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[54] **RELAY FOR PERSONAL INTERPRETER**

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[51] **Int. Cl.**[6] **H04M 11/00**; H04M 1/64

[52] **U.S. Cl.** **379/52**; 379/88.14; 379/93.15

[58] **Field of Search** 379/52, 88.14, 379/93.05, 93.09, 93.14, 93.15; 340/825.19; 704/235, 246, 270, 271

[56] **References Cited**

U.S. PATENT DOCUMENTS

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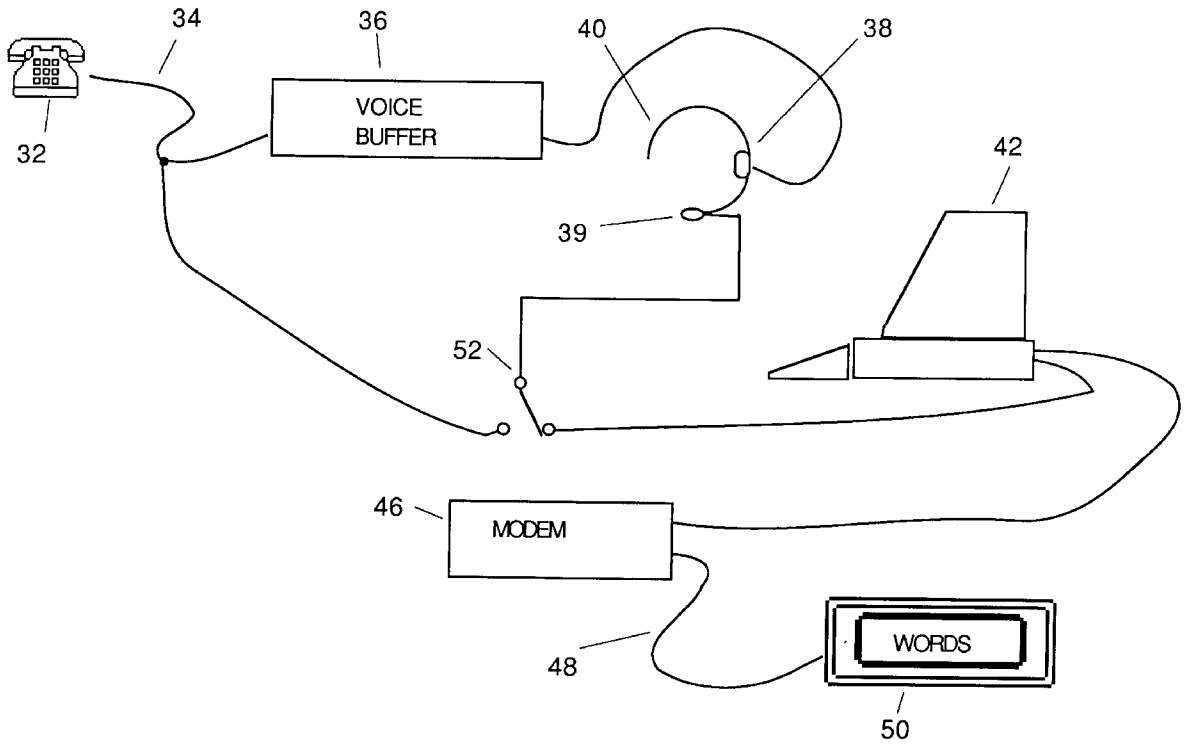
[57] **ABSTRACT**

A relay is described to facilitate communication through the telephone system between deaf people and hearing people. To overcome the speed limitations inherent in typing, the call assistant at the relay does not type most words but, instead, re-voices the words spoken by the hearing person into a computer operating a voice recognition software package trained to the voice of that call assistant. The conversation-type flow of communications achieved by this type of relay enables the design of a new class of interpreters for the deaf.

