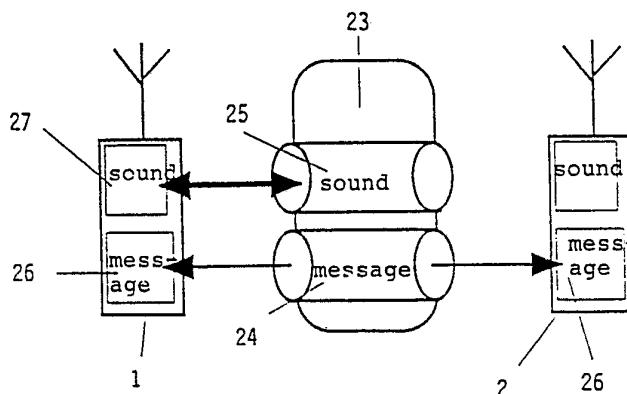




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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**(54) Title:** A METHOD FOR CONVEYING INFORMATION IN A MULTI-SERVICE NETWORK**(57) Abstract**

The invention relates to a method for relaying information in an integrated services network (23), in which network a message switching service (24) is operative between the terminal equipment units of the network. The method of the invention comprises the steps: using a terminal equipment unit (1) of the network, information is inquired, via the network (23), of another terminal equipment (2) connected to the network by means of a query message including at least a reply address; the terminal equipment (2) that is the target of the query generates a message containing the requested information; and the information is transmitted to the reply address automatically via the message switching service (24) of the network.

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A Method For Conveying Information In A Multi-Service Network.

5 The present invention relates to a method for relaying information in an integrated services network, in which network a message switching service is operative between the terminal equipment of the network.

10 The telephone and data networks that are currently realized and being designed are digital integrated services networks normally supporting both audio communication and digital signalling. By integrated services networks are understood in this context networks wherein access to both sound and signalling channels can be established with the same  
15 basic terminal equipment, and wherein the different services realized in them are capable of dividing between themselves the signalling and communication channels suitable for each purpose.

20 The most recent land mobile networks, such as the network known as the GSM network being designed for Europe, operating in the range 900 MHz, and the CMS88 mobile phone system being designed for the United States are in their communication modes digital  
25 TDMA networks, which means, besides high quality speech signal transmission, also possibilities for transfer and intermediate storage of data on data channels of different types and different rates. In addition to the subscriber traffic, the mobile phone  
30 system itself needs efficient data transmission services for ever diversifying forms of service and the signalling therein. Thus for instance short message service (SMS) is intended to be included in these networks, the short message service center (SC)  
35 appertaining to this service being capable of receiv-

ing and transmitting from a mobile phone short messages in digital form according to the so-called "store-and-forward" principle further to another mobile phone. Signalling is possible simultaneously with another service, since the short messages are transmitted as in an integrated services network for instance over the signalling channel of the GSM, not the voice channel.

A corresponding message switching service is also possible in a digital ISDN telephone network as defined by the CCITT, which has both voice channels and signalling channels.

The purpose of message switching is to improve the accessibility of terminal equipment subscribers. The specifications for short message transmission in the GSM, such as GSM 03.40, do not take a stand on the realization of the interface between the MSC and the SC, the structure of the SC, or the different forms of the actual use of the short message service. The communication between the MSC and the SC can be realized for instance by means of an X.25-based packet switching network, and in the connection between these the short message has an effective length of 140 bytes (à 8 bits). Further, short message services are divided into mobile terminated (MT) service, mobile originated (MO) service, and cell broadcast (CB). A cell broadcast means transmitting a message in the area of one or more cells to all mobile phones in that area.

The present invention is concerned with the utilization of this new form of service in the best possible way, so that the availability of the users of the integrated services network and their access of information is crucially improved and so that the speech communication between the users of the voice

channels is even partly replaceable by sophisticated  
informatory auxiliary functions.

One embodiment of the invention is based on the  
fact that people have a fairly large quantity of per-  
5       sonal communication information: telephone numbers,  
postal addresses, physical addresses, telefax, telex  
and teletex numbers, etc. Typically, a subgroup of  
this contact information which is experienced as  
meaningful is compiled on a person's visit card,  
10       which is distributed to others to facilitate com-  
munication. As telephone and data transmission  
traffic moves into extensive digital integrated ser-  
vices networks, it can be foreseen that communica-  
tion through these channels will rapidly increase.  
15       However, with the present techniques there is no ver-  
satile way of transmitting the above contact informa-  
tion in the network, if for instance the com-  
munication should fail for some reason.

For implementing this information in the con-  
20       text of new Public Land Mobile Network (PLMN) phone  
systems, such as the GSM network, and for utilizing  
the signalling connections of integrated services  
networks also in all cases where data acquisition can  
be arranged to be transmitted through said network,  
25       the system of the invention is characterized in that

- using a terminal equipment unit of the net-  
work, information is inquired, via the network, of  
another terminal equipment connected to the network  
by means of a query message including at least a  
30       reply address;

- that the terminal equipment that is the tar-  
get of the query generates a message containing data  
previously stored therein by the user of said equip-  
ment;

35       - and that the information is transmitted to

the reply address automatically via the message switching service of the network.

The other advantageous embodiments of the method of the invention are characterized in that  
5 which has been set forth in the ensuing claims.

The invention will be explained in the following by means of examples with reference to the accompanying drawings, wherein

Figure 1 shows a short message service system  
10 according to one embodiment of the invention,

Figure 2 shows one way of the invention to handle the distribution of new or changed information to others connected to the service in the case of Figure 1,

15 Figure 3 shows a short message service system according to another embodiment of the invention and a corresponding way of handling the distribution of changed information,

Figure 4 shows an example of the application of  
20 the system of the invention to other data transmission systems,

Figure 5 shows an example of the application of the system of the invention to remote paging systems,

25 Figure 6 shows the structure of the short message service system and its interfaces with a mobile phone system,

Figure 7 shows in block diagrams a service unit (Fig. 6) in a short message service center and its interfaces with the ambient system,

30 Figures 8a and 8b show one embodiment of the invention in a public integrated services network,

Figures 9 to 11 show another embodiment of the invention wherein the message switching service of the integrated services network is applied to an  
35 automatic information system,

Figures 12 and 13 show a query message of an integrated services network and its content.

