

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
5 October 2006 (05.10.2006)

PCT

(10) International Publication Number  
WO 2006/104887 A2

- (51) International Patent Classification:  
H04M 11/00 (2006.01)
- (21) International Application Number:  
PCT/US2006/010785
- (22) International Filing Date: 24 March 2006 (24.03.2006)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/665,591 25 March 2005 (25.03.2005) US

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

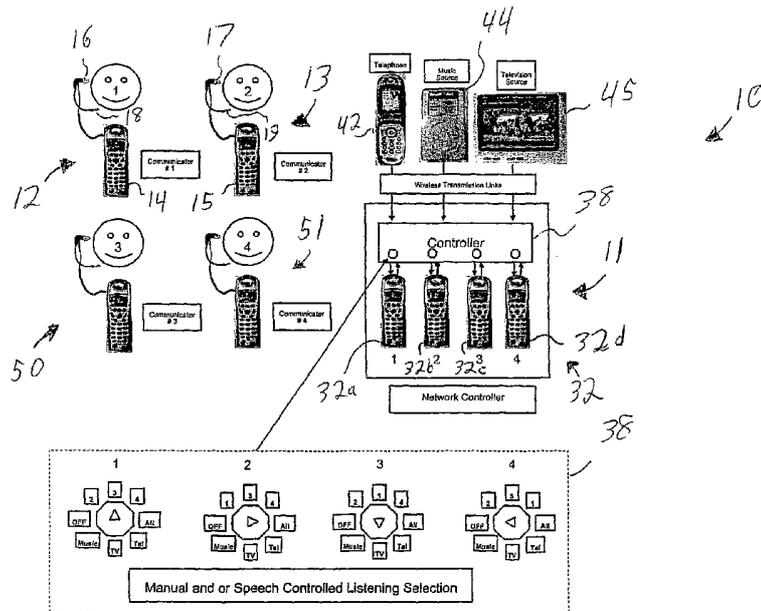
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

- (71) Applicants and
- (72) Inventors (for all designated States except US):  
SCHULEIN, Robert, B. [US/US]; 101 E. Monterey, Schaumburg, Illinois 60193 (US). BENDER, Lon, E. [US/US]; 880 S. Madison, Pasadena, California 91106 (US).
- (74) Agent: BISHOP, Edward, L.; FACTOR & LAKE LTD., 1327 W. Washington Blvd., Suite 5G/H, Chicago, Illinois 60607 (US).

Published:  
— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: AUDIO AND DATA COMMUNICATIONS SYSTEM



(57) Abstract: A communications system is disclosed that allows users to effectively communicate.

WO 2006/104887 A2

## AUDIO AND DATA COMMUNICATIONS SYSTEM

### RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application Serial No.  
5 60/665,591, filed on March 25, 2005, and incorporated herein by reference.

### FIELD OF THE INVENTION

The present invention relates to communications systems, and in particular to systems  
that allows users to effectively communicate and access information in private and public  
10 venues.

### FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

None

### 15 BACKGROUND OF THE INVENTION

In 1997, studies presented in MarkeTrak reports (MarkeTrack – The US Hearing  
Instrument Market, Sergei Kochkin, Ph.D., Published by Knowles Electronics, Itasca Illinois)  
estimated that of the 24 to 28 million Americans believed to experience significant hearing loss,  
approximately 21% of this population actually used hearing aids. It has also been projected in  
20 these and other studies that the impaired population is growing primarily as a result of the  
increase in the U.S. aging population, and due to an increase in exposure to high level sounds by  
the general population.

Individuals with hearing loss commonly have difficulty hearing low volume sounds as  
well as discriminating speech masked by speech like noise. In spite of the technical and  
25 marketing efforts of those producing hearing aids, market penetration of this population has not  
changed significantly. This is an unfortunate situation in that many individuals who suffer from  
hearing loss, and do not obtain help, tend to experience significant emotional stress by removing  
themselves from many desired social situations, due to an inability to effectively function.

A number of reasons have been documented, that contribute to the low penetration of  
30 hearing aid sales such as: 1) The fact that hearing loss typically comes on gradually and is not  
immediately obvious to an individual (“I am not convinced that I have a hearing problem”); 2)  
The negative stigma of being handicapped, associated with being a hearing aid user; 3) The  
belief that hearing aids do not create the same degree of improvement as say eyeglasses; and, 4)  
The fact that modern hearing aids are relatively expensive for their perceived value.

Hearing aid technology has however made steady improvements with respect to making sounds more audible and comfortable, as well as improving the perceived signal-to-noise ratio of amplified speech masked by noise.

5 In addition, products have also been developed that allow wireless connectivity between a microphone positioned near a desired but distant talker and a small radio receiver connected to a Behind-the-Ear (BTE) hearing aid. Wireless devices such as these are primarily used in teaching situations where one transmitter can serve a large number of students much like a radio station. Variations of such products have been developed as well for personal use, and in some cases allow remote communication from a cellular telephone or remote microphone by means  
10 such as a Bluetooth transmission link to a radio receiver connected to a user's hearing aid.

In general however these devices tend to be expensive, require a fair amount of user skill to operate, involve wireless transmission links that are often not secure to others monitoring the same radio channel, and do not allow two or more impaired individuals to communicate with each other in a wide variety of "real life" interactive situations.

15 These factors clearly indicate that products and technology that would enable the growing hearing impaired population to effectively communicate at home, in vehicles, and in a variety of private and public gatherings while at the same time removing barriers of cost, unimpressive performance, and the stigma of traditional hearing aids, is a highly desirable but unmet need.

20 In an embodiment, an objective of the current invention is to provide a means for individuals with varying degrees of hearing loss to effectively and easily communicate with family, friends, and the public in a variety of basic living, social and public settings.

In an embodiment, an objective of the current invention is to allow individuals with varying degrees of hearing loss to easily interact with modern communications technology such  
25 as cellular telephones, televisions, radios, computers, personal digital assistants, GPS systems, and information data bases.

In an embodiment, an objective of the current invention is to allow individuals with or without significant hearing loss to communicate more effectively in a variety of real world situations where achieving adequate speech intelligibility is difficult at best, such as in noisy  
30 restaurants, large social gatherings, and crowded public spaces.

In an embodiment, an objective of the current invention is to allow groups of individuals to communicate more effectively in business situations by eliminating the echo, interactive problems and difficulties for listeners at distant locations associated with hands free speaker

telephones particularly in teleconference situations, while at the same time allowing a high degree of mobility throughout a business environment.

#### SUMMARY OF THE INVENTION

5           The present invention is directed to communications systems, and in particular to systems that allows users to effectively communicate and access information in private and public venues. According to one aspect of the invention, the system includes multiple communicators coupled to each other with, in addition thereto, a controller operatively coupled to each of the communicators.

10           According to another aspect of the invention, a system includes a first remote unit comprising a receiver and a hearing aid circuit operatively coupled to a speaker. The system also includes a second remote unit comprising a transmitter operatively coupled to a microphone. Further, the system includes a base unit comprising a transceiver unit and relaying wireless transmissions from the second remote unit to the first remote unit.

15           Other embodiments, systems, methods, features, and advantages of the present invention will be, or will become, apparent to one having ordinary skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages included within this description be within the scope of the present invention, and be protected by the accompanying claims.

20

#### BRIEF DESCRIPTION OF THE DRAWINGS

          The present invention may be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale. Emphasis instead being placed on the principles of the invention. In the drawings like reference numerals designate  
25           corresponding parts throughout the several views.

          FIGURE 1 is a simplified block diagram of a communications system in accordance with the present invention;

          FIGURE 2 is a simplified circuit diagram of the communications system of FIGURE 1 wherein manual mode switching is utilized;

30           FIGURE 3 is a block diagram of a personal communicator used as a part of the communications system of FIGURE 1;

          FIGURE 4 is a simplified circuit diagram of a Bluetooth Cellular telephone interface for use with the communications system of FIGURE 1;

FIGURE 5 is a simplified circuit diagram of another embodiment of a communications system in accordance with the present invention that uses speech recognition for system control;

FIGURE 6 is a simplified functional block diagram of an individual speech control and speech prompting portion of the communications system shown in FIGURE 5;

5 FIGURE 7 is a simplified block diagram of another embodiment of a communications system in accordance with the present invention; and

FIGURE 8 is a simplified block diagram of yet another embodiment of a communications system in accordance with the present invention;

10 FIGURE 9 is a simplified block diagram of a cellular telephone in which the embodiment of FIGURE 7 is integrated into a cellular telephone; and

FIGURES 10A, 10B and 10C are embodiments of graphics for the user interface touch screen display shown in FIGURE 9.

