speech path. A LAN control (LAC)
1263 is also connected to the call control 1261, as illustrated. The
LAN control 1263 controls the LAN controller 125 in order to
interchange control information via Internet or Intranet 13.

25

A DNS control (DNSC) 1264, a voice compression control (VCC)
1265 and speech path control (SPC) 1266 are connected to the line

1 control 1262, as illustrated. The DNS control 1264 controls number
inquiry to the DNS server 16. The voice compression control 1265
controls the compression and reproduction of speech signals to be
executed by the speech compression controller 124. The speech
5 path control 1266 controls the terminal accommodating circuit 122
and switch 123 in order to selectively set up or interrupt the
connection path between the telephone terminals 11 and 15 and
the connection path between the terminal 11 and the voice
compression controller 124.

10

FIG. 4 shows specific number conversion information stored in
the DNS server 16 of the illustrative embodiment. The number
conversion information are based on rules prescribed by RFC
(Request For Comments) 1034 (Domain Names - Concepts and
15 Facilities). In FIG. 4, the gateways 12 and 14 are assumed to be
respectively located in Tokyo and Osaka, Japan, and respectively
provided with office numbers of "30" and "60". In addition, the
gateways 12 and 14 are provided with host names "TOKYO" and
"OSAKA", respectively. The control lines 132 of Internet 13
20 connected to the gateways 12 and 14, respectively, are provided
with IP addresses "133. 149. 30. 16" and "133. 149. 60. 16",
respectively. In this specific case, the IP addresses are respectively
related to the host names first, and then the office numbers "30"
and "60" are respectively assigned to the host names as double
25 definition, i.e., CNAMEs (Canonical Names).

1 Specific channels available with Internet or Intranet 13 will
be described with reference to FIG. 5. As shown, the gateways 12
and 14 each is capable of accessing the DNS server 16 via a UDP
(User Datagram Protocol) channel 141 included in the respective
5 control line 132 belonging to Internet or Intranet 13. The DNS
server 16 provides, e.g., the gateway 12 with the office number,
host name and IP address of, e.g., the gateway 14. Then, the
gateway 12 confirms the status of the telephone terminal
designated by the office number, host name and IP address, i.e., the
10 telephone terminal 14 via a TCP (Transmission Control Protocol)
channel 142 included in the associated control line 132. At the
same time, the gateway 12 selects an IP address assigned to the
speech line 131 belonging to Internet or Intranet 13. As a result, a
speech signal is sent via a UDP channel 143 on the IP address of the
15 speech line 131 selected. When the gateway 12 sends a speech
signal via the UDP channel 143, it cannot confirm its connection to
the destination telephone terminal 15. For this reason, the gateway
12 monitors the UDP channel 143 via the TCP channel 142 of the
same address as the channel 143. In this manner, at the time of
20 call connection, the illustrative embodiment relates the telephone
terminal 15 and the IP address of the UDP channel 143 to each
other. This obviates the need for the conventional assignment of a
particular IP address to each telephone terminal.

25 FIG. 6 demonstrates a specific communication sequence
available with the illustrative embodiment. How telephone

1 communication is held in the above system will be described with
reference to FIG. 6.

(1) Destination Address Inquiry

5 Assume that the telephone terminal 11 located in Tokyo
outputs a connection request meant for the telephone terminal 15
located in Osaka. In response to call origination 200 on the
telephone terminal (source hereinafter) 11, the gateway 11 causes
its central controller 126 to control the LAN controller 125 in order
10 to access the DNS server 16 via the UDP channel 141 of the control
line 132. Specifically, the LAN controller 125 inquires the DNS
server 16 of the IP address of the gateway 14 to be called, using
the host name corresponding to the office number of the gateway
14 accommodating the telephone terminal to be called (destination
15 hereinafter) 15. This is represented by a flow 201.

(2) Response to Inquiry

In response to the inquiry 201, the DNS server 16 searches its
table listing the correspondence between the host names and IP
20 addresses, using the host name "OSAKA". In this case, the DNS
server 16 reads the IP address "133. 149. 60. 16" assigned to the
gateway 14 to be called out of the table and returns it to the LAN
controller 125 of the gateway 12 over the UDP channel 141 of the
control line 132. Such a response of the DNS server 16 is
25 represented by a flow 202.

(3) Call Connection Request

1 On receiving the response 202, the LAN controller 125 of the
gateway 12 designates the IP address of the gateway 14 on the
speech line 131 under the control of the central controller 126.
Then, the LAN controller 125 sends a call connection request 203 to
5 the gateway 14 over the TCP channel 142 of the control line 132
having the above IP address.

(4) Connection Response

10 In response to the connection request 203, the central
controller 126 of the called gateway 14 determines whether or not
the destination 15 is busy. If the destination 15 is busy, then the
central controller 126 returns a message representative of the busy
state to the calling gateway 12. This message is transferred to the
call control 1261 of the calling gateway 12 via the LAN controller
15 125 and the LAN control 1263 of the central controller 126. On the
other hand, if the destination 15 is idle, the central controller 126 of
the called gateway 14 causes the destination 15 to ring or otherwise
display a call incoming 204. When a person at the telephone
terminal 15 off-hooks the terminal 15 to answer the phone, the
20 central controller 126 of the called gateway 14 detects the response
205 and then selects the IP address of the speech line 131. The IP
address selected is sent to the calling gateway 12 in the form of a
response message 206. In the calling gateway 12, the call control
1261 receives the response message 206. As a result, a response
25 207 representative of the response from the destination 15 is sent
to the source 11 in order to set up call connection between the
source 11 and the destination 15.

1 (5) Conversation

As a speech signal is sent from the source 11 to the calling gateway 12, the speech compression circuit 124 of the gateway 12 compresses the speech signal under the control of the central
5 controller 126. The compressed speech signal is sent from the calling gateway 12 to the called gateway 14 on the speech channel of the speech line 131, i.e., the UDP channel 143. In the called gateway 14, the voice compression controller 124 reproduces an analog speech signal from the compressed speech signal and sends
10 it to the destination 15. A speech signal is sent from the destination 15 to the source 11 in exactly the same way. In this manner, conversation 207 is held between the source 11 and the destination 15.