The embodiment of Figure 1 shows a simple model of communication information services in terminal equipment, in this case mobile phones, in an integrated services network, from the point of view of the actual user of the mobile phones. Therein the holder 3 of telephone 1 attempts to reach the holder of telephone 2. Arrow A indicates an operation wherein the person 3 is feeding a PLMN number and communication information request of telephone 2 into his own telephone 1. Arrow B indicates the forwarding of the communication information request as a short message from telephone 1 to telephone 2. When telephone 2 identifies the communication information request, it automatically transmits the communication information stored in its memory as a short message C back to telephone 1 wherefrom the information can be unloaded (arrow D) by the user 3 at any time. Many alternative or optional ways of realization can be connected to this basic transaction. Assuming that telephone sets 1 and 2 used are still connected to the PLMN network, telephone 2 for instance can indicate to its user that a contact information request B has arrived, and only after the user has accepted the request (for instance having first looked at the number or other identification of the maker of the contact information request in a manner known per se) will the call-back transmission C take place. Further, contact information can be provided in different setups for different situations, or for being picked up separately from a larger quantity of information for a certain transmission.

The purpose of the distribution of communication information is to make the communication bet-

ween mobile phone users easier also by facilitating contacts by other communication means in addition to voice telephone calls. By knowing the number of the mobile phone of the user, one can acquire for instance the user's telefax number or electronic mail address for leaving messages, or his postal address for delivering arbitrary material.

For instance in connection with a GSM network such a feature is very useful, since the GSM phone is envisioned to become an essential channel of communication between business people, as the increase in people's mobility which is to be anticipated increases the requirements on the distribution of contact information.

Figure 2 shows how the CB or MO and the MT facility possibly included in the short message system can be taken advantage of in the distribution of new or changed information relating to mobile phone 1 to other telephones 2a...2c connected to the service. Therein the user 4 feeds (arrow E) updated communication information into his telephone 1, whereafter a cell broadcast (arrows F) to the other telephones 2a...2c in the cell is effected. The changed information is addressed to all telephones in the cell (in which case the receiving telephone is capable of selecting what information is of interest for instance on the basis of its internal telephone directory), or only to the telephones existing in the internal telephone directory of telephone 1 using the MO and MT facility.

It should be noted in the context of Figures 1 and 2 that the short message service center (SC) transmits all communication information short messages transferred from one telephone to another, but for clarity it has not been drawn. This means that



the communication information requests can be made and received independently of the other use of the telephones. For instance, a failed call attempt can at least partly be replaced by storing the communication information of the other subscriber for later contact. The receiving and handling of short messages is automatic, so that it will not interfere with an ongoing call, for instance. The supplementary services to be generated by means of short messages can be services generated to be customer-specific, carrying out a precisely defined task, such as the transmission of taxi calls sent as short messages to vehicles and their acknowledgement from vehicles in short message form. The task of the service center SC in this case would be to locate the nearest vacant vehicles to serve a specific address, whereafter the call will be automatically transmitted to the vehicles which acknowledge the call either by accepting or declining it.

In the communication information service according to another embodiment of the invention presented in Figure 3, the communication information of the subscribers has been centralized in the internal database of the SC, and thus it replies to communication information queries and receives updating information. Thus, as the holder 3 of telephone 1 desires the communication information of telephone 2, arrow A indicates an operation wherein the person 3 feeds a PLMN number and communication information request for telephone 2 into his own telephone 1. Arrow B shows the travel of the communication information request as a short message from telephone 1 to the service center SC. When the SC identifies the communication information request, it automatically transmits the communication information stored in its database as a

short message C back to telephone 1 wherefrom the information can be unloaded (arrow D) by the user 3 at any time. Thus the procedure is fully analogous to the sequence of Figure 1.

5           When the user 4 of telephone 2 feeds (arrow E) updated communication information into his telephone 2, the telephone routes (arrow G) the information in this case to the service center SC, which updates its own internal database. It is possible not to notify  
10 of the changed information separately, or to organize that telephones storing an updated number in their own memory are informed thereof. The service center SC can, for instance, continually collect in its internal memory a list of those mobile phones that  
15 have requested the communication information of a certain mobile phone; when this communication information then changes, the change can be notified of in the manner described.

Figure 4 shows an example of the application of  
20 the services of the system of the invention to other data transmission systems, in this case to telefax terminals 5 and 6 whereof one is a telecopier of Group III and the other a telecopier of Group IV, for instance. Telecopier 5 is shown to be connected to a  
25 service center SC through a normal public switched telephone network (PSTN), and a future telecopier 6 of Group IV (shown in broken lines) through an integrated services digital network ISDN. A mobile phone (MS) in a vehicle 7 is connected to the telefax services of the short message center SC via the signaling channel of a PLMN network. If the service center SC itself stores in its memory the communication information of the sender of the short message, it  
30 can add this also to messages that do not include communication information in short message form. Thus  
35

a cover page containing the communication information of the sender can be received as a supplement to a message printed out at the telecopier, similarly as in normal transmission.

5           This is an example of how communication information and actual freely formulated short message text can be combined into a single short message. The short message center SC completes a free-content short message according to the GSM standard, sent by  
10 phone from vehicle 7, with the communication information of the sender and converts the resultant completed message to a message in facsimile form which is further sent to the desired telefax number.

          In the case of telefax, this is the only possible communication direction employing short messages, but since the contact information of the sender of the short message can be printed out in the telefax message or its heading field, the recipient can call said number or send short messages through other  
15 channels, for instance by means of a short message terminal (SMT) capable of short message communication with a PLMN network.

          Figure 5 shows another example of the application of the system of the invention to other types of data transmission. Here a remote paging system 8, with which a caller 9 by making a call in the normal way through a telephone network or equivalent, reaches a remote paging device 10 through a radio transmitter 11. The idea herein is that the short  
25 message service center SC emulates the remote paging system 8, so that the caller can give a similar call as when the remote paging device 10 is pursued, but the call is directed for instance via an asynchronous terminal (not drawn), the service center SC, and  
30 the PLMN network to a mobile phone 7 in a vehicle.  
35

Here the communication is unidirectional as well, but in this case towards the holder of the mobile phone, since now the communication information of an external caller with respect to the PLMN network is transmitted to his telephone as a short message. Actually this service integrates the mobile phone and the remote paging device into one and the same unit.

Examples of how combined contact information and actual short message text can be sent both from an exterior system to a mobile phone and vice versa are telex communication and so-called electronic mail, wherein an adapter at a short message service center transmits and receives short telex or electronic mail messages as short messages. Since accomplishing such a system would primarily mean changing the signal routes shown in Figure 4 to be duplex, it has not been separately drawn.

Figure 6 illustrates the layout of the short message service system and its interfaces with a mobile phone system. The software configuration of the short message service center SC consists of a number of services which can be described as function blocks.