**DETAILED DESCRIPTION**

15 The following descriptions of detailed embodiments are for exemplifying the principles and advantages of the inventions claimed herein. They are not to be taken in any way as limitations on the scope of the inventions.

In the FIGURES, the following reference numbers are used to depict corresponding elements wherein reference numbers having the same last two digits correspond to like  
 20 elements:

	<u>Reference Number</u>	<u>Element</u>
	10	System
	11	Base Unit or Network Controller
	12	Remote Unit or Communicator (#1)
25	13	Remote Unit or Communicator (#2)
	14	Receiver and/or Transmitter (#1)
	15	Receiver and/or Transmitter (#2)
	16	Speaker – Remote Unit (#1)
	17	Speaker – Remote Unit (#2)
30	18	Microphone - Remote Unit (#1)
	19	Microphone – Remote Unit (#2)
	20	Hearing Aid Signal Processing Block – (#1)
	21	Hearing Aid Signal Processing Block – (#2)
	22	Microphone Select and Control Block – (#1)

	23	Microphone Select and Control Block – (#2)
	24	Accessibility Control Block – (#1)
	25	Accessibility Control Block – (#2)
	26	Encryption and/or Decryption Block – (#1)
5	27	Encryption and/or Decryption Block – (#2)
	28	Controller – (#1)
	29	Controller – (#2)
	30	Voice Recognition Module – (#1)
	31	Voice Recognition Module – (#2)
10	32	Transceiver Unit – (#Base)
	34	Encryption and/or Decryption Block - (#Base)
	36	Accessibility Control Block – (#Base)
	38	Controller or Switch
	40	Voice Recognition Module
15	42	External Source 1
	44	External Source 2
	45	External Source 3
	46	Wireless Data Transmission Signal
	48	Wireless Data Transmission Signal
20	50	Remote Unit or Communicator (#3)
	51	Remote Unit or Communicator (#4)

In an embodiment, a communications system 10 in accordance with the present invention is shown in FIGURE 1, which involves up to four users. However, as will be appreciated by those having ordinary skill in the art, the present invention is not limited to four users and thus more or less users can be involved, if desired. Each user is equipped with an electronic/acoustical communicator 12, 13, 50 and 51 that enables both a wireless transmission and reception of audio signals with a system network controller or base unit 11. One possible method of transmission is that of a digitally processed, frequency hopping spread spectrum (DPFHSS) system operating at 5.8 GHz. This type of transmission is commonly used with consumer cordless telephone products, such as a Radio Shack Model 43-3703, for communications between a base telephone and an extension telephone. However, other wireless standards can be used such as, but not limited to, TD-SCDMA, WCDMA, CDMA2000.

The network controller or base unit 11 contains, in part, a transceiver unit 32 comprising, in an embodiment, four wireless transmission and receiving modules 32a-d that are uniquely paired with the four individual communicators 12, 13, 50 and 51, respectively. However, the transceiver unit 32 can comprise other suitable circuitry for conducting separate communication with each of the communicators 12, 13, 50 and 51. As shown in FIGURE 1, these paired combinations allow for establishing four separate and secure transmission/reception links between the four users and the network controller 11. As will be appreciated by those having ordinary skill in the art, a relatively high level of security is achieved by virtue of the DPFHSS transmission technology, which is inherently a one-to-one paired communications technology. Additional components within the network controller 11, such as switch 38, which will be explained in detail in subsequent figures, allow the individual communications links to be tied together by manual, speech controlled and or automatic means, so as to connect to other wired and wireless devices such as telephones, audio news and entertainment sources, and other information sources that can communicate by audio means.

FIGURE 2 shows a circuit diagram for the system shown in FIGURE 1, in which network control is accomplished by means of manual switching. In this embodiment, each communicator consists of a headset such as an Ety-Com Mobile Headset manufactured by Etymotic Research Incorporated, and a 5.8Ghz transmission and reception module, paired to a companion module in the network controller. However, as will be appreciated by those having ordinary skill in the art and indicated previously, other types of transmission are reception means and modes can be used without departing from the spirit of the invention.

As also shown in FIGURE 2, additional audio devices including a cellular telephone 42 and two audio program channels 44,45, are connected to the network controller by means of separate wireless transmission links. In this example these connections are accomplished by Bluetooth transmission at 2.4Ghz, following the Bluetooth protocols for cellular telephone communication and high fidelity audio transmission. The cellular telephone transmission link was established by modifying a Motorola Model HS 820 Bluetooth Receiver and Ear Piece, available from Radio Shack, and shown in detail in FIGURE 4, in conjunction with a Motorola Bluetooth Adapter Model SYN089B, also available from Radio Shack. Wireless connection to Audio Programs #1 and #2 were established by the use of a Blue Take Technology Model BT430 Transmitter and modified BT 420 Headphone. The headphone modification involved removing the headphone loudspeakers and making a direct connection to the outputs of the headphone amplifier.

Desired communications connections are implemented by an appropriate switching of four controller module selector switches involving eight individual switches each, and a four switch telephone talk selector. This combination of switches allows for the communicator users to select who of the additional users they wish to communicate with, what audio program  
5 sources they wish to hear and if the wish to receive or make a telephone call. Since each transmission and receiver module in the system desires a microphone level input and provides a line level output, a number of attenuating voltage dividers are used in this implementation consisting of a series resistor value of 3.3 k Ohms and a shunt value of 330 Ohms. As an example, the line level output of Controller Module 1 is attenuated by the combination of 3.3k  
10 ohms and 330 ohms when its output is selected as an input to Controller Module 2 by closing Switch number 1 of the Listen Selector switch for Controller Module 2. So as to avoid undesirable system echo when the system is used for connecting to a telephone system, it is desired that the side tone typically associated with normal telephone techniques, be turned off. This is not normally the situation, with cordless telephones, however when used as described in  
15 FIGURE 2, a portion of any signal driving the input of one of the Controller Modules will appear as an attenuated but audible signal at the output of that module, and consequently returned to the caller as an undesired echo.

FIGURE 3 presents a more detailed description of a communicator 12, 13, 50 and 51 shown in FIGURES 1 and 2, as well as showing other desirable features incorporated therein to  
20 allow improved communication for individuals with varying degrees of hearing loss. The functions described in the two system blocks (i.e., 20 and 22) between the transmitter 14b, receiver 14a, microphones 18a-c and in ear speaker 16, allow for both traditional hearing aid functions independent of wireless communications, as well as improved audibility for wireless communicator communications. By providing functions such as wide band compression,  
25 equalization, adaptive noise reduction, adaptive wind noise reduction, and adaptive microphone polar pattern selection, which are well understood by those skilled in the art of hearing aid technology, a communicator user will be capable of better communications intelligibility, as compared to conventional in ear speaker linear amplification. By integrating multiple microphones into the communicator, a user will obtain further benefit from head worn  
30 directional microphones, also well understood to those having ordinary skill in the art of hearing aid technology, when using the communicator in a hearing aid only mode. By using the Close Talking Noise Canceling Microphone, shown connected to the Microphone Selector and Control Signal Processing block, for communicator functions, other individuals in communications with

the user will benefit from reduced background noise masking the voice signals from the communicator user.

FIGURE 4 presents details of one method by which an external source, for example a cellular telephone such as a Motorola Model V300 Cellular telephone, can be wirelessly coupled to the network controller or base unit 11 shown in FIGURES 1 and 2. Transmissions from the telephone 42 are established by means of a Motorola Bluetooth adapter previously described. Transmissions from the Network Controller are established by means of a modified Motorola Bluetooth receiver and Ear Piece also previously described. The need for modification resulted from the fact that there was no common ground between the Ear Piece microphone input and loudspeaker output. If an attempt was made to establish a common ground so as to be compatible with the Network Controller, the Ear piece device would become unstable. To circumvent this problem, a Knowles Electronics Model BK 1613 receiver was connected to the loudspeaker terminals of the Ear Piece and acoustically coupled to one of two integral electret condenser microphones in a Radio Shack Model 33-1096 Amplified Listener. The output of the Amplified Listener was subsequently adjusted so as to be voltage level compatible with inputs to the Network Controller. The net result of this modification allowed a stable common ground to be established with the microphone input and loudspeaker output of a Bluetooth Link interface with the Motorola V300 Cellular telephone.

