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ADDRESSABLE CABLE TELEVISION CONTROL SYSTEM WITH  
VERTICAL INTERVAL DATA TRANSMISSION

BACKGROUND OF THE INVENTION

This invention relates to an addressable cable television control system. More particularly, the present invention relates to a cable television system having a multiple-function addressable converter and including data transmission during the vertical interval of the video data.

In recent years, the availability of cable television programs and services for the general public has expanded rapidly. Communication satellites have enabled nationwide programming for a number of "super stations". Sophisticated two-way interactive cable communication systems have laid the groundwork for a wide spectrum of cable television and data communication services for the consuming public. After years of development, cable television systems have been or are now being installed in many major cities to provide the television consumer with a vast array of programming choices as well as many other services which can be utilized at home, such as shopping, banking and schooling. Other services provided by such systems *include* home security monitoring, medical and emergency alert signaling and information retrieval.

In order to provide these new services and programs in a systematic and efficient manner, generalized control systems are required which can supervise access to both one-way and two-way sophisticated cable communication systems having different degrees of complexity. Control is required to differentiate and limit access on several bases, including different levels or tiers of subscribers to different television channels, and different programs and events on a given channel. In addition, for many subscribers it is desirable to be

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1 101 65.00CK  
1 102 158.00CK

able to limit access to certain programs because of the program subject matter. Presently, there are no cable systems having this degree of sophistication in controlling program access. Even simpler conventional cable systems which provide for limiting program access must be two-way interactive systems requiring more complex and expensive equipment than one-way systems.

Besides this problem of coordinating cable communications, the need for efficiency in the transmission of data has become increasingly apparent. Although approximately 55 video and sound channels are presently available between the allocated television frequencies of 50 and 400 megahertz, the varied types of possible cable television programming and data transmission services require the efficient utilization of these frequencies. For example, cable television programming includes movies, special events, news, consumer programming, community access and religious programming. An almost limitless range of data can be provided, including reports on stock and money markets, weather reports, airline schedules, shopping directories, entertainment schedules, traffic reports, home security data emergency and first aid information and unlimited library textual information. The possibility for cable system operators to lease available cable channels to private concerns for these and other services makes it imperative that cable transmission control be efficient and flexible. In order to effectively utilize the available portion of the electromagnetic spectrum for such a wide variety of programming and data transmission, the cable system should be able to process the data quickly and efficiently while using relatively simple and inexpensive equipment which is affordable to the general consuming public.

In the last few years, various experiments have been conducted regarding the transmission of data over the vertical blanking interval of a normal television signal. This interval in the video signal occurs 60 times each second as the cathode ray tube beam sweeps from the bottom to the top of the TV screen and is relatively unused for the transmission of data. Some early systems such as that shown in U.S. Patent 3,769,579 issued on October 30, 1973, utilized the vertical interval for transmitting control signals to individual transponders at the subscriber locations. More recently, there has been experimentation with television broadcasting systems which transmit visual

data on the vertical blanking interval, referred to as teletext transmission, for display as pages of text on suitably equipped television receivers. These experimental systems have generally been limited to over-the-air broadcasting of teletext transmissions for a single channel, and the necessary apparatus for cable television systems has been regarded as too complicated and expensive to be practical when compared to the high-speed transmission of compact data over a dedicated channel.

#### SUMMARY OF THE INVENTION

The present invention provides a relatively inexpensive and simple one-way cable television system having the capability of controlling access to a wide range of television program and data signals while efficiently transmitting data signals in the vertical interval (VI) of each television program channel. This VI data not only provides control data for an intelligent converter unit, but also provides a substantial amount of textual data per channel for use either to provide additional data to supplement a channel television program or as a separate all textual and graphic channel.

The present invention includes an intelligent addressable converter designed to convert and descramble video for up to 55 CATV channels. For dual cable systems, an optional cable switch on the converter doubles the available number to 110 channels. The converter of the present invention receives control data which allows the system operator to control subscription television services on a per channel, per service tier, and per event basis. In addition, the system and converter of the present invention enables each subscriber to define his own level of required eligibility based on program subject matter.

The system of the present invention also enables a complementary text channel to be transmitted on the vertical interval of each of the incoming video signals and to be decoded and displayed as an alternate channel to the video programming. The data for the complementary text channel is preferably displayed in a combination of text and graphics. This capability effectively adds 55 additional text channels for a wide spectrum of data-type information for the consumer. Thus, the present system provides 110 independent channels of television program and text viewing in a one cable system and 220 channels in two cable systems. Moreover the control system of the present invention, when used in conjunction with appropriate two-way



interactive apparatus, provides a complete two-way interactive communication system including pay-per-view, home security, opinion polling, channel monitoring, information retrieval, and with additional equipment, energy management.

5 For a better understanding of the present invention, together with other and further objects and features thereof, reference is made to the following description taken in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

10 FIGURE 1 is a simplified block diagram of a preferred embodiment of the addressable cable television control system of the present invention;

FIGURE 2 is a block diagram of a preferred embodiment of the head end portion of the system shown in Figure 1;

15 FIGURE 3 is a block diagram of the programming control system shown in Figure 2;

FIGURE 4 is a block diagram of the head end video processor shown in Figure 2;

20 FIGURE 5 is a more detailed block diagram of the head end video processor of Figure 4;

FIGURE 6 is a block diagram of a preferred embodiment of the addressable converter of the present invention shown in Figure 1;

FIGURE 7 is a block diagram of the converter control logic shown in Figure 6;

25 FIGURE 8 is a block diagram of the VI data extractor unit shown in Figure 5;

FIGURES 9 and 10 are schematic diagrams showing two preferred methods of connecting the converter of Figure 6 in a CATV system;

30 FIGURE 11 is a schematic diagram showing the data format for the system of the present invention;

FIGURE 12 is a flow diagram showing the operation of the converter shown in Figure 6; and

35 FIGURE 13 is a top plan view of the keyboard of the converter of Figure 6.

#### DETAILED DESCRIPTION

FIGURE 1 shows a simplified block diagram of a one-way cable television system 10 in accordance with the present invention. A head end station 11 includes a central data system 12 utilizing a control computer which gathers data from a wide variety of sources and formats the data for transmission on video frequency channels. The central data control system preferably has a two-way interface link 13 with a remote computer which may be used for central control and billing functions. The formatted data is then transmitted by communications link 14 to a television program processor 16 where it is incorporated into the vertical blanking intervals of video signals generated by a variety of television program sources. In addition, the data may be formatted for transmission in a separate channel dedicated only for the transmission of data. The dedicated data channel transmissions are connected over link 18 to a head end signal combiner 20 where they are combined with a plurality of video signals transmitted from television program systems 16 along transmission link 22. The head end unit then transmits the combined cable television and data signal to remote subscribers. Normally, the signals are then transmitted through a cable network, referred to as a cable plant to a plurality of subscribers.

FIGURE 1 shows a single cable plant 30 servicing a plurality of cable television subscribers by way of a one-way data link 32. The transmitted signals are received by an addressable converter 40 on a one-way data bus 32. Converter 40 then processes the data on line 38 as determined by subscriber input 34 for desired viewing on one or more television sets 36.

Referring now to FIGURE 2, the data control system 12 and television program processor 16 are shown in greater detail. A programming control system (PCS) 50 generates a continuous stream of data that contains a mixture of subscriber addressing signals and channel control signals. This data is transmitted to a plurality of head end video processors (HVP) 52 and 53 for combining with video signals in a plurality of different channel frequencies. PCS 50 is also preferably connected by a two-way data link to a remote computer for use in various control functions.

A text formatter system 54 receives data from a wide variety of sources such as weather, news, stock and others which are formatted for video transmission and then selectively transmitted in text form to the plurality of HVP units 52, 53. The text formatter system 54 preferably is comprised of a plurality of text formatters, each processing data from a text or graphics source. A variety of manufacturers produce equipment for cable television digital channels which are easily adaptable to the present system. One source of suitable conventional formatters is Video Data Systems, Happaque, L.I., N.Y.

Video signals are generated for input to each HVP unit by conventional sources, either from local video input sources as shown for HVP unit 52 or satellite video input sources for HVP unit 53. In either case, the signals are processed by a conventional channel processor 56 having modulator and demodulator units and a standard head end processor. Each television channel is preferably processed at base band video for purposes to be explained later.

The subscriber addressing and channel control data from PCS 50 is input to HVP 52 on line 41 where it is inserted in the vertical interval of the video signal. The channel control data from PCS 50 is processed at HVP 52 to generate scrambler signals, program identification signals, tier signals and eligibility code signals as will be discussed later. These signals are utilized by each subscriber's addressable converter 40 to determine the particular subscriber's authorization to receive each program and to control descrambling of the video signals.

One of the text signals from text formatter 54 is also input to HVP 52 on line 39 to be inserted into the vertical interval of the video signal. Preferably, a different type of textual data are inserted into the vertical interval of each video channel so that a complementary text channel may be selected by each remote subscriber.

HVP unit 52 then routes the base band-video output with vertical interval data on line 44 to a standard head end modulator and processor in processing unit 56. From there, the signal is sent to master head end unit 20 where it is combined with signals from other channel processors to provide the total multiple channel CATV signal for output on line 21 to the cable plant. An FSK data modulator 58 is connected directly between PCS 50 and head end signal combiner 20 by line 18 for transmission of data on dedicated data channels.



Looking now at FIGURE 3, the programming control system 50 is shown in greater detail. The heart of PCS 50 is a sophisticated control computer, having both a random access memory and a read-only memory. Computer 60 is preferably a conventional general purpose minicomputer utilizing a central data system. Computer 60 may be controlled by a conventional system operator console 62, a real time clock 64 and external data links 66 including a two-way interface with another remote computer for central control. Control computer 60 is also connected to magnetic storage devices such as a cartridge tape data storage unit 68 and a floppy disk subsystem 70 communicating with control computer 60 over two-way data links 72 and 74 respectively. Other outputs to conventional units such as remote terminal 76 and printer 78 are optional.

One preferred embodiment of control computer 60 comprises a rack-mounted Hewlett-Packard 1000 minicomputer system having standard operating system software. The computer may also include application programs allowing it to interface with two-way data acquisition and control systems. This interface is preferably carried out by communications with the home terminal shown in FIGURE 10.

