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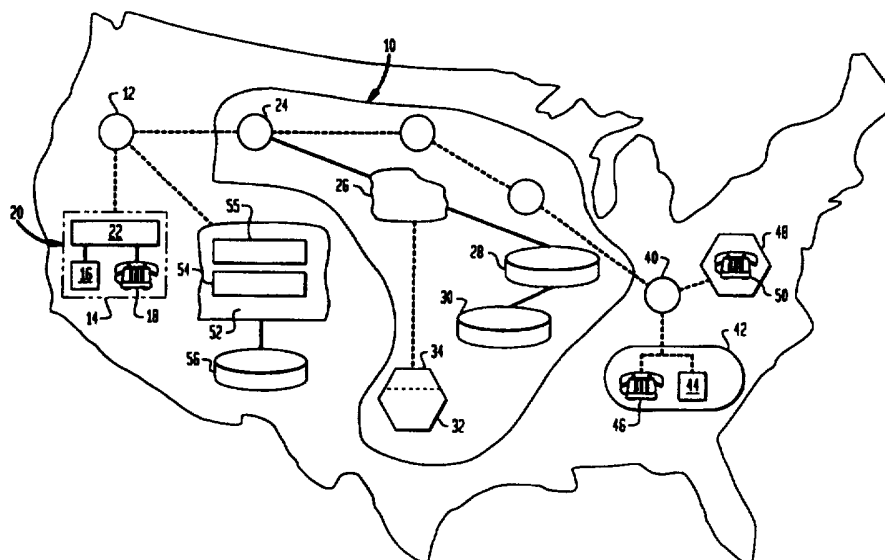
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(54) Title: APPARATUS AND METHOD IN SUPPORT OF COMPLETING TWO CALLS USING ANALOG INTERFACE TO TELEPHONE NETWORK



(57) Abstract

An interface apparatus combines multiple calls at a premises that is connected by a single point-of-attachment to a telephone network having a single phone number.

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**APPARATUS AND METHOD IN SUPPORT OF COMPLETING
TWO CALLS USING ANALOG INTERFACE TO TELEPHONE NETWORK**

Background of the Invention

The present invention relates to an apparatus and method for completing at least two calls to or from a premises that is connected by a single point-of-
5 attachment (or telephone line) to a telephone network and more particularly to an apparatus and method that processes multiple calls at the premises.

Multiple calls often are established over digital networks from terminals connected by a point-of-
10 attachment identified by a single terminal number. For example, networks using packet-switched data networks, described in ITU-T recommendations X.25, use digital terminations and allow multiple calls over the network. Other examples include frame-relay networks, described
15 in ITU-T recommendation I.233; narrow-band ISDN, described in ITU-T recommendation I.210; and broad-band ISDN networks, described in ITU-T recommendation I.211. These services use digital terminations that can be expensive to implement and maintain.

20 It would be advantageous if a premises connected by a point-of-attachment to the Public Switched Telephone Network (PSTN) with the standard, analog "tip-and-ring" interface could carry a modulated signal between the premises and the PSTN that includes multi-call

capability from terminal equipment located on the premises, such as a telephone, video, fax machine, or personal computer. This would be advantageous, for example, if someone at a premises is using a fax machine
5 while at the same time a telephone call needs to be made to a different location. Other examples could include someone making two telephone calls to the network, or using a computer and fax machine or a telephone and personal computer simultaneously.

10 It is therefore desirable if a method and apparatus could combine, at a premises, at least two calls to different locations originating from terminal equipment located at that premises, where the apparatus connects the combined calls to a public switched telephone
15 network by a point-of-attachment without digital termination such as ISDN systems.

Summary of the Invention

The present invention provides a method and
20 apparatus for combining, at a premises, at least two calls originating from terminal equipment located at that premises and connecting the combined calls to a public switched telephone network by a point-of-attachment where one dial tone is provided on an analog
25 interface to the premises. In typical realizations of the present invention, the point of attachment has a single telephone number associated therewith. The method and apparatus of this invention permits multiple calls, such as an analog phone, video, data, fax and
30 comparable calls over a single analog interface. It can be extended to allow an increased number of calls by utilizing additional analog interfaces. Such an extension, sometimes known as a multi-link arrangement, provides for any allocation of the multiple calls across
35 the plurality of analog interfaces.

In accordance with one aspect of the present invention, a control channel is established between the

telephone network, such as a public switched telephone network, and the terminal equipment located at the premises. At least two calls originating from premises equipment and the control channel are combined at the premises into a modulated analog signal having a separate channel for each call. Likewise, any incoming calls are combined with the above calls and with the control channel for transmission between the customer premises and the public switched telephone network.

10 Identity information is transmitted from the originating terminal equipment through the control channel to aid in determining a remote device with which a call is to be associated. This includes auxiliary information for progressing the call. The signal is transmitted from a modulation/demodulation device as a modulated analog signal to the public switched telephone network. The modulated analog signal is split into the respective calls and the control channel. The calls are then forwarded to a respective remote device based on identity information and auxiliary information received through the control channel.

