OPIC
OFFICE DE LA PROPRIÉTÉ INTELLECTUELLE DU CANADA

CIPO
CANADIAN INTELLECTUAL PROPERTY OFFICE

(12) (19) (CA) **Demande-Application**

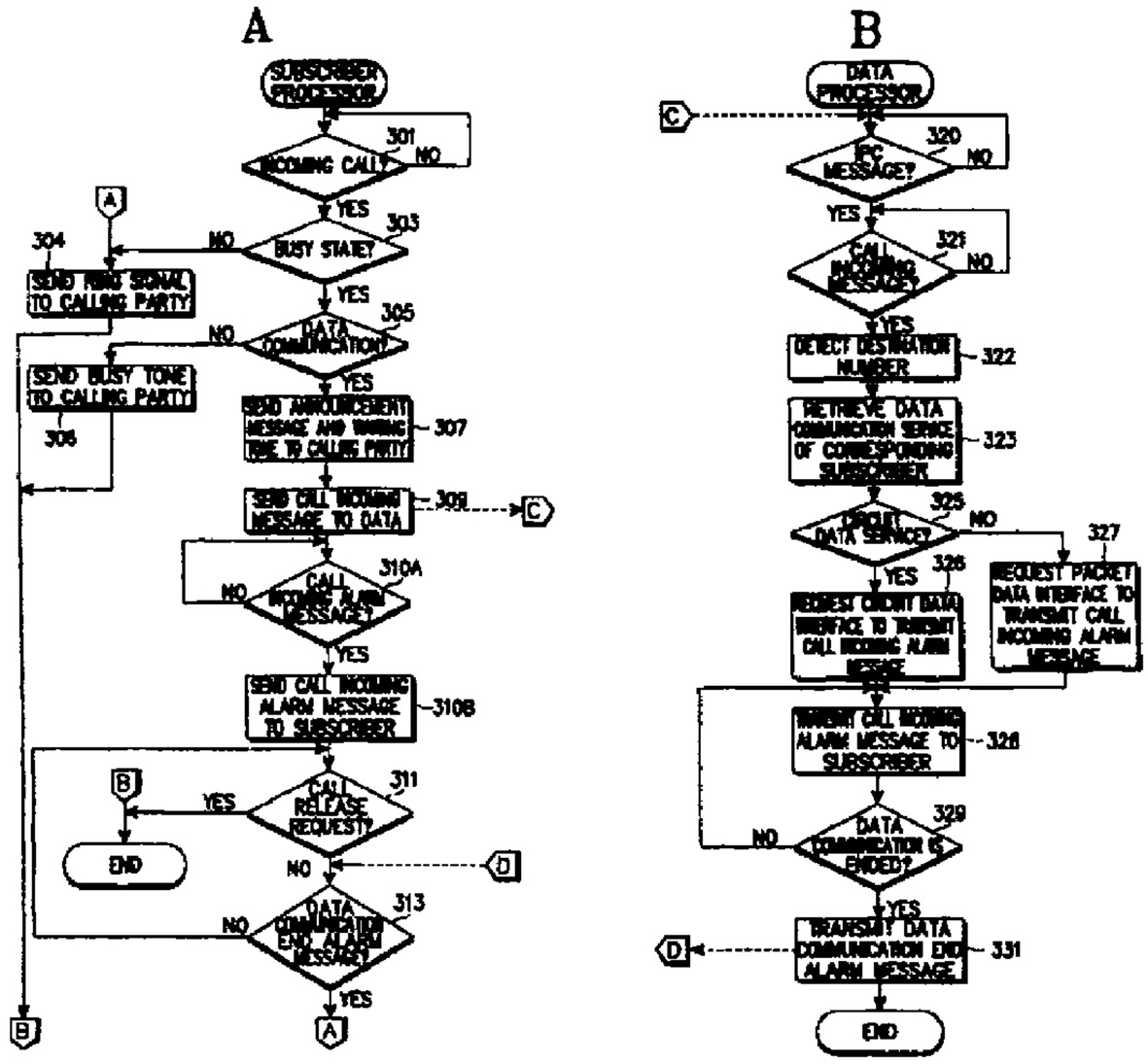
(21) (A1) **2,308,423**
(86) 1999/09/03
(87) 2000/03/16

(72) KIM, NAK-KOO, KR
(71) SAMSUNG ELECTRONICS CO., LTD., KR

(51) Int.Cl.[7] H04M 3/02, H04M 11/06
(30) 1998/09/03 (1998/36247) KR

(54) **DISPOSITIF ET PROCEDE SERVANT A INFORMER UN ABONNE DE L'ARRIVEE D'UN APPEL PENDANT UN SERVICE DE COMMUNICATION DE DONNEES**

(54) **DEVICE AND METHOD FOR INFORMING SUBSCRIBER OF CALL INCOMING DURING DATA COMMUNICATION SERVICE**



(57) Dispositif et procédé servant à informer un abonné communiquant des données de l'arrivée d'un appel dans un centre de commutation d'un système de communication de données. Ce dispositif comprend un sous-système de réseau d'accès à des données servant à fournir un service de communication de données par l'intermédiaire d'une voie affectée en réponse à une demande de service de communication de données et à transmettre un message à l'abonné l'avertissant de l'arrivée d'un appel, cet abonné communiquant des données sur une ligne téléphonique, ce message se présentant sous la forme d'un code de commande de

(57) A device and method for informing a subscriber who is data-communicating of an incoming call in a switching system of a data communication system. The device includes a data access network subsystem for providing a data communication service over a prescribed channel in response to a data communication service request, and transmitting a call incoming alarm message to the subscriber, who is data-communicating through a telephone line, in the form of a data control code upon receipt of a call incoming message for the subscriber; a subscriber access network subsystem for transmitting the call incoming message to the data access network

OPIC
Office de la propriété intellectuelle du Canada

CIPO
Canadian Intellectual Property Office

(21) (A1) **2,308,423**
(86) 1999/09/03
(87) 2000/03/16

données à réception d'un message d'arrivée d'appel pour l'abonné; un sous-système de réseau d'accès à l'abonné servant à transmettre le message d'arrivée d'appel au sous-système de réseau d'accès aux données et à recevoir le message d'avertissement d'arrivée d'un appel afin de transmettre le message reçu d'arrivée d'appel à l'abonné par l'intermédiaire de la ligne téléphonique; un sous-système de réseau de commutation servant à commuter des signaux entre le sous-système de réseau d'accès à des données et le sous-système de réseau d'accès à l'abonné. Ce procédé consiste à transmettre un message d'arrivée d'appel depuis le sous-système de réseau d'accès à l'abonné au sous-système de réseau d'accès aux données par l'intermédiaire du sous-système de réseau de commutation à réception de l'appel d'arrivée pour l'abonné communiquant des données; à transmettre un message d'avertissement de l'arrivée d'un appel depuis le sous-système de réseau d'accès à des données au sous-système de réseau d'accès à l'abonné par l'intermédiaire du sous-système de réseau de commutation; à transmettre à l'abonné le message d'avertissement de l'arrivée d'un appel depuis le sous-système de réseau d'accès à l'abonné par l'intermédiaire d'un trajet de communication de données afin d'informer l'abonné de l'arrivée de l'appel.