15 Advantages achievable with the illustrative embodiment are as follows. At the time of call connection, a telephone terminal and the IP address of a UDP channel for speech transfer are related to each other first. It is, therefore, not necessary to assign a particular
20 IP address to each telephone terminal by use of the entry registration principle. This allows a plurality of terminals to share a single IP address and thereby promotes the efficient use of the limited number of IP addresses. Further, because telephone
25 terminals do not have to be registered at a DNS server, they can be used for emergency calls. In addition, speech communication can be implemented by a DNS server customarily connected to a data network, i.e., without resorting to a special address server.

1 Referring to FIG. 7, an alternative embodiment of the present
invention will be described. In FIG. 7, reference numerals identical
with the reference numerals shown in FIG. 1 denote like structural
elements. As shown, this embodiment differs from the previous
5 embodiment in that private branch exchanges (PBXs) or switching
systems 11A and 15A are respectively connected between the
telephone terminal 11 and the gateway 12 and between the
telephone terminal 15 and the gateway 14. As for the rest of the
construction, this embodiment is identical with the previous
10 embodiment.

In this embodiment, the DNS server 16 stores number
conversion information in a specific format shown in FIG. 8. As
shown, the gateways 12 and 14 accommodating the PBXs 11A and
15A, respectively, are assumed to be located in Tokyo and Osaka,
respectively. In the illustrative embodiment, the office numbers
"30" and "60" are assigned to the PBXs 11A and 15A, respectively.
Also, host names "TOKYOPBX" and "OSAKAPBX" are given to the
PBXs 11A and 15A, respectively. The IP addresses of the control
20 lines 132 of Internet or Intranet 13 connected to the gateways 12
and 14, respectively, are "133. 149. 30. 16" and "133. 149. 60. 16",
respectively. In this specific case, such IP addresses are
respectively related to the host names first, and then the PBX office
numbers are respectively assigned to the host names as double
25 definition, i.e., CNAMEs.

1 The gateways 12 and 14 each stores subscriber data. In the
illustrative embodiment, the subscriber data are stored in the
memories 127 of the gateways 12 and 14 in a specific format
shown in FIG. 9. As shown, the format is made up of a division field
5 210, an office number field 211, and an extension number field
212. In the division field 210, a (logical) ZERO is set if the
apparatus accommodated in the gateway 12 or 14 is an extension,
or a (logical) ONE is set if it is a private branch exchange. In the
office number field 211, the office number assigned to the gateway
10 12 or 14 is set if the apparatus set in the division field 210 is an
extension, or the office number assigned to a private branch
exchange is set if it is a private branch exchange. Further, in the
extension number field 212, an extension number is set if the
apparatus set in the division field 210 is an extension.

15

A specific telephone communication sequence available with
the system shown in FIG. 7 will be described with reference to FIG.
10.

20

(1) Destination Inquiry

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Assume that the telephone terminal (source hereinafter) 11 in
Tokyo outputs a connection request 200 meant for the telephone
terminal (destination hereinafter) 15 in Osaka. In response, the
PBX 11A accommodating the source 15 sends a call 200a to the
gateway 12. In response, in the gateway 12, the LAN controller
125, FIG. 2, accesses the DNS server 16 via the UDP channel 141 of
the control line 132, FIG. 5, under the control of the central

1 controller 126, FIG. 2. The LAN controller 125 inquires the DNS
server 16 of the IP address of the gateway 14 accommodating the
PBX 15A, using the host name "OSAKAPBX" corresponding to the
office number of the destination 15 (flow 201). This is followed by
5 the response-to-call procedure (2) and call connection request
procedure (3) described previously with reference to FIG. 6.

Specifically, the DNS server 16 searches for the IP address of
the called gateway 14 and returns it to the calling gateway 12. In
10 response, the gateway 12 designates the IP address of the gateway
14 on the speech line 131, FIG. 5, and then sends a call connection
request 203 to the gateway 14 on the TCP channel 142, FIG. 5, of
the control line designated by the above IP address.

15 (4) Search

On receiving the call connection request 203, the called
gateway 14 causes its central controller 126 to search the
subscriber data stored in the memory 127. The central controller
126 determines the kind of an apparatus set in the division field
20 210 of the subscriber data searched for. If the apparatus is a
private branch exchange, then the controller 126 identifies the line
of a private branch exchange whose office number ("60" in this
case) is identical with the data stored in the office number field 211
of the subscriber data 127.

25

(5) Connection Response

1 In the called gateway 14, the central controller 126 having
detected the line to the PBX 15A determines whether or not the
PBX line is busy. If the PBX line is busy, then the central controller
126 returns a message representative of the busy state to the
5 calling gateway 12. If the PBX line is idle, then the central
controller 126 of the called gateway 14 causes the PBX 15A and
destination 15 to display a call incoming 204 and a call incoming
204a, respectively. When a person at the destination off-hooks the
telephone terminal 15 to answer the phone, the terminal 15 and
10 PBX 15A respectively return responses 205 and 205a to the called
gateway 14. The central controller 126 of the called gateway 14
detects the response 205a and then selects the IP address of the
speech line 131. The IP address selected is sent to the calling
gateway 12 in the form of a response message 206. In the calling
15 gateway 12, the call control 1261 receives the response message
206. As a result, a response 207 representative of the response
from the destination 15 is sent to the PBX 11A which, in turn, sends
a response 207a to the source 11 in order to set up call connection
between the source 11 and the destination 15.

