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(56) Documents Cited

EP 0395755 A1 EP 0345939 A2 US 5212809 A
US 5020094 A

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INT CL⁶ H04M 1/64 1/72 , H04Q 7/24 7/26 7/30 7/38
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(54) Cordless radio telephone system with a plurality of portable units

(57) The system has a base station 20 which can communicate with a plurality of portable units 21 to 25 each having a unique ID number. When an incoming call is received from a telephone line connected to base 20, an answering voice message is sent to the caller from the base 20, the message including the ID's of all the portable units. The caller then selects a particular portable unit by sending DTMF signals corresponding to the required ID. The base 20 detects the required portable from the DTMF signal, scans channels to find a free channel, and transmits the ID of the required portable on the selected channel. Each portable scans channels to find a channel with a signal strength above a reference level, then if the signal on the selected channel includes its own ID the portable operates a bell or buzzer to alert the user and transmits an acknowledge signal to the base 20 in response to which the base establishes a call mode. By operating certain buttons, a portable can be set in locked state which is registered with the base 20. If the base receives an incoming call for a portable which is in a locked state, it sends a voice message indicating that this portable is in a call denial state.

To set up a call from a portable, the portable scans channels for a free channel, indicated by signal strength below a reference, and then transmits its ID on the selected channel, and the base scans channels to find one with a signal strength above a reference, and then determines if the signal in the selected channel includes the ID of one of the portables.

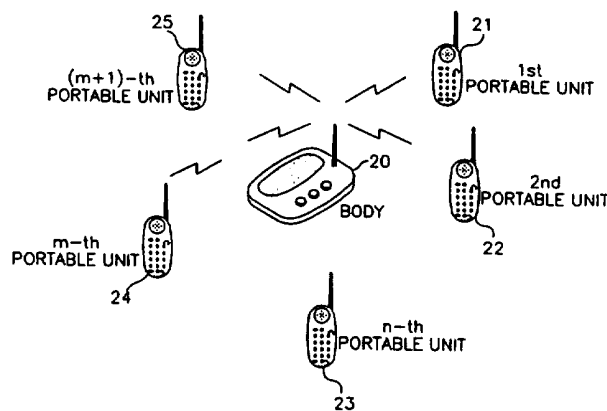


FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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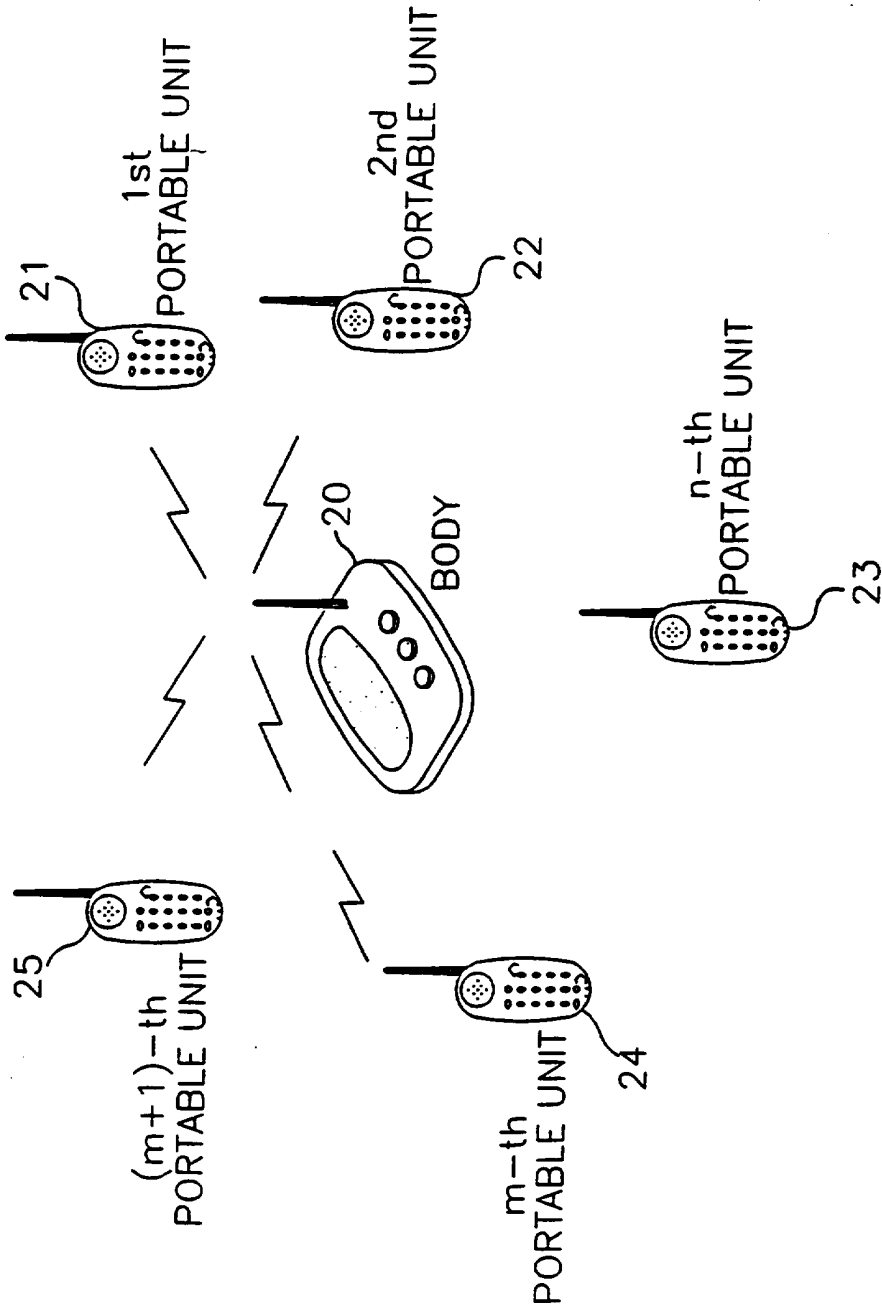


