US005999970A

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Krisbergh et al.

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[54] **ACCESS SYSTEM AND METHOD FOR PROVIDING INTERACTIVE ACCESS TO AN INFORMATION SOURCE THROUGH A TELEVISION DISTRIBUTION SYSTEM**

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[21] Appl. No.: **08/630,397**

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[51] **Int. Cl.**[6] **H04N 7/173**

[52] **U.S. Cl.** **709/217**; 345/327; 348/12

[58] **Field of Search** 348/6, 7, 10, 12; 455/3.1, 5.1, 6.1; 345/327; 709/217–219; H04N 7/10

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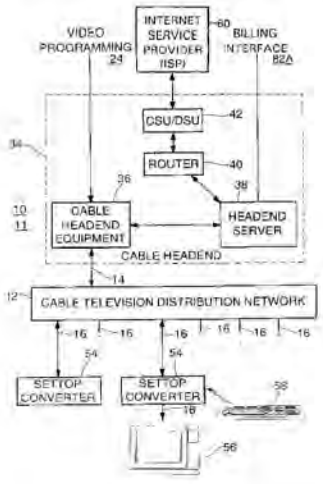
Primary Examiner—Nathan Flynn

Attorney, Agent, or Firm—Akin, Gump, Strauss, Hauer & Feld, L.L.P.

[57] **ABSTRACT**

An access system and method for providing interactive access to an information source through a television distribution system is disclosed. The distribution system includes a television distribution network, headend distribution equipment at the headend of the distribution network, and a plurality of terminals at terminal ends of the distribution network. An input device and an upstream transmitter are associated with one of the terminals to input a command for the information source and to transmit the inputted command on an upstream channel of the distribution network, respectively. A headend server, upstream receiver, and blank interval inserter are associated with the headend distribution equipment. The headend server is interfaced to the information source. The upstream receiver is interfaced to the headend server to receive and forward the command to the headend server. The headend server transmits the forwarded command to the information source, and the information source transmits responsive information to the headend server. The blank interval inserter receives the information from the headend server and inserts sequential portions into blank intervals of sequential picture fields of a television transmission on a downstream channel of the distribution network. The blank interval extractor is interfaced to the terminal to extract the inserted sequential portions. The extracted information is then displayed on a display device associated with the terminal.

58 Claims, 10 Drawing Sheets



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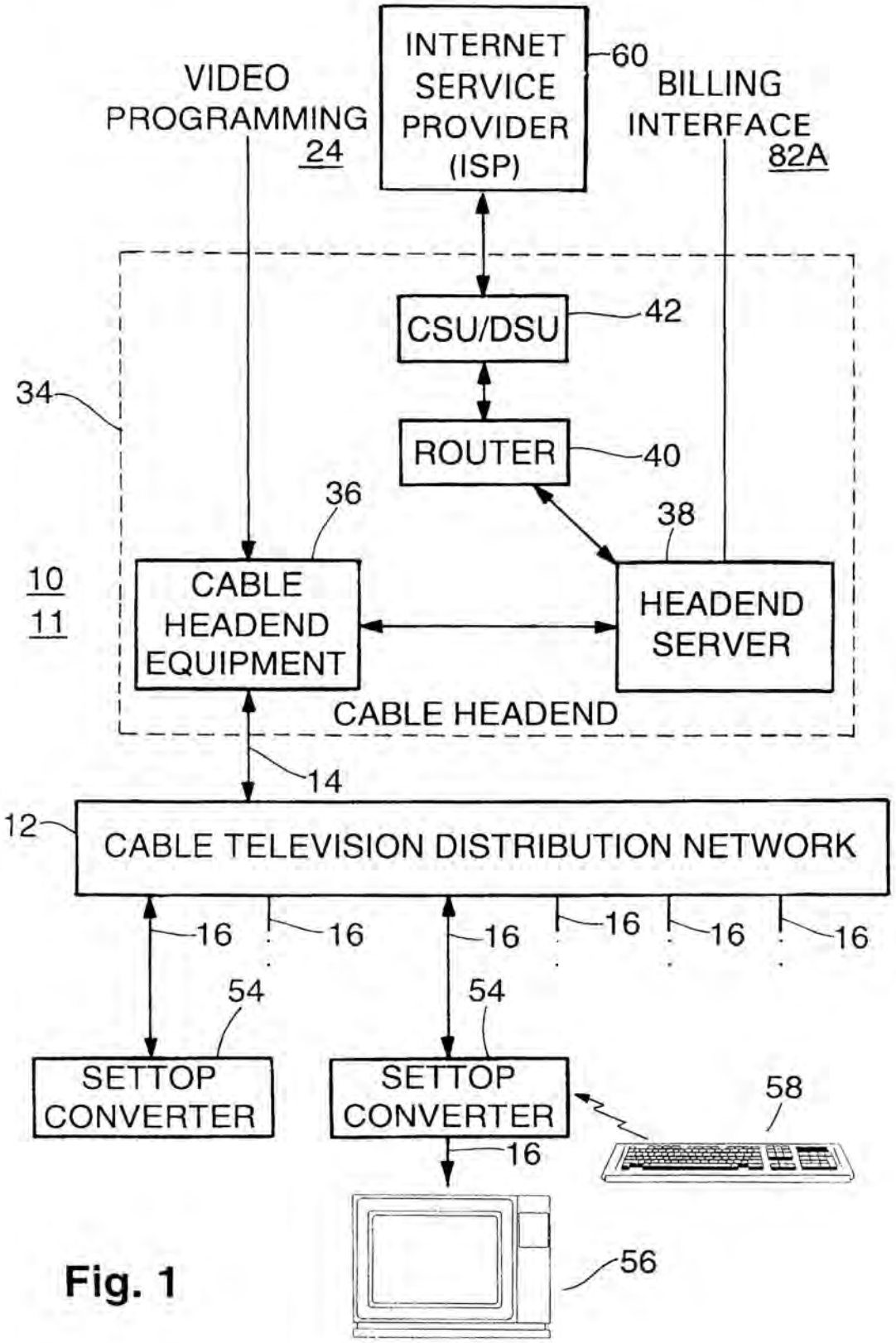

INTERNET SERVICE PROVIDER (ISP)
60
VIDEO PROGRAMMING 24
BILLING INTERFACE 82A
CSU/DSU
42
34
ROUTER
40
36
38
10
11
CABLE HEADEND EQUIPMENT
HEADEND SERVER
CABLE HEADEND
14
12
CABLE TELEVISION DISTRIBUTION NETWORK
16
16
16
16
16
16
54
54
SETTOP CONVERTER
SETTOP CONVERTER
58
16
56

