IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

PERSONALIZED MEDIA COMMUNICATIONS, LLC,	§	
	§	
Plaintiff,	§	
	§	
v.	§	
	§	Civil Action No.
ZYNGA, INC.,	§	
	§	JURY DEMANDED
Defendant.	§	
	§	
	§	
	§	
	§	
	§	

EXHIBIT 1-[PART 1 OF 3]

COMPLAINT FOR PATENT INFRINGEMENT

US007797717B1

(12) **United States Patent**
Harvey et al.

(10) **Patent No.: US 7,797,717 B1**
(45) **Date of Patent: Sep. 14, 2010**

(54) **SIGNAL PROCESSING APPARATUS AND METHODS**

(75) Inventors: **John Christopher Harvey**, New York, NY (US); **James William Cuddihy**, New York, NY (US)

(73) Assignee: **Personalized Media Communications, LLC**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/447,496**

(22) Filed: **May 23, 1995**

Related U.S. Application Data

(63) Continuation of application No. 08/113,329, filed on Aug. 30, 1993, which is a continuation of application No. 08/056,501, filed on May 3, 1993, now Pat. No. 5,335,277, which is a continuation of application No. 07/849,226, filed on Mar. 10, 1992, now Pat. No. 5,233,654, which is a continuation of application No. 07/588,126, filed on Sep. 25, 1990, now Pat. No. 5,109,414, which is a continuation of application No. 07/096,096, filed on Sep. 11, 1987, now Pat. No. 4,965,825, which is a continuation-in-part of application No. 06/829,531, filed on Feb. 14, 1986, now Pat. No. 4,704,725, which is a continuation-in-part of application No. 06/317,510, filed on Nov. 3, 1981, now Pat. No. 4,694,490.

(51) **Int. Cl.**

G06F 13/00	(2006.01)
H04N 7/173	(2006.01)
G06Q 30/00	(2006.01)

(52) **U.S. Cl.** **725/60**; 725/131; 725/38; 705/14.49

(58) **Field of Classification Search** 455/3.1, 455/3.2, 3.3, 4.1, 4.2, 5.1, 6.1, 6.2, 6.3, 2; 348/6, 7, 8, 9, 10, 11, 12, 13, 468, 1, 2, 3; 725/60, 131, 38; 705/14.4, 14.42, 14.49
See application file for complete search history.

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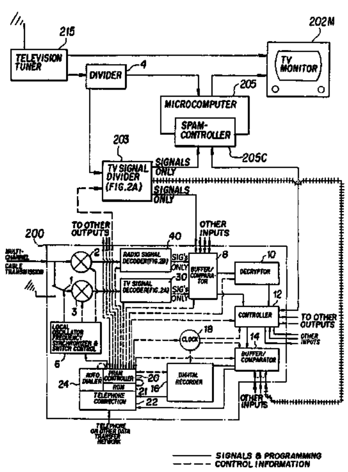
(57) **ABSTRACT**

A unified system of programming communication. The system encompasses the prior art (television, radio, broadcast hardcopy, computer communications, etc.) and new user specific mass media. Within the unified system, parallel processing computer systems, each having an input (e.g., **77**) controlling a plurality of computers (e.g., **205**), generate and output user information at receiver stations. Under broadcast control, local computers (**73**, **205**), combine user information selectively into prior art communications to exhibit personalized mass media programming at video monitors (**202**), speakers (**263**), printers (**221**), etc. At intermediate transmission stations (e.g., cable television stations), signals in network broadcasts and from local inputs (**74**, **77**, **97**, **98**) cause control processors (**71**) and computers (**73**) to selectively automate connection and operation of receivers (**53**), recorder/players (**76**), computers (**73**), generators (**82**), strippers (**81**), etc. At receiver stations, signals in received transmissions and from local inputs (**225**, **218**, **22**) cause control processors (**200**) and computers (**205**) to automate connection and operation of converters (**201**), tuners (**215**), decryptors (**224**), recorder/players (**217**), computers (**205**), furnaces (**206**), etc. Processors (**71**, **200**) meter and monitor availability and usage of programming.

15 Claims, 22 Drawing Sheets



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4,890,321	A		12/1989	Seth-Smith et al.	380/20
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4,963,995	A		10/1990	Lang	358/335
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4,967,273	A		10/1990	Greenberg	358/142
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4,974,252	A		11/1990	Osborne	379/92
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4,977,455	A		12/1990	Young	358/142
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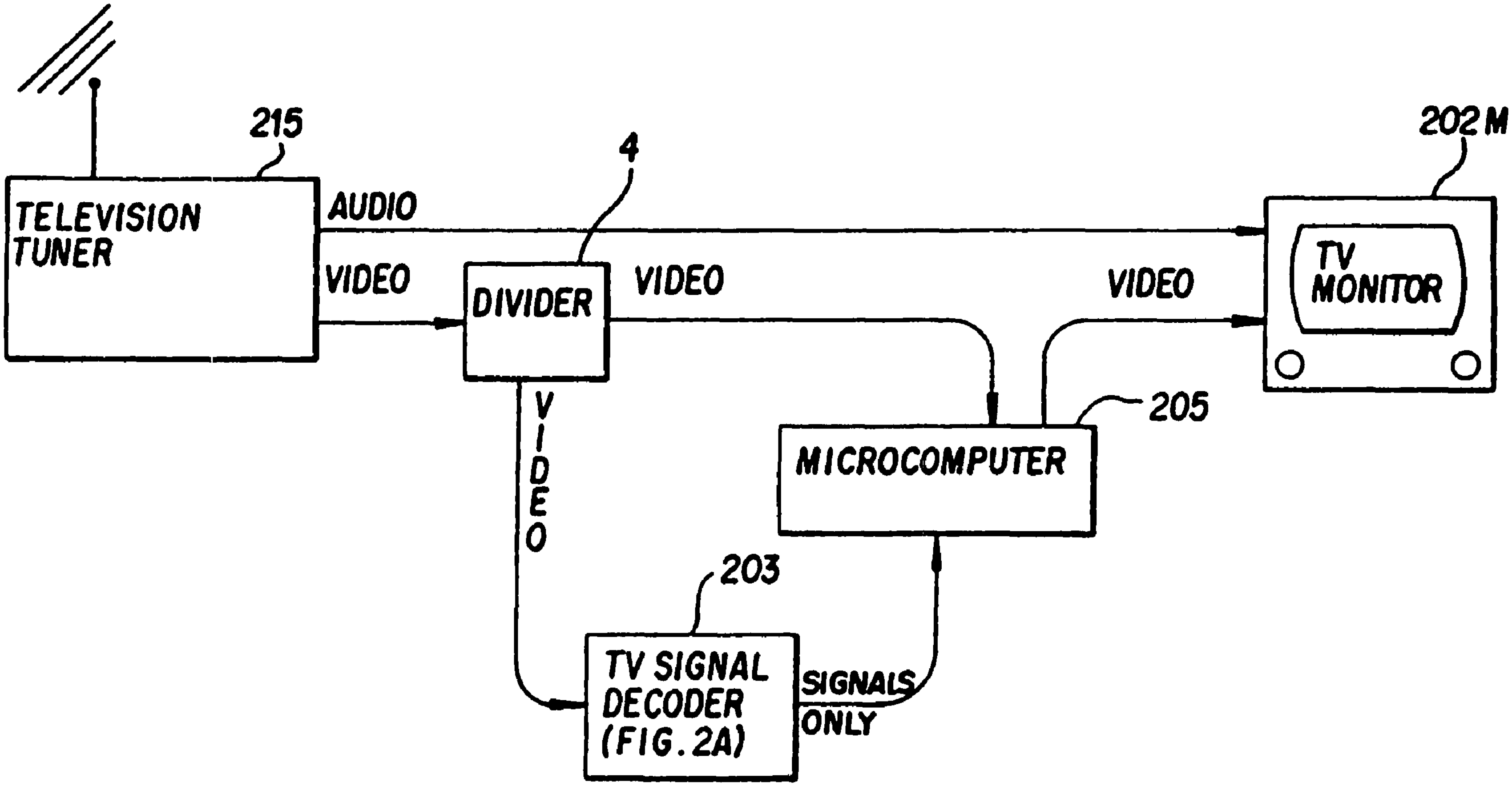

215
TELEVISION TUNER
AUDIO
VIDEO
4
DIVIDER
VIDEO
VIDEO
202M
TV MONITOR
VIDEO
205
MICROCOMPUTER
203
TV SIGNAL DECODER (FIG. 2A)
SIGNALS ONLY