subsystem and receiving the call incoming alarm message to transmit the received call incoming message to the subscriber through the telephone line; and a switch network subsystem for switching signals between the data access network subsystem and the subscriber access network subsystem. The method includes the steps of transmitting a call incoming message from the subscriber access network subsystem to the data access network subsystem via the switch network subsystem when the incoming call to the subscriber who is data-communicating is received; transmitting a call incoming alarm message from the data access network subsystem to the subscriber access network subsystem via the switch network subsystem; and transmitting the call incoming alarm message from the subscriber access network subsystem to the subscriber via a data communication path to inform the subscriber of the incoming call.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H04Q — A2

(11) International Publication Number: **WO 00/14974**

(43) International Publication Date: 16 March 2000 (16.03.00)

(21) International Application Number: PCT/KR99/00517

(22) International Filing Date: 3 September 1999 (03.09.99)

(30) Priority Data:
1998/36247 3 September 1998 (03.09.98) KR

(71) Applicant: SAMSUNG ELECTRONICS CO., LTD. [KR/KR]; 416, Maetan–dong, Paldal–gu, Suwon–shi, Kyungki–do 442–370 (KR).

(72) Inventor: KIM, Nak–Koo; Areummaeul Pungrim Apt. #503–802 Imae–dong, Puntang–gu, Songnam–shi, Kyonggi–do 463–060 (KR).

(74) Agent: LEE, Keon–Joo; Mihwa Building, 110–2, Myongryun–dong 4–ga, Chongro–gu, Seoul 110–524 (KR).

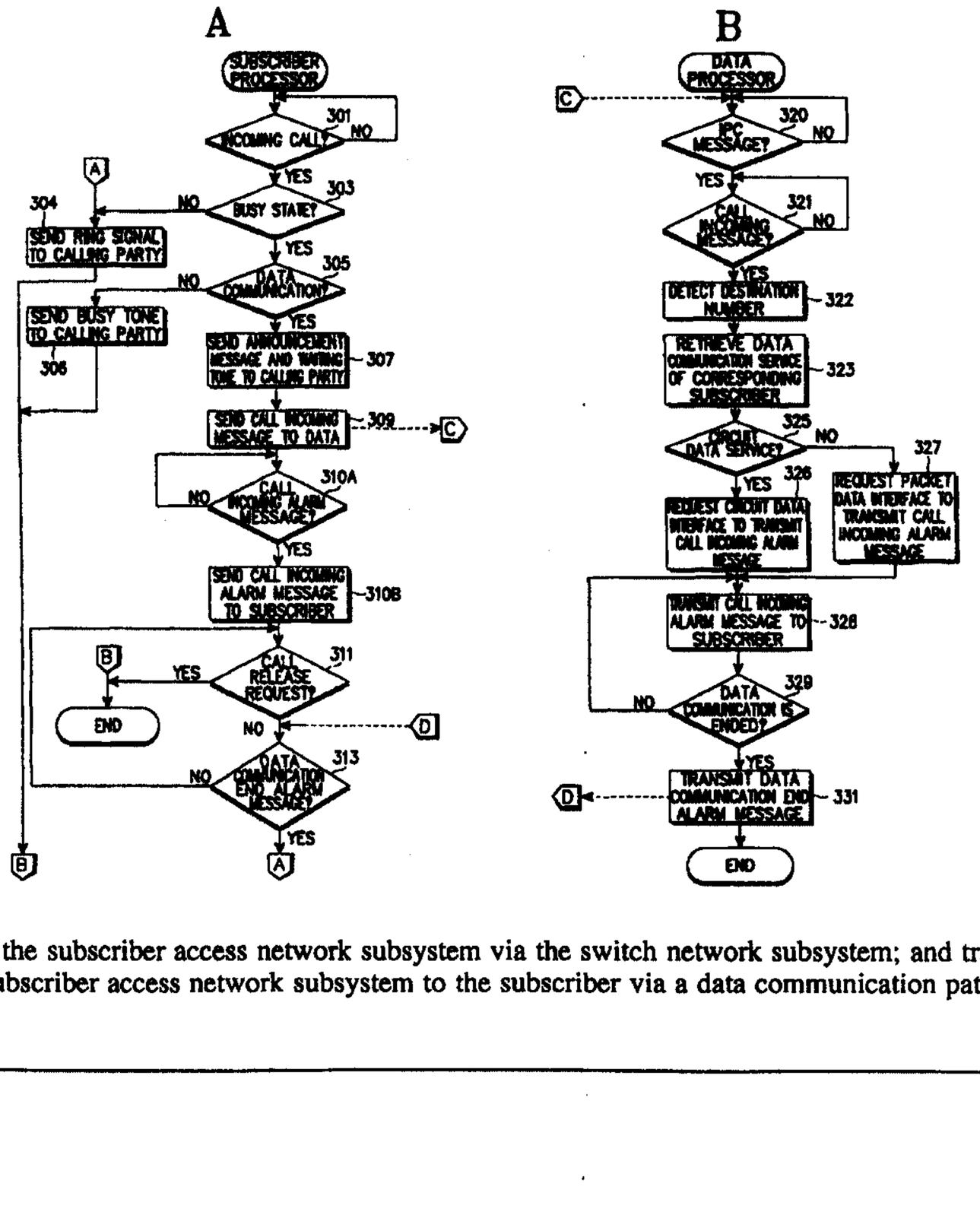
(81) Designated States: AU, BR, CA, CN, RU, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: DEVICE AND METHOD FOR INFORMING SUBSCRIBER OF CALL INCOMING DURING DATA COMMUNICATION SERVICE

(57) Abstract

A device and method for informing a subscriber who is data–communicating of an incoming call in a switching system of a data communication system. The device includes a data access network subsystem for providing a data communication service over a prescribed channel in response to a data communication service request, and transmitting a call incoming alarm message to the subscriber, who is data–communicating through a telephone line, in the form of a data control code upon receipt of a call incoming message for the subscriber; a subscriber access network subsystem for transmitting the call incoming message to the data access network subsystem and receiving the call incoming alarm message to transmit the received call incoming message to the subscriber through the telephone line; and a switch network subsystem for switching signals between the data access network subsystem and the subscriber access network subsystem. The method includes the steps of transmitting a call incoming message from the subscriber access network subsystem to the data access network subsystem via the switch network subsystem when the incoming call to the subscriber who is data–communicating is received; transmitting a call incoming alarm message from the data access network subsystem to the subscriber access network subsystem via the switch network subsystem; and transmitting the call incoming alarm message from the subscriber access network subsystem to the subscriber via a data communication path to inform the subscriber of the incoming call.