15 Claims, 2 Drawing Sheets



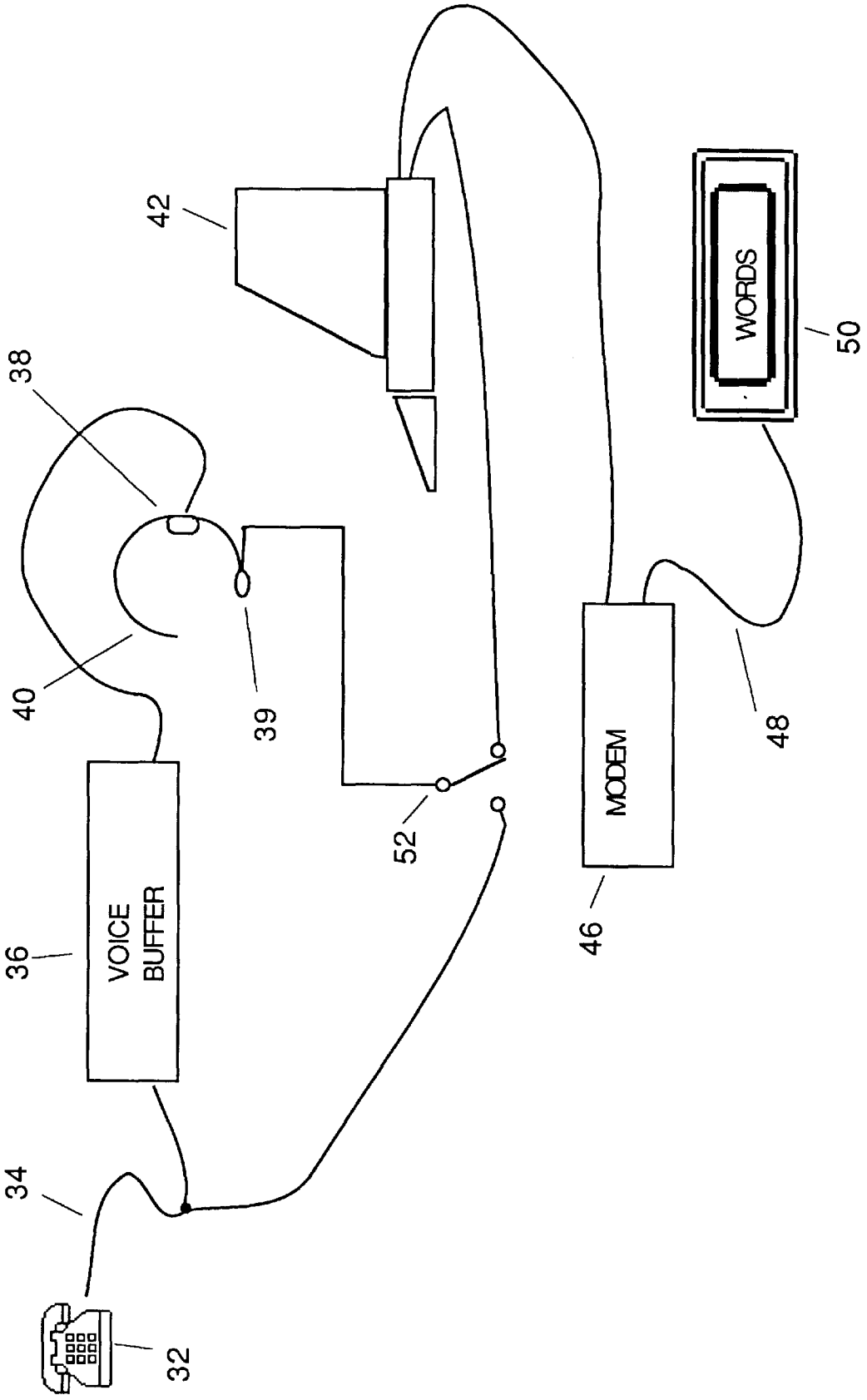


FIG. 1

FIG. 2

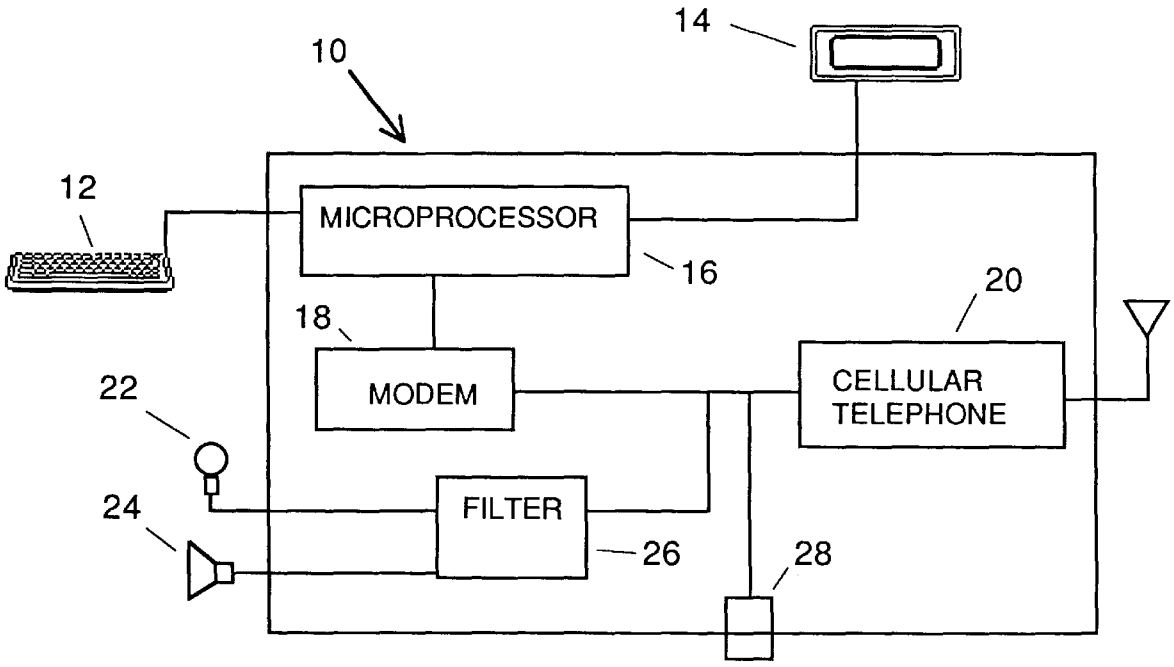


FIG. 3

RELAY FOR PERSONAL INTERPRETER

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

BACKGROUND OF THE INVENTION

The present invention relates to the general field of telephone communications. In more particular, the invention relates to systems to assist telephone communications by those persons who are deaf, hard of hearing, or otherwise have impaired hearing capability.

Most modern human communications in both social and business environments takes place through sound communications. Yet within modern society there are many persons who have attenuated hearing capability. To assist those persons in making use of our telephonic communication system built for the hearing majority, there has been developed a system of telephone communication which has been principally used by the deaf community. That system makes use of a category of device known variously as a telecommunication device for the deaf (TDD), text telephone (TT) or teletype (TTY). Current TDDs are electronic devices consisting of a key board and a display as well as a specific type of modem, to acoustically or directly couple to the telephone line. Modern TDDs permit the user to type characters into their keyboard, with the character strings then encoded and transmitted over the telephone line to be displayed on the display of a communicating or remote TDD device.

Most TDD communication is conducted in an idiosyncratic code specific to the community of TDD users. This code, known as Baudot, evolved historically at a time when many telecommunication devices for the deaf were based on mechanical or electromechanical devices rather than the current technology based on digital electronic components. Accordingly, the Baudot protocol was constructed for a set of constraints which are no longer relevant to present date devices. The original Baudot protocol was a unidirectional or simplex system of communication conducted at 45.5 Baud. The conventional Baudot character set was a character set consisting of 5 bit characters and the system encodes the bits of those characters in a two-tonal system based on carrier tones of 1400 and 1800 Hertz.

