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(71) Applicant: DIGEO, INC. [US/US]; 8815 122nd Avenue NE, Kirkland, WA 98033 (US).

(72) Inventor: ALLEN, Paul; 6451 West Mercer Way, Mercer Island, WA 98040 (US).

(74) Agent: CHRISTENSEN, Kory; Madson & Metcalf, 15 West South Temple, Suite 900, Salt Lake City, UT 84101 (US).

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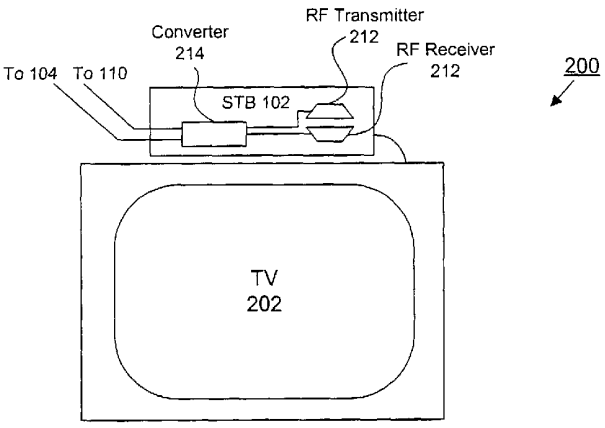

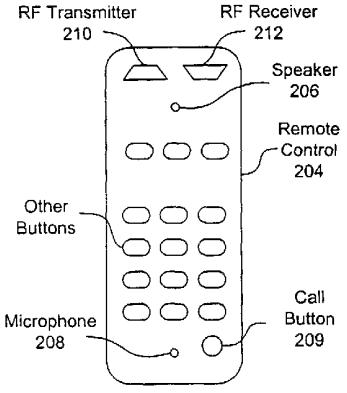

(57) Abstract: A remote control (204) for an interactive television system (200) includes a microphone (208) for capturing a first audio signal and a wireless transmitter (210) for transmitting the first audio signal to the interactive television system (200). The remote control (204) also includes a wireless receiver (212) for receiving a second audio signal from the interactive television system (200) and a speaker (206) for generating audible output from the second audio signal. A set top box (102) for the interactive television system (200) includes a wireless receiver (212) for receiving the first audio signal from the remote control (204) and a wireless transmitter (212) for transmitting the second audio signal to the remote control (204).

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SYSTEMS, METHODS, AND DEVICES FOR AUDIO CAPTURE AND TELECOMMUNICATION

BACKGROUND OF THE INVENTION

RELATED APPLICATIONS

The present application is related to and claims priority from U.S. Provisional Application No. 60/237,013, entitled "Systems, Methods, and Devices for Video and Audio Capture and Communications," filed September 29, 2000, with inventor Paul. G. Allen, which is hereby incorporated by reference in its entirety. The present invention is also related to and claims priority from U.S. Provisional Application No. 60/238,487, entitled "Systems, Methods, and Devices for Audioconferencing During Television Broadcasts," filed October 6, 2000, with inventor Paul. G. Allen, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

The present invention relates generally to interactive television systems, and more particularly, to systems, methods, and devices for audio capture and communication.

DESCRIPTION OF THE BACKGROUND ART

Television watching is an immensely popular pastime throughout the world. Indeed, one or more televisions may be found in virtually every residence in the United States and in many foreign countries.

For many, the television viewing experience is enhanced by watching television programs with other people. Thus, typical residences are equipped with numerous seats in front of a television to accommodate several family members and friends. Certain television programs are more frequently

viewed in the company of others. For example, sporting events, television premieres, political debates, and other significant television broadcasts are typically viewed by groups of people.

Often it is inconvenient for viewers to be physically present in the same room due to geographical distances, conflicting schedules, short notice, and other limitations. In such instances, viewers may watch a television program individually and then meet at a later time to discuss the program. However, if the viewers are unable to meet for an extended period of time, a discussion of the program may become stale.

Alternatively, viewers may teleconference during a television program (e.g., call one another on a telephone) for a more interactive discourse. Unfortunately, conventional teleconferencing presents a number of disadvantages.

For example, extended teleconferencing during a broadcast may deprive other household members of the use of a telephone. Moreover, a telephone may not be easily accessible at the viewer's location, and relocating a telephone to the viewer's location may be difficult or inconvenient, particularly after a program has commenced. In addition, teleconferencing may be expensive, particularly where more than two parties are connected simultaneously.

Thus, it would be an advancement in the art to provide a convenient technique for conversing during a television broadcast with one or more other viewers at remote physical locations. It would be a further advancement in the art to provide a cost-effective system for conferencing which provides minimal disruption of the television program being viewed.

SUMMARY OF THE INVENTION

The present invention provides systems, methods, and devices that overcome the above-described problems and disadvantages. In one aspect of

the invention, a remote control for an interactive television system includes a microphone for capturing a first audio signal and a wireless transmitter for transmitting the first audio signal to the interactive television system. The remote control also includes, in one embodiment, a wireless receiver for receiving a second audio signal from the interactive television system and a speaker for generating audible output from the second audio signal.

In another aspect of the invention, a set top box for an interactive television system includes a wireless receiver for receiving the first audio signal from the remote control and a wireless transmitter for transmitting the second audio signal to the remote control. The set top box also includes, in one embodiment, a digital storage device for recording the first audio signal.

In various embodiments, the set top box includes a converter for transforming the first audio signal into a network-compatible audio stream for transmission over a network to a second interactive television system. The converter is also configured, in one implementation, to transform a network-compatible audio stream received from the network into the second audio signal for transmission to the remote control.

Accordingly, the remote control in combination with the set top box may function as a telephone, using the network as a transmission medium. In various embodiments, the network may be embodied as a cable or telephone network. As such, the set top box may be coupled to a cable headend and/or a Central Office (CO) of a telephone provider. In one implementation, a remote control of a first set top box may establish an audio connection with a remote control of a second set top box coupled to the network. Alternatively, a remote control of a set top box may establish an audio connection with a standard telephone.

In yet another aspect of the invention, a user of a first set top box presses a call button or other suitable control in order to initiate an audio connection. Thereafter, the user of the first set top box selects a second set top

box, after which the first and second set top boxes establish a two-way audio connection. In one embodiment, the set top box and/or remote control indicates that a connection exists by a visual mechanism.

The microphone in the remote control then captures an audio signal, which is transmitted to the set top box using a wireless transmission method. In one embodiment, the audio signal is transformed into a network-compatible audio stream for transmission over a network. Thereafter, the set top box transmits the audio stream to the network.

The network routes the audio stream to the second set top box, where it is transformed into an audio signal. Thereafter, the audio signal is then transmitted from the second set top box to a corresponding remote control, where it is reproduced in sound waves by a speaker integrated with the remote control.

In return, the first set top box may receive an audio stream from the second set top box and convert the audio stream into an audio signal for playback. During the exchange and playback of the audio signals, viewers may watch television programs and converse with one another.