20

(6) Conversation

 As a speech signal is sent from the source 11 to the calling
gateway 12 via the PBX 11A, the speech compression circuit 124 of
the gateway 12 compresses the speech signal under the control of
25 the central controller 126. The compressed speech signal is sent
from the calling gateway 12 to the called gateway 14 on the speech
channel of the speech line 131, i.e., the UDP channel 143. In the

1 called gateway 14, the voice compression controller 124 reproduces
an analog speech signal from the compressed speech signal and
sends it to the destination 15 via the PBX 15A. A speech signal is
sent from the destination 15 to the source 11 in exactly the same
5 way. In this manner, conversation 208 is held between the source
11 and the destination 15.

As stated above, in the illustrative embodiment, the DNS
server 16 manages office numbers respectively assigned to the
10 PBXs 11A and 15A, names respectively given to the PBXs 11A and
15A, and IP addresses respectively assigned to the gateways 12
and 14 accommodating the PBXs 11A and 15A, respectively. The
gateways 12 and 14 each stores the subscriber data table 127 for
managing the subscriber data including the division field 210 and
15 office number field 211. The division field 210 stores data showing
whether an apparatus accommodated is a telephone terminal or an
exchange. The office number field 211 stores the office number of
the gateway 12 or 14 and the office number of the associated PBX
11A or 15A. With this configuration, the embodiment
20 advantageously implements speech communication using Internet
13 not only via a telephone terminal but also via a private branch
exchange belonging to a telephone network. Of course, it is not
necessary for both of a source and a destination to communicate via
respective private branch exchanges.

25

In a conventional system of the type including private branch
exchanges respectively accommodated by the calling gateway 12

1 and called gateway 14, it is necessary to register the telephone
numbers of telephone terminals at the associated gateways, i.e., to
set identical subscriber data in both of each exchange and gateway
associated therewith. By contrast, the illustrative embodiment
5 should only store the subscriber data in the memory of each
gateway and therefore promotes simple processing.

In summary, it will be seen that the present invention
provides a telephone communication method capable of relating a
10 telephone terminal and the IP address of a speech transfer channel
to each other. This obviates the need for the conventional
assignment of a particular IP address to each telephone terminal
and allows a plurality of telephone terminals to share a single IP
address. Therefore, the method of the invention promotes the
15 efficient use of the limited number of IP addresses. In addition, the
method of the invention allows a telephone communication system
using Internet to be used for emergency calls because it does not
register telephone terminals at a name server.

20 The entire disclosure of Japanese patent application No.
135503/1997 filed on May 26, 1997 including the specification,
claims, accompanying drawings and abstract of the disclosure is
incorporated herein by reference in its entirety.

25 While the present invention has been described with
reference to the illustrative embodiments, it is not to be restricted
by the embodiments. It is to be appreciated that those skilled in

1 the art can change or modify the embodiments without departing
from the scope and spirit of the present invention.

WHAT IS CLAIMED IS:

1 1. A telephone communication method for a network system
including a plurality of gateways given respective IP (Internet
Protocol) addresses corresponding to addresses of Internet or
Intranet, which includes a control line having a first and a second
5 channel and a speech line having a first and a second channel, for
holding communication with each other via Internet or Intranet on
the basis of said IP addresses, and a plurality of telephone
terminals given respective telephone numbers for holding
communication with each other via said plurality of gateways on
10 the basis of said telephone numbers, said telephone communication
method comprising the steps of:

 preparing a name server connectable to said plurality of
gateways via Internet or Intranet for managing names of said
gateways, IP addresses respectively corresponding to said names,
15 and office numbers respectively assigned to said gateways;

 causing, when a first one of said plurality of telephone
terminals outputs a connection request meant for a second one of
said telephone terminals, a first one of said plurality of gateways
accommodating said first telephone terminal to access said name
20 server via the first channel of the control line in response to a call
originated on said first telephone terminal, and inquire said name
server of the IP address of said second gateway by using the name
corresponding to the office number assigned to said second
gateway;

25 causing said name server to send the IP address of said second gateway to said first gateway on the first channel of the control line;

causing said first gateway to select the IP address of the speech line connected thereto and send a call connection request to
30 said second gateway on the second channel of the control line;

causing said second gateway to determine whether or not said second telephone terminal is busy, select, if said second telephone terminal is idle, the IP address of the speech line, and return the IP address selected to said first gateway, thereby setting up a
35 connection between said first telephone terminal and said second telephone terminal; and

causing said first gateway to transfer a speech signal received from said first telephone terminal to said second gateway on the speech line, and causing said second gateway to send the speech
40 signal to said second telephone terminal.

1 2. A telephone communication method in accordance with claim 1, wherein the first channels each includes a UDP (User Datagram Protocol) channel of Internet while the second channels each includes a TCP (Transmission Control Protocol) channel of
5 Internet.

1 3. A telephone communication method for a network system including a plurality of gateways given respective IP addresses corresponding to addresses of Internet or Intranet, which includes a control line having a first and a second channel and a speech line

5 having a first and a second channel, for holding communication with
each other via Internet or Intranet on the basis of said IP
addresses, a plurality of switching systems given respective office
numbers for holding communication with each other via said
plurality of gateways on the basis of said office numbers, and a
10 plurality of telephone terminals given respective telephone
numbers for holding communication with each other via said
plurality of gateways and said plurality of switching systems on the
basis of said telephone numbers, said telephone communication
method comprising the steps of:

15 preparing a name server connected to said plurality of
gateways via Internet or Intranet for managing office numbers and
names respectively given to said plurality of switching systems and
IP addresses assigned to said plurality of gateways to which said
switching systems are respectively connected;