FIGURE 5 is similar to FIGURE 2, except for the fact that the various connections and adjustments within the Network Controller or base unit 11 are established by means of the speech recognition, word spotting and simulated voice prompting methods. In contrast to the manual switches shown in FIGURE 2, these switches are replaced by four User Speech Control Modules 140a-d. With this method of control, individual communication network users each contribute to control the status of the system, with out need to make physical contact with the Network Controller. This capability allows the users to operate the system successfully as long as each user is within the coverage range of the individual, for example, 5.8 GHz transmission links. By so doing, a location for the Network Controller can be selected for optimum convenience by the users. As examples, Network Controllers could be centrally located in living quarters, carried on persons, placed in cars or other modes of transportation, located in restaurants, offices spaces, retail establishments, and in public areas.

FIGURE 6 presents details of one of the four Speech Control Modules 140a-d of FIGURE 5, in which the module inputs and outputs correspond to the equivalent inputs and outputs shown in FIGURE 5. The Voice Extreme Module manufactured by Sensory, Inc. has the capability of recognizing a small vocabulary of spoken commands on a speaker independent

or dependant basis, recognizing key words in continuous speech, and generating simulated speech as a means of providing feedback to a talker. Once the module has determined an action based on a speech input, it can react with the system users in many ways. If for example a user wants help using the system, a spoken command such as "I need System Help" would prompt a menu driven dialog with the module. Functions involving interconnections with the various communicator users, input source selection, telephone interactions functions, and level adjustments are a few examples.

These functions are executed by the Voice Extreme Module by means of logic signals and simulated speech output. These logic signals in turn activate logic controlled switches and volume controls, which are shown as system blocks (e.g., block 138) connected to the speech module and the inputs and outputs of the complete Speech Control Module. Once such a command and control capability has been established, it is possible to extend the system functionality to interact with any function that can respond to a user by means of sound. Examples of such functionality include: 1) Providing date, time, and calendar information; 2) Providing schedule prompts and event details; 3) Provide GPS based location and navigation functions; 4) Managing task lists; 5) Providing operating instructions for difficult to use equipment; 6) Interacting with guest Communicator users; 7) Interacting with location based information and assistance services; 8) Providing command functions for appliances and environmental control devices; and, 9) Providing command functions for personal computer.

FIGURES 7 and 8 are simplified block diagrams of other embodiments of communications system in accordance with the present invention. In FIGURE 7, the system includes, but is not limited to, a first remote unit 212 comprising a receiver 214 and a hearing aid circuit 220 operatively coupled to a speaker 216. Also, a second remote unit 213 is provided comprising a transmitter 215 operatively coupled to a microphone 219. Further, a base unit 211 is provided comprising a transceiver unit 232 and relaying wireless transmissions 246,248 from the second remote unit 213 to the first remote unit 212.

In FIGURE 8, direct communication is provided between the first remote unit 312 and the second remote unit 313. Accordingly, a base unit can be omitted, if desired.

In Figure 9, a system block diagram is shown in which the embodiment of FIGURE 7 is implemented within a cellular telephone. In addition to the typical components of a cellular telephone, this phone has been configured with the following addition: 1) a Bluetooth type transceiver configured for headset communications, such as a CSR BLUECORE 3 – Audio Flash Model Bc31A223A; 2) a Bluetooth type transceiver configured for multimedia communications, such as a CSR BLUECORE 3 – Audio Flash Model BC358239A; 3) Four

controller modules and associated electronic switching components as previously described in FIGURES 2, 5 and 6; 4) An analog touch screen such as an Apex Analog Resistive Touch Screen Model 9510, and touch screen interface such as a Texas Instruments Model TSC2000; and, 5) Control logic and signal connections between the added components and the cellular telephone main signal processor.

5 With these additions, the cellular telephone is able to take on the function of a system controller, and manage the interconnections between up to four communicators, a cellular telephone and two channels of multimedia audio information. Through the use of the touch screen interface, as shown in FIGURES 10A-C, the system host (H) is able to configure and  
10 view the audio connection status between up to three additional users. FIGURE 10A indicates that four users (H, 1, 2 and 3) have established contact with the controller, but that they are not as yet connected with each other. FIGURE 10B indicates that users 2 and 3 are no longer connected to the controller and that the host (H) and user 1 have an established a two-way connection. Further, FIGURE 10C indicates that four users are now connected and that users  
15 H, 1 and 3 configured for a three-way conversation, whereas user 2 is configured to speak over the cellular telephone.

It should be emphasized that the above-described embodiments of the present invention, particularly, any “preferred” embodiments, are possible examples of implementations merely set forth for a clear understanding of the principles of the invention. Many variations and  
20 modifications may be made to the above-described embodiment(s) of the invention without substantially departing from the spirit and principles of the invention. All such modifications are intended to be included herein within the scope of this disclosure and the present invention, and protected by the following claims.

**WHAT IS CLAIMED IS:**

1. A system comprising  
multiple communicators coupled to each other; and,  
a controller operatively coupled to each of the communicators.  
5
2. The system of claim 1 wherein the communicators include an earphone and a  
microphone connected to a transceiver.
3. The system of claim 1 wherein the controller provides a communication link between the  
10 communicators.
4. The system of claim 3 wherein the communication link is unidirectional.
5. The system of claim 3 wherein the communication link is bidirectional.  
15
6. The system of claim 1 wherein an external source is operatively coupled to the controller  
to provide audio signals to a user.
7. The system of claim 6 wherein an external source is wirelessly coupled to the controller  
20 to provide the audio signals to the user.
8. The system of claim 6 wherein the controller provides a link between the communicators  
and the external source.
- 25 9. The system of claim 6 wherein the controller provides a link between the  
communicators.
10. The system of claim 6 wherein the external source is a telephone.
- 30 11. The system of claim 6 wherein the external source is a radio.
12. The system of claim 6 wherein the external source is a television
13. The system of claim 6 wherein the external source is a media player.

14. The system of claim 8 wherein the controller provides a bidirectional communication link between the communicators.
- 5 15. The system of claim 1, each communicator comprising a signal processor.
16. The system of claim 15, the signal processor comprising wide band dynamic range compression circuitry.
- 10 17. The system of claim 15, the signal processor comprising adaptive noise reduction circuitry.
18. The system of claim 15, the signal processor comprising adaptive wind noise reduction circuitry.
- 15 19. The system of claim 15, the signal processor comprising adaptive microphone polar pattern selection and equalization circuitry.
20. The system of claim 1, the communicators comprising a microphone.
- 20 21. The system of claim 20, the microphone comprising an omni directional microphone.
22. The system of claim 20, the microphone comprising a first order directional microphone.
- 25 23. The system of claim 20, the microphone comprising a close talking noise canceling microphone.
24. The system of claim 20, the microphone operatively coupled to a signal processor coupled to a speaker.
- 30 25. The system of claim 24, the signal processor comprising wide band dynamic range compression circuitry.

26. The system of claim 24, the signal processor comprising adaptive noise reduction circuitry.
27. The system of claim 24, the signal processor comprising adaptive wind noise reduction  
5 circuitry.
28. The system of claim 24, the signal processor comprising adaptive microphone polar pattern selection and equalization circuitry.
- 10 29. The system of claim 1, wherein the controller is installed in a public structure.
30. The system of claim 29, the public structure comprising an office.
31. The system of claim 1, wherein the controller is installed in a house.  
15
32. The system of claim 1, wherein the controller is installed in a casino.
33. The system of claim 1, wherein the controller is installed in a retail environment.
- 20 34. The system of claim 1, wherein the controller is installed in a restaurant.
35. The system of claim 1, wherein a service provided of a restaurant or retail environment carries the controller.
- 25 36. The system of claim 1, wherein the controller is portable.
37. The system of claim 36, wherein the controller is battery powered.
38. The system of claim 1, wherein the controller is installed in a vehicle.  
30
39. The system of claim 1, wherein the controller is installed in a theater.
40. The system of claim 1, wherein the controller is installed in a conference room.

