

Australia

Australian Patent  
Application No. 23465/95

Patents Act 1990

## NOTICE OF ENTITLEMENT

We, Aarre Kilpinen and Aarni Kajaste

of Nokia Telecommunications Oy  
Mäkkylän puistotie 1  
of FIN-02600 Espoo  
Finland

being authorised by the Applicant(s)/Nominated Person(s) in respect of an application entitled:

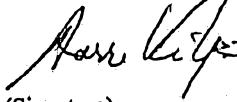
Call Forwarding Method and Arrangement for a Mobile Terminating Call

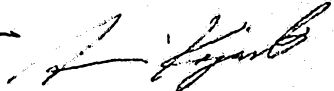
state the following:-

1. The Applicant(s)/Nominated Person(s) has/have, for the following reasons, gained entitlement from the actual inventor(s):-  
The Applicant/Nominated Person, by virtue of a Contract between the actual inventor(s) as employee(s) and the Applicant/Nominated Person as employer, is a person which would be entitled to have the patent assigned to it if a patent were granted on an application made by the actual inventor(s)
- 2a.\* The Applicant(s)/Nominated Person(s) is/are the applicant(s) of the of the basic application(s) listed\* on the Patent Request/ \*in the Declaration under Article 8 of the PCT.
- ~~2b.\* The Applicant(s)/Nominated Person(s) is/are entitled to rely on the basic application(s) listed\* on the Patent Request/ \*in the Declaration under Article 8 of the PCT as follows:-~~
- 3.\* The basic application(s) listed \*on the Patent Request/ \*in the Declaration under Article 8 of the PCT is/are the application(s) first made in a Convention Country in respect of the invention.
- ~~4a.\* The Applicant(s)/Nominated Person(s) is/are the depositor(s) of the deposit(s) listed in the Schedule hereto.~~
- ~~4b.\* The Applicant(s)/Nominated Person(s) has/have the consent of \_\_\_\_\_, of~~

~~the depositor(s) of the deposit(s) listed in the Schedule hereto, to rely on that/those deposit(s).~~

DATED this 12 day of December 19 95  
Nokia Telecommunications Oy

  
(Signature)  
Aarre Kilpinen  
Patent Coordinator  
(Name & Title)

  
Aarni Kajaste  
Patent Coordinator

\* Delete if not applicable.

INSTR CODE:

23 July 1991



AU9523465

(12) PATENT ABRIDGMENT (11) Document No. AU-B-23465/95  
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 683163

- (54) Title  
CALL FORWARDING METHOD AND ARRANGEMENT FOR A MOBILE TERMINATING CALL
- International Patent Classification(s)  
(51)<sup>6</sup> H04Q 007/22 H04M 003/54
- (21) Application No. : 23465/95 (22) Application Date : 02.05.95
- (87) PCT Publication Number : WO95/31076
- (30) Priority Data
- (31) Number (32) Date (33) Country  
942053 04.05.94 FI FINLAND
- (43) Publication Date : 29.11.95
- (44) Publication Date of Accepted Application : 30.10.97
- (71) Applicant(s)  
NOKIA TELECOMMUNICATIONS OY
- (72) Inventor(s)  
KEIJO PALVIAINEN
- (74) Attorney or Agent  
SPRUSON & FERGUSON, GPO Box 3898, SYDNEY NSW 2001
- (56) Prior Art Documents  
WO 9405124  
US 5168517  
GB 2244409
- (57) Claim

1. A call forwarding method for a mobile terminating call, comprising the steps of  
receiving a call;  
checking whether call forwarding is activated for the called subscriber;  
starting the activated call forwarding, with which is possibly associated an intermediate announcement to the calling subscriber,  
c h a r a c t e r i z e d by  
checking in case of call forwarding whether the type of the call is a speech or data call,  
preventing the intermediate announcement in case of a data call, and  
allowing the intermediate announcement in case of a speech call.

8. An arrangement for carrying out call forwarding in a mobile communication system comprising mobile stations (MS), mobile exchanges (MSC, GMSC) and subscriber databases (VLR, HLR) for maintaining user

(11) AU-B-23465/95  
(10) 683163

-2-

data, such as location data and activated services, in which arrangement a mobile exchange (MSC, GMSC) is provided with means (82, 84) for making intermediate announcements to the calling subscriber in connection with carrying out activated call forwarding, characterized in that the mobile exchange (MSC, GMSC) is arranged to check in case of call forwarding whether the type of the mobile terminating call is a data call or speech call, and to prevent intermediate announcements in case of data calls and to allow intermediate announcements in case of speech calls.

PCT

ANNOUNCEMENT OF THE LATER PUBLICATION OF INTERNATIONAL SEARCH REPORTS



23465/95

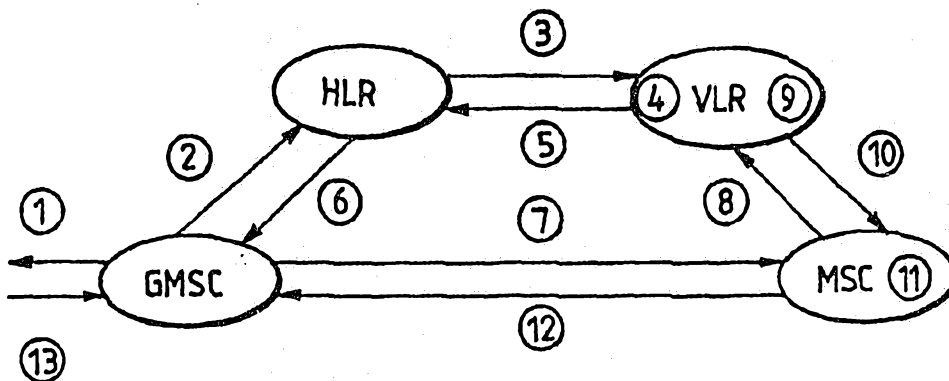
INTERNATIONAL AP

ION TREATY (PCT)

<p>(51) International Patent Classification 6 : H04Q 7/22, H04M 3/54</p>	<p>A3</p>	<p>(11) International Publication Number: <b>WO 95/31076</b> (43) International Publication Date: 16 November 1995 (16.11.95)</p>
<p>(21) International Application Number: PCT/FI95/00236 (22) International Filing Date: 2 May 1995 (02.05.95) (30) Priority Data: 942053 4 May 1994 (04.05.94) FI (71) Applicant (for all designated States except US): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Mäkkylän puistotie 1, FIN-02600 Espoo (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): PALVIAINEN, Keijo [FI/FI]; Halmetie 6 A 2, FIN-00700 Helsinki (FI). (74) Agent: OY KOLSTER AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).</p>	<p>(81) Designated States: AU, CN, DE, GB, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). <b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 21 December 1995 (21.12.95)</p>	