DEVICE AND METHOD FOR INFORMING SUBSCRIBER OF CALL INCOMING DURING DATA COMMUNICATION SERVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a device and method for data communication, and in particular, to a device and method for informing a subscriber who is data-communicating through a modem of a personal computer (PC) that there is an incoming call.

2. Description of the Related Art

Typically, a data communication service through a PC is provided by an ANS-D (Access Network Subsystem- Data) through a switching system. While a subscriber is doing data communication including Internet communication through a modem of the PC, he or she cannot receive an incoming call and a calling party continuously hears only a busy tone because the switching system separately operates from the ANS-D.

FIG. 1 illustrates a prior art data communication system for providing a PC communication service.

Referring to FIG. 1, a switching system 100 is connected to a plurality of general subscribers or ISDN (Integrated Services Digital Network) subscribers. The switching system 100 switches a call from, for example, a subscriber 1 to another subscriber connected to the same switching network or to a subscriber connected to another switching system 100-1. If the subscriber 1 dials a data communication service server's number through a modem or ISDN card of a PC, the switching system 100 switches a call to an ANS-D 200. The ANS-D 200 receives a data communication service request to form a call and provides a data communication service to the subscriber 1 through the PC.

The ANS-D 200 for providing such a data communication service includes a trunk interface 201, a circuit data interface 202, a packet data interface 203, an Internet interface 204, and a data processor 205.

The data processor 205 functions as a system main controller and is in charge of service call processing and maintenance. The data processor 205 has one Ethernet port for connecting a CAMA (Centralize Automatic Message) center, a network management center and an operation terminal, and has a VME (Versa Module Europe) bus interface which is used as a control path for service call processing and maintenance.

The trunk interface 201 is connected to an ANS-T (Access Network Subsystem-Trunk, not shown) of the switching system 100 and has a time switch. The trunk interface 201 connects a communication path from the subscriber to either the circuit data interface 202 or the packet data interface through the AND-T and the time switch. The trunk interface 201 has a VME bus interface used as a control path for call processing and maintenance and has a TDM (Time Division Multiplex) bus interface used as a data path for connecting a communication path with a mobile subscriber. The packet data interface 203 processes data for a packet service call, exchanged with a mobile subscriber or ISDN subscriber. The packet data interface 203 has an interface for call processing and maintenance functions and has an interface for connecting a communication path with a mobile subscriber. The circuit data interface 202 including a modem pool processes data for a circuit service call, exchanged with a subscriber and is in charge of facsimile/modem communication. The Internet interface 204 has at least one port for interfacing with an Internet network 300 and is connected to the Internet network 300 via the port to transmit and receive packet data.

If the subscriber 1 requests to provide an Internet service through the PC, the trunk interface 201 of the ANS-D 200 receives the Internet service request through the switching system 100 and switches the circuit data interface 202 or packet data interface 203 according to a demanded data communication service type. The switched data interface (i.e., the circuit data interface 202 or packet data interface

203) requests the Internet interface 204 to be connected to the Internet network 300. The Internet interface 204 connects the circuit data interface 202 or packet data interface 203 to the Internet network 300. The Internet interface 204 further connects the circuit data interface 202 to a server demanded by the subscriber 1 through the Internet network 300, thereby providing the Internet service to the subscriber 1.

While the data communication or Internet communication service is being provided to the subscriber 1, if a subscriber 2 connected to the same switching system 100 or a subscriber 3 connected to another switching system 100-1 telephones the subscriber 1, a busy tone is sent to the subscriber 2 or subscriber 3. That is, since the switching system 100 separately operates from the ANS-D 200, the subscriber 1 cannot receive a call and the subscriber 2 or the subscriber 3 telephoning the subscriber 1 hears only the busy tone.

As describe above, since the switching system and the ANS-D independently operate, voice and data communication services are separately provided. A subscriber cannot receive an incoming call during data and Internet communication services and a calling party continues to hear a busy tone.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a device and method which can simultaneously provide voice and data communication services and can inform a subscriber of an incoming call during a data communication service.

In one aspect of the present invention, a device for informing a subscriber who is data-communicating of an incoming call in a switching system of a data communication system. The device includes a data access network subsystem for providing a data communication service over a prescribed channel in response to a data communication service request, and transmitting a call incoming alarm message to the subscriber, who is data-communicating through a telephone line, in the form of a data control code upon receipt of a call incoming message for the subscriber; a subscriber access network subsystem for transmitting the call incoming message to

the data access network subsystem and receiving the call incoming alarm message to transmit the received call incoming message to the subscriber through the telephone line; and a switch network subsystem for switching signals between the data access network subsystem and the subscriber access network subsystem.

In another aspect of the present invention, there is provided a method for informing a subscriber who is data-communicating of an incoming call in a data communication switching system including a subscriber access network subsystem, a data access network subsystem, and a switch network subsystem interlinking the subscriber access and data access network subsystems. The method includes the steps of transmitting a call incoming message from the subscriber access network subsystem to the data access network subsystem via the switch network subsystem when the incoming call to the subscriber who is data-communicating is received; transmitting a call incoming alarm message from the data access network subsystem to the subscriber access network subsystem via the switch network subsystem; and transmitting the call incoming alarm message from the subscriber access network subsystem to the subscriber via a data communication path to inform the subscriber of the incoming call.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a block diagram illustrating a prior art data communication system for providing a PC communication service;

FIG. 2 is a block diagram illustrating a switching system according to an embodiment of the present invention; and

FIGs. 3A and 3B are flow charts illustrating the process of informing a subscriber of an incoming call during a data communication service according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

Referring to FIG. 2, a switching system 100 according to the present invention includes an ANS-C (Access Network Subsystem-Control) 10, an OMS (Operation and Maintenance Subsystem) 20, a SNS (Switch Network subsystem) 30, an ANS-T (Access Network Subsystem- Trunk) 40, and an ANS-D (Access Network Subsystem- Data) 50.

