**Title:** AN EMERGENCY CALL UNIT

**Abstract**

A call unit (20) for use in an emergency call system has means for establishing outgoing telephonic communication over the public switched telephone network. The call unit (20) also comprises a dialler (40) operable to dial at least one designated remote destination under the control of operating means (24) responsive to an alarm signal. The operating means (24) is arranged to transmit alarm data to the remote location and is responsive to a control signal to transmit at least one pre-determined verbal message. The unit also includes addresses for the storage of data regarding the status thereof and speech means (48) for emitting a verbal message corresponding to data stored at an address in response to interrogation of the address.
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This invention relates to an emergency call system, more particularly to a call unit for use in such a system.

Emergency call systems are used both in sheltered housing schemes for the elderly and infirm and, more recently, in ordinary dwellings. Such systems comprise at each location to be monitored a call unit incorporating or for connection to a telephone usually operable in hands-free mode to transmit and receive speech and/or data via the public switched telephone network (PSTN). A typical call unit includes an automatic dialler responsive to an alarm signal generated at will by pressing an alarm button or automatically by any of a wide variety of sensors or detectors that may be connected to the call unit to raise an alarm in the event of a fire, unauthorised entry of the premises or the like, to establish a connection via the PSTN with a monitoring station which may be a local warden's office or control centre responsible for many thousands of monitored locations over a wide geographical area.

Upon establishing a telephone link with the monitoring station, more specifically with a computer at the
station, the call unit will automatically transmit a limited amount of data identifying the location and the nature of the alarm. The station operator may then intervene causing a control signal to be transmitted from the monitoring station in response to which the local call unit is set in (hands-free) speech mode. It may be, however, that the occupier is absent or unable to respond in which case no further information is available to the station operator.

According to the present invention we propose a call unit for use in an emergency call system and having means for establishing incoming and outgoing telephonic communication over the PSTN, a dialler operable to dial at least one designated remote location under control of operating means responsive to an alarm signal, the operating means being arranged to transmit alarm data, for example, identifying the call unit and the nature of the alarm, to the remote location and being responsive to a control signal to transmit pre-determined verbal messages.

It is preferred that the dialling facility be arranged automatically to dial a number of different destinations in a predetermined order. This then enables a friend or relative to be alerted as first
priority thus relieving the monitoring station of the burden of responding to all alarm calls.

As in conventional emergency call systems, the call unit of the present invention may have associated therewith a remote trigger device to be carried or worn by the occupier or user of the premises. An alarm can therefore be raised by means of an alarm button either on the call unit itself or on the pendant.

In the preferred embodiment of this invention, the pendant incorporates a telephone keypad or other input device identical with that on the call unit and enabling remote operation of the call unit either in ordinary telephonic mode or in alarm mode.

The transmission of pre-determined verbal messages, for example, supplementary digital alarm data may be triggered by incoming control signals generated by the control centre or monitoring station operator. Alternatively, or in addition, verbal messages may be transmitted by the occupier using the telephone keypad enabling selected replies to be given in response to questions asked by the responder or monitoring station operator.
The pre-determined verbal messages may be pre-recorded and stored in either analogue form, for example, on magnetic tape or in digital form as in a solid-state ROM. Alternatively, and in the preferred embodiment verbal messages are constructed as appropriate to the particular control signals received and the operating mode or status, from a stored vocabulary of words and/or phrases or sounds assembled to simulate speech, by a speech encoder under control of the operating means.

According to another aspect of the invention there is provided a telephone unit including addresses for the storage of data regarding the status of the telephone unit and speech means for emitting a verbal message corresponding to data stored at an address in response to interrogation of the address.

In this way a user or a technician can readily check upon the status of a telephone unit and obtain information in a readily comprehensible form.

Preferably, the speech means is arranged to emit a verbal message in response to a dialled number sequence constituting an address interrogation code.