The head end video processor unit 52 of FIGURE 2 is shown in more detail in FIGURE 4. A digital control and timing unit 80 receives the text data from text formatter 54 on line 39 and the subscriber addressing and channel control data from PCS 50 on line 41 and processes it for insertion in the vertical interval of the video channels. The data on line 41 loops through unit 80 and back out on line 42 to the next digital control and timing unit. The base band video signal is input on line 43 to a video vertical interval processing unit 82 where it is processed for insertion of the subscriber addressing and channel control data from unit 80 via two-way data link 84. Preferably the data is inserted on two lines of each vertical interval and then directed to a conventional video scrambler 86. The resulting video signal which has been loaded with data and scrambled is then connected to the standard head-end processor 56 shown in FIGURE 2.

In order to understand how a data signal is transmitted on the vertical interval of a television program signal, the vertical interval of a conventional television signal will be described. Each television signal is made up of a series of "lines" each of which represent the length of time required for the cathode ray tube of the television set to make one horizontal sweep across the screen. The number of horizontal lines required to cover the screen is called a field, and there are two interlocking fields, both having 262.5 lines which together form a frame. In conventional systems, 30 frames are transmitted each second to make up the television picture. Each time the cathode ray tube reaches the bottom of the screen it must sweep diagonally upward to the top of the screen to begin a new field. This time period is referred to as the "vertical blanking interval" or simply "vertical interval" and is normally approximately 21 lines in length. Although no television picture data is transmitted during this time, the television industry has provided for a number of different types of control transmission on certain lines of the interval.

In most cases, the first nine lines of the vertical interval are used for equalizing and for vertical synchronization. Lines 10 to 14 are normally at black level to minimize picture interference on some sets. Thus, only lines 15 to 21 are available for data transmission. Lines 15 and 16 have already been utilized at least experimentally for other purposes. Lines 19-21 are normally used for network control information for transmission to the receiver sets. Thus, lines 17 and 18 are the only ones which are presently available for data transmission using the invention of the present system. These two lines normally contain network testing data to determine proper reception by the head end system. Once the television signals have been received, lines 17 and 18 can be cleared for passing data to the converters using the present invention. It should be understood that if additional lines in the vertical interval are cleared in the future, they could also be used for data transmission in accordance with the present invention.

The present invention uses line 17 and 18 of the vertical interval to transmit both the text data and the subscriber address and channel control data. In one field of a given frame lines 17 and 18 are used to transmit text data, and in the other frame field, the subscriber address and channel control data is projected on lines 17 and 18. The



present invention also uses line 10 which is at the black "zero" voltage level of each vertical interval for a DC reference level for the data signals. This reference signal passes to the converter as part of the vertical interval where it is used as a reference level for data  
 5 extraction. This procedure greatly enhances the accuracy of the data transmission by automatically compensating for any DC level shift in the vertical interval portion of the television signal.

Using the procedure described above an effective text character transfer rate of about 240 characters per second is achieved. This  
 10 is a relatively slow rate compared to some other methods of data transmission. However, since the text may be transmitted over all 55 television program channels the total text available to the user is very substantial. Moreover, as previously mentioned, the present invention may include one or more dedicated channels for only text data  
 15 transmission using the "line" format which will be described more fully in FIGURE 11. By using most of the 525 lines of each television signal frame for text data transmission a vast quantity of text can be transmitted and received on a given channel using the transmitting and receiving apparatus of the present system. No special expensive data  
 20 transmission equipment is required. Referring now to FIGURE 5, the head end video processor 52 is shown in greater detail. The digital control and timing unit 80 includes a data formatter 88, a scrambler controller 90, a sample and hold unit 92 and a timing signal generator 94. The video vertical interval processing unit 82 includes a sync  
 25 extractor 96 and a video switch unit 98.

The video signal is input on line 43 to the sample and hold unit 92, the sync extractor 96 and the video switches 98. The text data is input to the data formatter 88 on line 39 and the subscriber and control data is input on line 41 to data formatter 88 and output on line  
 30 42. The sync extractor unit 96 divides out the horizontal and vertical sync signals from the video signal and directs them to the timing signal generator on line 85. Timing signal generator 94 counts the lines of the vertical interval of each field and outputs enabling signals at the appropriate time.

A reference enable signal is output to sample and hold unit 92 on line 95 when "line 10" in each vertical interval is detected representing the black "zero" level which is used as the DC reference level. The sample and hold unit then outputs a DC reference signal on line 93 to the data formatter so that the incoming data or text can be properly positioned relative to "line 10" of the vertical interval. The properly formatted data is then output to video switches 98 to await transmission at the proper time in the vertical interval.

When timing signal generator 94 reaches "line 17" in the vertical interval, a data enable signal is output on line 83 to the video switches 98. Upon receipt of the data enable signal, video switches 98 turn off the video input and turn on the data input which is passed through on line 81 to the video scrambler unit 86. At the same time, a scramble disable timing signal is transmitted from data formatter 88 on line 89 to the scrambler controller 90 which in turn outputs a scramble disable signal on line 87. This signal enables the data on line 81 to pass through the video scrambler and out on line 44 without being scrambled. When timing signal generator detects the end of "line 18" of the vertical interval, a data disable signal is directed via line 83 to the video switches 98 which turn off the data line and turns on the video line. At the same time, a scramble enable timing signal is directed on line 89 to the scrambler controller which transmits a scramble enable signal to the video scrambler via line 87. This signal enables video scrambler 86 so that the video signals coming in on line 81 will be scrambled before being transmitted on line 44.

It should also be noted that scrambler controller unit 90 outputs a scramble/descramble timing signal on line 91 to the data formatter 88. This signal is added to the data which is sent to video switches 98 for transmission. This signal is utilized by the converter 40 as will be discussed later to control the descrambling of the video signal at the converter.

Referring now to FIGURE 6, the addressable converter unit 40 of FIGURE 1 is shown in greater detail. The converter, under direction of converter control logic, processes the RF data-loaded television signals from combined video output line 21 of head end signal combiner 20 and provides video and audio output for a television set, preferably on channels 3 or 4. In a two-way interactive system the RF input to the converter 40 also includes data from a two-way home terminal as will be shown and discussed in connection with Figure 10. Both types of signals are input to an RF/data separator 100 which directs the subscriber control data to a converter control logic 104 on SCB line 102. The RF data-loaded television signals are input to a conventional tuner 106 under the control of a tuner control unit 108 which in turn receives instructions from converter control logic 104.

Tuner 106 is preferably a conventional unit using a sliding band pass filter and a band switched front end that is tuned with phase lock loop control. The RF output signals are detected by an IF/amp detector 112 to provide a scrambled base-band video signal and a separate audio signal. Two-stage automatic gain control on feedback line 110 is provided to optimize noise reduction.

A vertical interval data extractor 114 is connected to the scrambled video output of unit 112 and provides a serial data stream extracted from the vertical interval of the scrambled video signal to the converter control logic 104. A logic command signal for timing control is transmitted to extractor 114 by logic 104 on line 117. IF amp detector unit also generated a synchronizing signal from the video signal which is transmitted to logic 104 on line 113.

A conventional video descrambler unit 116 processes the scrambled base-band video signal from the tuner and provides a descrambled base band video signal which is directed to a text/graphics generator 118. The scramble/descramble timing signal generated by the scrambler controller 90 of HVP unit 52 and transmitted to converter 40 as part of the control data is processed by converter control logic 40 and input on line 101 to the video descrambler 116 to control its operation. The channel sound information is amplitude adjusted or muted by an audio level/mute control unit 120 controlled by a signal on data line 122 from logic 104.



The text/graphics generator 130 provides display characters and graphic symbols that have been transmitted on the vertical interval. The converter control logic 104 directs screen control data on data link 124 to a display memory 130 which in turn sends the formatted display characters along data link 132 to the text/graphics generator 118 for display.

The text/graphics generator 118 includes a plurality of video switches which are used to bypass the text/graphics generator with the channel video. Optionally the video switches also permit the channel number display to be superimposed on the video signal of the channel which is being presented. The output of generator 118 is connected to a channel 3 or 4 modulator 134 which in turn is connected to a subscriber's television set.

Preferably the subscriber's television set is plugged into a power control outlet on the addressable converter 40 which is enabled on command from a user keyboard unit 146 connected to converter control logic 104. All manual user inputs required by the system are preferably keyed in on keyboard 146. Alternately, the user may provide inputs from a remote control unit 140 having a keyboard similar to user keyboard 146. Data is preferably sent from remote control unit 140 via an infra-red wireless link 142 to a conventional I/R receiver 144 which is connected to converter control logic 104. Hence, logic 104 receives input data from the vertical interval data extractor 114 and from the subscriber via the keyboard 146 or the remote control unit 140. In two-way cable systems input is also received from the subscriber control bus 102. Converter control logic 104 processes this information and operates the various modules in converter 40 under program control.

Referring now to FIGURE 7, converter control logic 104 is shown in greater detail. The central control logic 104 is carried out by a microprocessor unit 410. Microprocessor 410 is preferably a single microprocessor chip containing a random access memory, a read-only memory and timer. Unit 410 interfaces between the tuner control circuit 108 of converter 40 and a two-way data link 412 connecting it to the rest of the converter control logic.

A timer decoder unit 414 is connected to bus 412 and receives data from the vertical interval data extractor 114 on line 115. The VI data is buffered and decoded by unit 414 preparatory to being

transmitted to microprocessor 410. In addition, timer decoder unit 414 receives sync pulses from IF amp/detector 112 on line 113. Unit 414 includes line counting logic for determining when data is to be received on the vertical interval.

5 A subscriber control bus (SCB) interface unit 416 receives incoming data from subscriber control bus 102 related to the functions of a two-way home terminal such as home terminal shown in FIGURE 10. This SCB data is processed by interface unit 416 to be transmitted to microprocessor 410.

10 An identity ROM 420 is also connected by way of data link 412 to microprocessor 410. ROM 420 preferably contains a number of data codes which do not require changing in the normal operation of the system and which uniquely identify converter 40. These data codes include the identification number of the converter, the frequency  
15 configuration acceptable for the converter, and the "home channel" number, that is the channel number to which the converter will be tuned in the event of an emergency alert signal.