These and other features and advantages of the present invention will become fully apparent by examination of the following description of the preferred embodiments and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting and non-exhaustive embodiments of the present invention are described in the Figures, in which

FIG. 1 is a diagram of a communication network according to an embodiment of the invention;

FIG. 2 is a schematic block diagram of an interactive television system according to an embodiment of the invention;

FIG. 3 is a schematic block diagram of a set top box according to an embodiment of the invention;

FIG. 4 is a plan view of a remote control for an interactive television system according to an embodiment of the invention;

FIG. 5 is a schematic block diagram of an interactive television system according to an embodiment of the invention;

FIG. 6 is a schematic block diagram of a set top box according to an embodiment of the invention;

FIG. 7 is a plan view of a remote control for an interactive television system according to an embodiment of the invention; and

FIG. 8 is a flowchart of a method for audio capture and communication according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of systems, methods, and devices for audio capture and communication are described herein. In the following description, numerous specific details are provided, such as examples of programming, user selections, transactions, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

Referring now to FIG. 1, there is shown a communication network 100, such as a cable and/or telephone network, according to an embodiment of the invention. In one implementation, the network 100 includes a plurality of set top boxes 102 or other customer premises equipment (CPE) located, for instance, at customer homes. Generally, a set top box (hereinafter "STB") 102 is consumer electronics device that serves as a gateway between a customer's television and a broadband communication network, such as a cable network. As its name implies, an STB 102 is typically located on top of, or in close proximity to, a customer's television.

In one embodiment, an STB 102 receives encoded television signals and other data from the network 100 and decodes the same for display on the television. Additionally, an STB 102 receives commands from a user (typically via a remote control) and transmits such commands back to the network 100.

In various embodiments, each STB 102 is connected to a headend 104. In the context of cable network, a headend 104 is a centrally-located facility where cable TV (CATV) channels are received from a local CATV satellite downlink and packaged together for transmission to customer homes. In one embodiment, the headend 104 also functions as a Central Office (CO) in the telephone industry, routing audio streams and other data to and from the various STBs 102 serviced thereby.

Headends 104 may be coupled directly to one another or through a network center 106. In some cases, headends 104 may be connected via a separate network, one particular example of which is Internet 108.

As described in greater detail below, an STB 102 may transmit audio information (e.g., analog or digital audio signals) to one or more other STBs 102 connected to the network 100. The communication path for the transmission may involve one or more headends 104, network centers 106, and/or the Internet 108.

For example, a first STB 102 may send an audio transmission upstream to a first headend 104, then to a second headend 104, and finally downstream to a second STB 102. The transmission may use various standard protocols, such as MPEG or audio over IP (Internet Protocol).

The first and second headends 104 may be one and the same if the STBs 102 are served by the same headend 104. The transmission between headends 104 may occur (i) via a direct peer-to-peer connection between headends 104, (ii) upstream from the first headend 104 to a network center 106 and then downstream to the second headend 104, or (iii) via the Internet 108.

As illustrated in FIG. 1, each STB 102 may also be connected to a CO 110 of a telephone network, such as a public switched telephone network (PSTN). Thus, one STB 102 may establish a telephone connection with another STB 102. The telephone network may comprise standard POTS or digital lines (e.g., DSL). COs 110 may be coupled via regional offices, switches, and the like, indicated by a dashed line in FIG. 1.

Of course, the illustrated network topology of FIG. 1 is provided for example purposes only, and other types of networks and network configurations may be used within the scope of the invention.

As described in detail hereafter, each STB 102 may be identified by a unique number, code, or address, such as a telephone number or IP (Internet Protocol) address. Thus, a user of one STB 102 may select STB 102 to receive an audio transmission by specifying the corresponding number or address. The network 100 then establishes a connection, if necessary, and routes the transmission to its destination using conventional techniques.

Referring now to FIG. 2, there is shown an interactive television system 200 according to an embodiment of the invention. The television system 200 preferably includes a television 202, which is configured to receive and display standard analog or digital television signals or high-definition television (HDTV) signals. In one embodiment, the television system 200 also includes a

STB 102, as discussed above, for receiving television signals and sending and receiving audio information to and from the network 100.

In one embodiment, a remote control 204 is provided for convenient remote operation of the STB 102 and the television 202. As described below, the remote control 204 may communicate with the STB 102 and television 202 using conventional techniques in order to adjust, for example, the volume of the television, the displayed channel, and the like.

In the illustrated embodiment, the remote control 204 includes a microphone 208 for capturing sound waves and generating an analog or digital audio signal. The remote control is also depicted as including a speaker 206 for reproducing sound waves from an audio signal.

In one embodiment, the remote control 204 includes a call button 209 or other suitable control for initiating an audio connection, as described more fully below. The remote control 204 may further include additional buttons to control various features of the STB 102 and the television 202. As used herein, the term "button" contemplates other types of controls, such as switches and the like. In addition, multiple buttons or controls may be provided for performing a particular function. Thus, the term "button" means one or more controls for performing the stated function.

In the illustrated embodiment, the remote control 204 further includes a radio frequency (RF) transmitter 210 and an RF receiver 212. In alternative embodiments, the transmitter 210 and receiver 212 may be configured to use infrared (IR), microwave, VHF, UHF, or other frequencies along the electromagnetic spectrum.

In one implementation, the transmitter 210 is in electrical communication with the microphone 208 to receive captured audio information. The transmitter 210 preferably modulates the audio information with a carrier frequency to enable transmission thereof to the STB 102 using techniques well known in the art. For example, the transmitter 210 may operate according to the

IEEE 802.11a or 802.11b Wireless Networking standards, the "Bluetooth" standard, or according to other standard or proprietary wireless techniques. Modulation techniques may include spread spectrum, frequency shift keying, multiple carrier, or other techniques known in the art.

To achieve modulation and transmission, the transmitter 210 may include various additional components not specifically illustrated but well known in the art. For example, the transmitter 210 may include a source encoder to reduce the amount of bandwidth required, a channel encoder to modulate the audio information with a carrier wave, and a directional or non-directional transmission antenna. The antenna may comprise a substantially two-dimensional metal structure formed on the remote control's printed circuit board for compactness and efficiency in manufacture. The transmitter 210 may further include an amplifier to increase the transmission signal strength to an appropriate power level.

Likewise, the receiver 212 may further include components not specifically illustrated but well known in the art. For example, the receiver 212 may include an antenna for receiving the transmission, an amplifier for increasing the strength of the received signal, and a decoder for separating and demodulating the audio information from the carrier signal.

In one embodiment, the transmitter 210 and receiver 212 are configured to broadcast and receive digital signals. As such, the transmitter 210 may include an analog-to-digital converter (ADC) to convert analog audio signals into digital information. Likewise, the receiver 212 may include a digital-to-analog converter (DAC) to generate analog signals from digital information. The present invention contemplates both the use of analog and digital transmissions from the remote control 204.

In various embodiments, the remote control 204 is also in electrical communication with a processor (not shown), such as a microprocessor or digital signal processor (DSP), that senses a user's operation of the buttons of the

remote control 204 and generates appropriate command signals for transmission to the STB 102 and television 202 in order to control the operation of the same.

In the illustrated embodiment, the STB 102 includes an RF receiver 212 for receiving audio information and other data from the transmitter 210 in the remote control 204. Similarly, the STB 102 includes an RF transmitter 210 for sending audio information to the receiver 212 in the remote control 204.

In one implementation, the receiver 212 is in electrical communication with a converter 214, which converts audio information received from the remote control into an audio stream compatible for transmission over the network 100. The conversion process may include compressing the information to improve transmission speed.

As noted above, the converter 214 is in electrical communication with a headend 104 in order to transmit the network-compatible audio stream to one or more STBs 102 in the network 100. The converter 214 is further configured to receive network-compatible audio streams from the network 100 and transform the same into audio signals for transmission via the RF transmitter 212 in the STB 102 to the RF receiver 212 in the remote control 204 for playback on the speaker 206.

In one embodiment, the converter 214 includes conventional interface circuitry for communicating with the network 100. In an alternative embodiment, a separate network interface (not shown) may be provided, such as a cable modem or the like. Such a cable modem may operate in accordance with the DOCSIS or DAVIC standards.