According to a further aspect of the invention there
is provided a telephone unit including speech means
arranged to say a dialled number when it has been
dialled.

The information may be said through the telephone
handset or handspeaker, if one is provided, and this
function will help users with poor sight and provide a
check on a number dialled. The whole number
comprising a sequence of digits may be repeated after
dialling is complete or preferably the speech means is
arranged to say a dialled digit when it has been
dialled.

In each case, preferably the speech means comprises
operating means arranged to control a store to provide
speech signals to a speaker. The store may be pre-
recorded magnetic tape but preferably the store is a
solid-state ROM. Preferably the store forms part of a
speech encoder.

An embodiment of the present invention will now be
described by way of example with reference to the
accompanying drawings in which:

Figure 1 schematically illustrates an emergency call
system
Figure 2 is a block diagram of the call unit of the emergency call system of Figure 1;

Figure 3 schematically illustrates operation of the emergency control system in communication via the PSTN with a monitoring station; and

Figure 4 schematically illustrates operation of the emergency control system in communication via the PSTN with an outside caller using a conventional telephone.

The emergency call system of Figure 1 to 4, includes a call unit 20 connected to the public switched telephone network (PSTN) and having hands-free (loudspeaker) speech facility.

The call unit 20 incorporates a micro controller 24 and has a ringer 26, line switch 28, voice amplifier and switches 30, handset 32, microphone 34 and loudspeaker 36, power supply 38, and a dialler 40 and tone encoder 42 as in a conventional hands-free telephone. The micro controller 24 controls communication between the keypad 44, and dialler 40, activates the line switch 28 and, via the tone encoder 42 and tone decoder 46 establishes a two way data link enabling interrogation of the micro controller 24 via an external telephone line and a speech encoder 48.
outputs synthesised verbal messages composed of words and/or phrases pre-recorded in the micro controller, onto the external line.

A ring detector 50 provides an input to the micro controller 24 to indicate receipt of an external call.

When an alarm is raised for whatever reason, the call unit will dial out on the PSTN serving the premises in which the unit is installed. In the case of sheltered housing schemes for the elderly, the controller may be connected directly, for example, by dedicated lines, to a local warden or supervisor's office and capable of recognising the lack of response or an off-duty flag before dialling out on the PSTN to establish a telephone connection with a remote monitoring station or control centre. In the illustrated embodiment, however, the system is designed to dial out up to three predetermined telephone numbers as a first priority. These may be the numbers of friends or relatives and the last may be a local warden or help centre. If all of these attempts fail, the system is programmed to dial the number of the remote monitoring station or control centre. It will be understood, therefore, that the illustrated embodiment is not restricted to use in a sheltered housing scheme but may be used for
monitoring any number of unrelated dwellings.

Having established a connection with the control centre over the PSTN, the call unit then transmits data identifying the (location of the) unit and the nature of the alarm depending upon how the emergency call was initiated.

Most conventional emergency call systems include a portable alarm trigger in the form of a pendant or the like, carried or worn by the user (i.e. remote from the controller) and incorporating a radio, infra-red or ultra-sonic transmitter operable in response to pressing of an alarm button to transmit signals to a receiver in the call unit controller for initiating the emergency call procedure. This procedure may also be initiated by other alarm triggers in the form of pull-cords fire detectors, low temperature detectors etc.

In addition, any of a wide variety of activity detectors (e.g. point of entry sensors) are provided so that in normal use of the emergency call system an alarm can be raised if there has been insufficient activity over a given period. Such detectors also enable the system to provide intruder alarm protection. The micro-controller 24 is programmed
to be set in intruder alarm protection mode using the same detectors as are used in the activity monitoring mode which is suspended when intruder protection is armed.

A series of detectors $D_1$ to $D_n$ including the alarm trigger detectors and activity detectors, may all be hard wired to the emergency call unit but in this illustrated embodiment incorporate a radio transmitter in communication with a radio receiver 52 in the call unit.