Preferably units 410, 414, 416 and 420 are all conventional integrated circuit chips readily available in the marketplace. Suitable  
20 chips for microprocessor 410 and timer decoder unit 414 are chip numbers 8048 and 8041 respectively, both manufactured by Intel Corporation. A suitable chip for SCB interface unit 416 is UART chip 6402 manufactured by Intersil Corporation. The identity ROM 420 is preferably a TI chip 74288, which is a 32 by 8 program read-only  
25 memory manufactured by Texas Instruments.

With reference now to FIGURES 9 and 10, addressable converter 40 is shown in two different configurations for subscriber usage. In  
FIGURE 9, addressable converter 40 is connected in a stand alone, one-way configuration between a conventional RF splitter unit 150 and  
30 the subscriber's television set 46. This configuration is similar to that shown in FIGURE 1. The RF signals from a cable TV plant 152 are transmitted by way of a subscriber drop 154 to splitter 150 where they are separated and sent to a plurality of addressable converters such as unit 40. The remote control unit 140 for remote usage by a subscriber  
35 in controlling converter 40 is optional.

In FIGURE 10, addressable converter 40 is shown in an expanded system including a two-way security monitoring system 160. In this configuration, the RF signals from the CATV plant 152 are connected

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by way of a subscriber drop 154 to a two-way home terminal unit 34 which permits various accessor devices such as security monitoring system 160 to be controlled by a separate conventional two-way interactive data communications system (not shown) using cable plant 152. The converter 40 is connected to home terminal 34 by a subscriber control bus (SCB) 162 via SCB adapter 56. SCB bus 162 connects to the internal SCB bus 102 of converter 40 as shown in Figure 6. The SCB bus 162 preferably carries downstream RF cable television signals and two-way data signals over a single coaxial cable link 162 connected to the addressable converter 40. Additional converters may be connected by way of a two or four-way splitter 164 that has been modified to pass DC signals.

In this expanded configuration, addressable converter unit 40 is enabled to "talk back" to the two-way interactive data communications system by way of the subscriber control bus adapter 156 and the two-way home terminal 34. The two-way home terminal 34 is also connected to the security monitoring system 160 to perform a wide variety of security functions including monitoring fire, intrusion, assault and medical emergencies. One preferable unit for home terminal 34 is terminal model 3-B made by Tocom, Inc., of Dallas, Texas.

The system of the present invention provides for several different procedures to restrict access to the television programming, including restrictions on the basis of addressable tiers, special events and eligibility codes. These different types of access control are all effected by a one-way system of the present invention using an



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intelligent converter at each subscriber location which can compare program codes sent from the head end station identifying each television program to user codes sent from the head end station identifying the access parameters of each subscriber. Preferably each  
5 converter on the cable system has its own individual identification number. All television channels are preferably scrambled by HVP unit 52 at the head end and descrambled by video descrambler unit 116 in converter 40. The descrambling process at the converter is enabled only after the proper control parameters are satisfied by the  
10 converter. For tiered program control, the channel control signals from the control data system program the addressable converter to compare each program tier code with the tier code of the subscriber. Thus, the remote subscribers can have access to different tiers of service regardless of the channel selected depending upon the type of  
15 service subscribed to by each user. This capability allows many different programs to be transmitted on a given channel while discriminating between subscribers who may view a given program.

The system of the present invention also provides for restricting access to specific programs, such as special events. Access is enabled  
20 by the converter if the subscriber has placed an order in advance for the program and the authorization is transmitted<sup>to</sup> the converter by the data control system at the head end. Thus, this type of control enables the subscriber to have access to a given channel at a specific time.

With respect to eligibility control, the system of the present invention allows each subscriber to choose an eligibility level at which he would like to restrict access to incoming programs. Preferably each channel that is not showing general audience programs will contain an eligibility code for each program that defines a code representative of the subject matter of the program in question. These codes can be assigned on any basis including local community standards or national movie rating codes. This feature allows families with young children to control access to all movies having unsuitable subject matter. Eligibility codes may also be used for closed circuit government or corporate systems in which transmitted programs may require different levels of security classification.

In addition to the foregoing access control procedures, one-way cable system using the present invention can be programmed to recognize special emergency alert commands directed to all or selected units at any time. Through this means, it is possible to address selected groups such as city officials, police, firemen, national guard and so forth for emergency announcements at any time of the day or night.

Reference is now made to FIGURE 11 wherein the data formats are shown for the data transmitted on the vertical interval of the television signals between data control system 12 and addressable converter 40. As previously mentioned, the transmitted data is of two types, namely control data generated by PCS 50 and text data generated by text formatters 54 (see Figure 2). The control data is further divided into subscriber addressing data and channel control data. The format for both the control data and the text data is shown in the form of data words in FIGURE 11.

A channel control word 200 is generated by PCS 50 to define the codes required for access to each television program being transmitted. The codes identify the program to the converter of each user station so that a determination may be made as to whether the converter 40 will be enabled to process the given television signal to the television set of the user station. Channel control word 200 includes a tier code 202 defining the level of access required for the program in question. Channel control word 200 also includes a program identification code 204 to indicate whether the television program in question is a special event requiring further limitation on access by viewers to only those who have subscribed to the special event.

An eligibility code 206 defines a rating which may be assigned to many of the television programs for subject matter which may not be suitable for viewing by all parties at the user station. Finally, a descrambling code 208 is transmitted as part of channel control word 200 to provide the converter with the code necessary to operate its video descrambler unit 116. Preferably, the descrambling code 208 is generated by the video scrambler 86 of HVP unit 52 when the signal is scrambled prior to transmission.

The subscriber addressing data words includes the four words shown in FIGURE 11, namely a subscriber enable word 210, and event enable word 220, an eligibility word 230 and an emergency alert word 240. These words all contain codes for controlling access of the user to the cable television system. The codes are normally originated by the subscriber at the time he begins the service and may be periodically altered by the <sup>system operator and the request of the</sup> subscriber ~~as~~ <sup>desired</sup>. The subscriber enable word 210 includes an address code 212 which may be a single bit indicating that the word is a subscriber address word. Word 210 also includes a subscriber identification code 214 which is unique to a specific remote subscriber station. Code 214 thus identifies the subscriber enable word 210 as being appropriate only for the identified remote subscriber.



A channel enable code 216 is also included to provide bit information indicating which of the system frequency channels may be viewed by the identified subscriber at all times. Similarly, a tier enable code 218 indicates the program tiers or levels which are available for viewing by the identified user. Finally, a text enable code 219 identifies the text channels which are available for viewing by the subscriber identified in word 210.

Word 210 is transmitted as part of the data sent on the vertical interval from central data control station 12 to the converter control logic 104 shown in Figure 6. The data transmitted in word 210 is thus used by converter control logic 104 to determine whether the converter apparatus should be enabled for processing television program signals to the television set. The subscriber enable word 210 is preferably frequently updated by the control computer 60 of PCS 50 with new data concerning the subscriber is authorized to view. This update is primarily a function of the level and type of subscription subscribed for by the user.

Event enable word 220 comprises additional enabling data sent to the converter for special events. As with word 210, word 220 includes an address code 222, and a unique subscriber identification code 224. The special event to be viewed is identified by a channel number code 226 and a program enable code 228 which together provide the data necessary for the converter to be enabled so that the user can view the special event.

The event enable word 220 is also generated by PCS 50 and transmitted to converter 40 where it is stored in converter control logic 104. Only by having the appropriate codes in logic 104 at the time that the special event is broadcast, can a subscriber view the program on the indicated channel. Thus the event enable word controls access at a particular time on a given channel during which a special event is transmitted.

Another subscriber addressing word which is used to limit access is the eligibility word 230 shown in FIGURE 11. As with the other subscriber addressing words, word 230 includes an address code 232 and a subscriber identification code 234. The main parts of word 230 consist of a key number code 236 and an eligibility threshold code 238. Key number code 236 is a special confidential authorization code which is made known only to an authorized party at a given user station. The eligibility threshold code 238 is set by the authorized party <sup>and</sup> identifies certain eligibility codes 206 transmitted as part of channel control word 200 for certain television programs which require limited access because of the subject matter. Eligibility word 230 is also transmitted from PCS 50 to converter 40 where it is stored in converter control logic 104. When the eligibility threshold code 238 is exceeded by the eligibility code of a given television program being sent to the converter, logic 104 will disable the converter until key number 236 is input by the local keyboard 139 or the remote control unit 140.

The fourth word which is transmitted as part of the subscriber addressing data is emergency alert word 240. This word is normally transmitted only when there is an emergency for one or more user stations which requires an alert to be sent. An address code 242 identifies the word as a part of the subscriber addressing data. Word 240 also includes a subscriber identification code 244 and an emergency alert code 246. Emergency alert code 246 preferably identifies one of several different messages which may be displayed on the screen of the user station and/or one or more annunciator devices which may be activated to further alert parties at the user station.

Emergency alert word 240 is preferably generated by PCS 50 for transmission to converter 40 only if an emergency has occurred. If converter 40 receives an emergency alert word 240, the program being

viewed by the user station is overridden by switching to a "home channel" for the broadcast of emergency alert messages and signals. If the television set is off, it is turned on by the converter 40 so that the emergency signals and messages may be transmitted.

5       The text data transmitted from text formatters 54 to converter 40 may be arranged in whatever format is suitable for transmission on the vertical interval of the television signals. Text transmission word 250 preferably includes a text identification code 252 indicating that the following data is to be treated as text. The text transmission  
10 word 250 also includes a number of text characters 254, 255, 256 and 257 for transmitting the text data. The number of characters in a given text word are optional and may be determined by the parameters of the system. Preferably, each text word has a length equivalent to  
15 one horizontal scan. Using a modified ASCII code, four text characters are transmitted with each text word to provide an equivalent data rate of 240 characters per second.

Referring now to FIGURE 12, a flow diagram is shown describing the operation of a converter 40 in selecting a given channel  
20 and determining access to a given program. Reference should also be made to FIGURE 5 for the converter components. The process begins at step 310 with the user entering a new channel number on the converter keyboard. At that point, the converter control logic implements several preparatory steps in the converter. The ap-  
25 propriate video switches in text/graphics generator 118 switch to a text display mode which in turn provides a black screen output to the television set. Converter control logic 104 also signals the audio level/mute control 120 to mute the sound output to the television set. Tuner 106 retunes to the requested  
30 channel and vertical interval data extractor 114 separates out the data transmitted on the vertical interval of the selected television signal.