20 preparing subscriber data tables each being stored in a
respective one of said plurality of gateways and having a division
field storing division data showing whether an apparatus
accommodated in the respective gateway is the telephone terminal
or the switching system, and an office number field storing an office
25 number assigned to said gateway and an office number assigned to
the switching system accommodated in said gateway;

causing, when a first one of said plurality of telephone
terminals outputs a connection request meant for a second one of
said telephone terminals, a first one of said plurality of gateways
accommodating said first telephone terminal to access said name
30 server via the first channel of the control line in response to a call

originated on said first telephone terminal and a call originated on a first one of said plurality of switching systems accommodating said first telephone terminal, and inquire said name server of the IP address of a second one of said gateways accommodating a second one of said plurality of switching systems accommodating said second telephone terminal by using the name corresponding to the office number assigned to said second switching system;

causing said name server to send the IP address of said second gateway to said first gateway on the first channel of the control line;

causing said first gateway to select the IP address of the speech line connected thereto and send a connection request to said second gateway on the second channel of the control line;

causing said second gateway to search division data of said subscriber data and search for, if said division data is representative of a switching system, a line of a switching system at which the office number of said second switching system and the office number included in said subscriber data coincide;

causing said second gateway having detected said line of said switching system to determine whether or not said line of said switching system is busy, select, if said line is idle, the IP address of the speech line, and return the IP address selected to said first gateway, thereby setting up a connection between said first switching system and said second switching system and between said first telephone terminal and said second telephone terminal; and

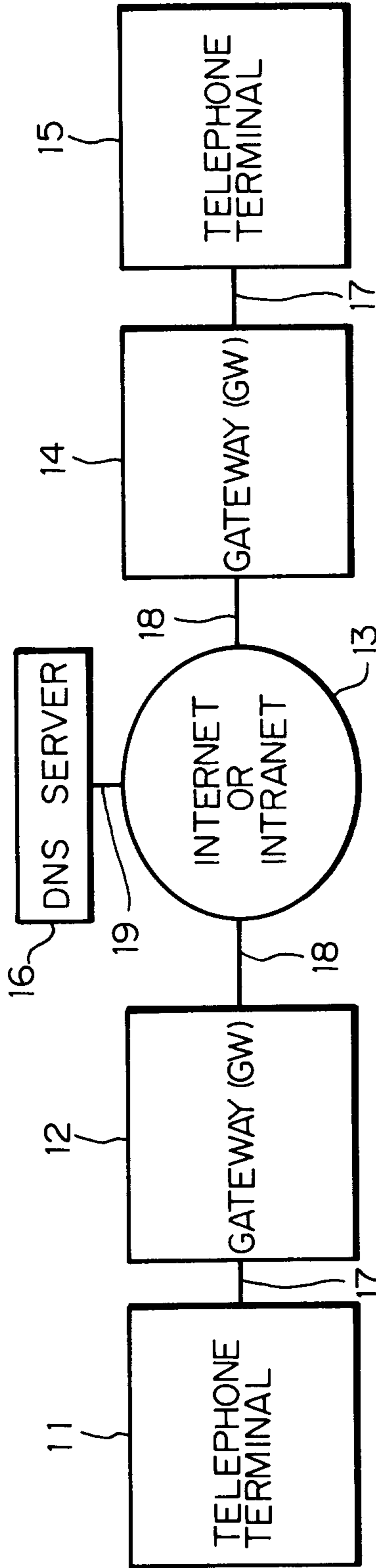
causing said first gateway to transfer a speech signal received from said first telephone terminal via said first switching system to said second gateway via the speech line, and causing said second gateway to send the speech signal to said second telephone terminal via said second switching system.

1 4. A telephone communication method in accordance with claim 1, wherein the first channels each includes a UDP channel of Internet while the second channels each includes a TCP channel of Internet.

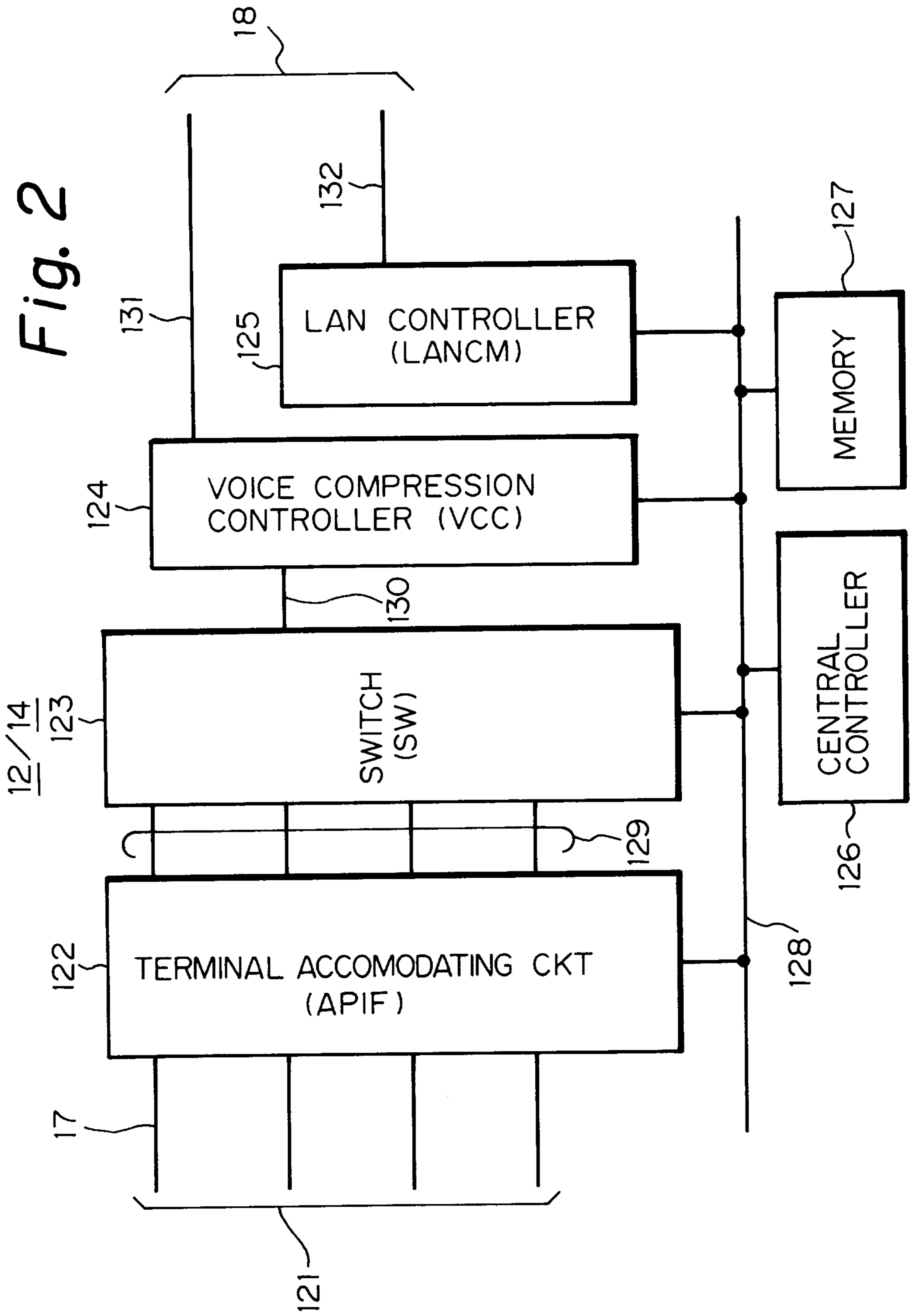
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Fig. 1