In particular, the transmission from the STB 102 to the network 100 must be made to be compatible with upstream transmission in the network 100. For example, in a cable distribution network 100, one or more frequency bands (for example from 5 to 30 MHz) may be reserved for upstream transmission. Digital modulation (for example, quadrature amplitude modulation or vestigial sideband modulation) may be used to send digital signals in the upstream transmission. Various protocols, such as MPEG or audio over IP, may be used

to embed the audio stream in the digital signals. Upstream transmission will be accomplished differently for different networks 100. Alternative ways to accomplish upstream transmission include: an analog telephone line, ISDN, DSL, and other techniques.

In various embodiments, the converter 214 may also include standard telephony circuitry for transforming the audio signal received by the RF receiver 212 into a telephony-grade audio signal. The telephony-grade audio signal may then be sent to a Central Office (CO) 110 of a telephone network for transmission to an STB 102 or a standard telephone. Likewise, the converter may be configured to receive a telephony-grade audio signal from a CO 110 and generate an audio signal compatible with the RF transmitter 212 of the STB 102 for transmission to the remote control 204.

Referring to FIG. 3, there is shown an expanded block diagram of an STB 102 according to an embodiment of the invention. In addition to the transmitter 210, receiver 212, and converter 214 previously discussed, the STB 102 may also include a storage interface 302. In one embodiment, the storage interface 302 provides access to a digital storage device 304, such as a hard disk drive or the like. In operation, the storage interface 302 may receive audio information from the receiver 212 and deliver the same to the digital storage device 304 for storage. The digital storage device 304 may also be used to store audio information received from the network 100. In various embodiments, the storage device 302 may be configured as a cache or a buffer, for example, to improve the performance of the STB 102, to allow a user to review past conversations, to archive audio information of continuing interest, and the like.

The STB 102 may further include a random access memory (RAM) 306 configured to store data for temporary use. Similarly, a read-only memory (ROM) 308 may be provided for storing more permanent data, such as fixed code and configuration information. In one embodiment, the ROM 308 may be used to store an operating system for the STB 102, such as Windows CE® or Linux®.

The STB 102 preferably includes a controller 310 that is in communication with the transmitter 210, receiver 212, converter 214, storage interface 302, RAM 306, and ROM 308. The controller 310 may be coupled to the other components of the STB 102 via a bus 312.

In various embodiments, the controller 310 may be embodied as a microcontroller, a microprocessor, a digital signal processor (DSP) or other device known in the art. The controller 310 manages the operation of the STB 102, including, for example, the conversion of the encoded audio information, the storage of the audio information, the transmission and reception of audio information to and from the network 100, and the like. As noted above, the controller 310 may perform these and other operations based on control signals generated by the remote control 204 and transmitted to the receiver 212.

As described in greater detail below, a remote control 204 in combination with an STB 102 may operate as a telephone, using the network 100 as a transmission medium. In one embodiment, audio information received from the remote control 204 may be converted by the STB 102 and sent to a headend 104 for transmission over a cable network to a second STB 102. The second STB 102 may then convert the audio information into an audio signal for payback on a corresponding remote control 204. In like manner, the remote control 204 of the second STB 102 may send audio information back to the remote control 204 of the first STB 102, enabling a two-way conversation.

Alternatively, a connection may be established between two STBs 102 via a telephone network, with the remote controls 204 functioning as cordless telephones and the STBs 102 functioning as base stations. In another embodiment, a telephone connection may be established between an STB 102 and a standard telephone, enabling a user of a remote control 204 to converse with a person who does not have access to an STB 102 or remote control 204.

Of course, the invention is not limited to two-party communications. Indeed, whether a cable or telephone network is used, audio connections may be established between three or more users.

FIG. 4 provides an expanded view of the remote control 204, including the speaker 206, microphone 208, transmitter 210, receiver 212, and call button 209. In addition, FIG. 4 illustrates a connection indicator 402, which illuminates when a two-way audio connection exists. Alternatively, the connection indicator 402 may illuminate immediately when the call button 209 is pressed. The connection indicator 402 may be embodied as an LED (light-emitting diode) or the like.

The various components of the remote control 204 may be positioned in different locations for functionality and ergonomics. For example, as shown in FIG. 4, the speaker may be positioned near the "top" of the remote control 204 (when viewed from the perspective of FIG. 4) and the microphone may be positioned at the "bottom" of the remote control 204. Thus, in one embodiment, a user may conveniently position the speaker 206 near the user's ear and the microphone near the user's mouth in order to operate the remote control 204 in the manner of a telephone. Alternatively or additionally, a hands-free headset may be coupled to the remote 204 (or to the STB 502). Such a headset may be used to reduce interference from the television audio (improving audio quality) and to provide for hands-free operation and convenience.

Referring now to FIG. 5, there is shown an alternative interactive television system 500 according to an embodiment of the invention. The television system 500 differs primarily from the television system 200 of FIG. 2 in that the speaker 206 and microphone 208 are disposed within an STB 502 rather than a remote control 504.

In the illustrated embodiment, the remote control 504 includes an infrared (IR) transmitter 506 for sending control signals to an IR receiver 508 within the STB 502 and/or the television 202. In alternative embodiments,

however, the transmitter may use RF, VHF, UHF, microwave, or other frequencies. In one embodiment, the remote control 504 also includes a call button 209 and a connection indicator 402.

Referring to FIG. 6, there is shown an expanded block diagram of the STB 502. The converter 214, speaker 206, storage interface 302, digital storage device 304, RAM 306, ROM 308, and controller 310 all function as previously described with reference to FIG 3. However, the STB 502 includes a speaker 206 and a microphone 208, which are depicted as being in communication with the bus 312. In one embodiment, the speaker 206 and microphone 208 in the STB 502 perform the same function as the speaker 206 and microphone 208 in the remote control 204, but with "hands-free" operation. In addition, the STB 502 is depicted as including a connection indicator 402 for visually indicating to a user when a connection is established.

FIG. 7 provides an expanded view of the remote control 504, including the IR transmitter 506 and call button 209. The remote control 504 may further include a separate connection indicator 402 in addition to the indicator 402 in the STB 502. Those skilled in the art will recognize that the various components of the remote control 504 may be positioned in different locations for convenience and ergonomics.

In yet another alternative embodiment, the remote control 504 and the STB 502 may both be configured with a microphone 208 and a speaker 206. This would allow a user to select between operating the remote control 204 as a telephone and "hands-free" communication via the STB 102. In one embodiment, the "switch" button 404 of FIG. 4 may be used for this purpose.

FIG. 8 is a flowchart of a method 800 for audio capture and communication according to an embodiment of the invention. The method 800 begins when a user of a first STB 102 presses 802 a call button 209 or the like on the remote control 204 in order to initiate an audio connection. For simplicity, the following discussion assumes a single, two-way audio connection. However, the

invention is not limited to only two parties. In addition, the method 800 assumes that each party has access to an STB 102, although, in alternative embodiments, one or more of the parties may use a standard telephone.

After the call button 209 is pressed, the user selects 804 a second STB 102 in the network 100 for establishment of an audio connection. The selection may be performed by entering an identification of the second STB 102, such as a telephone number, STB address, or a user name. If a user's name is specified, the first STB 102 may access a name server or directory (not shown) coupled to the network 100 in order to retrieve a corresponding STB address or telephone number for the second STB 102. In one embodiment, the first STB 102 may contain a local directory of frequently used addresses or numbers.

Once the first STB 102 has a valid telephone number or address, a connection is established 806 with the second STB 102. The procedure for establishing the connection depends on the type underlying network 100 used for the connection, such as a telephone or cable network, which may be pre-determined or selected at the time of the connection.