41. The system of claim 1, wherein the controller is contained in housing suitable for transport within a pocket in an article of clothing.
42. The system of claim 1, wherein the controller is operatively coupled to more than four  
5 pairs of communicators.
43. A system comprising:  
a first remote unit comprising a receiver and a hearing aid circuit operatively coupled to a speaker;  
10 a second remote unit comprising a transmitter operatively coupled to a microphone;  
a base unit comprising a transceiver unit and relaying wireless transmissions from the second remote unit to the first remote unit.
44. The system of claim 43, the hearing aid circuit operatively coupled to a microphone.  
15
45. The system of claim 43, the transceiver unit comprising a plurality of transceiver modules.
46. The system of claim 43, the transceiver unit comprising a plurality of transceiver  
20 modules, each transceiver module comprising a cordless telephone handset.
47. The system of claim 43, the transceiver unit comprising a plurality of transceiver modules, each transceiver module comprising a cordless telephone handset comprising encryption hardware and/or software.
- 25 48. The system of claim 43, the base unit comprising encryption hardware and/or software and decryption hardware and/or software.
49. The system of claim 43, the base unit comprising encryption hardware and/or software that encrypts data sent from the base unit to the first remote unit.  
30
50. The system of claim 43, the base unit comprising decryption hardware and/or software that decrypts data sent from the second remote unit to the base unit.
51. The system of claim 43, the base unit comprising an accessibility control function.

52. The system of claim 43, the base unit comprising an accessibility control function that allows another wireless remote unit to discover the base unit.
- 5 53. The system of claim 43, the base unit comprising an accessibility control function that allows another remote unit to wirelessly connect to the base unit.
54. The system of claim 53 wherein the another remote unit must be a paired device.
- 10 55. The system of claim 43, the base unit further comprising a controller.
56. The system of claim 43, the base unit further comprising a controller that switches communications between the first remote device and an external source.
- 15 57. The system of claim 43, the base unit further comprising a controller that switches communications between the first remote device and a plurality of external sources.
58. The system of claim 43, the base unit further comprising a controller that switches communication between the first remote device and another device comprising the second remote device or an external source.
- 20 59. The system of claim 43, the base unit further comprising a controller that switches communication between the first remote device and another device comprising another remote device or an external source.
- 25 60. The system of claim 43, the base unit further comprising a voice recognition module.
61. The system of claim 43, the base unit further comprising a voice recognition module utilizing any combination of speaker independent or dependent recognition, specific speaker identification, word spotting, and speech prompting by means of a simulated talker.
- 30 62. The system of claim 43, the base unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the first remote device and an external source.

63. The system of claim 43, the base unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the first remote device and another device comprising the second remote device or an external source.
- 5 64. The system of claim 43, the base unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the first remote device and another device comprising another remote device or an external source.
65. The system of claim 43, the wireless transmissions being frequency modulated.
- 10 66. The system of claim 43, the wireless transmissions being spread spectrum.
67. The system of claim 43, the wireless transmissions being frequency modulated and spread spectrum.
- 15 68. The system of claim 43, the wireless transmissions being frequency modulated and spread spectrum and packetized.
69. The system of claim 43, the base unit operatively connected to an external source
- 20 comprising a telephone for receiving sound input.
70. The system of claim 43, the base unit operatively connected to an external source comprising a telephone for receiving and transmitting sound data.
- 25 71. The system of claim 43, wherein the base unit enables battery recharging of the remote units.
73. The system of claim 43, the base unit operatively connected to an external source comprising a television for receiving sound input.
- 30 74. The system of claim 43, the base unit operatively connected to an external source comprising a radio.

75. The system of claim 43, the base unit operatively connected to an external source comprising a microphone.
76. The system of claim 43, the base unit operatively connected to an external source  
5 comprising the Internet.
77. The system of claim 43, the base unit operatively connected to an external source comprising a recorded media player.
- 10 78. The system of claim 43, the speaker of the first remote unit contained in an earpiece.
79. The system of claim 43, the microphone of the second remote unit contained within a piece of jewelry.
- 15 80. The system of claim 43, the microphone of the second remote unit contained within a brooch.
81. The system of claim 43, the receiver of the first remote unit comprising a transceiver.
- 20 82. The system of claim 43, the receiver of the first remote unit comprising a cordless telephone handset.
83. The system of claim 43, wherein the first or second remote unit is a self-contained module worn on or near the ear.
- 25 84. The system of claim 43, wherein the first or second remote unit is a self contained module within a telephone.
85. The system of claim 43, wherein the first or second remote unit are within a headset.
- 30 86. The system of claim 43, the receiver of the first remote unit comprising a cordless telephone handset comprising encryption hardware and/or software.

87. The system of claim 43, the first remote unit comprising encryption hardware and/or software and decryption hardware and/or software.
88. The system of claim 43, the first remote unit comprising encryption hardware and/or software that encrypts data sent from the first remote unit to the base unit.
89. The system of claim 43, the first remote unit comprising decryption hardware and/or software that decrypts data sent from the base unit to the first remote unit.
90. The system of claim 43, the first remote unit comprising an accessibility control function.
91. The system of claim 43, the first remote unit comprising an accessibility control function that allows another base unit or remote unit to discover the first remote unit.
92. The system of claim 43, the first remote unit comprising an accessibility control function that allows another base unit or remote unit to wirelessly connect to the first remote unit.
93. The system of claim 92 wherein the another base unit or remote unit must be a paired device.
94. The system of claim 43, the first remote unit further comprising a controller.
95. The system of claim 43, the first remote unit further comprising a controller that switches communications between the first remote device and another device comprising the base unit, another base unit, the second remote unit, another remote unit, or an external source.
96. The system of claim 43, the first remote unit further comprising a controller that switches communications between the first remote unit and the base unit.
97. The system of claim 43, the first remote unit further comprising a controller that enables communication between the first remote device and the second remote device.

98. The system of claim 43, the first remote unit further comprising a controller that enables communication between the first remote device and an external device.

5 99. The system of claim 43, the first remote unit further comprising a voice recognition module.

10 100. The system of claim 43, the first remote unit further comprising a voice recognition module responsive to a user's voice for controlling communication between the first remote device and an external source.

101. The system of claim 43, the first remote unit further comprising a voice recognition module responsive to a user's voice for controlling communication between the first remote device and another device comprising the second remote unit or an external source.

15 102. The system of claim 43, the first remote unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the base unit and another device comprising another base unit or an external source.

20 103. The system of claim 43, the wireless transmissions from the first remote unit being frequency modulated.

104. The system of claim 43, the wireless transmissions from the first remote unit being spread spectrum.

25 105. The system of claim 43, the wireless transmissions from the first remote unit being frequency modulated and spread spectrum.

30 106. The system of claim 43, the wireless transmissions from the first remote unit being frequency modulated, spread spectrum and packetized.

107. The system of claim 43, the first remote unit operatively connected to an external source comprising a telephone for receiving sound input.

108. The system of claim 43, the first remote unit operatively connected to an external source comprising a television for receiving sound input.
109. The system of claim 43, the first remote unit operatively connected to an external source  
5 comprising a radio.
110. The system of claim 43, the first remote unit operatively connected to an external source comprising a microphone.
- 10 111. The system of claim 43, the first remote unit operatively connected to an external source comprising the Internet.
112. The system of claim 43, the first remote unit operatively connected to an external source comprising a recorded media player.
- 15 113. The system of claim 43, the hearing aid circuit comprising wide band dynamic range compression circuitry.
114. The system of claim 43, the hearing aid circuit comprising adaptive noise reduction  
20 circuitry.
115. The system of claim 43, the hearing aid circuit comprising adaptive wind noise reduction circuitry.
- 25 116. The system of claim 43, the hearing aid circuit comprising adaptive microphone polar pattern selection and equalization circuitry.
117. The system of claim 43, the first remote unit comprising an omni directional microphone coupled to the hearing aid circuit.
- 30 118. The system of claim 43, the first remote unit comprising a first order directional microphone coupled to the hearing aid circuit.

119. The system of claim 43, the first remote unit comprising a close talking noise canceling microphone coupled to the hearing aid circuit.
120. The system of claim 43, the first remote unit comprising one or more devices coupled to  
5 the hearing aid circuit wherein the devices are from the group consisting of: an omni directional microphone; a first order directional microphone; and a close talking noise canceling microphone.
121. The system of claim 43, the first remote unit comprising an accessibility control function  
10 that allows another remote unit to discover the first remote unit.
122. The system of claim 43, the first remote unit comprising an accessibility control function that allows another remote unit to wirelessly connect to the first remote unit.
123. The system of claim 43, the first remote unit comprising an accessibility control function  
15 that allows a base unit to wirelessly connect to the first remote unit.
124. The system of claim 43, the first remote unit comprising encryption hardware and/or  
20 software and decryption hardware and/or software.
125. The system of claim 43, the first remote unit comprising encryption hardware and/or  
software that encrypts data sent from the first remote unit to the base unit.
126. The system of claim 43, the first remote unit comprising decryption hardware and/or  
25 software that decrypts data sent from the base unit to the first remote unit.
127. The system of claim 43, the first remote unit comprising a controller that enables  
communication between the first remote device and a plurality of external sources.
128. The system of claim 43, the first remote unit comprising a controller that enables  
30 communication between the first remote device and another device comprising the second remote device or an external source.