683163

(54) Title: CALL FORWARDING METHOD AND ARRANGEMENT FOR A MOBILE TERMINATING CALL



(57) Abstract

The present invention relates to a call forwarding method and arrangement for a mobile terminating call. Taped intermediate announcements are often made during call forwarding. These intermediate announcements cause a delay in the call set-up, the delay possibly causing the time-out of the calling modem or telefax terminal and thus the failure of the call. In the invention, information concerning the type of the call is transmitted to the mobile exchange (MSC) handling the call as included, for instance, in a message (10) where the subscriber database (VLR) notifies the carrying out of call forwarding and provides a call forwarding number. The mobile exchange (MSC) implementing the call forwarding checks (11) the type data of the call and omits possible intermediate announcements (12) associated with the call forwarding in case of a data call and allows intermediate announcements (12) in case of speech calls.

Call forwarding method and arrangement for a mobile terminating call

#### Field of the Invention

5           The present invention relates to a call forwarding method for a mobile terminating call, comprising the steps of receiving a call; checking whether call forwarding is activated for the called subscriber; starting the activated call forwarding, with  
10           which is possibly associated an intermediate announcement to the calling subscriber.

#### Background of the Invention

          Present-day mobile communication systems offer subscribers different data transmission features in  
15           addition to the conventional speech transmission. The data services of mobile communication systems can generally be divided into teleservices and bearer services. A bearer service is a telecommunication service, which provides signal transmission between user  
20           and network interfaces. For instance, modem services are bearer services whereas a telephone service and telefax service are teleservices. Data services are typically circuit-switched, which means that when using some  
25           services, a subscriber makes a call, during which data transmission takes place in the same manner as speech transmission during a speech call. However, mobile communication systems are not designed to take into  
30           account in all situations whether a circuit-switched connection is used for speech or data transmission but they handle different types of calls in the same manner, which causes problems in some situations.

          One subscriber facility of the present-day mobile communication systems is call forwarding, which a subscriber can activate. Call forwarding may be  
35           unconditional call forwarding, a call being thus always

forwarded to a given new number. Call forwarding can also be arranged to take place conditionally, for instance when the subscriber is busy, the subscriber does not answer or the subscriber is not reached.

5           Another aspect of the present-day mobile communication systems is that a mobile exchange can switch audio-format information to a subscriber during different phases of a call. Audio information can be divided into announcements and audible tones. An  
10 announcement is a recorded or synthesized speech message. An announcement may be chargeable or charge-free to the calling subscriber. An announcement can also be switched to the calling subscriber during call set-up, in which case a so-called intermediate announcement  
15 is in question. For instance in connection with call forwarding, the calling subscriber is informed of the forwarding of the call with a special intermediate announcement. Mobile communication network operators want to make this type of chargeable intermediate  
20 announcements of call forwardings, because otherwise the functions of a network would be used free of charge in this type of situation in cases where neither the calling subscriber nor the subscriber of the call forwarding number are in the operator's network.

25           Intermediate announcements of this type are problematic in connection with data calls. Both a modem and a telefax modem wait for an answer signal under time-out control. The time-out of a telefax modem is 30-40s, and the time-out of a modem is not defined in  
30 standards. The intermediate announcements made in connection with call forwarding may cause call set-up time to be prolonged to exceed the determined time limits, as a result of which the calling data modem or telefax modem assumes that the call attempt has failed  
35 and disconnects the call. As regards data calls, all

long intermediate announcements are problematic, especially in connection with call forwarding on no reply. In addition, modems and telefax terminals can in no manner utilize the announcements, subscribers thus  
5 having to pay for unnecessary announcements. The same applies to all other data terminal equipments. The most unfortunate situation is where a subscriber is charged for a chargeable intermediate announcement, but the call set-up fails due to a delay caused by the intermediate  
10 announcement.

Thus, a need exists for preventing intermediate announcements to be made in connection with data calls. In the present-day mobile communication systems, this need has in no manner been taken into account, and the  
15 exchanges making intermediate announcements, for instance transit exchanges or terminal exchanges, do not at present even know the type of a mobile terminating call in connection with call forwarding, and they do not have any facilities for checking the type of call and  
20 for preventing intermediate announcements in connection with data calls.

#### Summary of the Invention

The object of the present invention is to prevent the failure of the call set-up of data calls due  
25 to intermediate announcements made during call forwarding and to prevent unnecessary intermediate announcements.

This is achieved with the method described in the introduction, characterized according to the  
30 invention by checking in case of call forwarding whether the type of the call is a speech or data call, preventing the intermediate announcement in case of a data call and allowing the intermediate announcement in case of a speech call.

5 The invention also relates to an arrangement  
for carrying out call forwarding in a mobile  
communication system comprising mobile stations, mobile  
exchanges and subscriber databases for maintaining user  
10 data, such as location data and activated services, in  
which arrangement a mobile exchange is provided with  
means for making intermediate announcements to the  
calling subscriber in connection with carrying out  
activated call forwarding. The arrangement is  
15 characterized according to the invention in that the  
mobile exchange is arranged to check in case of call  
forwarding whether the type of the mobile terminating  
call is a data call or speech call, and to prevent  
intermediate announcements in case of data calls and to  
20 allow intermediate announcements in case of speech  
calls.

The mobile exchange handling a call is informed  
of the call forwarding activated for the called  
subscriber by some subscriber database of the network,  
25 this database usually also knowing the type of the call.  
Alternatively, this information can arrive with a call  
to be routed from a fixed network. In the preferred  
embodiment of the invention, information concerning the  
type of the call is transmitted to the mobile exchange  
30 as included for instance in a message where the  
subscriber database notifies the carrying out of call  
forwarding and gives a number to which the forwarding  
is to be performed. The mobile exchange implementing the  
call forwarding checks the type data of the call and  
omits possible intermediate announcements relating to  
the call forwarding in connection with a data call and  
allows intermediate announcements in connection with  
speech calls. The mobile exchange implementing the call  
forwarding may be a transit exchange routing the call



or a terminating exchange serving the mobile station, to which exchange the call is routed.