The system of TDD communications is widely used and in fact has become indispensable to the deaf community throughout the industrialized world. Deaf persons extensively communicate with their neighbors and with other deaf and hearing people remotely, using the TDD system. In addition, systems have been developed to facilitate the exchange of communication between the deaf community and hearing users who do not have access to or utilize a TDD device. In the United States, telephone companies have set up a service referred to as a "relay." A relay, as the term is used herein, refers to a system of voice to TDD communication in which an operator, referred to as a "call assistant," serves as a human intermediary between a hearing user and a deaf person. Normally the call assistant wears a headset that communicates by voice with the hearing user and also has access to a TDD device which can communicate to the deaf user using a TDD appropriate protocol. In normal relay

operations in the prior art, the call assistant types at a TDD keyboard the words which are voiced to her by the hearing user and then voices to the hearing user the words that the call assistant sees upon the display of his or her TDD. The call assistant serves, in essence, as an interpreting intermediary between the deaf person and the hearing person to translate from voice to digital electronic forms of communication.

A limitation in the effectiveness of current relay protocols is the necessity for the call assistant simply to type what is said. Typical call assistants can usually type reasonably well, typically in the range of 30 to 50 words per minute. While systems exist which permit the digital encoding of verbal communications at a faster rate, such as court stenography used in the legal system, such systems require extensive special training and are impractical for the numerous call assistants required by the relay systems in operation today. This limitation on the speed of conversion from speech to digital communications hampers the effective flow of communication in a relay call between the hearing person and a deaf person, since most hearing people speak at a rate which is higher than most call assistants can type. In addition, since conventional Baudot communications is unidirectional, the flow of conversation in a relay assisted communication session can be somewhat awkward. For example, first the hearing person must voice a statement or question. Then the calling assistant must type that statement or question, which is then transmitted at Baudot speeds, which are slower than normal human voice communication, to the deaf person. The deaf person waits until the entire statement or question is transmitted to him or her, after which he or she composes a response and types it in at his or her TDD. Then the communication flows backward to the call assistant who must voice to the hearing person what the deaf person has typed at his or her terminal. This process enables a degree of two-way communication between a deaf person and a hearing person, but the system tries the patience of the hearing person, since it is typically not conducted at a pace anywhere close to normal human communications.

BRIEF SUMMARY OF THE INVENTION

The present invention is summarized in that a relay system to facilitate the translation of information and communication between deaf and hearing persons includes a call assistant who re-voices the words of the hearing person which are spoken to the call assistant. The words spoken by the call assistant are recognized by a speech recognition computer program which has been trained to the voice pattern of the call assistant, such that the words are promptly translated into a high speed digital communication protocol. That high speed digital communication message is then transmitted electronically promptly by telephone to a visual display accessible to the deaf person.

It is an advantage of the invention described herein that the call assistant does not have to type most, if any, of the words spoken by the hearing person in the communication session so that the overall speed of communications from the hearing person to the deaf person is dramatically increased.

It is an object of the present invention that the design and utilization of a relay operated in accordance with the protocols described herein permits the introduction of small hand-held personal interpreter which will enable on the spot communications between deaf persons and hearing persons wherever the deaf persons might go.

Other objects, advantages and features of the present invention will become apparent from the following specification when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a schematic block diagram of a relay operated in accordance with the present invention.

FIG. **2** is an exterior view of a personal interpreter enabled by the relay of FIG. **1**.

FIG. **3** is a schematic block diagram of the personal interpreter of FIG. **2**.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed toward a relay system, and a method for operating a relay system, so as to provide more conversation-like performance of voice to text interpreting for translating between deaf and hearing users. The improvements to the relay system and method of operating the relay described herein are applicable to the broad TDD community and to all the applications in which a relay is normally used. However, since the advantages of this system are most clear in view of its usefulness in enabling the advent of the truly portable personal interpreter for the deaf, a brief diversion to discuss what this device is and how the relay may enable its practical use is appropriate here.

Shown in FIG. **2** is an illustration of what a personal interpreter **10** can look like. This would be a small hand held device typically the size of a small hardbound book. It would have a keyboard of minimal size, but useable by a deaf person who can type. It would have a two to four line display, but the display could be any size that conveniently fits in the case of the device. The device would also have a key or switch which would initiate its operation.