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Converter control logic 104 then makes several comparisons between the subscriber addressing data which describes the converter authorization and the channel control word which describes the required authorization for the television program currently being transmitted on the selected channel. As shown at decision step 320 of FIGURE 12, a determination is made as to whether the subscriber is enabled for the selected channel. This is done by comparing the channel enable code 216 of the subscriber enable word 210 with the selected channel number. If there is no correspondence between these two codes, the next decision step 322 is taken in which it is determined whether the subscriber is enabled for the tier or level of service of the television program in question. This is determined by comparing the tier enable code 218 of subscriber enable word 210 to the tier code 202 of channel control word 200. If the compared words do not correspond, the process moves to the next decision step 324 in which a determination is made as to whether the subscriber is enabled for the television program in question with regard to the current time slot. This determination is required only if there is transmission of a special event for which an additional access clearance is needed.

If the answer is no to each of decision steps 320, 322 and 324, then the user station is not enabled for reception of the television program being broadcast on the selected channel. In that event, step 326 is taken in which the text/graphics generator 118 generates an appropriate message for display on the television screen of the user indicating that the user station is not authorized for reception of the program currently being broadcast on a selected channel. The converter control logic then cycles back to step 310 where it waits for the user to enter a new channel number.

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206 of channel control word 200. If the threshold is not exceeded, then the converter is enabled for processing of the television signal. As shown at step 332, the video descrambler 116 is enabled to process the video signal of the selected television program and the audio level/mute control unit 120 is enabled  
5 to transmit the audio signal to the television set.

✓ In the event that the eligibility code threshold is exceeded, converter control logic 104 takes the next step 334 which is to enable text/graphics generator 118 to generate an appropriate message for display on the television set of the user. The message instructs the user to enter his  
10 confidential key number on the converter keyboard 139 in order to enable viewing of the program in question. The entered number is then compared with  
✓ the subscriber's key number as given in key number code 236 of the eligibility word 230 as indicated at decision step 338. If the key number matches with the entered number, the converter control logic 104 proceeds to the enabling step  
15 332 as previously mentioned. If the entered number does not match with the subscriber's key number, the converter control proceeds to step 326 in which the user is informed that he is not authorized for reception of the program in question.

The foregoing procedure describes the process the converter 40  
20 uses for authorization to process a program received on a selected channel. Similar procedures are followed by converter 40 in performing a broad spectrum of functions involving one-way and two-way interactive television and data transmission. The operation of the system of the present invention and its varied functions can best be understood by making reference to the converter  
25 keyboard 168 shown in FIGURE 13.

✓ Keyboard 168 is duplicated on the wireless remote unit 140 which is designed to control addressable converter 40 by infra-red signal transmission. The input from keyboard 168 determines the television and text outputs to be  
✓ viewed by the subscriber. Converter 40 provides for tuning of up to 55  
30 television program channels on a broad band (50-400 megahertz) cable system. It selectively processes each of these channels and outputs them individually to a standard television set on channels 3 or 4 for viewing in the home. Converter 40 and its attendant remote control unit 140 can be used as a stand-alone conventional CATV converter and is also upward compatible as an expansion

module for a two-way interactive system.

Referring now to keyboard 168 in FIGURE 13, a channel is selected by pressing the CHAN key 170 on the keyboard. This action places the converter in the channel select mode so that a channel number can be entered from the numeral keys 172. For two cable systems, cable A or cable B can be selected by pressing the A/B key 174. In the normal channel select mode, channel number recall, and screen display <sup>ed on the television screen</sup> occurs each time the CHAN key 170 is pressed.

In addition to the 55 television program channels each ~~providing~~ converter unit 40 also provides for a complementary television text and graphics channel (video only) extracted from the vertical interval of the television signal transmitted in each of the 55 television program channels as previously discussed. This text displays a variety of different information such as weather, stock market quotations, continually-updated news stories, shopping information, television listings and so forth. No sound is available for the text channels other than the complementary television program channel sound which is muted if desirable.

This approach of using the vertical blanking interval for each of the 55 television program channels effectively provides up to 110 usable channels per cable for transmission of television programming and <sup>text data</sup> test to the subscriber. By using the A/B key for a two cable system the number of available channels is expanded to 220 channels. Thus a vast array of textual and graphic material may be transmitted to the subscriber in addition to normal television programming.

Because of the large number of available channels, up to ten preferred channels may be stored for quick access on the converter. The channels are stored by pressing the ENTER key 176 first and then the PREF key 178 while the unit is in the channel select mode. Unit 140 will then generate the necessary signals to display the ten preferred channel assignments, if any, on the television screen. The subscriber can then enter or modify the preferred channels using the number keys and exit by pressing the CHAN key 170. Preferred channels are accessed after programming by pressing the PREF key 178. Each time the key is pressed, the converter unit 40 steps through the



preferred channel table and displays the next selected channel in sequence.

Unit 140 provides for a complete volume control and sound muting by pressing the "sound up" key 180, the "sound down" key 182 or the MUTE key 184. Preferably sound is always muted for channels that have not been authorized. The sound is also muted for channels providing text and graphic programming.

For display of text and graphics information, a channel is first selected by pressing channel select key 170. To view the complementary text channel, the TEXT key 186 is pressed. Text channels can be authorized independent of the program channels so that the information may be provided as an additional service for certain subscribers while others may be available for everyone. The text information of some complementary text channels may also be formatted to supplement the <sup>television</sup> programs on its complementary program channel. For example, the textual material may amplify various new stories, shopping advertisements and other programming briefly presented over the television program channel. Preferably the <sup>television</sup> system of the present invention has a capability of displaying 16 rows of 32 characters in a compact readable format. In one preferred embodiment of the present invention, text channels were formatted to contain up to ten pages of information using up to 512 alpha numeric characters, up to 3072 graphics cells or a combination of both in up to five different colors.

In addition to the one-way functions described above, the system of the present invention also provides the user with a wide variety of two-way functions which can be used in conjunction with a conventional two-way interactive system. These functions include pay-per-view premium programming, subscriber response and opinion polling, channel monitoring and test marketing, information retrieval, and home security.

For the pay-per-view premium programming feature, a channel is selected on keyboard 168. If the selected channel is a premium channel requiring additional billing, the system prints a message on the television screen requiring that the subscriber key number be entered on keyboard 168. When the key

*is similar to the special event limited access feature described above except no advance authentication is required for the viewer as in a one-way system. For the pay-per-view feature,*

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number is entered correctly, the converter requests the data control system at the head end to authorize reception of the channel. The data control system then commands the converter to allow or disallow the selected program and retains billing information for the service as required.

5 For the subscriber response/opinion polling feature, the subscriber tunes to a channel programmed to allow subscriber response to questions or items being viewed. Once the subscriber has familiarized himself with the transmitted program and chooses to participate, he presses the RESP key 188 at an appropriate time when opinions are solicited on the program. This action  
10 holds the selected channel and enables keyboard 168 for the entry of a numerical response using numeral keys 172. The subscriber's response is preferably displayed on the television screen. When the subscriber is satisfied with his selection, he presses the ENTER key 176 which allows the response to be transmitted to the central data control system. Using the ten numerical keys  
15 on keyboard 168, up to 100 different responses can be generated by the subscriber.

A channel monitoring and test marketing feature is also provided. Because the concept of monitoring channel viewing may not be acceptable to some subscribers, it is required that the subscriber previously give his written  
20 permission to monitor his television set. If so, converter 40 is enabled to transmit certain television set monitoring information to the central data control system. Such information preferably includes <sup>an indication that</sup> when the subscriber's set  
/ is turned on, <sup>it</sup> ~~what~~ channel it is tuned to and when the subscriber moves from one channel to another. This capability can be used for rating television  
25 programs and, in conjunction with the opinion polling capability, for test marketing of products shown on commercials or special programs. It is possible to entirely disable this function in the converter in all cases except for the per-view feature in which it is necessary to read the channel number.

The information retrieval feature allows a wide variety of  
30 information to be accessed from libraries and other data banks as the state of the art and programming services will allow. As previously mentioned, some television channels may be dedicated for interactive information retrieval to the

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exclusion of video transmission. The subscriber first selects the appropriate channel as previously mentioned and presses the TEXT key 186. Preferably, a message is displayed on the television screen informing the user that the channel is dedicated for interactive information retrieval. If the subscriber wishes to participate in the interactive service, he then enters the ENTER key 176 which links the converter to a remote data bank by way of the PCS unit control computer 60, shown in FIGURE 3. The data control system informs the subscriber converter of the time slot during which data for its use would appear. The converter then displays data directed to it by the information computer.

10 Preferably, the subscriber interacts through his keyboard and a "tree search" to obtain the information he desires.



Other para. ters  
may also be used to  
limit access within  
the scope of the present  
invention 27

As can be seen from the foregoing, the system of the present invention provide numerous important advantages over the prior art. The present invention enables the use of a one-way cable television system to be used for a variety of sophisticated functions which previously would only have been accomplished using two-way interactive cable systems. The present invention enables the control of user access to the cable television system based on several different parameters, including ~~different~~ television channels, ~~different~~ tiers of television service, special events and eligibility, based on television program content. The present system also provides for the transmission of data, including both control data and text data, on the vertical interval of the television program signals. This format may be used for all 55 channels, ~~per cable~~ <sup>thus</sup> providing a substantial ~~transmission of~~ <sup>amount of</sup> data which would otherwise have required one or more dedicated data channels for transmission. Moreover, by transmitting the data in the VI "line" format, the television <sup>program</sup> transmission and receiver apparatus may be utilized for data transmission as well.

Another advantage of the present invention is the procedure for inserting the data on the vertical interval using a reference level in the vertical interval so as to minimize errors which might otherwise occur through a shift in the DC level of the interval. The present invention also provides a very flexible data transmission system which enables the transmission of different types of data, each having its own identification type as part of the data format. This approach eliminates the need for upstream inquiry by the remote data receivers.