FIG. 1

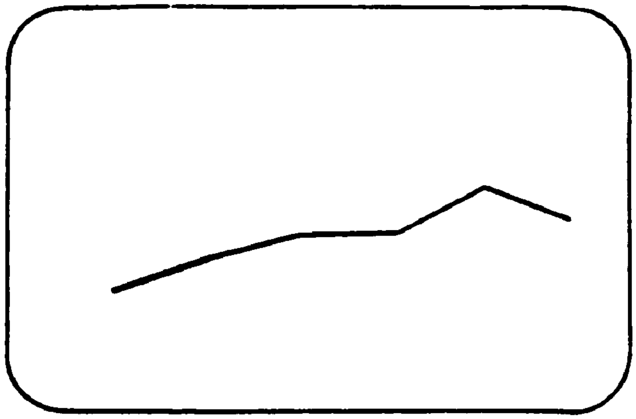


FIG. 1A

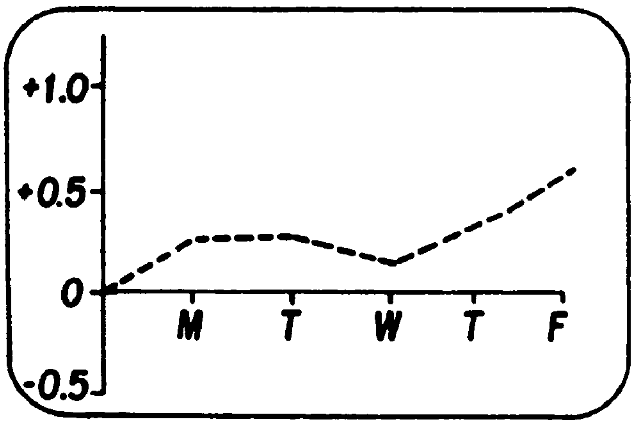


FIG. 1B

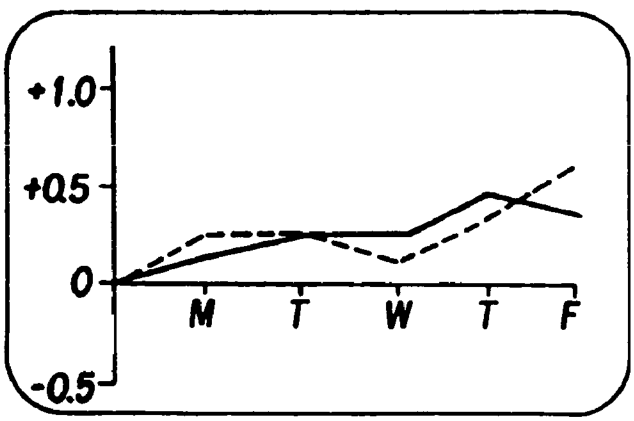


FIG. 1C

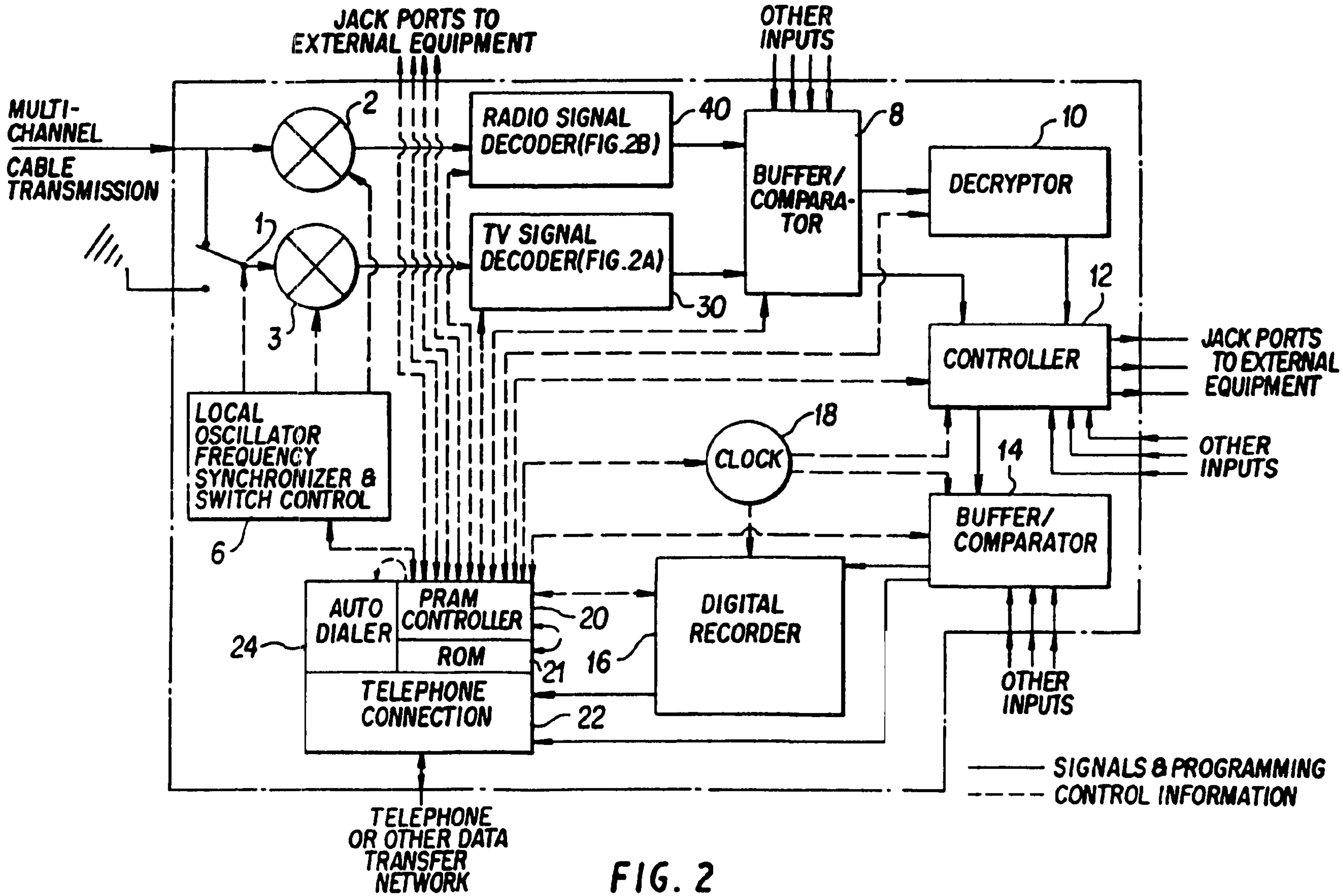
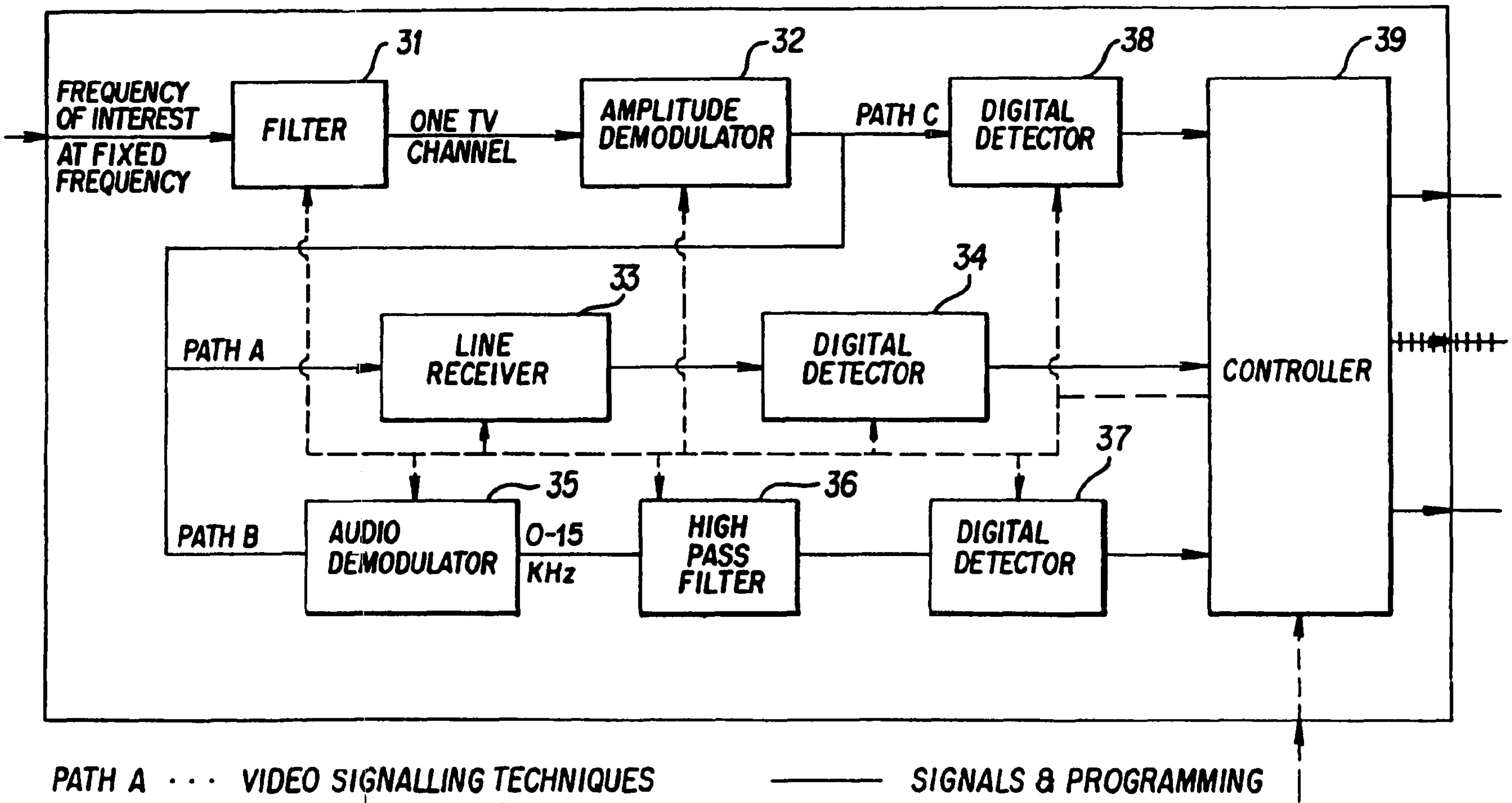

JACK PORTS TO EXTERNAL EQUIPMENT
OTHER INPUTS
MULTI-CHANNEL CABLE TRANSMISSION
2
1
3
RADIO SIGNAL DECODER(FIG.2B)
40
TV SIGNAL DECODER(FIG.2A)
30
BUFFER/ COMPARA-TOR
8
DECRYPTOR
10
CONTROLLER
12
JACK PORTS TO EXTERNAL EQUIPMENT
OTHER INPUTS
LOCAL OSCILLATOR FREQUENCY SYNCHRONIZER & SWITCH CONTROL
6
CLOCK
18
14
BUFFER/ COMPARATOR
AUTO DIALER
24
PRAM CONTROLLER
20
ROM
21
DIGITAL RECORDER
16
TELEPHONE CONNECTION
22
OTHER INPUTS
TELEPHONE OR OTHER DATA TRANSFER NETWORK
SIGNALS & PROGRAMMING
CONTROL INFORMATION

FIG. 2



PATH A · · · VIDEO SIGNALLING TECHNIQUES
PATH B · · · AUDIO SIGNALLING TECHNIQUES
PATH C · · · SEPARATE SIGNALLING TECHNIQUES

——— SIGNALS & PROGRAMMING
— — — CONTROL INFORMATION
+++++++ MONITOR INFORMATION

FIG. 2A

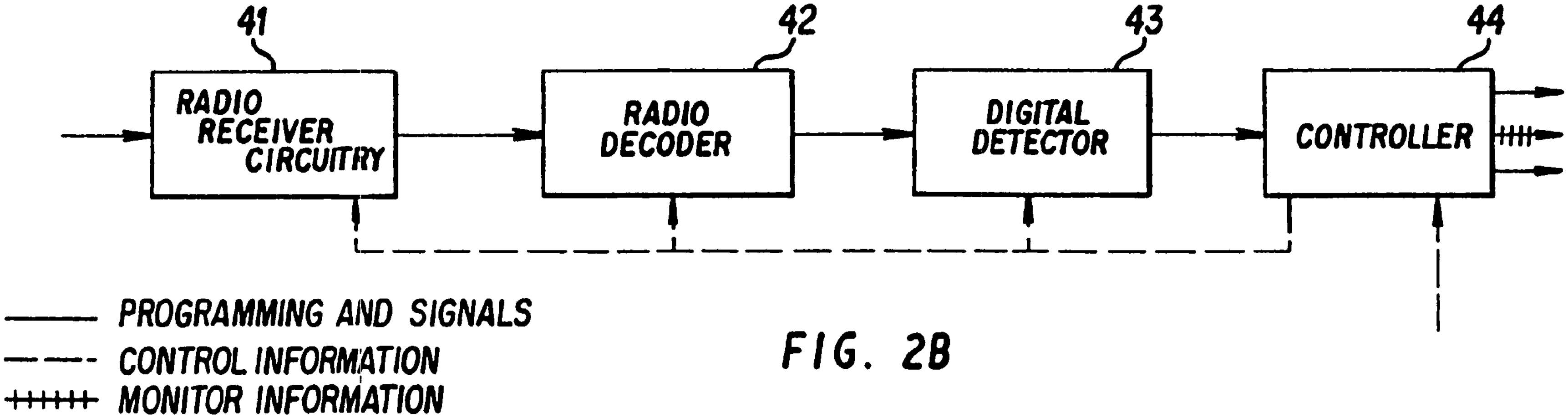

41
42
43
44
RADIO RECEIVER CIRCUITRY
RADIO DECODER
DIGITAL DETECTOR
CONTROLLER
PROGRAMMING AND SIGNALS
CONTROL INFORMATION
MONITOR INFORMATION

FIG. 2B

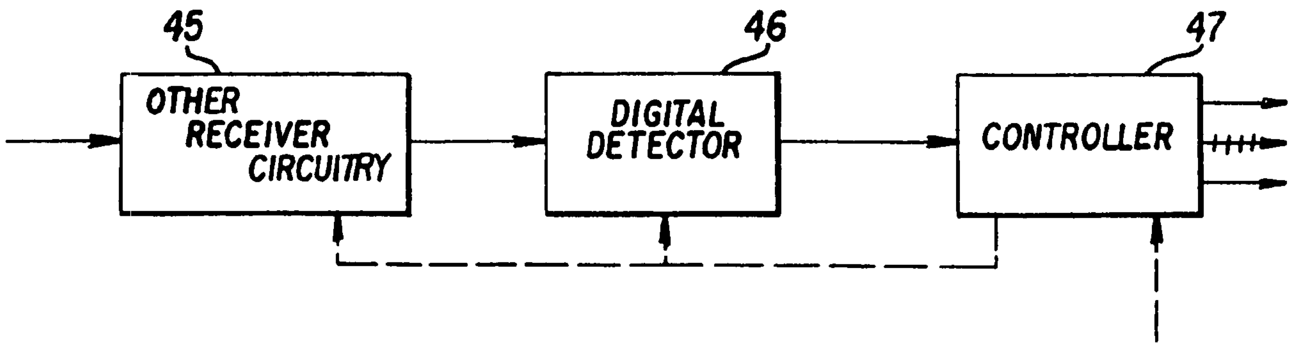
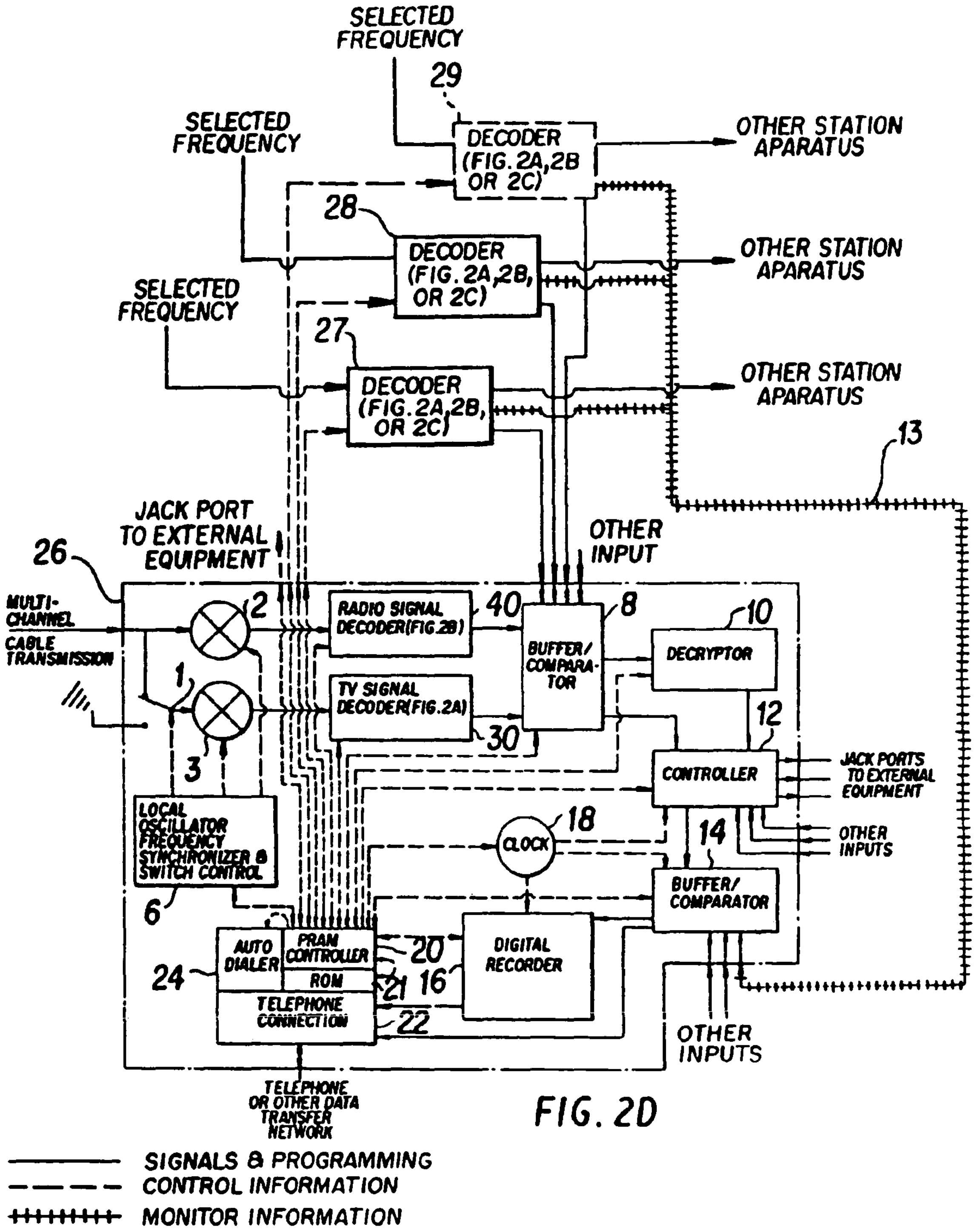