Blocks 11 and 12 are responsible for the communication of the SC outwards, block 11 communicates for instance via an optional telephone network or data network with short message terminals SMT, and block 12 with a mobile services switching center supporting short message service, SMS-MS. Normally, the service center SC is either directly integrated in the mobile services switching center MSC, or it has an X.25-based connection with the local MSC, but can also establish provisional connections with more remote mobile services switching centers. Block 13 consists of the "store-and-forward" transmission of

short messages and a number of services based on short messages, adding to the value of the mobile phone system, as set forth hereinabove. Block 14 is a maintenance unit of the internal database 15 of the service center SC. Block 16 is an operating and maintenance unit for the entire service station, through which the activity of the station can be managed from the operator terminal 17 and which makes printouts of different reports on the operation of the station, for instance for an invoicing unit 18.

Figure 7 shows in block diagram form a service unit 13 (Figure 6) in a short message service center and its interfaces with the ambient system. The interfaces are indicated with reference characters X, Y, Z and V. Block X is a telecommunication interface outwards into the world exterior of the PLMN, the setup of which is facilitated when all service adapters 19, 20, 21 (corresponding to remote paging, telefax and X.400 connections) have protocol modules P of similar connections.

The X.400 service enables duplex short message communication between any message handling equipment and a mobile phone by means of an X.400 message handling service MHS connected to the short message service center SC. In the exchange of more extensive messages, the X.400 short message can serve as a notice of arrival for a message that has arrived in the MHS service for further measures. Such a further measure may be for instance the sending of a short message to the MHS service, with which a more extensive X.400 message is unloaded from an interface U to another equipment, for instance to a telecopier designated as a telefax message.

Interface Y is an operating and maintenance interface and Z is an MSC communication interface.

This interface is divided into three units, receiving of short messages Z1, sending of short messages Z2, and flagging of the mobile phones accessibility Z3. These three services based on the MSC interface are controlled in a PLMN distribution center 22, which for instance routes MO short messages forward as MT messages under the control of the operating and database functions of the service center SC. The PLMN distribution center can also serve as a relay station for other than MO short messages, generated by the different services, by means of its W interface, in which situation it will send the messages further to mobile phones as MT messages.

Interface V is an interface for database functions (cf. Figure 6). If the communication information is stored in the database of some other system than the internal database of the SC, it must be possible to communicate with said other system through this interface.

In the embodiment according to Figures 8a and 8b, the essential feature is that the units of terminal equipment 1 and 2 are connected to a public integrated services network 23, which in addition to a message service 24 supports normal voice communication over sound channels 25. Thus the normal terminal devices 1 and 2, such as conventional GSM telephones as shown in Figure 1, can communicate with one another in the integrated services network using both the sound channels 25 and message service channels 24 of the network 23, making use of their built-in message and sound processing equipment 26, 27.

Figure 8b specifically highlights the fact that in some cases, one of the terminal equipment units 29 may be for instance an automatic system, supporting only a message service 24 and containing only a mess-

age service interface 26. The terminal equipment 29 is connected, for instance, to an information system 30, and thus the information contained in said information system can be inquired by means of terminal equipment 1. A concrete example of such an information system is a stock exchange information system, which can be inquired for data by any holder of a normal terminal equipment 1 (a GSM telephone), without any supplementary equipment or special operations.

Figure 9 shows another example of an embodiment of the invention wherein one of the terminal equipment units is automatic. Reference 32 denotes, for instance, a heating oil tank for a house, in which a sensor 34 monitors the amount of oil 33 in the tank. The sensor is connected to a terminal equipment unit 31 of an integrated services network, said terminal equipment being provided with a messaging feature 26, so that the terminal equipment is capable of replying to a message-based query concerning the amount of the oil.

Figure 10 shows a situation corresponding to Figure 9 wherein the integrated services network is for instance a GSM land mobile network, and wherein the person responsible for the heating of the house is able at any time to execute with his GSM mobile phone 1 a query (arrow 35), in reply (arrow 36) to which he receives the amount of the oil 33 in the tank 32 in short message form.

Figure 11 shows an example of an embodiment of the invention wherein both terminal equipment units are automatic, again in the environment shown in Figures 9 and 10. Therein the information system 37 of a heating oil company can automatically inquire the amounts of oil in the oil tanks 32a, 32b and 32c of

the houses attended to by said company, using the radio set of an automated GSM mobile phone 38. In the houses, heating systems furnished with terminal equipment 31 in accordance with Figure 10 reply to the queries by indicating the amount of oil in the respective tank by short message, regardless of whether the inquirer is for instance the caretaker with his GSM phone or the oil company by means of its information system. This arrangement makes possible the transfer of responsibility for the amounts of oil in the tanks to the oil company. The information system 37 can be fixed or can be located for instance in an oil distribution vehicle. At any rate, the system of Figure 11 opens up completely new horizons for optimizing distribution operations, for instance. Incorporation of equivalent features is not possible without the two important characteristics that constitute the invention, an integrated services network including a message switching service and the possibility of making message-based queries using normal terminal equipment. In the known solutions, the query systems need their own data transmission networks and their own terminal equipment.

Figures 12 and 13 show the layout of the messages in the integrated services network. The content of the message 41 is usually divided into heading information 42 and useful content 43. The division of the heading information into different fields and in part also its content is determined by the applicable message switching service, whilst the useful content can be freely determined by the units of terminal equipment or their users. For instance in the GSM short message service, a mobile phone receives the message in the format shown in Figure 12, in which situation the heading information 42 of the



message contains the address of the transmitting terminal equipment in field 39, and in field 40 an identification of the protocol, service, or equivalent. If the message is a query message, the telephone to which the message is addressed will find the equipment that has made the query in address field 39, and thereby also a reply address. On the other hand, the content of field 40 can indicate that the query message is a message of a certain query application.

While Figure 12 is an example of how the reply address and the address of the query message can be included in the heading information of the message, in the message layout of Figure 13 the identification 44 and the reply address 45 for the query message are included in the useful content of the message. In Figure 13, it has been assumed that the useful content of the message is in character form, in which situation certain character sequences (in the Figure, ##[] and ##{ }) differentiate the identification (2) and the address (12345). The terminal equipment replying to the query will go through the content of the message character for character, identify a query message on the basis of identification 44, and reply to address 45. Naturally, corresponding technology can also be applied when the useful content of the message has not been coded with any character set; however, character coding has the advantage that the message can also be construed by man as a query message, if for some reason the terminal equipment should not be capable of supporting said query application.

Thus a special case is a query message application in which the replying terminal equipment interprets all messages that have arrived as query messages, and thus no query message identification is needed in the messages. In that situation, the

appropriate terminal equipment utilizes the message switching service of the integrated services network only for receiving and replying to the queries.