The present invention includes ~~an extremely~~ <sup>a</sup> versatile converter unit at each remote user location which controls access as described above and interfaces with the user in a variety of applications. ~~The interface is accomplished using~~ <sup>to assist in this</sup> a graphics generator which provides graphic display signals which ~~can be~~ <sup>are</sup> presented to the user on the

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television receiver. The user ~~can~~<sup>is</sup> thereby ~~be~~ guided as to the channel being viewed, the input necessary in order to overcome certain access limitations, emergency messages and the procedure required for making a subscriber response or ~~an~~ information retrieval in two-way systems. In addition, the same graphics generator unit is used for providing the display signals for presenting the text data on the television receiver. The converter also is provided with a two-way subscriber control bus which can interface with a home terminal unit which in turn is part of a two-way interactive data acquisition and control system. <sup>11</sup> Another important advantage of the present system is the use of a versatile keyboard at each converter unit which interfaces with the converter logic and the graphics display unit to enable the user to interface with the converter in a number of different modes. The converter also includes<sup>5</sup> a number of special features such as an emergency feature which recognizes an emergency alert signal from a central station and executes ~~and~~<sup>an</sup> emergency procedure even if the set is turned off at the time. Moreover, the remote unit is designed to interface with the converter by an infrared wireless signal with the same flexible keyboard used on the converter, ~~itself~~. Access between the ~~dual~~ cables of a dual cable system is accomplished electronically by means of a special switch on the keyboard.

While there have been described what are at present considered to be preferred embodiments of the present invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is therefore intended to cover all such changes and modifications as falls in the spirit and scope of the invention.

What is claimed is:

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1. In a television communications system having a central station for transmitting a plurality of television signals at different frequency channels to a plurality of user stations each having a tuner for selecting one of said television signals, a method of limiting access of said user stations to only certain ones of said television signals, comprising:

generating a user identification signal at said central station for each user station, said identification signal including an indication of a predetermined user access criterion established by the user for access to said selected television signal;

generating a control signal at said central station for each one of said television signals, said control signal including an indication of a program access criterion assigned to said selected television signal and required for said user station to access to said selected television signal;

transmitting said user identification signal and said control signal to each of said user stations being tuned to receive said one television signal;

comparing the program access criterion of said control signal to the user access criterion of the identification signal associated with each user station; and

enabling only those user stations having the user access criterion corresponding to the program access criterion to receive and process said tuned television signal for display on a television set at the user station.

2. The method of Claim 1 wherein the user access criterion and the program access criterion correspond to a predetermined frequency channel.

3. The method of Claim 1 wherein the user access criterion and the program access criterion correspond to a predetermined tier of service regardless of frequency channel.

4. The method of Claim 1 wherein the user access criterion and the program access criterion correspond to a given program on a given frequency channel.

~~4a. The method of Claim 1 wherein the television signal comprises a text data signal containing text data and wherein said text data is displayed in graphics form by the television set.~~



5. The method of Claim 1 wherein the user access criterion and the program access criterion correspond to the type of subject matter of a given program on a given frequency channel.

6. The method of Claim 1 and further comprising the step of generating a graphics display signal for those user stations having identification signals not corresponding to said control signal.

7. The method of Claim 6 and further comprising the step of presenting a message on said television set in response to said graphics display signal to indicate that access to said one television signal is not enabled for said user station.

8. The method of controlling user access to a plurality of cable television signals each transmitted at a different frequency channel on a cable plant from a central station to a plurality of user stations each having a tuner for selecting one of said television signals, comprising:

generating a control signal at said central station for each one of said television signals, said control signal having a tier code representative of a user level required for access to said one television signal and a program code representative of user access to a given program transmitted by said television signal at a predetermined time;

transmitting said control signal to each user station tuned to said television signal;

generating a plurality of user identification signals at said central station, each user identification signal being representative of one of said user stations, said user identification signal including a channel enable code representative of the frequency channels to which said user station is authorized access, a tier enable code representative of a user level to which said user station is authorized for access to said television signals, and a program enable code representative of a time at which said user station is authorized access to said given program transmitted by the tuned television signal at said predetermined time;

transmitting each said user identification signal being transmitted to its respective user station;

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comparing said control signal of the tuned television signal to the user identification signal of said user station, including comparing the channel enable code to the channel of said tuned television signal, comparing the tier enable code to the tier code of said television  
5 signal and comparing the program enable code to the program code of said television signal; and

enabling said user station to access said tuned television station in response to the channel enable code corresponding to the tuned channel or the tier enable code corresponding to the tier code or the  
10 program enable code corresponding to the program code.

9. A television communications system for transmitting television programming signals on a plurality of frequency channels from a head end station to a plurality of user stations, comprising:  
a plurality of data signal processors at said head end station;  
5 a plurality of television signal processors at said head end station;

head end processing means in communication with said data signal processors and said television signal processors for periodically inserting said data signals in the vertical intervals of said television  
10 signals to generate a plurality of data loaded television signals for transmission to said user stations;

transmitting means in communication with said head end processing means for transmitting said plurality of data loaded television signals to said user stations, each data loaded television  
15 signal being transmitted in a different frequency channel;

receiver means at each of said user stations for selectively receiving one of said data loaded television signals;

extractor means connected to said receiver means for separating the data signal from the television signal of said data loaded  
20 television signal; and

actuable processor means selectively responsive to said television signal for processing television signal to a frequency compatible for display by a television receiver.

10. The system of Claim 9 wherein said actuable processor means includes means for processing said data signal to a frequency compatible for display by a television receiver.

11. The system of Claim 10 wherein said actuable processor means includes means for selectively transmitting either said data signal or its said respective video signal to said television receiver on the same frequency channel of said television receiver.

12. The system of Claim 9 wherein said data signal generators include means for generating control signals to control said actuable processor means at each of said user stations.

5 13. The system of Claim 9 wherein said data signal generators comprise a plurality of text means for generating text-formatted data signals, each being transmitted on the vertical interval of one of said television signals to each of said receiver means for processing by said processor means to be alternately accessed by the television receiver on the same channel as said one television signal.

5 14. The system of Claim 9 wherein said control signal generating means comprises subscriber addressing means for generating a subscriber addressing signal for each user station, each said subscriber addressing signal defining a predetermined access class allowed for the user station to enable said actuable processing means for each of said television programming signals received by the receiver means of said user station; and

10 channel control means for generating a channel control signal defining for each of said television programming signals a predetermined access class required for the subscriber addressing signal of each user station to actuate the processor means of said user station.

15. The system of Claim 14 wherein said subscriber addressing means comprises identification means for generating a unique identification code signal for each user station;

5 channel enable means for generating a signal representative of the channels to which the subscriber is permitted to have access;

and program enable means for generating a signal representative of the program level of the subscriber for access to selective television signals on each said channel.



16. The system of Claim 14 wherein said channel control means comprises program level means for generating a signal defining the subscriber level of service required to access to each of the television signals on each said channel.

17. The system of Claim 9 wherein each of said actuable processor means comprises a converter unit having means for selectively converting each of said television signals and the data signal inserted in the vertical interval of said television signal to a frequency compatible for display by a television receiver.

18. A cable television communications system for transmitting television signals for a plurality of frequency channels from a head end station to a plurality of user stations, comprising:

video means at the head end station for generating a plurality of video signals;

data means at head end station for generating a plurality of data signals, each data signal including a control portion and a text portion;

head end processor means for periodically injecting a different one of said data signals in the vertical interval of each of said video signals to provide a plurality of data loaded TV signals;

transmitting means for directing each of said data loaded TV signals in a different frequency channel to said plurality of user stations;

receiver means for selectively receiving one of said data loaded TV signals;

extractor means for separating the data signal from the video signal of the data loaded TV signals received by the receiver means; and

actuable processing means responsive to the control portion of said data signal for processing said video signal and the text portion of said data signal for generating a signal for display on a conventional television receiver means.

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19. In a cable television communications system for transmitting data signals and television signals on a plurality of frequency channels from a head end station to a plurality of user stations, the method comprising:

5 inserting each of the data signals in at least one of the lines of the vertical interval of one of said television signals to provide a data loaded television signal;

transmitting each of the data loaded television signals in a different frequency channel in said cable system to said user stations;

10 extracting each of the data signals from the vertical interval of its data loaded television signal;

processing said data for selective output at said user station; and

15 processing said television signal for reception by a television set at said user station.

20. The system of Claim 19 wherein said data signal processing step comprises generating a control signal in response to said data signal and wherein said television signal processing step is enabled in response to said control signal.

21. The system of Claim 19 wherein said data signal comprises coded textual data, wherein said data processing step comprises decoding the coded textual data and further comprising the step of processing said decoded textual data for reception in graphics format by a television set at said user station.

22. The system of claim 19 wherein said television signal comprises a scrambled video signal and wherein said selective processing of said television signal comprises descrambling said video signal.

23. The system of Claim 19 and further comprising the step of formatting each of said data signals into a data word corresponding approximately in length to the length of a line of the vertical interval of said television signal.

~~24. The system of Claim 23 and further comprising the step of inserting a different one of said data words on substantially all of the lines of a given frequency channel.~~

25. In a television communications system including a head end station for transmitting a television signal having a data signal in the vertical interval of the television signal for selective reception by a plurality of user stations, a converter comprising:

5 tuner means for selectively receiving the transmitted television signal;

extractor means connected to said tuner means for removing the data signal from the vertical interval of the television signal;

10 logic means connected to said tuner means and to said extractor means including first means for generating a first control signal in response to said extracted data; and

15 processing means connected to said tuner means for selectively converting the tuned television signal to a receiver frequency channel compatible for reception by a television receiver in response to said first control signal.

26. The converter of Claim 25 wherein said transmitted television signal is scrambled, and wherein said processing means comprises means for descrambling the scrambled television signal in response to said first control signal.

27. The converter of Claim 25 wherein said logic means includes second means for generating a second control signal in response to said extracted data and third means for generating a text signal in response to said extracted data, and further comprising  
5 graphics display means for generating a graphics signal in said receiver frequency channel in response to said second control signal.

28. The converter of Claim 25 and further comprising keyboard means for manually inputting user signals to said logic means, and wherein said logic means includes fourth means for generating a fourth control signal in response to said user signal for transmission to said  
5 tuner means to enable tuning of said television signal.