FIG. 1

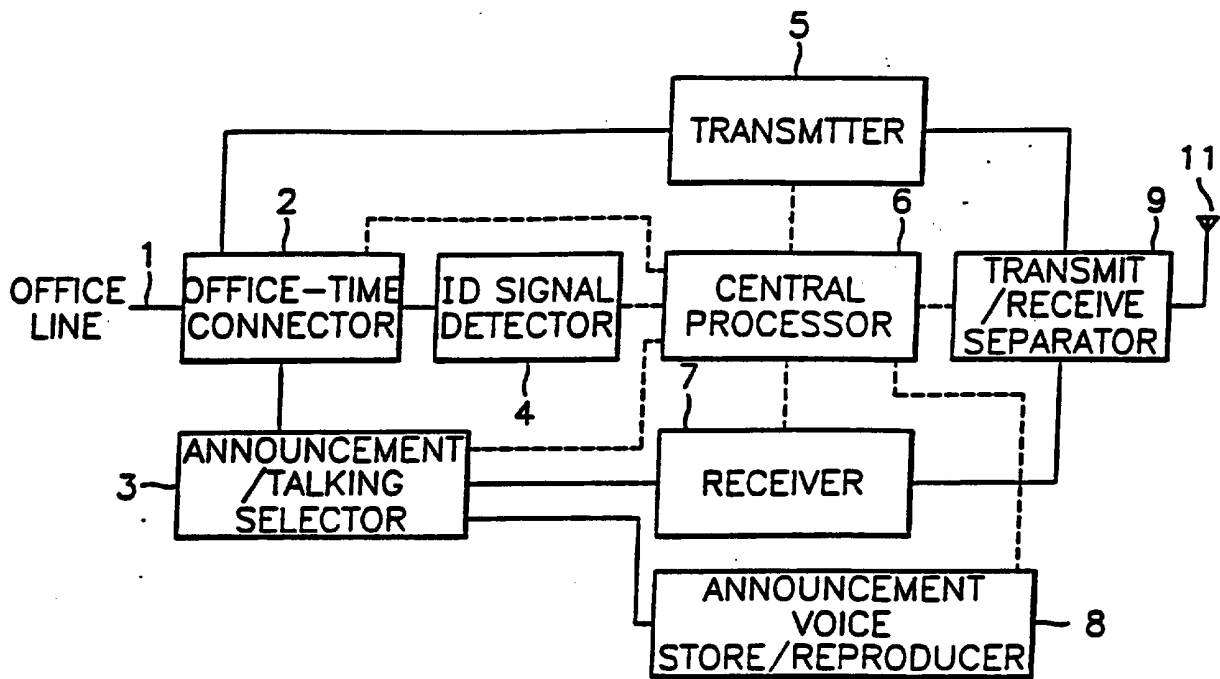


FIG. 2

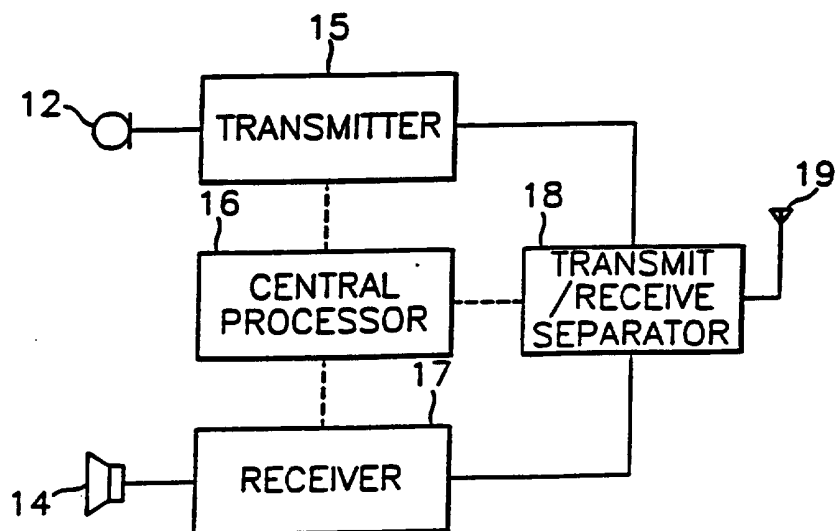


FIG. 3

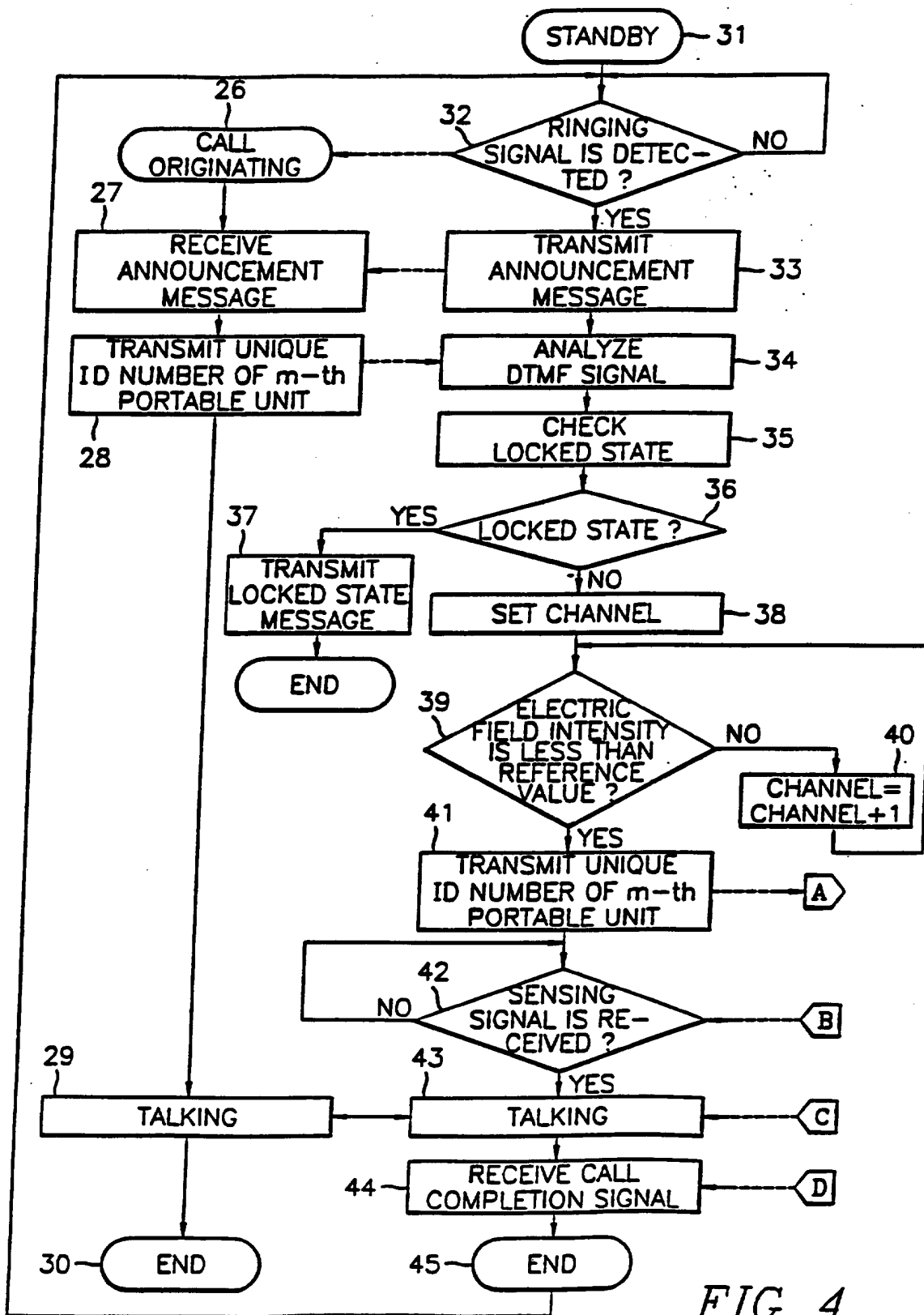


FIG. 4

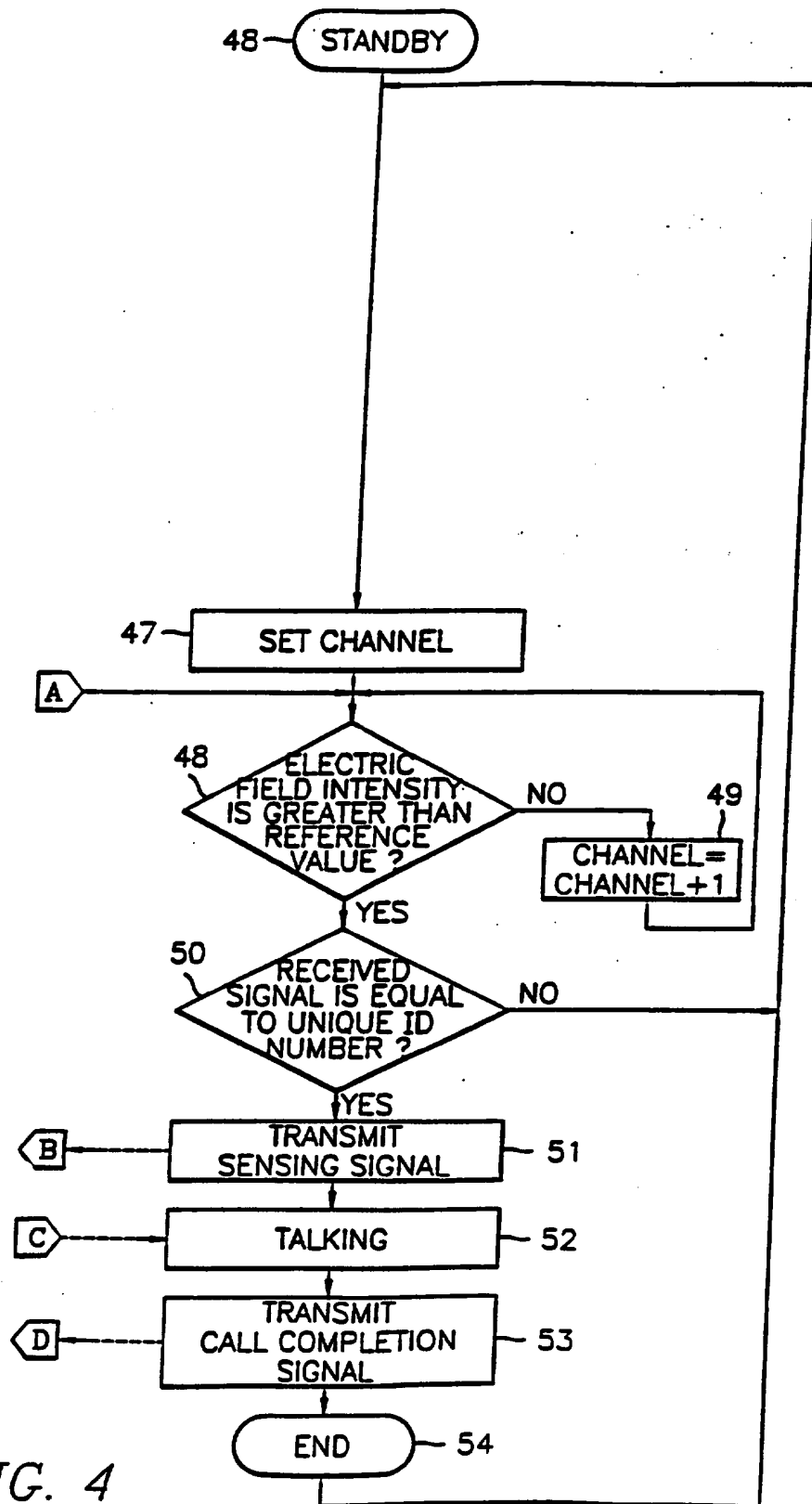


FIG. 4

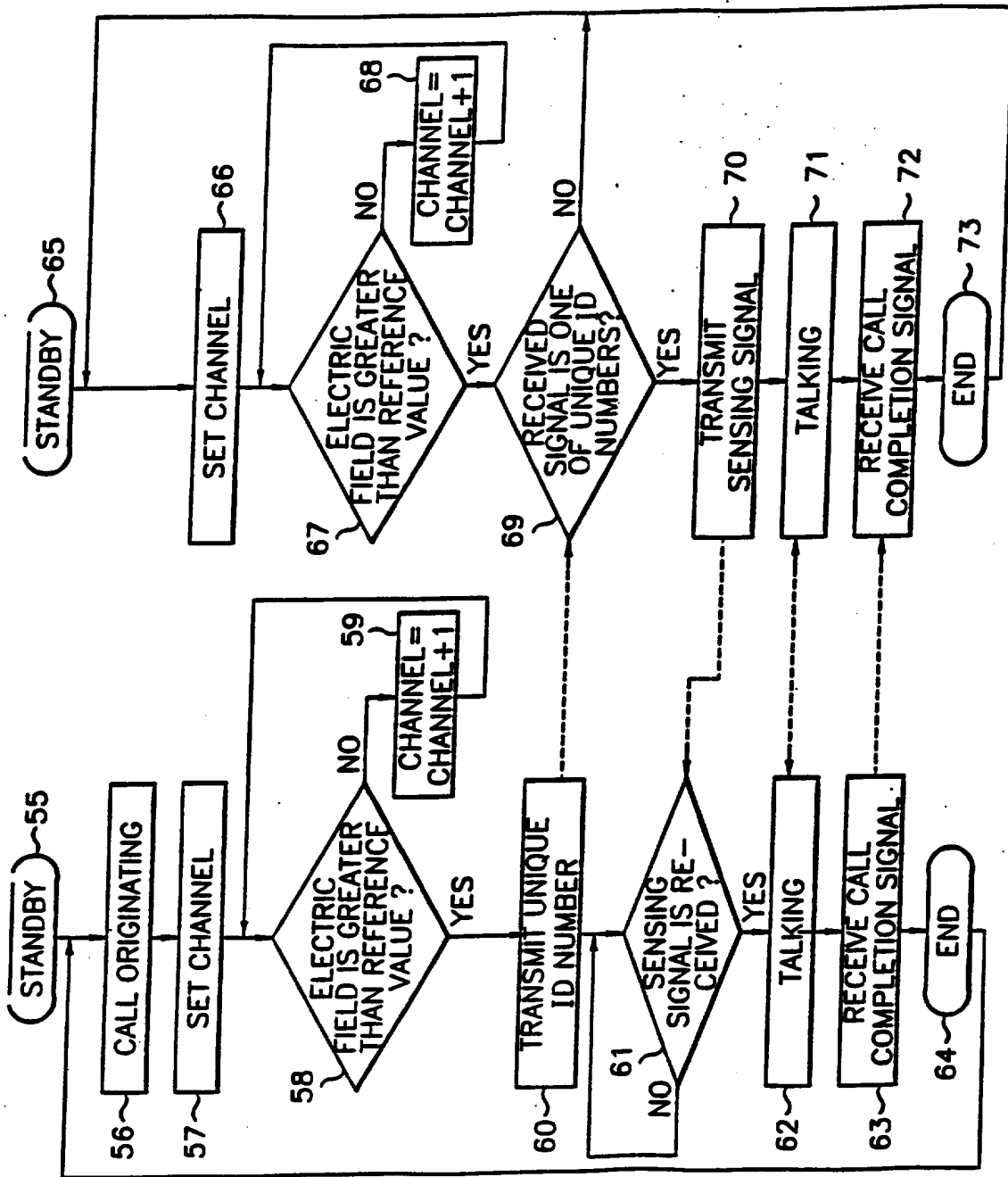


FIG. 5

RADIO TELEPHONE SYSTEM CALL CONTROL

The present invention relates to a method of controlling a radio telephone system having one body and at least two portable units.

5 Recently, radio telephone systems have tended to provide more than one portable unit for one body for the sake of users' convenience. That is, a plurality of portable units are provided as indicated in FIG. 1.

10 If a ringing signal is received by a body 20 of the radio telephone system of FIG. 1, the body 20 propagates incoming call data so as to ring an audible tone for the all the portable units. In other words, if the ringing signal is received through an office line, the body 20 sends the incoming call data to first, second, n-th, m-th and (m+1)-th portable units 21-25. All the portable units 21-25 then inform the user that a phone call is being made by driving a bell installed therein in response to the received call incoming data. In such a case, a talking path is formed between the body 20 and the first portable unit to respond.