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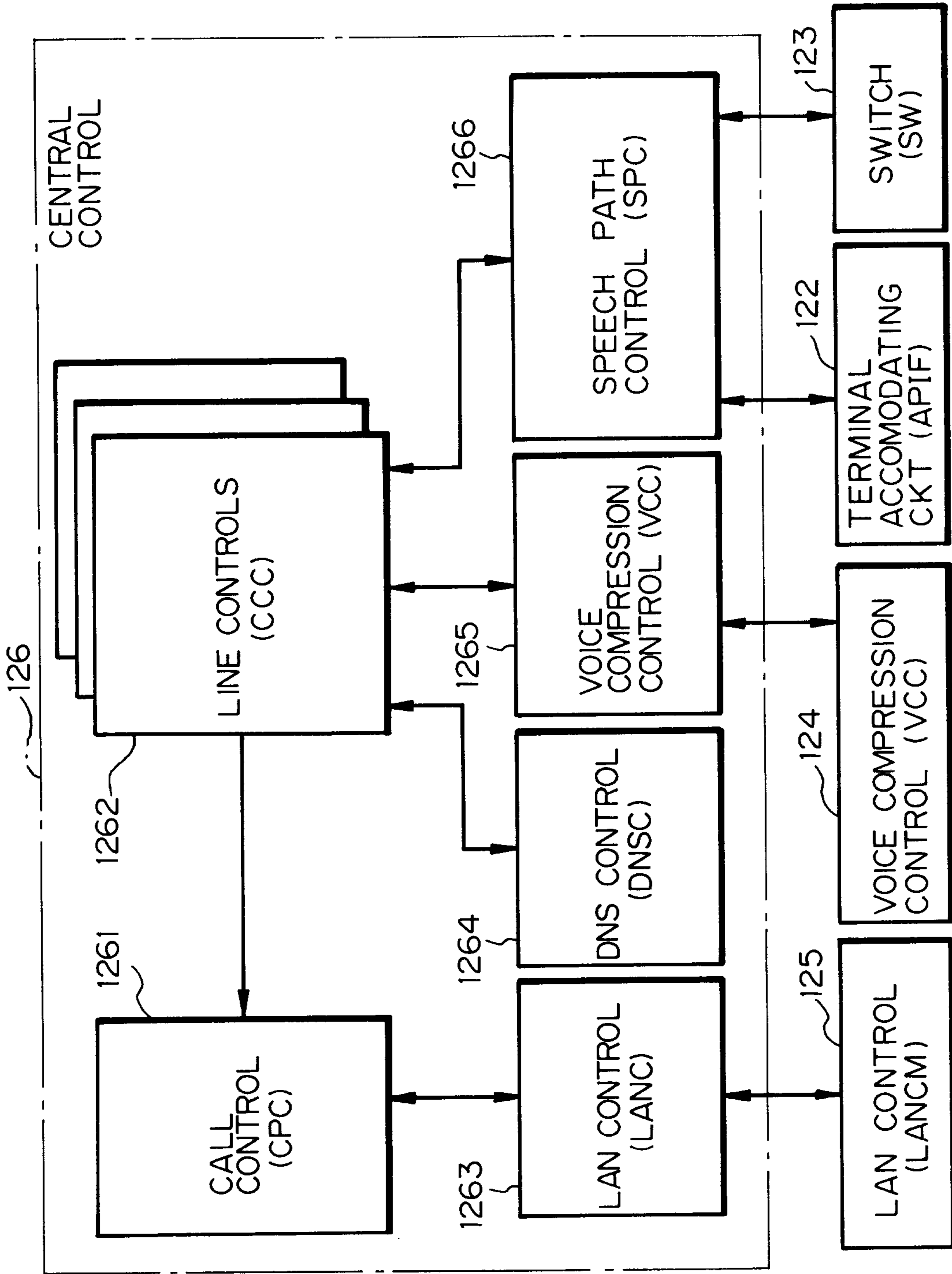