45
46
47
OTHER RECEIVER CIRCUITRY
DIGITAL DETECTOR
CONTROLLER

FIG. 2C



SELECTED FREQUENCY
29
DECODER (FIG. 2A, 2B OR 2C)
OTHER STATION APARATUS
SELECTED FREQUENCY
28
DECODER (FIG. 2A, 2B, OR 2C)
OTHER STATION APARATUS
SELECTED FREQUENCY
27
DECODER (FIG. 2A, 2B, OR 2C)
OTHER STATION APARATUS
13
JACK PORT TO EXTERNAL EQUIPMENT
OTHER INPUT
26
MULTI-CHANNEL CABLE TRANSMISSION
2
1
3
RADIO SIGNAL DECODER (FIG. 2B)
40
TV SIGNAL DECODER (FIG. 2A)
30
BUFFER/ COMPARA-TOR
8
DECRYPTOR
10
12
CONTROLLER
JACK PORTS TO EXTERNAL EQUIPMENT
OTHER INPUTS
LOCAL OSCILLATOR FREQUENCY SYNCHRONIZER & SWITCH CONTROL
6
CLOCK
18
14
BUFFER/ COMPARATOR
AUTO DIALER
PRAM CONTROLLER
ROM
TELEPHONE CONNECTION
24
20
21
16
22
DIGITAL RECORDER
OTHER INPUTS
TELEPHONE OR OTHER DATA TRANSFER NETWORK
SIGNALS & PROGRAMMING
CONTROL INFORMATION
MONITOR INFORMATION

FIG. 2D

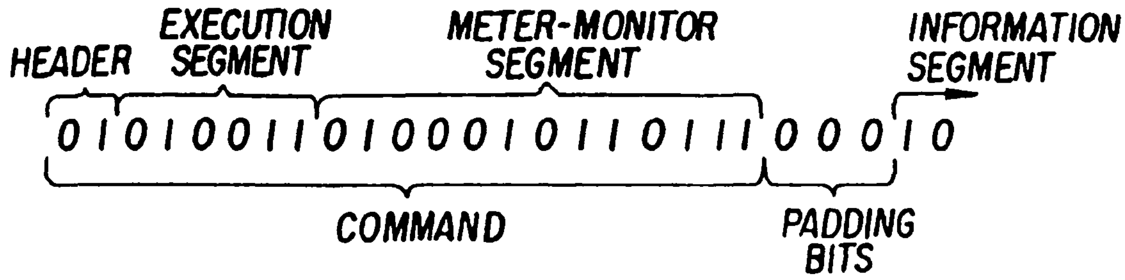


FIG. 2E

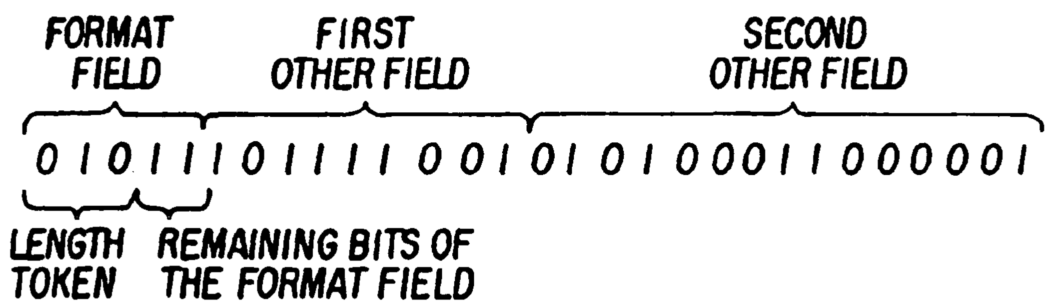


FIG. 2F

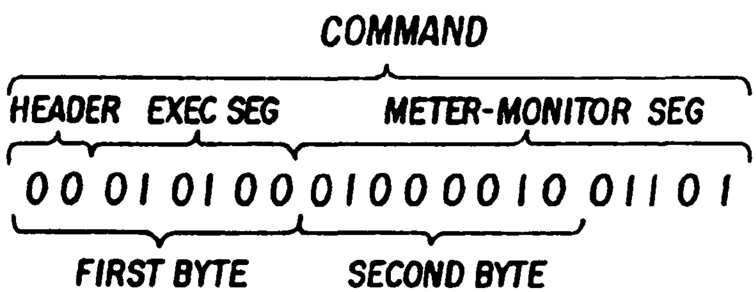


FIG. 2G

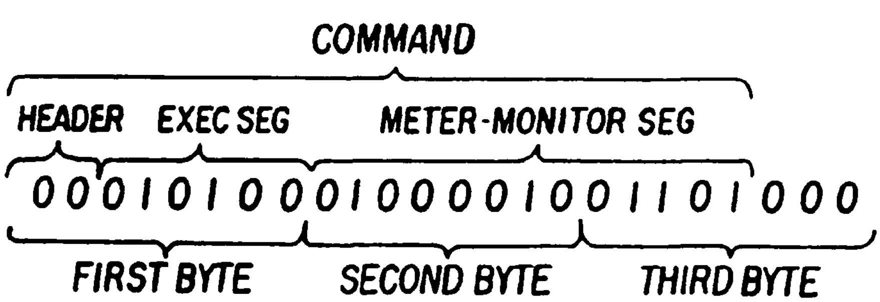


FIG. 2H

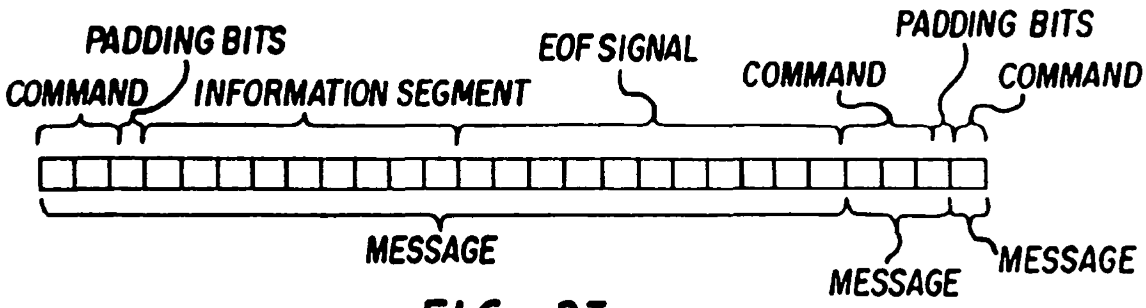


FIG. 2I

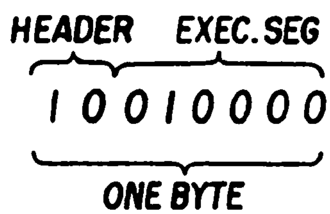


FIG. 2J

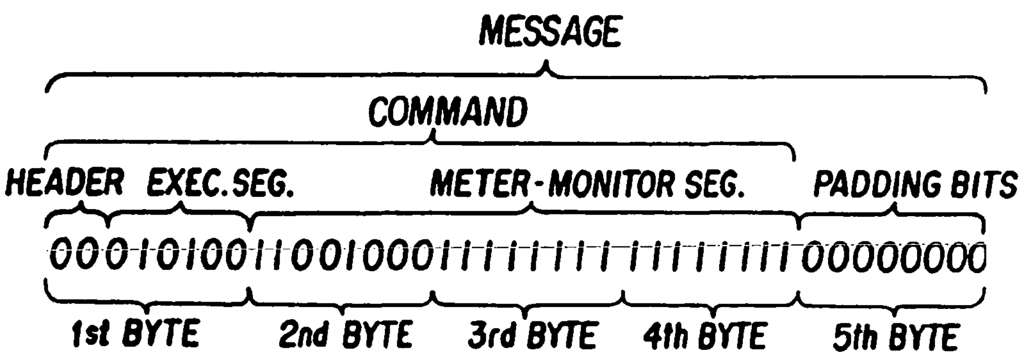


FIG. 2K

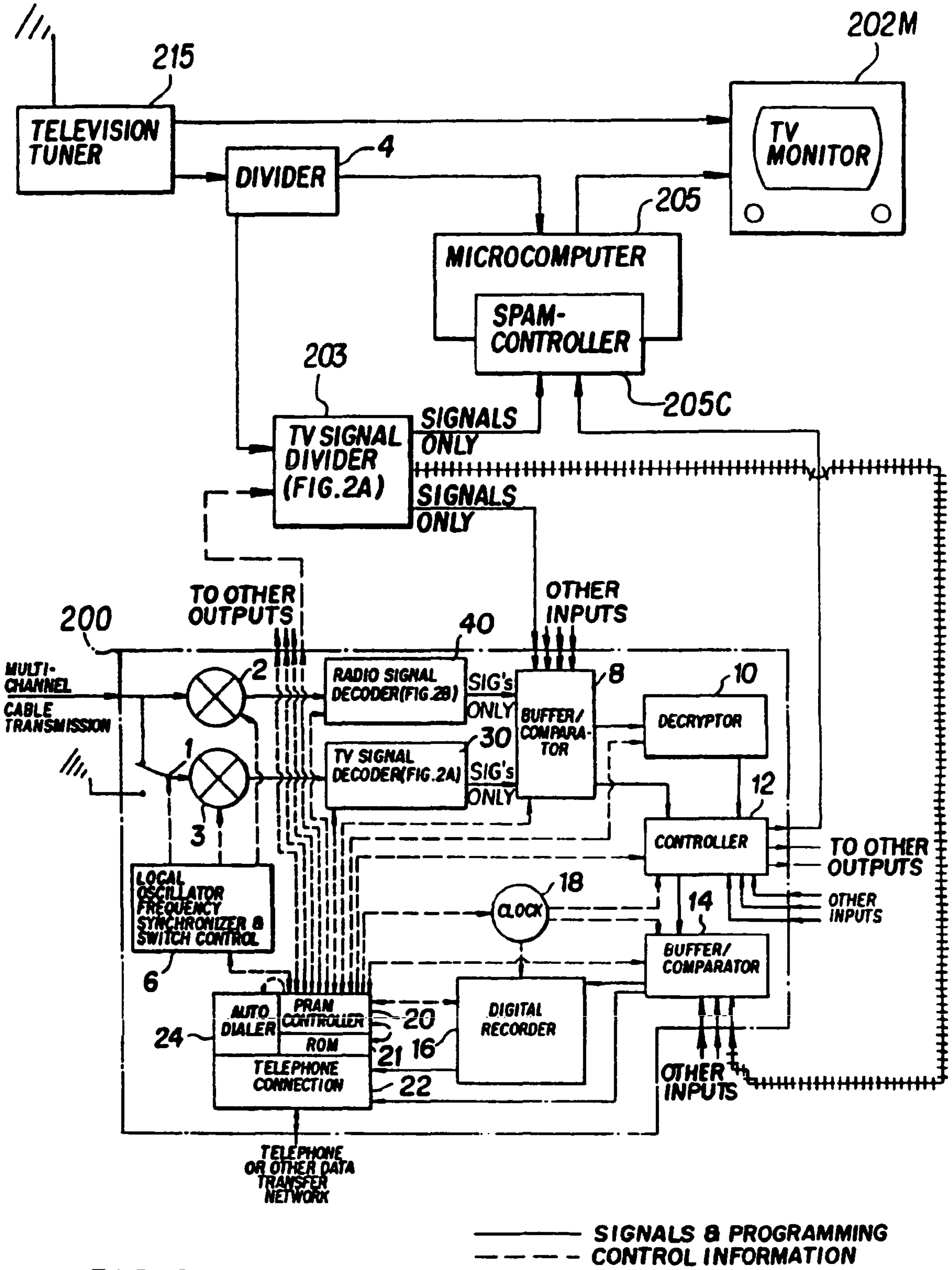

215
TELEVISION TUNER
202M
TV MONITOR
DIVIDER
4
205
MICROCOMPUTER
SPAM-CONTROLLER
205C
203
TV SIGNAL DIVIDER (FIG.2A)
SIGNALS ONLY
SIGNALS ONLY
TO OTHER OUTPUTS
OTHER INPUTS
200
40
MULTI-CHANNEL CABLE TRANSMISSION
2
RADIO SIGNAL DECODER(FIG.2B)
SIG's ONLY
8
BUFFER/ COMPARA-TOR
10
DECRYPTOR
1
30
TV SIGNAL DECODER(FIG.2A)
SIG's ONLY
12
3
CONTROLLER
TO OTHER OUTPUTS
LOCAL OSCILLATOR FREQUENCY SYNCHRONIZER & SWITCH CONTROL
18
CLOCK
14
OTHER INPUTS
BUFFER/ COMPARATOR
6
AUTO DIALER
PRAM CONTROLLER
ROM
20
DIGITAL RECORDER
24
21
16
TELEPHONE CONNECTION
22
OTHER INPUTS
TELEPHONE OR OTHER DATA TRANSFER NETWORK
SIGNALS & PROGRAMMING
CONTROL INFORMATION