Fig. 1

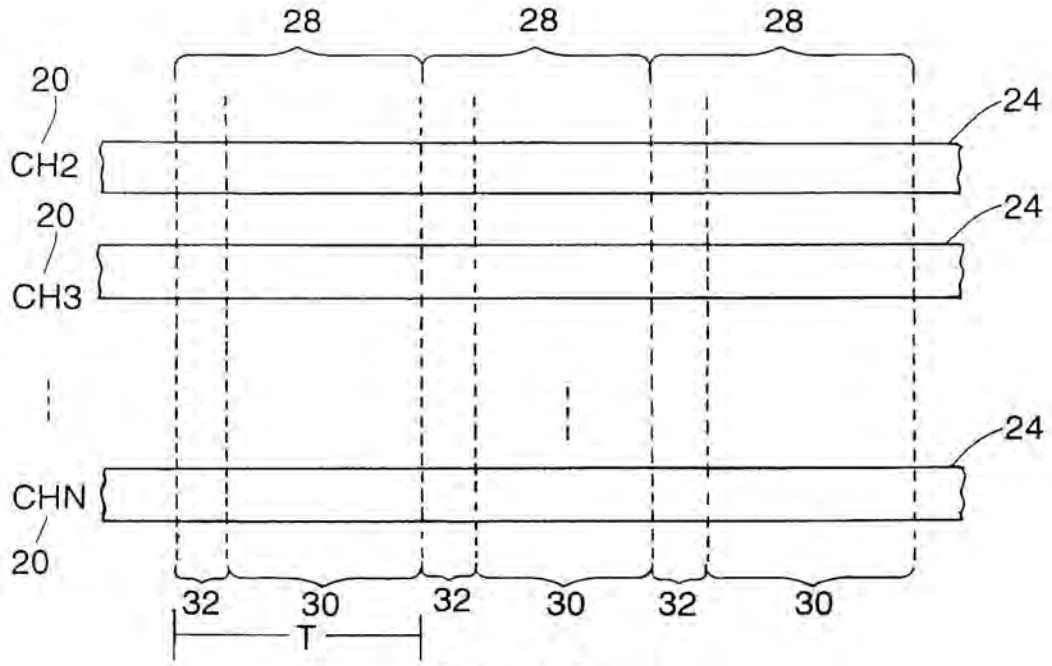

28
28
28
20
CH2
24
20
CH3
24
CHN
20
24
32
30
32
30
32
30
T

Fig. 2A

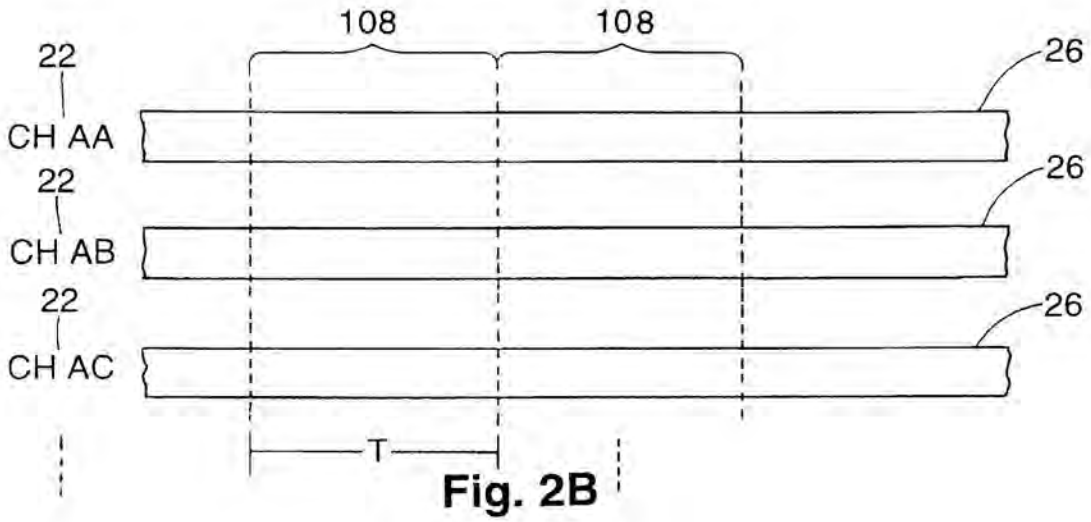

108
108
22
CH AA
26
22
CH AB
26
22
CH AC
26
T

Fig. 2B

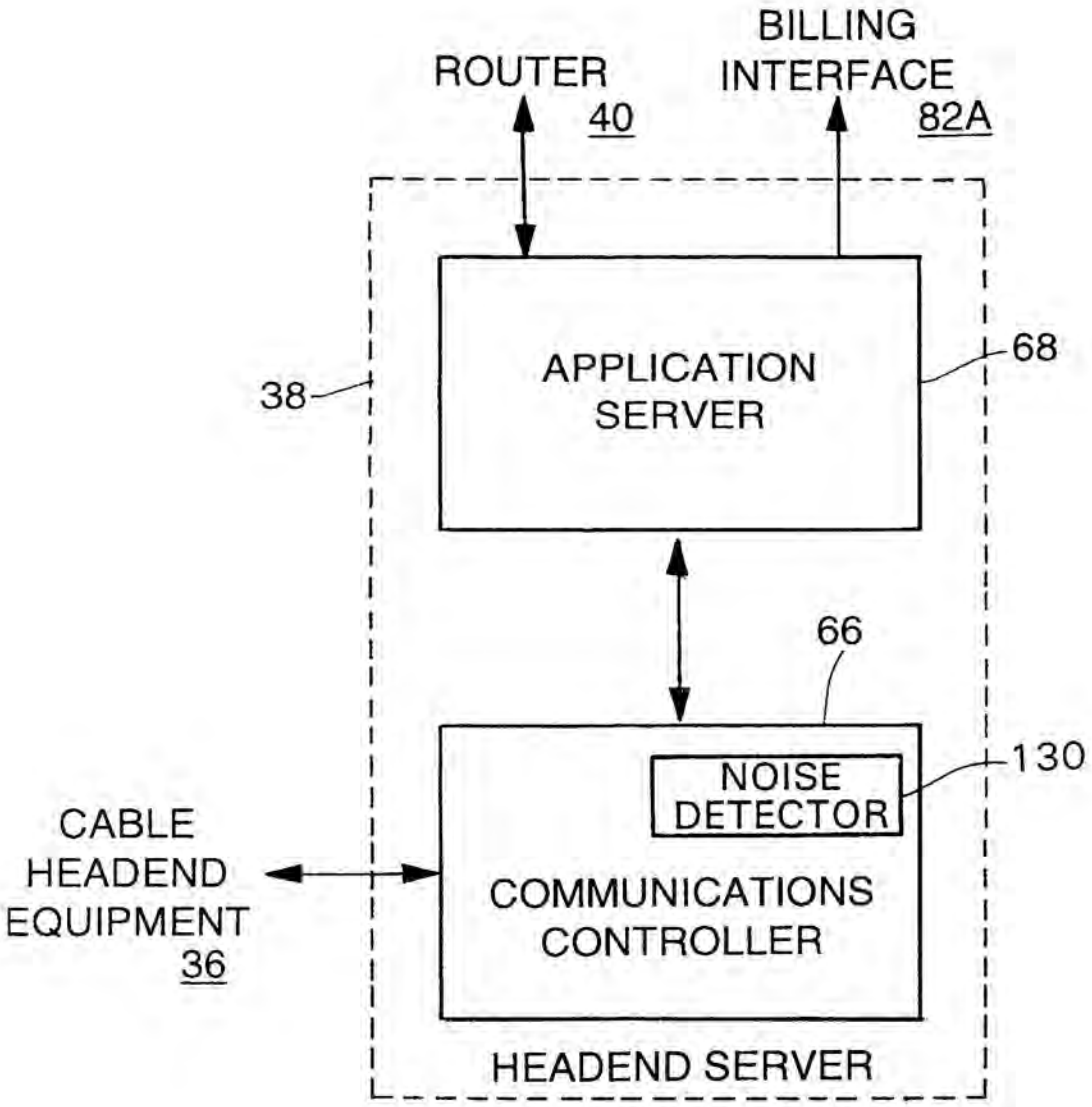

ROUTER
40
BILLING
INTERFACE
82A
APPLICATION
SERVER
68
38
66
NOISE
DETECTOR
130
CABLE
HEADEND
EQUIPMENT
36
COMMUNICATIONS
CONTROLLER
HEADEND SERVER

Fig. 3

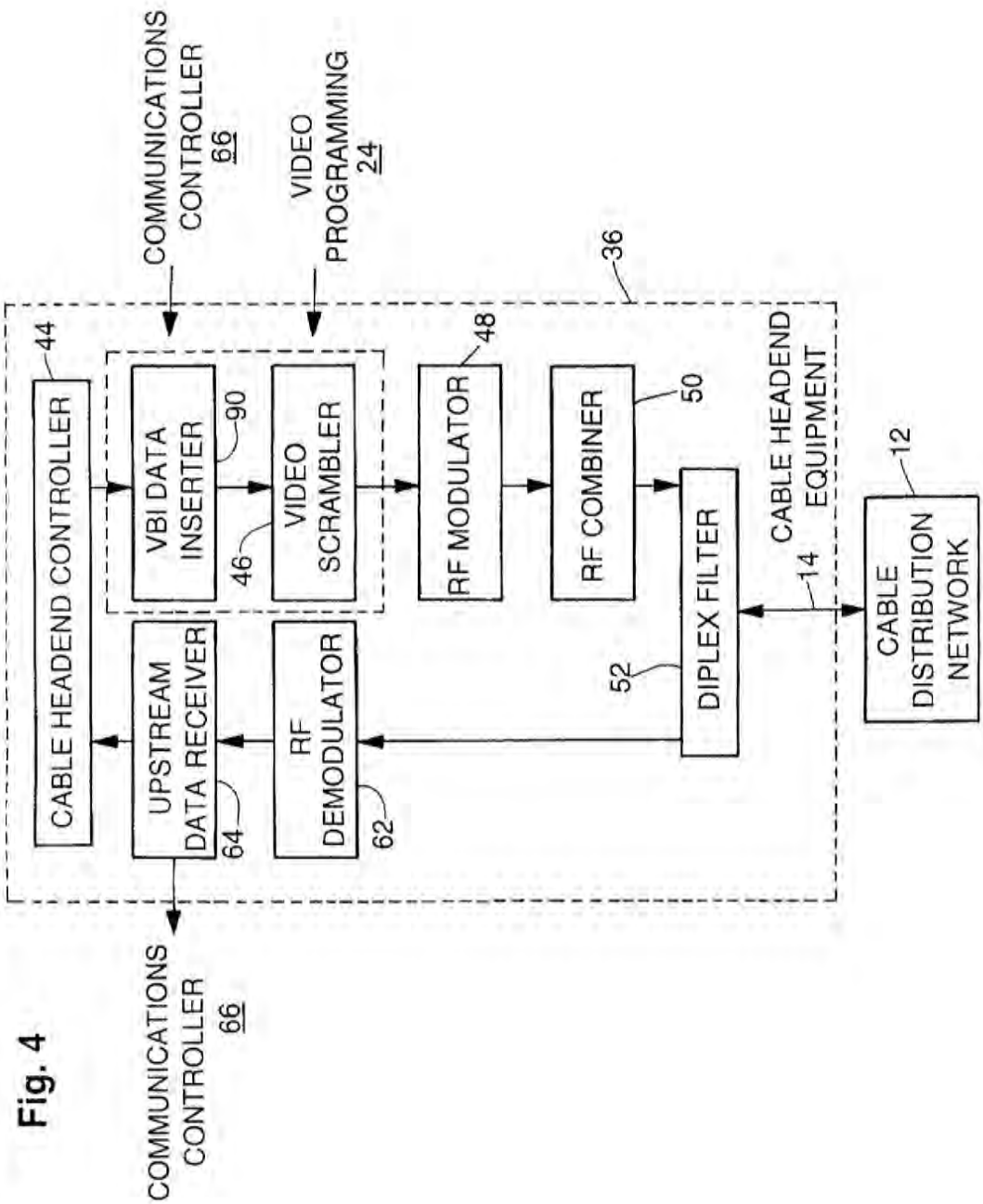

COMMUNICATIONS CONTROLLER 66
VIDEO PROGRAMMING 24
36
CABLE HEADEND CONTROLLER
44
VBI DATA INSERTER
90
VIDEO SCRAMBLER
46
RF MODULATOR
48
RF COMBINER
50
DIPLEX FILTER
52
CABLE HEADEND EQUIPMENT
14
CABLE DISTRIBUTION NETWORK
12
UPSTREAM DATA RECEIVER
64
RF DEMODULATOR
62
COMMUNICATIONS CONTROLLER 66

Fig. 4

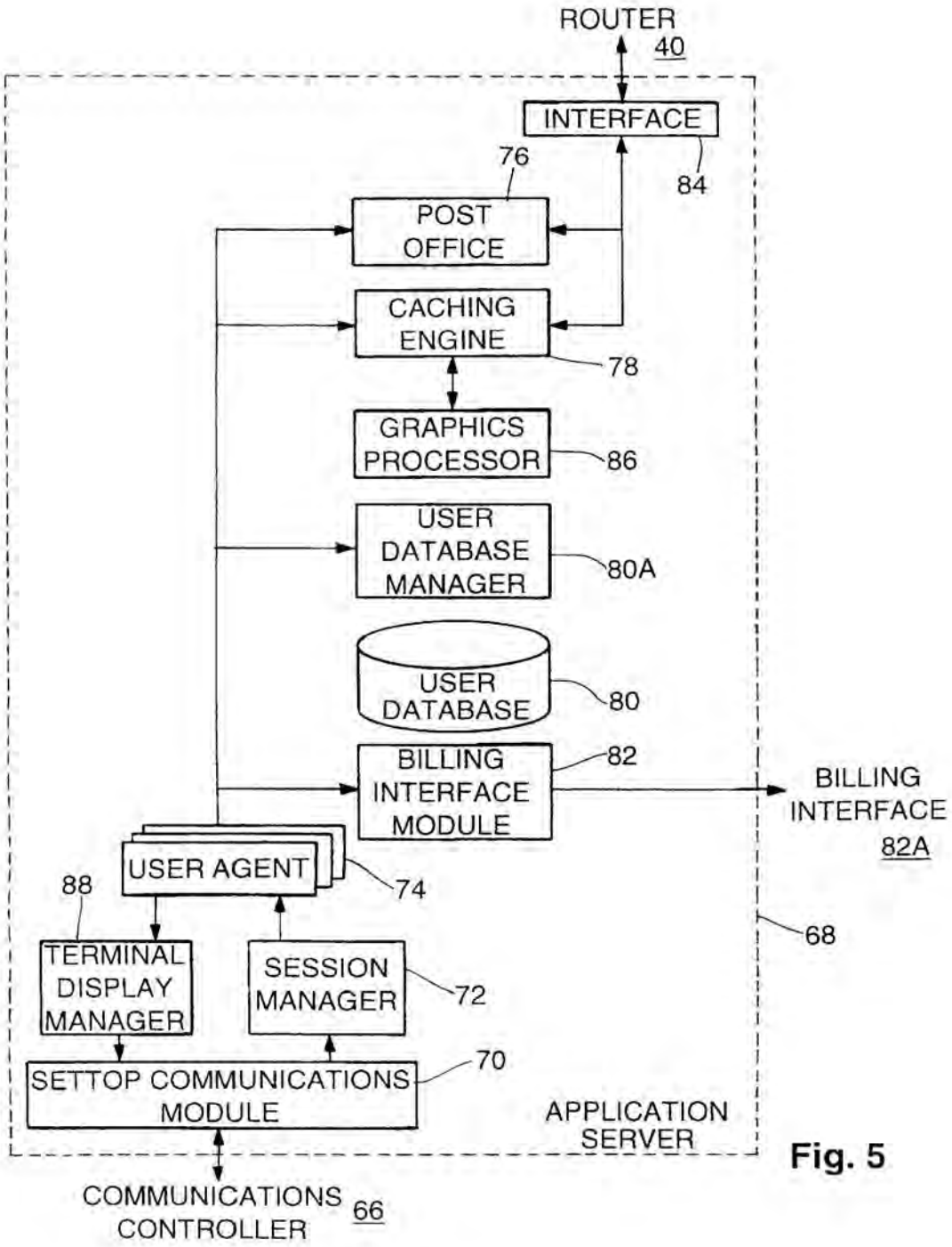

ROUTER
40
INTERFACE
84
76
POST OFFICE
CACHING ENGINE
78
GRAPHICS PROCESSOR
86
USER DATABASE MANAGER
80A
USER DATABASE
80
BILLING INTERFACE MODULE
82
BILLING INTERFACE
82A
USER AGENT
74
88
TERMINAL DISPLAY MANAGER
SESSION MANAGER
72
SETTOP COMMUNICATIONS MODULE
70
APPLICATION SERVER
68
COMMUNICATIONS CONTROLLER
66