Fig. 3

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*Fig. 4*16

OFFICE NO.	HOST NAME	GW IP ADDRESS
30	TOKYO	133.149.30.16
60	OSAKA	133.149.60.16

TOKYO IN 133.149.30.16
OSAKA IN 133.149.60.16

30 IN CNAME TOKYO
60 IN CNAME OSAKA

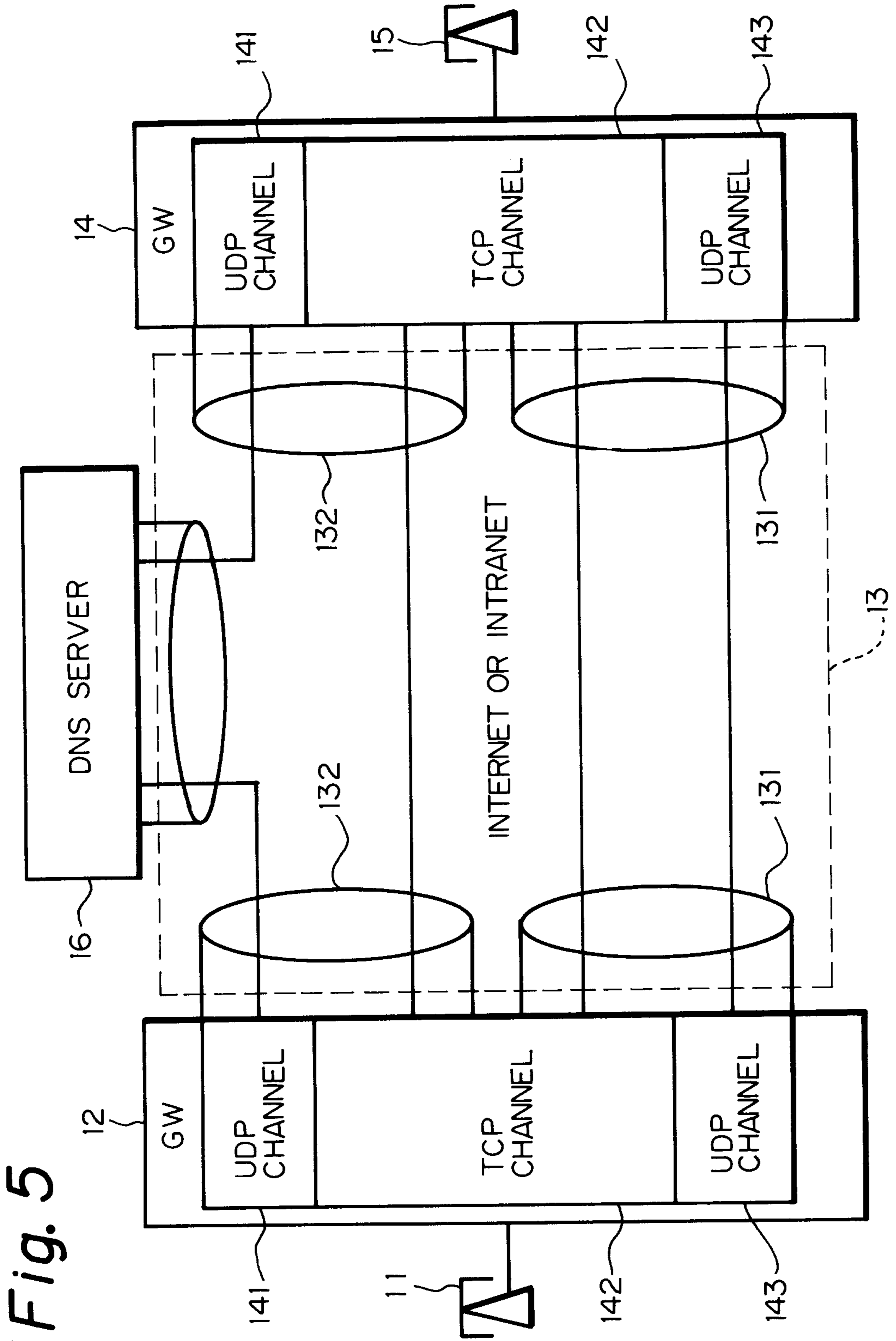


Fig. 5