15 If the n-th portable unit 23 responds first to the incoming call, whereas one whom an external calling party wants to call is around the m-th portable unit 24, a call transfer to the m-th portable unit 24 is needed at the request of the calling party. For the call transfer, the n-th portable unit 23 should transmit to the body 20 call transfer data indicating that the call is transferred to the m-th portable unit 24.

20 The body 20 receiving the call transfer data transmitted from the n-th portable unit 23 transmits a paging signal to the m-th portable unit 24. If the m-th portable unit 24 responds to the paging signal transmitted from the body 20, the body 20 cuts off the talking path with the n-th portable unit 23, and forms a talking path with the m-th portable unit 24. Therefore, the call is transferred from the n-th portable unit 23 to the m-th portable unit 24.

25 However, since the call is transferred by a user firstly responding to the incoming call (for example, generating the call transfer data), the waiting time of

the calling party is increased. Further, frequent call transfer processes result in deterioration in work efficiency.

5 It is therefore an object of the present invention to provide a control method which is capable of individually calling a portable unit in accordance with an external calling party's wishes, selecting that unit out of a plurality of portable units in a radio telephone system.

10 In accordance with one aspect of the present invention, a method of operating a body in a radio telephone system having the said body connected to a telephone line and at least two portable units each having a unique call number, the method comprises the steps of:

- (a) sending a predefined automatic answering message and individual call announcement messages of the portable units in response to a call signal from the telephone line;
- 15 (b) detecting an individual call number received through the telephone line; and
- (c) transmitting the detected call number to the portable units and forming a talking path to the portable unit responding to the transmitted call number.

20 Preferably, step (b) comprises the steps of:
receiving a dual tone multi-frequency (DTMF) signal from the telephone line, detecting the said individual call number and checking the state of the portable unit corresponding to the detected individual call number; and
if the portable unit corresponding to the individual call number is in a locked state, transmitting a call denial voice announcement message to the
25 telephone line.

Preferably, step (c) comprises the steps of:
scanning radio channels until the electric field intensity of a signal received on a particular channel exceeds a predetermined value;

receiving an individual call signal from a portable unit received through that particular channel; and

if the individual call signal is equal to said unique call number, driving a bell to indicate a call state.

5 According to a second aspect of the present invention, a method of operating a portable unit in a radio telephone system having at least two portable units and a body for transmitting an individual call signal received on an attached telephone line, comprises the steps of:

10 (a) periodically scanning radio channels until the electric field intensity of a signal received on a particular channel is greater than a given level;

 (b) comparing the signal received with an unique individual call signal; and

15 (c) if the received call signal is equal to the unique call signal, driving a call bell, transmitting a sensing signal to the body and forming a talking path with the body.

 In a third aspect of the invention, a method of operating a body in a radio telephone system having the said body connected to a telephone line and at least two portable units, each having an unique individual call signal, comprises the steps of:

20 (a) checking whether or not an electric field intensity of a signal received by periodically scanning a radio channel exceeds a reference value;

 (b) if the electric field intensity is less than the reference value, increasing the channel and repeating the checking step, and if the electric field intensity is greater than the reference value, checking whether the signal received is one of the unique individual call signals of the portable units; and

25 (c) if the received signal is one of the unique individual call signals, transmitting a sensing signal to the portable unit to form a talking path on the radio channel.

A fourth aspect of the present invention provides a body adapted to be connected to a telephone line and for use in a radio telephone system including at least two portable units each having a unique call number, the body comprising means for:

- 5 (a) sending a predefined automatic answering message and individual call announcement messages of the portable units in response to a call signal from the telephone line;
- (b) detecting an individual call number received through the telephone line; and
- 10 (c) transmitting the detected call number to the portable units and forming a talking path to the portable unit responding to the transmitted call number.

A fifth aspect of the invention provides a portable unit for use in a radio telephone system having at least two portable units and a body for transmitting an individual call signal received on an attached telephone line, the unit comprising means for:

- 15 (a) periodically scanning radio channels until the electric field intensity of a signal received on a particular channel is greater than a given level;
- (b) comparing the signal received with an unique individual call signal;
- 20 and
- (c) if the received call signal is equal to the unique call signal, driving a call bell, transmitting a sensing signal to the body and forming a talking path with the body.

A sixth aspect of the invention provides a body adapted to be connected to a telephone line and for use in a radio telephone system having at least two portable units, each having an unique individual call signal, the body comprising means for:

- 25 (a) checking whether or not an electric field intensity of a signal received by periodically scanning a radio channel exceeds a reference value;

(b) if the electric field intensity is less than the reference value, increasing the channel and repeating the checking step, and if the electric field intensity is greater than the reference value, checking whether the signal received is one of the unique individual call signals of the portable units; and

5 (c) if the received signal is one of the unique individual call signals, transmitting a sensing signal to the portable unit to form a talking path on the radio channel.

The present invention will now be described by way of example only, with reference to the accompanying drawings, in which:

10 FIG. 1 is a schematic diagram showing a radio telephone system having a plurality of portable units;

FIG. 2 is a block diagram showing a body of the radio telephone system;

FIG. 3 is a block diagram showing a portable unit of the radio telephone system;

15 FIG. 4 is a flow chart showing an individual calling procedure of a plurality of portable units during an incoming call according to the present invention; and

FIG. 5 is a flow chart showing an individual calling procedure of a plurality of portable units during call origination according to the present invention.