In the case of a telephone network, for instance, the first STB 102 may establish a connection with the second STB 102 by "dialing" a telephone number of the second STB 102. When the second STB 102 senses the attempted connection, it may generate a visually-perceptible or audible notification by means of the television 202 or the remote control 204, such as a text message, icon, tone, chime, flashing light, or the like.

In one embodiment, the user of the second STB 102 may complete the connection by pressing the call button 209 or other designated button on the remote control 204, after which a connection is established using conventional techniques. If the telephone line(s) servicing the STB 102 is in use, a busy signal may be returned.

In the case of a cable network, the first STB 102 may send a request across the network 100 to the second STB 102. The precise format of

the request is not crucial to the invention, but the request should indicate to the second STB 102 that the user of the first STB 102 desires to establish an audio connection.

In response to the request, the second STB 102 generates a notification, as described above. The user of the second STB 102 may indicate acceptance of the connection by pressing the call button 209 or the like, which results in an acceptance signal being returned to the first STB 102. If the second STB 102 is off-line or the user thereof does not respond, the first STB 102 may wait until a timeout period has expired, after which it notifies the user of the first STB 102 that an audio connection cannot be established.

The first and second STBs 102 may then initiate 804 a handshake procedure to establish a communication protocol. Such a handshake procedure may have some similarity with handshake procedures performed between facsimile (fax) machines. In this case, the STBs 102 may negotiate a new protocol or reaffirm an existing protocol for audio communication. The appropriate protocol may need to be determined because the two STBs have different audio conferencing capabilities. For example, the second STB may be capable of audio conferencing at a lower sound quality, so the communication protocol would be established as is suitable to this lower quality. The communication protocol used may also depend on the bandwidth and/or reliability of the connection between the two set top boxes. At this point, an active communication link is established between the STBs 102 across the network 100.

In one embodiment, the remote control 204 and/or STB 102 indicates 808 that the connection is established by a visual mechanism, such as an connection indicator 402 (e.g., LED). Thereafter, the microphone 208 in the remote control 204 or STB 102 captures 810 an audio signal. Where the microphone 208 is integrated with the remote control 204, the audio signal is transmitted to the STB 102 using a wireless transmission method.

In the case of a cable network, the converter 214 within the STB 102 transforms 812 the captured audio signal into a network-compatible audio stream for transmission over the network 100. Thereafter, the audio stream or audio signal is transmitted 814 to the network 100. As noted with reference to FIG. 1, the communication path for the transmission may involve one or more headends 104, network centers 106, COs 110, and/or the Internet 108, using conventional routing techniques.

In one embodiment, the audio stream or audio signal is then transmitted 816 from the network 100 to the second STB 102. In the case of a cable network, the audio stream is transformed 818 into audio signal. In addition, where the speaker 206 is integrated with the remote control 204, the audio signal is sent from the STB 102 to the remote control 204. Finally, the audio signal is played by the speaker 206 within the remote control 204 or the STB 102.

In a like manner, the second STB 102 may transmit audio information generated by a microphone 208 to the first STB 102. The audio connection may be terminated by either party, for example, by pressing the call button 209 a second time. Alternatively, another button or control may be provided for terminating an audio connection.

Alternatively or additionally, the audio conferencing may occur between the first STB 102 and a client terminal more generically (not just a second STB 102). The client terminal may comprise a phone, personal computer or other device with a connection to the Internet 108, or to a network center 106, or to a headend 104. Such other devices may include telephones, cell phones, Internet appliances, Internet-enabled personal digital assistants, and the like. For example, phones may be connected to the public switched phone system which in turn may be connected to the Internet 108, or to a network center 106, or to a headend 104. These devices are likely to have varying audio conferencing capabilities, so a handshaking procedure as described above is likely to be quite useful in determining a proper communication protocol.

In view of the forgoing, the present invention offers numerous advantages not available in the prior art. By integrating a speaker 206 and microphone 208 with a remote control 204 for an interactive television system 200, a user may easily converse during a television broadcast with one or more other users at remote physical locations with minimal disruption of the television program and in a cost-effective manner. The present invention removes the need for a separate telephone and remote control. Moreover, because remote controls are typically found in close proximity to televisions, the need to search for a telephone during a television broadcast is eliminated.

The above description of illustrated embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise forms disclosed. While specific embodiments of, and examples for, the invention are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize.

These modifications can be made to the invention in light of the above detailed description. The terms used in the following claims should not be construed to limit the invention to the specific embodiments disclosed in the specification and the claims. Rather, the scope of the invention is to be determined by the following claims, which are to be construed in accordance with established doctrines of claim interpretation.

CLAIMS

What is claimed is:

1. A device for audio capture and communication comprising:

a remote control for an interactive television system;

a microphone integrated with the remote control for capturing a first audio signal;

a wireless transmitter integrated with the remote control for transmitting the first audio signal to the interactive television system;

a wireless receiver integrated with the remote control for receiving a second audio signal from the interactive television system; and

a speaker integrated with the remote control for generating audible output from the second audio signal.

2. The device of claim 1, wherein the wireless transmitter comprises a radio-frequency transmitter.

3. The device of claim 1, wherein the wireless receiver comprises a radio-frequency receiver.

4. The device of claim 1, further comprising:

a specifically-designated button integrated with the remote control for initiating a two-way audio connection between the remote control and a second interactive television system.

5. The device of claim 1, further comprising:

a connection indicator integrated with the remote control for visually indicating when a two-way audio connection exists between the remote control and a second interactive television system.

6. A system for audio capture and communication comprising:

a remote control for an interactive television system, the remote control comprising a microphone for capturing a first audio signal, a wireless transmitter for transmitting the first audio signal to the interactive television system, a wireless receiver for receiving a second audio signal from the interactive television system, and a speaker for generating audible output from the second audio signal; and

a set top box for the interactive television system, the set top box comprising a wireless receiver for receiving the first audio signal from the remote control and a wireless transmitter for transmitting the second audio signal to the remote control.

7. The system of claim 6, wherein the wireless transmitter of the set top box comprises a radio-frequency transmitter.

8. The system of claim 6, wherein the wireless receiver of the set top box comprises a radio-frequency receiver.

9. The system of claim 6, wherein the set top box comprises a digital recording device for recording the first audio signal.

10. The system of claim 6, wherein the set top box comprises a converter for transforming the first audio signal into a network-compatible audio stream for transmission over a network.

11. The system of claim 10, wherein the network comprises a cable network.

12. The system of claim 6, wherein the set top box comprises a converter for transforming a network-compatible audio stream received from a network into the second audio signal.

13. The system of claim 6, wherein the set top box comprises a converter for transforming the first audio signal into a telephony-grade audio signal for transmission over a telephone network.

14. The system of claim 6, wherein the remote control comprises a specifically-designated button for initiating a two-way audio connection between the remote control and a second interactive television system.

15. The system of claim 6, wherein the remote control comprises a connection indicator for visually indicating when a two-way audio connection exists between the remote control and a second interactive television system.

16. A method for audio capture and communication comprising:

capturing a first audio signal using a microphone integrated with a remote control for an interactive television system;

transmitting the first audio signal to the interactive television system using a wireless transmitter integrated with the remote control;

receiving a second audio signal at a wireless receiver integrated with the remote control; and

generating audible output from the second audio signal using a speaker integrated with the remote control.

17. The method of claim 16, wherein the wireless transmitter comprises a radio-frequency transmitter.

18. The method of claim 16, wherein the wireless receiver comprises a radio-frequency receiver.

19. The method of claim 16, further comprising:

receiving the first audio signal at wireless receiver integrated with a set top box for the interactive television system.

20. The method of claim 19, further comprising:

recording the first audio signal in a digital storage device integrated with the set top box.