According to an embodiment of the invention, the call forwarding method in connection with a terminating exchange comprises the steps of receiving a call in a first exchange; performing a routing information interrogation to a first database indicated by the directory number of the called subscriber; performing a roaming number interrogation from the first database to a second database, within the area of which the called subscriber is located; transmitting the allocated roaming number from the second database to the first database and further to the first exchange; routing the call on the basis of the roaming number from the first exchange to a second exchange, which serves the area of said second database; observing at the second exchange that the called subscriber is busy, not reachable or does not answer; checking in the second database whether call forwarding is activated for the subscriber; initiating the activated call forwarding; checking on the basis of the information obtained from the second database or in a call set-up message whether the call is a speech call or a data call; preventing an intermediate announcement possibly associated with the call forwarding in case of a data call, and; allowing an intermediate announcement possibly associated with the call forwarding in case of a speech call.

According to a second embodiment of the invention, the call forwarding method in connection with a transit exchange comprises the steps of receiving a call in a first exchange; performing a routing information interrogation to a first database indicated by the directory number of the called subscriber; observing in the first database that call forwarding is activated for the called subscriber; starting the call

forwarding; checking on the basis of the information obtained from the first database or in a call set-up message whether the call is a speech call or a data call; preventing an intermediate announcement possibly associated with the call forwarding in case of a data call, and; allowing an intermediate announcement possibly associated with the call forwarding in case of a speech call.

#### Brief Description of the Figures

The invention will be described in more detail by means of the preferred embodiments with reference to the accompanying drawings, in which

Figure 1 shows a part of a mobile communication system,

Figure 2 is a block diagram illustrating the hardware configuration of the GSM system for telefax transmission,

Figure 3 is a block diagram illustrating the hardware configuration of the GSM system for data transmission,

Figure 4 illustrates a successful call set-up in the GSM system,

Figure 5 illustrates a call set-up, with which is connected call forwarding, in the GSM system,

Figure 6 is a block diagram illustrating a mobile exchange operating according to the invention,

Figure 7 illustrates another call set-up, with which is connected call forwarding, in the GSM system, and

Figure 8 is a flow diagram for describing the inventive operation of the mobile exchange.

#### Preferred Embodiments of the Invention

The present invention can be used in mobile communication systems in which circuit-switched data and speech calls can be established. The invention can be

used particularly advantageously in the pan-European digital mobile communication system GSM (Global System for Mobile Communications) and in subsequent mobile communications systems of the same type, such as DCS1800 (Digital Communication System) and PCN (Personal Communication Network). In the following, the preferred embodiment of the invention will be described as implemented in the GSM system, without restricting the invention to it, however.

In Figure 1, the basic elements of the GSM system will be described very briefly, without further treatment of their characteristics or the other areas of the system. As to the more detailed description of the GSM system, the GSM recommendations and the book "The GSM system for Mobile Communications", M. Mouly & M. Pautet, Palaiseau, France, 1992, ISBN:2-9507190-0-7, are referred to.

A mobile exchange MSC handles the switching of inbound and outbound calls. It performs tasks of a similar type as an exchange in a public switched telephone network (PSTN). In addition to these tasks, it also performs functions characteristic of mobile call traffic only, such as subscriber location management, in co-operation with the subscriber registers of the network. The GSM system comprises home location registers HLR and visitor location registers VLR as subscriber registers. Mobile stations MS connect with the mobile exchange MSC by means of base station systems. A base station system BSS consists of base station controllers BSC and base stations BTS. One base station controller BSC is used for controlling several base stations BTS. For the sake of clarity, Figure 1 shows only one base station system, in which six base stations BTS1 - BTS6 connect with the base station controller BSC.

A signal in the GSM system consists of TDMA frames transmitted in succession, each of which contains eight TDMA time slots, which are used as logical channels. Information is transferred as radio-frequency bursts transmitted in the time slots. The logical channels include traffic channels for the calls (speech or data) set up with the mobile radio stations MS located in a cell, and control channels for the signalling carried out with the mobile radio stations MS located in a cell. A speech connection or a data connection can be established on the traffic channels. Typically, a separate connection adapter is required at both ends of a data connection for adapting the data connection to terminal equipments and/or other transmission connections/transmission systems. The connection adapter connected with a terminal equipment is usually referred to as a terminal adapter, and the common adapter located at the network end is referred to as a network adapter.

The hardware configuration for a telefax connection according to the GSM recommendations is illustrated in Figure 2. A telefax terminal is connected by a normal two-wire modem connection to a special telefax adapter 2, by which the signals of the telefax terminal are adapted to a data connection, which is established via a radio connection between a mobile station MS and the base station system BSS to the mobile exchange MSC and a network adapter IWF located therein, this network adapter containing a second telefax adapter 8A. This second telefax adapter 8A adapts the above-mentioned data connection to a normal two-wire modem connection for instance via a public switched telephone network PSTN 9 to another telefax terminal B.

Figure 3 illustrates the hardware configuration according to the GSM recommendations for data

transmission carried out by means of modems. A radio terminal equipment A consists of a mobile station MS and a data terminal equipment DTE1 connected thereto. A data connection is established from the radio terminal equipment via a radio connection between the mobile station MS and the base station system BSS to the mobile exchange MSC and there further to a network adapter IWF, which contains a data modem MOD1. The data modem MOD1 has a line interface (modem interface), which is connected to a normal two-wire line (2w), which in the exemplifying case is connected via a public switched telephone network PSTN 9 to a remote terminal equipment B, which comprises a remote modem MOD2 and a data terminal DTE2 connected to it. The data modem MOD1 of the network adapter and the remote data modem 10 signal in the normal manner via the modem connection established between them. As for the data terminal equipment DTE1, it controls the operation of the data modem MOD1 via the data connection and transmits data to the data modem MOD1 and correspondingly receives it.

In the GSM system, each service may have its own directory number, MSISDN, Mobile Subscriber ISDN Number. For instance, a subscriber may have a number for a speech service, telefax service and modem service. This numbering is called the multi-numbering scheme. In the multi-numbering scheme, the calling subscriber must know which service relates to which directory number. The services of subscribers are defined in the home location register HLR of a subscriber. In the home location register HLR, each directory number is associated with a corresponding service. In addition, a certain BCIE element, Bearer Capability Information Element, is associated with an MSISDN number in the home location register HLR, the BCIE element indicating the call type and the network resources needed in the call.

BCIE is described in the GSM recommendation 04.08, version 4.5.0, pages 423-431.

