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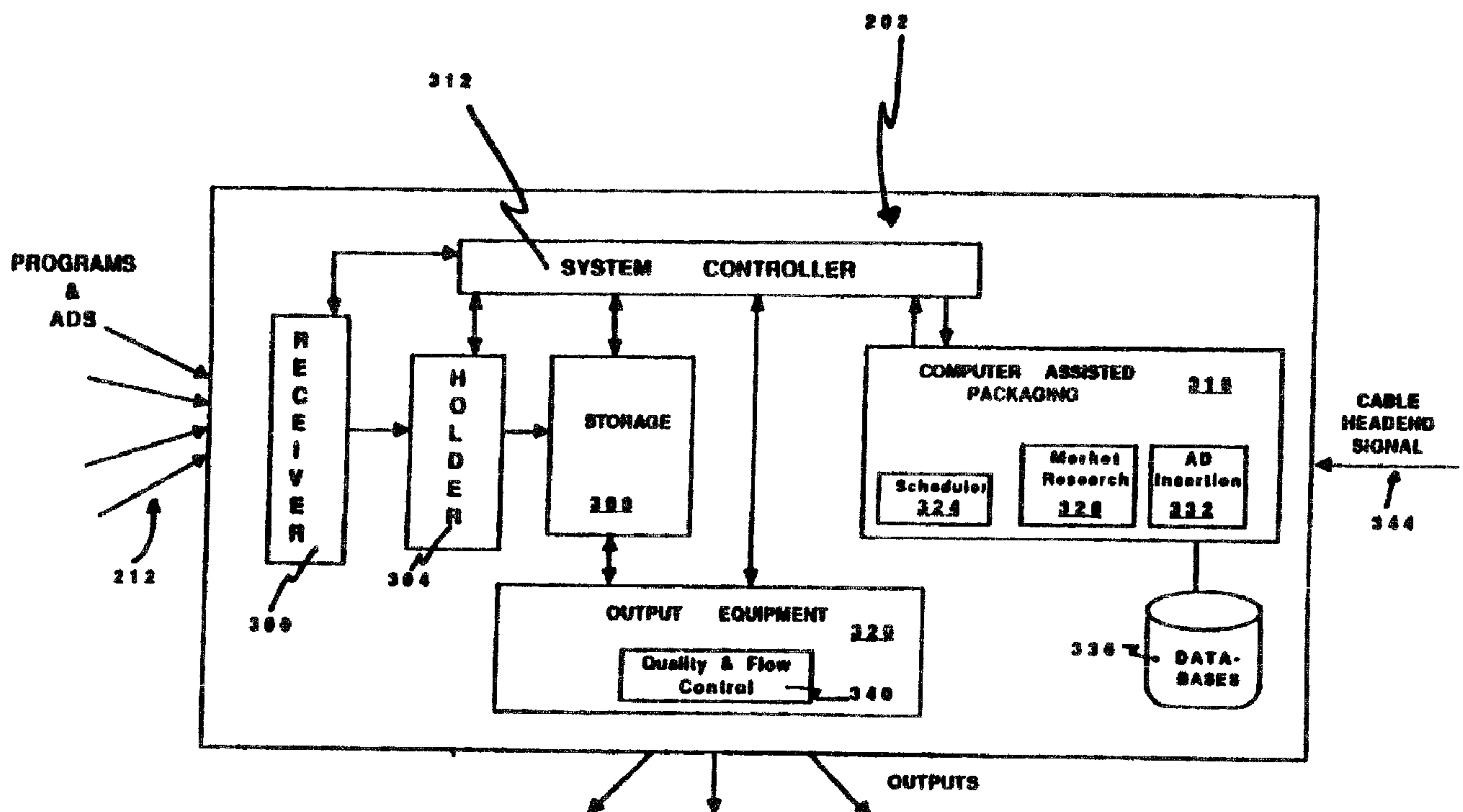
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(54) Titre : CENTRE D'EXPLOITATION DOTE D'UNE MEMOIRE VIDEO DESTINE A UN SYSTEME DE MISE EN
FORME ET DE DISTRIBUTION DE PROGRAMMES DE TELEVISION

(54) Title: AN OPERATIONS CENTER WITH VIDEO STORAGE FOR A TELEVISION PROGRAM PACKAGING AND
DELIVERY SYSTEM



(57) Abrégé/Abstract:

The present invention is an operations center that organizes and packages television programs for transmission in a television delivery system. The center is capable of receiving, storing, packaging and delivering countless programs in various signal formats. The center's primary components are a receiver, system controller, video storage, computer assisted packaging system, and output equipment. The components can receive, convert, store, select, retrieve, encode and otherwise process multiple program signals, gather program identities of analog and/or digital programs, generate menus, package programs efficiently based on subscriber needs and the available bandwidth, and output packaged program products to multiple remote sites. To perform these



(57) **Abrégé(suite)/Abstract(continued):**

functions, the CAP creates program lineups, menus, instructions on the packaging of programs, and/or allocates available bandwidth. In the preferred embodiment, the packaged program products contain programs, control information, and menus.

ABSTRACT

The present invention is an operations center that organizes and packages television programs for transmission in a television delivery system. The center is capable of receiving, storing, packaging and delivering countless programs in various signal formats. The center's primary components are a receiver, system controller, video storage, computer assisted packaging system, and output equipment. The components can receive, convert, store, select, retrieve, encode and otherwise process multiple program signals, gather program identities of analog and/or digital programs, generate menus, package programs efficiently based on subscriber needs and the available bandwidth, and output packaged program products to multiple remote sites. To perform these functions, the CAP creates program lineups, menus, instructions on the packaging of programs, and/or allocates available bandwidth. In the preferred embodiment, the packaged program products contain programs, control information, and menus.

**AN OPERATIONS CENTER WITH VIDEO STORAGE FOR A
TELEVISION PROGRAM PACKAGING AND DELIVERY SYSTEM**

5 This application is a divisional of Canadian application serial
number 2, 177,152 which is the Canadian National Phase of International
patent application PCT/US94/13809 filed 2 December 1994 (02.12.94),
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RELATED APPLICATIONS

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 This application is related to application PCT/US93/11617 entitled
AN OPERATIONS CENTER FOR A TELEVISION PROGRAM
PACKAGING AND DELIVERY SYSTEM published 23 June 1994 under
publication number WO 94/14281 and corresponding to U.S. Patent No.
15 5,659,350. The following other applications and patent are also related to
the above-referenced patent application:

 PCT/US93/11708 entitled REPROGRAMMABLE TERMINAL
FOR SUGGESTING PROGRAMS OFFERED ON A TELEVISION
PROGRAM DELIVERY SYSTEM published 23 June 1994 under
20 publication number WO 94/14284 and corresponding to U.S. Patent No.
5,798,785;

 PCT/US93/11616 entitled NETWORK CONTROLLER FOR
CABLE TELEVISION DELIVERY SYSTEMS published 23 June 1994
under publication number WO 94/14280 and corresponding to U.S.
25 Patent No. 5,600,362;

 PCT/US93/11618 entitled SET-TOP TERMINAL FOR CABLE
TELEVISION DELIVERY SYSTEMS published 23 June 1994 under
publication number WO 94/14282 and corresponding to U.S. Patent No.
5,734,853;

30 PCT/US93/11606 entitled ADVANCED SET-TOP TERMINAL
FOR CABLE TELEVISION DELIVERY SYSTEMS published 9 June

1994 under publication number WO 94/13107 and corresponding to U.S. Patent No. 5,990,927;

PCT/US93/11615 entitled DIGITAL CABLE HEADEND FOR CABLE TELEVISION DELIVERY SYSTEM published 23 June 1994
5 under publication number WO 94/13279 and corresponding to U.S. Patent No. 5,682,195;

PCT/US93/11706 entitled TELEVISION PROGRAM DELIVERY SYSTEM published 23 June 1994 under publication number WO 94/14283 and corresponding to U.S. Patent No. 5,559,549; and

10 U.S. Patent 5,986,690 entitled ELECTRONIC BOOK SELECTION AND DELIVERY SYSTEM.

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TECHNICAL FIELD

The invention relates to television entertainment delivery systems that provide television programming to consumer homes. More particularly, the invention relates to an operations center that organizes and packages cable television programming for delivery to consumer homes.

BACKGROUND ART

Advances in television entertainment have been primarily driven by breakthroughs in technology. In 1939, advances on Vladimir Zworykin's picture tube provided the stimulus for NBC to begin its first regular broadcasts. In 1975, advances in satellite technology provided consumers with increased programming to homes.

Many of these technology breakthroughs have produced inconvenient systems for consumers. One example is the ubiquitous three remote control home, having a separate and unique remote control for the TV, cable box and VCR. More recently, technology has provided cable users with 100 channels of programming. This increased program capacity is beyond the ability of many consumers to use effectively. No method of managing the program choices has been provided to consumers.

Consumers are demanding that future advances in television entertainment, particularly programs and program choices, be presented to the consumer in a user friendly manner. In order for new television entertainment products to be successful, the products must satisfy consumer demands. TV consumers wish to go from limited viewing choices to a variety of choices, from no control of programming to complete control. Consumers do not wish to pay for one hundred channels when due to lack of programming information, they seldom, if ever, watch programming on many of these channels.

The concepts of interactive television, high definition television and 300-500 channel cable systems in consumer homes will not sell if they are not packaged, delivered and presented in a useable fashion to consumers. The problem is that TV programming is not being managed.

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packaged, delivered, and presented to consumers in a user friendly manner.

Consumers are already being bombarded with programming options, numerous "free" cable channels, subscription cable channels and pay-per-view choices. Any further increase in TV entertainment choices will likely bewilder viewers with a mind-numbing array of choices.

The TV industry has traditionally marketed and sold its programs to consumers in bulk, such as continuous feed broadcast and long-term subscriptions to movie channels. The TV industry is unable to sell its programming in large quantities on a per unit basis, such as the ordering of one program.

In today's television world networks manage the program lineup for individual channels. Each network analyzes ratings for television shows and determines the appropriate schedule or program lineup to gain market share and revenue from advertising. Since each channel is in competition with every other channel, there is no coordinated effort to organize or package television programming in a manner that primarily suits the viewers.

Additionally, viewership fragmentation, which has already begun to decrease a channel's or program's market share, will increase. Programming not presented in a user friendly manner will suffer with a decrease in viewership and revenue.

And finally, with the imminent introduction of digital television technology, current television delivery systems do not have the capabilities or features necessary to operate in the digital environment.

What is needed is a distribution point for programs.

What is needed is a method of organizing programming to be offered to viewers.

What is needed is a television program delivery system that can be operated in a distributive fashion and controlled from one or more national centers.

What is needed is an operations center for a system which can gather television programming in a variety of formats, package the programs, deliver the programs, and present the programs through a

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user friendly interface which allows the consumer to easily select from among the many program choices.

What is needed is an operations center that is capable of handling hundreds of programs in different formats.

5 What is needed is an operations center that is expandable for future types of programming.

What is needed is an operations center that can control certain features and software of a television delivery system.

10 What is needed is an operations center that operates in the digital audio/video environment.

What is needed is an operations center that formulates program menus for viewer use.

What is needed is a computer assisted program packaging system.

15 What is needed is an operations center that includes a method for billing consumers.

What is needed is an operations center that analyzes data on programs watched by viewers

The present invention is addressed to fulfillment of these needs.

20

BRIEF SUMMARY OF INVENTION

This invention is a center for controlling the operations of a television program delivery system. Specifically, the present invention is an operations center that organizes and packages television programs for transmission in a television delivery system.

25 The operations center is the nerve center of the television program delivery system. The center is capable of receiving, storing, packaging and delivering countless television programs. It receives data on viewership behavior and utilizes the data to assist in packaging programs for future viewing. The operations center is a particularly useful
30 invention for television delivery systems which will provide subscribers with video on demand, near video on demand and/or the ability to select programs from on-screen menus.

The operations center's primary components are a receiver, system controller, video storage, computer assisted packaging system and output

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equipment. The operations center receives multiple video signals and outputs packaged program products to multiple remote sites. In the preferred embodiment, the packaged program products contain programs, control information, and subscriber menus.

5 The operations center receives multiple video inputs from external and/or internal sources in various signal and video data formats. The operations center performs any processing of the signal that is necessary, such as converting to different video data formats, and then stores the video data. After determining the manner in which the video data should
10 be packaged, such as the program identities and video format, the operations center packages and sends the video to one or more remote sites, such as a cable headend. The manner in which the operations center's product is packaged for a particular remote site is preferably customized and includes a customized program control signal with
15 program identities.

 The computer assisted packaging system (CAP) creates the program lineup (and/or instructions on the packaging of programs) and the packaging of menu and control information for later transmission and use in the cable television systems. The CAP can be specially designed to
20 generate graphical menu displays for user selection of programs. The CAP hardware and software for customizing packages of transmitted program signals is particularly useful in large television delivery systems which include multiple satellite and terrestrial transmissions to cable headends.

25 The software of the CAP performs the functions of gathering program identities of analog and/or digital program signals from a variety of sources such as broadcast television, premium channels, tape and video disk. The software causes the programs to be packaged efficiently for the available bandwidth and for subscriber viewing through computer
30 assisted creation of program line-up and allocating of bandwidth. The line-ups are created to effectively group programming for display in menus by categories. The television programs are then packaged for transmission by the operations center with the program control

information (such as cost for viewing certain program) and menu information.

The operations center of the present invention provides a method for remote management and control of video on demand, near video on demand, local cable and CATV programs available, and on-screen menu displays shown to subscribers. The operations center's
5 computer software programs and hardware provide both "real-time" and advance control over cable and CATV systems. By transmitting appropriate control information the operations center has the ability to change allocation of programs across physical channels, change video on demand programs available, update menu information (from the operations center location), reprogram menu formats and menu flow, and change or augment a packaged program signal
10 sent or programs made available to a particular region of the country. The operations center is able to control remotely certain features and software of the cable headend and set top terminals and if necessary reprogram menu display software stored at the cable headend or set top terminals.

In order to properly manage program lineups, the operations center acquires viewer
15 information on programs watched. Such viewer information includes information about the buy rates of specific shows, viewer preferences for programming, and the like, gathered by recording viewer transactions. A compilation of viewer information data is needed in order to make decisions on future individualized program lineup and program packaging. In addition, allocation of menu space and construction of menus is aided by the use of viewer information
20 data.

This information is usually received from the cable headends and processed using market research techniques.

Accordingly, in one aspect, the present invention provides an apparatus for use in an operation center for a video-audio program delivery system, wherein the operations center
25 receives a plurality of programs from external sources, stores one or more of the received programs, generates a program schedule, and causes program identities and at least one of the stored programs to be sent to one or more remote sites, comprising: means for receiving a plurality of programs provided from a plurality of external sources wherein one or more of the provided programs is individually identified; means, connected to the receiving means, for
30 storing at least one of the received and identified programs for subsequent retrieval; control means, connected to the receiving means and storage means, for providing communication and control; computer assisted means, connected to the control means, for generating a program schedule comprising program identities and associated time for sending one or more of the

stored programs to a remote site; and output means, connected to the control means and storing means, for sending program identities and programs to one or more remote sites, wherein the program identities are included in the program schedule and wherein the output means obtains one or more of the stored programs identified in the program schedule from the storing means to send to the remote sites.

5 In a further aspect, the present invention provides a method for packaging programs for delivery from an operations center to one or more cable headends, wherein programs are received from external sources and stored in a storage media at the operations center for subsequent transmission to each cable headend, comprising the steps of: receiving a plurality
10 of programs at the operations center which are provided from one or more external sources; identifying a first set of programs, the first set of programs comprised of one or more of the received programs; storing the first set of programs in a storage media for subsequent retrieval; generating a program list comprising the identities of one or more of the stored programs; determining a second set of programs, the second set of programs comprised of one or more of
15 the stored programs that are included on the program list; retrieving the second set of programs from the storage media; encoding the program list and retrieved programs for transmission; and transmitting the encoded program list and programs from the operations center to one or more cable headends.