Associated with the call unit 20 is a portable unit or pendant 54 having a key-pad 56 identical with the telephone key-pad 44 and in radio communication with the call unit 22 whereby all telephone key-pad functions can be performed remotely by a user either inside or outside (within a limited range) of the protected premises. The keypads have the keys: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #, A, B, C, MEM, LS, ALARM.

The telephone facility is operable via either the fixed unit keypad 44 or the pendant keypad 56 in an identical manner.

The pendant keypad 56 may be used if the user is remote from the fixed unit but within hearing distance
of it. To initiate a telephone call from the pendant 54 the user first presses the key LS to instruct the fixed unit to seize the telephone line, after which the user is able to dial the desired telephone number in the normal way and the fixed unit would signal to the exchange. Having established a call, the user and called party are able to converse using the loudspeaking speech facility of the fixed unit. The user can drop the line by pressing the LS key again. Additionally, having seized the line, any of the fast or abbreviated dialling facilities as also available on the fixed unit may be used.

Another feature of the emergency call system, see particularly Figure 3, is the ability to send standard digital data to a control centre 60 which would be interpreted and acted on by the centre equipment and then supplementing that with verbal data messages which would be interpreted by the centre operator.

With the system in an alarm state having been activated by the user or some automatic sensor, such as, for example, medical emergency, fire, intruder or heating plant failure, a telephone link with the centre equipment 60 is established. The system unit controller 22 then passes digital data to the centre 60 and expects to get some response to confirm a
successful data transaction. This data includes the call unit identity and the type of alarm call. The choice of the latter is limited to the number of options available at the control centre 60. Control centres are normally computer based and the existence of the alarm call is indicated by a list of pending calls from which the control centre operator can choose. Having chosen the alarm call any data held in the computer relating to the particular call unit would be displayed. Some information displayed might also relate to the alarm call type. A speech path is then established between the operator and call unit user under control of the operator precluding the transmission of further data. In the present system, however, pre-recorded verbal messages may be sent under command of the system unit controller, to elaborate on the type of alarm which initiated the call, by, for example announcing 'pullcord in bathroom' when the digital data only identifies a pullcord. In addition, verbal messages announcing further alarms such as 'fire' or 'intruder zone 1' might be generated providing the operator with a real time understanding of the activity at the system unit location.

An alarm call is generated by the user, by for example activating the radio pendant 54 whose transmission is
received by the radio receiver 52. The signal from
the radio receiver 52 is sent to the microcontroller
24. The following sequence of activity of the call
unit 22 is controlled by the microcontroller 24.

The call unit 22 emits an audible bleep and flashes a
lamp. At this stage the user may stop the alarm by
pressing the cancel key on the key pad 44 or pendant
key pad. After a period of 10 seconds the bleep
stops and the lamp is illuminated constantly. This
signifies that the 'pre-alarm' period is over and the
call unit will attempt to contact the centre and the
user has no option to cancel.

The call unit seizes the PSTN line by enabling the
line switch 28 and dials the appropriate centre
telephone number by activating the dialler 40. The
call unit has a preset sequence of repeat numbers and
different numbers to ring should it fail to establish
connection to the monitoring station or control centre
on the first attempt.

Having dialled the number the call unit outputs a
'cozy tone' from the tone encoder 46 onto the line.
The 'cozy tone' serves two purposes: firstly it
announces the fact that the equipment using the line
is automatic dialling apparatus, should it
inadvertently connect to the wrong party, and secondly it acts as an identifier to the control centre equipment so that it is recognised as alarm equipment.

When the control centre equipment detects ringing on one of its lines it will seize that line and also output a 'cozy tone'. The 'cozy tone', is of a pulsed nature and during the quiet periods the control centre equipment listens to the line to detect any signal being emitted by the caller.

The control centre equipment detects the 'cozy tone' being emitted by the call unit, and sends a [request ID] message. The tone decoder 46 detects this message and signals it to the microcontroller 24.