Fig. 5

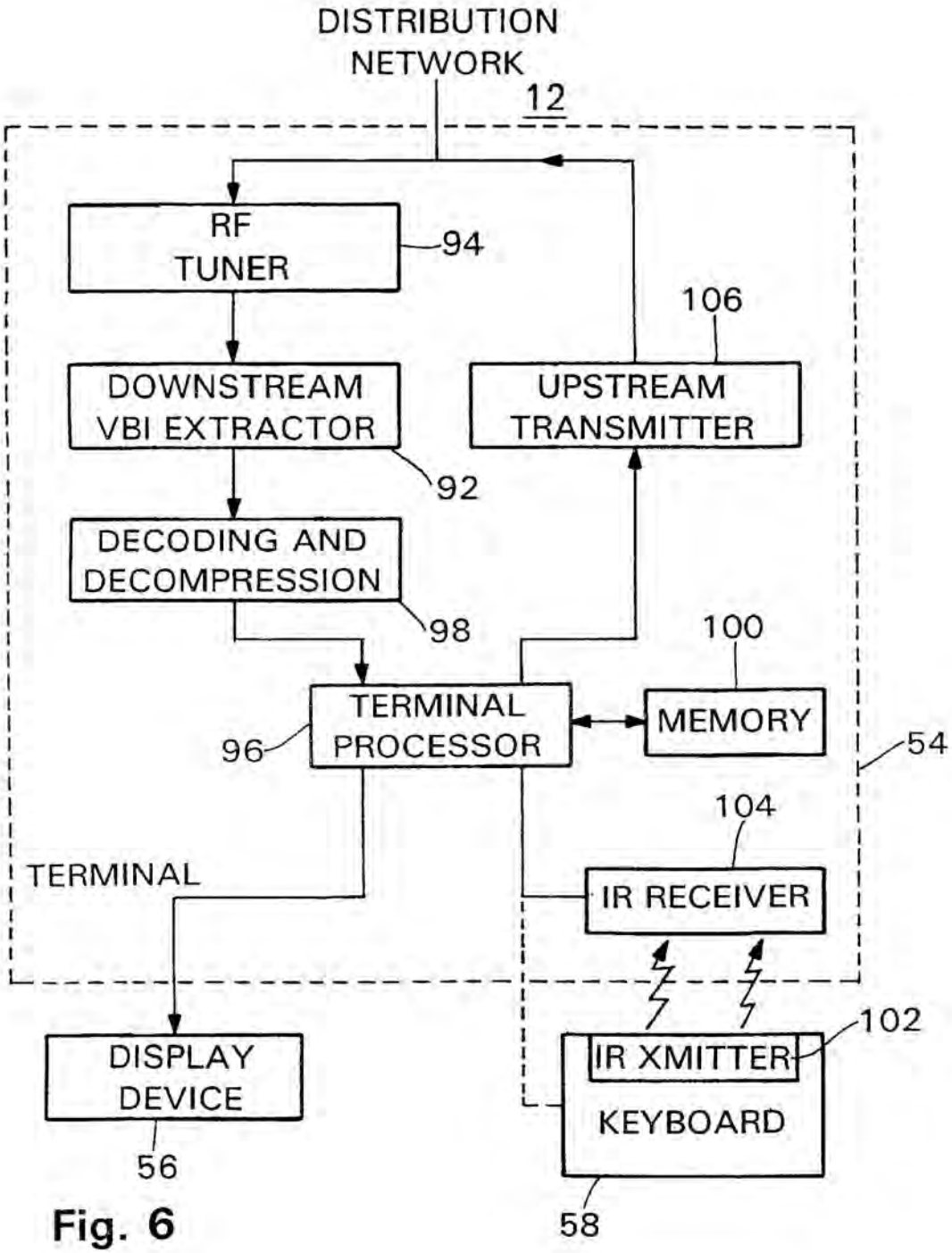

DISTRIBUTION NETWORK
12
RF TUNER
94
106
DOWNSTREAM VBI EXTRACTOR
UPSTREAM TRANSMITTER
92
DECODING AND DECOMPRESSION
98
100
TERMINAL PROCESSOR
96
MEMORY
54
104
TERMINAL
IR RECEIVER
102
DISPLAY DEVICE
IR XMITTER
KEYBOARD
56
58

Fig. 6

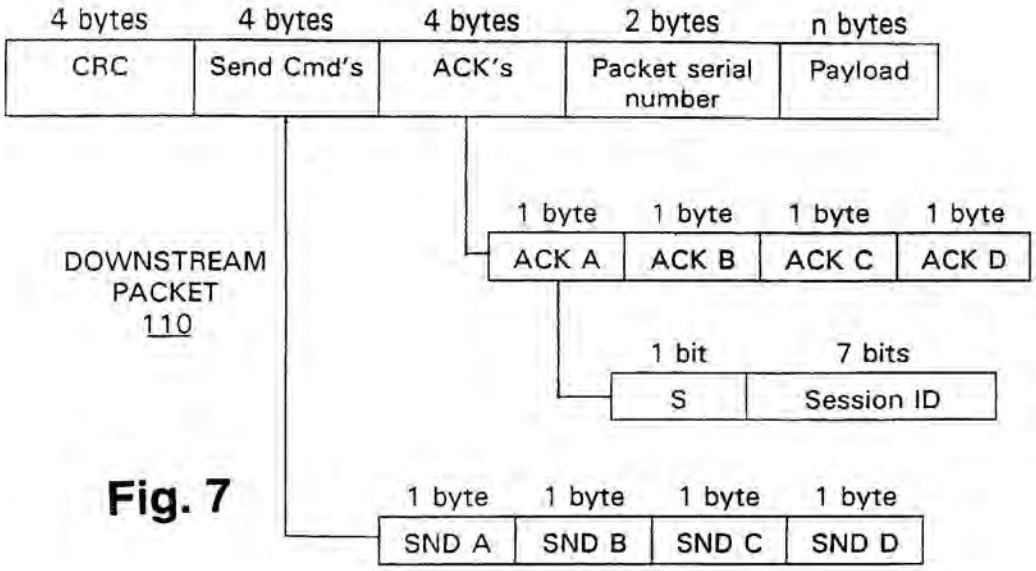


Fig. 7

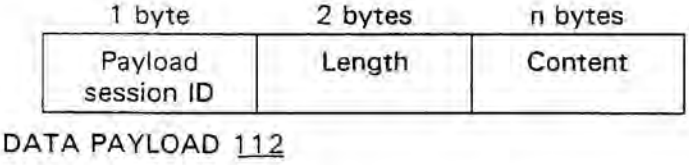


Fig. 8A

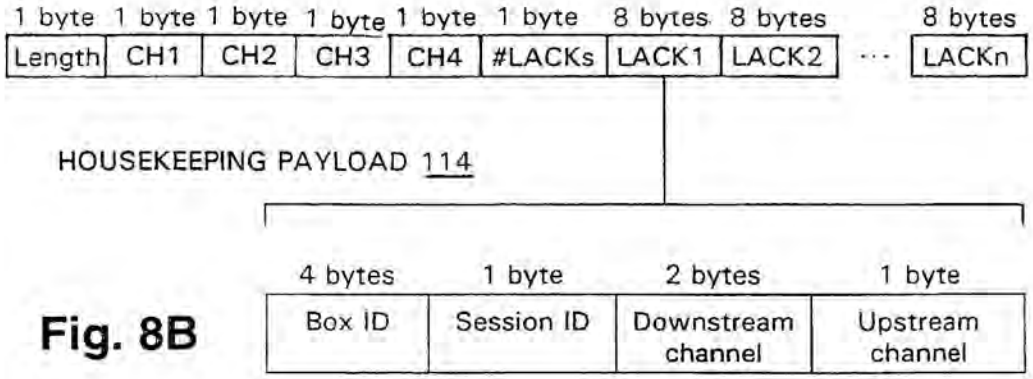


Fig. 8B

Fig. 9

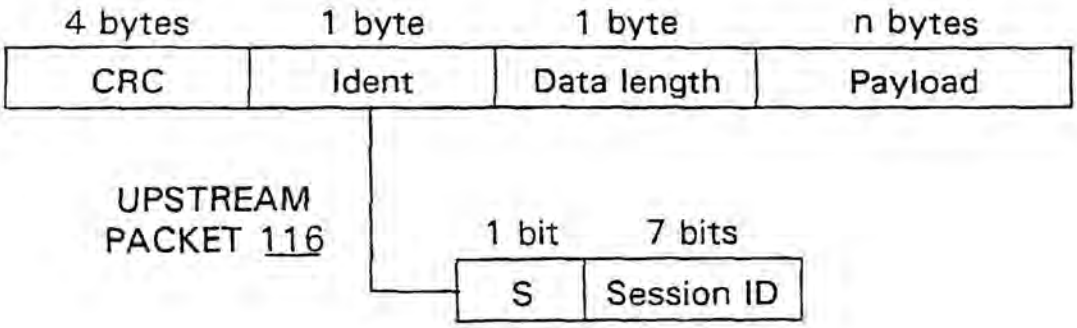
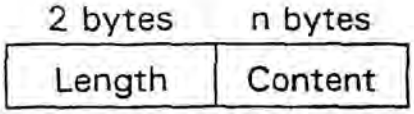
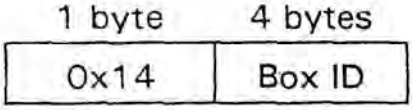