129. The system of claim 43, the first remote unit comprising a controller that enables communication between the first remote device and another device comprising another remote device or an external source.

5 130. The system of claim 43, the first remote unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the first remote device and an external source.

10 131. The system of claim 43, the first remote unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the first remote device and another device comprising the second remote device or an external source.

15 132. The system of claim 43, the first remote unit further comprising a voice recognition module responsive to a user's voice for controlling switching of communications between the first remote device and another device comprising another remote device or an external source.

133. The system of claim 43, wherein the base unit is installed in a public structure.

20 134. The system of claim 133, the public structure comprising a casino.

135. The system of claim 133, the public structure comprising a restaurant.

25 136. The system of claim 43, the wireless transmission in a transmission carrier frequency of about 5.8GHz.

137. The system of claim 43, the base unit wirelessly connected to an external audio source.

30 138. The system of claim 43, the base unit contained in a housing suitable for fitting within a pocket in an article of clothing.

139. The system of claim 43, the base unit being battery powered.

140. The system of claim 43, the base unit connected to an external audio source comprising a microphone.

141. The system of claim 43, wherein the base unit is installed in a vehicle.

5

142. The system of claim 1, wherein an external device comprising a computer is operatively coupled to the controller and a user can issue voice commands to the computer via the first or second pair of communicators.

10 143. The system of claim 1, wherein an external device comprising an appliance or environmental control device is operatively coupled to the controller and a user can issue voice commands to the external device via the first or second pair of communicators.

144. The system of claim 1, wherein the controller is installed in a retail environment.

15

145. The system of claim 1, wherein the controller is installed in a business environment.

146. The system of claim 1, wherein the controller is installed in an educational environment.

20 147. The system of claim 43, wherein the base unit relays wireless transmissions from more than four remote units.

148. The system of claim 43, wherein the base unit is operatively coupled to a computer and a user can issue voice commands to the computer via the first or second remote units.

25

149. The system of claim 43, wherein the base unit is operatively coupled to an external device comprising an appliance or environmental control device and a user can issue voice commands to the external device via the first or second remote units.

30 150. The system of claim 43, the base unit relaying wireless transmissions from more than four remote units.

151. The system of claim 43, further comprising signals from another microphone, wherein the signals are relayed to the first or second remote units.

152. The system of claim 151, wherein the another microphone is located at a strategic locations within an environment such as a retail, public, or private environment.

5 153. The system of claim 151, wherein the another microphone is located in an artificial flower arrangement.

154. The system of claim 43, further comprising signals from a public address system relayed to the first or second remote units by the base unit.