21. The method of claim 19, further comprising:

transforming the first audio signal into a network-compatible audio stream for transmission over a network.

22. The method of claim 21, wherein the network comprises a cable network.

23. The method of claim 21, further comprising:

transmitting the network-compatible audio stream over the network to a second interactive television system.

24. The method of claim 19, further comprising:

transforming the first audio signal into a telephony-grade audio signal for transmission over a telephone network.

25. The method of claim 16, further comprising:

receiving from a network a network-compatible audio stream at a set top box for the interactive television system.

26. The method of claim 25, further comprising:

transforming the network-compatible audio stream into the second audio signal.

27. The method of claim 26, further comprising:

recording the second audio signal in a digital storage device integrated with the set top box.

28. The method of claim 26, further comprising:

transmitting the second audio signal to the wireless receiver integrated with the remote control.

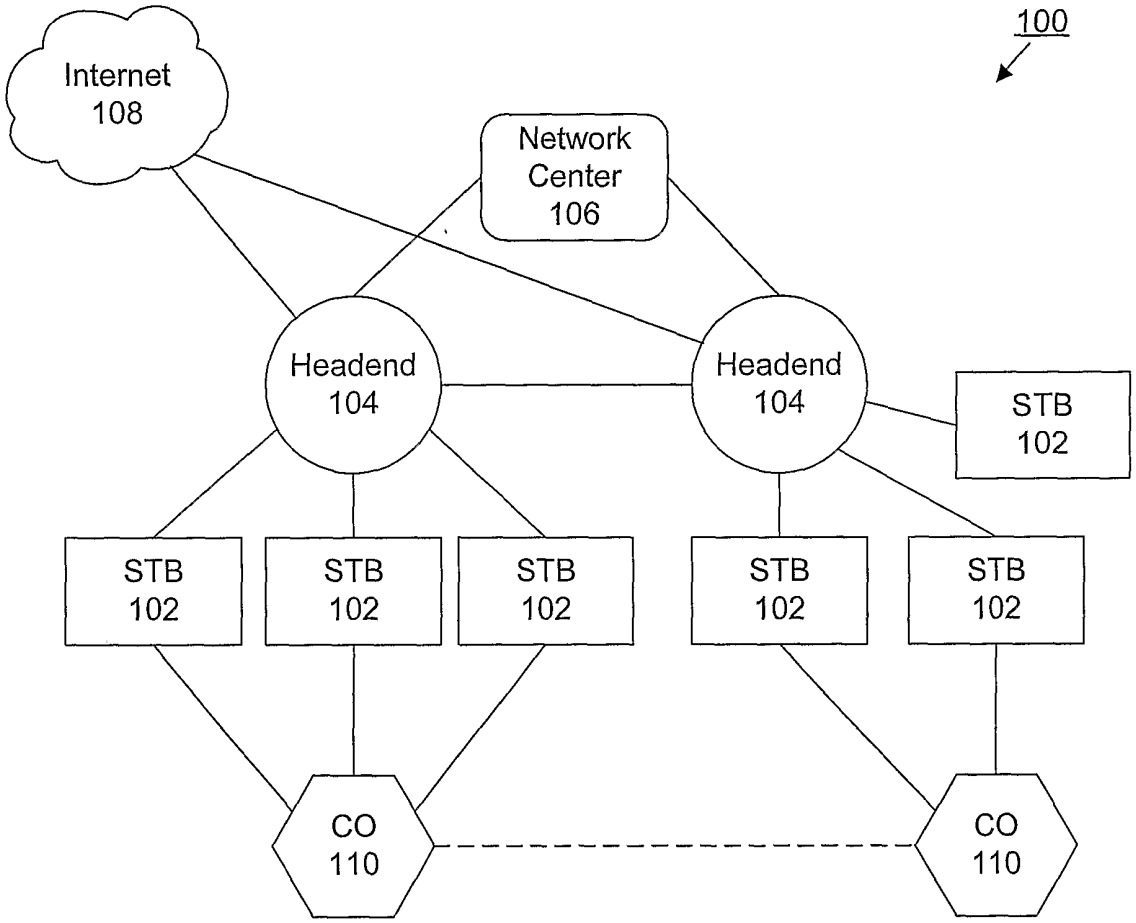
100
Internet
108
Network
Center
106
Headend
104
Headend
104
STB
102
STB
102
STB
102
STB
102
STB
102
STB
102
CO
110
CO
110

FIG. 1

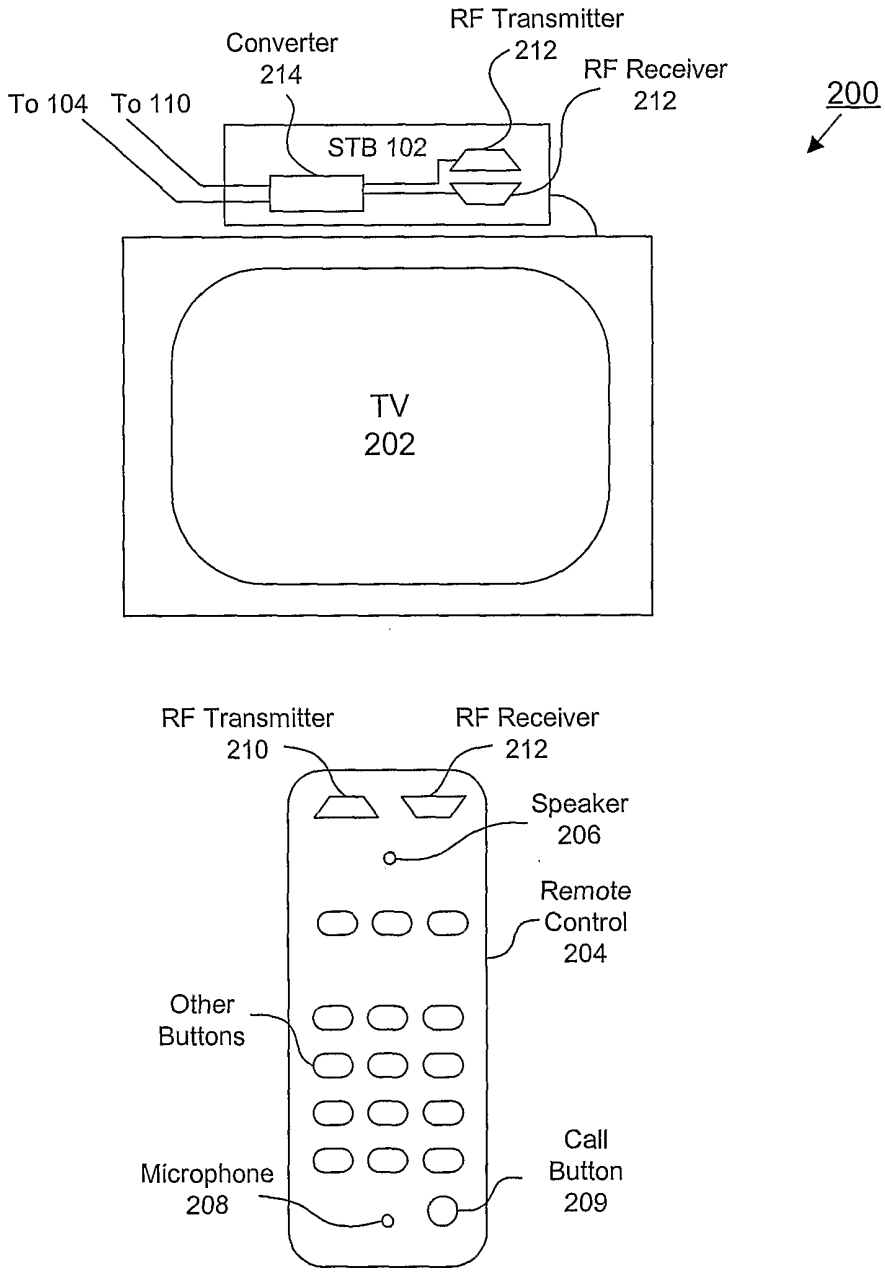
RF Transmitter
212
Converter
214
RF Receiver
212
200
To 104
To 110
STB 102
TV
202
RF Transmitter
210
RF Receiver
212
Speaker
206
Remote
Control
204
Other
Buttons
Microphone
208
Call
Button
209