Fig. 10A



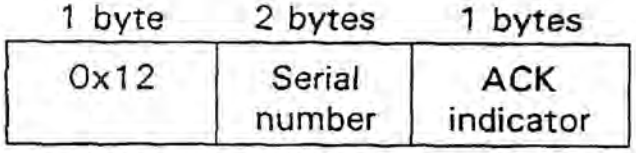
UPSTREAM PAYLOAD STRUCTURE 118

Fig. 10B



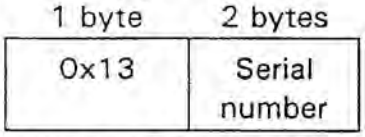
LOGIN REQUEST 120

Fig. 10C



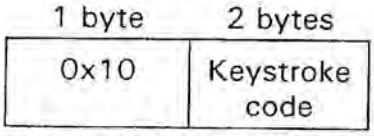
UPSTREAM ACKNOWLEDGE 122

Fig. 10D



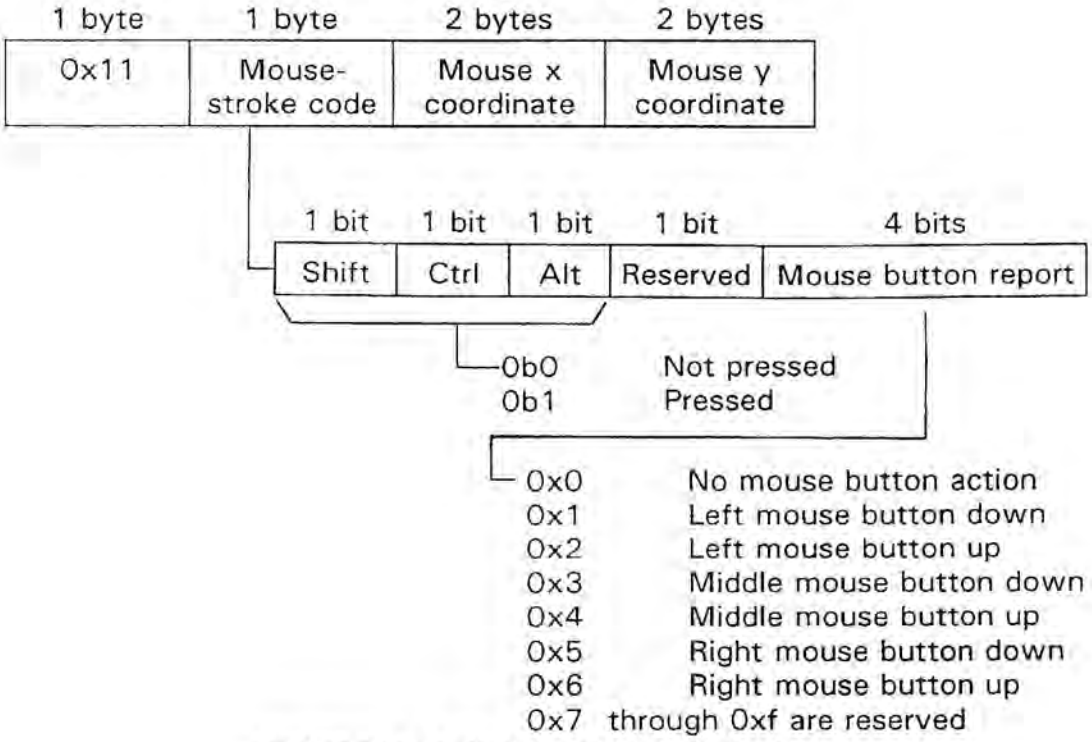
UPSTREAM RE-SEND REQUEST 124

Fig. 10E



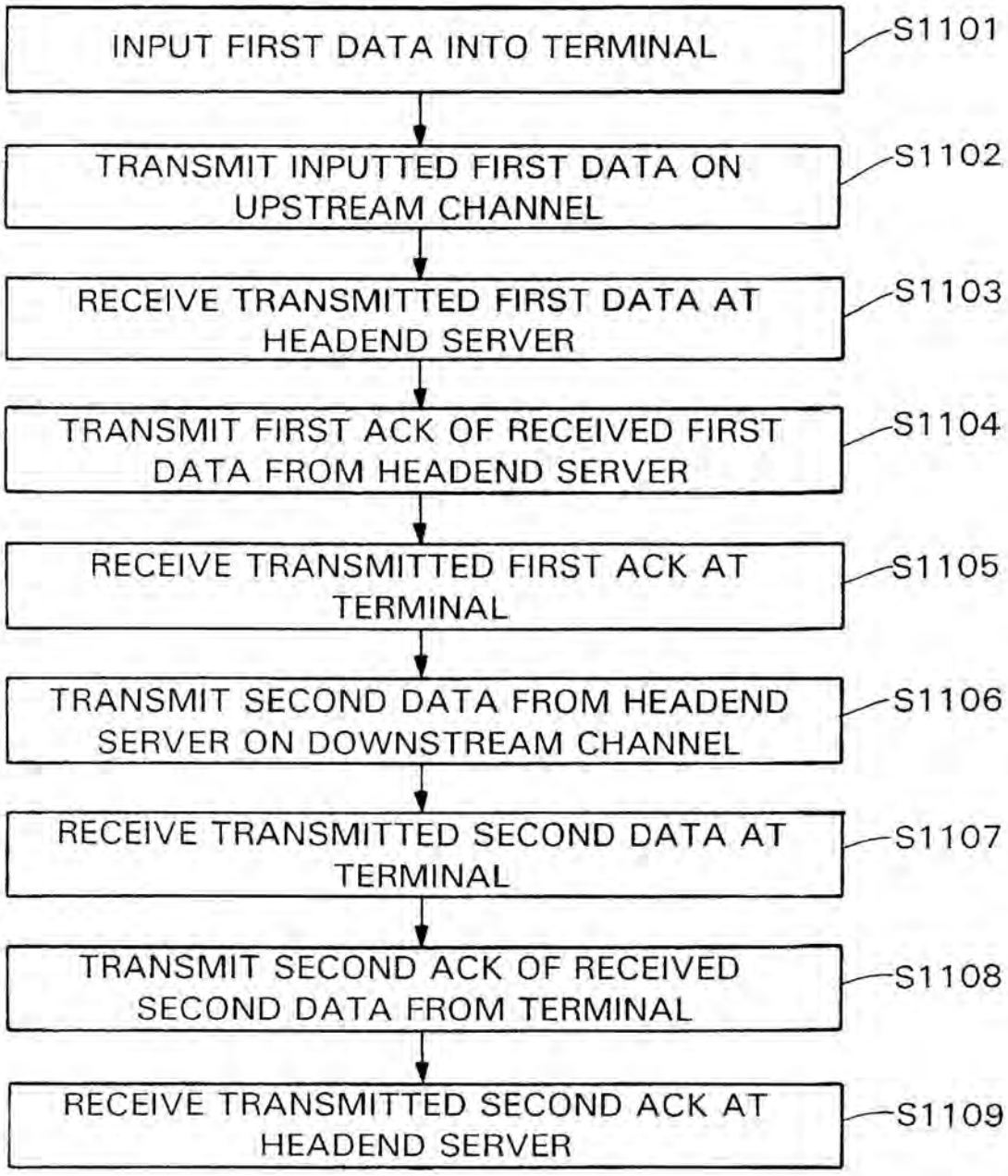
UPSTREAM KEYSTROKE 126

Fig. 10F



UPSTREAM MOUSE MOVEMENT 128

Fig. 11


INPUT FIRST DATA INTO TERMINAL
S1101
TRANSMIT INPUTTED FIRST DATA ON UPSTREAM CHANNEL
S1102
RECEIVE TRANSMITTED FIRST DATA AT HEADEND SERVER
S1103
TRANSMIT FIRST ACK OF RECEIVED FIRST DATA FROM HEADEND SERVER
S1104
RECEIVE TRANSMITTED FIRST ACK AT TERMINAL
S1105
TRANSMIT SECOND DATA FROM HEADEND SERVER ON DOWNSTREAM CHANNEL
S1106
RECEIVE TRANSMITTED SECOND DATA AT TERMINAL
S1107
TRANSMIT SECOND ACK OF RECEIVED SECOND DATA FROM TERMINAL
S1108
RECEIVE TRANSMITTED SECOND ACK AT HEADEND SERVER
S1109

ACCESS SYSTEM AND METHOD FOR PROVIDING INTERACTIVE ACCESS TO AN INFORMATION SOURCE THROUGH A TELEVISION DISTRIBUTION SYSTEM

FIELD OF THE INVENTION

The present invention relates generally to an access system and method for providing interactive access to an information source-without the need for expensive computer hardware. More particularly, the present invention relates to providing access to the Internet through a cable television distribution system.

BACKGROUND OF THE INVENTION

As is well-known, "internet" a world-wide interconnected network of computers, and access to the Internet may be had for purposes of communication, research, entertainment, and the like. However, and as is also well-known, such access normally requires the use of relatively expensive equipment including a personal computer and related hardware and software. Since a first significant percentage of the general population cannot afford such expensive equipment, such first population is prevented from accessing the Internet.

Further, using such a personal computer and related equipment requires a relatively high degree of technical sophistication and commitment. Accordingly, even if a user can afford to buy a system including a personal computer, a printer, a modem, cables, and other necessary related gear, the user must properly connect and configure each device, must learn how to operate each device, and must update hardware and software as necessary to maintain the system. Since a second significant percentage of the general population does not have the technical sophistication required for such a system, and since a third significant percentage of the general population either cannot or will not dedicate the time and resources necessary to learn, operate, and maintain such a system, such second and third populations are prevented from accessing the Internet. Accordingly, a need exists for an access system and method that is relatively inexpensive, that requires only a minimum of technical sophistication and commitment, and is relatively easy to use.

SUMMARY OF THE INVENTION

The aforementioned need is satisfied by an access system and method for providing an interactive access system to an information source through a television distribution system which includes a television distribution network, headend distribution equipment, and a plurality of terminals. The television distribution network has a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels. Each downstream channel carries a television transmission which includes a plurality of sequentially transmitted picture fields, and each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data. Each upstream channel carries data transmissions to the network headend.

The headend distribution equipment is interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network. Each terminal is interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, and is also interfaced to a display device for displaying a selected one of the television transmissions.

The access system includes an input device, an upstream transmitter, a headend server, an upstream receiver, a blank interval inserter, and a blank interval extractor. The input device is associated with one of the terminals for inputting into the terminal a command for the information source. The upstream transmitter is associated with the terminal and transmits the inputted command on an upstream channel of the distribution network. The headend server is associated with the headend distribution equipment and is interfaced to the information source. The upstream receiver is also associated with the headend distribution equipment and is interfaced to the headend server for receiving the inputted command on the upstream channel of the distribution network and for forwarding the received command to the headend server.

The headend server transmits a command based on the forwarded command to the information source, and the information source transmits information to the headend server in response to the forwarded command. The blank interval inserter is associated with the headend distribution equipment and is interfaced to the headend server to receive information based on the transmitted information from the headend server and to insert sequential portions of the received information into the blank intervals of sequential picture fields of at least one of the television transmissions. The blank interval extractor is interfaced to the terminal for extracting the inserted sequential portions of the information from the blank intervals of the sequential picture fields of the television transmissions. The extracted information is then displayed on the display device.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing summary as well as the following detailed description of a preferred embodiment of the invention will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings an embodiment which is presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

FIG. **1** is a block diagram of the architecture of an access system and a television distribution system in accordance with a preferred embodiment of the present invention;

FIGS. **2**A and **2**B are timing diagrams of downstream and upstream channels, respectively, of the television distribution network shown in FIG. **1**;

FIG. **3** is a block diagram of the headend server shown in FIG. **1**;

FIG. **4** is a block diagram of the cable headend equipment shown in FIG. **1**;

FIG. **5** is a block diagram of the application server shown in FIG. **3**;

FIG. **6** is a block diagram of the application server s own in FIG. **3**;

FIG. **7** is a diagram of a downstream packet transmitted on one of the downstream channels shown in FIG. **2**A;

FIGS. **8**A–**8**B are diagrams of payloads that can be sent in the downstream packet shown in FIG. **7**;

FIG. **9** is a diagram of an upstream packet transmitted on one of the upstream channels shown in FIG. **2**B;

FIGS. **10**A–**10**F are diagrams of payloads that can be sent in the upstream packet shown in FIG. **9**; and

FIG. **11** is a flow diagram showing the acknowledgement process performed in the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings in detail, wherein like are used to indicate like elements throughout, there is shown in FIG. **1** a preferred embodiment of an access system **10** for providing interactive access to an information source through a television distribution system **11**. As seen, the components of the access system **10** and of the television distribution system **11** are by necessity commingled. Preferably, the television distribution system **11** is a cable television distribution system **11** comprising a nodal television distribution network **12** of branched fiber-optic and/or coaxial cable lines. As one skilled in the art will appreciate, such a television distribution system **11** and network **12** are well-known and are used extensively by cable television service providers throughout the United States. However, one skilled in the art will also recognize that other types of television distribution systems **11** and networks **12** may be employed without departing from the spirit and scope of the present invention. Such other types of television distribution systems and networks include but are not limited to orbiting satellite systems, terrestrial wireless cable systems, and the like.

As seen in FIG. **1**, the television distribution network **12** has a network headend **14** and a plurality of terminal ends **16**. As should be understood, and referring now to FIGS. **2A** and **2B**, the network **12** has a frequency spectrum which is divided into a plurality of RF-modulated downstream channels **20** (FIG. **2A**) and a plurality of RF-modulated upstream channels **22** (FIG. **2B**), where each downstream channel **20** carries a television transmission **24** from the network headend **14** to the terminal ends **16**, and each upstream channel carries data transmissions **26** from the terminal ends **16** to the network headend **14**.

As seen in FIG. **2A**, each television transmission **24** on a respective downstream channel **20** includes a plurality of sequentially transmitted picture fields **28**, where each transmitted picture field **28** includes a picture interval **30** corresponding to a transmission of pixelated picture data, and a blank interval or vertical blanking interval **32** corresponding to a transmission of no pixelated picture data. As is known, the blank interval **32** is necessary due to constraints imposed by electron gun display devices. More particularly, many (but not all) television display devices employ an electron gun (not shown) and a phosphorescent screen (also not shown) to display a television transmission **24**, and a picture from a transmitted picture field **28** is created on the screen by focusing the electron gun to fire electrons onto the screen in a series of horizontal lines sequentially applied from the top of the screen to the bottom. Accordingly, after the end of a first picture field **28**, a vertical blanking interval **32** is necessary at the beginning of a second picture field **28** to allow time to retrace the electron gun from the bottom of the screen to the top. As is known, each transmitted picture field **28** also includes a horizontal blanking interval (not shown) between each transmitted horizontal line to allow time to retrace the electron gun from the end of one line to the beginning of another line. As is also known, each picture field **28** in the USA broadcasting convention is 1/60th of a second in temporal length T, and two picture fields **28** combine to form one picture frame.

As seen in FIG. **1**, the network headend **14** of the television distribution system **11** is connected to a cable headend **34**, and the cable headend **34** includes cable headend equipment or headend distribution equipment **36** and a headend server **38**. Referring now to FIG. **4**, it is seen that the cable headend equipment **36** includes a cable network headend controller **44** for controlling the distribution of the television transmissions **24** over the respective downstream channels **20** of the television distribution network **12**. The headend controller **44** is well-known and therefore need not be further described here.

For each downstream channel **24**, the cable headend equipment **36** may also include a video scrambler **46** for receiving the television transmissions **24** in the form of video programming and scrambling such video programming **24** (only one video scrambler **46** is shown in FIG. **4**). As should be understood by one skilled in the art, not all television distribution systems **11** scramble, and scrambling is not a requirement in the preferred embodiment of the present invention. An RF modulator **48** is included in the cable headend equipment for each downstream channel **20** to modulate the respective television transmission **24** to the downstream channel **20** frequency (only one RF modulator **48** is shown in FIG. **4**), and a single RF combiner **50** receives the outputs from all RF modulators **48** and combines such outputs to form a single signal. The single signal output from the RF combiner **50** is fed to a diplex filter **52** and then to the network headend **14**. As should be understood, the diplex filter **52** also receives the upstream data transmissions **26** on the upstream channels **22** and separates out such upstream data transmissions **26** to be sent further upstream.

Referring again to FIG. **1**, it is seen that the television distribution system **11** also has a plurality of set top converters or terminals **54**, each terminal **54** being interfaced to a terminal end **16** of the television distribution network **12** for receiving the television transmissions **24** over the respective downstream channels **20** of the television distribution network **12**. As should be understood, each terminal **54** is for selecting one of the downstream channels **20** and is for being interfaced to a display device **56** for displaying the television transmission **24** carried on the selected downstream channel **20**. Typically, the display device **56** is a tunable television set, although one skilled in the art will recognize that a non-tunable television monitor may also be employed without departing from the spirit and scope of the present invention.

With the television distribution system **11** as thus far described, the access system **10** will now be discussed. Still referring to FIG. **1**, it will be seen that the access system **10** includes an input device **58** associated with one of the terminals **54** for inputting into the terminal a command for an information source **60**. As seen in FIG. **6**, the command input into the terminal **54** by the inputting device **58** is transmitted by an upstream transmitter **106** on an RF-modulated upstream channel **22** of the television distribution network **12** from the terminal **54** to the cable headend equipment **36**.

Preferably, the information source **60** is an Internet service provider having access to the well-known Internet intercommunications network. However, one skilled in the art will recognize that other information sources may be accessed without departing from the spirit and scope of the present invention. For example, the information source **60** may be a local information source at the cable headend **34**, an E-mail interchange, a "chat room" interchange, the application server **68** itself, or the like.