5 Still another feature of the invention relates to the protection of the terminal equipment. It is possible to agree that the network has general queries defined therein, to which queries each terminal equipment always replies with a certain reply message containing public information, such as the  
10 communication information of the user. It is also possible to agree between two or more users that certain information is only given when the identification of the query message is of a private type agreed upon between the users of the terminal equipment, or  
15 that one or several message records are sent to the same recipient at a time. The terminal equipment can also be programmed to reply to query messages only when the reply address contained in the query message has been stored in the terminal equipment in advance,  
20 or if the password contained in the query message corresponds to a password stored in advance in the terminal equipment.

Correspondingly, the communication information of each terminal equipment connected to the message  
25 switching service of the integrated services network can be updated by means of an addressed message to those units of terminal equipment the addresses of which are in the internal telephone catalog of said terminal equipment.

30 It is evident to one skilled in the art that the different embodiments of the invention are not restricted to the examples set forth above, but they can vary freely within the scope of the appended claims.

## Claims:

1. A method for relaying information in an integrated services network (23), in which network a message switching service (24) is operative between the terminal equipment units of the network, characterized in that
- using a terminal equipment unit (1;38) of the network (23), information is inquired, via the network, of another terminal equipment (2;29;31) connected to the network by means of a query message (41) including at least a reply address;
  - that the terminal equipment (2;29;31) that is the target of the query generates a message containing the requested information;
  - and that the information is transmitted to the reply address automatically via the message switching service (24) of the network.
2. A method as claimed in claim 1, characterized in that the query messages (41) are distinguished from the other messages in the network by means of a separate identification in the useful content (43) or in the heading information (42).
3. A method as claimed in claim 1 or 2, characterized in that the query messages (41) contain an identification specific to the query type, on the basis of which the terminal equipment of the network can distinguish different queries from one another.
4. A method as claimed in claim 3, characterized in that when the identification of the query message (41) is of the general type defined in the network, the terminal equipment always replies to the query with a certain reply message con-

taining public information.

5 5. A method as claimed in claim 3, characterized in that when the identification of the query message (41) is of a type agreed upon between the users of the terminal equipment, the terminal equipment replies to the query with a reply message containing information agreed upon between the users.

10 6. A method as claimed in any one of claims 1 to 5, characterized in that the terminal equipment unit (2;29;31) replies to the query messages only when the reply address contained in the query message has been stored in advance in the terminal equipment unit.

15 7. A method as claimed in any one of claims 1 to 5, characterized in that the terminal equipment unit (2;29;31) replies to the query messages only when a password contained in the query message corresponds to a password stored in advance  
20 in the terminal equipment unit.

25 8. A method as claimed in claim 6, characterized in that the information of each terminal equipment connected to the message switching service of the integrated services network can be updated by means of an addressed message to the units of terminal equipment the addresses of which are in the internal telephone catalog of said terminal equipment.

30 9. A method as claimed in any one of claims 1 to 8, characterized in that each user of terminal equipment connected to the message switching service of the integrated services network can send one or several message records to the same recipient at a time.

35 10. A method as claimed in any one of claims 1

to 9, characterized in that the terminal equipment unit (29) replying to the queries is connected to an automatic system (30;34) that, among the services of the integrated services network, supports only a message switching service (24).

11. A method as claimed in any one of claims 1 to 9, characterized in that both the inquiring and the replying terminal equipment (38, 31) are connected to an automatic system (37;34) supporting only a message switching service (24).

12. A method as claimed in any one of claims 1 to 11, characterized in that in message switching service centers (SC), communication from terminal equipment units (MS) to the exterior of the integrated services network (PLMN), and vice versa, has been realized by means of different service modules (19,20,21) that are capable of converting, at least unidirectionally, short messages transferred over the signalling channel of the network, to a format intelligible to exterior systems (5,6,8), and vice versa.

13. A method as claimed in claim 12, characterized in that the message switching center has an adapter (20) for telefax transmission in message form from the units of terminal equipment.

14. A method as claimed in claim 12, characterized in that the message switching center has an adapter (19) for routing a remote paging call to the terminal equipment unit (7) in message form.

15. A method as claimed in claim 12, characterized in that the message switching center has an adapter (21) for realizing X.400 communications in message form.

16. A method as claimed in claim 12, characterized

a c t e r i z e d in that the message switching center has an adapter for sending and/or receiving short telex communications as messages.

5 a c t e r i z e d in that the message switching center has an adapter for sending and/or receiving electronic mail as messages.

10 18. A method as claimed in any one of claims 1 to 17, c h a r a c t e r i z e d in that by means of the method communication information of mobile phone users is transmitted via the short message service of a digital land mobile network.

15 19. A method as claimed in claim 18, c h a r a c t e r i z e d in that the communication information of each mobile phone (1) connected to the short message service of the network can be updated by means of a cell broadcast to all mobile phones (2a, 2b, 2c) operating under the same cell.

20 20. A method as claimed in any one of claims 1 to 17, c h a r a c t e r i z e d in that by means of the method messages are transmitted in a digital services network, such as an ISDN telephone network, provided with a message switching service.