In one aspect of the present invention, the calls can be split at the public switched telephone network. The public switched telephone network can also include a cellular network. Identifiers are associated with each channel for distinguishing each channel within the public switched telephone network. Each channel can also comprise a plurality of information blocks, and identifiers can be associated between the public switched telephone network and the terminal equipment for each channel to distinguish the information blocks belonging to each call or control channel.

In addition, in accordance with the present invention the premises apparatus that combines the calls also splits the calls to return information to the respective terminal equipment at the premises.

Brief Description of the Drawings

FIG. 1 is a simplified block diagram of a telephone network including intelligent network components of a public switched telephone network and other components
5 suitable for use with the present invention.

FIG. 2 is a simplified block diagram of a multi-call terminal apparatus in accordance with an embodiment of the present invention.

FIG. 3 is a more detailed block diagram of the
10 multi-call terminal according to an embodiment of the present invention.

FIG. 4 is a schematic representation of a control channel between terminal equipment at the premises and the public switched telephone network.

FIG. 5 shows in greater detail multiple channels
15 between terminal equipment and the public switched telephone network and respective calls extending to remote units.

FIG. 6 shows in greater detail the use of the
20 identifiers for information blocks to distinguish between calls.

FIG. 7 is a schematic diagram showing operation of the control channel.

FIG. 8 is a block diagram showing one aspect of the
25 method of the present invention.

Detailed Description

Referring now to FIG. 1, there is illustrated an overview of the public switched telephone network
30 that is connected via a first Local Exchange Company (LEC) 12 to a premises 14, such as a residential premises, having a fax machine 16 and an analog telephone 18. The present method and system allows multi-call capability to and from the premises 14
35 connected via an analog interface having a single phone number. Multi-call capability in accordance with the present invention includes the merging of two or more

outgoing calls such as analog phone, data, video, fax and other similar calls and the separating of two or more incoming calls. In accordance with the present invention, the analog telephone 18 and fax machine 16, as well as any other equipment (not shown) such as personal computer or video, are devices connected to or included as part of multi-call terminal equipment 20 (hereafter "terminal equipment"), and includes a multi-call interface apparatus 22 that includes a modulation/demodulation device. The multi-call terminal equipment 20 can be integrated into one physical structure or box at the premises and can be located in a small business, residential premises, or other premises where a single point-of-attachment having a single phone line to a public switch telephone network uses an analog interface. The modulation/demodulation device can be a regular modem, limited distance modem, or a line driver. Further details regarding the multi-call interface apparatus will be provided below.

The LEC 12 is connected to the premises 14 and terminal equipment 20 by a point-of-attachment having a single phone line using an analog interface that supplies one dial tone to the premises. In this example of a public switched telephone network, 10, the network includes Service Switching Points (SSP) 24 and a standard CCS7 signaling network 26 that is connected to a Service Control Point (SCP) 28, which also includes a database 30 as is conventional. The PSTN 10 may also include a cellular network 32 that is connected to a Service Switching Point 24 via a Mobile Switching Office (MSO) 34. Naturally, the present invention can be implemented in other network configurations as well as be understood from the description of the interface apparatus and a service element that follows.

For purposes of describing the present invention as shown in FIG. 1, the PSTN 10 also connects to a second LEC 40, which connects to a second premises 42 having

remote devices, e.g., fax machine 44 and an analog telephone 46, and a third premises 48 having an analog telephone 50.

A multi-call service element (MC-SE) 52 in the form of an adjunct processor 54 is connected to the LEC 12 and is shown in this example, outside the network 10 and in such a circumstance could be located in a separate premises. Alternatively, MC-SE 52 could be an integral part of the switch 24 or otherwise disposed to communicate with SSP 24. MC-SE 52 includes processing hardware, including a modulation/demodulation function 55, and may have an associated database 56 that could store routing information, the telephone numbers of those subscribers who use the present system and method for establishing multi-call capability using a single phone line and analog interface. The database 30 also can be used for storing telephone numbers of subscribers, and would be preferred. The LEC 12 provides modem to modem connectivity between the first premises and the MC-SE.

FIG. 2 illustrates a block diagram of an embodiment of a multi-call interface apparatus disposed at the premises 14 for interfacing the multiple sources of calling information to the PSTN. In this figure the interface device has three ports. A first port 210 is a modem port that is coupled to the line providing access to the network. Second and third ports 220 and 230 are connected respectively to terminal equipment which seeks to originate or receive calls from or to the premises. As indicated above, such equipment can include an analog telephone, a fax machine, a personal computer, video devices or the like.

FIG. 3 illustrates in further detail an example of the construct of the interface apparatus where one of the equipment ports, 32, is coupled to a fax machine and another, 33, is coupled to an analog telephone.

The fax port 32 is an RJ11 port that has the ability to do normal signaling through the port. An artificial central office interface 301 is coupled to port RJ11 and provides such central office functionality as collecting dialed dual-tone multi-frequency (DTMF) signals and providing signals back to the fax machine like "busy", "fast busy", "ringing", etc. Such an interface can be conventional line port circuitry including a 4 to 2 and 4 to 2 wire hybrid circuitry, line circuit feed and off-hook detection capability. The information from the fax machine (not shown) is then treated by data handling elements 305 which include the fax modem DAA 302, the Fax Modem CODEC 303 and a Local Fax Modem 304. As a consequence, fax/data are supplied to controller 310.