Referring again to FIG. **4**, all upstream channels are received from the network headend **14** of the cable distri-

bution network **12** at the diplex filter **52**, are separated by the diplex filter **52** from the downstream channels **20**, and are forwarded to RF demodulators **62**, one RF demodulator **62** for each upstream channel **22** (only one RF demodulator **62** is shown in FIG. **4**). Accordingly, the RF-modulated upstream channel **22** having the transmitted command is demodulated, and the command is forwarded to an upstream data-receiver **64** which in turn forwards the received command to the headend server **38** (as seen in FIGS. **1** and **3**).

As seen, the headend server **38** is associated with the cable headend equipment **36** and is interfaced to the information source **60**. Accordingly, the headend server **38** transmits a command based on the forwarded command from the upstream receiver **64** to the information source **60** by way of the router **40** and the CSU/DSU **42**. More specifically, and referring now to FIG. **3**, the headend server **38** is preferably partitioned into a communications controller **66** and an application server **68**, and the command from the upstream receiver **64** is received by the communications controller **66** and is then forwarded to the application server **68**. As will be discussed more fully below, the communications controller **66** packetizes downstream data, de-packetizes upstream data, handles session requests from terminals **54**, and otherwise performs functions necessary to maintain communications between the application server **68** and the terminals **54**.

Referring now to FIG. **5**, it is seen that the application server **68** includes a set top communications module **70** in communication with the communications controller **66** for interfacing the application server **68** to the communications controller **66**, and the received command from the communications controller **66** is forwarded to the set top communications module **70** and then in turn forwarded to a session manager **72**. As should be understood, the session manager **72** manages multiple sessions from multiple set top terminals **54**, and therefore maintains an association between the received command and the terminal **54** that originated the received command. Depending on the command and the current application, the received command is forwarded by the session manager **72** to one of several user agents **74**. As should be understood, the user agents **74** include a browser for browsing through the information source **60**, an E-mail agent for facilitating E-mail through the information sources **60**, a chat agent for facilitating on-line chat sessions, and the like. User agents are well-known and therefore need not be described here in more detail.

In response to a received command, a user agent **74** issues one or more further commands based on the received command in a format understandable by the information source **60**, and the issued commands are forwarded to the information source **60** by way of a post office **76**, a caching engine **78**, or by bypassing the post office **76** and the caching engine **78**. As should be understood, the post office **76** facilitates the sending and receiving of E-mail, and the caching engine **78** stores and forwards traffic in either direction. In addition, the caching engine **78** may keep track of issued commands and store certain data if requested on a regular basis. As should also be understood, the post office **76** and the caching engine **78** may be bypassed when not needed, e.g. during an on-line chat session. As with user agents, post offices and caching engines are well-known and therefore need not be described here in more detail.

Preferably, the application server **68** also has a user database manager **80**A in combination with a user database **80** for managing access system user information. As should be understood, such information includes information on each user, certain characteristics and attributes associated with each user, information on frequently accessed information for each user, and the like. The application server **68** may also have a billing interface module **82** associated with a billing interface **82**A for purposes of billing users for use of the access system **10**. As one skilled in the art will recognize, the billing interface **82**A can connect with any of a plurality of known accounting systems for purposes of billing, including the accounting system for billing use of the television distribution system **11**.

Preferably, the application server **68** includes an information source interface **84** for allowing the application server **68** to communicate with the information source **60** by way of whatever protocol the information source **60** may be expecting. For example, if the information source **60** is an Internet service provider, the protocol would preferably be the TCP/IP (transmission control protocol/Internet protocol) protocol normally used to communicate on the Internet. However, depending on the information sources **60**, one skilled in the art will recognize that other protocols may be employed without departing from the spirit and scope of the present invention.

Preferably, and referring again to FIG. **1**, the interface **84** in FIG. **5** communicates with the information source **60** by way of a router **40** and a consumer service unit/digital service unit (CSU/DSU) **42** associated with the cable headend **34**. As should be understood, the router **40** is connected to the interface **84** for routing/pipelining data between the information source **60** and the interface **84**, and the CSU/DSU **42** (also seen in FIG. **1**) is a service unit for interfacing the router **40** to the information source **60**. Both routers and CSU/DSUs are well-known and therefore further description is not necessary. Moreover, one skilled in the art will recognize that other methods of interfacing the information source **60** to the headend server **38** may be employed without departing from the spirit and scope of the present invention. Further, one skilled in the art will also recognize that not all commands need be forwarded to the information source **60**. For example, if requested information is already available in the application server **68** at the caching engine **78** (a highly requested Internet home page, for example), the information source **60** need not be communicated with to procure the requested information. Likewise, if the command is a message from a first terminal **54** to a second terminal **54** by way of the headend server **38** (as discussed below), no communication need be had with the information source **60**.

Once the information source **60** has received a command, the information source **60** preferably processes the command to produce information in response thereto. The produced information is transmitted by the information source **60** to the headend server **38**, and must then be sent to the terminal **54** from which the corresponding command originated. Accordingly, and as seen in FIG. **5**, the information from the information source is received in the application server **68** by way of the interface **84** and is forwarded through the post office **76** and/or the caching engine **78** to the appropriate user agent **74**.

As should be recognized, depending upon the information source **60**, the information from the information source **60** may not be in a form that is compatible for display on the display device **56** associated with the terminal **54**. More particularly, in the situation where the information source **60** is an Internet service provider, the information will likely include graphics in a first graphic form (e.g. a screen having 640 pixels×480 pixels×256 colors) while the terminal **54** and display device **56** are likely expecting the information to be in a second graphics form (e.g. 320 pixels×200 pixels×16

colors). Accordingly, the graphics portion of the information must be converted by a graphics processor **86** in communication with the caching engine **78**. The operation of a graphics processor in converting graphic data from one form to another is well-known and need not be further described here.

The information from the information source **60** is forwarded by the user agent **74** to a terminal display manager **88**. Preferably, the terminal display manager **88** is designed to minimize the actual amount of information that must be transmitted to the terminal **54**. Accordingly, it is preferable that the terminal display manager **88** render screens at the application server **68** for display at the appropriate terminal **54**, that the terminal display manager **88** retain information on the screen currently being displayed at the appropriate terminal **54**, and that the terminal display manager **88** transmit only the information necessary to refresh portions of a screen that are to be changed. The process of rendering screens for display by a screen renderer or the like is well-known and need not be further described here.

As should be understood, transmitting only refresh information can greatly reduce the amount of downstream information that must be sent to the terminal **54**, especially if only a small change to a screen is necessary. Preferably, the terminal **54** is programmed to operate based on such refresh information.

The refresh information from the terminal display manager **88** and other information from the application server **68** is forwarded to the communications controller **66** by way of the set top communication module **70**. Referring again to FIG. **4**, the communications controller **66** receives the forwarded information and in turn forward such information to a vertical blanking interval (VBI) data inserter or VBI inserter **90**. As should be understood, a VBI inserter **90** is provided for each downstream channel **20** (only one VBI inserter **90** is shown in FIG. **4**) to insert sequential portions of the forwarded information from the communications controller **66** into the blank intervals **32** of sequential picture fields **28** of the television transmission **24** of the respective downstream channel **20**.

As seen, each VBI inserter **90** is interposed in a downstream flow between the cable headend controller **44** and a respective video scrambler **46**. As should be understood, many manufacturers provide a VBI inserter **90** and a video scrambler **46** in a combined package. Once the information from the communications controller **66** is inserted into the blank intervals **32** of a television transmission **24**, the inserted information then proceeds with the television transmission **24** through the video scrambler **46**, the RF modulator **48**, the RF combiner **50**, the diplex filter **52**, and the cable distribution network **12** to the terminal **54** from which the corresponding command originated. As one skilled in the art should appreciate, in some circumstances a horizontal blanking interval (HBI) data inserter (not shown) may be employed instead of the VBI inserter **90** without departing from the spirit and scope of the present invention.

Referring now to FIG. **6**, it will be seen that the terminal **54** includes an RF tuner **94** and a downstream VBI extractor **92**. More particularly, the RF tuner **94** is preset to tune in and demodulate the downstream channel **20** having the television transmission **24** with the inserted information, and the VBI extractor **92** extracts the inserted sequential portions of the inserted information from the blank intervals **32** of the sequential picture fields **28** of the demodulated television transmission **24**. The extracted information is then forwarded to a terminal processor **96**.

As one skilled in the art will recognize, a significant advantage is obtained from employing VBI insertion and extraction to send downstream data from the headend server **38** to the terminal **54** in that the equivalent baud rate of such down stream data can approach 100K or more. More particularly, assuming the equivalent baud rate of each blank line in a VBI is about 12.5K, and assuming eight lines of each VBI are employed by the access system **10** of the preferred embodiment of the present invention, the 100K equivalent baud rate is achieved.

Preferably, the inserted information sent downstream from the cable headend equipment **36** is coded and/or compressed by the terminal display manager **88** using well-known techniques to minimize transmission time. Preferably, the processor **96** includes software for performing the function of decoding and decompressing the coded and/or compressed refresh information. Alternatively, the terminal **54** may include a decoding and/or decompression module **98** interposed between the VBI extractor **92** and the processor **96** for decoding and decompressing the coded and/or compressed refresh information before such information is presented to the terminal processor **96**. As seen in FIG. **6**, the terminal processor **96** may be associated with a memory **100** to facilitate the various processing functions performed thereby.

Preferably, the terminal processor **96** and the memory **100** produce display information from the extracted information, and the display information is displayed on the display device **56**. Preferably, the extracted information includes the screens rendered by the terminal display manager **88** of the application server **68**. The process of producing display information by a set top terminal **54** and terminal processor **96** is well-known and need not be further described here.

Preferably, and as seen in FIGS. **1** and **6**, the input device **58** for inputting the commands into the terminal **54** is a computer-style keyboard **58**. Accordingly, a user of the access system **10** can type word commands, E-mail, and the like. Also preferably, the keyboard **58** includes a mouse device for moving a graphic pointer displayed on the display device **56**.

Preferably, the keyboard **58** includes an infrared (IR) transmitter **102** for transmitting keystroke signals from the keyboard **58** in the form of an IR transmission. Correspondingly, it is also preferable that the terminal **54** include an IR receiver **104** for receiving the IR transmissions from the keyboard **58** and for forwarding signals corresponding to the transmitted keystroke signals to the terminal processor **96**.

However, the keyboard **58** may be tethered to the terminal **54** without departing from the spirit and scope of the present invention. Additionally, the keyboard **58** may be replaced with a remote control device having directional buttons and an execute button without departing from the spirit and scope of the present invention. As should be understood, such a remote control device is of the type typically employed with a terminal **54** in a television distribution system **11** for inputting into the terminal **54** a selection of one of a plurality of downstream channels **20** for display on the display device **56**. Regardless of the source of the command, the terminal **54** transmits the command by way of the upstream transmitter **106** as a data transmission **26** on one of the upstream channels **22** of the television distribution network **12**.

In the access system **10** of the preferred embodiment of the present system, the headend server **39** is a centralized processor for each of the plurality of the terminals **54**.

Accordingly, the upstream receiver **64** may receive a plurality of inputted commands from a plurality of the terminals **54** on one or more of the upstream channels **22** of the distribution network **12**, and then forward the respective received commands to the headend server **38**. As should now be understood, the headend server **38** transmits commands based on the respective forwarded commands to the information source **60**, the information source **60** transmits the information to the headend server **38** in response to the respective forwarded commands, the VBI inserter **90** receives information based on the respective transmitted information from the headend server **38** and inserts sequential portions of the received information into the blank intervals **32** of sequential picture fields **28** of at least one of the television transmissions **24**, and each of the blank interval extractors **92** in the respective terminals **54** extracts the respective inserted sequential portions of the information.

Preferably, the headend server **39** acting as a centralized processor for each of the plurality of the terminals **54** allows for terminal-to-terminal communications, at least among the terminals **54** in the television distribution system **11**. As should be understood, in such communication, a message is sent from a first terminal **54** to the headend server **38** and is then routed by the headend server **38** to a second terminal **54**, bypassing the information source **60**. Preferably, the message is an e-mail message or is a message transmitted during a chat session.

The transmission of upstream and downstream data between the terminal **54** and the communications controller **66** of the headend server **38** will now be described with reference to FIGS. **7–10**F. Preferably, each upstream channel **22** of the television distribution network **12** is multiplexed into a plurality of upstream slots **108**, as sees in FIG. **2**B, where the temporal length T of each slot **108** is equal to the temporal length T of picture field **28**, As seen in FIG. **2**A. Also preferably, a plurality of the upstream channels **22** are paired with each downstream channel **20**. In the preferred embodiment of the present invention, up to four upstream channels **22** are paired with each downstream channel **20**. Also preferably, each terminal **54** on the system **10** is assigned to at least one of the upstream slots **108** at any one time.