The ANS-C 10 includes a subscriber circuit 15 connected to a plurality of general subscribers, an ISDN subscriber circuit 16 connected to a plurality of ISDN subscribers, a time switch and local data link (TSL) 17 including two optic link interfaces (OLIs) 18 and 19, and a subscriber processor 12 of an access network processor (ANP) for controlling the overall operation of the ANS-C 10. The ANS-C 10 which is connected to general subscribers and ISDN subscribers receives dial numbers, processes subscriber signals, and carries out a concentration function.

The OMS 20 includes an operation and maintenance processor (OMP) 21 for controlling the overall operation of the OMS 20, a cathode-ray tube (CRT) 22 of a peripheral device, a disk unit (DKU) 23, and a magnetic tape unit (MTU) 24. The OMS 20 communicates with the system, and manages and collects billing statistics.

The SNS 30 includes a plurality of OLIs 32-35, space switches (S-SWs) 36 and 37, a packet link 38 for processing packet data applied to the ISDN subscriber, an interprocessor communication (IPC) link 39 for controlling IPC, and a switch network processor (SNP) 31 for controlling the overall operation of the SNS 30. The IPC through the IPC link 39 is performed by transmitting and receiving an IPC message. A structure of the IPC message is listed below in Table 1.

Table 1

Physical Address	2 bytes	Header
Message Type	1 byte	Header
Message sequence Number	1 byte	Header
Piggyback Number	1 byte	Header
Destination Address	4 bytes	Header
Source Address	4 bytes	Header
Signal Identifier	2 bytes	Header
Signal Priority	1 byte	Header
Message length only	1 byte	Header
Message Content	N bytes	Body
S/W Sumcheck Flag	4 bytes	Tail

The IPC message is divided according to the contents of the message into a message header ranging from a physical address to a message length only, a massage body of a message content, and a tail of a software sumcheck flag. A system message without the message body is used for controlling the system and a general message is provided to general subscribers. According to size, the general message is classified into a short-form message of 78 bytes and a long-form message of 254 bytes.

In Table 1, the physical address indicates a physical address of a processor to be received, the message type indicates an initial signal, and the destination address indicates an address of a processor to be received. The sumcheck flag is assigned to check whether the message has an error. The message content area is actually used by a user program and its size is N(<228) bytes. If there is an incoming call while a subscriber 4 is data-communicating, an initial signal representing a call incoming message is inserted as the message type in the IPC message transmitted from the ANP 12 to a data processor 51. The message content is comprised of a 16-bit destination number (DN).

The ANS-T 40, which is an interoffice repeater connected to another switching system, includes a plurality of digital trunk interfaces (DTIs) 45, a TSL 44 including OLIs 42 and 43, and a trunk processor 41 of an ANP for controlling the

overall operation of the ANS-T 40. The ANS-T 40 is connected to a mobile switching system (not shown) and interfaces signals with mobile terminals and general subscribers or ISDN subscribers.

The SNS 30, ANS-C 10 and ANS-T 40 are connected to each other through respective OLIs.

The ANS-D 50 includes a switch link interface 52, a circuit data interface 55, a packet data interface 56, an Internet interface 56, and a data processor 51.

The switch link interface 52 includes OLIs 53 and 54. The switch link interface 52 interfaces with the SNS 30 through the OLI 53 connected to the OLI 35 and through the OLI 54 connected to the OLI 34, thereby processing a data service call and connecting a communication path. The switch link interface 52 further includes a time switch to switch data received through a link from a mobile subscriber and PSTN subscriber to the circuit data interface 55 or packet data interface 56. The switch link interface 52 has a VME bus interface as a control path for call processing and maintenance and has a TDM bus interface as a data path for connecting the mobile subscriber and PSTN subscriber to the communication path.

The data processor 51 communicates with an upper processor (not shown) within the system and processes all types of service calls within the subsystem.

The circuit data interface 55 processes PPP (Point-to-Point Protocol), IP (Internet Protocol), and TCP (Transfer Communication Protocol) protocols for transmitting data to a terminal, processes modem protocol for communicating with a PSTN subscriber modem, and processes facsimile protocol for communicating with a PSTN subscriber facsimile.

The packet data interface 56 processes a call to connect a packet service call to a mobile terminal over a data transmission channel. The packet data interface 56 monitors the state of a packet processing device and manages statistics and errors.

The Internet interface 57 processes a call to connect a packet service call with Internet. The Internet interface 57 serves as a PPP server for PPP connection with the terminal, monitors the state of an Ethernet port, and manages statistics and errors.

In the procedure of the switching system for connecting a call with Internet, which is described below, a general subscriber and a general wire telephone are interchangeably used with the same reference numeral.

If it is desired that a general subscriber 4 connects data communication or Internet through a PC, he or she dials a dial number providing data communication or Internet service by using a communication emulator within the PC. The PC then transmits the dial number to the switching system 100 through a modem. The switching system 100 analyzes the dial number and handshakes with a modem pool of the circuit data interface 55 via the subscriber circuit 15, OLI 18 of TSL 17, OLI 32 of the SNS 30, S-SW 36, OLI 35, and switch link interface of the ANS-D 50.

Thereafter, the modem pool of the circuit data interface 55 sends the data processor 51 information (for instance, communication bit rate, error correction and compression) communicating with the PC and sends the PC an initial screen. Then the subscriber 4 can see a menu screen through the PC. If the subscriber 4 selects Internet on the menu screen, this select information is transmitted to the Internet interface 57 via the circuit data interface 55. The Internet interface 57 then communicates with the emulator within the PC through the PPP and assigns an IP address to the PC. The PC receives the IP address and drives a web browser. If the subscriber selects a desired site after the web browser is driven, the Internet interface 57 connects the site through the Internet network 300 and provides an Internet service through the TCP between the subscriber and the site.

While data communication or Internet is provided to the subscriber, if an incoming call is received from another subscriber connected to the ANS-T 40 or to the same switching system 100, the subscriber processor 12 of the ANS-C 10 and the data processor 51 of the ANS-D 50 execute the operation illustrated in FIGs. 3A and 3B.

Referring to FIGs. 3A and 3B, the subscriber processor 12 determines at step 301 if an incoming call is detected from another subscriber (i.e., calling party) through the subscriber circuit 15, ISDN subscriber circuit 16 or ANS-T 40. If an incoming call from the calling party to the general subscriber 4 is detected, the subscriber processor 12 determines if the general subscriber 4 is in a busy state at step 303. If not, a ring signal is sent to the general subscriber 4. If the general subscriber 4 is in a busy state, the subscriber processor 12 checks whether the subscriber 4 is data-communicating at step 305 by examining information about the subscriber 4. If the subscriber 4 is not data-communicating, the subscriber processor 12 sends a busy tone to the calling party at step 306. If the subscriber 4 is data-communicating, the subscriber processor 12 sends, at step 307, an announcement message and a waiting tone to the calling party. Then the calling party should wait until the general subscriber 4 completes data communication.