FIG. 3

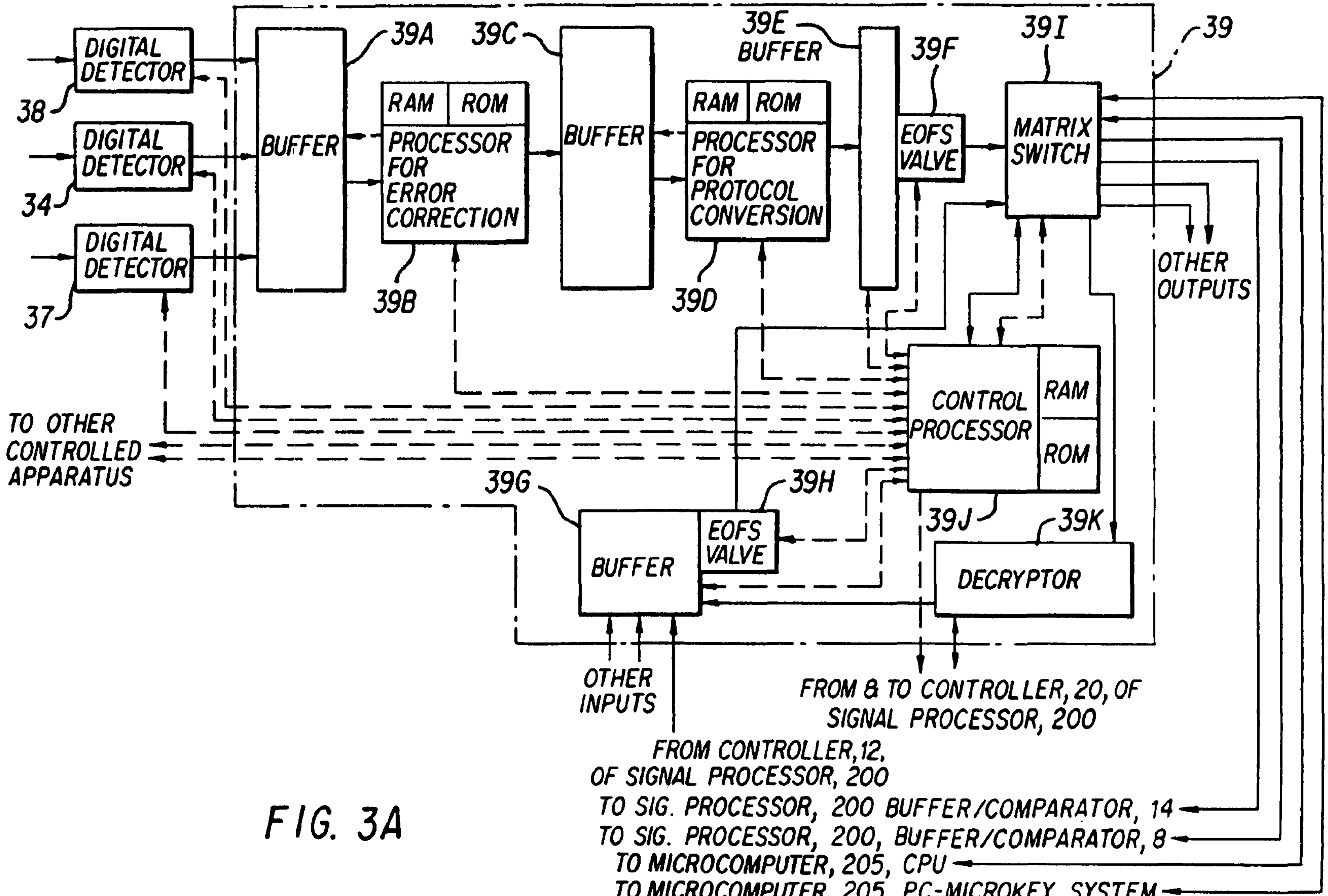

DIGITAL DETECTOR
38
DIGITAL DETECTOR
34
DIGITAL DETECTOR
37
BUFFER
39A
RAM
ROM
PROCESSOR FOR ERROR CORRECTION
39B
39C
BUFFER
RAM
ROM
PROCESSOR FOR PROTOCOL CONVERSION
39D
39E
BUFFER
39F
EOFS VALVE
39I
MATRIX SWITCH
39
OTHER OUTPUTS
CONTROL PROCESSOR
RAM
ROM
TO OTHER CONTROLLED APPARATUS
39G
BUFFER
39H
EOFS VALVE
39J
39K
DECRYPTOR
OTHER INPUTS
FROM & TO CONTROLLER, 20, OF SIGNAL PROCESSOR, 200
FROM CONTROLLER, 12, OF SIGNAL PROCESSOR, 200
TO SIG. PROCESSOR, 200 BUFFER/COMPARATOR, 14
TO SIG. PROCESSOR, 200, BUFFER/COMPARATOR, 8
TO MICROCOMPUTER, 205, CPU
TO MICROCOMPUTER, 205, PC-MICROKEY SYSTEM

FIG. 3A

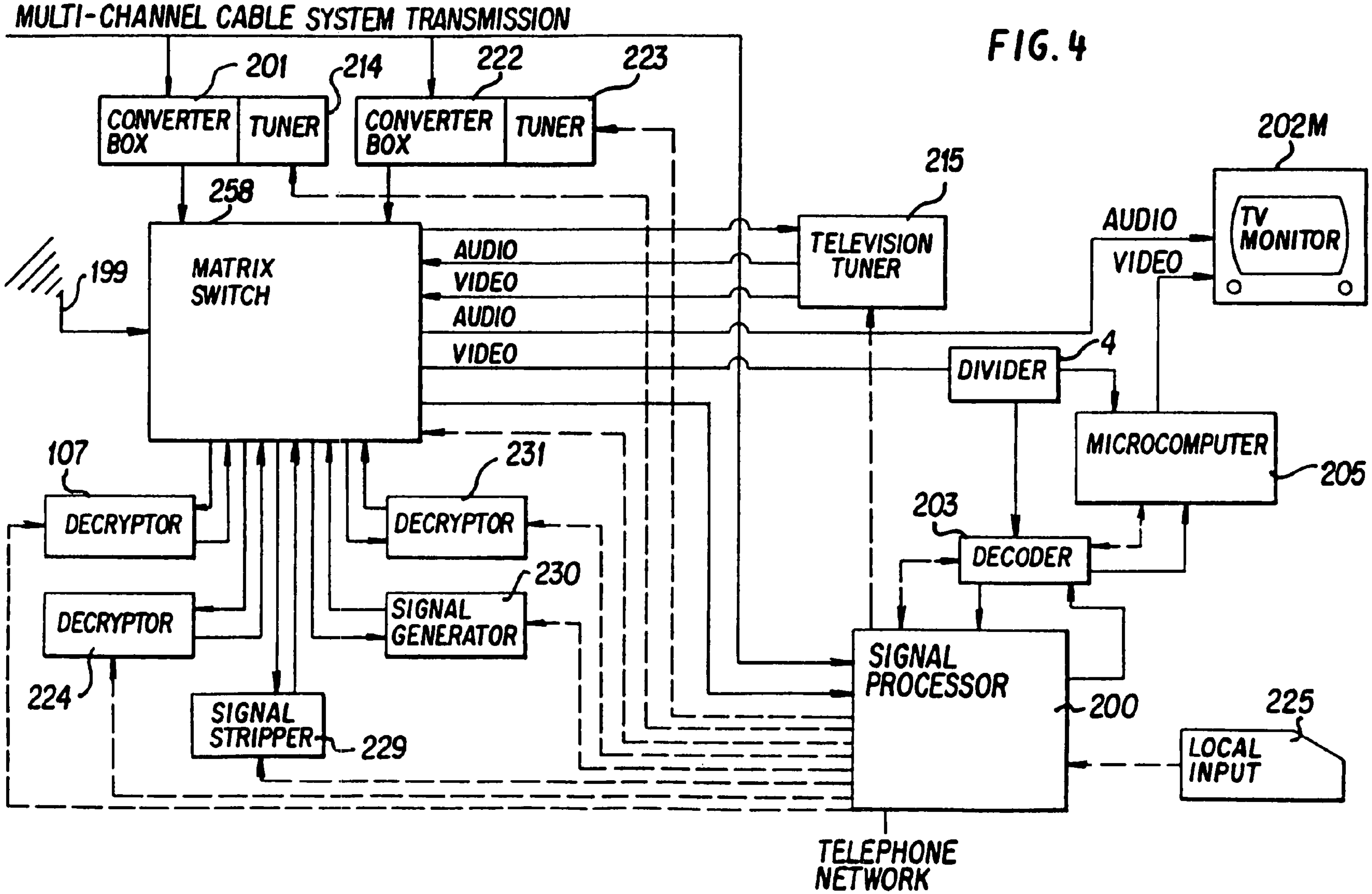

MULTI-CHANNEL CABLE SYSTEM TRANSMISSION
201
214
222
223
CONVERTER BOX
TUNER
CONVERTER BOX
TUNER
258
MATRIX SWITCH
199
AUDIO
VIDEO
AUDIO
VIDEO
215
TELEVISION TUNER
202M
TV MONITOR
AUDIO
VIDEO
4
DIVIDER
MICROCOMPUTER
205
203
DECODER
107
DECRYPTOR
231
DECRYPTOR
230
SIGNAL GENERATOR
DECRYPTOR
224
SIGNAL STRIPPER
229
SIGNAL PROCESSOR
200
225
LOCAL INPUT
TELEPHONE NETWORK

FIG. 4

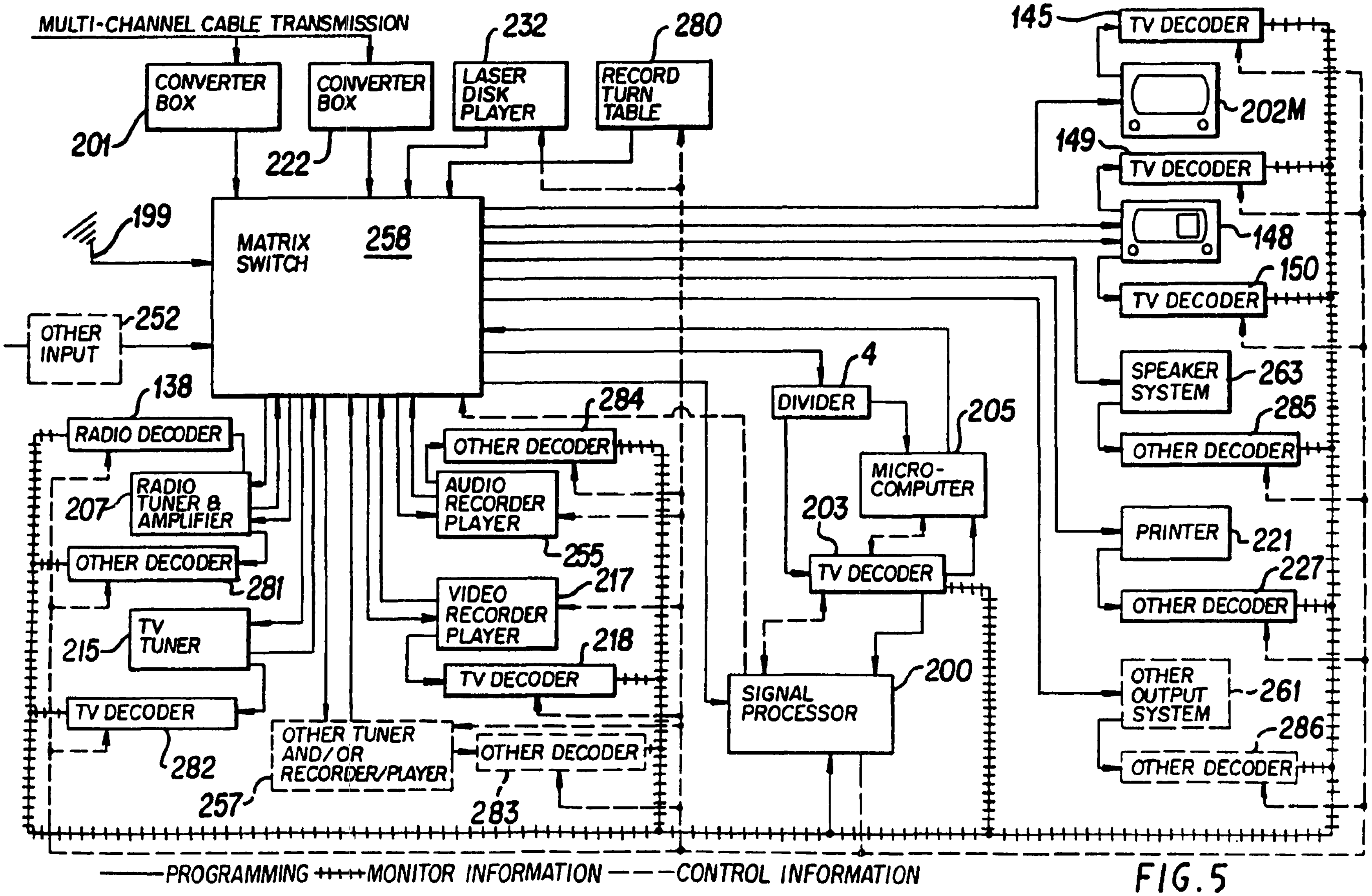

MULTI-CHANNEL CABLE TRANSMISSION
CONVERTER BOX
201
CONVERTER BOX
222
LASER DISK PLAYER
232
RECORD TURN TABLE
280
199
MATRIX SWITCH
258
OTHER INPUT
252
138
RADIO DECODER
207
RADIO TUNER & AMPLIFIER
OTHER DECODER
281
215
TV TUNER
TV DECODER
282
OTHER TUNER AND/OR RECORDER/PLAYER
257
OTHER DECODER
283
284
OTHER DECODER
AUDIO RECORDER PLAYER
255
VIDEO RECORDER PLAYER
217
218
TV DECODER
DIVIDER
4
205
MICRO-COMPUTER
203
TV DECODER
SIGNAL PROCESSOR
200
145
TV DECODER
202M
149
TV DECODER
148
150
TV DECODER
SPEAKER SYSTEM
263
285
OTHER DECODER
PRINTER
221
227
OTHER DECODER
OTHER OUTPUT SYSTEM
261
286
OTHER DECODER
PROGRAMMING
MONITOR INFORMATION
CONTROL INFORMATION