Preferably, and referring now to FIG. **7**, each transmission of downstream data from the communications controller **66** of the headend server **38** is in the form of at least one downstream packet **110**. As seen in FIG. **7**, the downstream packet **110** includes a four-byte cyclical redundancy check (CRC) value based on the rest of the downstream packet **110**, where the CRC value is employed to detect any corruption of the data in the packet **110**. The use of CRC values is well-known and, therefore, need not be further described.

The downstream packet **110** also includes four SND bytes (SND A–SND D), where each SND byte corresponds to an upstream channel **22** associated with the downstream channel **20** on which the downstream packet **110** is being sent. Each SND byte contains a session ID of a sender (i.e., a terminal **54**) that is allowed to transmit upstream data in the next upstream slot **108** of the corresponding upstream channel **22**. For example, if the SND B byte has a value of '1', then the terminal **54** assigned the session ID '1' may transmit in the next upstream slot **10**B on the upstream channel **22** that corresponds to 'B'. Preferably, if a particular SND byte has a value of zero, any terminal **54** is allowed to transmit in the next corresponding upstream slot **108**, for example, to request a new session.

Each downstream packet **110** also has four acknowledgment (ACK A–ACK D) bytes, where each ACK byte corresponds to an upstream channel **22** associated with the downstream channel **20** on which the downstream packet **110** is being sent. As should be understood, each ACK byte is sent in response to the successful receipt of upstream data on a respective upstream channel **22** in the previous upstream slot **108**. Preferably, each ACK byte includes the session ID of the transmitting terminal **54** and a check bit indicating whether the serial number of the upstream packet being acknowledged was an even or an odd number.

The downstream packet **110** also has a two-byte packet serial number, followed by a multi-byte payload. Referring now to FIG. **8**A, it is seen that a downstream data payload **112** includes a one-byte payload session ID for identifying the session ID of the intended receiving terminal **54** for the payload, a two-byte length indicator, and the contents of the data being sent in the packet. As should be understood, although all terminals **54** on the downstream channel **20** will receive all downstream packets **110**, a particular terminal **54** will ignore the contents of the data being sent in the packet **110** unless the data payload **112** has a payload session ID corresponding to the session ID of the terminal **54**.

Preferably, a downstream packet **110** periodically has a housekeeping payload **114** rather than a data payload **112**, as seen in FIG. **8**B. As seen, the housekeeping payload **114** includes four channel bytes, each channel byte identifying a respective one of the four upstream channels **22** associated with the downstream channel **20** on which the downstream packet **110** is being sent. Accordingly, if a terminal **54** wishes to initiate a session on the access system **10**, the terminal **54** must listen on the downstream channel **20** for a housekeeping packet **114**, and upon receipt of such housekeeping packet can determine what upstream channels **22** are associated with the downstream channel **20**. The terminal **54** can then send a session request on one of the associated upstream channels **22**.

If session requests were recently made and acted upon by the communications controller **66**, the housekeeping payload **114** also includes a number of session request (log-in) acknowledgements (LACKs). In particular, the housekeeping payload **114** includes a one-byte indicator of the number of LACKs, followed by each LACK. As seen, each LACK includes a 'box ID' corresponding to a unique terminal ID number associated with a requesting terminal **54**, a one-byte session ID that identifies the requesting terminal **54** during the session, a two-byte downstream channel indicator indicating the downstream channel **20** the requesting terminal **54** should tune in to, and a one-byte upstream channel indicator indicating the upstream channel **22** the terminal **54** should be-broadcasting on.

Referring now to FIG. **9**, upstream data from the terminal **54** is sent in the form of an upstream packet **116**. As seen, each upstream packet **116** includes a 4-byte CRC value, as with each downstream packet **110**, a one-byte identifier which has the session ID assigned to the terminal **54** and a check bit indicating whether the upstream packet **110** has an even or an odd packet number, a one-byte data length indicator indicating the length of a multi-byte upstream payload in the packet **116**, and the payload. As seen in FIG. **10**A, the upstream payload has a structure **118** that includes a two-byte length indicator and the contents of the payload. FIGS. **10**B–**10**F are examples of the contents of various upstream payloads.

As seen in FIG. **10**B, a session or log-in request **120** from terminal **54** includes a one-byte indicator signifying that the

upstream packet **116** is a log-in request **120** and the unique box ID of the requesting terminal **54**. As seen in FIG. **10**C, an upstream acknowledge payload **122** includes a one-byte indicator signifying that the upstream packet **116** is an upstream acknowledge **122**, a two-byte serial number of the downstream packet **110** that is being acknowledged, and a one-byte acknowledge (ACK) indicator.

On occasion, an expected downstream data packet **110** is not received, or else is received with a corruption or error. Accordingly, and as seen in FIG. **10**D, an upstream packet **116** may have an upstream re-send request payload **124** which includes a one-byte indicator signifying that the upstream packet **116** is an resend request **124**, and a two-byte serial number of the downstream packet **110** that must be re-sent.

If the data being sent upstream by the terminal **54** is a keystroke from a computer-style keyboard **58** or other input device **58**, then the upstream packet **116** has an upstream keystroke payload **126**, as seen in FIG. **10**E, which includes a one-byte indicator signifying that the upstream packet **116** is a keystroke payload **126**, and a two-byte keystroke code. As should be understood, if the keystroke is from a keyboard **58**, the keystroke code includes information on whether a CTRL/ALT/SHIFT key is being pressed at the time a key is struck.

Preferably, the input device **58** includes a mouse or mouse-like device (not shown), and mouse movements are input to the terminal **54** and the access system **10** as commands. Accordingly, an upstream packet **116** may have upstream mouse movement information **128**, as seen in FIG. **10**F. The mouse movement information **128** includes a one-byte indicator signifying that the upstream packet **116** is a mouse movement payload **128**, a one-byte mouse-stroke code, a two-byte mouse X-coordinate, and a two-byte mouse Y-coordinate. As should be understood, the one-byte mouse-stroke code includes information on whether a SHIFT/CTRL/ALT key is being pressed, and left, middle, and right mouse button information.

As one skilled in the art will readily appreciate, the particular structures of the downstream and upstream packets **110**, **116** may be changed without departing from the spirit and scope of the present invention. For example, if only three upstream channels **22** are assigned to a downstream channel **20**, only three SND and three ACK bytes are necessary in the downstream packet **110** (FIG. **7**). Similarly, fields in the packets **110**, **116** may be added, deleted, or changed in terms of structure or size.

As should be understood, due to the structure of a typical television distribution network **12**, noise on upstream channels **22** is problematic. As a result, it is known that upstream channels **22** can have error rates as high as 1:100000 to 1:100. Accordingly, it is preferable that upstream data packets **116** are kept relatively short to lessen the probability that any one packet will be corrupted by noise. It should be noted, however, that such short upstream packets **116** are not prohibitive in that most upstream commands are relatively short: a mouse movement, a keystroke, etc.

Preferably, the problem of noise is also addressed by the present invention by including a noise detector **130** in the communications controller **66** at the cable headend **34**, as seen in FIG. **3**. Preferably, the noise detector **130** detects a noise level on each of the upstream channels **22**, and if necessary, the communications controller **66** can re-assign a terminal **54** from a first upstream channel **22** to a second upstream channel **22** based on the noise level of the first upstream channel **22** and the second upstream channel **22**. Alternatively, the communications controller **66** can direct the terminal **54** to transmit at a higher level on the upstream channel **22** if necessary based on the detected noise level of the upstream channel **22**. Preferably, the noise detector **130** comprises software that determines noise levels by keeping statistics corresponding to the number of corrupted upstream packets **116** received on each upstream channel **22**.

With the access system **10** as described above, a terminal **54** requests a session in the following manner. Preliminarily, the terminal **54** tunes into a downstream channel **20** on which downstream packets **110** are being sent, and listens for a housekeeping packet **114** (as seen in FIG. **8**B) to determine which upstream channels **22** are associated with the downstream channel **20**. A random one of the upstream channels **22** is selected, and a log-in request **120** (FIG. **10**B) is sent in an upstream slot **108** that has not been preassigned by a respective SND byte (as seen in FIG. **7**). If a log-in acknowledge (LACK) (FIG. **8**B), is subsequently received within a pre-determined number of time periods T (corresponding to the length of a picture field **28** (FIG. **2**A) and to the length of an upstream slot (FIG. **2**B)), the session request is successful. If not, a new random downstream and upstream channel **20**, **22** may be tried.

In the unlikely event that two terminals **54** send a session request in the same upstream slot **108**, the communications controller **66** will receive collided data and neither terminal **54** will receive a LACK. Preferably, each terminal **54** then waits a random amount of time and attempts a second session request. The process is repeated until both session requests are handled by the communications controller **66**.

Once logged in, and after the terminal **54** issues an upstream command, the terminal waits for a downstream packet **110** that has been addressed to the terminal **54** in response to the command. Preferably, each received downstream packet **110** is checked to determine if the packet serial number is correct. If the packet serial number is wrong, a re-send request **124** (FIG. **10**D) is sent with the packet serial number of the last packet that was successfully received. Preferably, the headend server **38** interprets a re-send request **124** as a request to re-send the packet **110** having the re-send serial number and every packet **110** sent thereafter.

If a re-send request **124** is sent multiple times without result, or if a downstream packet **110** has not been received by the terminal **54** in a predetermined period of time, the terminal **54** can attempt a re-connect. Preferably, in a re-connect attempt, the terminal makes a session request **120** on a new downstream and upstream channel **20**, **22**.

As was discussed above, each downstream packet **110** and upstream packet **116** is quickly acknowledged (ACKed) by the packet recipient, as seen in FIGS. **7** and **10**C. As should be understood, such quick ACKs are necessary to address the problem of noise (as was discussed above) and to provide real-time access to the information source **60**. Preferably, a packet sender waits for up to two upstream slots **108** or picture fields **28** to receive an ACK from a packet recipient. If an ACK is not received in this time by a terminal **54**, the terminal **54** preferably re-sends the upstream packet **116** for which acknowledgment is sought. If a terminal **54** is forced to re-send data a predetermined number of times, a re-connect attempt is preferably made on new downstream and upstream channels **20**, **22**.

It is preferable that the following method be employed to send commands and receive information in the access system **10** as described above. In the method, and referring now to FIG. **11**, first data is input for the headend server **38** into

one of the terminals **54** (step **S1101**), and is transmitted from the terminal **54** on an upstream channel **22** of the distribution network **12** (step **S1102**). The transmitted first data is then received on the upstream channel **22** of the distribution network **12** at communications controller **66** of the headend server **38** (step **S1103**), And a first acknowledgment (ACK) of the received first data is transmitted from the headend server **38** on a downstream channel **20** of the distribution network **12** (**S1104**). The transmitted first ACK is then received on the downstream channel **20** of the distribution network **12** at the terminal **54** (step **S1105**) to indicate that the inputted first data was successfully received. Preferably, the first ACK is received by the terminal **54** within about two picture fields **28** or upstream slots **108** (2T).

In the method shown in FIG. **11**, second data is also transmitted from the communications controller **66** of the headend server **38** on a downstream channel **20** of the distribution network **12** (step **S1106**) and is received by the terminal **54** (**S1107**). In response, the terminal **54** transmits a second ACK of the received second data on an upstream channel **22** of the distribution network **12** (step **S1108**), and the transmitted second ACK is received by the headend server **38** (step **S1109**) to indicate that the second data was successfully received by the terminal **54**.

As should be understood, and as was previously described, each transmitting step on a downstream channel **20** in the real-time acknowledgment method described above includes the step of inserting sequential portions of information (i.e. the second data or the first ACK) into the blank intervals **32** of sequential picture fields **28** of at least one of the television transmissions **24** and each of the receiving steps on a downstream channel **20** includes the step of extracting the inserted sequential portions of the information from the blank intervals **32** of the sequential picture fields **28** of the television transmissions **24**.

In the embodiment of the access system **10** as described above, a user at a terminal **54** may view a television transmission **24** carried on a selected downstream channel **20** and automatically retrieve information from the information source **60** relating to the contents of the television transmission **24**. More specifically, it is preferable that the user agent **74** of the access system **10** have access to a commercial database **132** (as seen in FIG. **5**), where the commercial database **132** includes resource location information relating to at least some portions of the television transmission **24**. For example, the commercial database **132** may include a schedule of television commercials on the various downstream channels **20**, and for each commercial may include a universal resource locator (URL) associated with the product and/or service advertised in the commercial. As should be understood, each URL refers to a home page or web site on the Internet that is maintained in connection with the product or service.