The subscriber processor 12 transmits, at step 309, a call incoming message to the data processor 51 via the OLI 19 of the TSL 17, the OLI 33 of the SNS 30, the IPC link 39, the OLI 34, and the OLI 54 of the ANS-D 50. The call incoming message indicates the IPC message shown in Table 1. The subscriber processor 12 checks whether a call incoming alarm message is received from the ANS-D 50 at step 310A. Upon receiving the call incoming alarm message, the subscriber processor 12 transmits it to the subscriber 4 at step 310B. Then the PC connected to the subscriber 4 displays on the monitor the call incoming alarm message, for instance, "YOU ARE WANTED ON THE PHONE. END COMMUNICATION, PLEASE." The subscriber processor 12 checks whether the calling party requests to release a call at step 311. If so, the subscriber processor 12 terminates a series of steps. If no call release request is detected, the subscriber processor 12 checks whether a data communication end alarm message is received at step 313.

The data processor 51 determines if an IPC message is received from the subscriber processor 12 at step 320. Upon receiving the IPC message, the data processor 51 checks whether the IPC message indicates a call incoming message by examining a message type at step 321. If the type of the IPC message is a call incoming message, the data processor 51 detects a destination number from the message content of the IPC message at step 322. Upon detecting the destination

number, the data processor 51 checks what kind of data communication service is provided to the subscriber 4 having the detected destination number at step 323. The data processor 51 determines if the data communication service is a circuit data service at step 325. If so, the data processor 51 requests the circuit data interface 55 to transmit the call incoming alarm message at step 326. If the data communication service is not a circuit data service, the data processor 51 requests the packet data interface 56 to transmit the call incoming alarm message at step 327. The circuit data interface 55 transmits at step 328 the call incoming alarm message to the subscriber 4 via the OLI 53 of the switch link interface 52, the OLI 35 of the SNS 30, the S-SW 36, the OLI 32, the OLI 18 of the TSL 17, and the subscriber circuit 15. The packet data interface 56 transmits at step 328 the call incoming alarm message to the subscriber 4 via the OLI 54 of the switch link interface 52, the OLI 35 of the SNS 30, the packet link 38, the OLI 33, the OLI 19 of the TSL 17, and the subscriber circuit 15.

If the incoming call alarm message is transmitted, the data processor 51 checks whether the subscriber 4 completes data communication at step 329. If the subscriber 4 does not complete data communication, the data processor 51 requests the circuit data interface 55 or the packet data interface 56 to transmit the call incoming alarm message until the calling party releases a call request. However, if the subscriber 4 completes data communication, the data processor 51 transmits the data communication end alarm message to the subscriber processor 12 at step 331. Upon receiving the data communication end alarm message, the subscriber processor 12 sends a ring signal to the calling party at step 304. Upon answering the phone, the subscriber 4 communicates with the calling party.

As described previously, since the ANS-D is incorporated in the switching system, both a data communication service and a voice service can be provided. Furthermore, since the subscriber can sense that there is an incoming call while he or she is data-communicating, the subscriber can answer the phone and the calling party will not hear a busy tone.

While the invention has been shown and described with reference to a certain preferred embodiment thereof, it will be understood by those skilled in the art that

various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

CLAIMS:

1. A device for informing a subscriber who is data-communicating of an incoming call in a switching system of a data communication system, said device comprising:

a data access network subsystem for providing a data communication service over a prescribed channel in response to a data communication service request, and transmitting a call incoming alarm message to the subscriber, who is data-communicating through a telephone line, in the form of a data control code upon receipt of a call incoming message for the subscriber;

a subscriber access network subsystem for transmitting the call incoming message to the data access network subsystem and receiving the call incoming alarm message to transmit the received call incoming message to the subscriber through the telephone line; and

a switch network subsystem for switching signals between the data access network subsystem and the subscriber access network subsystem.

2. The device as claimed in claim 1, wherein the switch network subsystem has an interprocessor communication link and a packet link for data communication between the access network subsystem and the subscriber.

3. The device as claimed in claim 2, wherein the call incoming message is transmitted to the data access network subsystem through the interprocessor communication link.

4. The device as claimed in claim 1, wherein the data access network subsystem includes:

a circuit data interface for providing a circuit data service in response to the data communication service request, and generating the call incoming alarm message upon receipt of the call incoming message during the circuit data service;

a packet data interface for providing a packet data service in response to the data communication service request, and generating the call incoming alarm message upon receipt of the call incoming message during the packet data service;

a switch link interface for determining a channel type of the data

communication service in response to the data communication service request, and forming a link with either the circuit data interface or the packet data interface;

an Internet interface for forming a link with an Internet network in response to an Internet network connection request from the circuit data interface or the packet data interface; and

a data processor for controlling the switch link interface, circuit data interface, packet data interface, and Internet interface.

5. The device as claimed in claim 1, wherein the subscriber access network subsystem includes:

a general subscriber circuit connected to a plurality of general subscribers;

an ISDN (Integrated Services Digital Network) subscriber circuit connected to a plurality of ISDN subscribers;

a time-division switching circuit for switching signals exchanged with the switch network subsystem to the general subscriber circuit or the ISDN subscriber circuit; and

a subscriber processor for storing data communication information for the subscriber who is data-communicating, transmitting the call incoming message to the data access network subsystem upon occurrence of the incoming call to the subscriber who is data-communicating, and receiving the call incoming alarm message through the time-division switching circuit to transmit the received message to the subscriber through the general subscriber circuit or the ISDN subscriber circuit.

6. A method for informing a subscriber who is data-communicating of an incoming call in a data communication switching system including a subscriber access network subsystem, a data access network subsystem, and a switch network subsystem interlinking the subscriber access and data access network subsystems, said method comprising the steps of:

(a) transmitting a call incoming message from the subscriber access network subsystem to the data access network subsystem via the switch network subsystem when the incoming call to the subscriber who is data-communicating is received;

(b) transmitting a call incoming alarm message from the data access network subsystem to the subscriber access network subsystem via the switch network

subsystem; and

(c) transmitting the call incoming alarm message from the subscriber access network subsystem to the subscriber via a data communication path to inform the subscriber of the incoming call.