FIG. 2

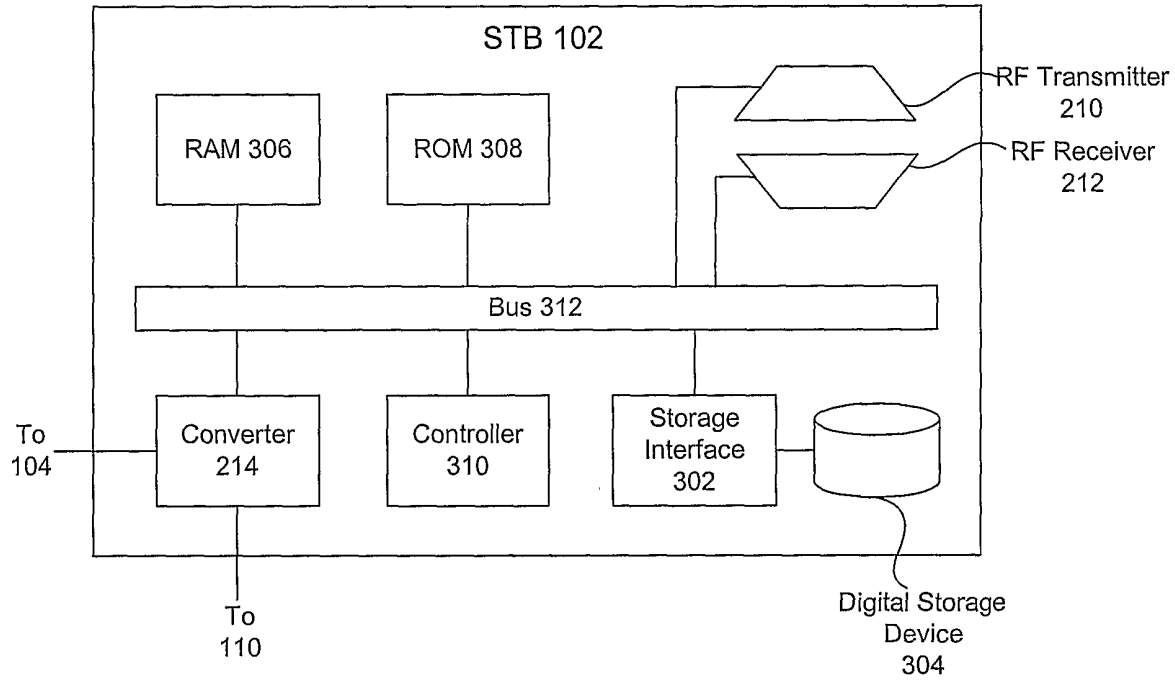
STB 102
RAM 306
ROM 308
RF Transmitter 210
RF Receiver 212
Bus 312
To 104
Converter 214
Controller 310
Storage Interface 302
To 110
Digital Storage Device 304

FIG. 3

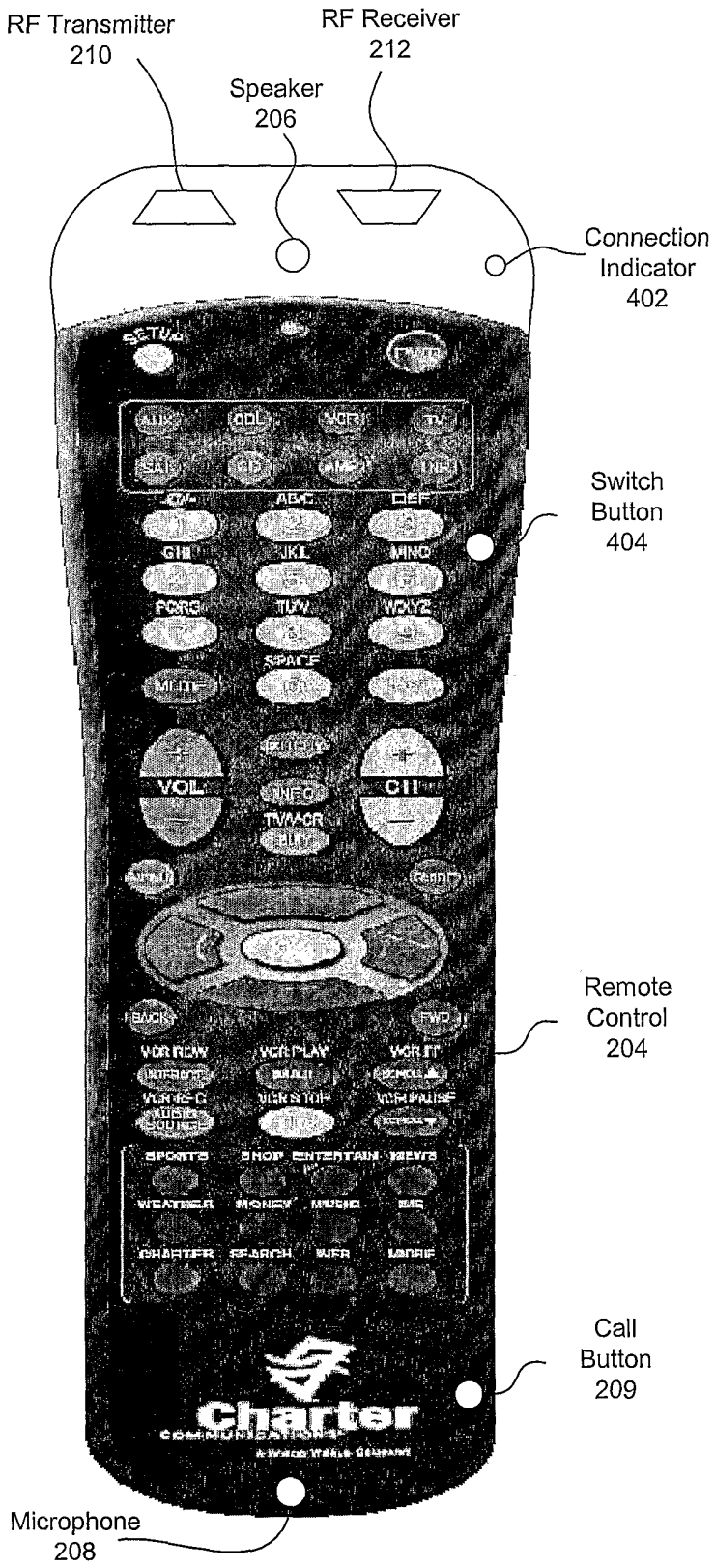
RF Transmitter
210
RF Receiver
212
Speaker
206
Connection
Indicator
402
Switch
Button
404
Remote
Control
204
Call
Button
209
Microphone
208
Charter