29. The converter of Claim 28 wherein said transmitted television signal is scrambled, wherein said logic means includes fifth means for generating a fifth control signal in response to said user signal, and wherein said processing means comprises means for descrambling the scrambled television signal in response to said fifth control signal.

30. The converter of Claim 25 and further comprising a subscriber control bus connected to said logic means for transmitting input and output signals between said logic means and a two-way data communications system, keyboard means connected to said logic means for inputting subscriber data signals to said logic means and two-way output generating means in said logic means for generating output signals to be transmitted to said two-way system via said subscriber control bus.

31. The system of Claim 30 wherein said logic means further comprises two-way input generating means responsive to said input graphics data for generating a display signal in the receiver frequency channel in response to said output signal.

95/ 32. In a television system having a central station for transmitting a television signal at a transmitted frequency channel and a plurality of user stations for receiving said television signal, a method of providing visual feedback on a television set at a user station comprising:

tuning the user station to the frequency of said transmitted television signal;

converting the transmitted television signal from the transmitted frequency channel to a receiver frequency channel compatible for reception by the television receiver;

sensing a predetermined criterion of said transmitted television signal;

generating graphics display data representative of said predetermined criterion; and

transmitting said graphics display data on said receiver frequency channel for display by said television receiver.

5 33. The method of Claim 32 wherein said sensing step comprises sensing the transmitted frequency channel, and wherein said graphics display data is transmitted to the television receiver simultaneously with said converted television signal for displaying the transmitted frequency channel superimposed over the television picture.

Sub 9b  
5 34. The method of Claim 32 wherein said sensing step comprises sensing a data portion of said transmitted television signal, and said generating step comprises generating graphics display data representative of a message corresponding to said data portion for display on said television receiver.

35. The method of Claim 34 wherein the message to be displayed indicates that the user is not authorized to receive the television signal.

36. The method of Claim 34 wherein the message to be displayed indicates that the user should input additional data at the user station.

37. The method of Claim 34 wherein the message to be displayed indicates an emergency for the user.

38. In a television communications system transmitting a television signal and a data signal from a central station to a remote user station, a method for transmitting the data signal in the vertical interval of the television signal comprising:

- 5       sensing a constant voltage level in a reference portion of the vertical interval;
- referencing the data signal to the constant voltage level;
- inserting the referenced data signal in the vertical interval at the central station;
- 10       transmitting the television signal with the data signal in said vertical interval from the central station to the remote user station;
- sensing the constant voltage level of the vertical interval in the television signal at the remote user station;
- 15       referencing the data signal to the constant voltage level; and
- removing the referenced data signal from the vertical interval.

39. The method of Claim 38 wherein said constant voltage level is the black line of the vertical interval.

40. In a data communications system which transmits a plurality of different types of data signals from at least one data source to a remote data receiver, said transmission of data signals being in a timing format utilized in conventional television signal transmission, the method of identifying the data signals to the remote data receiver comprising:

- 5 generating an identifier signal for each different type of data signal;
- appending one of the identifier signals to each corresponding
- 10 type of the data signals;
- transmitting each data signal with appended identifier signal to the remote data receiver; and
- sensing the identifier signal of each data signal to identify the type of data signal to the remote data receiver.

41. The method of Claim 40 wherein said data signals comprise control signals and text signals.

42. The method of Claim 40 wherein said data signals are transmitted on the vertical interval of a conventional television signal.

43. In a television communications system in which a television signal is transmitted from a central station to a remote user station for display on a conventional television receiver, the combination comprising:

- 5 a keyboard at the user station having a set of numerical keys and a set of function keys for inputting numerical signals and function signals respectively to the user station;
- a logic unit at the user station connected to the keyboard for processing the numerical signals and function signals and for generating a control signal in response to said numerical and function
- 10 signals;
- graphics display means connected to the logic unit for generating a display signal for the television receiver at the user station in response to said control signal.

*add 97*



ABSTRACT OF THE DISCLOSURE

An addressable cable television control system ~~monitors and~~ controls television program and data signal transmission from a central station to a plurality of user stations. The data signals are inserted on the vertical interval of the television signals, thereby freeing all channels for transmission of both television and data signals. An intelligent converter at each remote user location <sup>uses the data signals to</sup> ~~controls~~ access to the system on the basis of channel, tier of service, special event and program subject matter. The converter uses a graphics display generator to generate display signals for the presentation of <sup>the</sup> ~~text~~ data on the television receiver and for the generation of predetermined messages for the viewer concerning access, emergencies and other functions. The keyboard of the subscriber provides a number of different functional inputs for the subscriber to interface with the system. The converter also includes apparatus for interfacing with two-way interactive data acquisition and control systems.