The call unit now sends an [ID] message. The [ID] message comprises five parts:

a. Start character
b. Unit identity
c. Alarm type
d. Message type
e. Data checksum

On receipt of the [ID] message the control centre equipment transmits an [acknowledge] message.
At this stage the control centre equipment will look-up the corresponding data in the database and will indicate the presence of the call to the central control receiving station operators together with the associated data records. It will also display the type of alarm, but only within the limited range of alarm types available within the standard communication protocol. For example "Pendant".

When a control centre operator accepts the call, by operating a control console, an [operator listen] message is sent to the call unit.

On receipt of the [operator listen] message by the call unit it will activate its speech encoder 48 and play a pre-recorded verbal message announcing the type of alarm which initiated the call. For example it might announce "Pendant number one". This message would be announced four times to ensure the control centre operator receiving it. On completion of the announcements the microphone 34 and voice amplifier and voice switches 30 would be activated so that the control centre operator could hear the user.

When the control centre operator wants to speak to the user they would press their speak button and the control centre equipment would transmit an [operator
speak] message. On receipt of the [operator speak] message the call unit would switch between microphone 34 and loudspeaker 36 so that the user could hear the control centre operator.

When the control centre operator wishes to again listen to the user they would release the speak button and the control centre equipment would send another [operator listen] message. On receipt of this message the call unit would switch between loudspeaker 36 and microphone 34 and the control centre operator would again hear the user.

The use of the speak button, by the control centre operator, could continue as long as the control centre operator wished.

If a further alarm occurred during the conversation, for example a smoke detector went off, the following would happen.

The call unit would wait for an [operator listen] message from the control centre equipment. On receipt it would deactivate its microphone 34, loudspeaker 36 and voice amplifier and voice switches 30 and would enable its speech encoder 48.
The speech encoder 48 contains a stored vocabulary of words and/or phrases used in all verbal messages that are likely to be used. In response to a sequence of instructions from the controller 24 the speech encoder 48 emits the selected words in sequence to construct the predetermined verbal message announcing for example "Smoke - zone 3". This message would be announced four times to ensure the central control receiving station operator receiving it.

On completion of the announcements the microphone 34 and voice amplifier and voice switches 30 would be activated so that the control centre operator could hear the user. Any further alarms would be announced in a similar way.

Once the control centre operator decided to finish the call, they would enter the appropriate command at the console and the control centre equipment would send a [finish] message to the call unit. On receipt of this message the call unit would drop the line and return to a quiescent state, ready for reuse as a telephone or alarm unit. The control centre equipment would also drop the line and await further calls.

The system enables pre-determined verbal messages to
be announced to a respondent using a simple telephone in the same way as announcements to a control centre operator once they had selected a call as described above. This facility is illustrated in Figure 4, and enables the provision of information, possibly in response to spoken questions, and information about a multiplicity of alarms rather than one alarm only at the beginning of a call.

The user then having initiated an alarm and being in contact with either a centre operator or a respondent is able to initiate an announcement of any one of a number of pre-recorded words or phrases to communicate to the centre operator or respondent. This is done by pressing a key or combination of keys to select the desired message. The key sequence entered into 56 is interpreted by the microcontroller 24 which initiates a sequence of individual words and phrases to make up the intelligible message required. This facility would be of assistance to any user with impaired speech.