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FIG. 2 is a block diagram of the body 20 of the radio telephone system. An office line connector 2 detects a ringing signal from an office line 1 and connects a talking path with the office line 1. An announcement voice store/reproducer 8 records/reproduces an automatic answering message, and an announcement message reciting a unique ID number for each portable unit. An announcement/talking selector 3 selects the announcement message or a talking voice received from the portable unit or both to be connected to the office line connector 2. An ID signal detector 4 connected to the office line connector 2 detects dual tone multi-frequency (DTMF) signals received by additionally selecting the portable unit after a calling party dials a telephone number and

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converts the DTMF signal to digital data. A transmitter 5 modulates a signal from the office line connector 2 in response to a transmitting control signal. A receiver 7 demodulates a received modulation signal in response to a receiving control signal and supplies the demodulated signal to the announcement/talking selector 3. A transmit/receive separator 9 separates the transmitter 5 and the receiver 7 to be connected to an antenna 11. A central processor 6 controls each circuit.

The central processor 6 has a memory for storing unique ID numbers of portable units which are able to communicate. In addition to the ID numbers, data received from each portable unit is also stored in the memory.

10 Referring to FIG. 3, the portable unit of the radio telephone system includes a microphone 12, a speaker 14, a transmitter 15 for modulating and transmitting a voice signal generated from the microphone 12 in response to a transmitting control signal, a receiver 17 for demodulating a received modulation
15 signal in response to a receiving control signal and transmitting the demodulated signal to the speaker 14, a transmit/receive separator 18 for separating the transmitter 15 and the receiver 17 in response to a transmitting and receiving control signal and matching the transmitter 15 and receiver 17 with an antenna 19, and a central processor 16 for controlling the portable unit.

20 The portable unit constructed in the above-mentioned way analyzes data received from a key pad, stores the data in an internal memory, and transmits the analyzed data to the body 20.

FIGs. 4 and 5 illustrate an individual calling procedure of a plurality of portable units during an incoming call and during call origination, respectively.

25 Now, a process for individually calling the portable units when an incoming call signal is received by the radio telephone system, and a call originating process of a plurality of portable units will be described with reference to FIGs. 1 to 5.

If the body 20 is operational, the central processor 6 which has been in standby mode at step 31 as shown in FIG. 4 periodically checks, at step 32, whether or not a ring detection signal is received from the office line connector 2. In this time, respective portable units 21-25 having the construction of FIG. 3 are in a stand-by mode at step 46.

If an external calling party who wants to call the user of any portable unit dials the telephone number of the radio telephone system at step 26, an exchange device of a public telephone communication network sends a ringing signal through the office line 1 to the office line connector 2 within the body 20. The office line connector 2 detects the ringing signal from the office line 1 and transmits the information that the ringing signal has arrived at the central processor 6. Then central processor 6 which has been in the standby mode transmits to the announcement voice store/reproducer 8 a voice announcement control signal for announcing an ID number assigned to each portable unit to the calling party, and simultaneously transmits an announcement select signal to the announcement/talking selector 3, at step 33.

The announcement voice store/reproducer 8 receiving the voice announcement control signal from the central processor 6 transmits a voice signal of each portable unit ID number to the announcement/talking selector 3. The announcement/talking selector 3 sends an announcement voice signal generated from the central processor 6 to the calling party through the office line connector 2. The calling party listens to the unique ID number of the portable unit generated from the body 20, at step 27.

The announcement voice signal recites the unique ID number of each portable unit. The central processor 6 of the body 20 checks whether or not a DTMF signal is received by periodically scanning the output of the ID signal detector 4.

Meanwhile, if the calling party transmits the unique ID number of the m-th portable unit 24 by the DTMF signal while listening to the announcement voice or after listening to the announcement voice, in order to call the user of the m-th portable unit, the DTMF signal is received at the office line connector 2 via a talking path. The DTMF signal can be easily generated by operating the keys on the key pad of the caller's telephone. The DTMF signal received at the office line connector 2 is supplied to the ID signal detector 4. The ID signal detector 4 may be easily constructed using a one-chip circuit typically known as a DTMF decoder or a DTMF receiver. The ID signal detector 4 converts the DTMF signal generated from the office line connector 2 into 4-bit digital data to be transmitted to the central processor 6.

The central processor 6 analyzes the 4-bit digital data, i.e. DTMF data, generated from the ID signal detector 4 to sense the unique ID number of the portable unit, at step 34.

The central processor 6 checks, at step 35, a locked state set in the internal memory based on the unique ID number of the portable unit as shown in the following table. The locked state of the portable unit is registered in the central processor 6 of the body 20 by communication between the portable units 21-25 and the body 20. For instance, if the user of the m-th portable unit 24 generates a call denial signal by the combination of the ten-key and function keys installed on the key pad, the m-th portable unit 24 transmits call denial data including its unique ID number to the body 20.

Table

Unique ID Number of Portable Unit	Locked State Flag of Portable Unit
1	0
2	0
n	0
m	0
m+1	0

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The central processor 6 of the body 20 analyzes the call denial data received through the transmit/receive separator 9 and the receiver 7, and sets the locked state flag corresponding to the unique ID number of the m-th portable unit. If the flag in the locked state table is set, the portable unit having the corresponding unique ID number becomes a call denial state. For resetting the flag of the locked state table, the above-mentioned processes are repeated. In the above table, if the flag is "0", a call is accessible and if it is "1", a call is not accessible.

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The central processor 20 checking the locked state table at step 35 checks, at step 36, whether or not the locked state flag of the portable unit corresponding the received unique ID number is a locked state. If so, the central processor 6 transmits, at step 37, a voice message indicating that the portable unit selected by the calling party is a call denial state to the calling party through the office line connector 2 by controlling the announcement voice store/reproducer 8 and the announcement/talking selector 3, and then terminates the call. Therefore, the denial message is transmitted to the calling party and the incoming call can be denied.