FIG.5

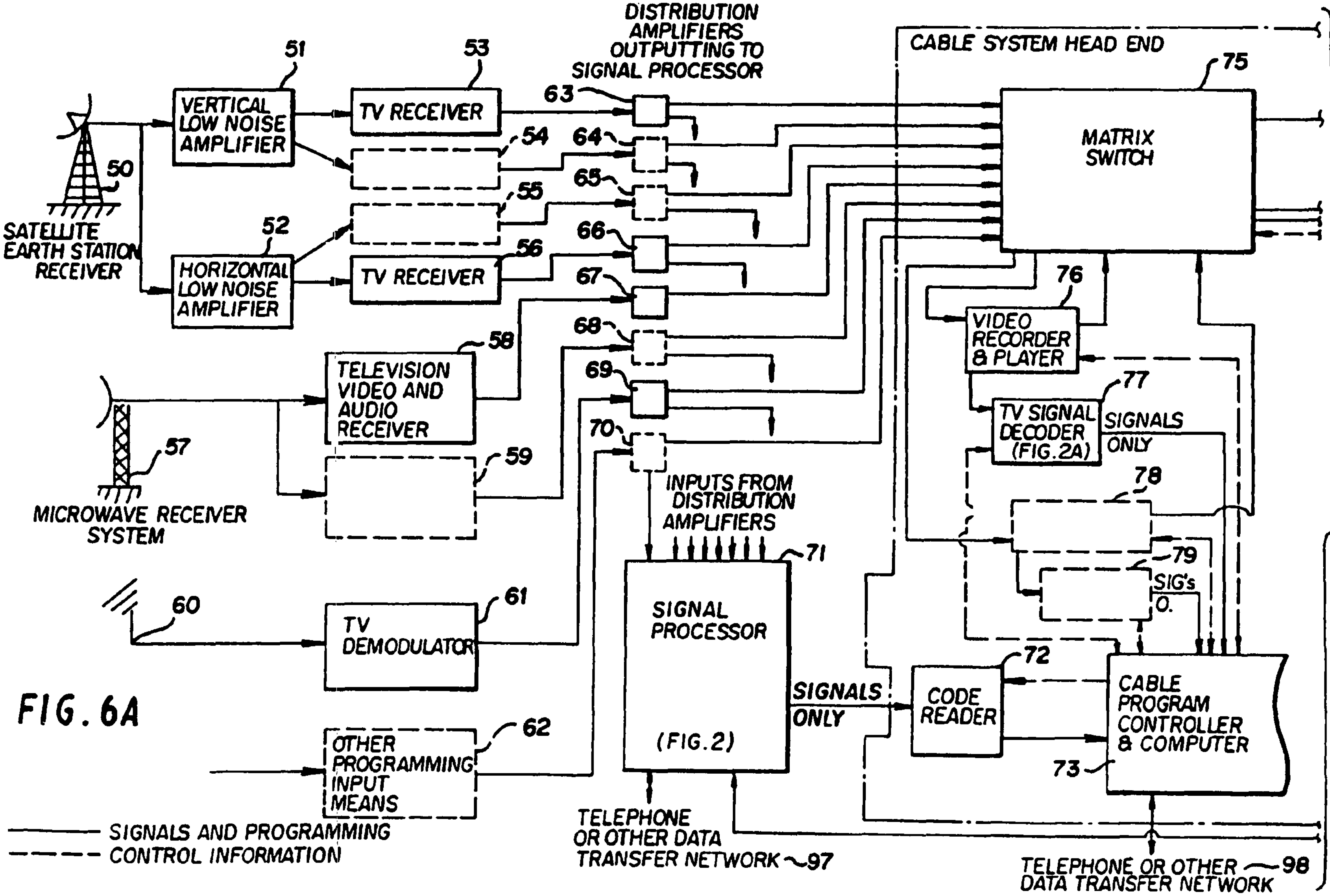

DISTRIBUTION AMPLIFIERS OUTPUTTING TO SIGNAL PROCESSOR
CABLE SYSTEM HEAD END
51
53
75
VERTICAL LOW NOISE AMPLIFIER
TV RECEIVER
63
64
54
65
55
66
67
68
69
70
MATRIX SWITCH
50
SATELLITE EARTH STATION RECEIVER
52
HORIZONTAL LOW NOISE AMPLIFIER
TV RECEIVER
56
76
VIDEO RECORDER & PLAYER
58
TELEVISION VIDEO AND AUDIO RECEIVER
77
TV SIGNAL DECODER (FIG. 2A)
SIGNALS ONLY
57
59
78
MICROWAVE RECEIVER SYSTEM
INPUTS FROM DISTRIBUTION AMPLIFIERS
71
79
SIG's O.
TO FIG. 6B
60
61
TV DEMODULATOR
SIGNAL PROCESSOR
(FIG. 2)
SIGNALS ONLY
72
CODE READER
CABLE PROGRAM CONTROLLER & COMPUTER
73
62
OTHER PROGRAMMING INPUT MEANS
SIGNALS AND PROGRAMMING
CONTROL INFORMATION
TELEPHONE OR OTHER DATA TRANSFER NETWORK 97
TELEPHONE OR OTHER DATA TRANSFER NETWORK 98

FIG. 6A

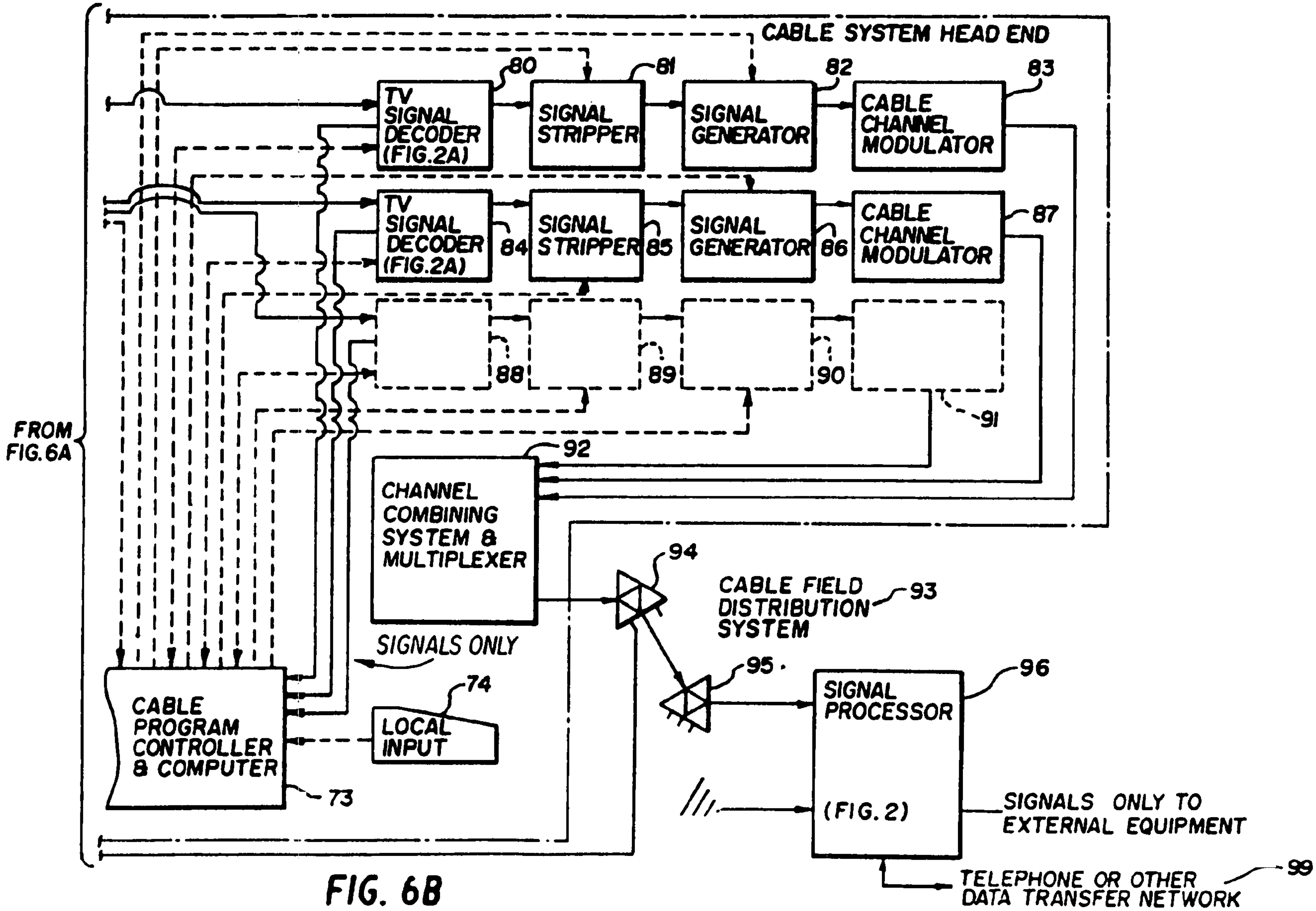
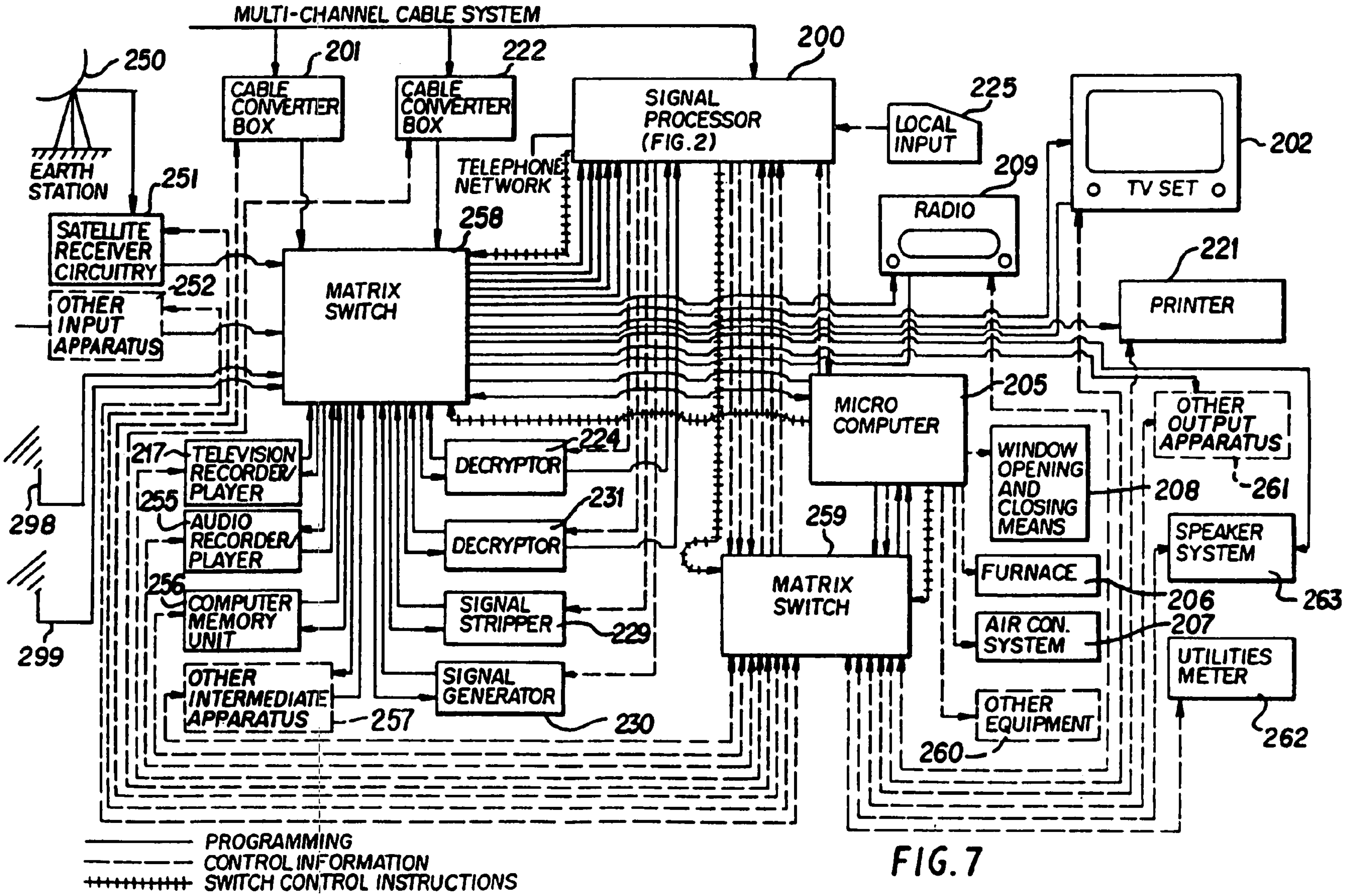
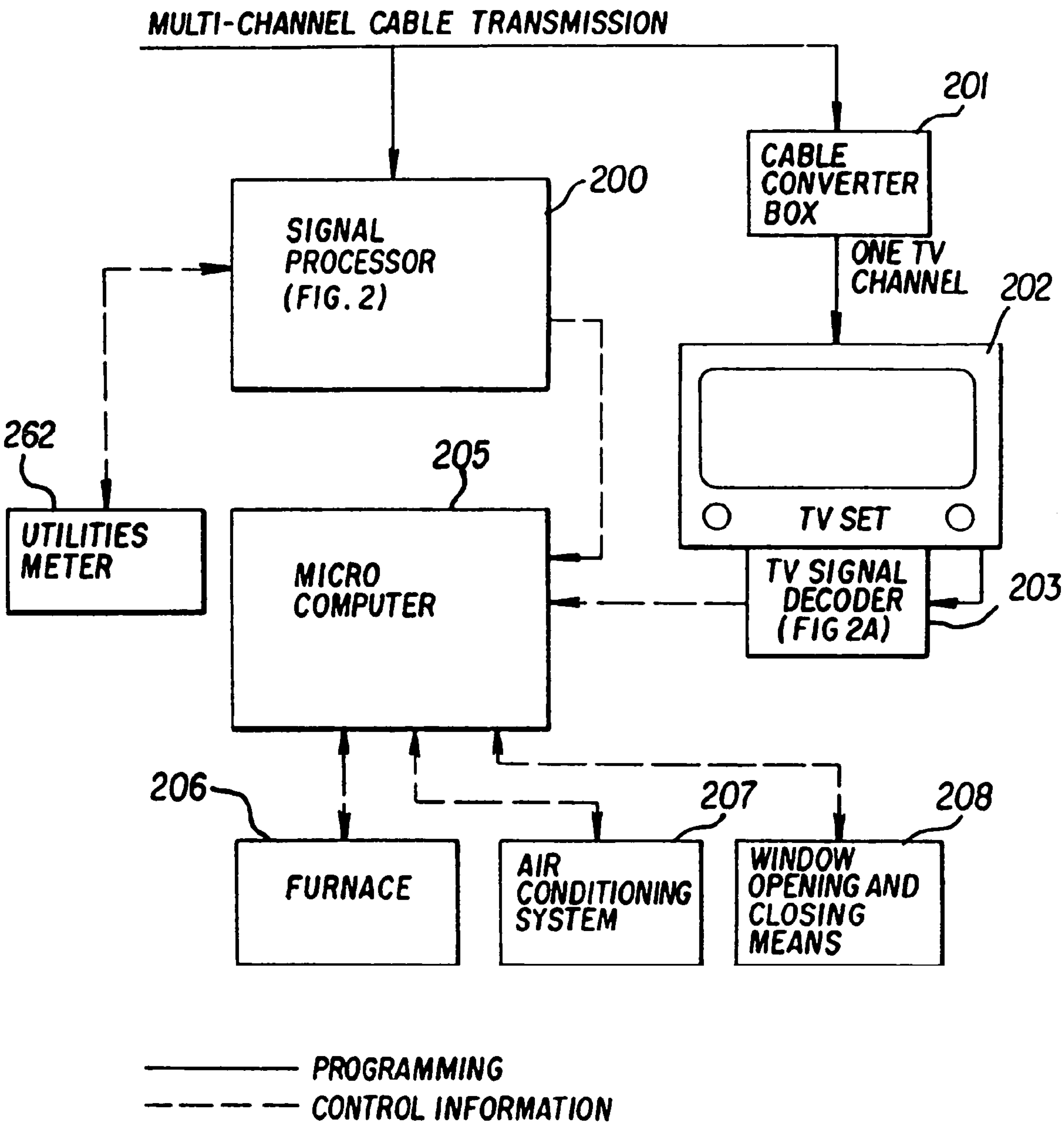