The speech encoder 48 may also be arranged to say through the user's telephone speaker facility 36 what number is being dialled as it is dialled. This will help users with poor sight and will provide a helpful running check on the number dialled.
The speech encoder 48 stores synthesised verbal messages and it may store messages not only relating to the alarm function but also or alternatively to enable status checks through interrogation of the microcontroller by the user. Thus information such as the stored telephone numbers for which an abbreviated code can be used will be stored under a numerical address. The user or a technician checking the telephone can dial the address and will receive the information at that address in spoken form from the microcontroller 24 via the speech encoder 48. Examples of other information which could be stored for retrieval in this way are the call unit identity, a name identity for the telephone, user or premises, or the length of the pre-alarm delay during which an alarm can be cancelled by the user.
CLAIMS

1. A call unit for use in an emergency call system and having means for establishing outgoing telephonic communication over the public switched telephone network, a dialler operable to dial at least one designated remote destination under the control of operating means responsive to an alarm signal, the operating means being arranged to transmit alarm data, to the remote location and being responsive to a control signal to transmit at least one pre-determined verbal message.

2. A call unit as claimed in claim 1, wherein the call unit includes means for establishing incoming telephonic communication over the public switched telephone network.

3. A call unit as claimed in claim 1 or claim 2, wherein the alarm data includes data identifying the call unit.

4. A call unit as claimed in claim 1, 2 or 3, wherein the alarm data includes data identifying the nature of the alarm.

5. A call unit as claimed in any preceding claim,
wherein the dialler is arranged automatically to dial a plurality of different destinations in a predetermined order.

6. A call unit as claimed in any preceding claim, wherein the call unit includes an input keypad.

7. A call unit as claimed in any preceding claims, wherein the call unit has associated therewith a remote trigger device to be carried or worn by the user.

8. A call unit as claimed in claim 7, wherein the remote trigger device incorporates an input keypad enabling remote operation of the call unit.

9. A call unit as claimed in claim 6 or claim 8, wherein the input keypad comprises a telephone keypad.

10. A call unit as claimed in claim 6, 8 or 9, wherein verbal messages are selectively transmitted by the user using the input keypad.

11. A call unit as claimed in any preceding claim, wherein the transmission of the or each pre-determined verbal message is triggered by incoming control signals generated at a call destination.
12. A call unit as claimed in any preceding claim, wherein the pre-determined verbal messages are pre-recorded and stored on magnetic tape.

13. A call unit as claimed in any of claims 1 to 11, wherein the pre-determined verbal messages are stored in a solid-state ROM.

14. A call unit as claimed in claim 11 or claim 12 or 13 when dependent thereon, wherein the verbal messages are constructed as appropriate to the particular control signals received, from a stored vocabulary of words and/or phrases or sounds assembled to simulate speech, by a speech encoder under control of the operating means.

15. A telephone unit including addresses for the storage of data regarding the status of the telephone unit and speech means for emitting a verbal message corresponding to data stored at an address in response to interrogation of the address.

16. A telephone unit as claimed in claim 15, wherein the speech means is arranged to emit a verbal message in response to a dialled number sequence constituting an address interrogation code.
17. A telephone unit including speech means arranged to say a dialled number when it has been dialled.

18. A telephone unit as claimed in claim 17, wherein the speech means is arranged to say a dialled digit when it has been dialled.

19. A telephone unit as claimed in any of claims 15 to 18, wherein the speech means comprises operating means arranged to control a store to provide speech signals to a speaker.

20. A telephone unit as claimed in claim 19, wherein the store is a solid-state ROM.

21. A telephone unit as claimed in claim 20, wherein the store forms part of a speech encoder.
Fig. 3.

Fig. 4.

SUBSTITUTE SHEET
**INTERNATIONAL SEARCH REPORT**

**International Application No.** PCT/GB 92/00219

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### I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC

**IPC:** H 04 M 11/04

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### II. FIELDS SEARCHED

**Classification System** | **Classification Symbols**
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IPC^5 | H 04 M 11/00, G 08 B 25/00

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### III. DOCUMENTS CONSIDERED TO BE RELEVANT

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**IV. CERTIFICATION**

**Date of the Actual Completion of the International Search:** 28 April 1992

**Date of Mailing of this International Search Report:** 13.05.92

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**International Searching Authority:**

**EUROPEAN PATENT OFFICE**

**Signature of Authorized Officer:**

Nicole De Blé

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