FIG. 4

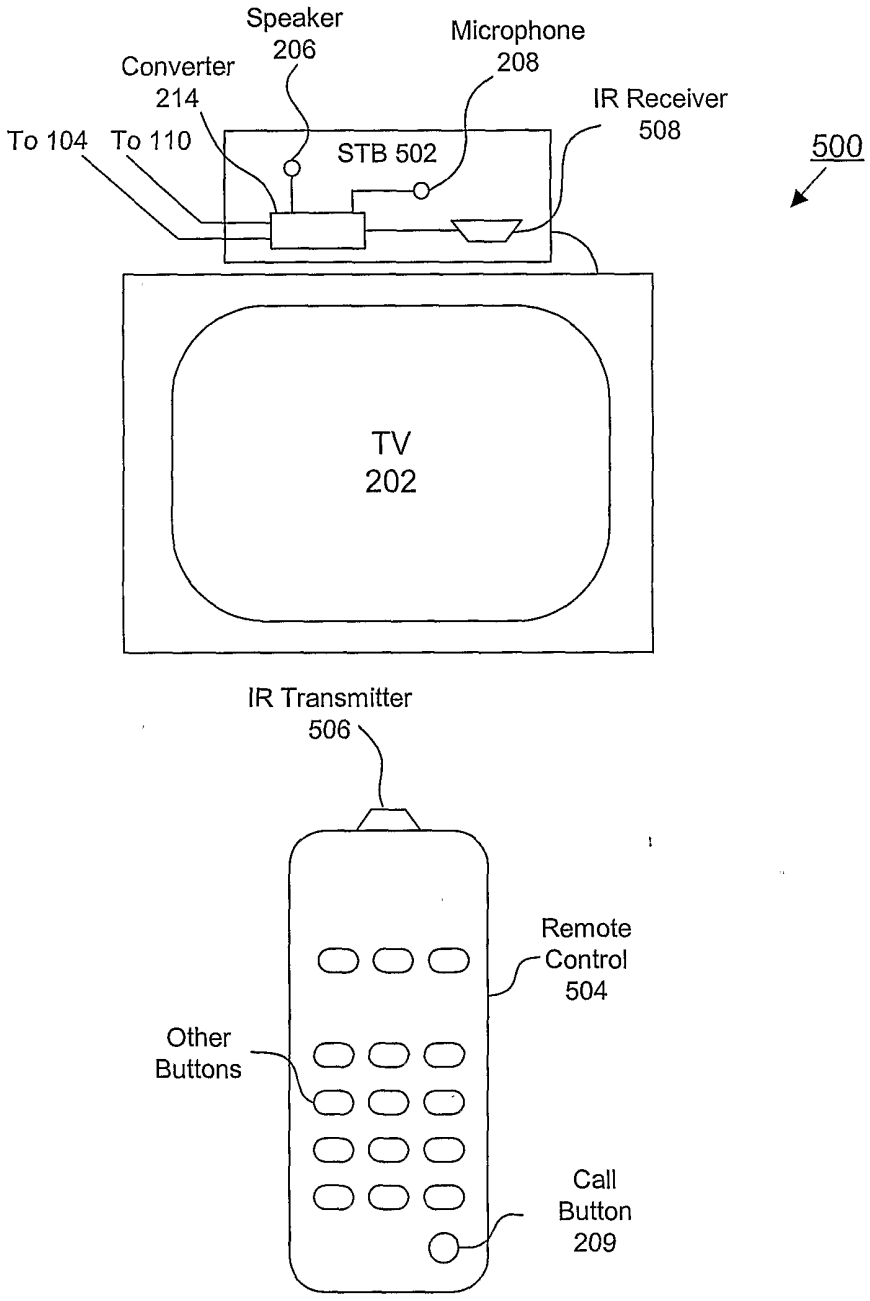
Speaker
206
Microphone
208
Converter
214
IR Receiver
508
To 104
To 110
STB 502
500
TV
202
IR Transmitter
506
Remote
Control
504
Other
Buttons
Call
Button
209

FIG. 5

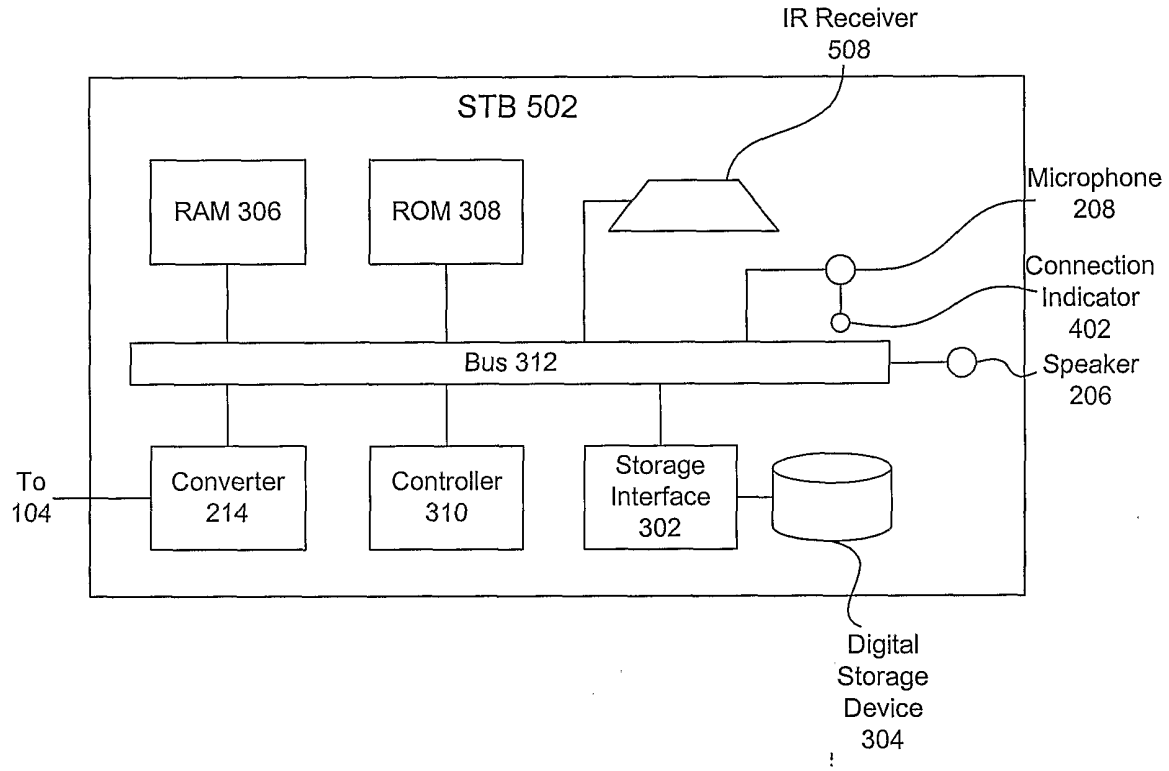
IR Receiver
508
STB 502
RAM 306
ROM 308
Microphone
208
Connection
Indicator
402
Bus 312
Speaker
206
To
104
Converter
214
Controller
310
Storage
Interface
302
Digital
Storage
Device
304