7. The method as claimed in claim 6, wherein step (a) includes the steps of:

checking whether the subscriber is in a busy state upon detection of the incoming call;

sending a ring signal to a calling party if the subscriber is not in a busy state, and checking whether the subscriber is data-communicating if the subscriber is in a busy state; and

sending a busy tone to the calling party if the subscriber is not data-communicating, and informing the data access network subsystem of the incoming call to the subscriber.

8. The method as claimed in claim 6, wherein step (b) includes the steps of:

detecting a destination number upon receiving the call incoming message from the subscriber access network subsystem;

retrieving a data communication service type of a subscriber corresponding to the destination number; and

transmitting the call incoming alarm message to the subscriber access subsystem over a channel corresponding to the retrieved data communication service type.

9. The method as claimed in claim 8, further comprising the step of transmitting a data communication end alarm message to the subscriber access network subsystem if the subscriber ends data communication after the call incoming alarm message has been transmitted.

10. The method as claimed in claim 9, further comprising the steps of: transmitting a waiting announcement message to the calling party if the subscriber is data-communicating; and

establishing a call with the calling party by sending a ring signal to the calling party upon receiving the data communication end alarm message after the waiting

announcement message has been transmitted.

11. The method as claimed in claim 10, wherein the waiting announcement message is a waiting tone signal.

FIG. 1

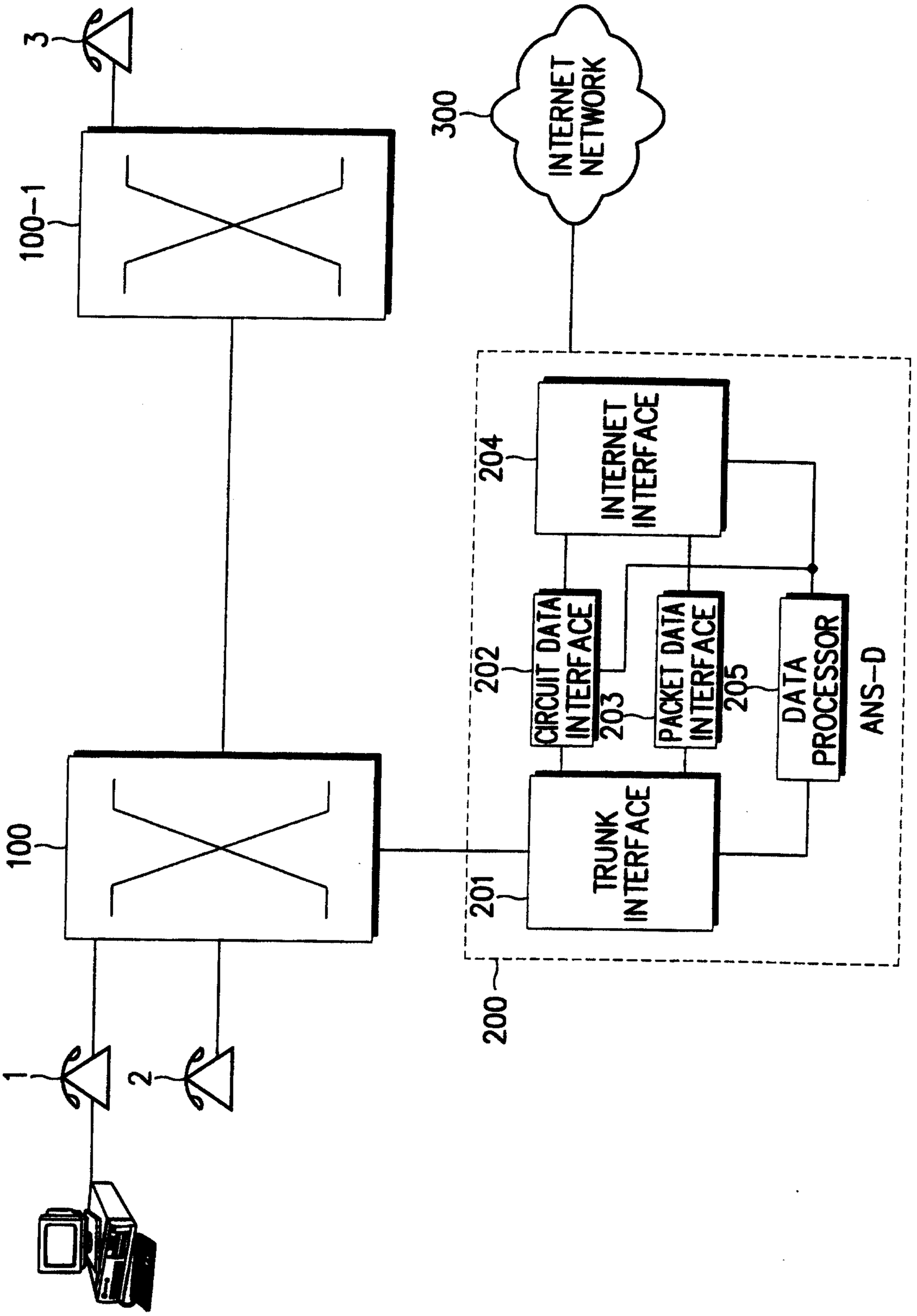
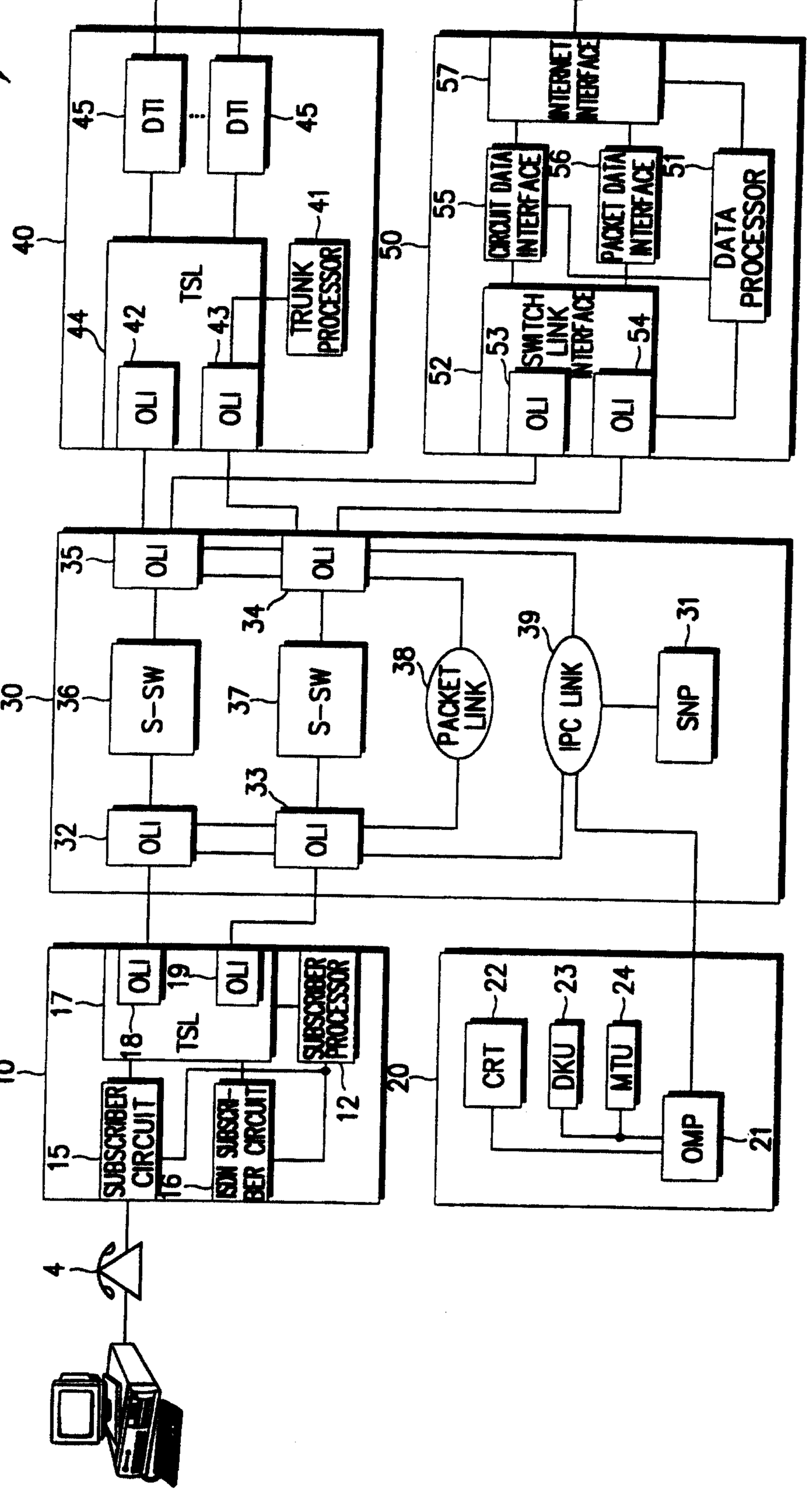