CABLE SYSTEM HEAD END
80
81
82
83
TV SIGNAL DECODER (FIG.2A)
SIGNAL STRIPPER
SIGNAL GENERATOR
CABLE CHANNEL MODULATOR
TV SIGNAL DECODER (FIG.2A)
84
SIGNAL STRIPPER
85
SIGNAL GENERATOR
86
CABLE CHANNEL MODULATOR
87
88
89
90
91
FROM FIG.6A
92
CHANNEL COMBINING SYSTEM & MULTIPLEXER
94
CABLE FIELD DISTRIBUTION SYSTEM
93
SIGNALS ONLY
95
96
SIGNAL PROCESSOR
(FIG. 2)
74
LOCAL INPUT
CABLE PROGRAM CONTROLLER & COMPUTER
73
SIGNALS ONLY TO EXTERNAL EQUIPMENT
TELEPHONE OR OTHER DATA TRANSFER NETWORK
99

FIG. 6B



MULTI-CHANNEL CABLE SYSTEM
250
EARTH STATION
201
CABLE CONVERTER BOX
222
CABLE CONVERTER BOX
200
SIGNAL PROCESSOR (FIG.2)
225
LOCAL INPUT
202
TV SET
209
RADIO
221
PRINTER
TELEPHONE NETWORK
251
SATELLITE RECEIVER CIRCUITRY
252
OTHER INPUT APPARATUS
258
MATRIX SWITCH
205
MICRO COMPUTER
OTHER OUTPUT APPARATUS
261
224
DECRYPTOR
231
DECRYPTOR
229
SIGNAL STRIPPER
230
SIGNAL GENERATOR
217
TELEVISION RECORDER/ PLAYER
255
AUDIO RECORDER/ PLAYER
256
COMPUTER MEMORY UNIT
OTHER INTERMEDIATE APPARATUS
257
298
299
259
MATRIX SWITCH
WINDOW OPENING AND CLOSING MEANS
208
FURNACE
206
AIR CON. SYSTEM
207
OTHER EQUIPMENT
260
SPEAKER SYSTEM
263
UTILITIES METER
262
PROGRAMMING
CONTROL INFORMATION
SWITCH CONTROL INSTRUCTIONS

FIG. 7



MULTI-CHANNEL CABLE TRANSMISSION
201
CABLE CONVERTER BOX
200
SIGNAL PROCESSOR (FIG. 2)
ONE TV CHANNEL
202
262
205
TV SET
UTILITIES METER
MICRO COMPUTER
TV SIGNAL DECODER (FIG 2A)
203
206
207
208
FURNACE
AIR CONDITIONING SYSTEM
WINDOW OPENING AND CLOSING MEANS
PROGRAMMING
CONTROL INFORMATION

FIG. 7A

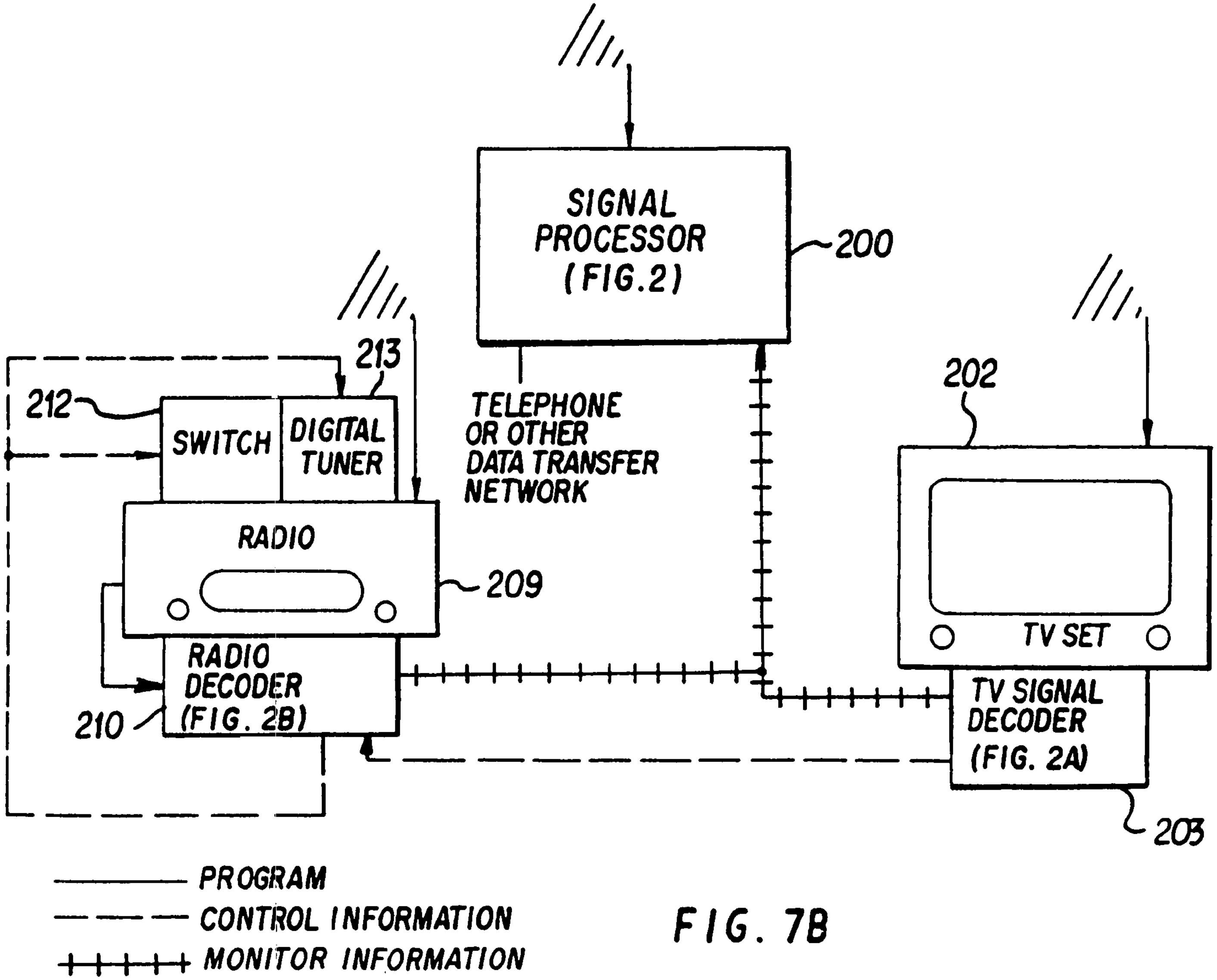

SIGNAL
PROCESSOR
(FIG.2)
200
TELEPHONE
OR OTHER
DATA TRANSFER
NETWORK
212
213
SWITCH
DIGITAL
TUNER
RADIO
209
RADIO
DECODER
(FIG. 2B)
210
202
TV SET
TV SIGNAL
DECODER
(FIG. 2A)
203
PROGRAM
CONTROL INFORMATION
MONITOR INFORMATION