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5 If the locked state flag of the portable unit corresponding to the received unique ID number is "0" which is not the locked state, the central processor 6 sets, at step 38, any channel, and checks, at step 39, whether or not the electric field intensity of a signal received over the set channel is less than a reference value. The electric field intensity checking process is the same as the operation of a general radio telephone. If the electric field intensity is greater than the reference value, the central processor 6 judges that the adjacent radio telephone uses the set channel, and increments, at step 40, the channel by 1 to check again the electric field of the received signal.

10 If the electric field intensity of the signal received by another channel is less than the reference value, the central processor 6 transmits through the set channel the unique ID number of the portable unit, i.e. the unique ID number of the m-th portable unit. The signal transmitted from the body 20 is transmitted as in a typical radio telephone through the transmitter 5 and the transmit/receive separator 9 by the control of the central processor 6. The body 20 sending the unique ID number of the m-th portable unit at step 41 checks, at step 42, whether or not a sensing signal is received by the output of the receiver 7.

20 On the other hand, the central processor 16 of each portable unit which has been in a standby state, sets, at step 47, any channel, and checks, at step 48, whether the electric field intensity in the set channel is greater than the reference value. That is, whether or not data is transmitted from the body 20 is checked. If the electric field intensity is less than the reference value, the channel is incremented by 1. If the electric field intensity is greater than the reference value, the central processor 16 receives a signal transmitted from the body 20. The signal transmitted from the body 20 is received through the transmit/receive separator 18 and the receiver 17 of the portable unit of FIG. 3, and the central processor 16 receives the data signal through the receiver 17.

The central processor 16 receiving the data signal through the receiver 17 of the portable unit checks, at step 50, whether or not the received data signal is

equal to the unique ID number. If they are not equal, the central processor 16 returns to step 46. If they are equal, the central processor 16 informs the user that there is an incoming call by driving a bell or a buzzer, at step 51. If the user responds thereto, the sensing signal is transmitted to the body 20 through the transmitter 15, the transmit/receive separator 16 and the antenna 19. Therefore,
5 even when all the portable units receive the unique ID number for calling the m-th portable unit from the body 20, only the portable unit having the corresponding unique ID number generates the sensing signal.

If the sensing signal is received from the receiver 7 at step 42, the central
10 processor 6 of the body 20 is set to a call mode and transmits a signal received from the office line connector 2 to the m-th portable unit 25. That is, if the central processor 6 of the body 20 receives the sensing signal sent from the m-th portable unit 25, a call between the calling party and the m-th portable unit 25 is made.

The user of the m-th portable unit 25 completes the call, the central
15 processor 16 of the m-th portable unit 25 transmits, at step 53, a call completion signal to the body 20 through the transmitter 15 and the transmit/receive separator 18. The body 20 receives the call completion signal transmitted from the portable unit at step 44 and completes the call by hook-on of the office line connector 2.
20 The body 20 and the m-th portable unit 25 then switch to standby mode.

Therefore, if the ringing signal is received from the calling party to the
body 20, the calling party listens to the automatic answering message and the unique ID number of each portable unit generated from the body 20. The call connection with the portable unit is made by the selection operation of the calling
25 party.

If any one of the portable units 21-25 in the standby mode telephones an external person, the call originating process is shown in FIG. 5.

If the user of the portable unit which has been in standby mode at step 55 originates a call, at step 56, by selecting a call originating key (not shown), the central processor 16 of the portable unit sets, at step 57, any channel. The central processor 16 of the portable unit checks, at step 58, whether or not the electric field intensity of a signal received by the channel is less than a reference value to see if the set channel is being used. If the electric field intensity is greater than the reference value, the central processor 16 of the portable unit increments, at step 59, the set channel by 1 and returns to step 57 to set another channel. If the channel which is not used is set, the central processor 16 of the portable unit transmits, at step 60, the unique ID number to the body 20, and checks, at step 61, whether or not a sensing signal is received through the transmit/receive separator 18 and the receiver 17.

The central processor 6 of the body 20 which has been the standby state at step 65 sets, at step 66, any channel, and checks, at step 67, whether or not the electric intensity of a signal received by the set channel is greater than the reference value to see if the signal is received by the set channel. If the electric field intensity is less than the reference value, the central processor 6 increments the channel by 1 at step 68 and returns to step 66. If the electric field intensity is greater than the reference value, the received unique ID number is checked to see if it is one of the unique ID numbers stored in the internal memory. If not, the central processor 6 of the body 20 returns to step 66.

If the received signal is one of the unique ID numbers stored in the memory, the central processor 6 of the body 20 transmits, at step 70, the sensing signal to the portable unit, and enters a call mode. That is, the central processor 6 controls the office line connector 2 to a hook-off state in response to the unique ID number of the portable unit. The sensing signal transmitted from the body 20 is received by the central processor 16 through the antenna 19, the transmit/receive separator 18 and the receiver 17. If the sensing signal is received, the central processor 16 of the portable unit performs the call mode. Then a talking path is formed between the body and the portable unit transmitting the

unique ID number. If a call completion signal is transmitted to the body 20 at step 63, the body 20 receives the call completion signal at step 72, and cuts off the talking path.

5 Consequently, the talking path is formed between the body 20 and the portable unit transmitting the unique ID number.

10 As described above, a unique ID number is designated to each of a plurality of portable units, and the automatic answering voice message and the unique ID number are announced in response to incoming calls. Therefore, the portable unit is individually called by the external calling party and there is no need to transfer external calls manually.