5 In the future, it will be possible to use ISDN BCIE in a GSM network together with the above-described GSM BCIE, this ISDN BCIE being described in the recommendation ETS 300102-1/Q.931 (Bearer Capability IE). This information element does not directly include call type information, wherefore the information elements High Layer Compatibility (HLC) or Low Layer  
10 Compatibility (LLC) are used together with it, these elements being defined in the recommendations ETS 300102-1/Q.931 HLC and ETS 300102-1/Q.931 LLC. ISDN BCIE (and HLC and/or LLC) may arrive at a mobile exchange in a call set-up message from a fixed network.

15 In the following, the set-up of a mobile station MS terminating call in the GSM system will be described with reference to Figure 4, the numbering following the multi-numbering scheme. At stage 1, a call arrives to the first transit exchange GMSC of the  
20 network, this transit exchange transmitting a routing information interrogation, message 2, to the subscriber's home location register HLR, which is determined by the directory number MSISDN of the subscriber. The MSISDN number of the subscriber (and  
25 possibly ISDN BCIE + HLC + LLC) is also transmitted in the routing information interrogation message 2. During location updating, information on the visitor location register VLR within the area of which the subscriber is located has been updated to the subscriber's home  
30 location register HLR. On the basis of this information, the home location register HLR transmits a mobile station roaming number allocation request, message 3, to the visitor location register. The BCIE relating to said MSISDN (or the ISDN BCIE arrived in message 2) is  
35 also transmitted to the visitor location register VLR

in the mobile station roaming number allocation request, this BCIE indicating for instance whether the type of the call is a data call or a speech call. The visitor location register VLR stores the BCIE it has received and allocates a mobile station roaming number MSRN. The visitor location register transmits the roaming number it has allocated to the home location register HLR in a response message 5. The home location register HLR then transmits the roaming number in a message 6 further to the exchange GMSC which had requested the routing information. The roaming number space is defined in such a manner that the call is always routed to the exchange MSC the visitor location register VLR of which has allocated the roaming number. The transit exchange GMSC can thus route the call forward on the basis of the roaming number by transmitting an initial address message 7 to the mobile exchange MSC indicated by the roaming number.

After having received the initial address message 7, the exchange MSC notices in a roaming number analysis that the call is terminating in the area of that particular exchange and it is not intended to be routed further. The MSC thus requests next from its own visitor location register VLR for the information on the called subscriber for call set-up, message 8. In a normal situation, the visitor location register VLR returns the necessary information in a response message 9, this information including for instance the BCIE. If the MSC is capable of providing the data transmission resources required by the BCIE, call set-up signalling according to the GSM recommendations is carried out between the MSC and the MS, this signalling being illustrated with arrows 10 and 11. The call set-up proceeds in the above-mentioned manner irrespective of

whether it is a question of call set-up for speech transmission or data transmission.

As stated earlier, the subscribers of mobile communication systems can define different call forwarding functions. In unconditional call forwarding, a mobile terminating call is always forwarded to a given forwarding number. In conditional forwarding, a mobile terminating call is forwarded to a determined call forwarding number when a certain condition is fulfilled, for instance when the subscriber is busy, when the mobile station is not reachable, or when the mobile station is reached but the subscriber does not answer within a certain period of time, for instance 30 seconds.

In the GSM system, call forwardings are set and activated basic service group-specifically. When the multi-numbering scheme is used, a mobile subscriber has a separate directory number MSISDN for each service. The subscriber can thus perform call forwardings service-specifically, if there are no other basic services in the same group. The subscriber can for instance forward speech calls to a secretary and telefax calls to the office telefax number. Information on the call forwarding functions activated by the subscriber is stored permanently in the home location register HLR of the subscriber. In addition, information on at least the activated conditional call forwardings is also given to the visitor location register VLR serving the subscriber and stored therein.

Figure 5 illustrates the call-set-up procedure of a mobile station MS terminating call, with an associated conditional call forwarding in an exchange MSC serving the mobile station. In Figure 5, call set-up messages and operations 1, 2, 3, 4, 5, 6, 7 and 8 are entirely similar to the ones described above in



connection with Figure 4. When the VLR receives a subscriber information request 8 from the exchange MSC in the case of Figure 5, the VLR checks the status of the mobile station MS in the subscriber data and notices for instance that the mobile station is busy. Next, the VLR checks in the subscriber data whether the mobile subscriber has activated conditional call forwarding when the subscriber is busy. The VLR notices that the subscriber has such conditional call forwarding to a certain call forwarding number and transmits a response message 9 to the exchange MSC, this message commanding the exchange to perform a call forwarding to the given number. The exchange MSC has a possibility to make an intermediate announcement to the calling subscriber, in which announcement it is declared that the call is forwarded to the call forwarding number. The announcement may be chargeable to the calling subscriber or to the called subscriber. In the exemplifying case of Figure 5, the exchange MSC makes an announcement to the calling subscriber at stage 11, this announcement being recorded speech, for instance taped or synthesized speech. The announcement is transmitted at stage 12 from the exchange MSC to the transit exchange GMSC and from there further to the calling subscriber, stage 13.

Such an intermediate announcement is not problematic in connection with a speech call. However, intermediate announcements are problematic in data calls, in which the calling modem or telefax terminal waits for an answer from the modem or telefax terminal at the other end only for a predetermined period, which is typically 10-40 s. If there is no reply within this period, the calling modem or telefax terminal disconnects the call. The intermediate announcements described above cause a delay to the call set-up, this delay possibly causing the time-out of the calling modem

or telefax terminal during call forwarding and thus an unnecessary release of the call.

To obviate this problem, the visitor location register VLR is arranged, according to the invention, to also provide information in the response message 10 of Figure 5, in which are given a call forwarding command and a call forwarding number, on whether the call is a data call or a speech call. This information is preferably a BCIE element. Alternatively, the mobile exchange may also receive BCIE, HLC and LLC in a call set-up message (SETUP), if ISUP signalling is used between the exchanges. If an intermediate announcement is associated with the call forwarding, the exchange MSC is arranged to check the type of the call on the basis of the information provided and to prevent the intermediate announcement to be switched to the calling subscriber if the call is a data call. If the call is a speech call, the intermediate announcement is switched in a normal manner. This is a way of obviating the harmful delay due to intermediate announcements during data calls, such delay possibly causing the time-out of the calling modem or telefax terminal.