Fig. 6

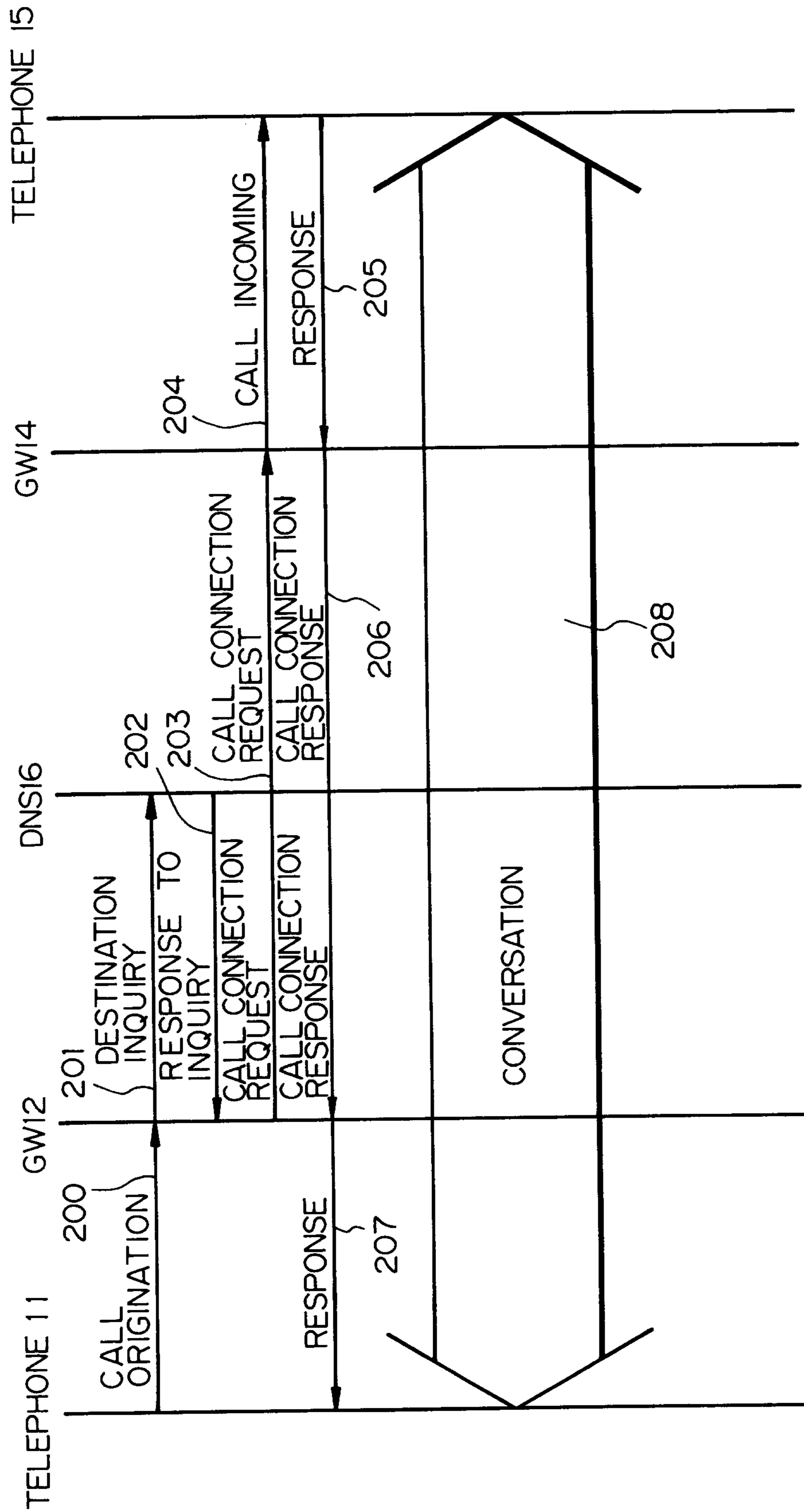
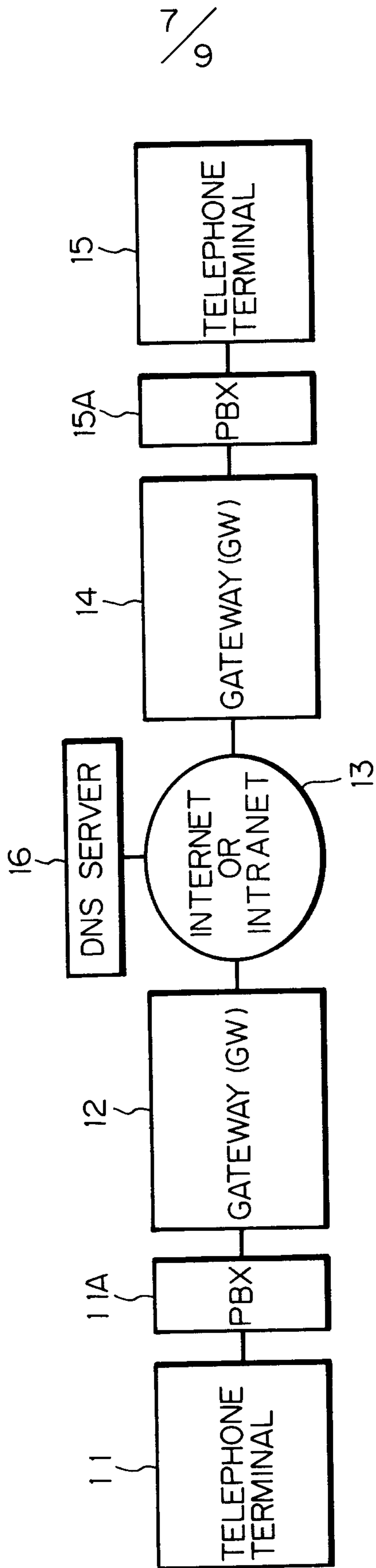


Fig. 7



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*Fig. 8*16

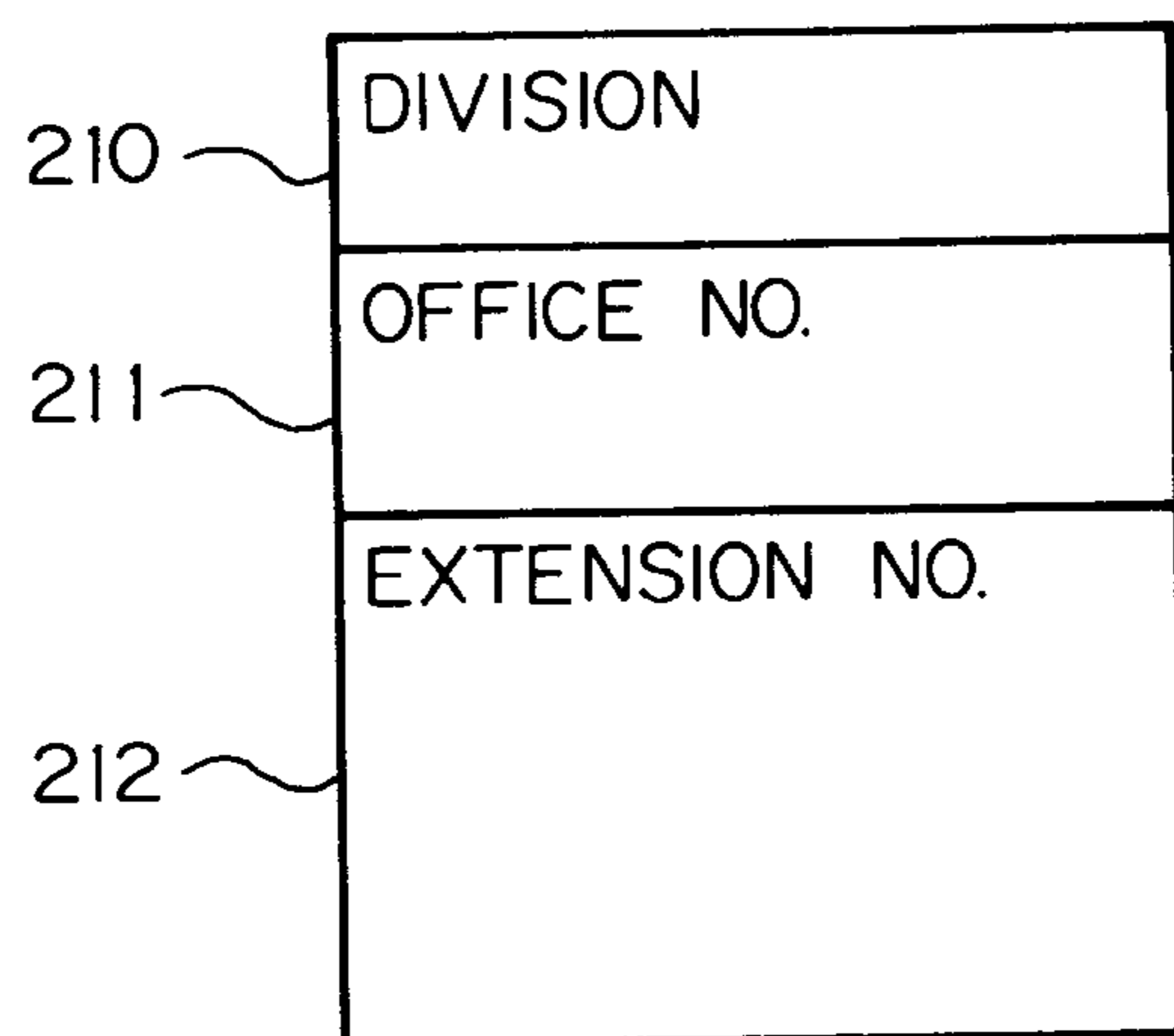
OFFICE NO.	HOST NAME	GW IP ADDRESS
30	TOKYOPBX	133.149.30.16
60	OSAKAPBX	133.149.60.16