In a still further aspect, the present invention provides a method of allocating bandwidth
20 to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of: selecting specific programs received from television programming sources; allocating a segment of the bandwidth to the specifically selected programs; and continuing said allocating step with additional selected programs until at least one of the following conditions occurs: all of said programs are allocated, all of said
25 bandwidth is allocated.

In yet another aspect, the present invention provides a method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of: prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels
30 including a high priority level and progressively lower priority levels; dividing said bandwidth so that each program category receives a segment of said bandwidth; allocating a portion of said segments of bandwidth to high priority level programs in each category; and continuing said allocating step with progressively lower priority levels programs until at least one of the

following conditions occurs: all of said programs are allocated, all of said bandwidth is allocated.

In a further aspect, the present invention provides a method of transmitting a plurality of programs to a cable headend, each of said plurality of programs corresponding to one of a plurality of categories, said method comprising the steps of: prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels; forming a plurality of signals, each of said signals comprising programs corresponding to a single priority level; appending a header to each of said signals, wherein said header identifies said priority level for a corresponding signal, thereby enabling recognition by said cable headend; dividing bandwidth so that each program category receives a segment of said bandwidth; allocating a portion of said segments of bandwidth to signals comprising high priority level programs in each category; continuing said allocating step with signals comprising progressively lower priority level programs until at least one of the following conditions occurs: all of the signals are allocated; and all of said bandwidth is allocated: and transmitting each of said headers and said corresponding signals to said cable headend.

In a further aspect, the present invention provides a method of transmitting a plurality of programs in a first amount of bandwidth for reception by a first cable headend, and in a second amount of bandwidth for a second cable headend, said method comprising the steps of: prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels; allocating said first amount of bandwidth to high priority level programs in each category; continuing said first amount of bandwidth allocation step with said progressively lower priority level programs until at least one of the following conditions occurs: all of the programs are allocated; all of said first amount of bandwidth is allocated; allocating said second amount of bandwidth to high priority level programs in each category; continuing said second amount of bandwidth allocation step with said progressively lower priority level programs until at least one of the following conditions occurs: all of the programs are allocated; all of said second amount of bandwidth is allocated; transmitting the programs in said first amount of bandwidth to said first cable headend; and transmitting the programs in said second amount of bandwidth to said second cable headend.

In a still further aspect, the present invention provides a computer assisted packaging system for allocating bandwidth to a plurality of programs, each of the programs corresponding

to one of a plurality of categories, comprising: a central processing unit for selecting programs received from television programming sources: a delivery control processor unit connected to said central processing unit; and a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to said selected programs and continuing to allocate segments of bandwidth until either all the programs are allocated bandwidth or all the bandwidth is allocated.

In another aspect, the present invention provides a system for allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, comprising: an operations center comprising a computer assisted packaging system; said computer assisted packaging system comprising: a central processing unit for assigning priority levels to the programs by assigning to each of the programs a priority level from a plurality of priority levels, said plurality of priority levels includes a high priority level and progressively lower priority levels and also for dividing the bandwidth so that each program category receives a segment of the bandwidth; a delivery control processor unit connected to said central processing unit; and a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to the programs in each of the categories with highest of said priority levels and continuing to allocate said segments of bandwidth to progressively lower priority level programs in each of the categories.

In a further aspect, the present invention provides an apparatus for use in an operations center for a video-audio program delivery system, wherein the operations center receives a plurality of programs from external sources, stores one or more of the received programs, generates a program schedule, and causes program identities and at least one of the stored programs to be sent to one or more remote sites, comprising: means for receiving a plurality of programs provided from a plurality of external sources comprising a holder means, connected to storing means, for holding the received plurality of program signals before making the program signals available to the storing means, wherein one or more of the provided programs is individually identified; means, connected to the receiving means, for storing at least one of the received and identified programs for subsequent retrieval; control means,

connected to the receiving means and storing means, for providing communication and control; computer assisted means, connected to the control means, for generating a program schedule comprising program identities and associated time for sending one or more of the stored
5 programs to a remote site; output means, connected to the control means and storing means, for sending program identities and programs to one or more remote site, wherein the program identities are included in the program schedule and wherein the output means obtains one or more of the stored programs identified in the program schedule from the storing
10 means to send to the remote sites.

In a still further aspect, the present invention provides an operations center which receives video programs, stores the video programs in a file server, generates a schedule, and outputs the schedule as well as scheduled programs to remote sites, the operations center
15 comprising: a video program receiver, comprising at least one of an encoder, converter and input buffer; a first file server, operably connected to the video program receiver, having a storage capacity sufficient to store two or more received video programs and having an output connected to one or more distribution ports; a system controller
20 containing a processor, connected to the first file server; a computer assisted packaging device, in communication with the system controller, running program packaging software and comprising a scheduler; and output equipment, operably connected to the one or more distribution ports and system controller, comprising at least one of an output buffer
25 and decoder, and wherein the program packages and schedule determined by the computer assisted packaging device are passed to the remote sites.

In a further aspect, the present invention provides a computer assisted packaging system for generating program control information,
30 packaging programs and for allocating bandwidth to a plurality of programs comprising: a multiplexer for receiving at least one program signal and at least one program control signal and for allocating a portion

of said segments of bandwidth to said selected programs; a delivery control processor unit connected to said multiplexer, whereby said program signals and said program information signals are multiplexed by said multiplexer; and a central processing unit connected to said delivery control processor unit, whereby said delivery control processor unit receives commands from said central processing unit.

In a still further aspect, the present invention provides a computer assisted packaging system for allocating bandwidth to a plurality of programs, each of the programs corresponding to one of a plurality of categories, comprising: a central processing unit for selecting the programs and also for dividing the bandwidth so that each of the program categories receives a segment of the bandwidth; a delivery control processor unit connected to said central processing unit; and a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to the selected programs in at least one of the categories.

In a further aspect, the present invention provides a system for allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, comprising: an operations center comprising a computer assisted packaging system; said computer assisted packaging system comprising: a central processing unit for selecting programs received from television programming sources; a delivery control processor unit connected to said central processing unit; and a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to the selected programs.

In a still further aspect, the present invention provides a method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of: selecting specific programs received from television programming sources; allocating a segment of the bandwidth to the specifically selected programs; and continuing said allocating step with

additional selected programs until at least one of the following conditions occurs: all of said programs are allocated, all of said bandwidth is allocated, wherein the step of allocating includes dynamically changing the bandwidth allocation over time, and wherein the step of dynamically
5 changing the bandwidth allocation over time includes varying a compression ratio of at least one of the selected programs.

In a further aspect, the present invention provides a method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising
10 the steps of: selecting specific programs received from television programming sources; allocating a segment of the bandwidth to the specifically selected programs; and continuing said allocating step with additional selected programs until at least one of the following conditions occurs: all of said programs are allocated, all of said bandwidth is
15 allocated, wherein the step of allocating includes dynamically changing the bandwidth allocation over time, and wherein the step of dynamically changing the bandwidth allocation over time includes allocating bandwidth to at least one of the selected programs based on an amount of changes within one of the selected programs over time.

20 In a further aspect, the present invention provides a method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of: selecting programs received from television programming sources; and allocating bandwidth to the categories from whence the
25 selected programs correspond, wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming, and wherein said bandwidth allocation is dynamically changed on demand.

In a still further aspect, the present invention provides a method of
30 allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of: selecting programs received from television programming

services; and allocating bandwidth to the categories from whence the selected programs correspond, wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming, and wherein said bandwidth allocation
5 is dynamically changed based on consumer demand.

In a further aspect, the present invention provides a method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of: selecting programs received from television programming
10 sources; and allocating bandwidth to the categories from whence the selected programs correspond, wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming, and wherein said bandwidth allocation is dynamically changed in real-time.

15 In a further aspect, the present invention provides a method of transmitting programs to a plurality of transponders, said method comprising the steps of: prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower
20 priority levels; forming a plurality of signals, each of said signals comprising programs corresponding to a single priority level; allocating a portion of bandwidth to signals comprising high priority level programs; dynamically changing bandwidth allocation for at least one of said signals; continuing said allocating step with signals comprising
25 progressively lower priority level programs until at least one of the following conditions occurs: all of the signals are allocated; all of said bandwidth is allocated; and transmitting said plurality of signals to said plurality of transponders so that none of said transponders receives more than one of said signals.

30 The present invention is not only able to operate in the digital environment but introduces many new features to television program delivery.

It is an object of this invention to provide a system for efficiently organizing television programs to be offered to viewers.

It is an object of this invention to provide an operations center for a television program delivery system.

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It is an object of this invention to provide an operations center for a television program delivery system which can gather television programming in a variety of formats, package the programs, and deliver the packaged programs.

5 It is an object of this invention to provide an operations center for a program delivery system which presents programming viewing options to the consumer through a user friendly interface which allows the consumer to easily select from among the many program choices.

10 It is an object of this invention to provide an operations center that is capable of handling video/audio programming in different formats.

It is an object of this invention to provide an operations center capable of offering interactive television, video on demand, high definition television (HDTV) and/or other advanced television features.

15 It is an object of this invention to provide an operations center that can control software and program features at the cable headend.

It is an object of this invention to provide an operations center that can control and if necessary reprogram set top terminals.

It is an object of this invention to provide an operations center for a digital program delivery system.

20 It is an object of this invention to provide an operations center that designs program menus.

It is an object of this invention to provide an operations center that uses data on programs viewed to create or aid in the selection of program line-ups.

25 It is an object of this invention to provide a computer assisted program packaging system for a television program delivery system.

These and other objects and advantages of the invention will become obvious to those skilled in the art upon review of the following description, the attached drawings and appended claims.

30

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a diagram of the primary components of the television delivery system.

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Figure 2 is a block diagram of the primary components of the operations center.

Figure 3a is a schematic of the components of a receiver with a single connection to the holder.

5 Figure 3b is a schematic of a receiver with multiple connections to the holder.

Figure 4 is a schematic of the system controller.

Figure 5 is a schematic of the output equipment.

Figure 6 is a diagram of the computer assisted packaging system.

10 Figure 7 is a schematic of one embodiment of the operations center.

Figure 8 is a schematic of an alternative embodiment of the operations center, which includes encryption and scrambling of signals.

15 **DISCLOSURE OF INVENTION. BEST MODE FOR CARRYING OUT**
INVENTION. INDUSTRIAL APPLICABILITY. AND DETAILED
DESCRIPTION

A **Television Program Delivery System Description**

1. **Introduction**

20 Figure 1 shows the present invention as part of an expanded cable television program delivery system 200 that dramatically increases programming capacity using compressed transmission of television program signals and video storage. Developments in digital bandwidth compression technology now allow much greater throughput of television
25 program signals over existing or slightly modified transmission media. Video file servers provide greater storage capacity and quicker retrieval of stored programs than most other storage media. The program delivery system 200 shown provides subscribers with a user friendly interface to operate and exploit the increase in current program delivery capability.
30 In addition, video on demand of the subscriber and near video on demand is possible with this new delivery system.

Subscribers are able to access an expanded television program package and (with the appropriate set top terminal and remote) view selected programs through a menu-driven access scheme that allows

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each subscriber to select individual programs by sequencing a series of menus. The menus are sequenced by the subscriber using simple alpha-numeric and iconic character access or moving a cursor or highlight bar on the TV screen to access desired programs by simply pressing a single
5 button (or by pressing the actual two or more digit numeric number assigned to a selection). Thus, with the press of a single button, the subscriber can advance from one menu to the next. In this fashion, the subscriber can sequence the menus and select a program from any given menu. The programs are grouped by category so that similar program
10 offerings are found on the same menu.

2. Major Delivery System Components

In its most basic form, the system uses a program delivery system 200 in conjunction with a conventional concatenated cable television system 210. The program delivery system 200 generally includes (i) at
15 least one operations center 202, where program packaging and control information are created and then assembled in the form of digital data, (ii) a digital distribution system, where the digital data is compressed, combined/multiplexed, encoded, and mapped into digital signals as necessary for satellite 206 or terrestrial 218 transmission to the cable
20 headend 208, (iii) a cable headend or remote site 208 for receiving and distributing program signals, and (iv) a set of in-home set top terminals 220 and remote controls 219. The program delivery system 200 transports digital signals or analog signals to the cable headend 208 via satellite 206 or terrestrial 218 link. The signals are then transmitted by
25 the cable headend through a concatenated cable television system 210. Within the cable headend 208, the received signals may be decoded, demultiplexed, managed by a local central distribution and switching mechanism (such as network controller or network manager 214), stored by a file server 215, combined and then transmitted to the set top
30 terminal 220 located in each subscriber's home over the cable system 210. Although concatenated cable systems 210 are the most prevalent transmission media to the home, telephone lines, cellular networks, fiberoptics, Personal Communication Networks satellite communication,

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and similar technology for transmitting to the home can be used interchangeably with this program delivery system 200.

The delivery system 200 generally has a reception region 207 with decompression capability. This capability is performed by a decompressor housed within a set top terminal 220 or at the cable headend 208. The decompressor remains transparent from the subscriber's point of view and allows any compressed signal to be decompressed. The decompressed video signals are usually simultaneously converted into analog signals for television display. Such analog signals include NTSC formatted signals for use by a standard television. Various digital compression techniques such as MPEG may be used with the system 200. The subscriber interface is a device with buttons located on the set top terminal 220 or on a portable remote control 219. In the preferred system embodiment, the subscriber interface is a combined alpha-character, numeric and iconic remote control device 219, which provides direct or menu-driven program access. The preferred subscriber interface also contains cursor movement and go buttons as well as alpha, numeric and iconic buttons. This subscriber interface and menu arrangement enables the subscriber to sequence through menus by choosing from among several menu options that are displayed on the television screen. In addition, a user may bypass several menu screens and immediately choose a program by selecting the appropriate alpha-character, numeric or iconic combinations on the subscriber interface.

25 3. Operations Center Overview

The operations center 202 performs two primary services, packaging television programs for transmission and generating the program control information signal. At the operations center 202, many television programs are received from external program sources in either analog and digital form. Figures 1 and 2 show an embodiment of the operations center receiving signals from various external sources 212. Examples of the external program sources are networks, sporting events, children's programs, specialty channels, news, advertisements, infomercials or any other program source that can provide audio or visual

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signals. Once the programs are received from the external program sources 212, the operations center 202 digitizes (and preferably compresses) any program signals received in analog form. Preferably, the operations center 202 also maintains an internal storage of programs.

5 The internally stored programs may be in analog or digital form and stored on permanent or volatile memory sources, including magnetic tape or RAM or a video file server system.

Subsequent to receiving programming, the operations center 202 packages the programs into the groups and categories which provide the

10 optimal marketing of the programs to remote sites, cable headends, and subscribers. For example, the operations center 202 may package the same programs into different categories and menus for weekday, prime-time viewing and Saturday afternoon viewing. Also, the operations center 202 packages the television programs in a manner that enables both the

15 various menus to easily represent the programs, and the subscribers to easily access the programs through the menus. These packets of programs, menus and control information are then transmitted to cable headends or remote sites 208. Figure 1 shows that cable headends 208 may be serviced by the operations center 202 using satellites 206, one-

20 way terrestrial links (not shown), and two-way terrestrial links 218. A return path from the cable headend 208 to operations center 202, such as one-way terrestrial link 217 or two-way terrestrial link 218, carries cable headend data to the operations center 202.