10

155. The system of claim 154, wherein the public address system is in an airport or train station.

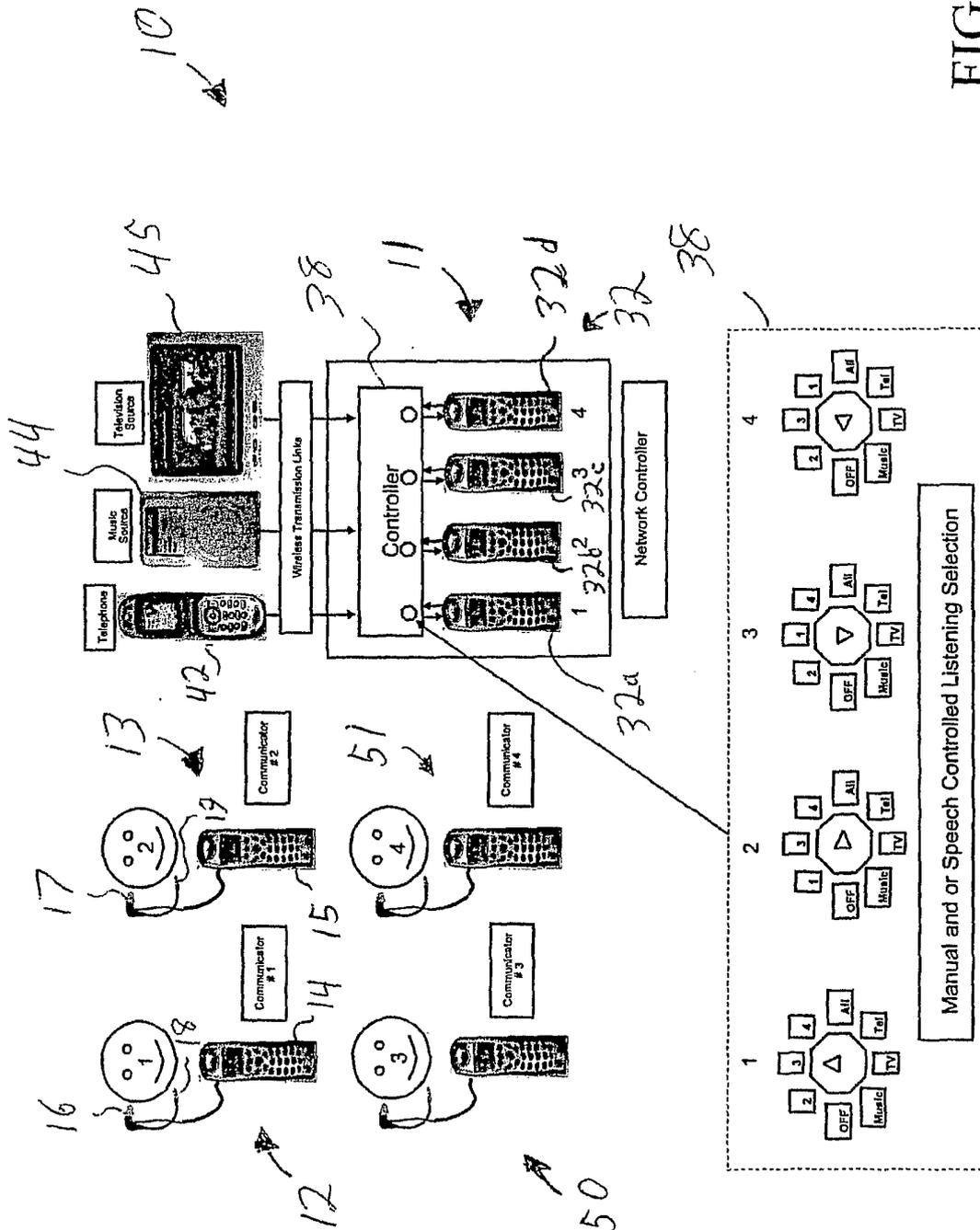


FIG. 1



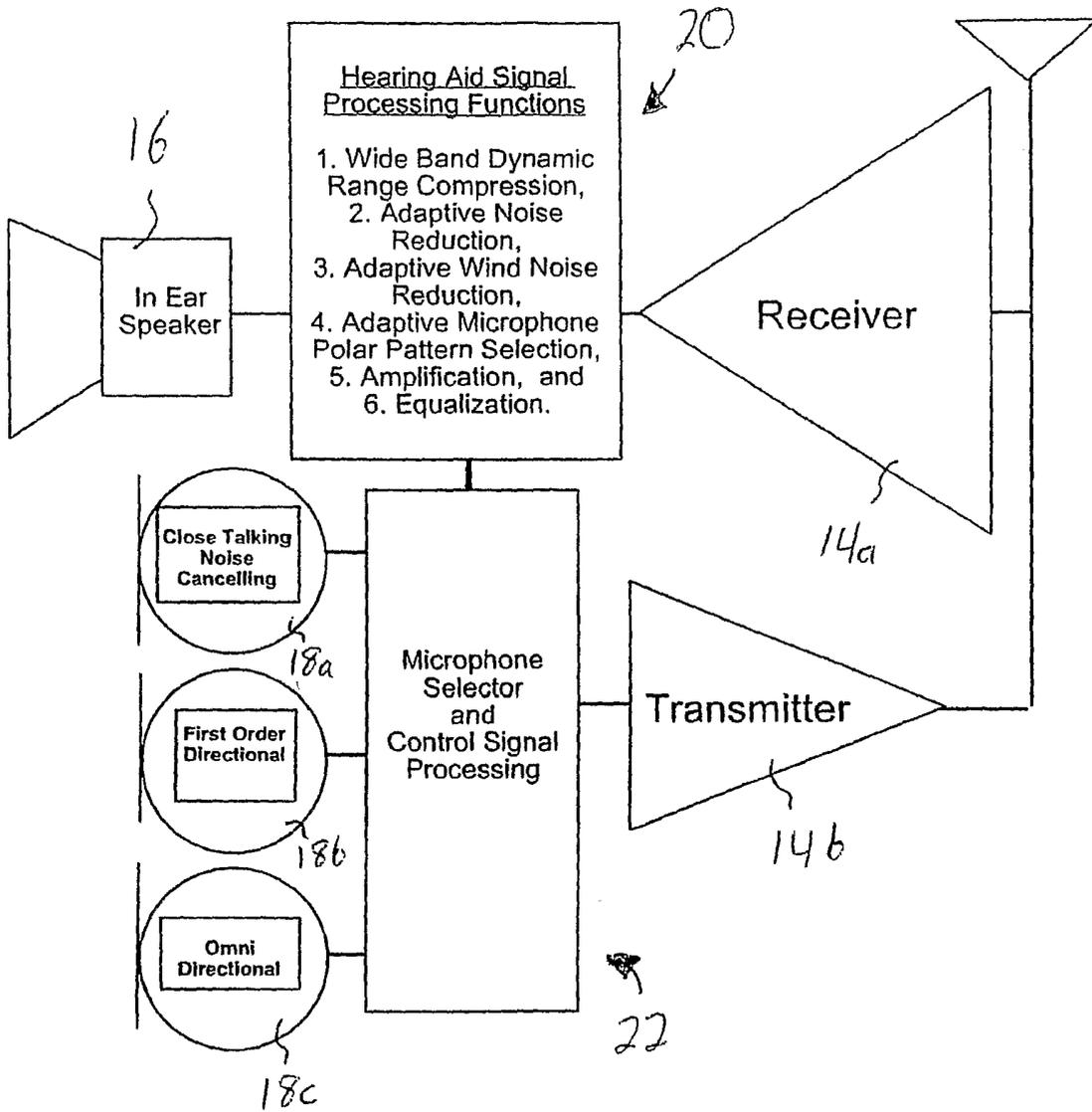


FIG. 3

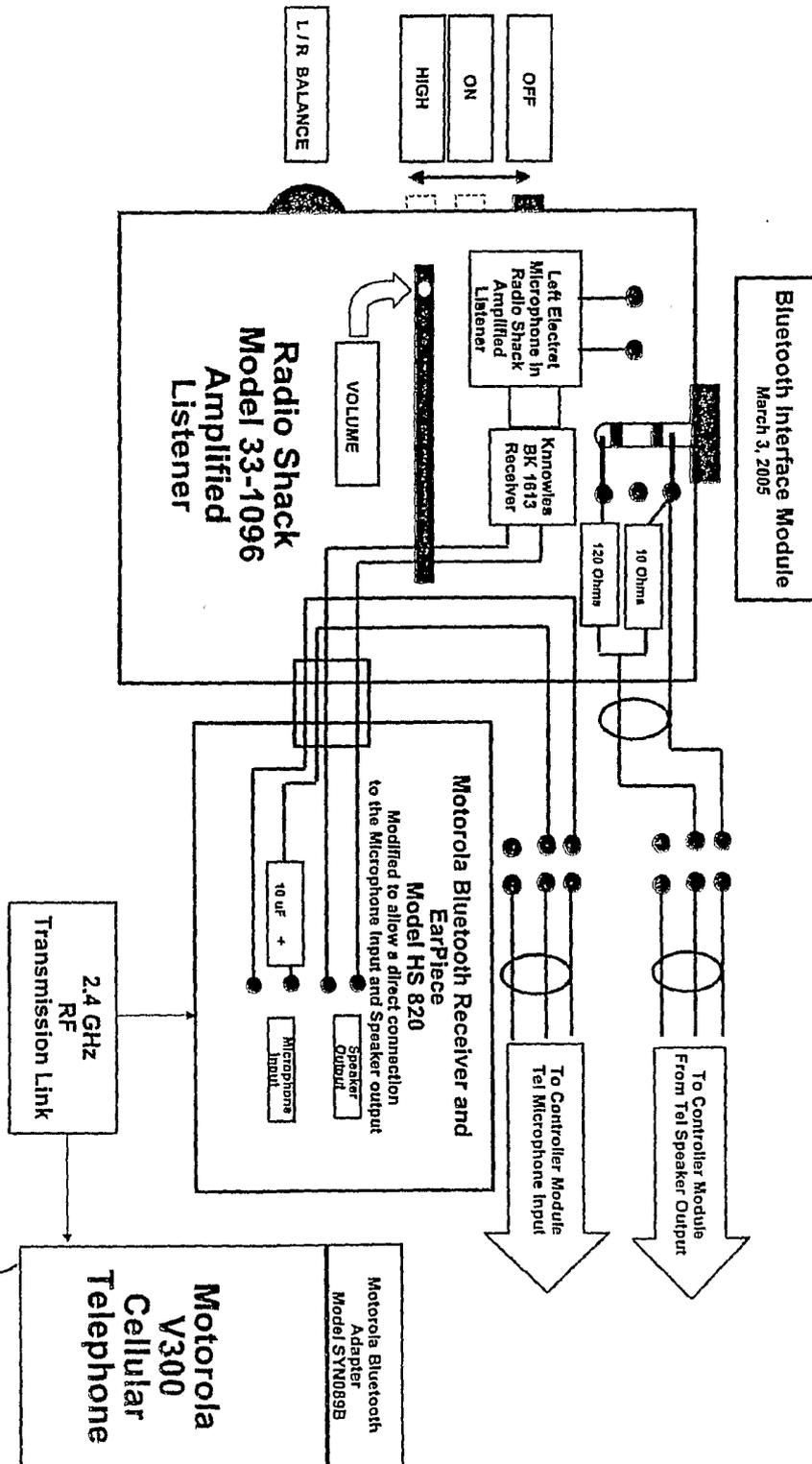


FIG. 4

42

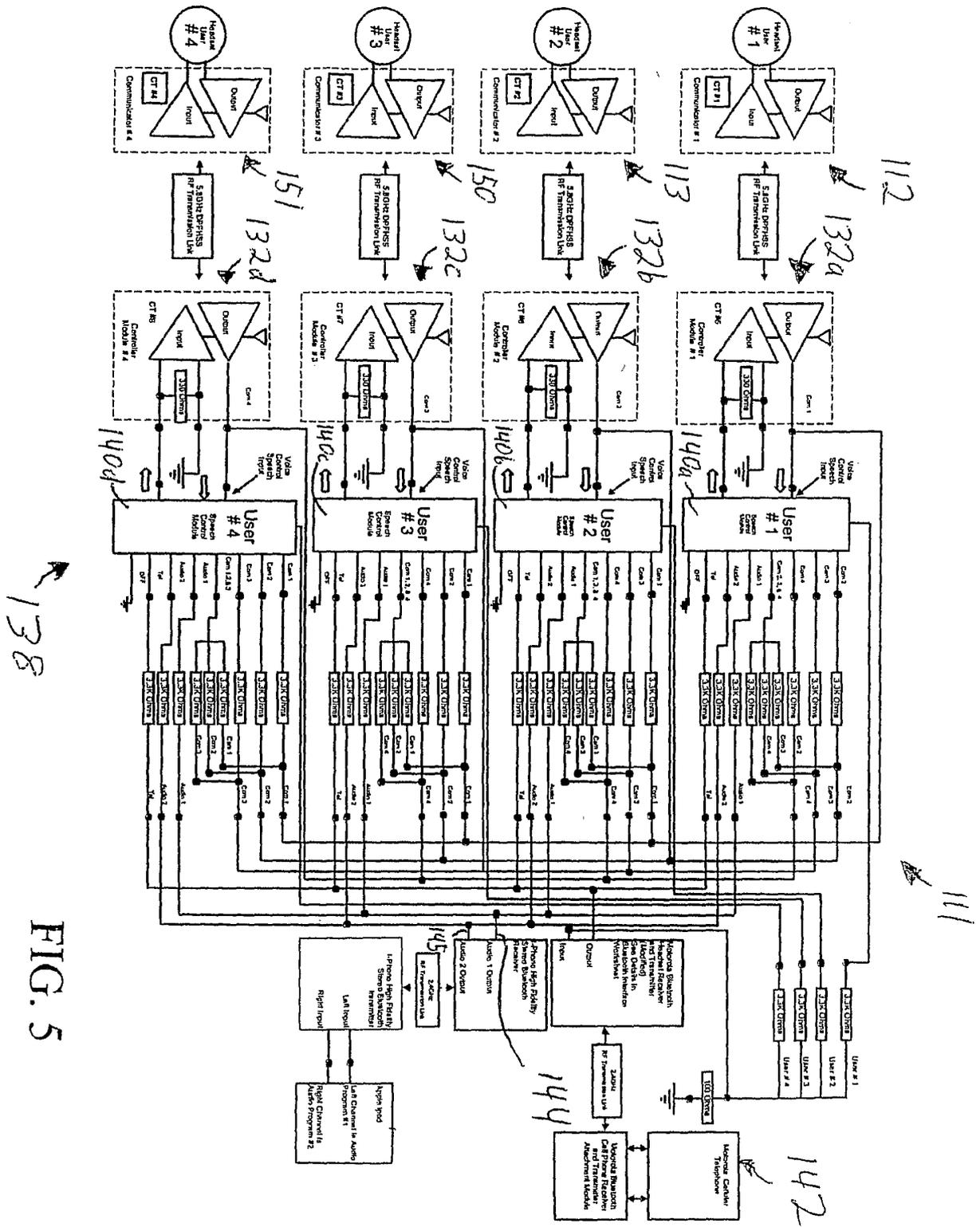


FIG. 5

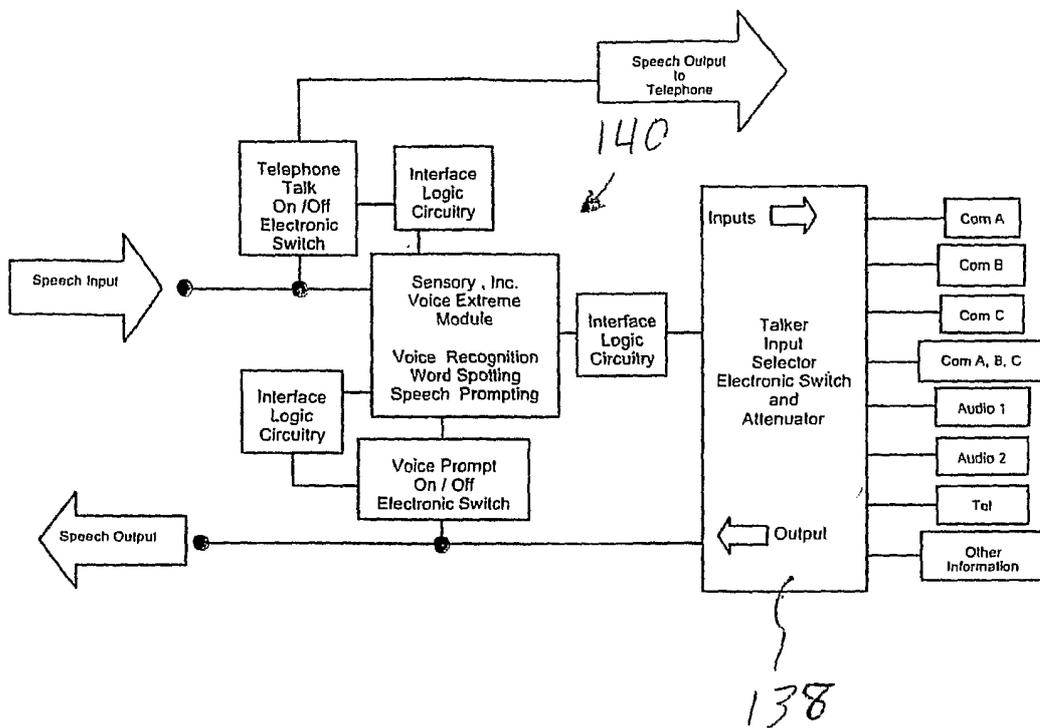