Figure 6 illustrates a case in which call forwarding is performed in a transit exchange GMSC. The transit exchange receives a mobile terminating call, stage 1, and performs a routing information interrogation to the subscriber's home location register HLR, stage 2, in the same manner as described in connection with Figure 4. The HLR notices that there is an unconditional call forwarding for the called subscriber, or that the subscriber has disconnected itself from the network and there is a call forwarding for the subscriber in case of such a situation (stage 3). In the present-day systems, the home location register HLR provides the transit exchange GMSC with a

notification of active call forwarding and a call forwarding number in a response message 4. The GMSC performs a call forwarding. If an intermediate announcement is associated with the call forwarding, the  
5 GMSC switches the intermediate announcement to the calling subscriber (stages 5 and 6) in the same manner as the MSC in the case of Figure 5. A problematic delay as regards the calling modem or telefax terminal is thus produced again.

10 This is solved according to the invention in such a manner that the home location register HLR provides in the response message 4 information on whether the call is a data call or a speech call in addition to providing the call forwarding number. This  
15 information is preferably a BCIE element.

Alternatively, the GMSC can use ISDN BCIE, HLC and/or LLC if it obtains these information elements in a call set-up message.

If an intermediate announcement is connected  
20 with the call forwarding, the GMSC is arranged to check the type of the call and to prevent the switching of the intermediate announcement in the case of a data call. If the call is a speech call, the intermediate announcement is switched normally. Also in this  
25 situation, the delay which is caused by the intermediate announcement and which is problematic as regards the calling modem or telefax terminal is avoided.

Figure 7 illustrates a way of applying the invention in a mobile exchange MSC. For the sake of  
30 clarity, Figure 7 shows of the exchange only a switching matrix 83, call control 82, audio announcement unit 84, telefax adapter 8A and modem 8B, but in practice the MSC comprises a significant number of different equipments. The switching matrix 83 may be an analogue or digital  
35 switching device, which selectively switches speech and

data connections between the transmission lines 12 arriving from the base station system BSS and the transmission lines 13 leaving the mobile exchange. As an example of such digital exchanges, Nokia Telecommunications DX 220 MSC can be mentioned. A transit exchange GMSC can also be a similar exchange.

Along with the switching matrix 83 are connected the telefax adapter 8A and the modem 8B as network adapters. In the case of a data call, the call control 82 controls the switching matrix 83 to switch a required adapter to the transmission connection in such a manner that the connection according to Figure 2 or 3 is produced. The network adapters are not essential as regards the invention, however.

The audio announcement unit 84 is also connected to the switching matrix 83. The call control 82 controls the switching matrix 83 and the audio announcement unit 84 in such a manner that the unit 84 can be switched, if necessary, via the switching matrix 83 to make announcements to the calling or called subscriber.

According to the invention, the call control 82 of the exchange, for instance a computer, is arranged to perform the switching of audio announcements during call forwarding in accordance with the flow diagram of Figure 8. At stage 91, the call control 82 receives a call forwarding command, which contains a BCIE. At stage 92, the call control 82 checks whether an intermediate announcement is connected with the call forwarding. If no intermediate announcement is connected with the call forwarding, the call control proceeds directly to stage 96 to perform the call forwarding. If an intermediate announcement is connected with the call forwarding, the call control 82 checks the type of the call on the basis of the BCIE (or ISDN BCIE + HLC + LLC) at stages 93 and

94. If the call is not a data call, the call control 82 controls the switching matrix 83 and the audio announcement unit 84 to switch the intermediate announcement to the calling subscriber at stage 95. If  
5 the call is a data call, the call control omits the intermediate announcement and proceeds directly past stage 95 to stage 96 to perform the call forwarding.

The figures and the description relating thereto are merely intended to illustrate the present  
10 invention. In its details, the invention may vary within the spirit and scope of the appended claims.

## Claims

1. A call forwarding method for a mobile terminating call, comprising the steps of

5 receiving a call;

checking whether call forwarding is activated for the called subscriber;

starting the activated call forwarding, with which is possibly associated an intermediate announcement to the calling subscriber,

10 characterized by

checking in case of call forwarding whether the type of the call is a speech or data call,

preventing the intermediate announcement in case of a data call, and

15 allowing the intermediate announcement in case of a speech call.

2. A method according to claim 1, characterized by

20 receiving a call in a first exchange;

performing a routing information interrogation to a first database indicated by the directory number of the called subscriber;

performing a roaming number interrogation from the first database to a second database, within the area of which the called subscriber is located;

25 transmitting the allocated roaming number from the second database to the first database and further to the first exchange;

30 routing the call on the basis of the roaming number from the first exchange to a second exchange, which serves the area of said second database;

observing at the second exchange that the called subscriber is busy, not reachable or does not answer;

35

checking in the second database whether call forwarding is activated for the called subscriber;

initiating the activated call forwarding;

5 checking on the basis of the information obtained from the second database or in a call set-up message whether the call is a speech call or a data call;

10 preventing an intermediate announcement possibly associated with the call forwarding in case of a data call, and;

allowing an intermediate announcement possibly associated with the call forwarding in case of a speech call.

15 3. A method according to claim 2, characterized by

transmitting said information on the type of the call from the second database to the second exchange in response to the subscriber information interrogation performed by the second exchange.

20 4. A method according to claim 1, characterized by

25 receiving a call in a first exchange; performing a routing information interrogation to a first database indicated by the directory number of the called subscriber;

observing in the first database that call forwarding is activated for the called subscriber;

starting the call forwarding;

30 checking on the basis of the information obtained from the first database or in a call set-up message whether the call is a speech call or a data call;

35 preventing an intermediate announcement possibly associated with the call forwarding in case of a data call, and;

allowing an intermediate announcement possibly associated with the call forwarding in case of a speech call.

5           5. A method according to claim 4, c h a r -  
a c t e r i z e d by

maintaining in the first database a dedicated directory number for each service available to the called subscriber,

10           transmitting from the first database a  
notification of the call forwarding, the call forwarding number and information concerning the type of the call to the first exchange when the database receives the routing information interrogation for the directory number of the called subscriber and call forwarding is  
15           activated for the called subscriber.

20           6. A method according to any one of the preceding claims, c h a r a c t e r i z e d in that said call type information is a Bearer Capability Information Element according to the recommendation GSM 04.08.

25           7. A method according to any one of the claims 1 - 5, c h a r a c t e r i z e d in that said call type information is a Bearer Capability Information Element according to the recommendation ETS 300102-1/Q.931, with which is connected a High Layer Compatibility or Low Layer Compatibility information element, which are defined in the recommendations ETS 300102-1/Q.931 HLC and ETS 300102-1/Q.931 LLC, respectively.