With respect to Figures 1 and 2, the scheduling or packaging

25 determinations for the digital signals is typically performed at the operations center 202 by computer assisted packaging equipment (CAP) 316. The CAP system 316 normally includes at least one computer monitor, keyboard, and mouse. A packager packages the signals by entering certain information into the CAP 316. This information includes

30 the date, time slot (if necessary), and program category of the various programs. The packager and the CAP 316 utilize demographic data, buy data, and ratings in performing the packaging tasks. After the packager selects the various programs from a pool of available programs and inputs the requisite information, the packager, with assistance from the CAP

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316, can select the price and allocate satellite transponder space or a terrestrial link for the various programs. After the process is complete, the CAP 316 displays draft menus or program schedules that correspond to the entries of the programmer. The CAP 316 may also graphically display allocation of satellite transponder space. The packager may edit the menus and satellite transponder allocation several times until satisfied with the programming schedule. During the editing, the packager may direct the exact location of any program name on a menu with simple commands to the CAP 316.

10 The packaging process also accounts for any groupings by satellite transponder which are necessary. The operations center 202 may send different groups of programs to different cable headends 208 and/or set top terminals 220. One way the operations center 202 may accomplish this task is to send different program packages to each satellite transponder. Each satellite transponder, or set of transponders, then relays specific program packages to specific cable headends 208 and/or set top terminals 220.

Alternatively, the operations center 202 may send programs and control information by satellite for reception by many remote sites. Customizing may still be performed with this technique. Using this technique, customized control signals directed at specific remote sites are sent with the programs. The customized control signals inform the remote site of programs to accept and store (and those programs to ignore). The allocation of satellite transponder space is an important task performed by the operations center 202. This customized grouping of programs for a particular remote site is more easily accomplished using direct terrestrial links, such as ATM (Asynchronous Transfer Mode) or direct leased lines.

20 The operations center 202 may also "insert" customized directions for filling local available program time in the packaged signal to enable local cable and television companies to fill the program time with local advertising and/or local programming, as well as customized menus.

After the CAP 316 determines the packages of programs, it creates a program control information signal to be delivered with the program

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package to the cable headend 208 and/or set top terminal 220. The program control information signal contains a description of the contents of the program package (including program lineup information and categories), commands to be sent to the cable headend 208 and/or set
5 top terminal 220, menu information, scheduled transmission times and other information relevant to the signal transmission.

In addition to packaging the signal, the operations center 202 employs digital compression techniques to increase existing transmission capacity. A number of digital compression algorithms currently exist
10 which can achieve the increase in capacity and improved signal quality desired for the system. The algorithms generally use one or more of three basic digital compression techniques: (1) within-frame (intraframe) compression, (2) frame-to-frame (interframe) compression, and (3) within carrier compression. Specifically, in the preferred embodiment,
15 the MPEG 2 digital data format (which includes a compression method) is used. After digitizing, the signals are combined (multiplexed) and encoded. The combined signal is subsequently transmitted by terrestrial links or to various uplink sites 204.

There may be a single uplink site 204 or multiple uplink sites
20 (represented by 204', shown in phantom in Figure 1) for each operation center 202. The uplink sites 204 may either be located in the same geographical place or may be located remotely from the operations center 202. Once the composite signal is transmitted to the uplink sites 204, the signal may be multiplexed with other signals, modulated,
25 upconverted and amplified for transmission over satellite. Multiple cable headends 208 may receive such transmissions and the transmissions may be customized for specific headends as described above.

In addition to multiple uplinks, the delivery system 200 may also contain multiple operations centers. The preferred method for using
30 multiple operations centers is to designate one of the operations centers as a master operations center and to designate the remaining operations centers as slave operations centers. In this configuration, the master operations center coordinates various functions among the slave operations centers such as synchronization of simultaneous transmissions

and distributes the operations workload efficiently. Alternatively, the operations center 202 may operate independently.

4. Cable Headend or Remote Site

After the operations center 202 has packaged and transmitted the program signals, the cable headend or remote site 208 receives and further processes the signals before they are relayed to each set top terminal 220. Each cable headend site is generally equipped with multiple satellite receiver dishes and terrestrial links. Each dish is capable of handling multiple transponder signals from a single satellite and sometimes from multiple satellites.

With reference to Figure 1, as an intermediary between the set top terminals 220 and the operations center 202 (and uplink site 204), the cable headend 208 performs two primary functions. First, the cable headend 208 acts as a distribution center, or signal processor, by relaying the program signal to the set top terminal 220 in each subscriber's home. Second, the cable headend 208 acts as a network controller or manager 214 by receiving information from each set top terminal 220, responding to the set top terminal, and passing such information on to an information gathering site such as the operations center 202. Thus, the cable headends 208 may be a conduit to an operations center 202 in an operations center 202 video on demand system, where the cable headend 208 simply passes video on demand requests to the operations center 208. The operations center 208 responds to the video on demand request by sending the requested program to the cable headend 208 for distribution to the requesting subscribers.

Also, the local cable headends 208 are not constrained to showing only programs transmitted from the operations center 202. New set top converters will incorporate both digital and analog channels. Therefore, the cable headend 208 may combine analog signals with the digital signals prior to transmitting the program signals to the set top terminals 220. Further, the cable headends 208 may store programs in local file servers 214 for later distribution. The cable headends 208 may also receive programs from other sources, possibly from other operations centers.

B. Detailed Description of Operations Center

Figure 2 is a high-level block diagram of the operations center 202. The operations center 202 has five primary components: a receiver 300, a storage device 308, a system controller 312, computer-assisted packaging system (CAP) 316, and output equipment 320. The receiver 300 receives multiple video/audio programs and advertisements 212 from external sources (not shown). The programs and advertisements may be in various signal formats and video formats (e.g., HDTV). The receiver 300 is under the control of the system controller 312. Preferably, there is a two-way communication link between the system controller 312 and the receiver 300. The storage device 308 receives programs and advertisements 212 either directly from the receiver 300 or through the optional holder 304. The storage device 308 stores some or all of the received programs and advertisements 212.

Although not required for the functioning of the system, it is preferred that the storage device also be capable of spooling the programs and advertisements 212 stored. The storage device 308 spools the programs and advertisements 212 preferably directly to the output equipment 320. As with the receiver 300, the storage device 308 is preferably under the control of the system controller 312. A video file server 215 with a redundant array of independent disks (RAID) is the primary and preferred hardware component for the storage and spooling device 308. A simple example of a video file server is described in U.S. Patent 5,262,875 entitled AUDIO/VIDEO FILE SERVER INCLUDING DECOMPRESSION/ PLAYBACK MEANS, issued on November 16, 1993.

The video file server hardware and software acts as a bulk storage and control center capable of spooling video. The file server stores hundreds of hours of programming and is able to control or interface with many distribution ports or distributions servers. Output capacities of thousands of configurable ports are possible. The file servers may be built modularly for upgrading. Configurable storage space, local inventory and local configuration control is preferred. Other large scale storage

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devices capable of storing video and audio may be used with the present invention.

5 The output equipment 320 receives programs and data from either the storage device 308 or the system controller 312. The output equipment 320 must receive the programs and data and determine the proper output connection to send the programs and data to remote sites 208, such as cable headends. Since, in the preferred embodiment, the output equipment 320 handles several video inputs and several outputs to remote sites 208, equipment for quality and flow control 340 are used by
10 the output equipment 320 in the preferred embodiment. The CAP 316 communicates with the system controller 312 and determines how the final product of the operations center 202 (the programs and other information) will be packaged. In order to determine how the programs should be packaged, the CAP 316 can use a variety of different
15 components.

In Figure 2, the CAP 316 uses three components: a scheduler 324, a market research component 328 and an ad insertion component 332. In addition, to perform its functions, the CAP 316 utilizes databases 336. The scheduler component 324 creates the program lineup information
20 necessary to determine what programs will be made available to which remote sites, when the programs will be made available to viewers (start times or video on demand periods), and schedules when the remote sites will receive the packaged product from the operations center 202. The market research component 328 receives and analyzes data on viewer
25 requests for programs, program ratings, and the like to assist the scheduler component 324 in formulating a program lineup. The ad insertion component 332 determines what advertisements located at the operations center 202, as well as what advertisements located locally will be inserted into the program lineup. All three components, the
30 scheduler 324, market research component 328, and ad insertion component 332, utilize databases 336 as needed to perform their functions. In addition, information received from remote sites 208, such as cable headends, are received by the CAP 316 in operations center 202. The CAP 316 is equipped with a port to receive signals from cable

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headends 208. For example, cable headend signal 344 is shown in Figure 2 arriving at the operations center 202. This signal which contains buy data (program watched data), as well as cable franchise information, is generally processed by the CAP 316 and information is stored as necessary in the databases 336.

The system controller 312 constantly monitors all components in the system and ensures the smooth operation of the operations center 202. The optional holder 304 may be utilized to perform any preprocessing of signals prior to storing the signals in the storage device 308. As the number of incoming program and advertisement signals 212 increase, the holder 304 functions become more important. In many instances, the holder 304 may simply perform the function of buffering signals prior to reception by the storage device 308. With the above components, the operations center 202 is capable of receiving multiple program and advertisement signals 212, processing the signals and packaging the signals to be sent to one or more remote sites 208. Also, the operations center 202 is capable of handling real-time program feeds and passing the feeds quickly through the receiver 300, storage device 308 and output equipment 320 so that the programs can be quickly received by subscribers.

Figures 3a and 3b show two alternative embodiments for the receiver 300 and holder 304 combination of components. Figure 3a shows a multiplexing receiver with a single connection to the holder 304 and Figure 3b shows a non-multiplexing receiver with multiple connections to the holder 304.

Figure 3a shows the receiver 300 receiving satellite signals 348 using integrated receiver components (IRC) 356 and integrated receiver demodulators (IRD) 360. The receiver 300 is also shown receiving terrestrial or land line signals 352. In addition, the receiver 300 is shown receiving NTSC formatted video signals, MPEG formatted video signals and ATM electronic signals containing MPEG formatted video signals. Since it is preferred that the holder 304 receive MPEG formatted video signals, the receiver 300 has the appropriate hardware to convert the received signals to MPEG video format. The holder 304

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may also receive and store ATM signals, which is provided for by this receiver 300. More particularly, the receiver 300 has an MPEG encoder 364 which encodes NTSC video formatted signals into MPEG formatted video signals. The receiver 300 receives MPEG signals and buffers them, if necessary, using a buffer 368 as shown. For signals received in ATM signal format, the receiver 300 may either convert the ATM signal to a simple MPEG video data format signal using an ATM to MPEG converter 372 or it may simply buffer the signal using a buffer 376 prior to delivering the signal to the holder 304.

10 The receiver 300 obtains instructions from the system controller 312 which tells the receiver 300 which signals need to be passed on to the holder 304 and what format each signal must be in when it reaches the holder 304. Following the reception and proper conversion of the signals to correct format, the receiver 300 multiplexes the signals using a
15 mux device 380. The multiplexing device 380 combines the signals as necessary to place them on a bus or other similar type of connection to the holder 304. It is preferred that the holder 304 be capable of receiving multiple program signals from the receiver 300 at the same time. The holder 304 is then expected to buffer the signal and perform
20 any preprocessing on the signal prior to delivering the programs to the storage device 308.

Some of the preprocessing that may be done to the signal by the optional holder 304 includes: buffering, organizing of the video signals, calculations for interleaving (disk interleaving) the signals, encrypting of
25 digital program signals such as MPEG, conversion of ATM to MPEG, or MPEG to ATM, and scrambling of programs. Thus, it is possible that some of the functions of the receiver 300 may be performed at the holder 304 or that the receiver 300 and holder 304 may share some functions, such as conversions from ATM to MPEG.

30 The holder 304 may organize the programming video data in such a manner that it is more easily stored in the storage device 308. This would include determining appropriate file locations in the storage device 308 for specific programs. This type of organizing of the programming data may include calculations of how the data may be

interleaved in the storage device 308 so that the holder 304 may send the information to the storage device 308 in the appropriate manner to effectuate the interleaving. Various other preprocessing of the program signals may be conducted by the holder 304. Those skilled in the art will
5 realize that the processing described may be done by the holder 304, or may be performed by shared processing responsibilities between the receiver 300, holder 304, and storage device 308.

The preferred hardware component for the holder 304 is a video file server system capable of handling multiple incoming video signals.
10 Preferably, this video file server has less storage capacity than the storage device 308.

Figure 3b shows an alternative embodiment of the receiver 300 and holder 304. The reference numerals in Figure 3b carry the same meaning as in Figure 3a. In Figure 3b, the receiver 300 does not have a
15 multiplexer and the holder 304 is capable of receiving multiple program signals through multiple ports 384. Those skilled in the art will recognize when building the system that, depending on the specific components, various additional buffering devices may be necessary for the smooth operation of the receiver 300, holder 304 and storage 308.

Figure 4 is a diagram of the system controller 312. The system controller 312 has seven parts: a computer network server 400, a receiver controller 404, a holder control 408, a storage control 412, an output equipment control 416, a CAP interaction module 420, and an executive 424. In the preferred embodiment, the system controller 312
25 is made up of a mini-computer or powerful PC acting as a computer network server 400 and six PCs or similar computing devices with additional hardware as necessary. Each PC and associated hardware performs the functions of the six remaining parts of the system controller 312. One large processor may be configured to perform all the
30 functions of the system controller 312.

The executive component 424 provides monitoring of the system controller's 312 status, as well as overall monitoring of the operations center 202 and provides information and statistics on the functioning of the operations center 202. This executive system 424 has various

warning devices for informing personnel of problems in the operations center 202 and generates various reports on the functioning of the operations center 202. Preferably a windows-based graphical user interface capable of performing executive information system functions is provided at the executive component 424. A PC set up with multiple input ports and output ports and a printer can serve as the executive component 424.

The receiver controller 404 controls the receiver 300 by sending various control signals to the receiver 300. These include the selection of various input feeds to the receiver 300, the timing of the feeds, the format of the feeds and any conversion of formats that must be performed by the receiver 300. The receiver controller is preferably a PC with at least one connection to the receiver 300.

The holder control 408 controls the holder 304 through instructions informing the holder 304 of: time to buffer programs, names of programs, various directory information, event numbers for program events, and various tags. The holder control 408 also provides instructions to the holder 304 on preprocessing of the program signals if necessary. Preferably, a processor with memory and a connection to the holder 304 is used for the holder control 408.

The storage control 412 provides control information to the storage device 308 primarily informing the storage device 308 of which stored program files and on what schedule to output or spool the stored programs to the output equipment 320. The storage control 412 may also provide the storage device 308 with the program control information from the CAP 316 and various other information which instructs the storage device 308 in the method of packaging the stored programs for output to one or more remote sites. In certain instances, it is advantageous for the storage device 308 to store the program control information or other data sent by the storage control component 412.

The output equipment control 416 communicates configuration information to the output equipment 320, instructing the output equipment 320 on its proper configuration to accomplish the multiple output tasks at any given time. The output equipment control 416 closely

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monitors the quality and flow control 340 of the output equipment 320 to ensure that the packaged programs arrive at the remote sites 208. If necessary, the output equipment control 416 may send the program control information from the CAP 316 to the output equipment 320, or
5 simple scheduling data may be sent directly to the output equipment 320 by the output equipment control 416 thereby bypassing the storage device 308. The CAP 316 and output equipment 320 can work together, for example, to schedule times and/or timing for transmission of program packages and control information.

10 In situations where the operations center 202 is supporting video on demand requests from subscribers, it may be more efficient for the output equipment control 416 to receive the program control information from the CAP interaction component 316 and send it to the output equipment 320 directly. Also, it is preferred that the output
15 equipment control 416 instruct the output equipment 320 on video data format and signal format for any particular program package.