*include both  
control signals  
and text  
signals  
which*

358 Tcom  
B 3676  
114  
DB-9

print of drawing as  
SHEET 1 of 12  
originally filed

135987

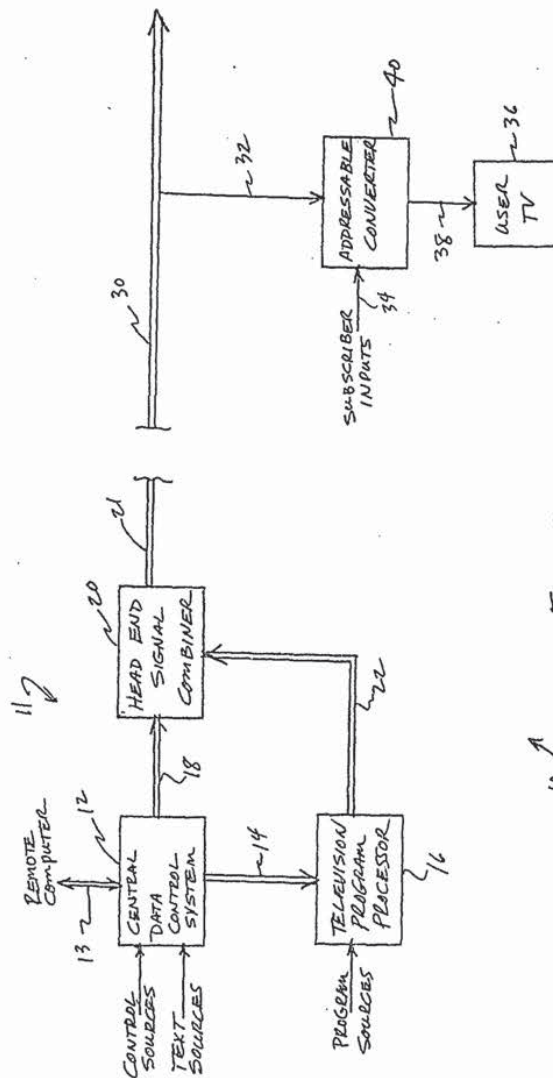


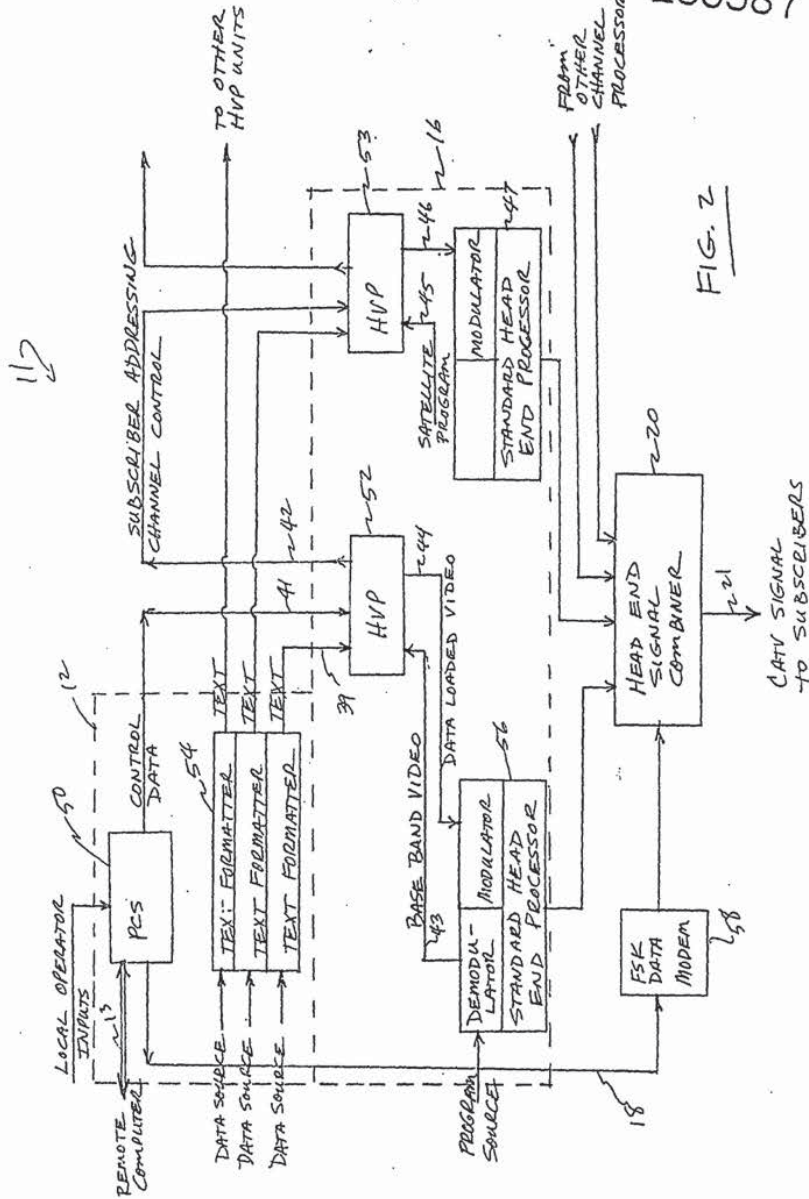
FIG. 1

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TCOM B3676

SHEET 3 OF 12  
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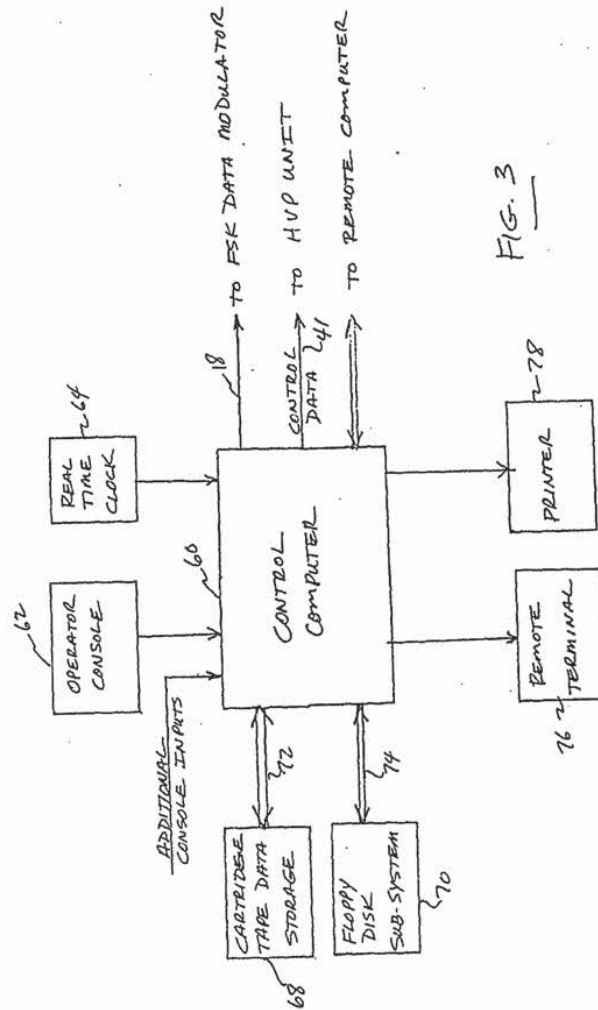


FIG. 3

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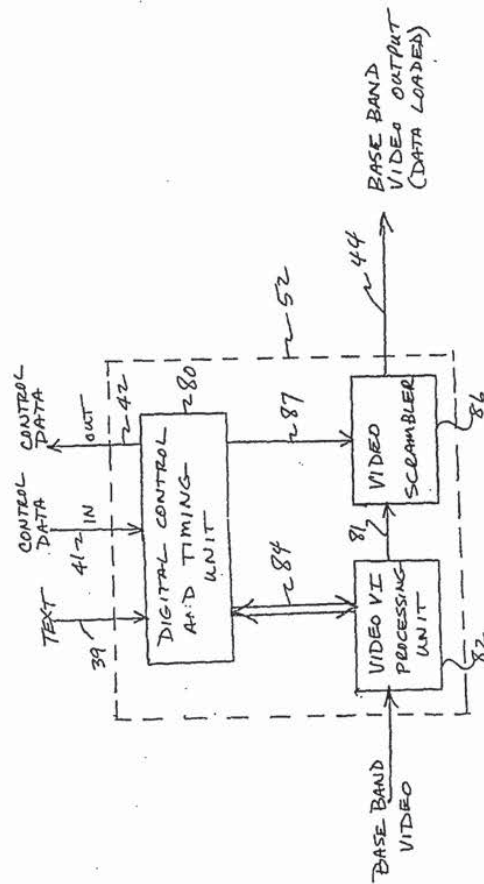
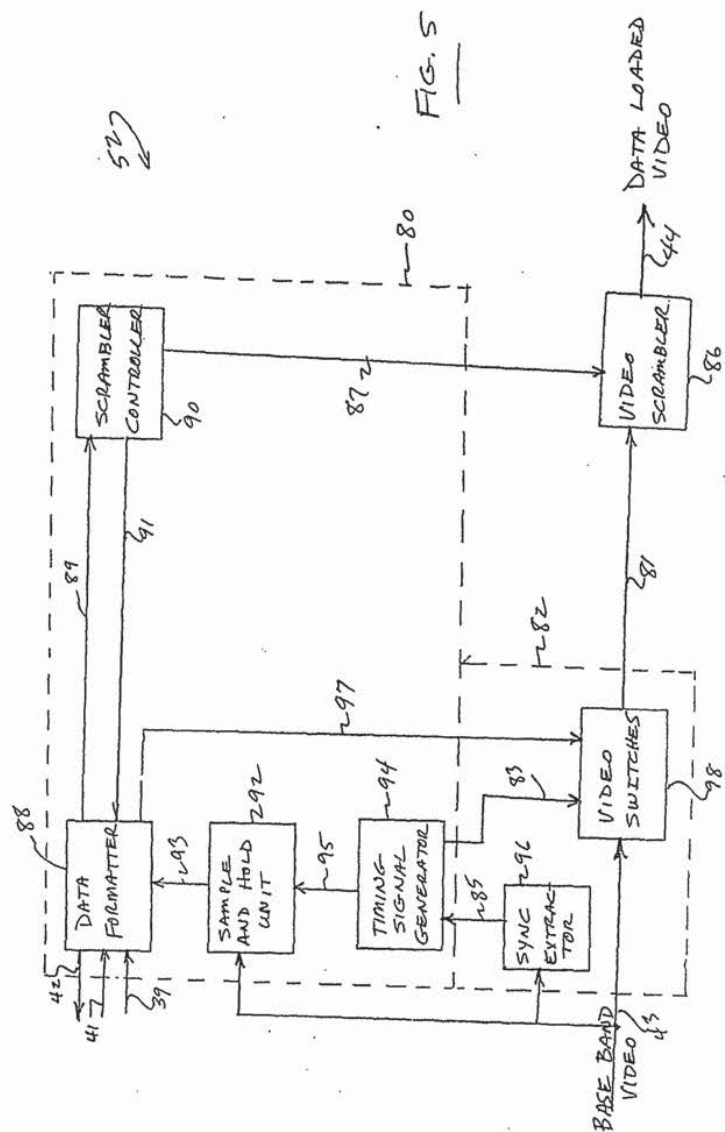


FIG. 4

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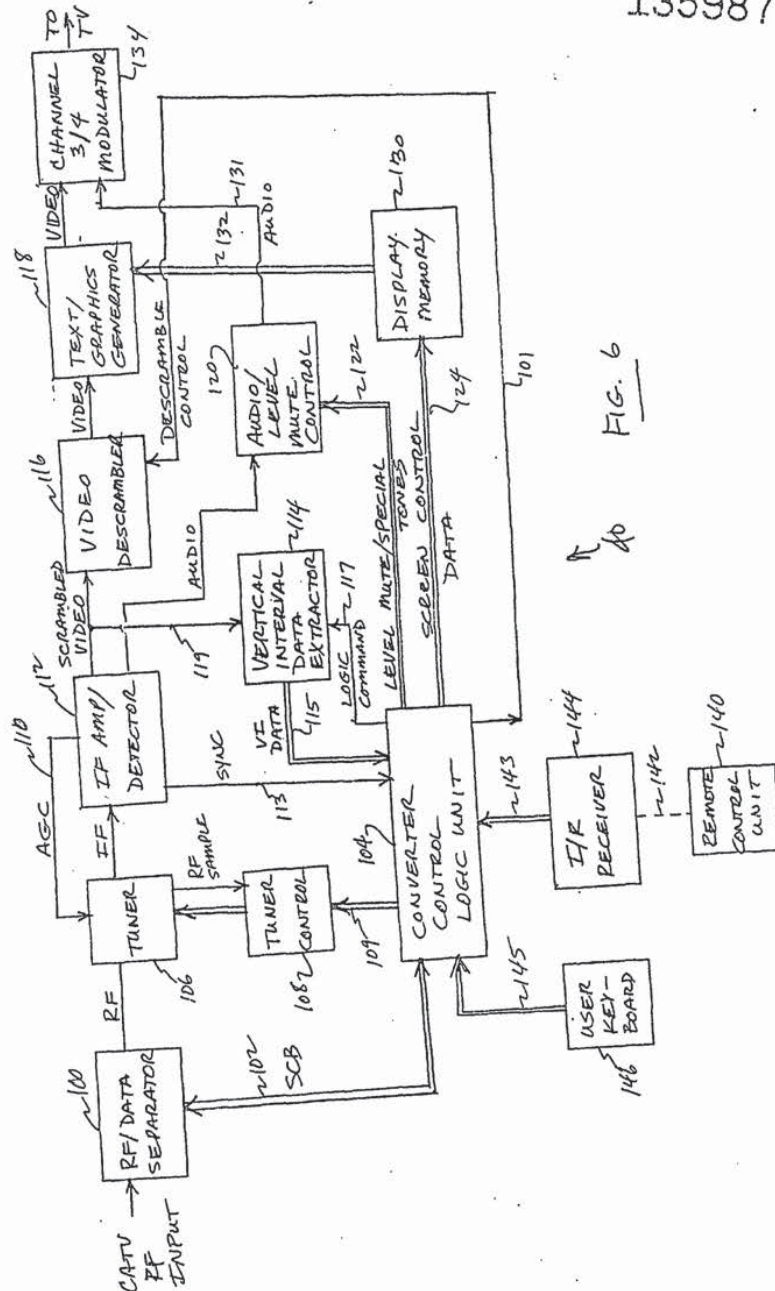


FIG. 6

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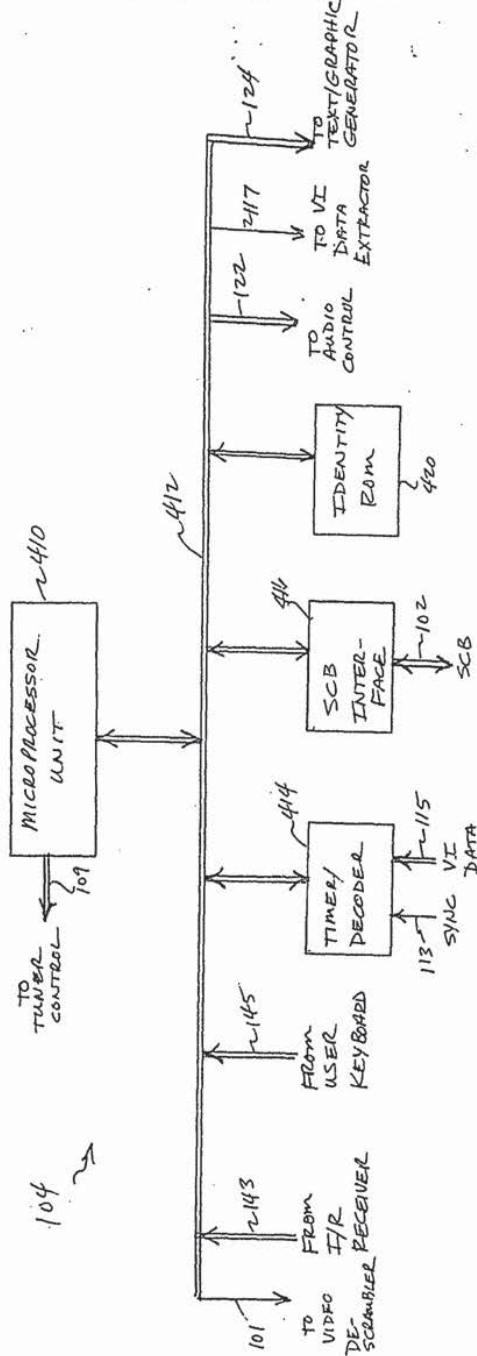