30           8. An arrangement for carrying out call forwarding in a mobile communication system comprising mobile stations (MS), mobile exchanges (MSC, GMSC) and subscriber databases (VLR, HLR) for maintaining user data, such as location data and activated services, in which arrangement a mobile exchange (MSC, GMSC) is  
35           provided with means (82, 84) for making intermediate



announcements to the calling subscriber in connection with carrying out activated call forwarding, c h a r -  
a c t e r i z e d in that the mobile exchange (MSC, GMSC) is arranged to check in case of call forwarding  
5 whether the type of the mobile terminating call is a data call or speech call, and to prevent intermediate announcements in case of data calls and to allow intermediate announcements in case of speech calls.

9. An arrangement according to claim 8,  
10 c h a r a c t e r i z e d in that a subscriber database (VLR, HLR) is arranged to provide information on the type of the call to a mobile exchange (MSC, GMSC) in response to the interrogation performed by the mobile exchange.

15 10. An arrangement according to claim 8 or 9, c h a r a c t e r i z e d in that the call type information is a Bearer Capability Information Element according to the recommendation GSM 04.08.

20 11. An arrangement according to claim 8 or 9, c h a r a c t e r i z e d in that said call type information is a Bearer Capability Information Element according to the recommendation ETS 300102-1/Q.931, with which is connected a High Layer Compatibility or Low Layer Compatibility information element, which are  
25 defined in the recommendations ETS 300102-1/Q.931 HLC and ETS 300102-1/Q.931 LLC, respectively.