The CAP interaction module 420 provides the CAP 316 with necessary information from the other components of the operations center 202, enabling the CAP 316 to perform its functions. Specifically,
20 the CAP interaction module 420 provides the CAP 316 with verification of programs received and programs available in storage 308 for scheduling and packing. In return, the CAP interaction module 420 receives from the CAP 316 scheduling information (which may or may not be embedded in program control information signals) including any ad insertions. It is
25 preferred that the CAP 316 determine as far in advance the programs and the video format needed for those programs in order to satisfy the packaging of programs to the remote sites. Specifically, it is preferred that the CAP 316 inform the CAP interaction module 420 in advance that a particular program, such as Cheers, will be needed and that it is
30 preferred if the program Cheers is available in the storage device 308 in two formats, an ATM format and a simple MPEG format. In this manner the CAP interaction module 420 can inform the various other components of the system control 312 and ensure in advance that the program Cheers is available on the storage device 308 in both needed

formats. Preferably, a multipin cable or bus and ports are used to communicate between the CAP 316 and the CAP interaction module 420.

The CAP interaction module 420 must be able to quickly respond to subscriber video on demand requests which are being processed by the CAP 316. These video on demand requests may be received by the operations center 202 directly from subscribers or through the cable headend 208. To properly perform its functions, the CAP interaction module 420 must communicate to the other components of the system controller 312 the needs of the CAP 316, and must inform the CAP 316 of information that has been obtained by the various other components of the system controller 312. It is preferred that this communication between components of the system controller 312 be performed using the computer network server 400. However, it is possible that the components may communicate with each other through other means. For example, either through the executive 424 or through direct computer connections.

Figure 5 is a schematic of the output equipment 320. The preferred output equipment 320 generally has six primary components: an output command and control module 500, a quality control module 504, an MPEG decoder 508, signal buffers 512, MPEG to ATM converter 516, and flow control modules 520.

The output command and control module 500 receives output control 524 from the system controller 312. It can also receive information 540 from the storage device 308 or file server, about the file server, through port 528 if necessary. This information may include the rate of flow of information from the storage device 308 to the output equipment 320. The output control signal 524 from the system controller 312 informs the output command and control module 500 of the electronic configuration needed for the packaged program outputs. This information would include data such as, that an MPEG signal being received from the storage device 308 with a particular header needs to be converted into NTSC video format using MPEG decoder 508. The output command and control module 500 communicates with the output equipment control component 416 of the system controller 312. The

output command and control module 500 informs the output equipment control 416 of any quality and flow control problems.

5 The quality control module 504 checks the quality of the outgoing signals from the output equipment 320. To do so, the quality control module 504 is connected to the outputs of the MPEG decoder 508, signal buffers 512 and the MPEG to ATM converter 516 (an example of one such connection is shown at 573). It is preferred that the quality control module 504 use computer check equipment 532, set top terminals 220, and monitors 536 to perform its quality control functions. The computer
10 check equipment 532 runs algorithms on the received data to try and determine that the quality of the video data is acceptable for subscribers. Those skilled in the art are aware of several algorithms available for this automatic computer check. The set top terminals 220 and monitors 536 work in unison to create a manual visual check. The set top terminals
15 220 convert the various signals which will be outputted by the output equipment 320 and display those signals on the monitors 536. Various combinations of multiple set top terminals 220 and multiple monitors 536 may be used to perform a random or continual manual visual check on the output equipment 320 signals.

20 Figure 5 shows that the output equipment 320 receives a file server signal 540 which contains programming (video and audio and advertisements) preferably spooled from the storage device 308 (a file server). Figure 5 shows that four possible output signals from the output equipment 320. Moving from left to right, the first one is an ATM signal
25 544 which is buffered and sent out in ATM format. A signal buffer 512 is used along with flow control 520 to monitor the ATM signal. The flow control 520 monitors the flow of the signal through the signal buffer 512 and signals the output command and control module 500 (connection now shown, but an example of one such connection is shown at 572) if
30 the flow is too fast or too slow.

Generally, the ATM signal 544 has an MPEG encoded program within the signal. This ATM signal 544 is then output either to an ATM system 548 or a satellite uplink 552.

Moving to the second signal, an MPEG signal 556 is received by an MPEG to ATM converter 516 and flow control 520. The signal 556 is converted to an ATM format by converter 516 and the flow of the signal 556 is checked by flow control 520. Again, the flow control 520 reports to the output command and control module 500 any flow problems (connection not shown for simplicity). This converted signal is either sent to ATM system 548 or satellite uplink 552.

The next example, third from the left, is an MPEG signal 560. This MPEG signal 560 is simply buffered by signal buffer 512 and checked by flow control 520. The signal 560 is then sent through the output equipment to either a satellite uplink site 552 or terrestrial links 564.

The fourth signal, MPEG signal 568, is processed through an MPEG decoder 508 and flow control 520. Following the conversion, an NTSC signal is output either to a terrestrial link 564 or a satellite uplink 552. Again, the flow control 520 reports back to the output command and control 500. This is shown in this specific example by flow control signal 572. Similar connections are present in the buffer 512 and MPEG to ATM decoder 516.

Thus, with this configuration, the output equipment 320 can receive multiple program signals from the storage and spooling device 308 through the one signal 540 and port 528 shown. The programs on the signal 540 are processed through equipment such as signal buffers 512, MPEG decoder 508 and MPEG to ATM decoder 516. An output command and control module 500 monitors the output equipment 320, checking the quality and flow using quality control module 504 and flow control 520. Depending on the number of signals that must be simultaneously processed, the output equipment 320 may need a much larger capacity and many of the components shown or similar components may be duplicated to meet the need of the greater output of signals. In addition, the output equipment 320 may also be configured to handle analog scrambling and digital decryption. This is described subsequently in reference to Figure 8.

Figure 6 is a diagram of the routines which make up the CAP 316 and the attached databases 336. The CAP 316 has a main program 600

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and main program interface 604 which control the software and hardware of the system. Databases 336 are accessed by the main program 600 or the subroutines as necessary. Various types of memory devices may be used to store the data that is necessary for the system.

- 5 The databases contain information such as cable franchise, programs purchased or watched, advertisements available, menu templates, transponders, programs available, programs received (by the operations center) billing and collection site information. The cable franchise information preferably includes detailed data on video storage space,
10 hardware configurations, set top terminals 220, types of services (e.g., NVOD, PPV, IPPV, VVOD, VOD) and signal and video data formats (and rates) required at each cable headend. In addition, source provider data (providers of programs and advertisements) including a directory of programs available and expected time of receiving programs is stored in
15 the databases 336. Data about the current operations center 202 transmission schedule, storage device 308 content and cable headend storage space allocated for special services or events is also maintained in the databases 336.

- The CAP 316 preferably uses a hardware system similar to the
20 system controller 312. That is, a network of PCs may be used with a computer network server. (See Figure 7 for another example of a possible hardware configuration.) The main program 600 is the nerve center and controls the subroutines. The main program 600 may be located either at a computer network server or at a PC. Preferably, the
25 main program is stored in an instruction memory with certain portions of the program being available in RAM at any given moment. Various other hardware configurations may be used to run the CAP 316 and the main program 600.

- The CAP 316 must be capable of receiving outside signals from
30 remote sites or cable headends such as a signal including the video on demand request from the subscriber. In order to accomplish this, preferably the CAP 316 has a port (not shown) for receiving this cable headend data. In addition, the CAP 316 must receive and provide data to the system controller 312. This is performed by the main program 600

or main program interface 604. Thus, when the system controller 312 needs to send data or receive data from the CAP 316, it will query either the main program 600 or the main program interface 604. Preferably, a bus connection is provided between the system controller 312 and the
5 CAP 316.

The CAP 316 may receive information on incoming programs (such as title and length) from various sources. The information may be manually entered or the information may be received from the system controller 312 or directly from the external program sources 212. In the
10 preferred embodiment, either the receiver hardware 300 is used to obtain this information or separate communication hardware such as a modem or port (not shown) may be used by the CAP 316.

Although eleven subroutines are shown on Figure 6 for the CAP 316, it is possible to have additional features requiring more subroutines or to
15 eliminate certain features and have less subroutines. It is also possible to configure the system to use more or less subroutines for the same functions. As with the system controller 312, separate PCs may be used to perform one or more of the subroutines shown. An instruction memory holding computer program instructions, a processor for
20 executing stored computer program instructions and memory such as RAM may be used to effectuate the subroutines.

The eleven preferred subroutines shown on Figure 6 are: the packager data entry interface 608, the marketing research information interface 612, cable franchise 616, advertisement insertion 620,
25 generating and editing of menus 624, scrambling and encryption determiner 628, allocating transponder space 632, generating program schedule 636, video on demand request (from cable headend) 640, generating program control information 644, and billing 648. For the most part, these subroutines are capable of performing their functions
30 without interacting with the other subroutines once they have received all the necessary information and data needed to perform their processing function. However, several of the subroutines perform better or more optimally if they interface with other subroutines allowing dynamic changes in the processing. For example, program schedules can

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be automatically generated by the generating program schedule routine 636 and menus can be automatically generated by the generating and editing of menus routine 624. However, it is preferred that a person, a packager, interface with these routines through the packager data entry interface 608. This allows the packager to ensure proper customizing of menus and program schedules for a particular remote site. In the preferred embodiment, the eleven subroutines call upon each other as necessary to perform optimally.

The packager data entry interface 608 is preferably a windows-based graphical user interface which allows a packager to interact with the CAP 316. This interaction includes initiation of routines in the CAP 316, and initiation of reception or sending of information to the computer system controller 312 or remote sites (such as a cable headend signal 344 or the like). The packager data entry interface 608 allows the packager to analyze market research information, cable franchise information, advertisement insertion information, menus, allocation of transponder space, program schedules and billing. In this manner, a packager is able to manually customize menus and program lineups, including advertisements, to be sent to remote sites.

The market research information interface 612 receives data from remote sites, such as the cable headend signal 344. The market research information interface 612 includes the appropriate associated hardware to receive the signal. After receiving raw data on market research, the routine 612 processes the information and stores data as necessary in databases 336. This market research information is then used in its processed form to aid in the generating of program schedules and menus.

The cable franchise routine 616 also processes information received from remote sites, such as the cable headend signal 344. The cable franchise routine 616 processes the data received on cable headend (or remote site) configurations and analyzes the data. The analysis determines for each headend, among other things, how much video storage space is available, types of menus needed, and what type of signal format and video data format is needed. Also, the cable franchise routine 616 analyzes the type of set top terminals help determine the type of

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menus and number of menus that will be needed at a cable headend site. This type of data is then stored in the database 336 as cable franchise information. Although much of this data can be preprocessed, in certain instances the menu generation routine 624, program schedule routine 5 636 and program control information routine 644 may need to interact with the cable franchise routine 616 in order to determine exactly what data (control data, menus, and programs) to send to a particular cable headend. For example, if a cable headend already has a particular program stored in memory, there is no need for the operations center 10 202 to send the program.

The advertisement insertion routine 620 receives data from the system controller 312 on advertisements that are available to be inserted and their storage location in the storage (and spooling) device 308. The advertisement insertion 620 also receives information on the geographic 15 focus of the advertisement, the length of the advertisement, and information on when the advertisement should be inserted. The advertisement insertion routine 620 analyzes this type of data and stores part of the data in databases 336. As a program schedule is being generated by routine 636, the advertisement insertion routine 620 may 20 be used to determine the identity of ads to insert at locations in the schedule or data stream. If the advertisement insertion data has been sufficiently processed, the program schedule generation routine 636 may be able to obtain all needed information from databases 336. In addition, the advertisement insertion routine 620 may accept advertisements or 25 information on advertisements from external sources. It is preferred that all advertisements are stored in the storage device 308.

The generation and editing of menus routine 624 is an important routine, because it controls the menus seen by all the subscribers on their menu selection system. Menus can be either graphical displays or 30 simple displays of text. The menus can be stored in MPEG video data format, as graphical data, as ASCII data, text data or other suitable format. Menus and menu templates may be stored in database 336 for use by the CAP 316. The routine 624 must both create aesthetically pleasing templates for menus, as well as customizing the menus with the

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appropriate program names, descriptions, abstracts, and, if necessary, start times. When menus are transmitted and when menus will first be made available to the subscriber is determined by the scheduling routine 636. The exact location a program name appears on a menu can be critical in marketing the program to the public. Therefore, even though menus can be automatically generated based on marketing information, editing changes made by a packager are usually preferred. Depending on whether a particular cable headend is a video on demand cable headend, near video on demand cable headend, or other type of program provider to subscribers, affects the way the generating and editing of menus 624 is conducted. For example, if the cable headend provides video on demand capability, then the generating and editing of menus 624 can be performed for the most part automatically with reference to the routine on generating program schedules 636 only to determine when a video on demand program is scheduled to first be made available to subscribers. The only scheduling that is needed by a scheduler or scheduling routine 636 is the time that menu information and programs will be sent to a cable headend by the operations center 202 and when those menus and programs will first be made available to subscribers. However, other types of services provided to subscribers, such as near video on demand and simple broadcast, require the program scheduler 636 and generating and editing of menus routine 624 to operate in unison, interacting as necessary to determine and schedule exact start times for programs.

The scrambling and encryption determiner 628 receives program scheduling information from the generating of program schedule 636 and determines (using stored information on cable franchises in the databases 336) what format the incoming programs and advertisements should be stored at the storage (and spooling) device 308. If the scrambling and encryption determiner 628 determines that a particular program needs to be sent out in more than one format, it informs the system controller 312 through the main program interface 604. The system controller 312 then informs the receiver 300 which can adapt itself to store programs in one or more formats. In an alternative embodiment, the scrambling and encryption determiner 628 determines the scrambling or encryption

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method needed for a particular program and that information is passed on to the output equipment 320 through the main program interface 604 and the system controller 312. The output equipment 320 then configures itself to handle the appropriate scrambling and encryption before transmission. Scrambling and encryption is further detailed in reference to Figure 8 below.

Since the operations center 202 of the preferred embodiment will be sending some of its signals through satellite links, the CAP 316 allocates transponder space 632 on the satellites 206 and controls output through the output equipment 320 to accommodate the allocation of transponder space. The allocating of transponder space routine 632 receives data on transponder space available, as well as data about the cable franchises and the program schedules. The allocating transponder space routine 632 then analyzes this data and determines when a package (program control information signal along with the necessary programs) can be sent to a remote site using available transponder space. It is preferred that a packager analyze the allocation of transponder space using a graphical user interface with bar graphs or charts in colored format for quick visual checks. When necessary, the packager can reallocate transponder space using the allocating transponder space routine 632.

The generating program schedule routine 636 generates the lineup of programs, schedules which programs need to be sent to particular remote sites, and schedules the time that the programs need to be sent to the remote sites. With video on demand systems, particular program start times are less important. However, program lineups or program listings still need to be created and a time must be chosen for the programs or lineup to become first available to subscribers on a video on demand basis. To create the program lineup, the generating program schedule routine 636 uses marketing research information, cable franchise information, advertisement insertion information and entries from the packager data entry interface 608. Preferably, the program lineup is manually checked by the packager and changed as necessary to suit the needs of a particular remote site. Once the lineup is prepared.

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the generating program schedule routine 636 can determine which programs are not already available at the cable headend location and therefore need to be transmitted to the cable headend. Having determined the programs that must be transmitted, the generating
5 program schedule 636 can determine the rough length of the transmission time needed to transmit the programs and can schedule or estimate a time to transmit a program package (the programs along with the program control information) to the cable headend location. When
10 using transponder space, the allocating transponder space routine 632 is also involved in the process of determining when the transmission to the cable headend is scheduled.