CLAIMS:

1. A method of operating a body in a radio telephone system having the said body connected to a telephone line and at least two portable units each having a unique call number, the method comprising the steps of:

5 (a) sending a predefined automatic answering message and individual call announcement messages of the portable units in response to a call signal from the telephone line;

(b) detecting an individual call number received through the telephone line; and

10 (c) transmitting the detected call number to the portable units and forming a talking path to the portable unit responding to the transmitted call number.

2. A method as claimed in claim 1, wherein step (b) comprises the steps of: receiving a dual tone multi-frequency (DTMF) signal from the telephone
15 line, detecting the said individual call number and checking the state of the portable unit corresponding to the detected individual call number; and

if the portable unit corresponding to the individual call number is in a locked state, transmitting a call denial voice announcement message to the telephone line.

20 3. A method as claimed in claim 1 or claim 2, in which step (c) comprises the steps of:

scanning radio channels until the electric field intensity of a signal received on a particular channel exceeds a predetermined value;

25 receiving an individual call signal from a portable unit received through that particular channel; and

if the individual call signal is equal to said unique call number, driving a bell to indicate a call state.

4. A method of operating a portable unit in a radio telephone system having at least two portable units and a body for transmitting an individual call signal received on an attached telephone line, the method comprising the steps of:

5 (a) periodically scanning radio channels until the electric field intensity of a signal received on a particular channel is greater than a given level;

(b) comparing the signal received with an unique individual call signal; and

10 (c) if the received call signal is equal to the unique call signal, driving a call bell, transmitting a sensing signal to the body and forming a talking path with the body.

5. A method as claimed in claim 4, further comprising, if a talking completion signal is received, transmitting the talking completion signal to the body and entering a standby mode.

15 6. A method of operating a body in a radio telephone system having the said body connected to a telephone line and at least two portable units, each having an unique individual call signal, the method comprising the steps of:

(a) checking whether or not an electric field intensity of a signal received by periodically scanning a radio channel exceeds a reference value;

20 (b) if the electric field intensity is less than the reference value, increasing the channel and repeating the checking step, and if the electric field intensity is greater than the reference value, checking whether the signal received is one of the unique individual call signals of the portable units; and

25 (c) if the received signal is one of the unique individual call signals, transmitting a sensing signal to the portable unit to form a talking path on the radio channel.

7. A method of operating a body in a radio telephone system having the said body connected to a telephone line and at least two portable units, the method being substantially as described herein with reference to the accompanying drawings.

8. A method of operating a remote unit in a radio telephone system having a body connected to a telephone line and at least two portable units, the method being substantially as described herein with reference to the accompanying drawings.

5 9. A body adapted to be connected to a telephone line and for use in a radio telephone system including at least two portable units each having a unique call number, the body comprising means for:

10 (a) sending a predefined automatic answering message and individual call announcement messages of the portable units in response to a call signal from the telephone line;

(b) detecting an individual call number received through the telephone line; and

15 (c) transmitting the detected call number to the portable units and forming a talking path to the portable unit responding to the transmitted call number.

10. A body as claimed in claim 9, wherein the individual call number is detected by means for:

20 receiving a dual tone multi-frequency (DTMF) signal from the telephone line, detecting the said individual call number and checking the state of the portable unit corresponding to the detected individual call number; and

if the portable unit corresponding to the individual call number is in a locked state, transmitting a call denial voice announcement message to the telephone line.

25 11. A body as claimed in claim 9 or claim 10, in which the detected call is transmitted by means for:

scanning radio channels until the electric field intensity of a signal received on a particular channel exceeds a predetermined value;

receiving an individual call signal from a portable unit received through that particular channel; and

if the individual call signal is equal to said unique call number, driving a bell to indicate a call state.

5 12. A portable unit for use in a radio telephone system having at least two portable units and a body for transmitting an individual call signal received on an attached telephone line, the unit comprising means for:

(a) periodically scanning radio channels until the electric field intensity of a signal received on a particular channel is greater than a given level;

(b) comparing the signal received with an unique individual call signal; and

10 (c) if the received call signal is equal to the unique call signal, driving a call bell, transmitting a sensing signal to the body and forming a talking path with the body.

15 13. A body adapted to be connected to a telephone line and for use in a radio telephone system having at least two portable units, each having an unique individual call signal, the body comprising means for:

(a) checking whether or not an electric field intensity of a signal received by periodically scanning a radio channel exceeds a reference value;

20 (b) if the electric field intensity is less than the reference value, increasing the channel and repeating the checking step, and if the electric field intensity is greater than the reference value, checking whether the signal received is one of the unique individual call signals of the portable units; and

(c) if the received signal is one of the unique individual call signals, transmitting a sensing signal to the portable unit to form a talking path on the radio channel.

25 14. A body for use in a radio telephone system substantially as described herein with reference to the accompanying drawings.

15. A portable unit for use in a radio telephone system substantially as described herein with reference to the accompanying drawings.



Application No: GB 9522812.8
Claims searched: 1,2,3,9,10,11

Examiner: M J Billing
Date of search: 7 February 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): H4L LDJ, LDLX, LDSJ, LDSX.

Int CI (Ed.6): H04M 1/64, 1/72; H04Q 7/24, 7/26, 7/30, 7/38.

Other: ONLINE : JAPIO, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP0395755A1 (TOSHIBA) - page 11 line 7 to page 13 line 13	1,9
A	EP0345939A2 (PLESSEY) - page 2 lines 26-48	1,9
A	US5212809 (SEIKO) - column 2 line 33 to column 3 line 50	1,9
X	US5020094 (RASH) - column 5 line 48 to column 8 line 49, column 9 lines 23-39	1,9 at least

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.