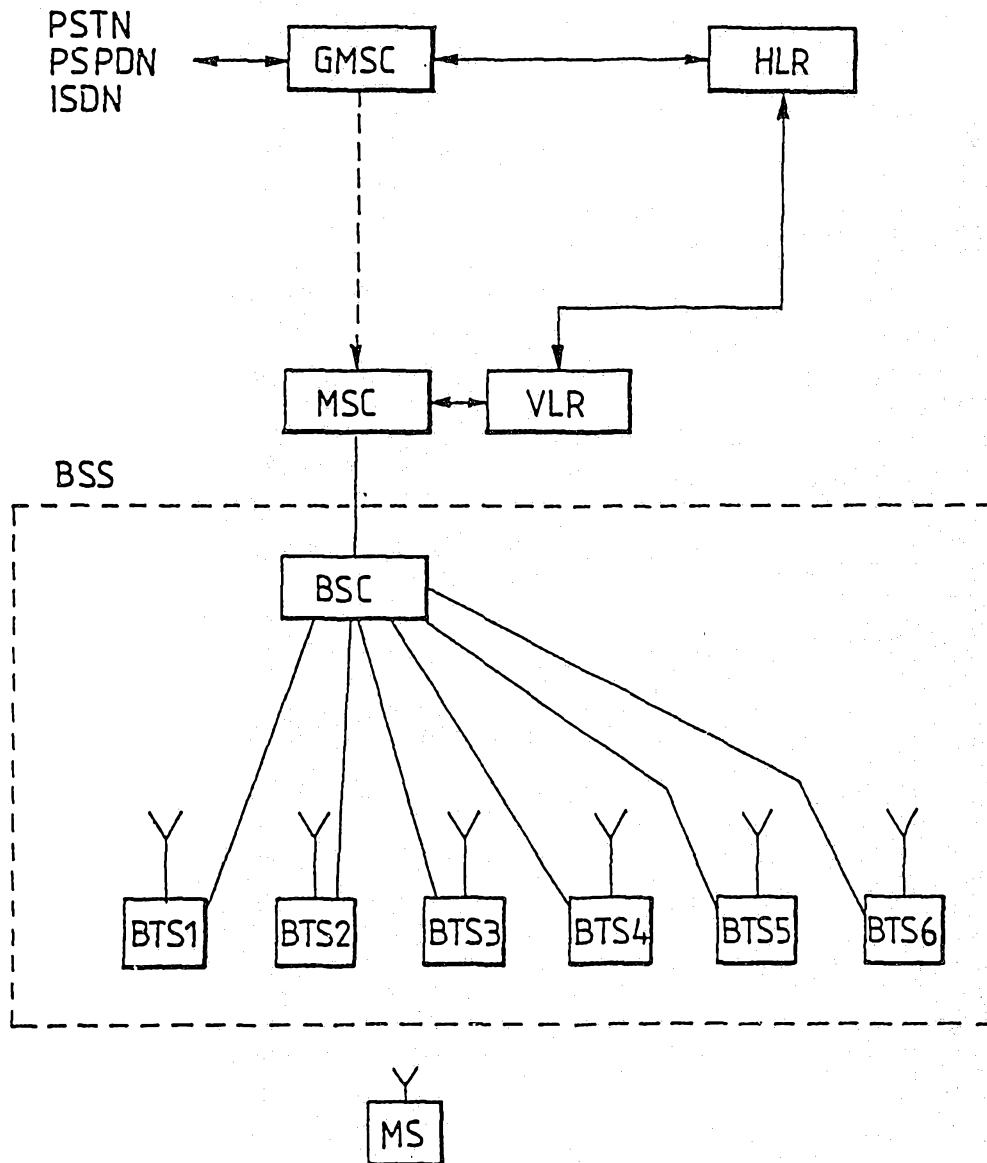


FIG. 1

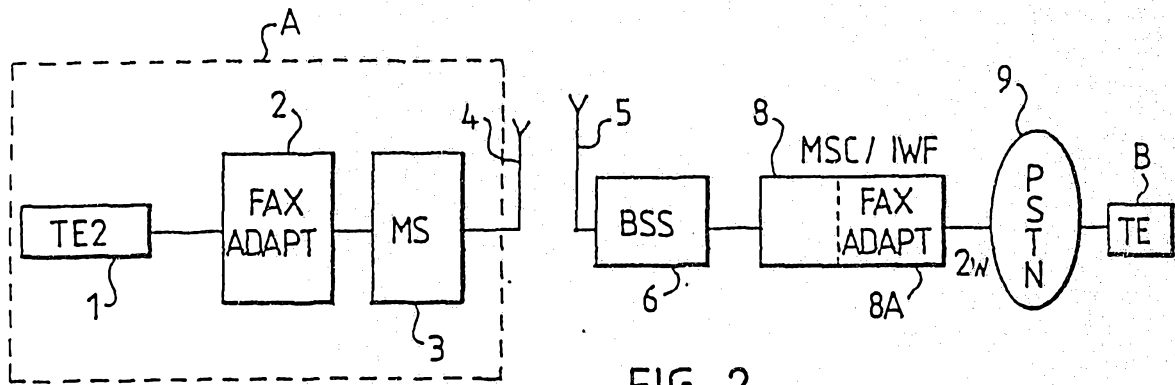


FIG. 2

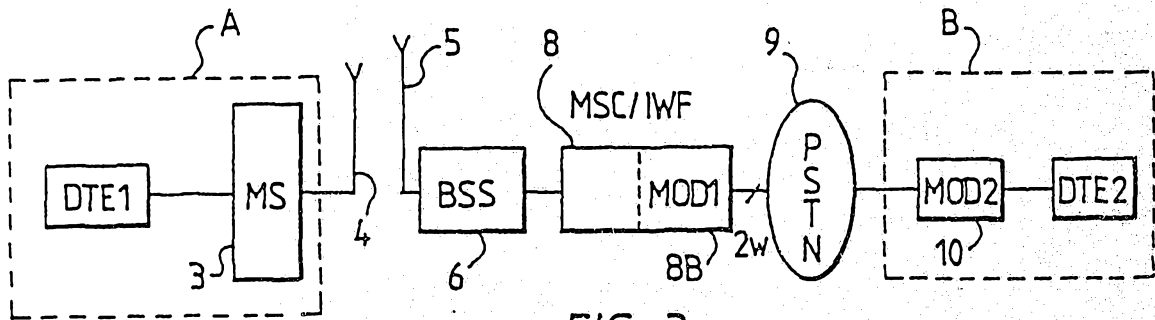


FIG. 3

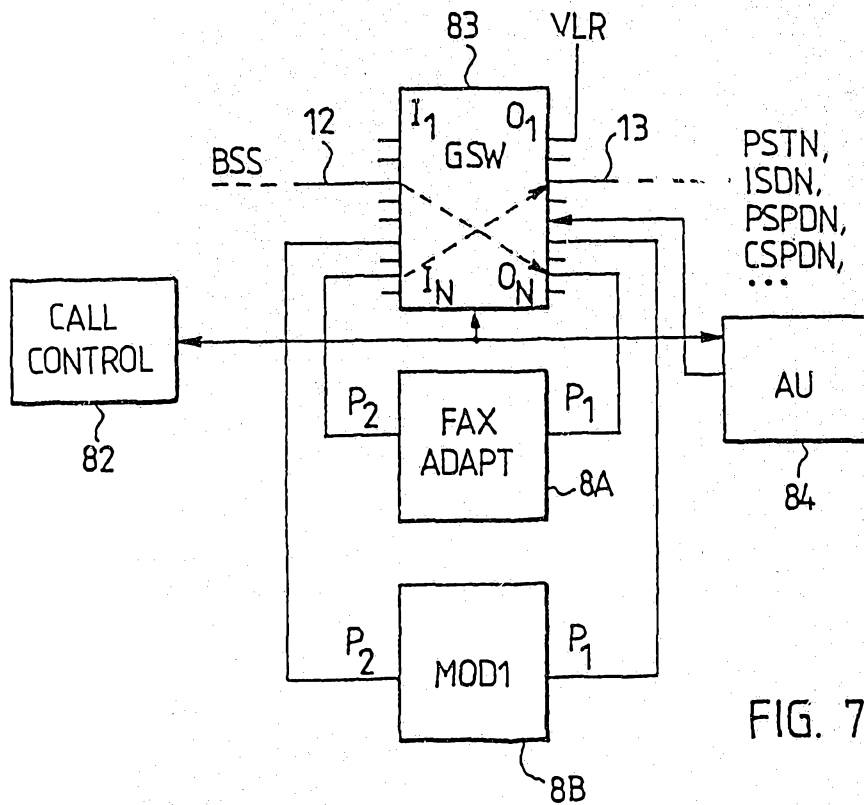


FIG. 7

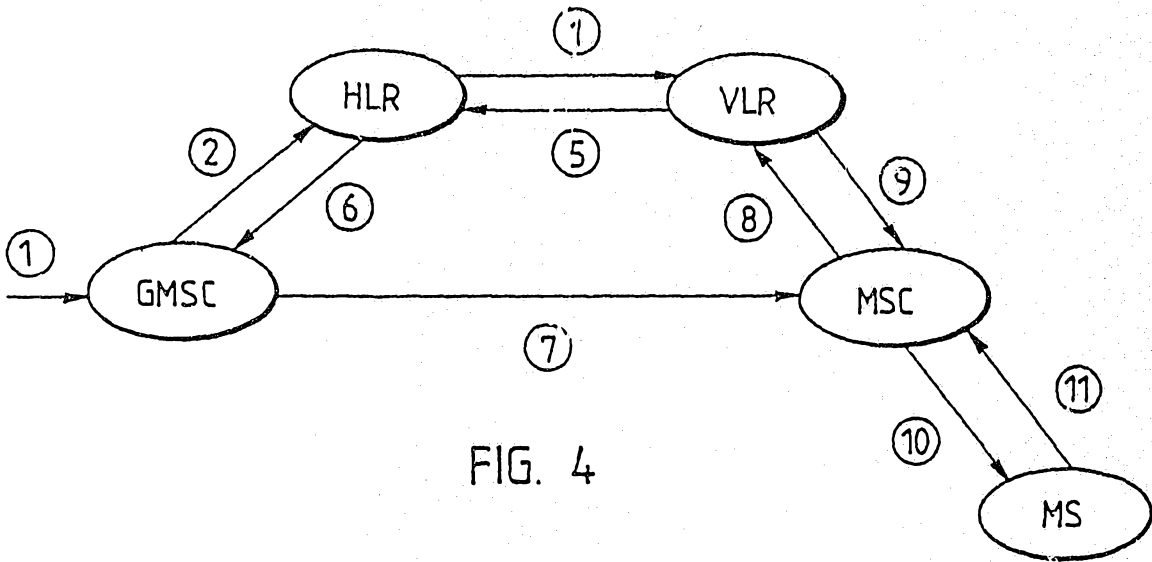


FIG. 4

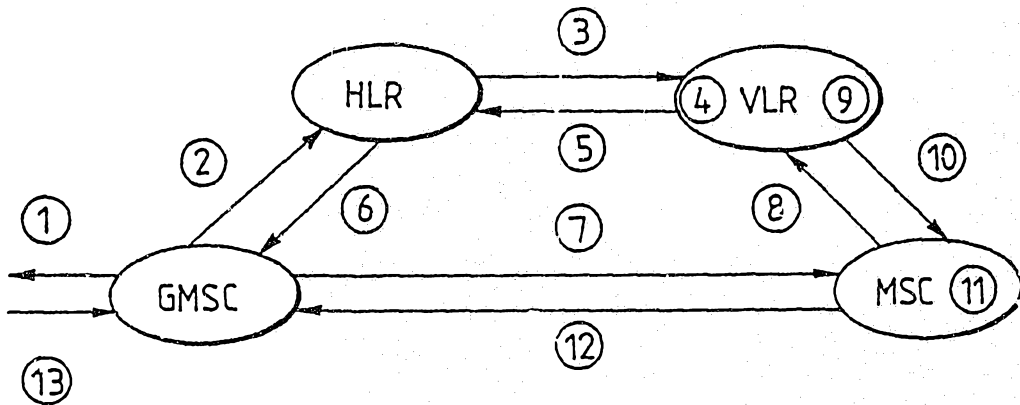


FIG. 5

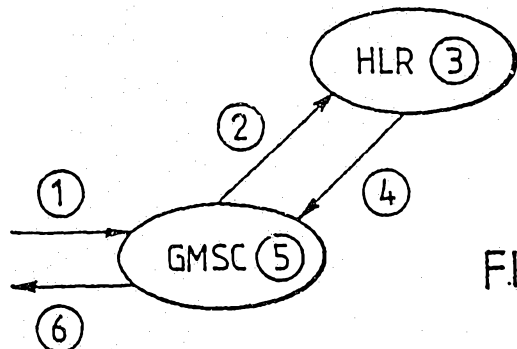
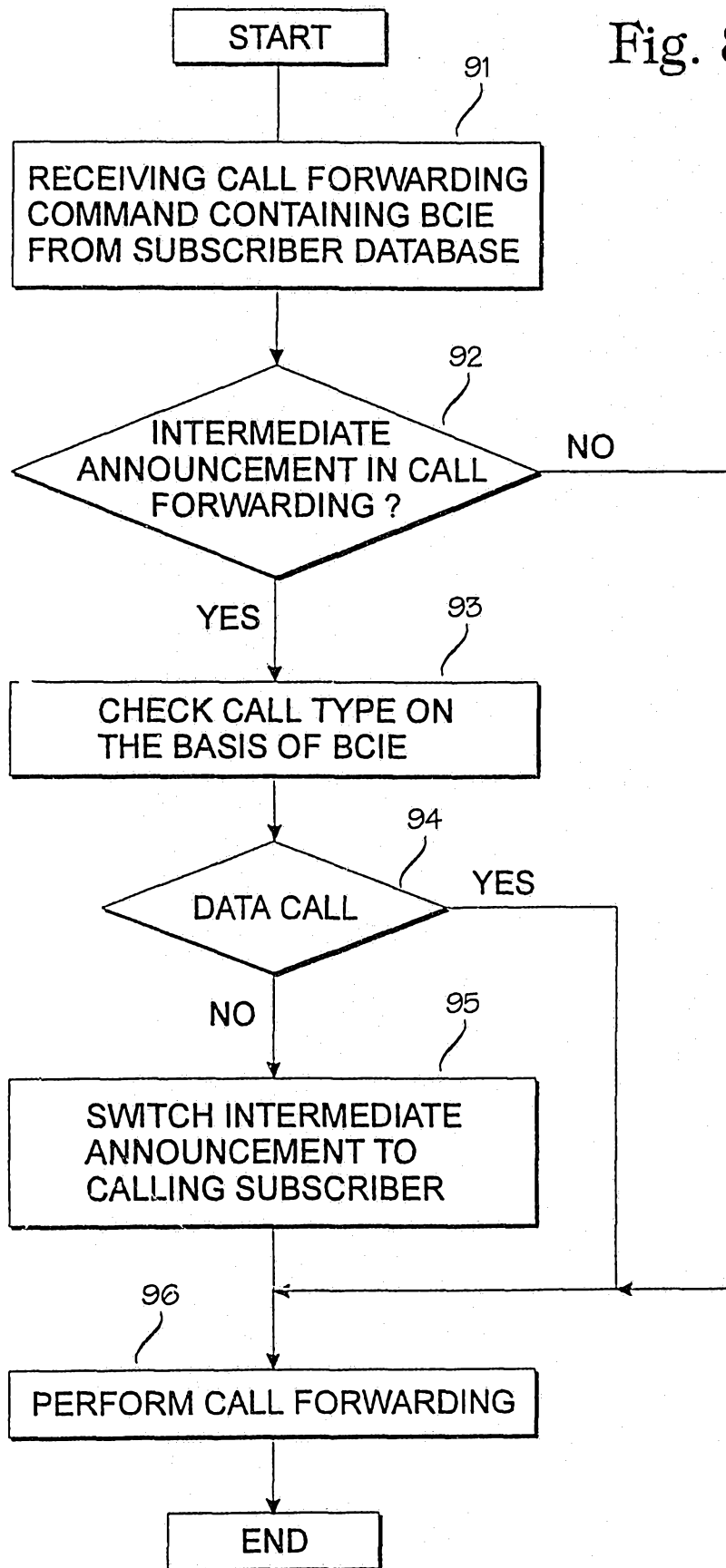


FIG. 6

Fig. 8



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00236

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: H04Q 7/22, H04M 3/54 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: H04Q, H04M		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched: SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI, CLAIMS, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9405124 A1 (NOKIA TELECOMMUNICATIONS OY), 3 March 1994 (03.03.94), the whole document --	1-11
A	US 5168517 A (HERBERT WALDMAN), 1 December 1992 (01.12.92), the whole document --	1-11
A	GB 2244409 A (TELECOM SECURICOR CELLULAR RADIO LIMITED), 27 November 1991 (27.11.91), the whole document -- -----	1-11
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
<ul style="list-style-type: none"> <li>* Special categories of cited documents:</li> <li>*A* document defining the general state of the art which is not considered to be of particular relevance</li> <li>*B* earlier document but published on or after the international filing date</li> <li>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</li> <li>*O* document referring to an oral disclosure, use, exhibition or other means</li> <li>*P* document published prior to the international filing date but later than the priority date claimed</li> <li>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</li> <li>*X* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</li> <li>*Y* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</li> <li>*Z* document member of the same patent family</li> </ul>		
Date of the actual completion of the international search		Date of mailing of the international search report
22 November 1995		24-11-1995
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer  Henrik Fehninger Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/10/95

International application No.  
PCT/FI 95/00236

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9405124	03/03/94	NONE	
US-A- 5168517	01/12/92	NONE	
GB-A- 2244409	27/11/91	NONE	