Although the operations center 202 can handle video on demand requests that are received directly from subscribers via modem or other communication means, it is preferred that video on demand requests are
15 filtered or received from remote sites or cable headends 208. The video on demand request routine 640 must be connected with the appropriate reception equipment (such as a modem or multiplexer) to receive signals from either the cable headend 208 or subscribers in order to process these video on demand request signals.

20 Upon receipt of a video on demand request, the routine 640 determines whether the program is available for distribution and whether there is a link available to distribute the program. In alternative embodiments, the video on demand request routine 640 may also determine whether the subscriber or cable headend 208 is entitled to
25 receive the program and whether there are sufficient funds or credit for that subscriber or cable headend 208.

An important part of this routine is its ability to act in real time. It must receive the request, process it and have the program made available as soon as possible. Preferably this is done within seconds and no more
30 than a few minutes. However, in the preferred embodiment, the operations center 202 has sent to the cable headend location the first few minutes of video for any program the cable headend has available to the subscriber. This "leader video" or first few minutes of video is generally stored in a local file server at the cable headend 208. In this

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way, when the cable headend receives the subscriber request for video on demand, it is able to immediately spool out the program requested (the leader video) from its local file server 214 in the cable headend 208. The cable headend spools out several minutes of programming immediately to the subscriber fulfilling his request within seconds (or possibly within a second). While the subscriber is viewing the first few minutes of his program from the local file server 214, the transaction can occur between the cable headend 208 and the operations center 202 in which the operations center 202 provides the cable headend with the program requested by the cable headend subscriber. Upon receipt of the program from the operations center 202, the cable headend 208 can seamlessly spool out the remainder of the requested program to the subscriber. Generally, the cable headend 208 will receive and store all but the first few minutes of video from the operations center 202 in real time. When the prestored first few minutes of video expires, the cable headend 208 seamlessly switches to the recently received and stored video (without leader sequence). This entire transaction is transparent to the subscriber. As far as the subscriber knows, the entire movie was available at the cable headend.

20 In fulfilling these video on demand requests at the operations center 202, the video on demand request routine 640 may need the ability to interrupt other processing occurring at the operations center 202 in order to gain processing power and fulfill a video request as quickly as possible.

25 When most of the routines in the CAP 316 have completed their functions in relation to a particular cable headend, the generating program control information routine 644 begins its processing. This routine 644 creates the data signal which becomes the program control information signal and is sent to remote sites informing each remote site of its program lineup, menus that have been provided and any other control information that is needed either by the remote site 208 (such as cable headend) or subscriber. This program control information is preferably generated in advance and stored at the storage (and spooling) device 308 until needed by the output equipment 320. Alternatively, the

program control information can be stored in the databases 336 and sent through the system controller 312 to the output equipment 320, bypassing the storage (and spooling) device 308. In yet another embodiment, the program control information can be created in real time as it is needed to be sent out by the output equipment 320. Various data formats and signal formats
 5 may be used for the program control information signal. For a detailed frame format that may be used, please refer to the parent patent application, PCT/US93/11617 entitled OPERATIONS CENTER FOR A TELEVISION PROGRAM PACKAGING AND DELIVERY SYSTEM.

The billing routine 648 tracks the charges incurred by cable headends and by specific subscribers to cable headends. The billing routine 648 monitors video on demand requests made
 10 through video on demand request routine 640 and monitors the program control information signal created by the CAP (routine 644) to determine the charges incurred by remote sites 208, cable headends and subscribers. The billing routine 648 tabulates this information and stores it in the databases 336. In the preferred embodiment, the invoices are generated at an external collection system site (not shown) and the billing routine 648 periodically transmits the
 15 necessary tabulations to the collection system site. This may be performed by a modem utilizing telephone system or through ATM or terrestrial links between the billing routine 648 and the collection system site (not shown).

The billing routine 648 may also flag subscribers or cable headends which are delinquent and not entitled to receive any more packaged programs or services from the
 20 operations center 202. This flag of warning information may be provided to the other routines within the CAP 316. A PC with a modem may be used to perform the billing functions.

For a more detailed description of the CAP software and the information stored in the databases 336, see PCT/US93/11617 entitled OPERATIONS CENTER FOR A TELEVISION PROGRAM PACKAGING AND DELIVERY SYSTEM.

25 Using the described components, software, and databases the operations center 202 is able to perform the following tasks: receive and fulfill VOD requests (using CAP 316 and/or system controller 312), receive multiple program signals (using receiver 300), select a subset of the received programs on the program signals (using instructions from the system controller 312 or CAP 316), store the subset of the received programs (using the storage device 308), generate
 30 a list of programs (using the CAP 316), determine whether a remote site needs programs (or portions of programs for operations center VOD) on the program list (using the CAP 316), schedule the programs on the program list to be made available to subscribers and schedule a time for a transmission to a remote site (using the CAP 316), allocate bandwidth or transponder

space (using the CAP 316), retrieve the programs needed by a remote site from the storage device (using the storage device 308, output equipment 320 or system controller 312), prepare (or package) one or more signals containing programs, a program list, a schedule, menus, and/or program control information for transmission (using the output equipment 320), transmit
5 the signal (using output equipment 320 and/or an uplink site 204), and perform quality and flow checks (using quality and flow control 340). In addition, before transmission, the operations center may scramble, encrypt, or convert program signals using the receiver 300, holder 304, storage device 308, or output equipment 320 as described in reference to Figure 8.

Also, the operations center 202 may create schedule, menus, and/or control signals to
10 send to remote sites (using the CAP 316 and associated databases 336) and if necessary, store the schedule, menu and/or control signals in the storage device 308 before transmission. The control signals can include information on programs, schedules, advertisement insertion, menus, video on demand, and requests for buy data on programs watched. For purposes of many of these functions, advertisements, menus expressed in video data format, and
15 video-audio programs are treated in the same manner and can be described as

programs. Using the operations center described, nearly any data can be stored at the storage device 308, retrieved, and/or packaged and sent to the remote sites 208. Many other functions and subfunctions described elsewhere in the specification (such as billing) are also performed by the operations center 202 configuration described.

Figure 7 is an expanded schematic of a delivery system utilizing an embodiment of the operations center 202 of the present invention. Certain portions of the operations center 202 have been expanded upon in this schematic. This system is capable of supporting pay per view (PPV), impulse pay per view (IPPV), near video on demand (NVOD), VOD, virtual video on demand (VVOD), HDTV, Interactive TV and data delivery. Multiple signals are received at the operations center 202 and processed by the receiver 300. These received signals include satellite signals 348 received in NTSC format and MPEG format, as well as land line 352 signals received in NTSC video format, ATM or other formats. In particular, satellite dishes can receive signals such as those produced by ABC, CBS, NBC, HBO, DCI, and Showtime. Land line signals 352 may be received in various signal formats, for example DS1, DS3, OC3 and D1 formats. Additionally, these inputs to the operations center 202 may be from tape or other storage devices 720, as well as received through ATM switches. Figure 7 shows the receiver 300 passing the program signals to the holder 304, which in turn passes it on to a storage (and spooling) device 308'.

Specifically, the storage and spooling device 308' utilized here is a video file server system with two data storage devices. The file server, as well as the holder 304 and receiver 300, are under the control of the system controller 312. The CAP 316 is shown in Figure 7 as a network including terminals 704 and PCs 708. The CAP 316 is shown receiving buy data from cable headend signals 344 through a multiplexer 700. This multiplexed buy data from the cable headends is shown being received by the market research component 328. Several terminals 704 are shown connected to the scheduler 324 to perform scheduling functions and several PCs 708 are shown connected to the market research component 328 to perform market research functions. A PC 712 is also shown

connected to the ad insertion component 332 performing ad insertion functions. In this particular embodiment, the ad insertion component 332 is shown directly connected to the file server 308' to provide ad insertion data directly to the file server software.

5 An output multiplexer 320' is shown as part of the output equipment in Figure 7. The output multiplexer 320' sends signals in OC3 or DS3 signal format to ATMs and also sends analog or digital signals to an uplink site 204 with a satellite dish. The uplink site 204 is shown servicing a DBS or "PRIMESTAR"TM remote site 208, as well as a headend 208 with an integrated receiver demodulator 716. In this schematic, the output equipment 320' is servicing
10 many different types of remote sites: a DBS or Primestar site 208, headend with satellite feed 208, a file server type headend system (verified by ATM 208), and video dialtone based systems, such as "BELL ATLANTIC"TM 208, "BELL SOUTH"TM 208 and "PACTEL"TM 208. This schematic highlights the multiple inputs, processing, and multiple outputs possible with the operations center 202. Using this operations center 202, hundreds of headends and remote
15 sites may be serviced in a program delivery system 200.

For additional information on the delivery system shown in Figure 7, see U.S. Patent 5,986,690 entitled ELECTRONIC BOOK SELECTION AND DELIVERY SYSTEM by inventor John Hendricks.

Figure 8 shows an alternative embodiment of the receiver 300, which enables the
20 operations center 202 to handle analog scrambling and digital encryption of signals. Specifically, the receiver 300' is capable of performing any conversions necessary so that the storage device 308 may store any types of program signals which may be needed by remote sites 208. More specifically, the embodiment shown handles analog scrambled programs in MPEG digital format 800, MPEG encrypted programs 804, MPEG stored programs that are not
25 scrambled or encrypted 808, ATM stored programs that are analog scrambled 812, and ATM programs in digital encrypted format 816.

The system controller 312 instructs the receiver 300', through one or more connections, on the signal formats that are needed for the various programs being received on the multiple inputs to the receiver 300'. Generally, the system controller 312 receives information from the CAP 316 (not shown in Figure 8) on the scrambling and encryption of programs that is necessary prior to the programs being stored in storage device 308. More particularly, the scrambling and encryption determiner 628 of the CAP 316 (utilizing cable franchise information stored in the databases 336 and the program listing or lineup) informs the system controller 312 in advance of the desired program formats to be stored in the storage device 308. The system controller 312 then informs the receiver 300' of the program formats needed. The receiver 300' then, through a combination of hardware and software, configures itself appropriately to perform the conversions and send the appropriate converted programs to the holder 304. Various hardware or software switches may be used to achieve the desired effect in the receiver 300'.

To store MPEG analog scrambled programs 800 in the storage device 308, the receiver 300' processes the incoming signals through a variety of steps. For example, an NTSC signal 820 may be sent to either a "GENERAL INSTRUMENTS"™ (GI) scrambler 824 (a GI scrambler 824), or a "SCIENTIFIC ATLANTA"™ (SA) scrambler (SA scrambler 828). Once the analog NTSC signal 820 is processed by either analog scrambler 824, 828, then the analog scrambled signal may be processed by an MPEG encoder 832. When scrambling and MPEG encoding an analog signal, the included sync signal should be properly handled so that a set top terminal 220 can recreate the exact NTSC signal that existed prior to scrambling. Although the sync signal can be sent unscrambled, an unscrambled sync signal can be more easily pirated and become a security risk to cable operators. Generally, using standard equipment, scrambling an NTSC signal and running the scrambled signal through the MPEG encoder 832 will create synchronization problems. Popularly used scrambling techniques generally invert the sync signal and/or suppress the sync signal.

Although there are several methods of properly handling the sync signal, the preferred method is to route the sync signal around the scrambler 824, 828 to the MPEG encoder 832. Preferably, a stripping component (not shown) is used to strip the sync signal from the analog program signal prior to scrambling. This stripped sync signal is then routed to the MPEG encoder 832 or similar device. The sync signal is used by the MPEG encoder 832 (if needed for encoding) and modified as if it had been processed by the scrambler. To modify the sync signal, it is preferred that the sync scrambling technique be known in advance. The modified sync signal is then encoded into a data signal for later use in digital to analog conversion.

Preferably, the modified sync signal is inserted into the MPEG data stream using the MPEG private data packet format. When needed by a digital to analog converter, the MPEG private data packets are used to create a scrambled sync signal.

Following processing by the MPEG encoder 832, the signal is sent by the receiver 300' to the holder 304. The holder 304 may preprocess the program signal and pass it to the storage device 308 for storage in the appropriate location for MPEG analog scrambled signals 800. It is preferred that the scrambler encryption determiner 628 of the CAP 316 inform the system controller 312 of the desired scrambling method, GI 824 or SA 828. Thus, when the signal is finally spooled out by the storage device 308 to the output equipment 320, the spooled signal is in the exact analog scrambled format that is needed by the remote site 208 requesting the program. Alternatively, that MPEG analog scrambled signal 800 may be converted to an ATM format by the receiver 300' prior to being stored, using the MPEG to ATM converter 836. This ATM signal would then be stored as an ATM analog scrambled signal 812 at the storage device 308, and then spooled in ATM signal format.

Similarly, signals received in ATM format and signals received in MPEG format may be converted to NTSC analog video format so that they may be analog scrambled by a GI scrambler 824 or SA scrambler 828. To accomplish this, the receiver 300 uses an ATM to MPEG encoder 840 and MPEG decoders 844. Again, these signals are processed through

analog scramblers 824, 828, the MPEG encoder 832 and then passed to the holder 304, or processed through the MPEG to ATM converter 836 before being sent to the holder 304.

5 If analog scrambling is not necessary or needed by the remote site 208, the programs may be stored in MPEG encrypted format 804, MPEG video format that is not scrambled or encrypted 808, or ATM digitally encrypted format 816. To accomplish this result, the receiver 300 may pass ATM signals directly to the holder 304 for storage in the storage device 308 (if the ATM signals are already digitally encrypted).
10 Alternatively, the ATM signals may be converted to MPEG (using ATM to MPEG converter 840) then digitally encrypted while in MPEG format (using MPEG encryption 818) and then converted from MPEG back to ATM format (using the MPEG to ATM converter 836) and finally stored in the storage device 308.

15 Similarly, MPEG signals may either be passed through and stored as MPEG signals not scrambled or encrypted 808 or MPEG signals may be MPEG encrypted 804 using MPEG encryption device 848.

The result is that this embodiment of receiver 300' may accept a signal containing video in an ATM signal format, MPEG digital video
20 format or NTSC analog video format; and perform any necessary scrambling, encryption and conversion so that the signal may be stored in storage device 308 in numerous formats. Those skilled in the art will recognize that numerous hardware and software variations of the design are possible to accomplish the multiple input, multiple outputs of this
25 receiver 300' which handles scrambling, encryption and converting for later storage of the signal. Thus, the program signals may be spooled directly to the output equipment 320 in proper format for transmission.

As an alternative to a receiver 300' that is capable of handling scrambling, encryption and conversion, the operations center 202 may
30 use output equipment 320 (not shown in Figure 8) that is capable of similar scrambling, encryption and conversions prior to transmission. Equipment similar to that shown for the receiver 300' of Figure 8 may be configured for the output equipment 320. In a large operations center 202 handling many headends, for reasons of efficiency, it is preferred

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that the receiver 300 perform the scrambling, encryption and conversion prior to storage. In smaller operations centers 202 for purposes of saving on disk storage space or other storage space (in storage device 308), it is preferred that the output equipment 320 perform the scrambling, encryptions and conversions necessary. When the output equipment 320 performs the scrambling, encryption and conversion, the programs only need to be stored in storage device 308 once, in one format. Thus, the output equipment 320 will handle any necessary changes in scrambling, encryption and conversion. When the scrambling, encryption and conversion is performed by the receiver 300, the storage device 308 must be larger, since each program may be stored numerous times in different formats.

Although the present invention has been shown and described with respect to preferred embodiments, various changes and modifications that are obvious to a person skilled in the art to which the invention pertains are deemed to lie within the spirit and scope of the invention as defined by the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

selecting specific programs received from television programming sources;

allocating a segment of the bandwidth to the specifically selected programs; and

continuing said allocating step with additional selected programs until at least one of the following conditions occurs:

all of said programs are allocated,

all of said bandwidth is allocated;

wherein the step of selecting uses an algorithm to select specific programs based on each program's bandwidth requirement.