As for the port to which the telephone is connected, 230 in FIG. 2, another RJ11 port connection 33 is provided. A second artificial central office interface 331 of the type described above is coupled to the RJ11 to provide the same types of functionality as described above with respect to artificial central office interface 301. The telephone processing circuitry includes an Audio CODEC 332 and an element for providing audio compression 333 so that a voice signal is transferred to controller 310. The audio codec can be a conventional analog to μ -law PCM (A/D) and μ -law to analog (D/A) conversion. The audio compression block is a digital signal processor (DSP) implementing one of the standards for speech compression such as AT&T's international standards G.728 Low Delay CELP Speech Coding. In an optional configuration, equipment coupled to the telephone port can include a speakerphone. Additional elements which would be of assistance in connection with such a configuration are shown as speakerphone jack 33A and speaker phone Acoustic Echo Canceller (AEC) 334.

As can be seen, the fax/data information can be provided from a fax machine coupled to RJ11 port 32 while at the same time voice information can be transferred to the host from telephone equipment coupled to RJ11 port 33.

The controller then acts as a call manager. The controller multiplexes the information together thereby creating, in effect, two different communication channels which are provided on or with a control channel established to the public switch telephone network interface. The multiplexed data from the controller is then transferred to modem equipment including telephone line modem and modem DAA. As a consequence, the analog signal provided to the PSTN interface includes the combined signals supplied by the two independent communication devices, namely the fax machine and the analog telephone.

It is also beneficial to assure that at least telephone equipment will be able to access the PSTN interface as a single equipment access if there is some power failure. This is important for being able to assure that emergency services, e.g., 911-type services, are always available. FIG. 3 illustrates that a power failure bypass mechanism 360 can be coupled between RJ11 port 33 and the PSTN interface. Thus, where there is a power failure the bypass mechanism would default to a condition that bypasses the processing circuitry that would otherwise transfer the telephone call to the controller and instead directly connects the telephone to the PSTN interface.

In accordance with this terminal equipment it is possible to combine the various independent sources of information and transfer all of that information on the same PSTN interface, such as a single telephone line with a single assigned telephone number.

The operation of this terminal equipment in connection with the remainder of the network will now be described.

Referring now to the flow chart of FIG. 8, and in greater detail to FIGS. 4 through 7, details of the method and system of the present invention are set forth below with a description for completing multiple calls from a residential premises having the equipment of FIG. 3 coupled to a fax machine 16 and an analog telephone 18. For purposes of clarity, each step corresponding to a block begins with the numerical sequence starting at 100. It should be understood that this description is only one example. For purposes of description, the steps will be explained with reference to the MC-SE positioned in the public switched telephone network.

The terminal equipment of the present invention contacts the public switched telephone network, and more particularly the multi-call service element and a modulated signal is established (Block 100). It should be understood, that the public switched telephone network could contact the multi-call terminal equipment for a first incoming call. The public switched telephone network 10, through its multi-call service element 52, then establishes a control channel 58 (FIG. 4) for signaling purposes between the multi-call service element and the terminal equipment 20 (Block 102). It should be understood that the establishment of a control channel could be done by either party after the modem connection has been made regardless of which side originated the modem connection. As shown in FIG. 4 the control channel 58 is used for signaling and goes over the modulated connection 60. The originating terminal equipment 20 then can place a call, such as voice, data, fax or video call, via the control channel 58 and the multi-call service element 52, to a remote multi-call terminal element that is also a subscriber to the present multi-call system, such as the fax machine 44

shown in the second premises 42 in FIG. 1 and to a remote existing terminal that is not a subscriber to the present multi-call system, such as the analog telephone 50 shown in the third premises 48 in FIG. 1 (Block 103).

5 The multi-call service element 52, as part of the public switched telephone network 10, then places a call to the remote terminal equipment (Block 104). This is done through an interface to a telephone switch by signaling the need to set up a new call. The signaling
10 on this interface naturally depends on the relationship between the multi-call service element 52 and the telephone switch 24. For example, the relationship could involve a mapping of the information flow (messages) and the information elements (semantics and
15 syntax) between the Multi-Call interface apparatus/MC-SE on the first interface and the MC-SE/telephone switch interface. The mapping would involve mapping a connect message on the first interface to an Initial Address Message (IAM) on the second, providing, the MC-SE has
20 the capability of sending these messages to the SSP 24 as shown in FIG. 1.

When the call is made, a query is sent to the database 56 contained in the multi-call service element 52 or database 30 to determine if the called number is a
25 subscriber to the multi-call system of the present invention (Block 106). If the called number is not a subscriber to the multi-call system, or if any remote terminal equipment 42 is not using this service at the time, a normal "tip-and-ring" call is placed to the
30 remote device (Block 108). During call set-up, unique identifiers are associated with the call (Block 105) on the calling side, and if the remote device is also a subscriber to the present invention, at the called side and the set of identifiers are associated with both
35 sides (110).