FIG. 6

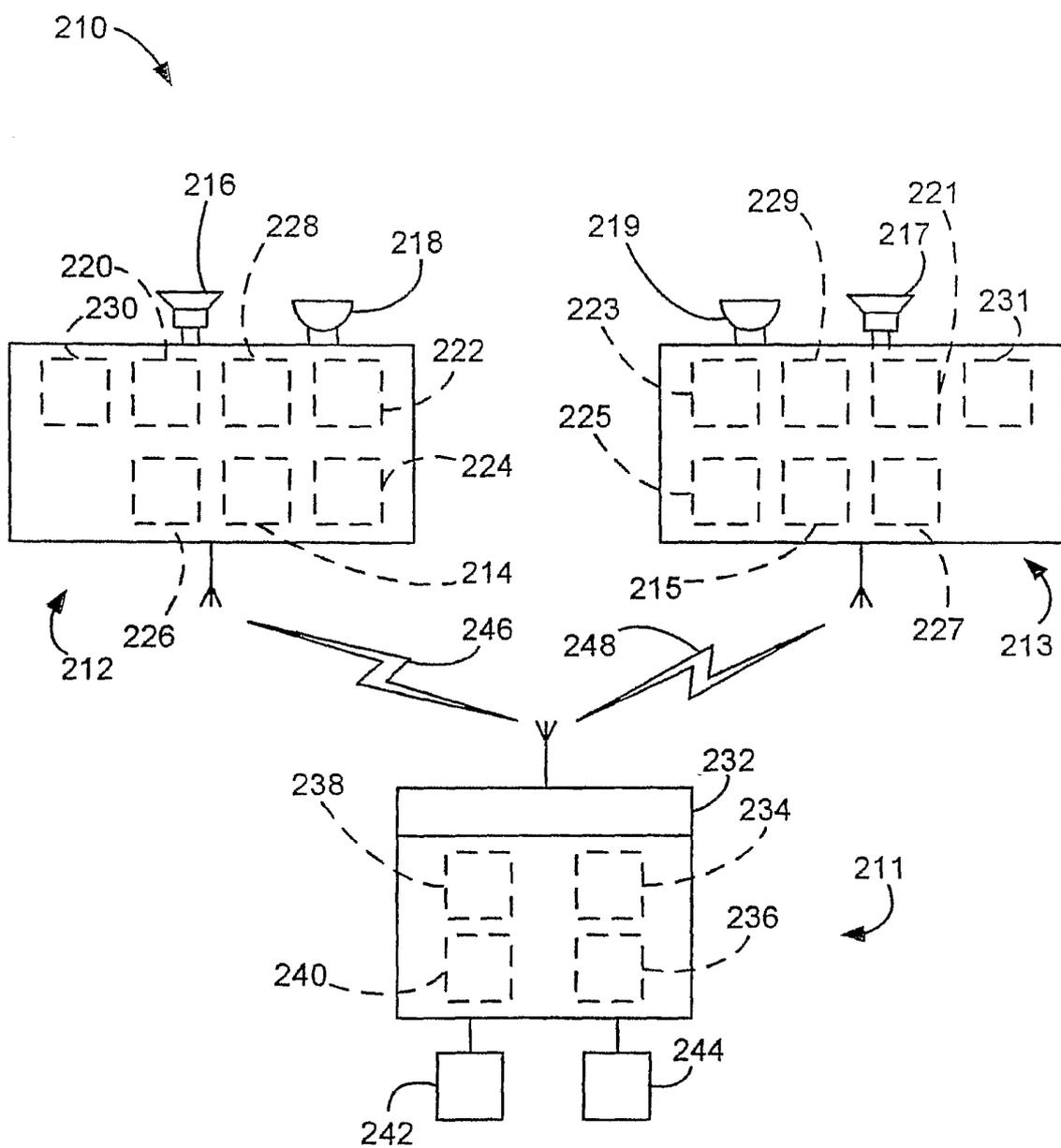


FIG. 7

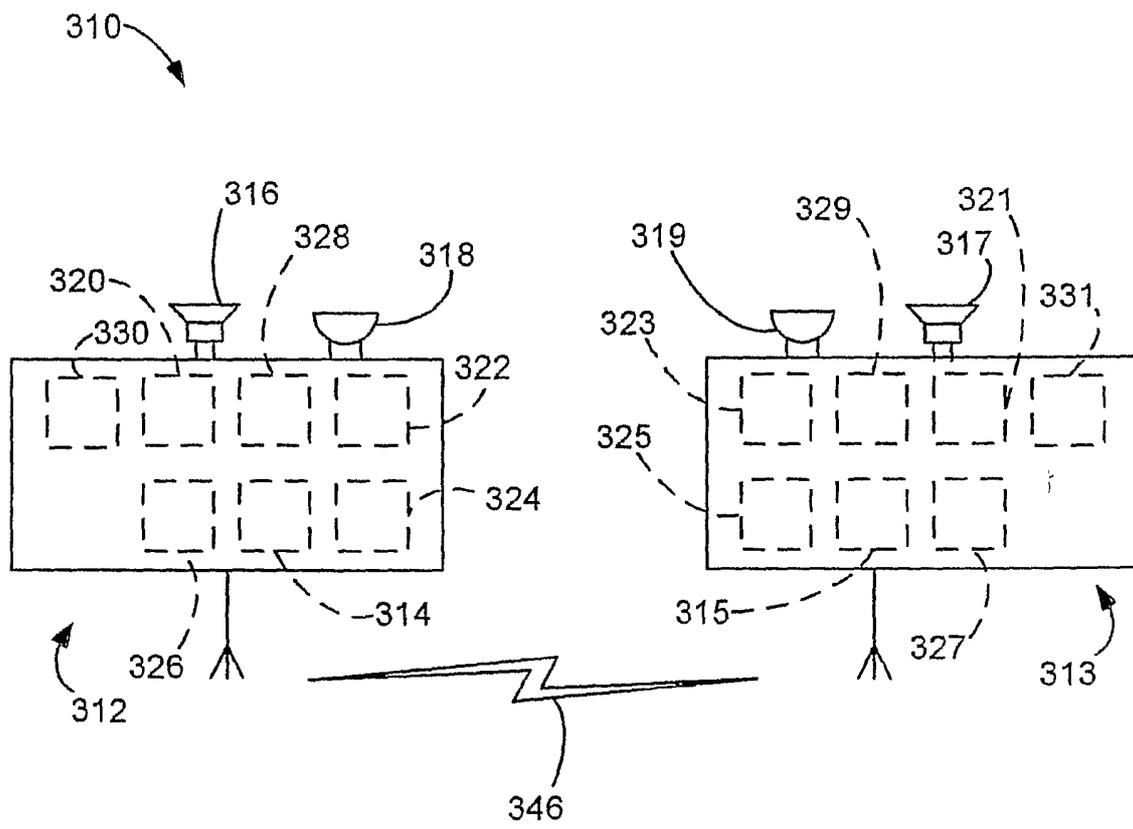
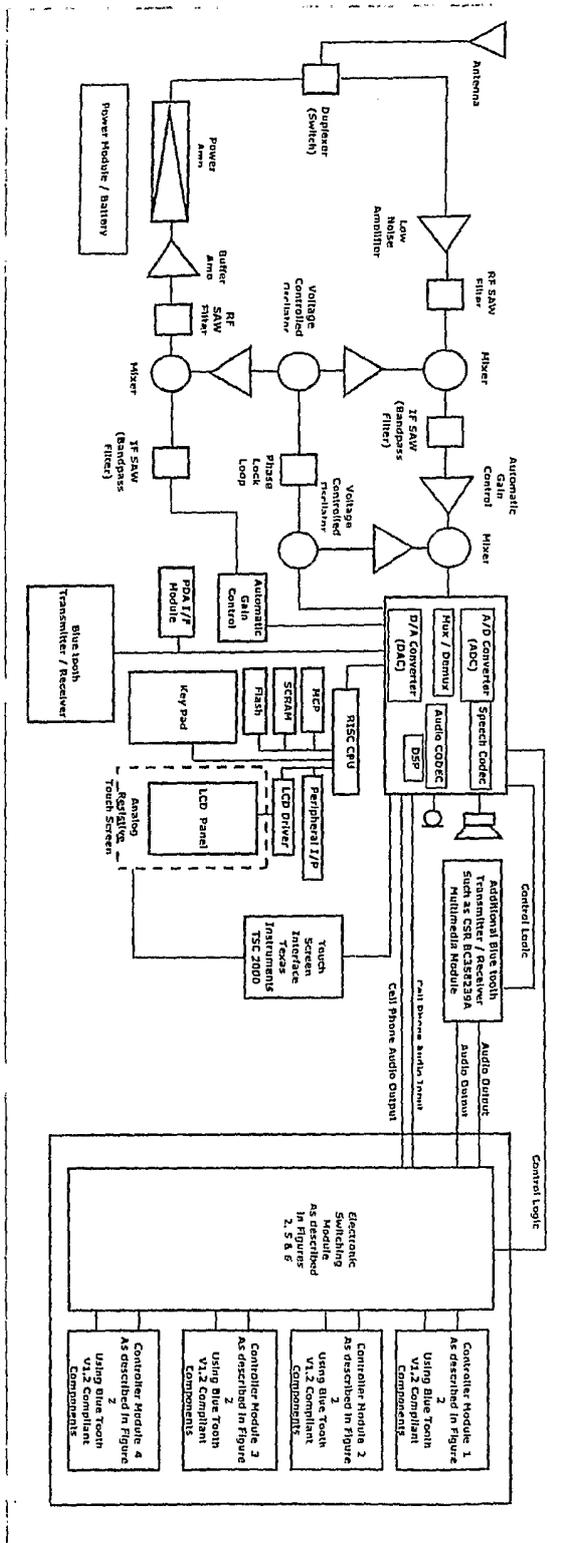


FIG. 8

4/10

FIG. 9

- Communicator 1 As described in Figure 1 using Blue Tooth V1.2 Compliant Components
- Communicator 2 As described in Figure 2 using Blue Tooth V1.2 Compliant Components