Shown in FIG. **2** is a schematic block diagram of the internal mechanics of the personal interpreter. The personal interpreter keyboard shown at **12** and its display as shown at **14**. Inside the interpreter itself is a microprocessor shown at **16**. Not shown, but included within the personal interpreter, would be the appropriate memory and interface devices so as to allow the microprocessor to be programmed and to operate the personal interpreter and perform its functions, in a manner well known in the art. Also inside of the personal interpreter is a modem **18**. The modem **18** is preferably a modem specifically designed for interface with the deaf telecommunications system. Most telecommunications with the deaf community are conducted using a Baudot type code. It is preferred that the mode be designed to use the enhanced form of Baudot communication known as "Turbo Code" (Ultratec), which is generally described in U.S. Pat. Nos. 5,432,837, No. 5,517,548, and 5,327,479, the disclosure of which is hereby incorporated by reference. It is even more preferred that the modem use a new variant of Turbo Code, one which uses higher carrier frequencies (in the range of 3000–3500 hertz) and a faster baud rate (over 100 baud). The output of the modem is preferably wired to a cellular telephone **20** included within the case of the personal interpreter **10**. The cellular telephone **20** has a suitable antenna provided on it so that it may dial a cellular telephone network by radio frequency communications of the type normally conducted by cellular telephones. The personal interpreter also includes jack **28** to connect to a conventional wired or land-line telephone line as well. The personal interpreter also include a microphone **22** and a speaker **24**. A filter **26** connects the speaker **24** and the microphone **22** to the telephone **20**.

A brief description of the operation and functionality of the personal interpreter reveals the dramatic improvement and convenience and portability that this device gives to deaf people. A deaf user could go into an establishment, be it a government office or retail facility, in which there are only hearing persons. The deaf person would carry with him or her the personal interpreter **10**. The deaf person would then place the personal interpreter **10** upon a counter or other surface, open it up, and press the initiation key or start button. The microprocessor **16** and modem **18** of the personal interpreter then power up and act in many ways like a normal TDD device operating in telecommunication standard, such as Turbo Code. However, there is one critical difference. The start or initiation key further causes the microprocessor **16** of the personal interpreter to dial a relay to set up a relay communication session and includes in its communication with the relay a message, using the enhanced command features available in advanced telecommunication protocols, such as Turbo Code, to initiate a special format of relay call adapted for the personal interpreter. Other codes which permit command functions, such as ASCII or CC ITT, could also be used. The first operation is to activate the cellular telephone and direct the cellular telephone to dial the number of a relay operating in accordance with the method of the present invention. The cellular telephone dials the relay. Obviously, no wired connection is required to allow the cellular telephone function to establish a telephone connection with the remote relay, but alternatively the jack **28** to a conventional telephone line could be used. In addition, when the relay answers the telephone connection, the microprocessor **18** of the personal interpreter **10** is instructed to provide command codes to the remote relay. These command codes, a feature possible through the use of Turbo Code, permits the personal interpreter to tell the relay that this is a personal interpreter-type relay communication session. All of this can happen in the time necessary to initiate the cellular call, perhaps two to ten seconds.

Then, the deaf person can use the personal interpreter to translate words spoken by hearing persons in the presence of the personal interpreter into visually readable text. This is done by the personal interpreter **10** through an unseen relay. Words spoken by the hearing persons in the presence of the personal interpreter **10** are picked up by the microphone **22**. Those words are then transmitted through the cellular telephone **20** to the remote relay. The relay, operating as will be described below, then immediately transmits back, in enhanced Turbo Code, a digital communication stream translating the words that were just spoken. The words are received by the modem **18**, and the microprocessor **16** in the personal interpreter **10**, and it is displayed promptly upon the display screen **14**. If the deaf person can speak, he or she may then answer the hearing person with a spoken voice, or, the deaf person may alternatively type upon the keyboard **12**. If the deaf user types on the keyboard **12**, the personal interpreter transmits the communication by digital communication to the relay. The call assistant at the relay then reads and speaks the words typed by the deaf user which are transmitted to the speaker **22** contained in the personal interpreter into a voice communication which can be understood by the hearing users. The filter **26** filters out the digital communication frequencies from the sound generated by the speaker **22**. Thus, in essence, the deaf person has a personal interpreter available to him or her at all times of the day or night wherever the deaf person is within the range of the cellular telephone system. Also, because the relay is preferably operating in accordance with the fast translation methodology described below, a very conversation-like feel can occur in the communication session between the deaf

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