TOKYOPBX IN 133.149.30.16

OSAKAPBX IN 133.149.60.16

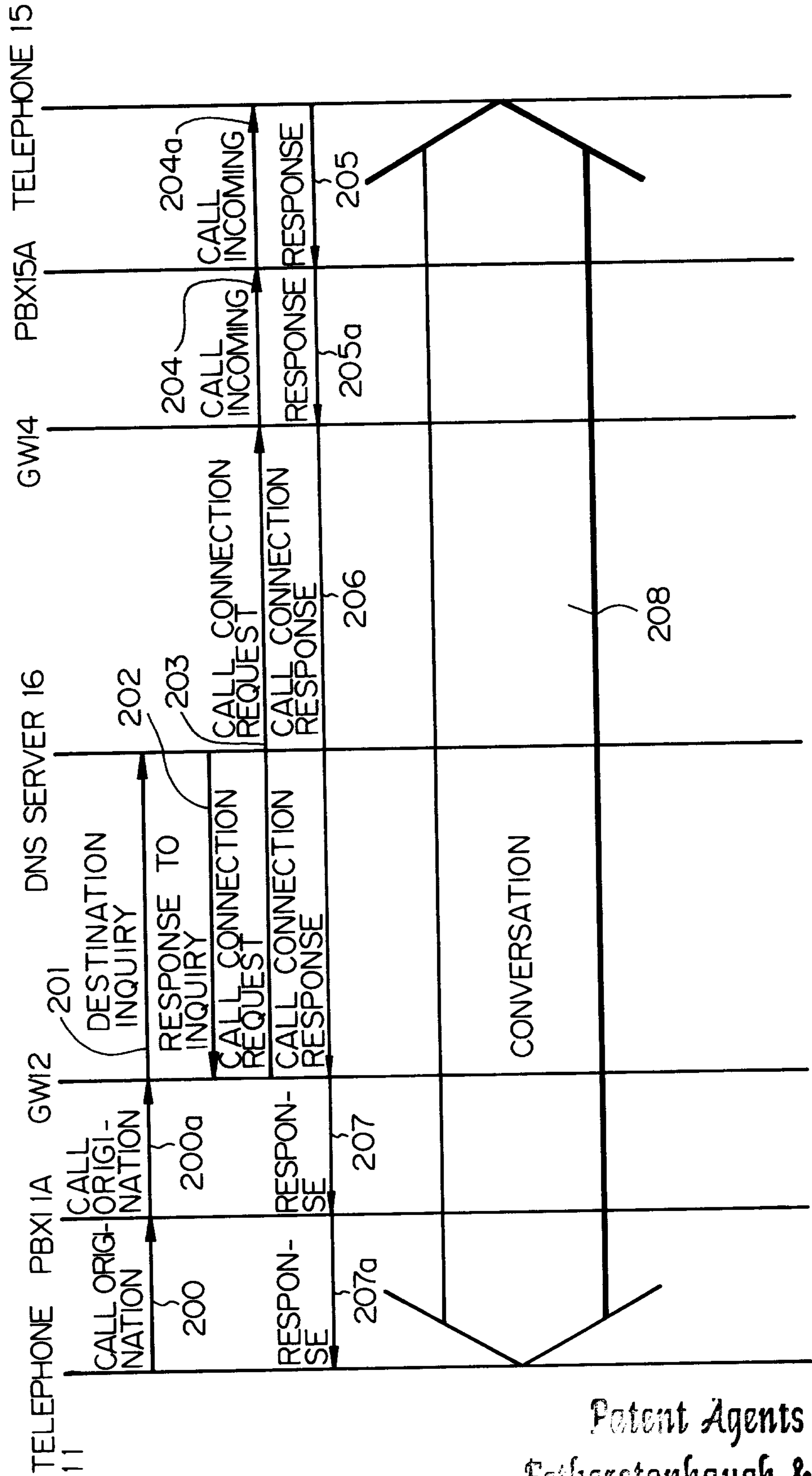
30 IN CNAME TOKYOPBX

60 IN CNAME OSAKAPBX

*Fig. 9*127

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Fig. 10



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