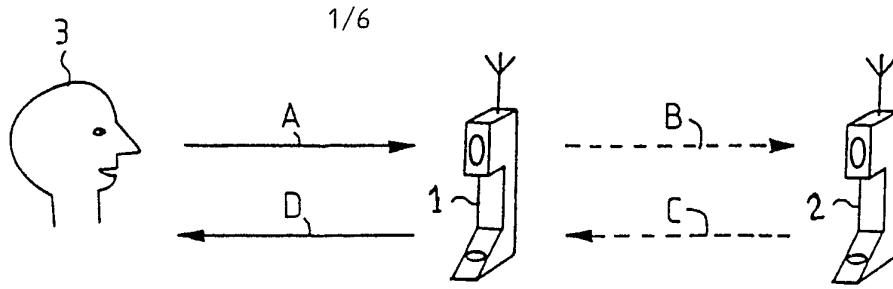


FIG. 1

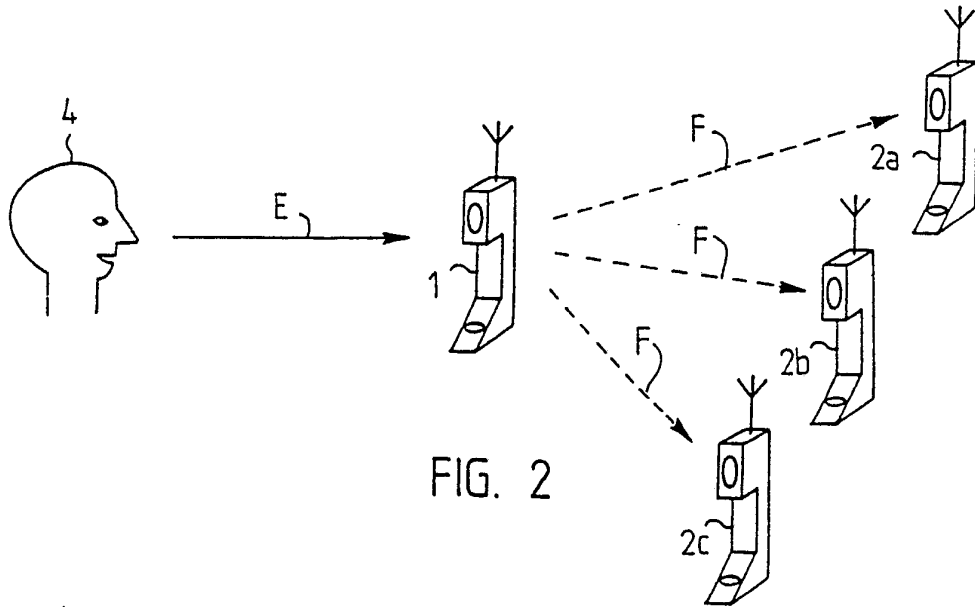


FIG. 2