FIG. 7 shows the relationship of control channels between MC-SE and Multi-Call Interface Apparatus when

the called party is a subscriber to the multi-call system. One control channel is designated by letter "a" between the premises and the PSTN, and "b" between the PTSN and the interface apparatus at the second premises

5 42. Both control channels are labeled with channel identifier CId=0, (identifiers). As illustrated, an information channel is established from the first premises interface apparatus into the PSTN, labeled CId=3, and a second information channel labeled CId=27

10 is established from PSTN 10 and the second premises MC-TE 42. The network maintains a mapping of CId=3 and CId=27 to support the call between premises 20 and premises 42. If the called party was not a subscriber channel identifiers would only be necessary on the path

15 from the calling party to the MC-SE 52.

When establishing a call using the control channel (after it has been setup), a unique identifier is chosen by the establishing party (e.g., premises 14 for outgoing call; MC-SE 52 for incoming call). This is

20 used subsequently by both parties to identify the "blocks" or packets of information that flow over the channel (between the premises and the MC-SE) belonging to each call associated with that premises. One packet format that could be used with this invention is

25 described in ITU-T Recommendation V.76 (1996), incorporated herein by reference. The control channel has its own identifier (probably zero since it is the first channel established). But these identifiers are local to the premises/MC-SE interface. If the remote

30 end is also served by this invention, that second MC-SE/premises combination picks its own identifier for the channel serving that part of the call; if not, then a regular call is set up and no identifier is used or needed at the remote end. FIG. 6 illustrates a flow of

35 information blocks, having unique identifiers, between the interface apparatus of the present invention and the MC-SE of the present invention.

In addition to the identifiers, auxiliary information can be transmitted to aid in progressing the call. Auxiliary information from the calling side could include the type of calling device (e.g., fax) for proper completion at the remote end or a request for language translation between the two parties. For incoming calls, auxiliary information includes the remote side's calling party ID for display at the premise, assuming it is not blocked.

10 The information blocks, or packets, carry information pertaining to the control channel. For the control channel, these can be messages for setting up calls. For voice channels, these are compressed and digitized voice packets. For fax channels, these are digital parts of the scanned page. The identifier is a unique number or other unique identifier. Using the unique identifier as established during the call set up, the public switched telephone network 10, through its multi-call service element 52, transmits information blocks associated with that first call between the multi-call terminal equipment 20 and the remote device (Block 112).

In accordance with the embodiment shown in FIGS. 1 to 3, it is presumed that a first call from the premises 14 involves a fax machine 16 that desires to transmit fax information to fax machine 44 at the second premises 42. That first call is established in accordance with steps 100 to 112 of FIG. 8. Thus, the MC-SE 52 coordinates the transmission so that it is properly routed from premises 14 to premises 42 over the appropriately identified channels. Subsequently, and during the first call, the first premises may desire to initiate a call to telephone 50 at the third premises 48. In that case the multi-call interface apparatus at premises 14 creates the combined call signal combining the fax call and voice call as described above with respect to FIG. 3. The MC-SE receives the request to

establish the second call (to telephone 50), splits the combined signal and sends the respective portions fax and voice, on to their intended destinations based on identification information transmitted to the MC-SE with the combined calls. The Flow Chart of FIG. 8, shows the step of originating another call (or receiving another call), from other terminal equipment in Block 114. Furthermore, FIG. 5 illustrates, in schematic form the information channel configuration that exists after the MC-SE 52 establishes both of the connections associated with equipment 20.

When one of the calls is then finished (Block 116), if there are any remaining calls (Block 118), then information blocks continue to be transmitted (Block 112) on the remaining channels. If there are no remaining calls, the connection can be terminated with the public switched telephone network (Block 120).

The current invention as set forth in the apparatus and method as described above now allows multi-call capability even with the analog interface existing between the public switched telephone network 10 and the premises. Various advantages accrue as noted in the following examples.

1) A telecommuter could be working at home and accessing an e-mail server. While this interaction occurs, the telecommuter also can place a voice call to a fellow worker to discuss another project. The multi-call service of the present invention provides the capability of the telecommuter to originate two calls. Additionally, the telecommuter could receive a call while accessing the e-mail server.

2) A child can access a game server or "surf-the-web". At the same time, the child's parents can originate or receive voice calls.

3) A worker in a "small-office/home office" may need to discuss an ongoing project with his/her partner using material in a fax. The partner may not have the

proper type of terminal equipment, but the partner does have two separate phone lines, one of which is connected to a fax machine. The service of the present invention can be used by the worker to split the calls within the public switched telephone network, placing the voice call to the partner on the proper line and a fax call to the other line.

4) A network trouble-shooter receives a voice call from a customer having trouble accessing the network, which is remote from the customer. Both people have multi-call terminal equipment capable of using the system of the present invention. While talking to the customer, the trouble-shooter could access the network and determine the problem and then resolve it. The customer could be directed to access the network without hanging up with the trouble-shooter. When the customer is satisfied that the problem has been resolved, each party can then release both calls.

5) A person at home could be talking to someone on a voice call. While this is occurring, someone in the same home can place a second call using the same phone line and number. The two calls can be to different destinations.

Many other examples could occur as necessary and as the user of the system of the present invention determines are necessary.