3
4
100-1
300
INTERNET NETWORK
204
INTERNET INTERFACE
202
CIRCUIT DATA INTERFACE
203
PACKET DATA INTERFACE
205
DATA PROCESSOR
ANS-D
100
201
TRUNK INTERFACE
200
1
2

FIG. 2


100
300
INTERNET NETWORK
40
45
DTI
45
41
TRUNK PROCESSOR
44
42
OLI
TSL
43
OLI
50
57
INTERNET INTERFACE
55
CIRCUIT DATA INTERFACE
56
PACKET DATA INTERFACE
51
DATA PROCESSOR
52
53
SWITCH LINK INTERFACE
OLI
54
OLI
35
OLI
34
OLI
30
36
S-SW
37
S-SW
38
PACKET LINK
39
IPC LINK
31
SNP
32
OLI
33
OLI
10
17
OLI
19
OLI
18
TSL
SUBSCRIBER PROCESSOR
12
15
SUBSCRIBER CIRCUIT
16
SUBSCRIBER CIRCUIT
20
22
CRT
23
DKU
24
MTU
OMP
21
4

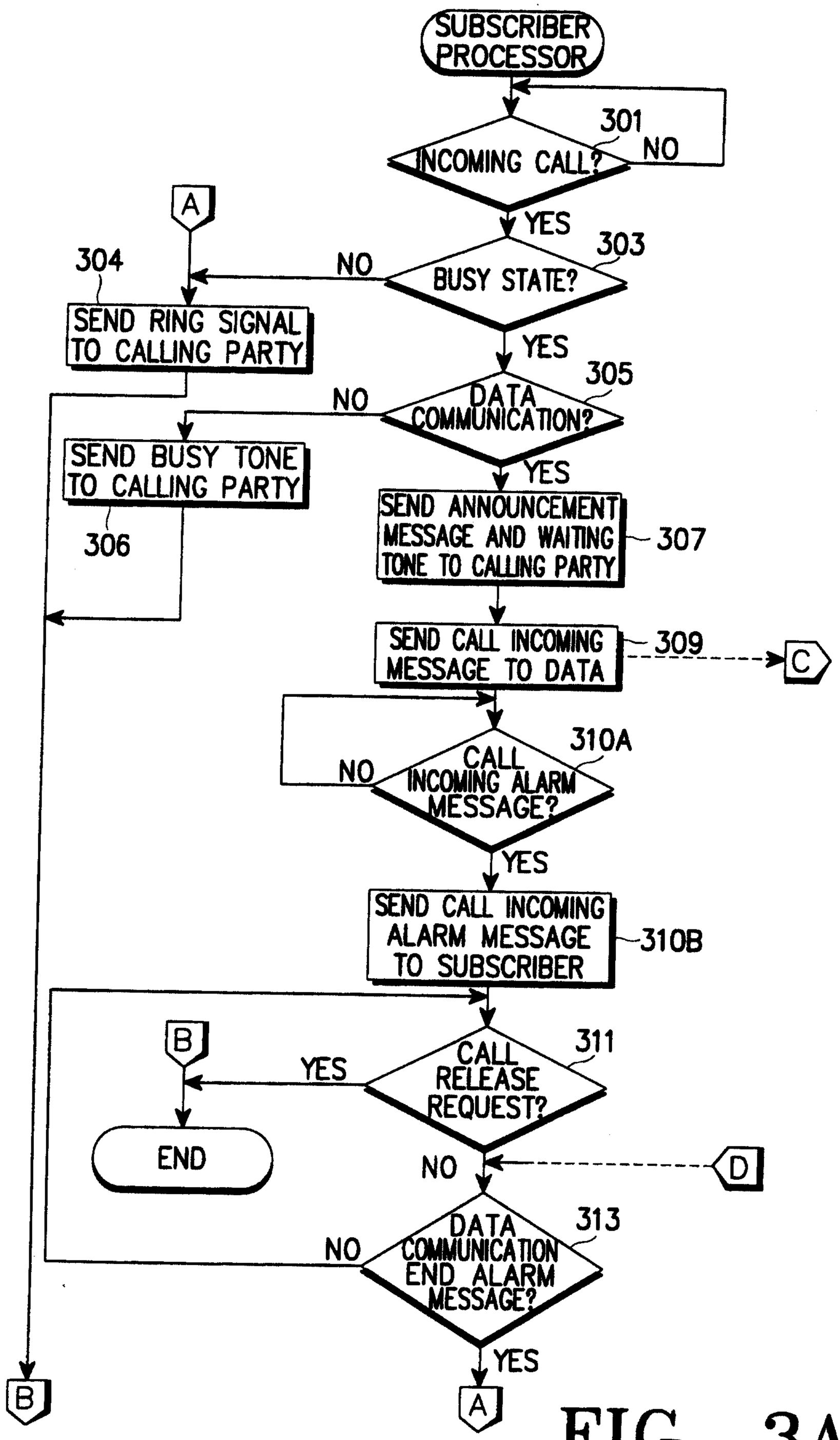

SUBSCRIBER PROCESSOR
301
INCOMING CALL?
NO
YES
303
BUSY STATE?
NO
YES
304
SEND RING SIGNAL TO CALLING PARTY
305
DATA COMMUNICATION?
NO
YES
SEND BUSY TONE TO CALLING PARTY
306