If a user viewing the commercial wishes to obtain more information on the product or service advertised therein, the user need only input a command to the headend server **38**. For example, the command may merely be the push of a button on the input device **58**, without,anything more. In response, the headend server **38** automatically acquires the URL corresponding to the commercial and retrieves the web page to which the URL refers from the information source **60**. The web page may then be displayed to the user, and the user may input further access system commands or else return to viewing a television transmission **24** carried on a selected downstream channel **20**. Alternatively, the URL may be transmitted to the user and stored in the memory **100** of the terminal **54**. If it is envisioned that there is sufficient demand for a web page by multiple users at multiple terminals, the headend server **38** may be pre-programmed to obtain such web page in advance and cache the web page in the cache engine **78**.

As was previously discussed, it is preferable that the information source **60** of the preferred embodiment of the present invention be an Internet service provider having access to the well-known Internet intercommunications network, but nevertheless one skilled in the art will recognize that other information sources may be accessed without departing from the spirit and scope of the present invention. As should be understood, depending upon the information source **60** accessed by the access system **10** of the present invention, not all of the afore-described elements are necessary. As but one example, if the information source is the application server **68** itself, the router **40** and the CSU/DSU **42** are not likely necessary.

From the foregoing description, it can be seen that the present invention comprises a new and useful access system for accessing information from a remote information source. The access system is particularly useful since it takes advantage of an already-existing television distribution system, since a user of the access system need not invest substantial resources in personal computers, modems, and the like, since a user need not be technically sophisticated, and since a user need not tie up a telephone line to obtain such information. Moreover, the equivalent baud rate of such an access system is significantly higher than that available from a conventional 28.8K baud rate telephone modem. It will be appreciated by those skilled in the art that changes could be made to the embodiment described above without departing from the broad inventive concepts thereof. For example, it may be appreciated that a personal computer (not shown) could be interfaced to the terminal **54** to provide enhanced access while still being within the spirit and scope of the present invention. It is understood, therefore, that this invention is not limited to the particular embodiment disclosed but is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

We claim:

1. An access system for providing interactive access to information available from an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission, the television transmission including a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being adapted to initiate terminal sessions, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television

distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the access system comprising:

an input device associated with one of the terminals for inputting into the terminal a first command for the information source;

an upstream transmitter associated with the terminal and interfaced to the respective terminal end of the television distribution network for transmitting the inputted first command on an available upstream channel of the distribution network, wherein the available stream channel is selected from the plurality of upstream channels and is selected for each initiated terminal session;

a headend server associated with the headend distribution equipment, the headend server being interfaced to the information source;

an upstream receiver associated with the headend distribution equipment and interfaced to the headend server for receiving the inputted first command on the upstream channel of the distribution network and for forwarding the received first command to the headend server, the headend server transmitting a second command based on the forwarded first command to the information source, the information source transmitting the information to the headend server in response to the second command;

a blank interval inserter associated with the headend distribution equipment, the blank interval inserter being interfaced to the headend server for receiving the information from the headend server and for inserting the received information into the blank intervals of picture fields of at least one of the television transmissions; and

a blank interval extractor interfaced to the terminal for extracting the inserted information from the blank intervals of the picture fields of the television transmissions, the extracted information being displayed on the display device.

2. The access system of claim **1** wherein the input device is also for inputting into the terminal a selection of one of the plurality of downstream channels for display on the display device.

3. The access system of claim **1** wherein the input device is a computer-style keyboard.

4. The access system of claim **3** wherein the terminal includes an infrared receiver interfaced thereto and wherein the keyboard includes an infrared transmitter for transmitting keystroke signals to the infrared receiver of the terminal.

5. The access system of claim **1** wherein the terminal includes an infrared receiver interfaced thereto and wherein the input device is a remote control device having an infrared transmitter for transmitting remote control signals to the infrared receiver of the terminal.

6. The access system of claim **1** wherein the transmitted information from the information source is in a first graphics form, and wherein the headend server includes a graphics processor for converting the transmitted information from the first graphics form to a second graphics form compatible with the display device.

7. The access system of claim **1** wherein each upstream channel of the television distribution network is multiplexed into a plurality of upstream slots, and wherein the terminal is assigned to at least one of the upstream slots at any one time.

8. The access system of claim **1** wherein each upstream channel of the television distribution network is multiplexed into a plurality of upstream slots, wherein at least one of the upstream slots is a session request slot for allowing any of a plurality of the terminals to request a session.

9. The access system of claim **8** wherein the session request is received by the headend server, the headend server assigning the requesting terminal to at least one of the upstream slots.

10. The access system of claim **9** wherein the headend server includes a noise detector for detecting a noise level on each of the upstream channels, the headend server re-assigning the terminal from a first upstream channel to a second upstream channel if necessary based on the noise level of the first upstream channel and the second upstream channel.

11. The access system of claim **9** wherein the headend server includes a noise detector for detecting a noise level on each of the upstream channels, the headend server directing the terminal to transmit at a higher level on the upstream channel if necessary based on the noise level of the upstream channel.

12. The access system of claim **1** comprising:

a plurality of input devices, each input device associated with one of a plurality of the terminals;

a plurality of upstream transmitters, each upstream transmitters associated with one of the plurality of the terminals; and

a plurality of blank interval extractors, each blank interval extractor interfaced to one each of the plurality of the terminals;

the headend server being a centralized processor for each of the plurality of the terminals;

wherein the upstream receiver receives a plurality of inputted first commands from the plurality of terminals on the available upstream channel of the distribution network and forwards the respective received first commands to the headend server, the headend server transmits second commands based on the respective forwarded first commands to the information source, the information source transmits the information to the headend server in response to the respective second commands, each second command causing respective information to be transmitted from the information source, the blank interval inserter receives the respective information from the headend server and inserts the received respective information into the blank intervals of the picture fields of at least one of the television transmissions, and each of the blank interval extractors in the respective terminals extracts the respective inserted information from the blank intervals of the picture fields of the television transmissions.

13. An access system for providing interactive access to information available from an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission, the television transmission including a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for display a selected one of the television transmissions;

the access system comprising:

an input device associated with one of the terminals for inputting into the terminal a first command for the information source;

an upstream transmitter associated with the terminal and interfaced to the respective terminal end of the television distribution network for transmitting the inputted first command on an upstream channel of the distribution network;

a headend server associated with the headend distribution equipment, the headend server being interfaced to the information source;

an upstream receiver associated with the headend distribution equipment and interfaced to the headend server for receiving the inputted first command on the upstream channel of the distribution network and for forwarding the received first command to the headend server, the headend server transmitting a second command based on the forwarded first command to the information to the source, the information source transmitting the information to the headend server in response to the second command;

a blank interval inserter associated with the headend distribution equipment, the blank interval inserter being interfaced to the headend server for receiving the information from the headend server and for inserting the received information into the blank intervals of picture field of at least one of the television transmissions; and

a blank interval extractor interfaced to the terminal for extracting the inserted information from the blank intervals of the picture fields of the television transmissions, the extracted information being displayed on the display device, wherein the headend server includes a screen renderer for rendering screens for display at the display device interfaced to the terminal, the information inserted into the blank intervals of the picture fields being the rendered screen displays, and wherein the extracted information displayed on the display device includes the rendered screens.

14. A method for providing interactive access to information available from an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission, the television transmission including a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being adapted to initiate terminal sessions, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a first command for the information source into one of the terminals;

transmitting the inputted first command from the terminal that received the inputted first command on an available upstream channel of the distribution network, wherein the available upstream channel is selected from the plurality of upstream channels and is selected for each initiated terminal session;

receiving the inputted first command on the upstream channel of the distribution network at the headend of the television distribution network;

forwarding the received first command to a headend server at the headend;

transmitting a second command based on the forwarded first command from the headend server to the information source;

transmitting information from the information source to the headend server in response to the second command;

inserting the information from the headend server into the blank intervals of picture fields of at least one of the television transmissions, the inserting step being performed at the headend, the inserted information being based on the transmitted information;

extracting the inserted information from the blank intervals of the picture fields of the television transmissions, the extracting step being performed at the terminal; and

displaying the extracted information on the display device.

15. The method of claim **14** wherein the inputting step comprises transmitting keystroke signals from an infrared transmitter interfaced with a computer-style keyboard to an infrared receiver interfaced with the terminal.

16. The method of claim **14** wherein the inputting step comprises transmitting remote control signals from an infrared transmitter interfaced with a remote control device to an infrared receiver interfaced with the terminal.

17. The method of claim **14** wherein the transmitted information from the information source is in a first graphics form, the method further including the step of converting the transmitted information from the first graphics form to a second graphics form compatible with the display device.

18. The method of claim **14** further comprising the steps of:

multiplexing each upstream channel of the television distribution network into a plurality of upstream slots; and

assigning the terminal to at least one of the upstream slots at any one time.

19. The method of claim **14** further comprising the steps of:

multiplexing each upstream channel of the television distribution network into a plurality of upstream slots, at least one of the upstream slots is a session request slot; and

transmitting a session request on the session request slot by any of a plurality of the terminals.

20. The method of claim **19** further comprising the steps of:

receiving the session request by the headend server; and

assigning, by the headend server, the requesting terminal to at least one of the upstream slots.

21. The method of claim **20** further comprising the steps of:

detecting a noise level on each of the upstream channels; and

re-assigning the terminal from a first upstream channel to a second upstream channel if necessary based on the noise level of the first upstream channel and the second upstream channel.

22. The method of claim **20** further comprising the steps of:

detecting a noise level on each of the upstream channels; and

directing the terminal to transmit at a higher level on the upstream channel if necessary based on the noise level of the upstream channel.

23. The method of claim **14** further comprising the steps of:

inputting a plurality of first commands for the information source into a respective plurality of the terminals;

transmitting each of the plurality of first commands from the respective terminal that received the inputted first command on an available upstream channel of the distribution network;

receiving the plurality of first commands on the available upstream channel of the distribution network and forwarding the respective received first commands to the headend server;

centrally processing each of the plurality of first commands at the headend server;

transmitting second commands based on the respective forwarded first commands from the headend server to the information source;

transmitting information from the information source to the headend server in response to the respective second commands, each second command causing respective information to be transmitted from the information source;

inserting the respective information from the headend server into the blank intervals of picture fields of at least one of the television transmissions, the inserting step being performed at the headend;

extracting the respective inserted portions of the information from the blank intervals of the picture fields of the television transmissions, the extracting step being performed at the respective terminals.

24. The method of claim **23** further comprising the steps of:

sending a command from a first terminal to the headend server, the command being a message; and

routing the message from the headend server to a second terminal.

25. A method for providing interactive access to information available from an information source through a television distribution system which includes:

television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying television transmission, the television transmission including a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a first command for the information source into one of the terminals;

transmitting the inputted first command from the terminal that received the inputted first command on an upstream channel of the distribution network;

receiving the inputted first command on the upstream channel of the distribution network at the headend of the television distribution network;

forwarding the received first command to a headend server at the headend;

transmitting a second command based on the forwarded first command from the headend server to the information source;

transmitting information from the information source to the headend server in response to the second command;

inserting the information from the headend server into the blank intervals of picture fields of at least one of the television transmissions, the inserting step being performed at the headend, the inserted information being based on the transmitted information;

extracting the inserted information from the blank intervals of the picture fields of the television transmissions, the extracting step being performed at the terminal;

displaying the extracted information on the display device; and

rendering screens at the headend server for display at the display device interfaced to the terminal, the information inserted into the blank intervals of the picture fields being the rendered screen displays.

26. The method of claim **14** wherein a user at a terminal views a television transmission carried on a selected downstream channel, the method further comprising the steps of:

determining that the user wishes to obtain information in connection with a portion of the television transmission by the reception of an inputted command from the terminal;

accessing a database which includes resource location information relating to the portion of the television transmission and retrieving such resource location information;

retrieving resource information from the information source based on the resource location information;

displaying the resource information to the user.

27. The method of claim **26** further comprising the step of pre-caching the resource information prior to the determining step.

28. A method for providing real-time interactive access in a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting first data into one of the terminals;

repeatedly transmitting the inputted first data from the terminal that received the inputted first data on an upstream channel of the distribution network until an acknowledge is received by the terminal on the downstream channel of the distribution network that the inputted first data has been received;

receiving the transmitted first data on the upstream channel of the distribution network at the headend distribution equipment;

transmitting a first acknowledgement of the received first data from the headend distribution equipment on a downstream channel of the distribution network;

receiving the transmitted first acknowledgement on the downstream channel of the distribution network at the terminal;

transmitting second data from the headend distribution equipment on a downstream channel of the distribution network;

receiving the transmitted second data on the downstream channel of the distribution network at the terminal;

transmitting a second acknowledgement of the received second data from the terminal on an upstream channel of the distribution network; and

receiving the transmitted second acknowledgement on the upstream channel of the distribution network at the headend distribution equipment.