FIG. 6

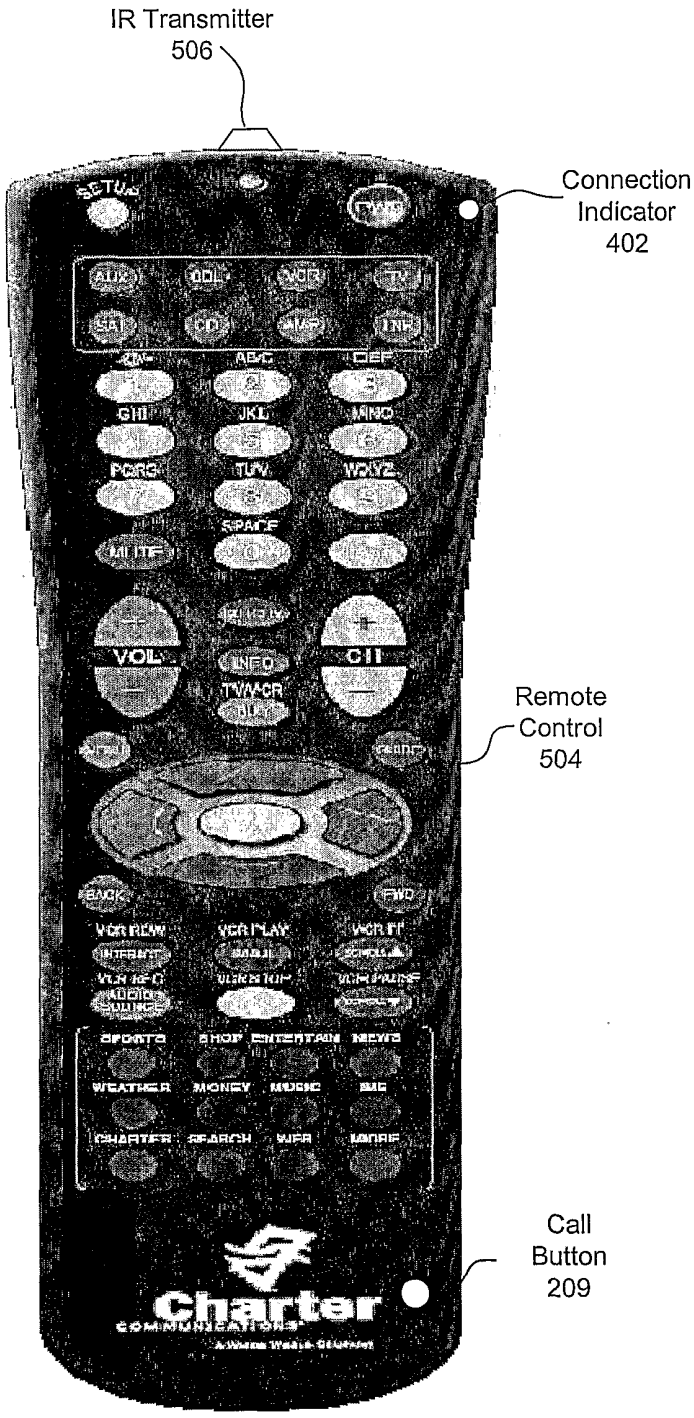
IR Transmitter
506
Connection
Indicator
402
Remote
Control
504
Call
Button
209
Charter

FIG. 7

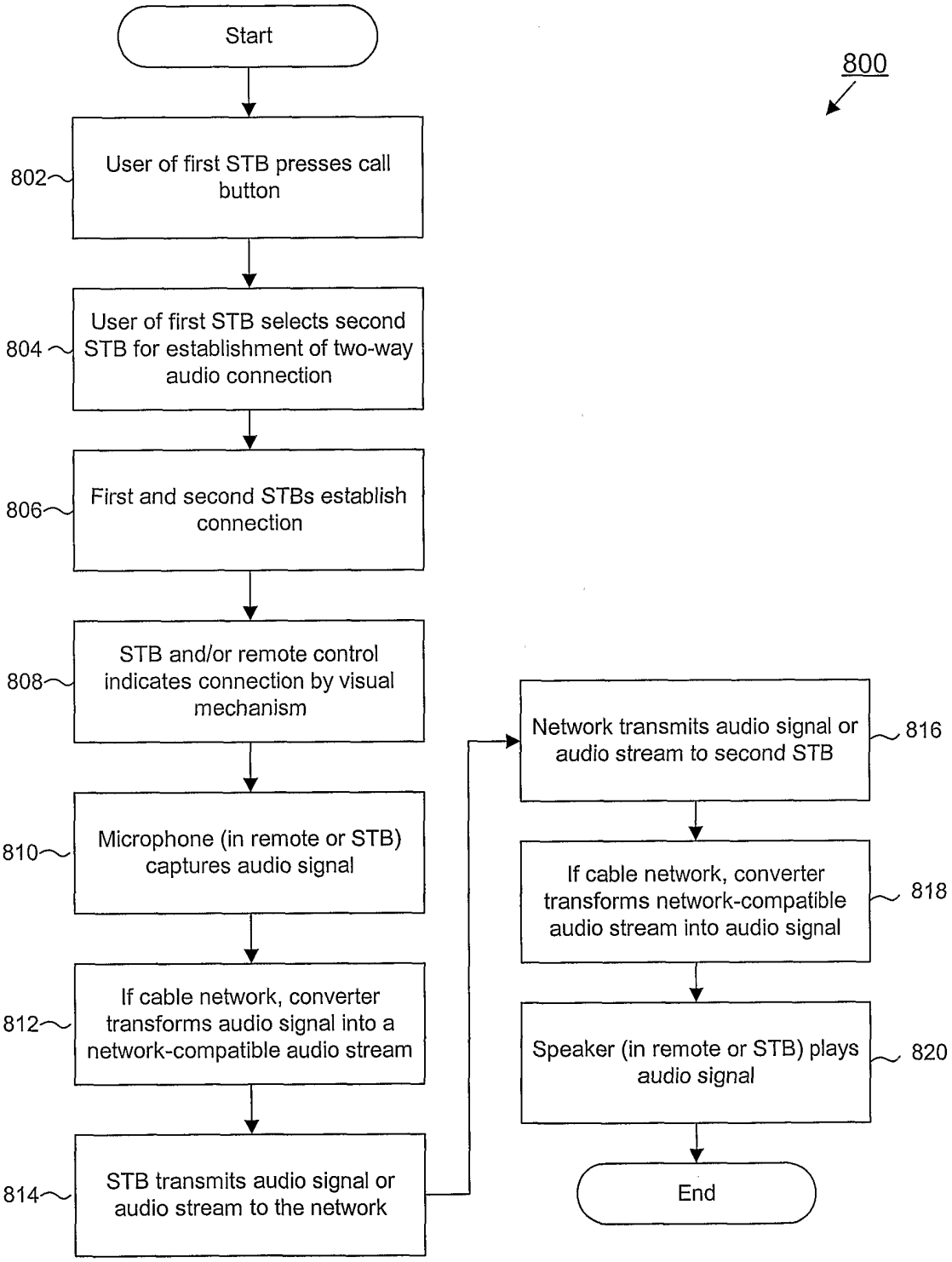
800
Start
802
User of first STB presses call button
804
User of first STB selects second STB for establishment of two-way audio connection
806
First and second STBs establish connection
808
STB and/or remote control indicates connection by visual mechanism
810
Microphone (in remote or STB) captures audio signal
812
If cable network, converter transforms audio signal into a network-compatible audio stream
814
STB transmits audio signal or audio stream to the network
816
Network transmits audio signal or audio stream to second STB
818
If cable network, converter transforms network-compatible audio stream into audio signal
820
Speaker (in remote or STB) plays audio signal
End

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/14794

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :HO4N 7/173. 5/445, 5/44

US CL :725/105, 106, 133, 37, 38; 348/734

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 725/105, 106, 133, 37, 38; 348/734

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST - remote control, speaker, microphone, settop, tv

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,675,390 A (SCHINDLER et al) 07 October 1997, whole document	1-28
A	US 5,410,326 A (GOLDSTEIN) 25 April 1995, ALL	1-28
A	US 5,283,819 A (GLICK et al) 01 February 1994, ALL	1-28

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 29 JULY 2001	Date of mailing of the international search report 24 AUG 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Vivek Srivastava Telephone No. (703) 305 - 4038

Form PCT/ISA/210 (second sheet) (July 1998) ★