SEND ANNOUNCEMENT MESSAGE AND WAITING TONE TO CALLING PARTY
307
SEND CALL INCOMING MESSAGE TO DATA
309
310A
CALL INCOMING ALARM MESSAGE?
NO
YES
SEND CALL INCOMING ALARM MESSAGE TO SUBSCRIBER
310B
311
CALL RELEASE REQUEST?
YES
NO
END
313
DATA COMMUNICATION END ALARM MESSAGE?
NO
YES
A
B
C
D

FIG. 3A

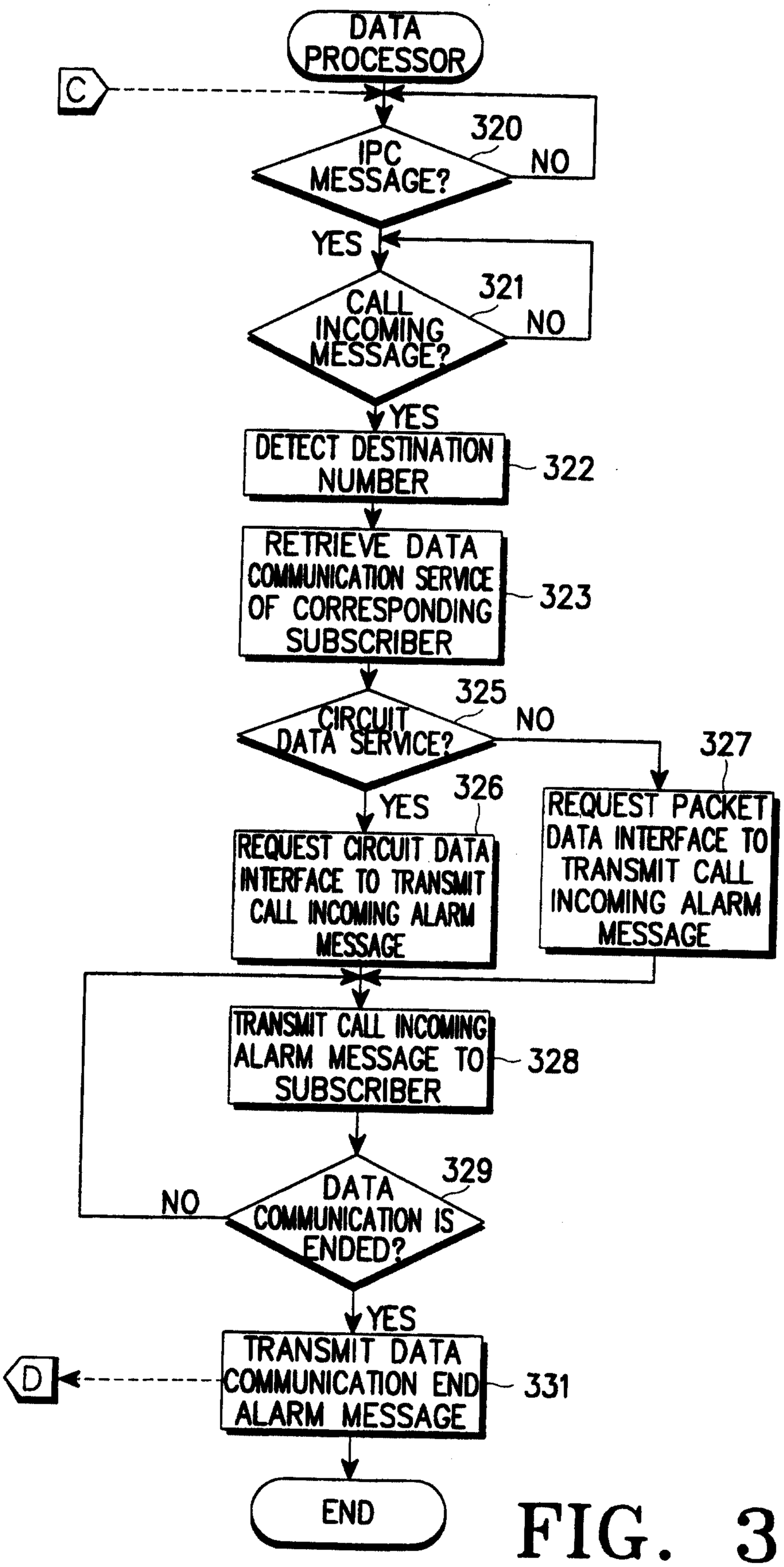

DATA PROCESSOR
C
320
IPC MESSAGE?
NO
YES
321
CALL INCOMING MESSAGE?
NO
YES
DETECT DESTINATION NUMBER
322
RETRIEVE DATA COMMUNICATION SERVICE OF CORRESPONDING SUBSCRIBER
323
325
CIRCUIT DATA SERVICE?
NO
327
YES
326
REQUEST CIRCUIT DATA INTERFACE TO TRANSMIT CALL INCOMING ALARM MESSAGE
REQUEST PACKET DATA INTERFACE TO TRANSMIT CALL INCOMING ALARM MESSAGE
TRANSMIT CALL INCOMING ALARM MESSAGE TO SUBSCRIBER
328
329
DATA COMMUNICATION IS ENDED?
NO
YES
D
TRANSMIT DATA COMMUNICATION END ALARM MESSAGE
331
END

FIG. 3B