It is to be understood that the above description is only one preferred embodiment of the invention. Numerous other arrangements may be devised by one skilled in the art without departing from the spirit and scope of the invention.

WHAT IS CLAIMED:

1 1. A method for interfacing a telephone line and
2 multiple independent communication terminals comprising
3 the steps of:
4 establishing a control channel on the telephone
5 line;
6 establishing a first additional channel for a call
7 involving a first one of the multiple independent
8 communication terminals;
9 establishing a second additional channel for a call
10 involving to a second one of the multiple independent
11 communication terminals;
12 providing identifiers concerning each of said first
13 and second additional channels to said control channel;
14 and
15 combining said control channel and said first and
16 second additional channels into a modulated signal
17 having a separate channel for each call.

1 2. The method of claim 1 comprising the further steps
2 of:
3 receiving a second modulated signal including said
4 control channel and two additional channels;
5 splitting the second modulated signal into calls
6 for the first and the second independent communication
7 terminals in accordance with identifier information
8 incorporated in said second modulated signal; and
9 providing as separate outputs calls for the first
10 and second independent communication terminals.

1 3. A method for sharing, between at least two
2 independent communication terminals, an assigned
3 communication path, the method comprising the steps of:
4 assigning a first communication channel of the path
5 to a first one of said terminals;

6 assigning a second communication channel to a
7 second one of said terminals;
8 combining said first and second communication
9 channels with a control channel to form a multichannel
10 link to said assigned communication path.

1 4. The method of claim 3 wherein said first
2 communication channel carries communications between
3 said first terminal and a first off-premises equipment.

1 5. The method of claim 4 wherein said second
2 communication channel carries communications between
3 said second terminal and a second off-premises
4 equipment.

1 6. The method of claim 3 wherein said first
2 communication channel carries voice information.

1 7. The method of claim 6 wherein said second
2 communication channel carries fax information.

1 8. The method of claim 6 wherein said second
2 communication channel carries other voice information.

1 9. The method of claim 6 wherein said second
2 communication channel carries video information.

1 10. The method of claim 6 wherein said second
2 communication channel carries data.

1 11. The method of claim 3 wherein said first
2 communication channel carries fax information.

1 12. The method of claim 3 wherein said first
2 communication channel carries video information.

1 13. The method of claim 3 wherein said first
2 communication channel carries data.

1 14. Apparatus for providing simultaneous access to a
2 single dial tone service for multiple independent
3 communication terminals comprising:
4 a first port that provides an access point to a
5 single dial tone service provider;
6 a second port that provides an access point to a
7 first one of the independent communication terminals;
8 a third port that provides an access point to a
9 second one of the independent communication terminals;
10 a host coupled to said second port and said third
11 port and including a multiplexer and demultiplexer; and
12 a modem coupled between said host and said first
13 port;
14 wherein said multiplexer combines communication
15 information from said second and third ports and
16 provides the combined information to the modem and said
17 demultiplexer is provided with received communication
18 information for said modem and splits said received
19 communication information so that said second port
20 receives information intended for said first terminal
21 and said third port receives information intended for
22 said second terminal.

23
24 15. The apparatus of claims 14 further comprising:
25 an artificial central office interface coupled
26 between said second port and said host and emulating
27 selected central office functionality to the first
28 terminal.

1 16. A method of simulating an independent telephone
2 line connection to each of first and second
3 communication terminals, the terminals being of a type
4 which normally requires coupling to an independent
5 telephone line, the method comprising the steps of:

6 receiving a plurality of data packets from a single
7 telephone line at a telephone customer premises, the
8 plurality of packets including a first set of packets
9 representing information from a first information source
10 and a second set of packets from a second information
11 source;

12 for each of said first and second communication
13 terminals, generating information signals to be provided
14 to the terminal based on one or more of the plurality of
15 data packets having address data corresponding to the
16 terminal, wherein the information signals are in a
17 format suitable for use by the terminal; and

18 providing information signals to each of the
19 corresponding communication terminals over independent
20 channels to simulate independent telephone line
21 connections between said first terminal and said first
22 source and between said second terminal and said second
23 source.

1 17. An interface for simulating an independent
2 telephone line connection to each of first and second
3 communication terminals, the terminals being of a type
4 which requires normally coupling to an independent
5 telephone line, the interface comprising:

6 an input telephone interface, the input telephone
7 interface for receiving a plurality of data packets from
8 a single telephone line at a telephone customer
9 premises, the plurality of packets including a first set
10 of packets representing information from a first
11 information source and a second set of packets from a
12 second information source;

13 a signal generator for generating, for each of said
14 first and second communication terminals, information
15 signals to be provided to the terminal based on one or
16 more of the plurality of data packets having address
17 data corresponding to the terminal, wherein the

18 information signals are in a format suitable for use by
19 the terminal; and
20 output telephone interfaces for providing
21 information signals to each of the corresponding
22 communication terminals over independent channels, said
23 output interfaces and channels simulating independent
24 telephone line connections between said first terminal
25 and said first source and between said second terminal
26 and said second source.