FIG. 7

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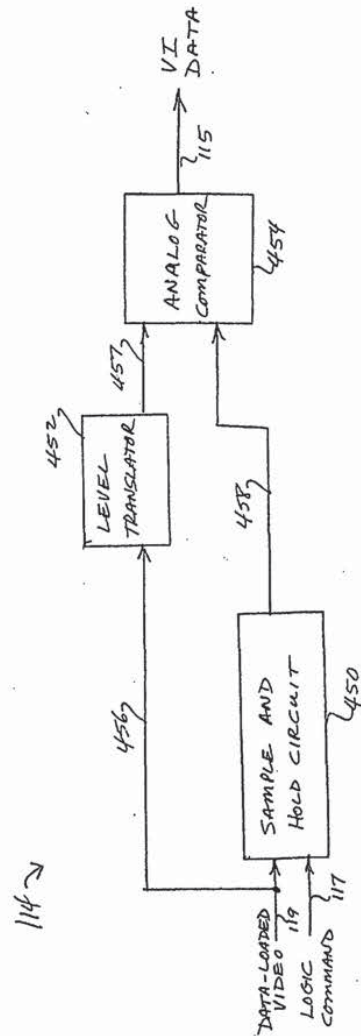


FIG. 8



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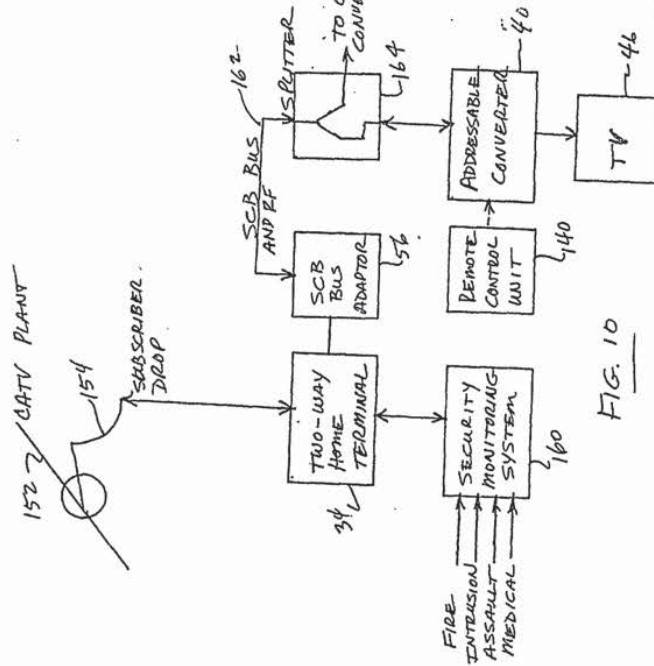


FIG. 10

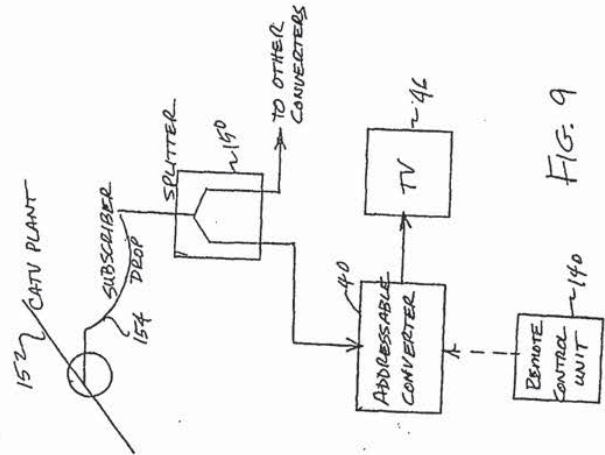


FIG. 9

print of drawing as  
originally filed

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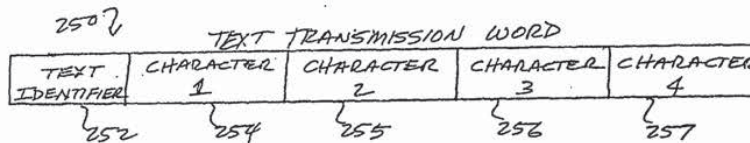
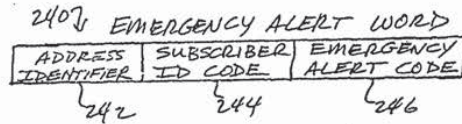
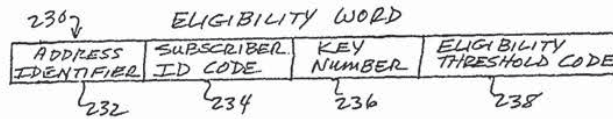
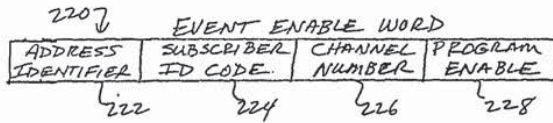
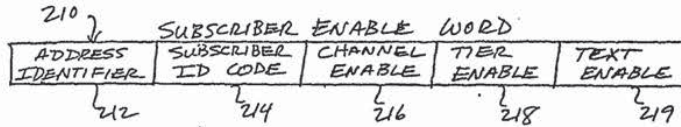
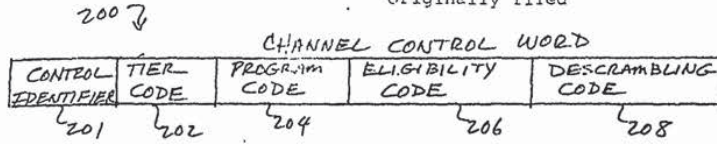
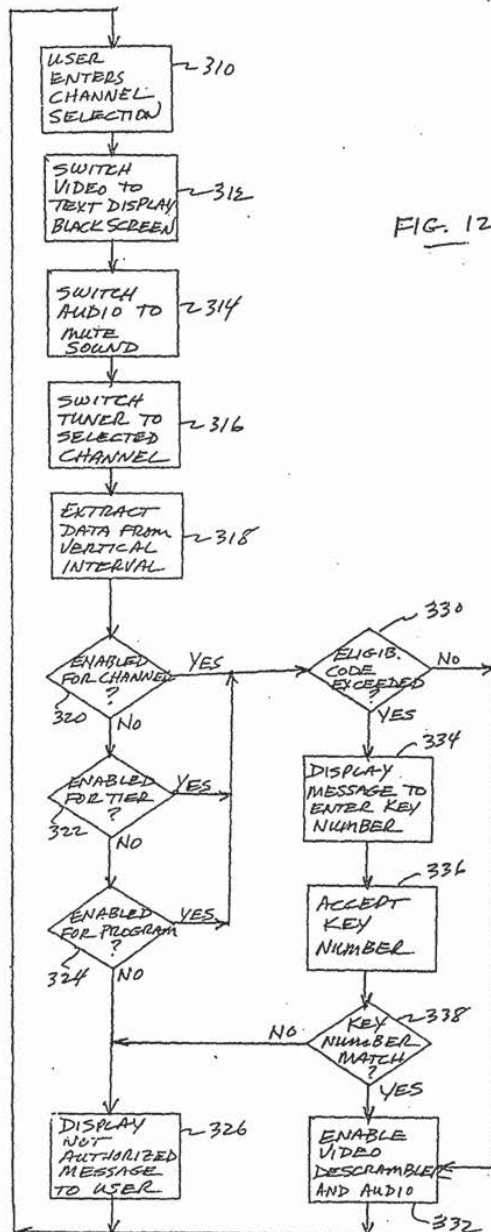


FIG. 11

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FIG. 12





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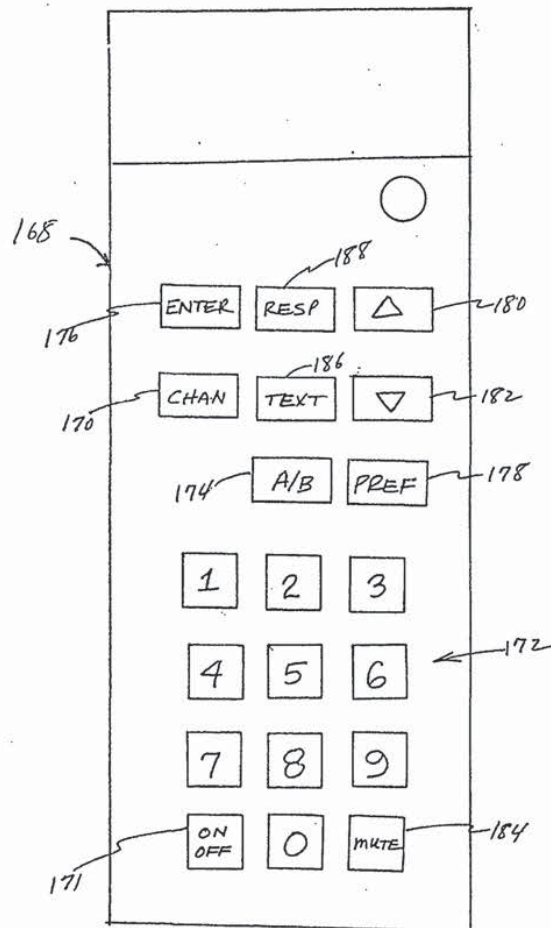


FIG. 13