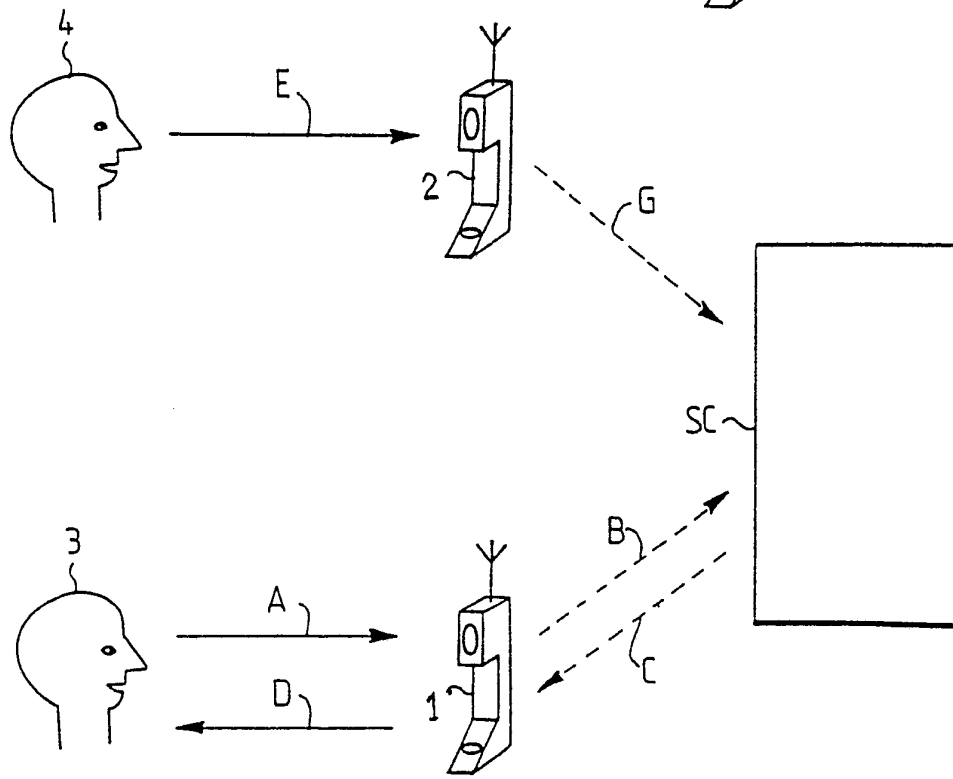
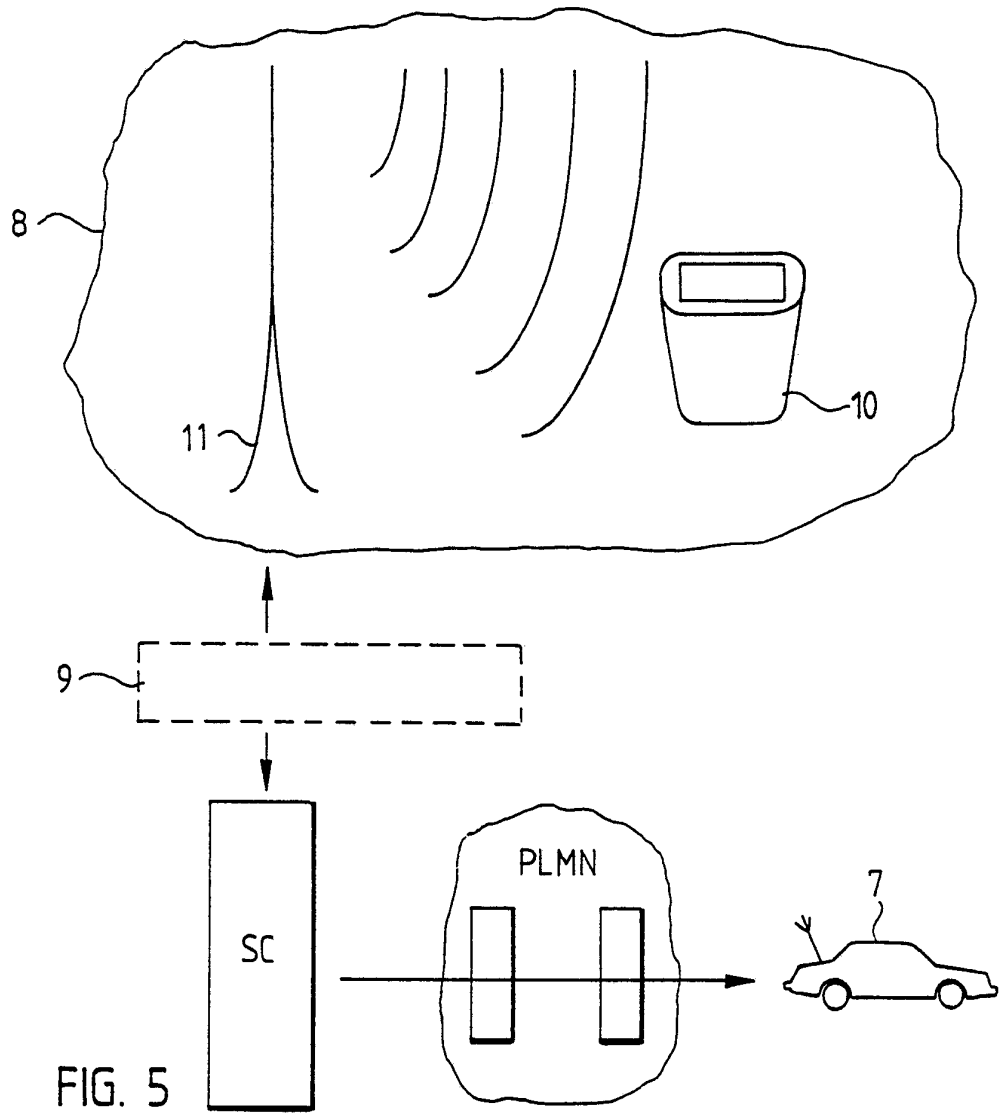
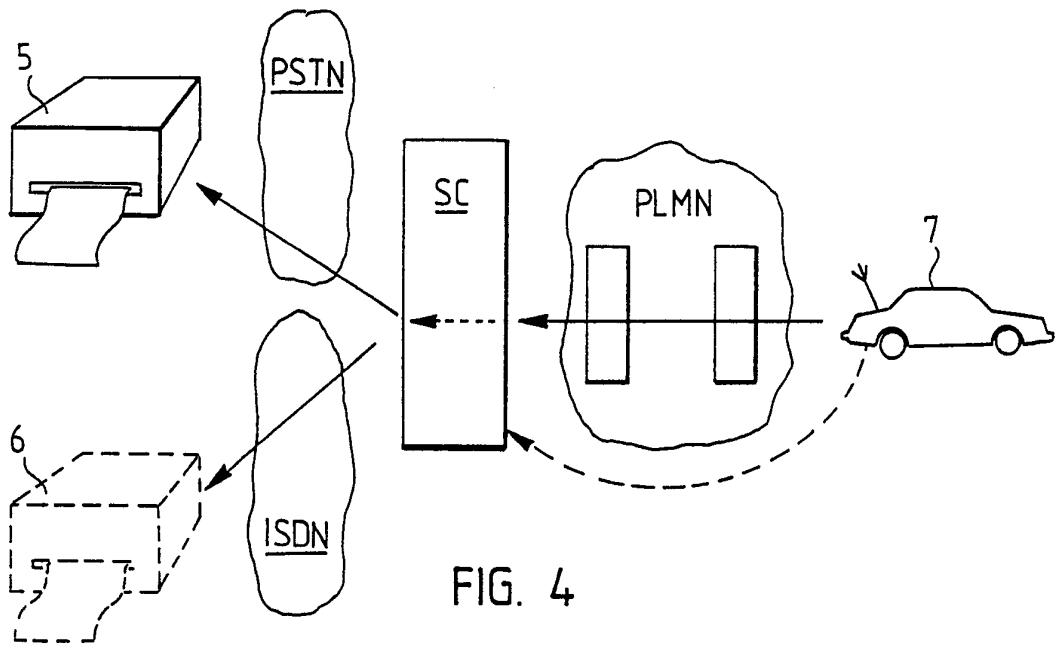