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FIG. 1

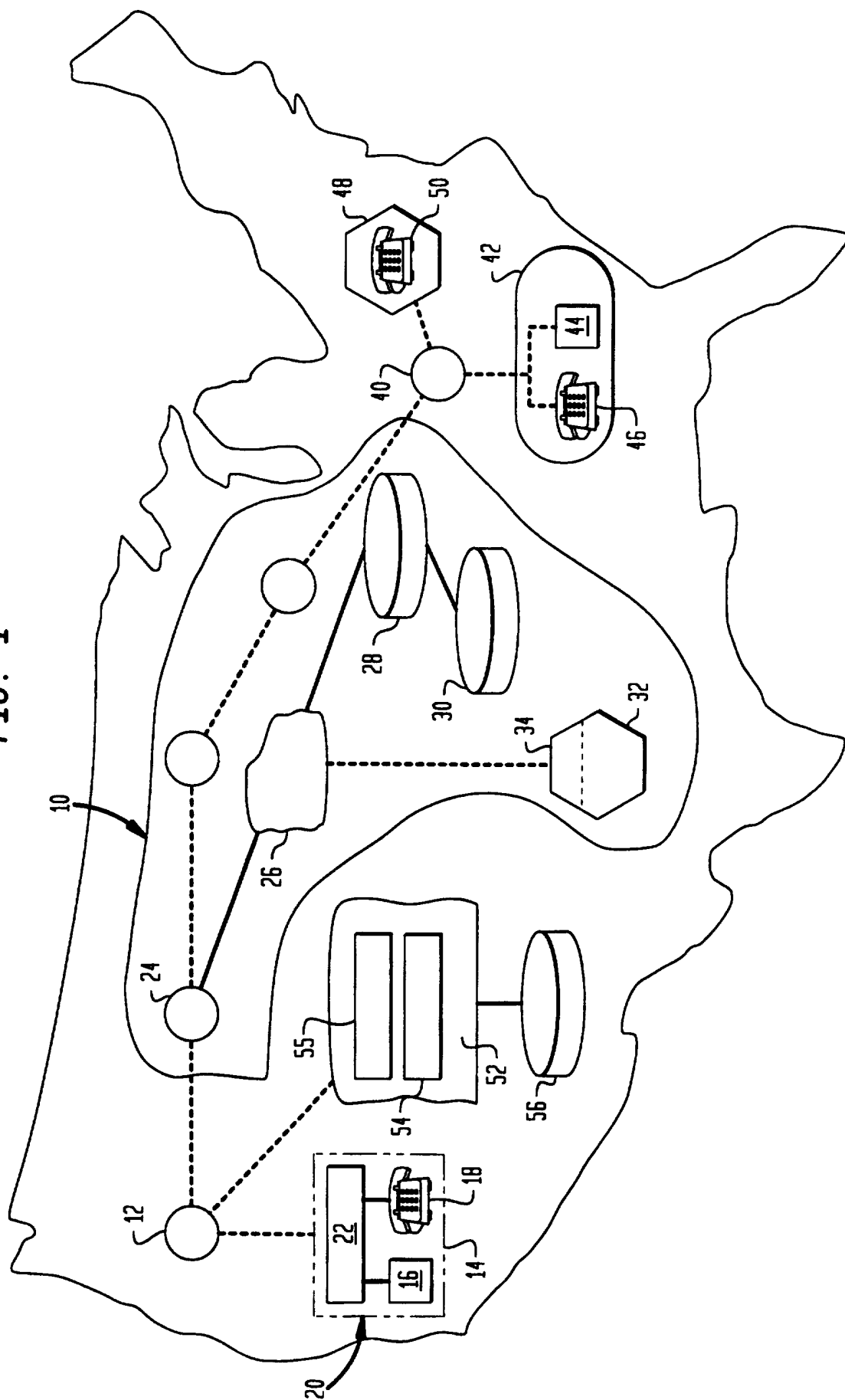


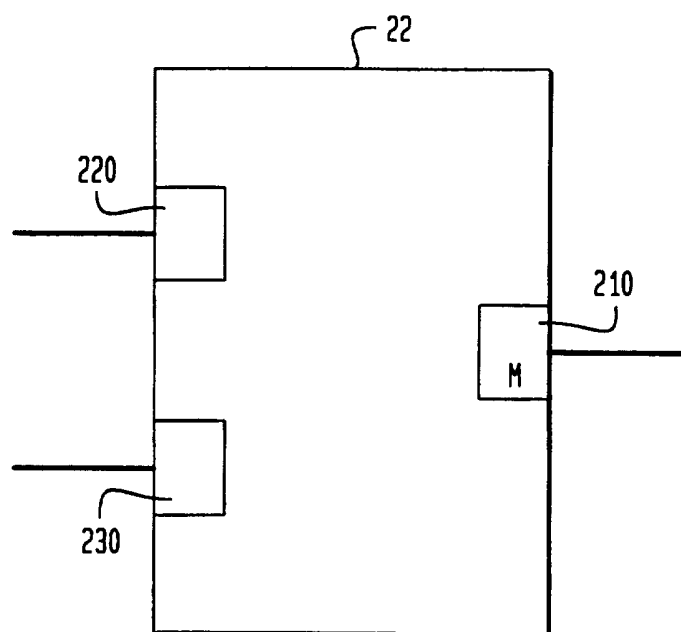
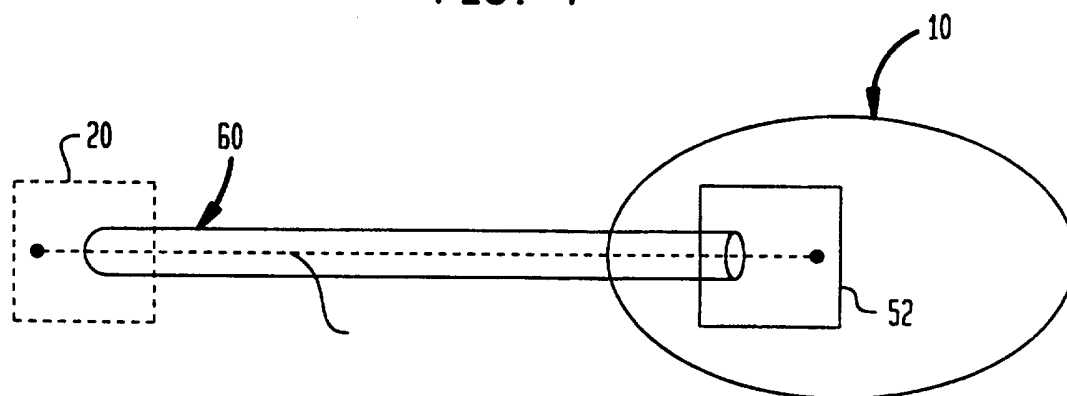
FIG. 2**FIG. 4**