FIG. 7B

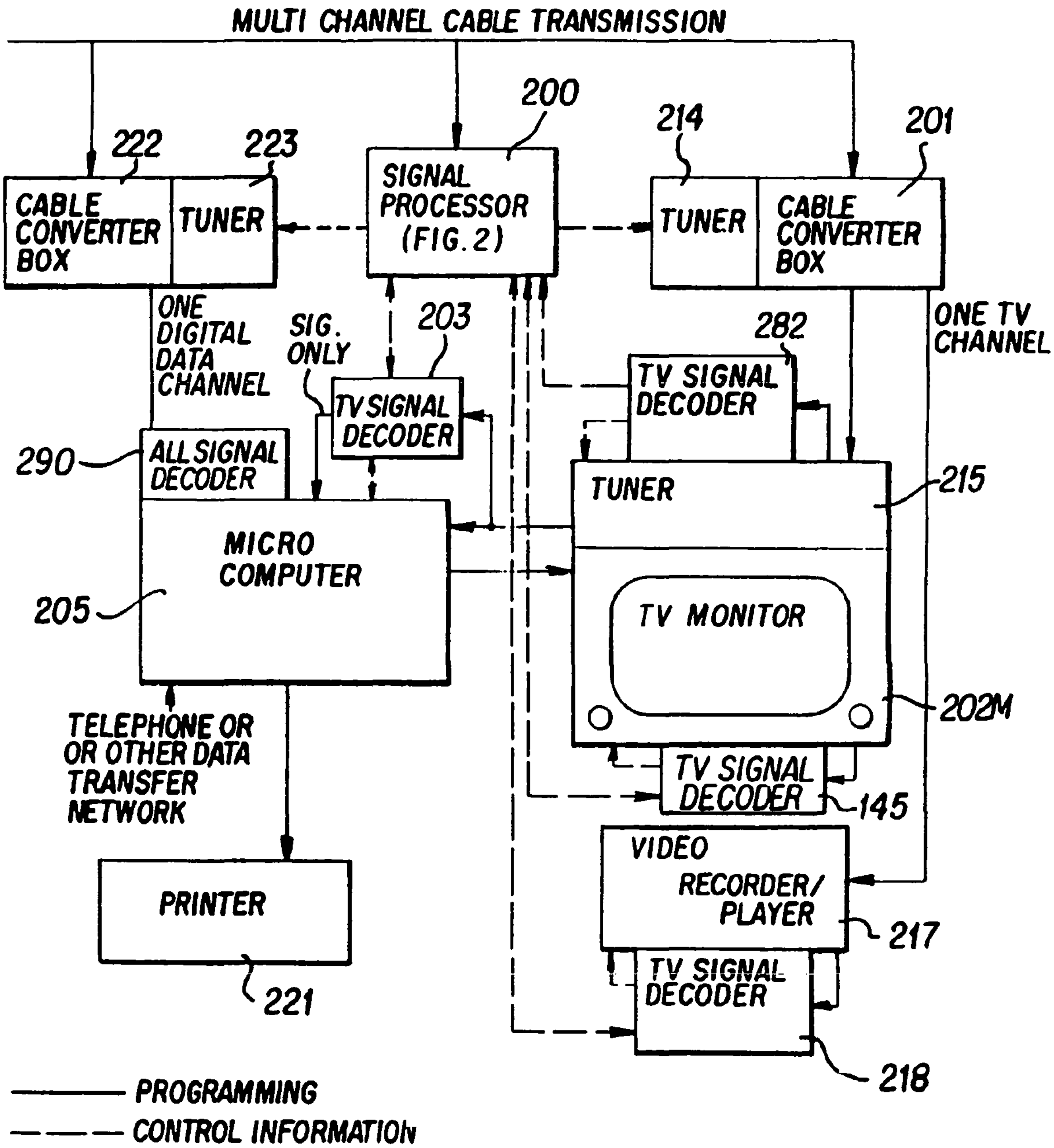

MULTI CHANNEL CABLE TRANSMISSION
200
SIGNAL PROCESSOR (FIG. 2)
222
223
CABLE CONVERTER BOX
TUNER
214
201
TUNER
CABLE CONVERTER BOX
ONE DIGITAL DATA CHANNEL
SIG. ONLY
203
TV SIGNAL DECODER
282
TV SIGNAL DECODER
ONE TV CHANNEL
290
ALL SIGNAL DECODER
MICRO COMPUTER
205
TUNER
215
TV MONITOR
202M
TV SIGNAL DECODER
145
TELEPHONE OR OR OTHER DATA TRANSFER NETWORK
VIDEO RECORDER/ PLAYER
217
PRINTER
221
TV SIGNAL DECODER
218
PROGRAMMING
CONTROL INFORMATION

FIG. 7C

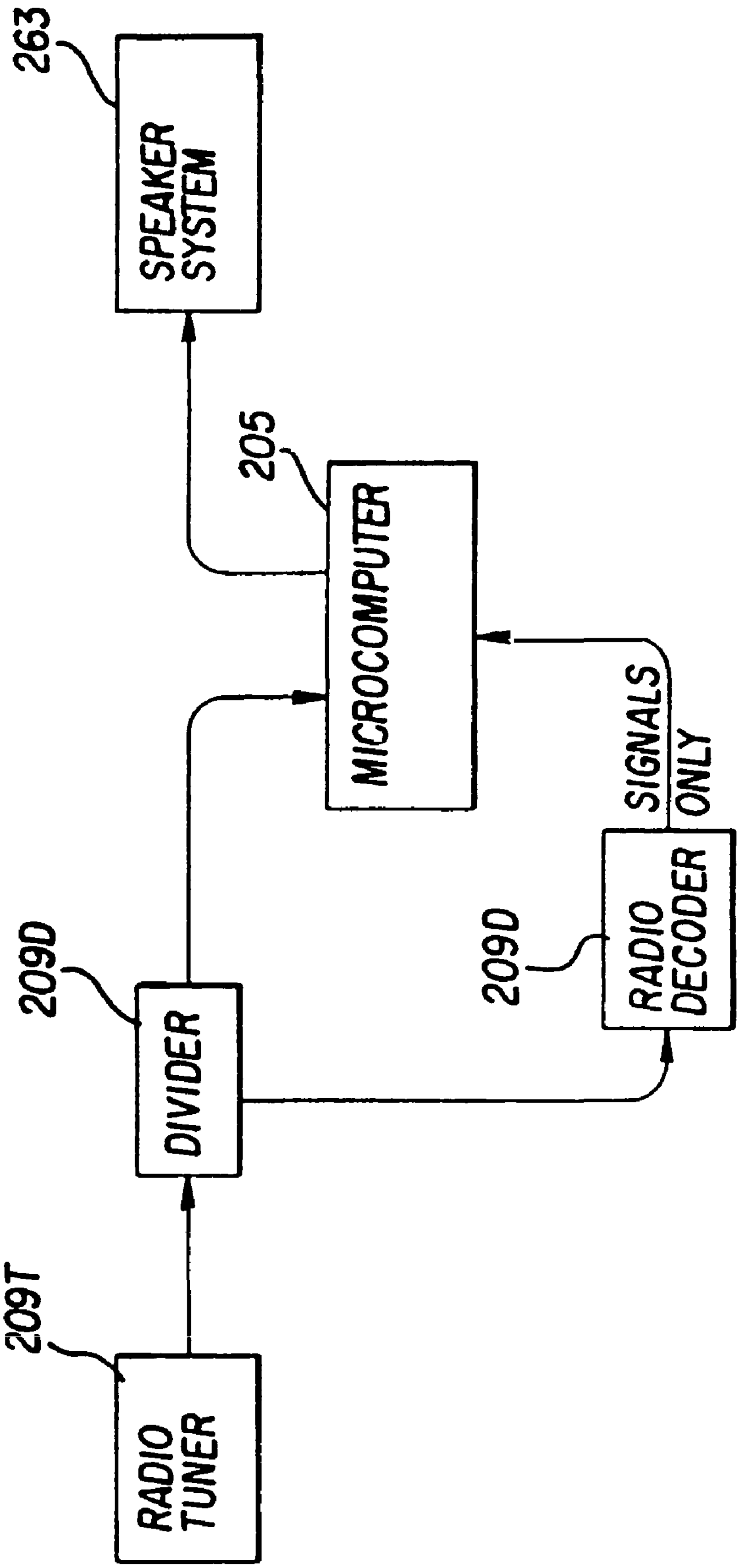

263
SPEAKER SYSTEM
205
MICROCOMPUTER
SIGNALS ONLY
209D
DIVIDER
209D
RADIO DECODER
209T
RADIO TUNER

FIG. 7D

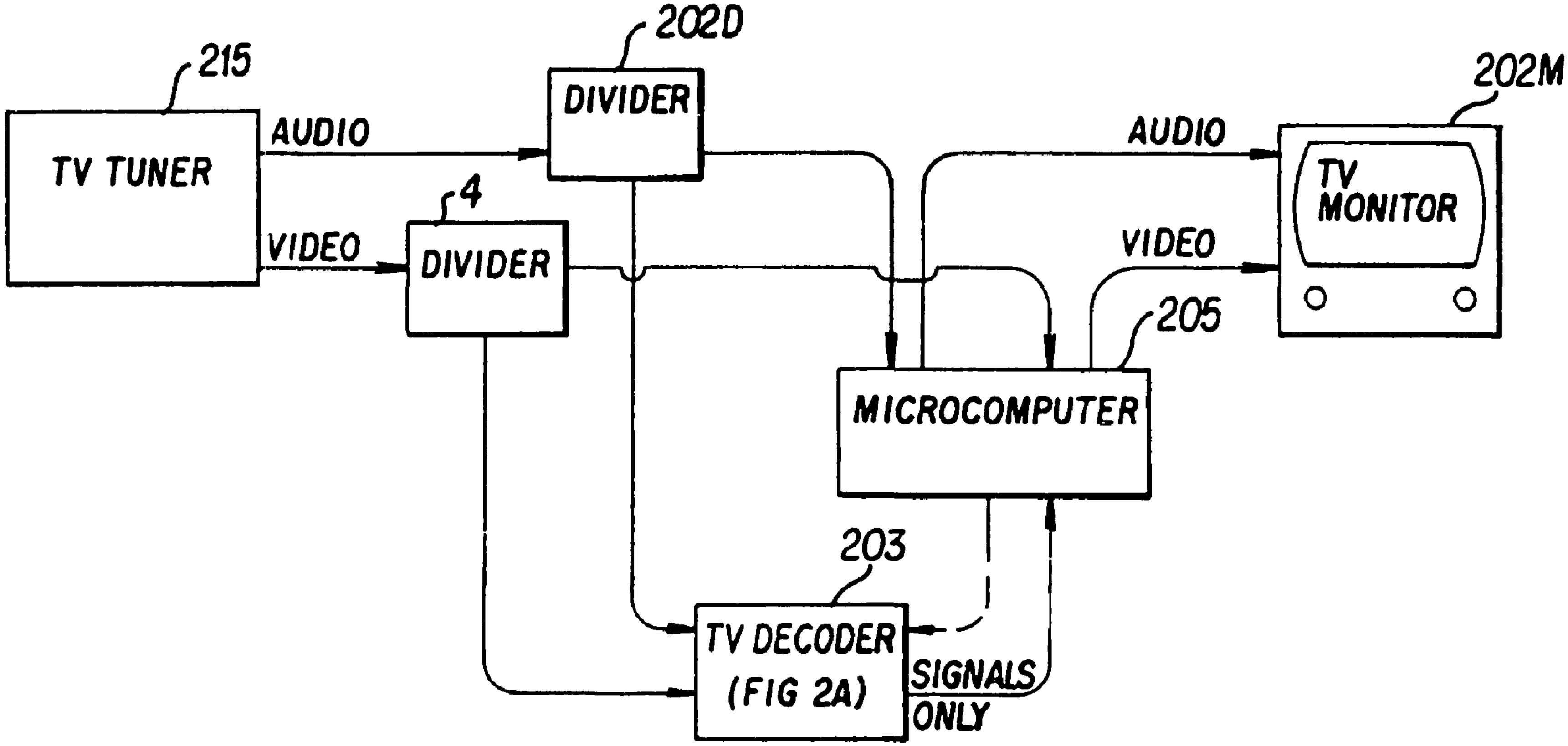

215
TV TUNER
AUDIO
VIDEO
202D
DIVIDER
4
DIVIDER
AUDIO
VIDEO
202M
TV
MONITOR
205
MICROCOMPUTER
203
TV DECODER
(FIG 2A)
SIGNALS
ONLY