29. The method of claim **28** wherein the television transmission on each downstream channel of the television distribution network includes a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

wherein each of the transmitting steps on a downstream channel includes the step of inserting sequential portions of information into the blank intervals of sequential picture fields of at least one of the television transmissions; and

wherein each of the receiving steps on a downstream channel includes the step of extracting the inserted sequential portions of the information from the blank intervals of the sequential picture fields of the television transmissions.

30. An access system for providing interactive access to information available from an information source through a television distribution system which includes;

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the access system comprising:

an input device associated with one of the terminals for inputting into the terminal a first command for the information source;

an upstream transmitter associated with the terminal and interfaced to the respective terminal end of the television distribution network for transmitting the inputted first command as well as information identifying the terminal that received the inputted first command on an upstream channel of the distribution network;

a headend server associated with the headend distribution equipment, the headend server being interfaced to the information source;

an upstream receiver associated with the headend distribution equipment and interfaced to the headend server for receiving the inputted first command and the terminal identifying information on the upstream channel of the distribution network and for forwarding the received first command and the terminal identifying information to the headend server, the headend server transmitting a second command based on the forwarded first command to the information source, the information source transmitting the information to the headend server in response to the second command;

a downstream transmitter interfaced to the headend server for receiving information based on the transmitted information from the headend server and for transmitting the received information on any available downstream channel to the terminal that receive the inputted first command upon the terminal identifying information; and

a downstream receiver interfaced to the terminal for receiving the transmitted information on the downstream channel as terminal information, the terminal information being displayed on the display device;

the headend server including a screen renderer for rendering screens for display at the display device interfaced to the terminal, the terminal information including the rendered screens.

31. An access system for providing interactive access to information available from an information source through television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the access system comprising:

an input device associated with one of the terminals for inputting into the terminal a first command for the information source;

an upstream transmitter associated with the terminal and interfaced to the respective terminal end of the television distribution network for transmitting the inputted first command on an upstream channel of the distribution network;

a headend server associated with the headend distribution equipment, the headend server being interfaced to the information source;

an upstream receiver associated with the headend distribution equipment and interfaced to the headend server for receiving the inputted first command on the upstream channel of the distribution network and for forwarding the received first command to the headend server, the headend server transmitting a second command based on the forwarded first command to the information source, the information source transmitting the information to the headend server in response to the second command;

a downstream transmitter interfaced to the headend server for receiving information based on the transmitted information from the headend server and for transmitting the received information on a downstream channel; and

a downstream receiver interfaced to the terminal for receiving the transmitted information on the downstream channel as terminal information, the terminal information being displayed on the display device;

the headend server including a screen renderer for rendering screens for display at the display device interfaced to the terminal, the terminal information including the rendered screens,

wherein the screen renderer generates refresh information corresponding to changes to be made to a screen, wherein the downstream transmitter receives the refresh information and transmits the refresh information on a downstream channel, wherein the downstream receiver receives the transmitted refresh information on the downstream channel, and wherein the refresh information is employed by the terminal to perform changes to the screen.

32. A method for providing interactive access to information available from an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a first command for the information source into one of the terminals;

transmitting the inputted first command from the terminal that received the inputted first command and information identifying the terminal that received the inputted first command on an upstream channel of the distribution network;

receiving the inputted first command and the terminal identifying information on the upstream channel of the distribution network at the headend of the television distribution network;

forwarding the received first command and the terminal identifying information to a headend server at the headend;

transmitting a second command based on the forwarded first command from the headend server to the information source;

transmitting information from the information source to the headend server in response to the second command;

rendering a screen at the headend server based on the transmitted information from the information source, the rendered screen for display at the display device interfaced to the terminal;

transmitting information including the rendered screen from the headend server on any available downstream channel to the terminal that received the inputted first command based upon the terminal identifying information;

receiving the transmitted information on the downstream channel at the terminal; and

displaying the rendered screen on the display device.

33. A method for providing interactive access to information available from an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a first command for the information source into one of the terminals;

transmitting the inputted first command from the terminal that received the inputted first command on an upstream channel of the distribution network;

receiving the inputted first command on the upstream channel of the distribution network at the headend of the television distribution network;

forwarding the received first command to a headend server at the headend;

transmitting a second command based on the forwarded first command from the headend server to the information source;

transmitting information from the information source to the headend server in response to the second command;

rendering a screen at the headend server based on the transmitted information from the information source, the rendered screen for display at the display device interfaced to the terminal;

transmitting information including the rendered screen from the headend server on a downstream channel;

receiving the transmitted information on the downstream channel at the terminal;

displaying the rendered screen on the display device;

rendering refresh information corresponding to changes to be made to a screen;

transmitting the refresh information on a downstream channel;

receiving the transmitted refresh information on the downstream channel; and

performing changes to the screen based on the refresh information.

34. A method for providing interactive access to an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a command into one of the terminals to signify that a user at the terminal wishes to obtain information in connection with a portion of a displayed television transmission;

transmitting the inputted command from the inputted-into terminal on an upstream channel of the distribution network;

receiving the inputted command on the upstream channel of the distribution network at the headend of the television distribution network;

accessing a database which includes resource location information relating to the portion of the television transmission and retrieving such resource location information;

retrieving resource information from the information source based on the resource location information;

transmitting the retrieved resource information on a downstream channel;

receiving the transmitted resource information on the downstream channel at the terminal; and

displaying the resource information on the display device.

35. A method for providing interactive access to an information source through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a command into one of the terminals to signify that a user at the terminal wishes to obtain information in connection with a portion of a displayed television transmission;

transmitting the inputted command from the inputted-into terminal on an upstream channel of the distribution network;

receiving the inputted command on the upstream channel of the distribution network at the headend of the television distribution network;

accessing a database which includes resource location information relating to the portion of the television transmission and retrieving such resource location information;

transmitting the retrieved resource location information on a downstream channel; and

receiving the transmitted resource location information on the downstream channel at the terminal.

36. The access system of claim **1** wherein the transmitted information from the information source is in multi-media form including one or more video, audio, graphics, still images, and text, and wherein the headend server includes a multi-media processor for converting the transmitted information from a first multi-media form to a second multi-media form compatible with the display device.

37. The access system of claim **1** wherein the blank interval inserter inserts the received information into the blank intervals of sequential picture fields of at least one of the television transmissions, and

the blank interval extractor extracts the information from the sequential picture fields.

38. The method of claim **14** wherein the inserting step includes inserting the information into the blank intervals of sequential picture fields of at least one of the television transmissions, and

the extracting step includes extracting the information from the sequential picture fields.

39. An access system for providing interactive access to information available from an Internet Service Provider (ISP) through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission, the television transmission including a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the access system comprising:

an input device associated with one of the terminals for inputting a terminal command into the terminal;

an upstream transmitter associated with the terminal and interfaced to the respective terminal end of the television distribution network for transmitting the inputted terminal command on an upstream channel of the distribution network;

a headend server associated with the headend distribution equipment;

an Internet router for allowing communication between the headend server and an ISP, the Internet router transmitting Internet commands from the headend server to the ISP, and transmitting information from the ISP to the headend server;

an upstream receiver associated with the headend distribution equipment and interfaced to the headend server for receiving the terminal command on the upstream channel of the distribution network and for forwarding the terminal command to the headend server, the headend server transmitting an Internet command to the ISP via the Internet router in response to the terminal command, the ISP transmitting the information to the headend server via the Internet router in response to the Internet command;

a blank interval inserter associated with the headend distribution equipment, the blank interval inserter being interfaced to the headend server for receiving the information from the headend server and for inserting the received information into the blank intervals of the picture fields of at least one of the television transmissions; and

a blank interval extractor interfaced to the terminal for extracting the inserted information front the blank intervals of the picture fields of the television transmissions, the extracted information being displayed on the display device.

40. The access system of claim **39** wherein the terminal command is interpreted by the headend server as a request for a specific web page.

41. The access system of claim **39** wherein the terminal command is converted by the headend server into an Internet command.

42. The access system of claim **39** wherein the headend server includes a screen renderer for rendering screens for display at the display device interfaced to the terminal, the information inserted into the blank intervals of the picture fields being the rendered screen displays, and wherein the extracted information displayed on the display device includes the rendered screens.

43. A method for providing interactive access to information available from an Internet Service Provider (ISP) through a television distribution system which includes:

a television distribution network having a network headend, a plurality of terminal ends, a plurality of upstream channels, and a plurality of downstream channels, each downstream channel for carrying a television transmission, the television transmission including a plurality of sequentially transmitted picture fields, each transmitted picture field including a picture interval corresponding to a transmission of pixelated picture data and a blank interval corresponding to a transmission of no pixelated picture data, each upstream channel for carrying data transmissions to the network headend;

headend distribution equipment interfaced to the network headend of the television distribution network for distributing the television transmissions over the respective downstream channels of the television distribution network; and

a plurality of terminals, each terminal being interfaced to a terminal end of the television distribution network for receiving the television transmissions over the respective downstream channels of the television distribution network, each terminal also being interfaced to a display device for displaying a selected one of the television transmissions;

the method comprising the steps of:

inputting a terminal command for the ISP into one of the terminals;

transmitting the inputted terminal command from the terminal on an upstream channel of the distribution network;

receiving the terminal command on the upstream channel of the distribution network at the headend of the television distribution network;

forwarding the received terminal command to a headend server at the headend;

transmitting an Internet command based on the forwarded terminal command from the headend server to the ISP via an Internet router interfaced to the headend server;

transmitting information from the ISP to the headend server in response to the Internet command via the Internet router;

inserting the information from the headend server into the blank intervals of picture fields of at least one of the television transmissions, the inserting step being performed at the headend, the inserted information being based on the transmitted information;

extracting the inserted portions of the information from the blank intervals of the picture fields of the television transmissions, the extracting step being performed at the terminal; and

displaying the extracted information on the display device.

44. The method of claim **43** further comprising the step of:

the headend interpreting the terminal command as a request for a specific web page.

45. The method of claim 43 further comprising the step of:

the headend converting the terminal command into an Internet command.

46. The method of claim 44 further comprising the step of rendering screens at the headend server for display at the display device interfaced to the terminal, the information inserted into the blank intervals of the picture fields being the rendered screen displays.

47. The access system of claim 1 wherein the headend server which is interfaced with the information source receives information therefrom which is different in content than the content of the television transmissions.

48. The method of claim 14 wherein in the information transmitting step, the information from the information source is different in content than the content of the television transmissions.

49. The access system of claim 30 wherein the headend server which is interfaced with the information source receives information therefrom which is different in content than the content of the television transmissions.

50. The method of claim 32 wherein in the information transmitting step, the information from the information source is different in content than the content of the television transmissions.

51. The access system of claim 39 wherein the information transmitted from the ISP is different in content than the content of the television transmissions.

52. The method of claim 43 wherein the information from the ISP is different in content than the content of the television transmissions.

53. The access system of claim 30 wherein the information transmitted by the downstream transmitter comprises the rendered screens.

54. The access system of claim 1 wherein the upstream transmitter also transmits information identifying the terminal that received the inputted first command and wherein the upstream receiver receives such terminal identifying information and forwards the same to the headend server to facilitate the transmission of the information from the information source to the terminal that received the inputted first command.

55. The method of claim 14 wherein the step of transmitting the inputted first command on an upstream channel further comprises transmitting information identifying the terminal that received the inputted first command on the upstream channel; and

the step of receiving the inputted first command on the upstream channel further comprises receiving information identifying the terminal that received the inputted first command on the upstream channel at the headend of the television distribution network, wherein the information identifying the terminal is used to facilitate the transmission of the information from the information source to the terminal that received the inputted first command.

56. The method of claim 34 wherein:

the step of transmitting the inputted first command on an upstream channel further comprises transmitting information identifying the terminal that received the inputted first command on the upstream channel;

the step of receiving the inputted first command on the upstream channel further comprises receiving information identifying the terminal that received the inputted first command on the upstream channel at the headend of the television distribution network; and

the step of transmitting the retrieved resource information on a downstream channel further comprises transmitting information identifying the terminal that received the inputted first command on the downstream channel.

57. The access system of claim 1 wherein the blank interval inserter inserts the received information into the blank intervals of picture fields of any available television transmission, the received information thereby being transmitted to the terminal on any available downstream channel.

58. The method of claim 14 wherein the inserting step includes inserting the information into the blank intervals of picture fields of any available television transmission, the information thereby being transmitted to the terminal on any available downstream channel.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,999,970
DATED : December 7, 1999
INVENTOR(S) : Harold M. Krisbergh et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [75] Inventors: Add -- David A. Dill --

Signed and Sealed this

Sixteenth Day of October, 2001

Attest:

Nicholas P. Godici

Attesting Officer

NICHOLAS P. GODICI
Acting Director of the United States Patent and Trademark Office