FIG. 3

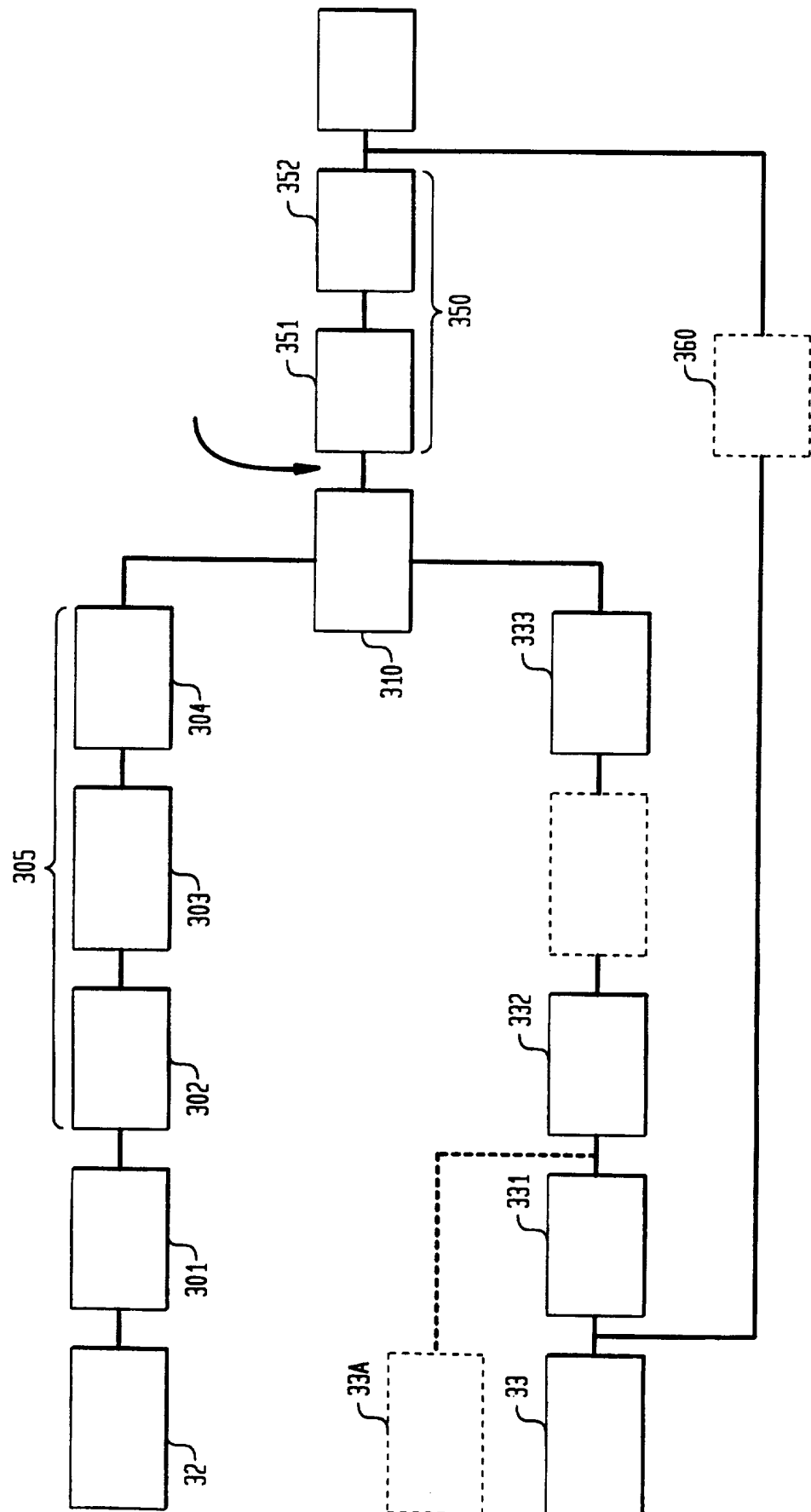


FIG. 5

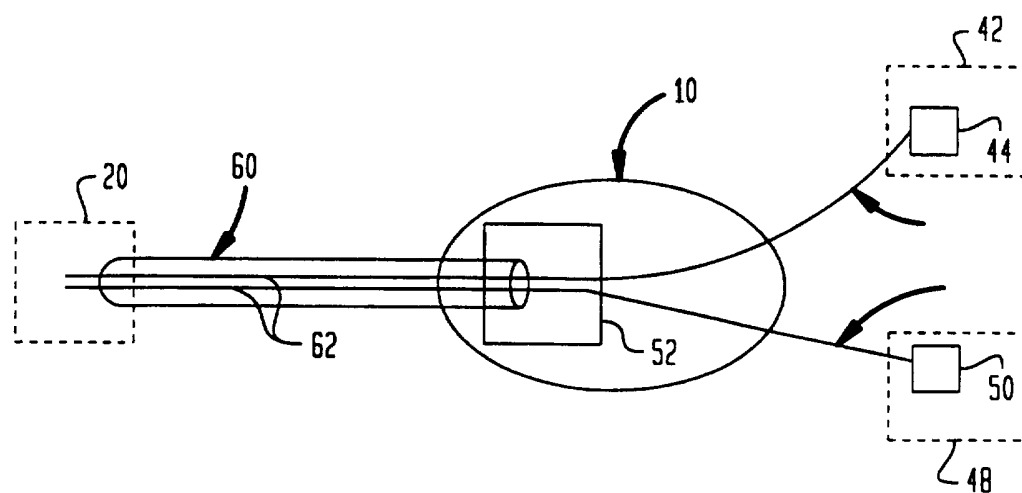