- Communicator 3 As described in Figure 3 using Blue Tooth V1.2 Compliant Components
- Communicator 4 As described in Figure 4 using Blue Tooth V1.2 Compliant Components



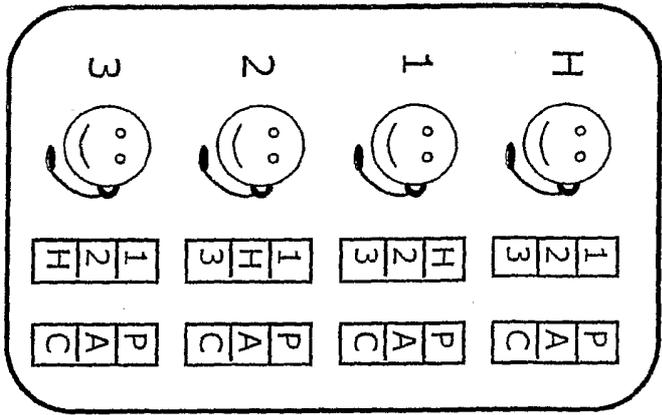


FIG. 10A

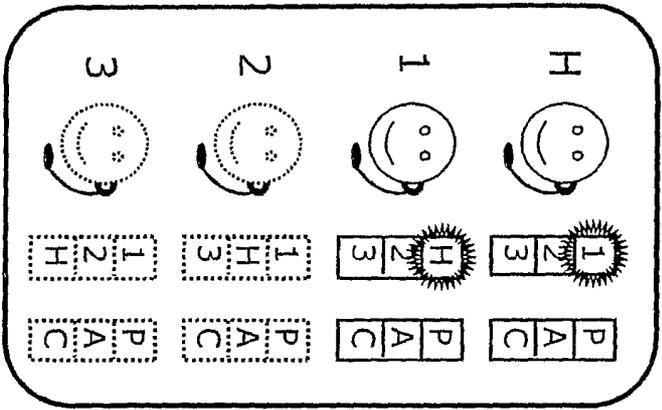


FIG. 10B

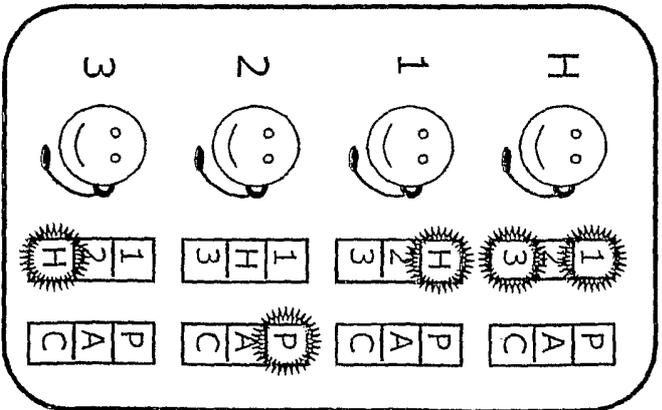


FIG. 10C