2. The method of claim 1, wherein the step of selecting further uses an algorithm to select specific programs based on marketing information.

3. The method of claim 1, wherein the step of selecting further uses an algorithm to select specific programs based on buy rates of the programs.

4. The method of claim 1, wherein the step of selecting further uses an algorithm to select specific programs based on each program's length.

5. The method of claim 1, wherein the step of selecting further uses an algorithm to select specific programs based on each program's watched information.

6. The method of claim 5, wherein the step of selecting further uses an algorithm to select specific programs based on marketing information.

7. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels;

dividing said bandwidth so that each program category receives a segment of said bandwidth;

allocating a portion of said segments of bandwidth to high priority level programs in each category; and

continuing said allocating step with progressively lower priority levels programs until at least one of the following conditions occurs:

all of said programs are allocated,

all of said bandwidth is allocated.

8. The method of claim 7, wherein the step of prioritizing uses an algorithm to weigh each program's watched information when determining a program's priority.

9. The method of claim 7, wherein the step of prioritizing uses an algorithm to weigh marketing information when determining a program's priority.

10. A method of transmitting a plurality of programs to a cable headend, each of said plurality of programs corresponding to one of a plurality of categories, said method comprising the steps of:

prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels;

forming a plurality of signals, each of said signals comprising programs corresponding to a single priority level;

appending a header to each of said signals, wherein said header identifies said priority level for a corresponding signal, thereby enabling recognition by said cable headend;

dividing bandwidth so that each program category receives a segment of said bandwidth;

allocating a portion of said segments of bandwidth to signals comprising high priority level programs in each category;

continuing said allocating step with signals comprising progressively lower priority level programs until at least one of the following conditions occurs:

all of the signals are allocated; and

all of said bandwidth is allocated; and

transmitting each of said headers and said corresponding signals to said cable headend.

11. The method of claim 1, 7 or 10 wherein the step of allocating includes dynamically changing the bandwidth allocation over time.

12. The method of claim 7 or 10, wherein the high priority level corresponds to programs included in a cable television service and a lower priority level corresponds to programs included in a different cable television service.

13. The method of claim 7 or 10, wherein each priority level includes a different set of programs from a variety of categories, and wherein the first priority level includes a first finite number of programs from each of the plurality of categories and the second priority level includes a second finite number of remaining programs from each of the plurality of categories.

14. The method of claim 7 or 10, wherein the high priority level corresponds to cable television programs and a lower priority level corresponds to pay-per-view programs.
15. The method of claim 14, wherein an even lower priority level corresponds to high definition television programs.
16. The method of claim 7 or 10, wherein the high priority level corresponds to sports-related television programs and a lower priority level corresponds to news-related television programs.
17. The method of claim 16, wherein an even lower priority level corresponds to documentaries.
18. The method of claim 7 or 10, wherein the high priority level corresponds to television programs available during a specified period of time and a lower priority level corresponds to television programs available during a different period of time.
19. A method of transmitting programs to a plurality of transponders, said method comprising the steps of:
 - prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels;
 - forming a plurality of signals, each of said signals comprising programs corresponding to a single priority level;
 - allocating a portion of bandwidth to signals comprising high priority level programs;
 - continuing said allocating step with signals comprising progressively lower priority level programs until at least one of the following conditions occurs:

all of the signals are allocated; and
all of said bandwidth is allocated; and
transmitting said plurality of signals to said plurality of transponders so that none of said transponders receives more than one of said signals.

20. The method of claim 10 or 19, further comprising the steps of:
digitizing each of said headers and said corresponding signals into digitized signals;
compressing the digitized signals into compressed signals; and
combining the compressed signals with a program information signal.

21. The method of claim 19 or 20, further comprising the step of dynamically changing bandwidth allocation for at least one of said signals.

22. The method of claim 10, 20 or 21, further comprising the step of appending a header to each of said signals, wherein said header identifies said priority level for a corresponding signal, thereby enabling recognition by said transponder.

23. A method of transmitting a plurality of programs in a first amount of bandwidth for reception by a first cable headend, and in a second amount of bandwidth for a second cable headend, said method comprising the steps of:

prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels;

allocating said first amount of bandwidth to high priority level programs in each category;

continuing said first amount of bandwidth allocation step with said progressively lower priority level programs until at least one of the following conditions occurs:

all of the programs are allocated;

all of said first amount of bandwidth is allocated;

allocating said second amount of bandwidth to high priority level programs in each category;

continuing said second amount of bandwidth allocation step with said progressively lower priority level programs until at least one of the following conditions occurs:

all of the programs are allocated;

all of said second amount of bandwidth is allocated;

transmitting the programs in said first amount of bandwidth to said first cable headend; and

transmitting the programs in said second amount of bandwidth to said second cable headend.

24. The method according to claim 21, wherein the step of dynamically changing the bandwidth allocation includes varying a compression ratio of at least one of the selected programs.

25. The method according to claim 21, wherein the step of dynamically changing the bandwidth allocation includes allocating bandwidth to at least one of the selected programs based on an amount of changes within at least one of the selected programs over time.

26. The method according to claim 25, wherein said changes occur frame to frame.

27. The method according to claim 25, wherein said changes are changes in visual detail.

28. The method according to claim 11, wherein the step of dynamically changing the bandwidth allocation over time includes varying the compression ratio of at least one of the selected programs.

29. The method according to claim 11, wherein the step of dynamically changing the bandwidth allocation over time includes allocating bandwidth to at least one of the selected programs based on an amount of changes within at least one of the selected programs over time.

30. The method according to claim 29, wherein said changes occur frame to frame.

31. The method according to claim 29, wherein said changes are changes in visual detail.

32. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

- selecting programs received from television programming sources;
- allocating bandwidth to the categories from whence the selected programs correspond.

33. The method according to claim 32, wherein the step of allocating bandwidth to the categories further comprises the steps of:

- allocating bandwidth to the selected programs within the categories; and

- continuing allocating bandwidth to additional selected programs until at least one of the following conditions occurs:

- all of the programs are allocated bandwidth,
 - all of the bandwidth is allocated.

34. The method according to claim 32, wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming.

35. The method according to claim 34, wherein the step of dynamically changing the bandwidth allocation includes varying a number of the selected programs within at least one of the categories.

36. The method according to claim 34, wherein the step of dynamically changing the bandwidth allocation over time includes varying a compression ratio of at least one of the selected programs within at least one of the categories of programming.

37. The method according to claim 34, wherein the step of dynamically changing the bandwidth allocation over time includes allocating bandwidth to at least one of the selected programs based on an amount of changes within at least one of the selected programs over time.

38. The method according to claim 37, wherein said changes occur frame to frame.

39. The method according to claim 37, wherein said changes are changes in visual detail.

40. A computer assisted packaging system for generating program control information, packaging programs and for allocating bandwidth to a plurality of programs comprising:

a multiplexer for receiving at least one program signal and at least one program control signal and for allocating a portion of said segments of bandwidth to said selected programs;

a delivery control processor unit connected to said multiplexer, whereby said program signals and said program information signals are multiplexed by said multiplexer; and

a central processing unit connected to said delivery control processor unit, whereby said delivery control processor unit receives commands from said central processing unit.

41. The system according to claim 40, further comprising at least one workstation connected to said central processing unit for allowing a packager or programmer to interface with said computer assisted packaging system.

42. The system according to claim 40 or 41, further comprising at least one database connected to said central processing unit, whereby said central processing unit processes information within each of said databases.

43. The system according to claim 42, wherein said at least one database further comprises an operations center database.

44. The system according to claim 42, wherein said at least one database further comprises a cable franchise information database.

45. The system according to claim 42, wherein said at least one database further comprises a local video storage database.

46. A computer assisted packaging system for allocating bandwidth to a plurality of programs, each of the programs corresponding to one of a plurality of categories, comprising:

a central processing unit for selecting programs received from television programming sources;

a delivery control processor unit connected to said central processing unit; and

a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to said selected programs and continuing to allocate segments of bandwidth until either all the programs are allocated bandwidth or all the bandwidth is allocated.

47. A computer assisted packaging system for allocating bandwidth to a plurality of programs, each of the programs corresponding to one of a plurality of categories, comprising:

a central processing unit for selecting the programs and also for dividing the bandwidth so that each of the program categories receives a segment of the bandwidth;

a delivery control processor unit connected to said central processing unit; and

a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to the selected programs in at least one of the categories.

48. The computer assisted packaging system for allocating bandwidth to a plurality of programs according to claim 47, wherein said central processing unit further assigns priority levels to the programs by assigning to each of said programs a priority level from a plurality of priority levels, said plurality of priority levels includes a high priority level and progressively lower priority levels and also for dividing the bandwidth so that each program category receives a segment of the bandwidth; and

said multiplexer further allocates a portion of said segments of bandwidth to selected programs in each of the categories with highest of said priority levels and continues to allocate segments of bandwidth to progressively lower priority level programs in each of the categories.

49. A system for allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, comprising:

an operations center comprising a computer assisted packaging system;

said computer assisted packaging system comprising:

a central processing unit for selecting programs received from television programming sources;

a delivery control processor unit connected to said central processing unit; and

a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to the selected programs.

50. The system for allocating bandwidth to a plurality of programs according to claim 49, wherein said central processing unit also divides the bandwidth so that each of the program categories receives a segment of the bandwidth.

51. The system according to any of claims 47 to 50, wherein said central processing unit dynamically changes bandwidth by varying a number of selected programs within at least one of the selected categories.

52. A system for allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, comprising:

an operations center comprising a computer assisted packaging system;

said computer assisted packaging system comprising:

a central processing unit for assigning priority levels to the programs by assigning to each of the programs a priority level from

a plurality of priority levels, said plurality of priority levels includes a high priority level and progressively lower priority levels and also for dividing the bandwidth so that each program category receives a segment of the bandwidth;

a delivery control processor unit connected to said central processing unit; and

a multiplexer connected to said delivery control processor unit for allocating a portion of said segments of bandwidth to the programs in each of the categories with highest of said priority levels and continuing to allocate said segments of bandwidth to progressively lower priority level programs in each of the categories.

53. The system according to any of claims 40 to 52, further comprising a video/audio equipment connected to said central processing unit for dynamically changing the bandwidth allocation over time.

54. The system according to any of claims 40 to 52, wherein said video/audio equipment dynamically changes bandwidth allocation by changing a compression ratio of each of the programs, whereby programs with higher compression ratios require lower bit rates and less bandwidth, and programs with lower compression ratios require higher bit rates and more bandwidth.

55. The system according to any of claims 40 to 52, wherein the step of dynamically changing the bandwidth allocation over time includes allocating bandwidth to at least one of the selected programs based on an amount of changes within at least one of the selected programs over time.

56. The system according to claim 55, wherein said changes occur frame to frame.

57. The system according to claim 55, wherein said changes are changes in visual detail.

58. The system according to any of claims 46 to 49, wherein said central processing unit further comprises an algorithm for assigning said priority levels.

59. The system according to any of claims 52 to 58, wherein said central processing unit appends a header to all the selected programs with the same priority level, wherein said appended header identifies said priority level for the program.

60. The system according to claim 59, further comprising at least one cable headend, wherein each of said cable headends receives said programs from said operations center according to said assigned headers.

61. The system according to any of claims 52 to 60, further comprising at least one transponder for receiving programs for one of said assigned priority levels from said operations center.

62. The system according to claim 61, further comprising at least one cable headend, wherein each of said cable headends receives said programs from at least one of said transponders according to said assigned priority levels.

63. The system according to claim 61, further comprising at least one cable headend and at least one transponder, wherein each of said cable headends receives said programs from said transponders according to customized priority.

64. The method of claim 7, wherein the step of prioritizing uses an algorithm to weigh consumer demand when determining a program's priority.

65 The method of claim 7, 10, 19, 23 or 32, wherein said step of allocating includes dynamically changing the bandwidth allocation on demand.

66. The method of claim 7, 10, 19, 23 or 32, wherein said step of allocating includes dynamically changing the bandwidth allocation based on consumer demand.

67. The method of claim 7, 10, 19, 23 or 32, wherein said step of allocating includes dynamically changing the bandwidth allocation in real-time.

68. The system of any of claims 40 to 52, further comprising video/audio equipment connected to said central processing unit for dynamically changing the bandwidth allocation on demand.

69. The system of any of claims 40 to 52, further comprising video/audio equipment connected to said central processing unit for dynamically changing the bandwidth allocation based on consumer demand.

70. The system of any of claims 40 to 52, further comprising video/audio equipment connected to said central processing unit for dynamically changing the bandwidth allocation in real-time.

71. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

selecting specific programs received from television programming sources;

allocating a segment of the bandwidth to the specifically selected programs; and

continuing said allocating step with additional selected programs until at least one of the following conditions occurs:

all of said programs are allocated,

all of said bandwidth is allocated,

wherein the step of allocating includes dynamically changing the bandwidth allocation over time, and wherein the step of dynamically changing the bandwidth allocation over time includes varying a compression ratio of at least one of the selected programs.

72. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

selecting specific programs received from television programming sources;

allocating a segment of the bandwidth to the specifically selected programs; and

continuing said allocating step with additional selected programs until at least one of the following conditions occurs:

all of said programs are allocated,

all of said bandwidth is allocated,

wherein the step of allocating includes dynamically changing the bandwidth allocation over time, and wherein the step of dynamically changing the bandwidth allocation over time includes allocating bandwidth to at least one of the selected programs based on an amount of changes within one of the selected programs over time.

73. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

**selecting programs received from television programming sources;
and**

allocating bandwidth to the categories from whence the selected programs correspond,

wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming, and

wherein said bandwidth allocation is dynamically changed on demand.

74. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

**selecting programs received from television programming services;
and**

allocating bandwidth to the categories from whence the selected programs correspond,

wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming, and

wherein said bandwidth allocation is dynamically changed based on consumer demand.

75. A method of allocating bandwidth to a plurality of programs, each of said programs corresponding to one of a plurality of categories, said method comprising the steps of:

**selecting programs received from television programming sources;
and**

allocating bandwidth to the categories from whence the selected programs correspond,

wherein said step of allocating includes dynamically changing the bandwidth allocation over time for at least one of the categories of programming, and

wherein said bandwidth allocation is dynamically changed in real-time.