FIG. 6

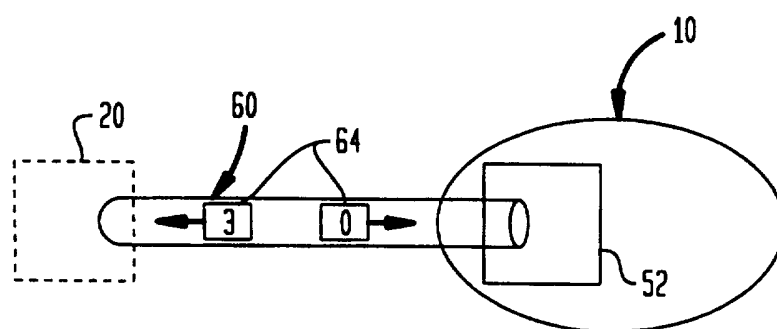


FIG. 7

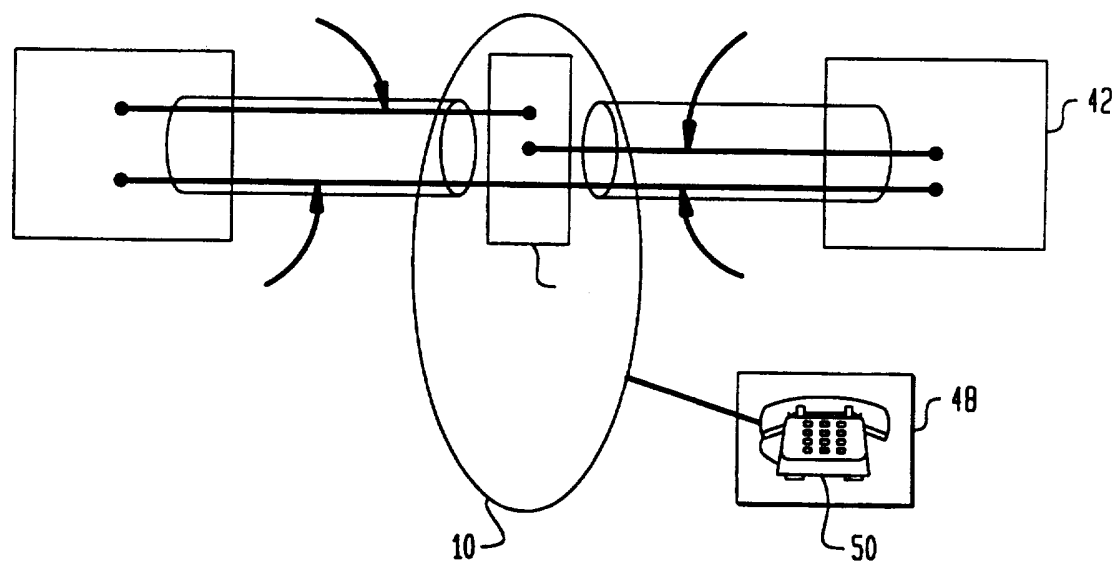


FIG. 8