FIG. 3





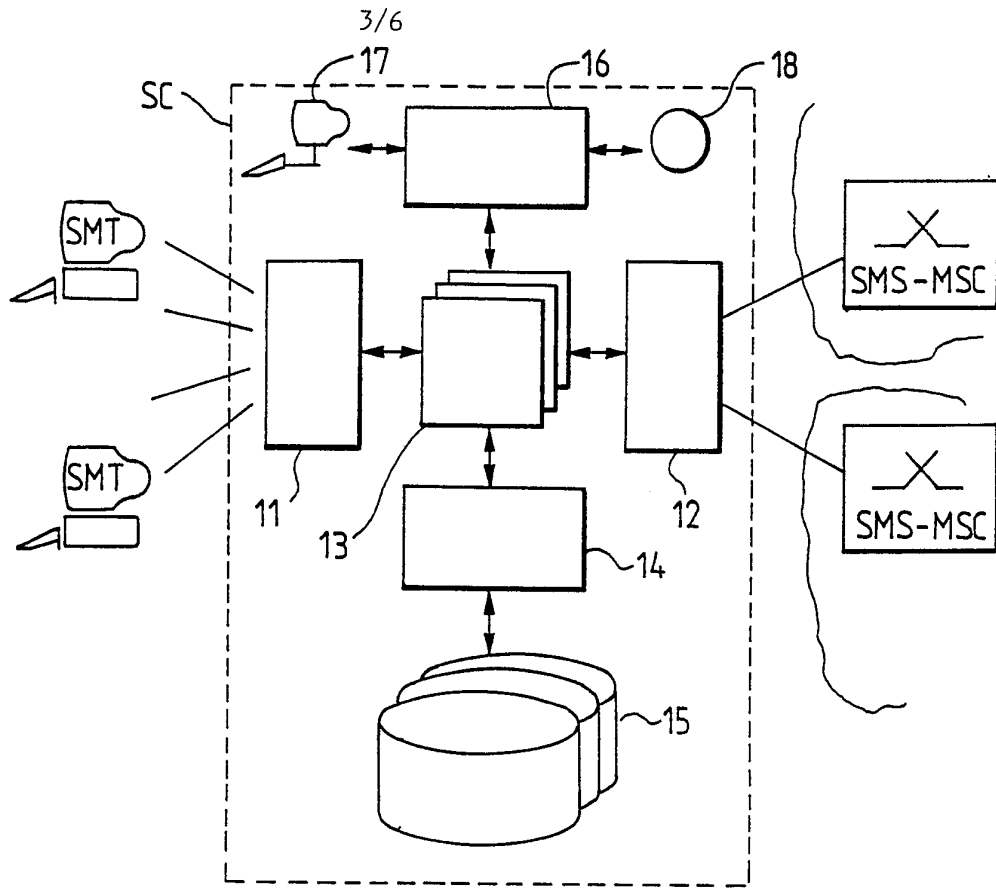


FIG. 6

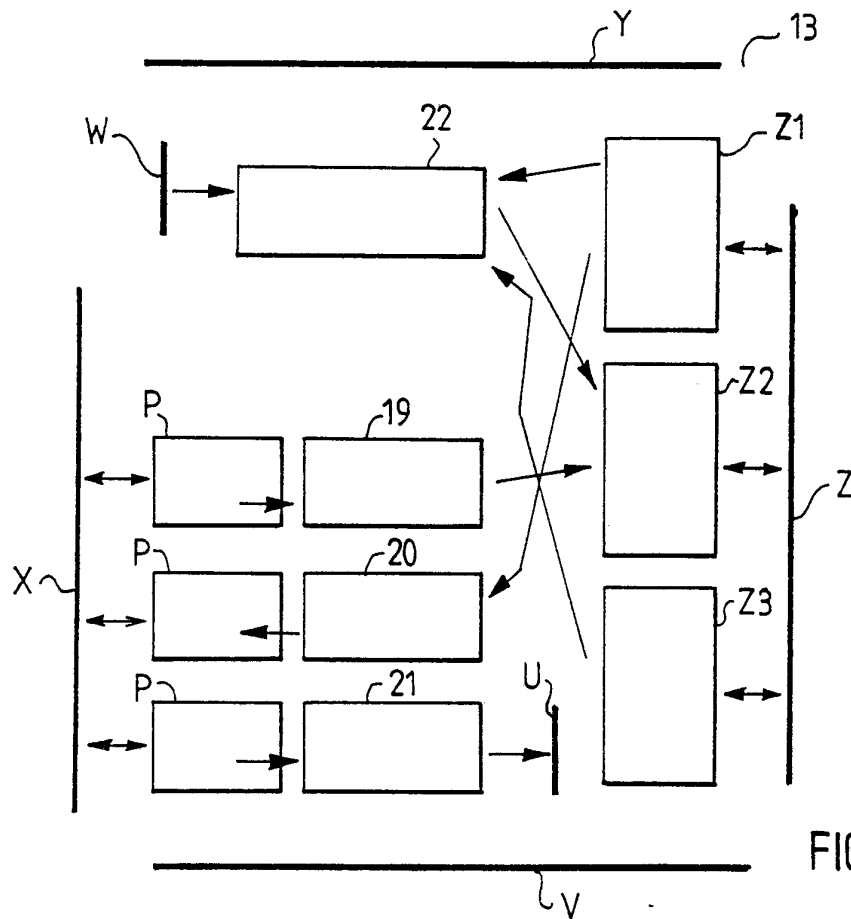


FIG. 7

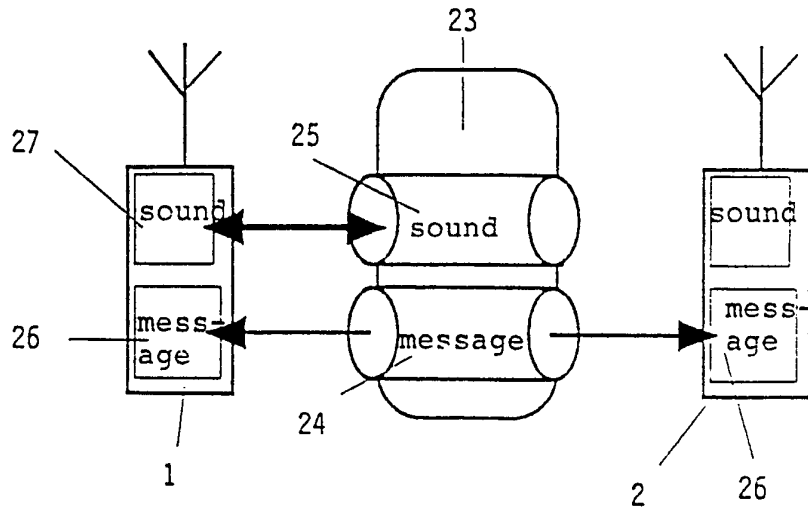


FIG. 8a

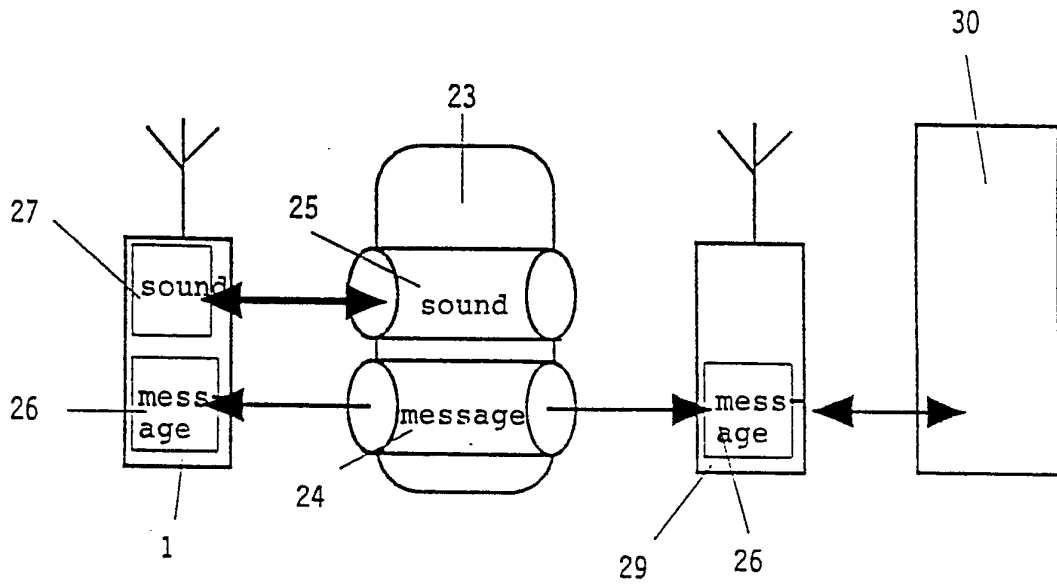


FIG. 8b

FIG. 9

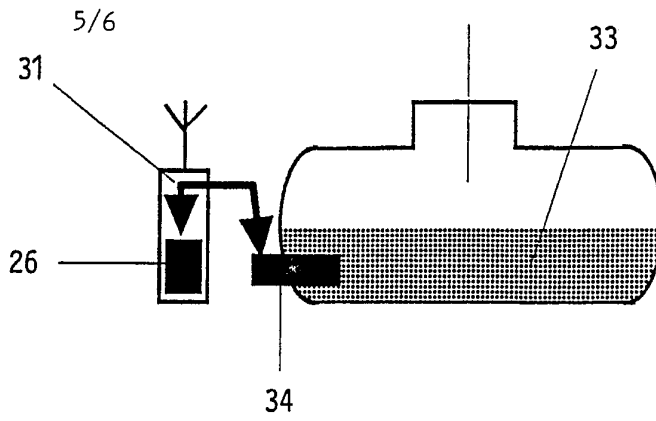


FIG. 10

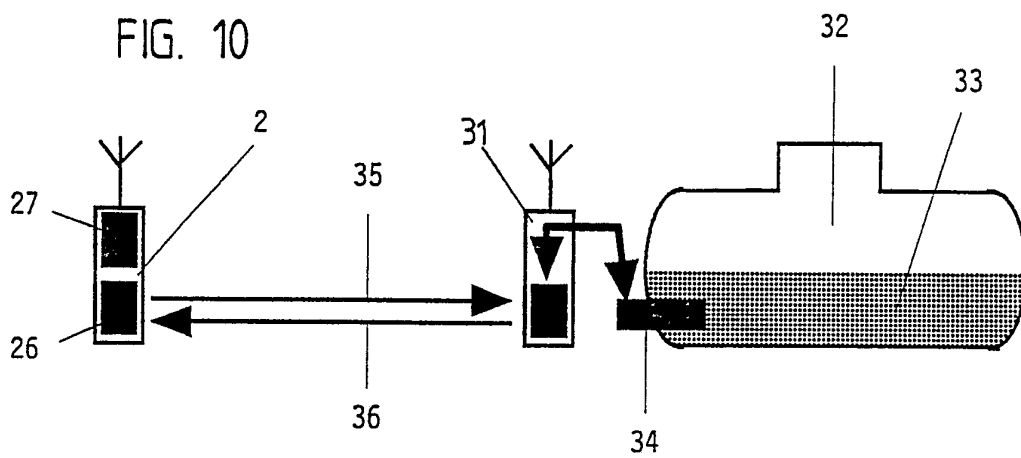
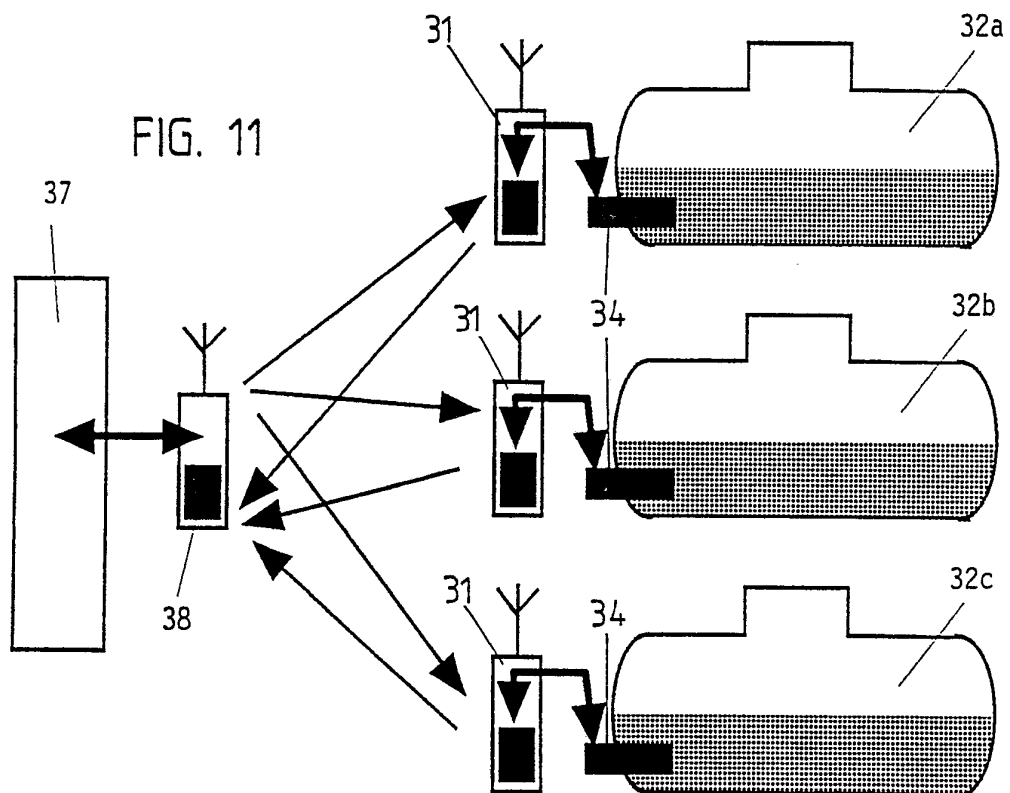


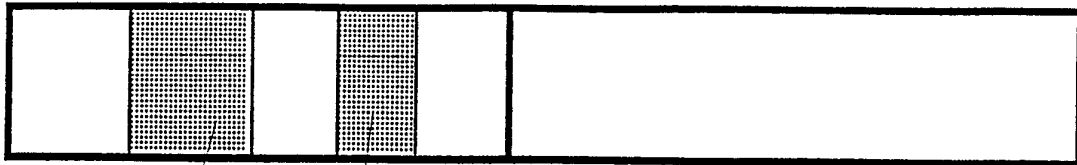
FIG. 11



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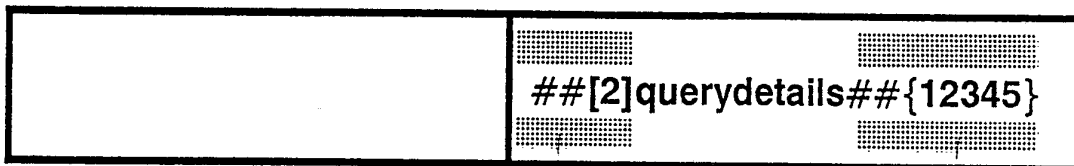
40 TP-PID

FIG. 12

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FIG. 13

# INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00035

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                 |                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                 |                                                     |
| According to International Patent Classification (IPC) or to both National Classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                 |                                                     |
| IPC5: H 04 M 3/42, H 04 Q 3/42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                 |                                                     |
| <b>II. FIELDS SEARCHED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                 |                                                     |
| Minimum Documentation Searched <sup>7</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                 |                                                     |
| Classification System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Classification Symbols                                                                                                                          |                                                     |
| IPC5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | H 04 M, H 04 Q                                                                                                                                  |                                                     |
| Documentation Searched other than Minimum Documentation<br>to the Extent that such Documents are Included in Fields Searched <sup>8</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                 |                                                     |
| SE,DK,FI,NO classes as above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                 |                                                     |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                 |                                                     |
| Category *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>                                  | Relevant to Claim No. <sup>13</sup>                 |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US, A, 4922486 (WILLIAM P. LIDINSKY ET AL)<br>1 May 1990, see column 17, line 21 -<br>line 68; column 66, line 11 -<br>column 67, line 27<br>-- | 1-17                                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | WO, A1, 8705764 (AMERICAN TELEPHONE & TELEGRAPH<br>COMPANY) 24 September 1987,<br>see page 11, line 1 - line 25;<br>figure 2<br>--<br>-----     | 1-17                                                |
| <p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p> |                                                                                                                                                 |                                                     |
| <b>IV. CERTIFICATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                 |                                                     |
| Date of the Actual Completion of the International Search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                 | Date of Mailing of this International Search Report |
| 12th May 1992                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                 | 1992 -05- 18                                        |
| International Searching Authority                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                 | Signature of Authorized Officer                     |
| SWEDISH PATENT OFFICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                 | <i>Göran Magnusson</i><br>GÖRAN MAGNUSSON           |

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00035**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 28/03/92  
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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