76. A method of transmitting programs to a plurality of transponders, said method comprising the steps of:

prioritizing each of said programs by assigning to each of said programs one of a plurality of priority levels, said plurality of priority levels including a high priority level and progressively lower priority levels;

forming a plurality of signals, each of said signals comprising programs corresponding to a single priority level;

allocating a portion of bandwidth to signals comprising high priority level programs;

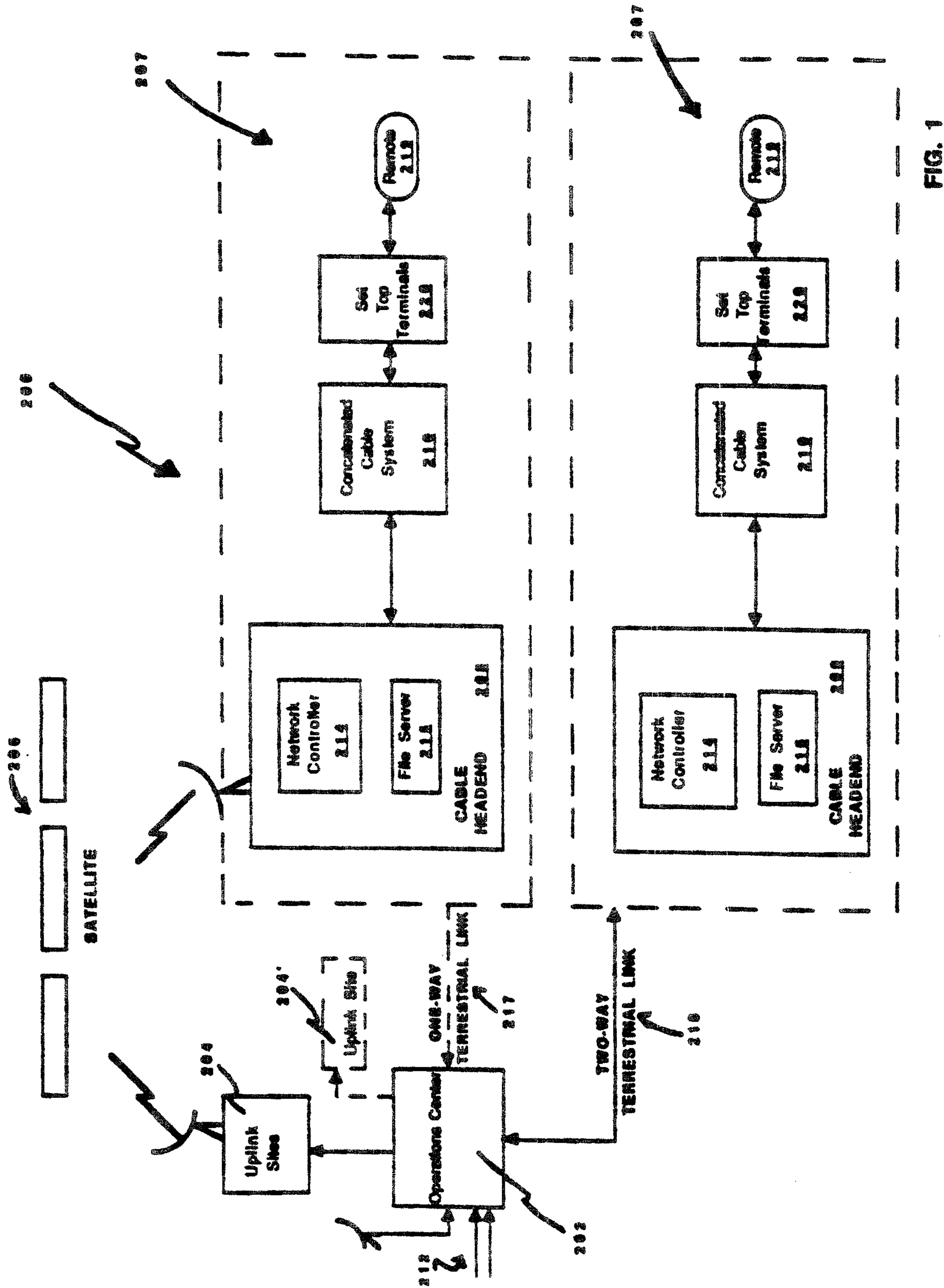
dynamically changing bandwidth allocation for at least one of said signals;

continuing said allocating step with signals comprising progressively lower priority level programs until at least one of the following conditions occurs:

all of the signals are allocated;

all of said bandwidth is allocated; and

transmitting said plurality of signals to said plurality of transponders so that none of said transponders receives more than one of said signals.



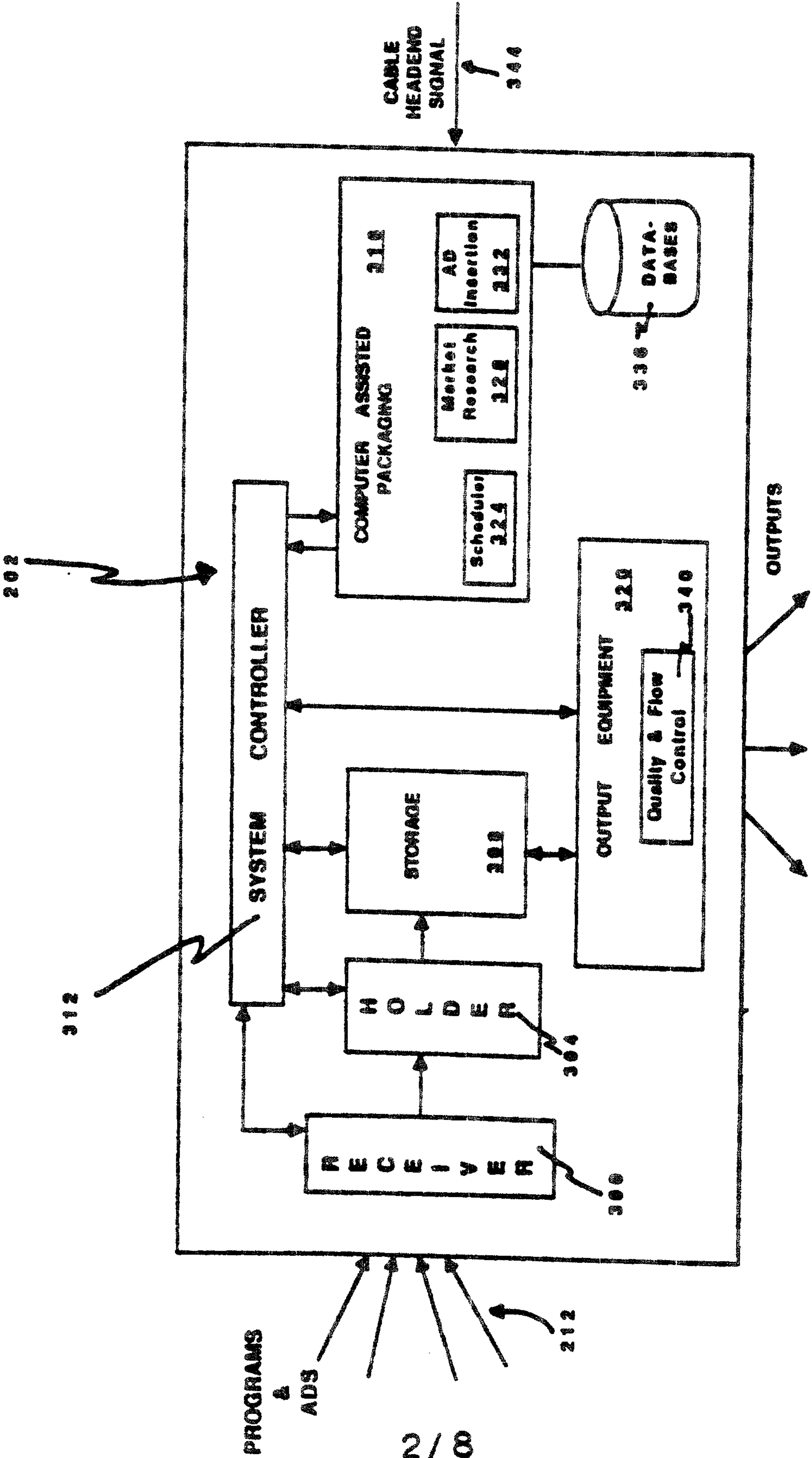
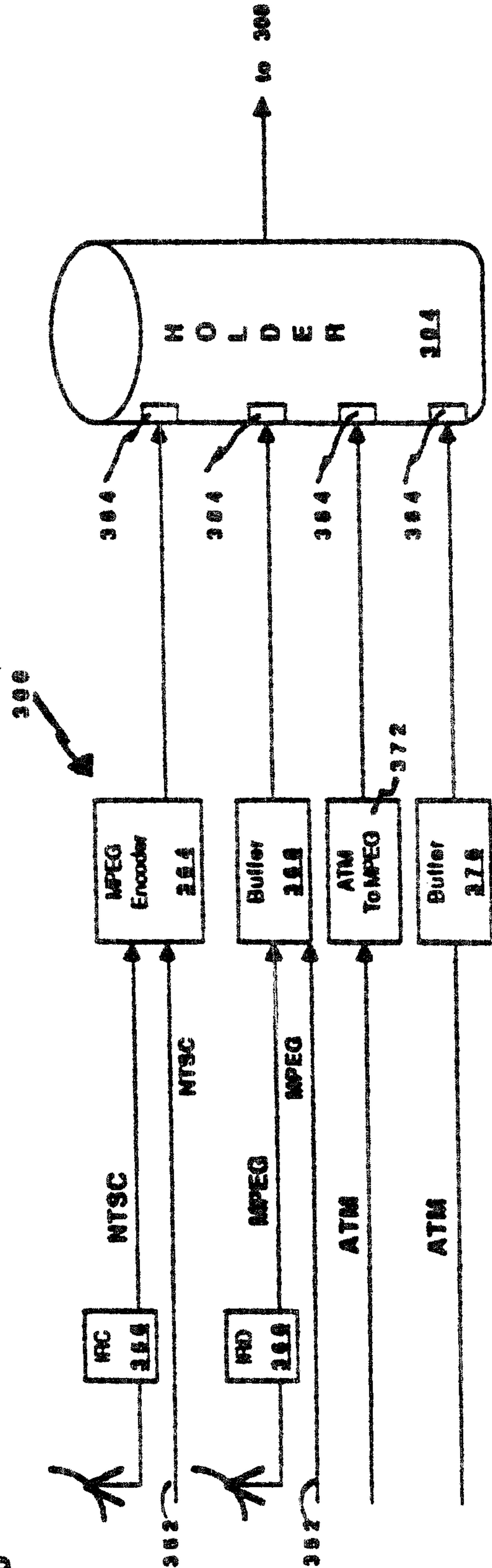
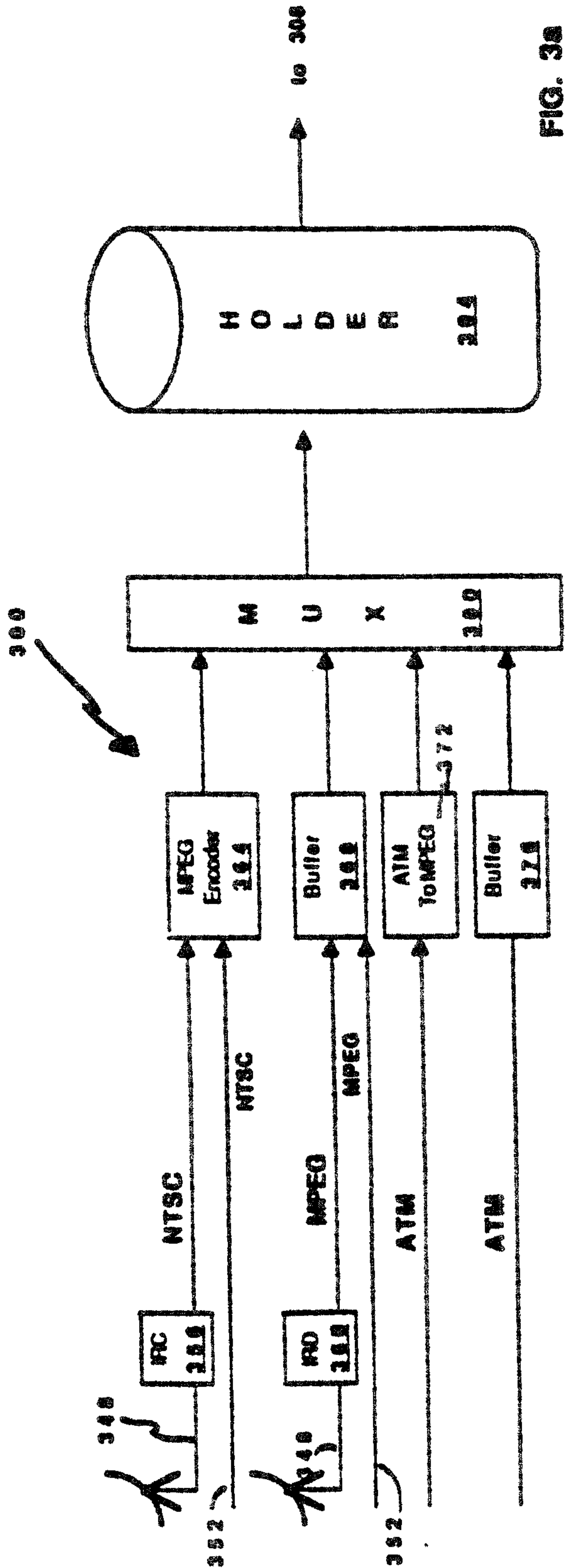


FIG. 2



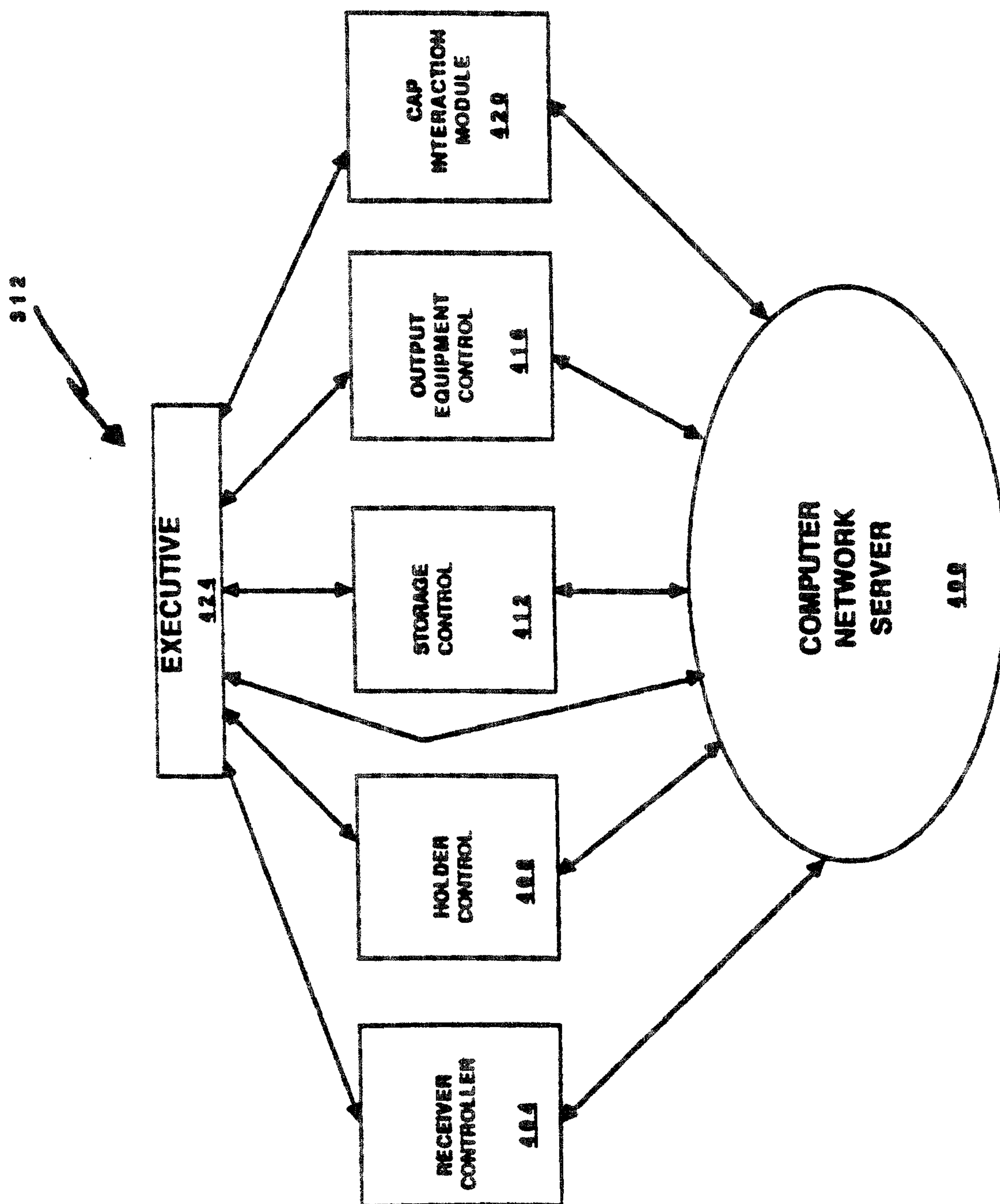


FIG. 4

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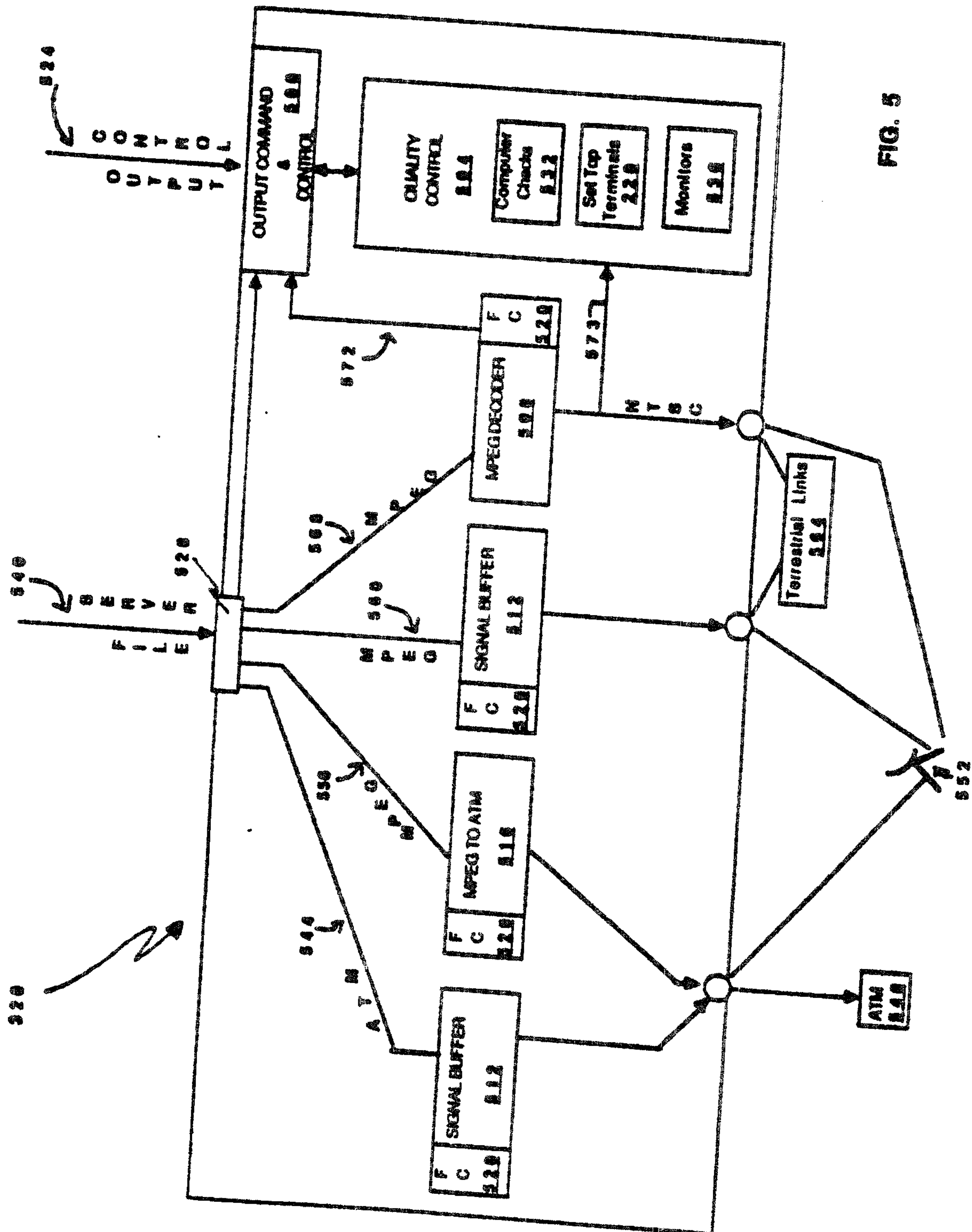


FIG. 5

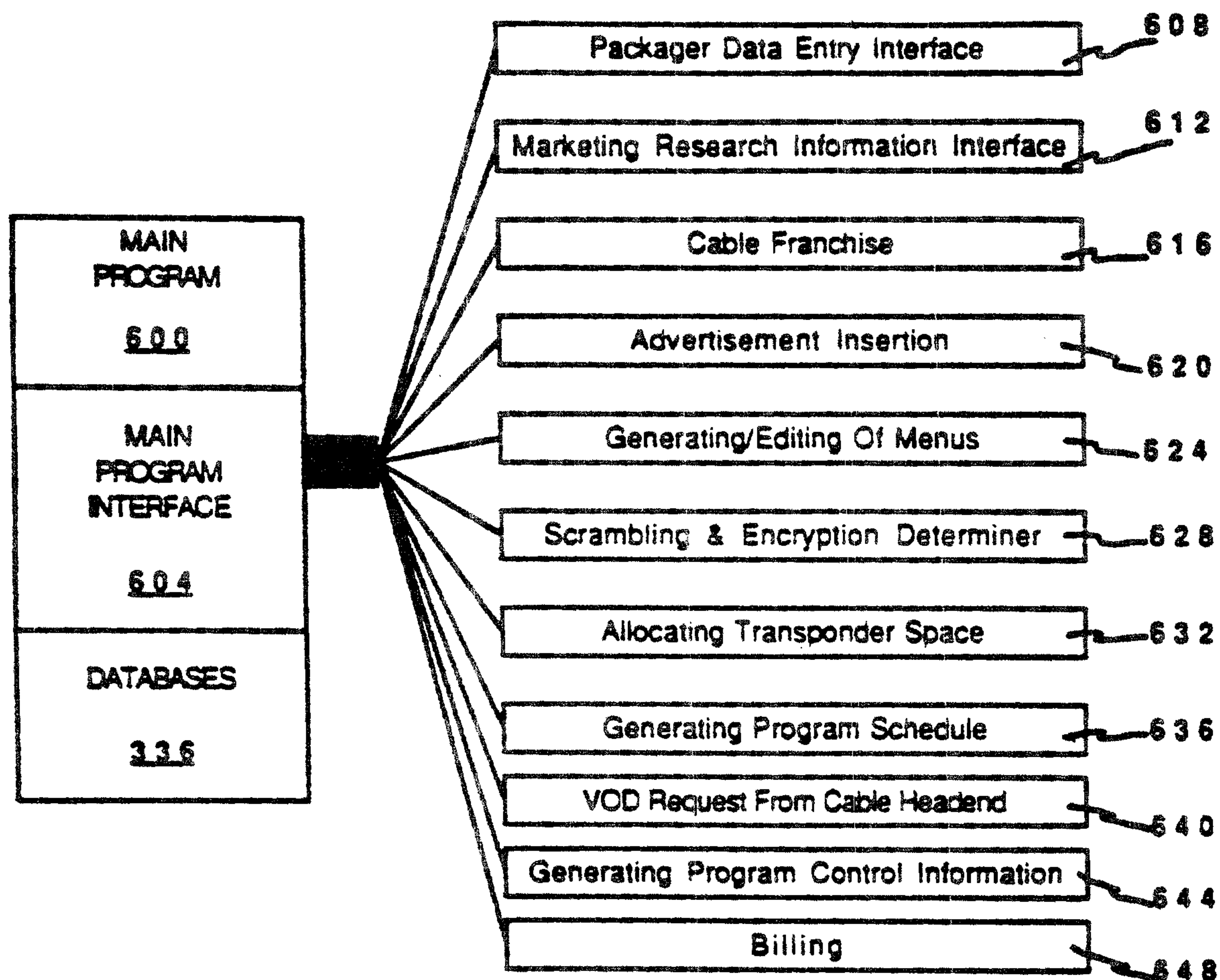
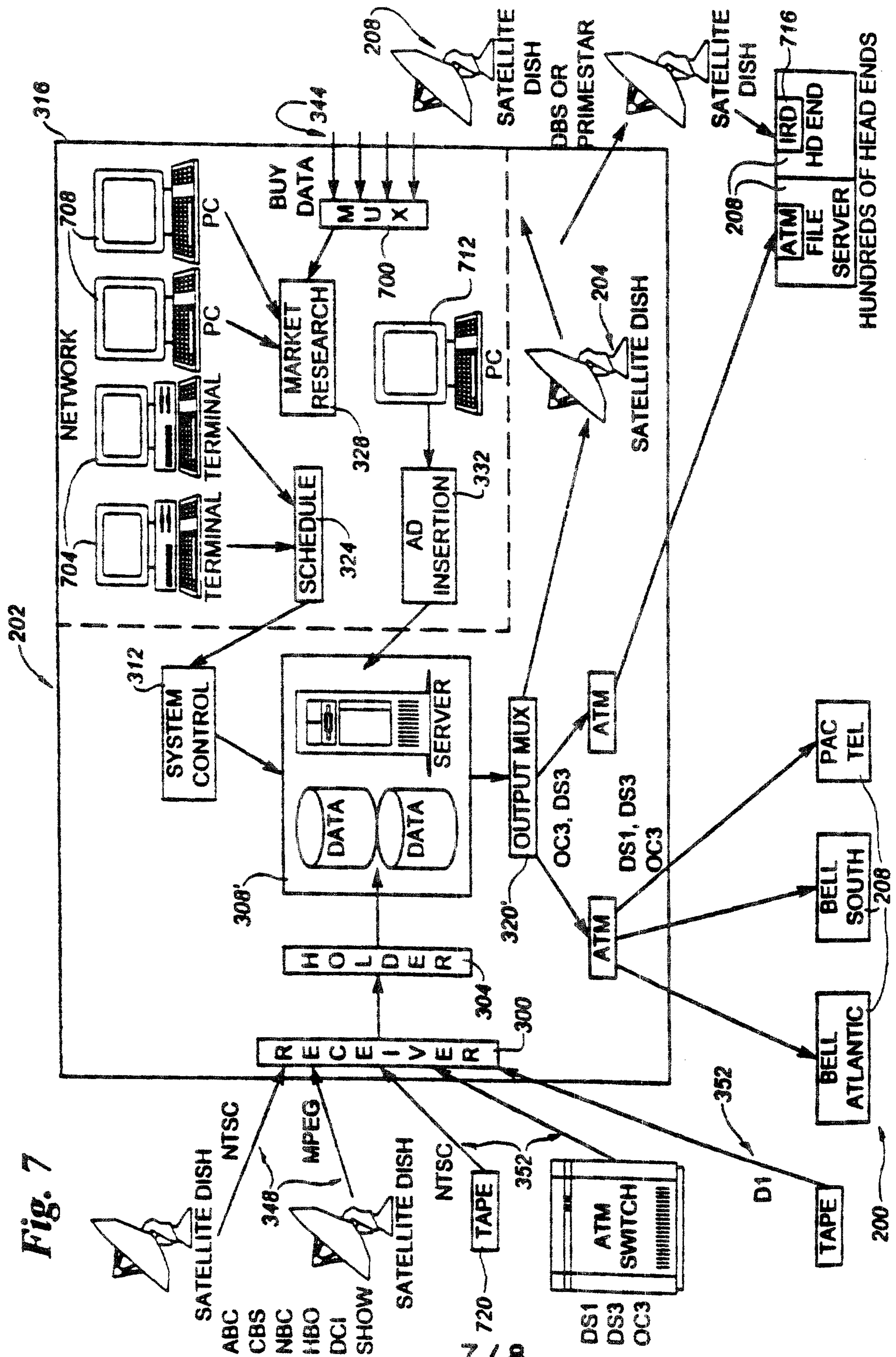


FIG. 6

Fig. 7



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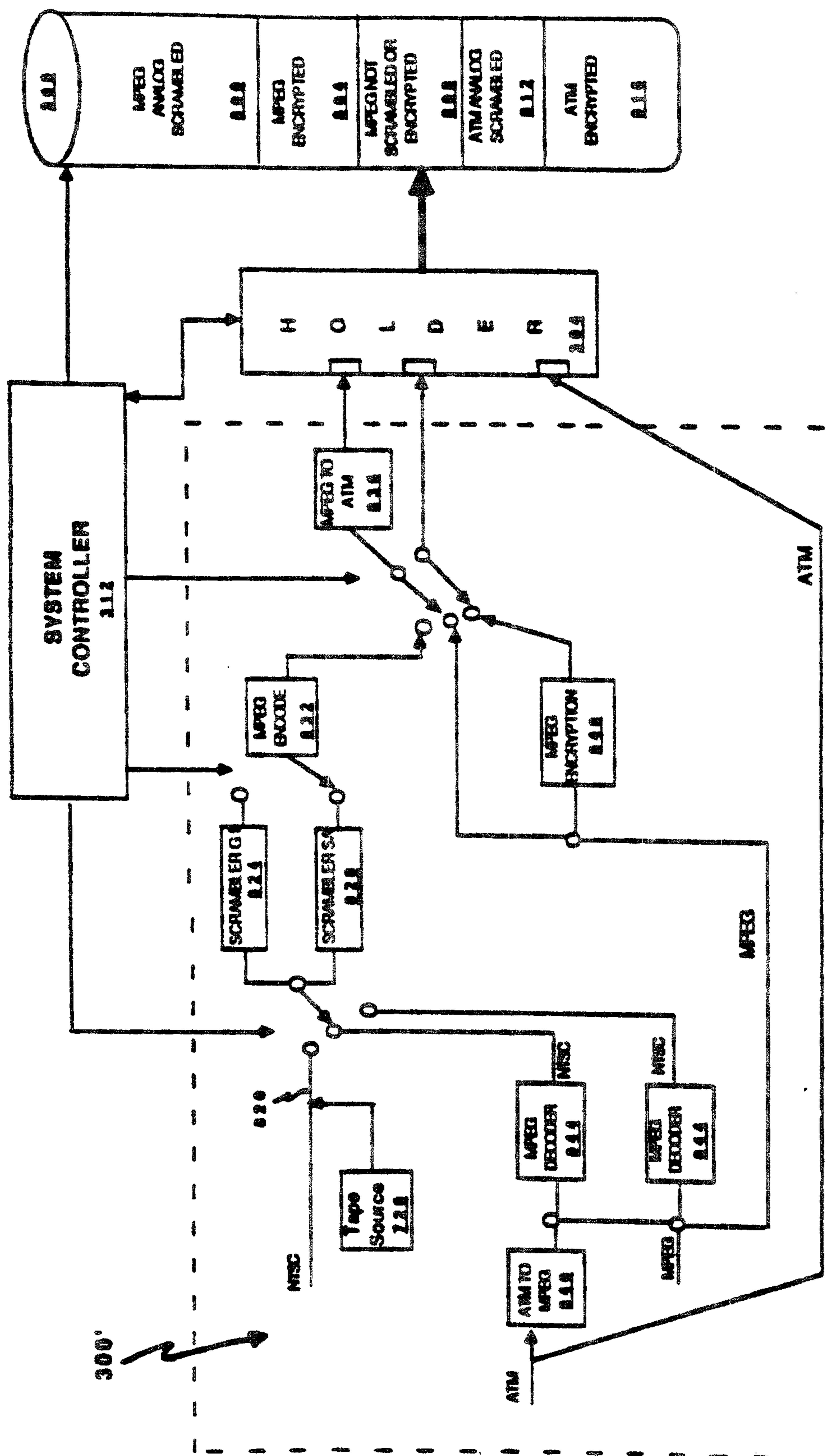


FIG. 8