FIG. 7E

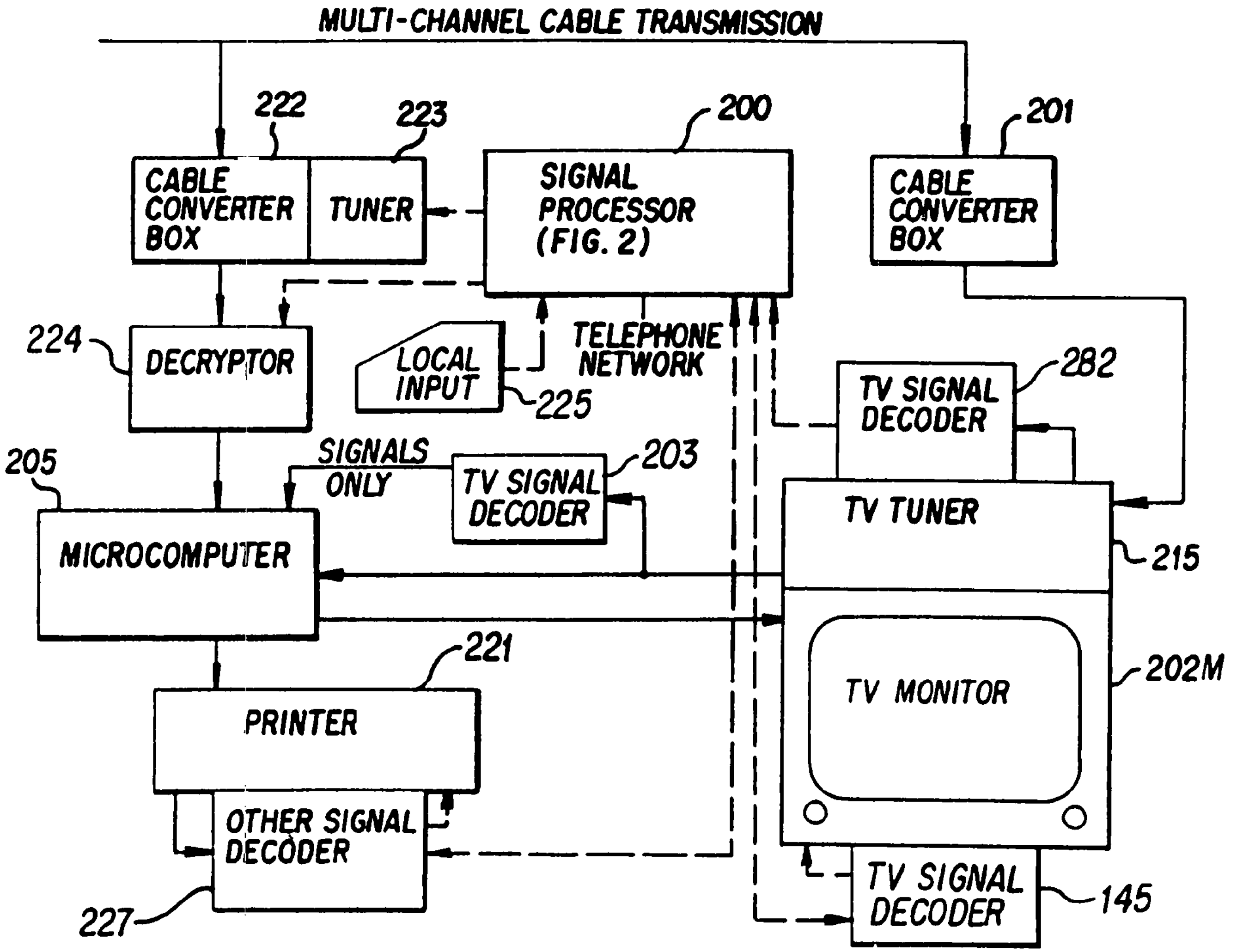


FIG. 7F

PROGRAMMING
CONTROL INFORMATION

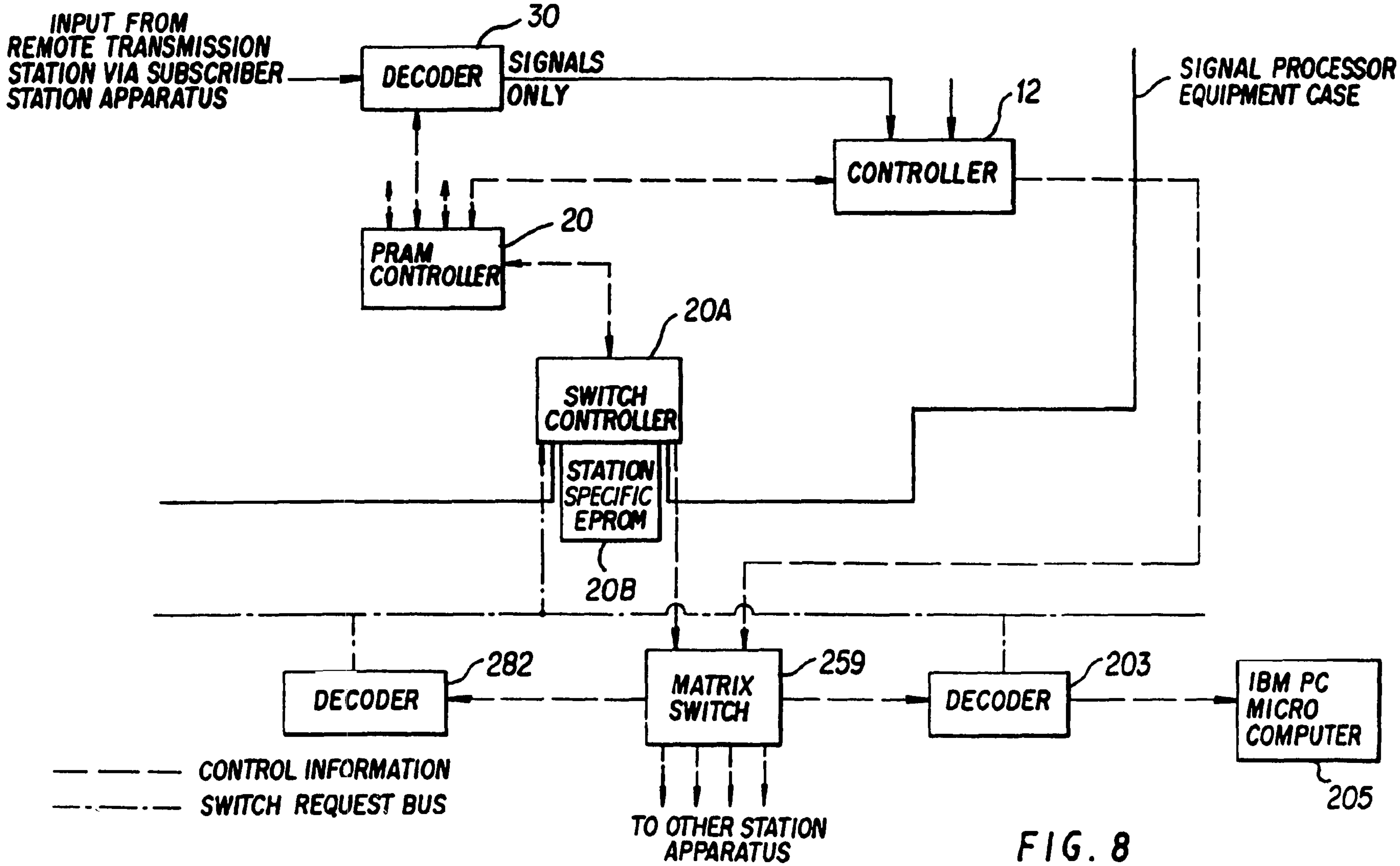

INPUT FROM
REMOTE TRANSMISSION
STATION VIA SUBSCRIBER
STATION APPARATUS
30
DECODER
SIGNALS
ONLY
SIGNAL PROCESSOR
EQUIPMENT CASE
12
CONTROLLER
20
PRAM
CONTROLLER
20A
SWITCH
CONTROLLER
STATION
SPECIFIC
EPROM
20B
282
DECODER
MATRIX
SWITCH
259
DECODER
203
IBM PC
MICRO
COMPUTER
205
CONTROL INFORMATION
SWITCH REQUEST BUS
TO OTHER STATION
APPARATUS

FIG. 8

SIGNAL PROCESSING APPARATUS AND METHODS

This is a continuation of application Ser. No. 08/113,329, filed Aug. 30, 1993, herein incorporated by reference in its entirety, which is a continuation of application Ser. No. 08/056,501, filed May 3, 1993, now U.S. Pat. No. 5,335,277, which was a continuation of application Ser. No. 07/849,226, filed Mar. 10, 1992, now U.S. Pat. No. 5,233,654, which was a continuation of application Ser. No. 07/588,126, filed Sep. 25, 1990, now U.S. Pat. No. 5,109,414, which was a continuation of application Ser. No. 07/096,096, filed Sep. 11, 1987, now U.S. Pat. No. 4,965,825, which was a continuation-in-part of application Ser. No. 06/829,531, filed Feb. 14, 1986, now U.S. Pat. No. 4,704,725, which was a continuation of application Ser. No. 06/317,510, filed Nov. 3, 1981, now U.S. Pat. No. 4,694,490.

BACKGROUND OF THE INVENTION

The invention relates to an integrated system of programming communication and involves the fields of computer processing, computer communications, television, radio, and other electronic communications; the fields of automating the handling, recording, and retransmitting of television, radio, computer, and other electronically transmitted programming; and the fields of regulating, metering, and monitoring the availability, use, and usage of such programming.

For years, television has been recognized as a most powerful medium for communicating ideas. And television is so-called "user-friendly"; that is, despite technical complexity, television is easy for subscribers to use.

Radio and electronic print services such as stock brokers' so-called "tickers" and "broad tapes" are also powerful, user friendly mass media. (Hereinafter, the electronic print mass medium is called, "broadcast print.")

But television, radio, and broadcast print are only mass media. Program content is the same for every viewer. Occasionally one viewer may see, hear, or read information of specific relevance to him (as happens when a guest on a television talk show turns to the camera and says, "Hi, Mom"), but such electronic media have no capacity for conveying user specific information simultaneously to each user.

For years, computers have been recognized as having unsurpassed capacity for processing and displaying user specific information.

But computer processing is not a mass medium. Computers operate under the control of computer programs that are inputted by specific users for specific purposes, not programs that are broadcast to and executed simultaneously at the stations of mass user audiences. And computer processing is far less user friendly than, for example, television.

Today great potential exists for combining the capacity of broadcast communications media to convey ideas with the capacity of computers to process and output user specific information. One such combination would provide a new radio-based or broadcast print medium with the capacity for conveying general information to large audiences—e.g., "Stock prices rose today in heavy trading,"—with information of specific relevance to each particular user in the audience—e.g., "but the value of your stock portfolio went down." (Hereinafter, the new media that result from such combinations are called "combined" media.)

Unlocking this potential is desirable because these new media will add substantial richness and variety to the communication of ideas, information and entertainment. Understanding complex subjects and making informed decisions will become easier.

To unlock this potential fully requires means and methods for combining and controlling receiver systems that are now separate—television and computers, radio and computers, broadcast print and computers, television and computers and broadcast print, etc.

But it requires much more.

To unlock this potential fully requires a system with efficient capacity for satisfying the demands of subscribers who have little receiver apparatus and simple information demands as well as subscribers who have extensive apparatus and complex demands. It requires capacity for transmitting and organizing vastly more information and programming than any one-channel transmission system can possibly convey at one time. It requires capacity for controlling intermediate transmission stations that receive information and programming from many sources and for organizing the information and programming and retransmitting the information and programming so as to make the use of the information and programming at ultimate receiver stations as efficient as possible.

To unlock this potential also requires efficient capacity for providing reliable audit information to (1) advertisers and others who pay for the transmission and performance of programming and (2) copyright holders, pay service operators, and others such as talent who demand, instead, to be paid. This requires capacity for identifying and recording (1) what television, radio, data, and other programming and what instruction signals are transmitted at each transmission station and (2) what is received at each receiver station as well as (3) what received programming is combined or otherwise used at each receiver station and (4) how it is received, combined, and/or otherwise used.

Moreover, this system must have the capacity to ensure that programming supplied for pay or for other conditional use is used only in accordance with those conditions. For example, subscriber station apparatus must display the commercials that are transmitted in transmissions that advertisers pay for. The system must have capacity for decrypting, in many varying ways, programming and instruction signals that are encrypted and for identifying those who pirate programming and inhibiting piracy.

It is the object of this invention to unlock this great potential in the fullest measure by means of an integrated system of programming communication that joins together all these capacities most efficiently.

Computer systems generate user specific information, but in any given computer system, any given set of program instructions that causes and controls the generation of user specific information is inputted to only one computer at a time.

Computer communications systems do transmit data point-to-multipoint. The Dataspeed Corporation division of Lotus Development Corporation of Cambridge, Mass. transmits real-time financial data over radio frequencies to microcomputers equipped with devices called "modios" that combine the features of radio receivers, modems, and decryptors. The Equatorial Communications Company of Mountain View, Calif. transmits to similarly equipped receiver systems by satellite. At each receiver station, apparatus receive the particular transmission and convert its data content into unencrypted digital signals that computers can process. Each subscriber programs his subscriber station apparatus to select particular data of interest.

This prior art is limited. It only transmits data; it does not control data processing. No system is preprogrammed to simultaneously control a plurality of central processor units, operating systems, and pluralities of computer peripheral units. None has capacity to cause simultaneous generation of user specific information at a plurality of receiver stations. None has any capacity to cause subscriber station computers to process received data, let alone in ways that are not inputted by the subscribers. None has any capacity to explain automatically why any given information might be of particular interest to any subscriber or why any subscriber might wish to select information that is not selected or how any subscriber might wish to change the way selected information is processed.

As regards broadcast media, systems in the prior art have capacity for receiving and displaying multiple images on television receivers simultaneously. One such system for superimposing printed characters transmitted incrementally during the vertical blanking interval of the television scanning format is described in U.S. Pat. No. 3,891,792 to Kimura. U.S. Pat. No. 4,310,854 to Baer describes a second system for continuously displaying readable alphanumeric captions that are transmitted as digital data superimposed on a normal FM sound signal and that relate in program content to the conventional television information upon which they are displayed. These systems permit a viewer to view a primary program and a secondary program.

This prior art, too, is limited. It has no capacity to overlay any information other than information transmitted to all receiver stations simultaneously. It has no capacity to overlay any such information except in the order in which it is received. It has no capacity to cause receiver station computers to generate any information whatsoever, let alone user specific information. It has no capacity to cause overlays to commence or cease appearing at receiver stations, let alone commence and cease appearing periodically.

As regards the automation of intermediate transmission stations, various so-called "cueing" systems in the prior art operate in conjunction with network broadcast transmissions to automate the so-called "cut-in" at local television and radio stations of locally originated programming such as so-called "local spot" advertisements.

Also in the prior art, U.S. Pat. No. 4,381,522 to Lambert describes a cable television system controlled by a minicomputer that responds to signals transmitted from viewers by telephone. In response to viewers' input preferences, the computer generates a schedule which determines what prerecorded, so-called local origination programs will be transmitted, when, and over what channels. The computer generates a video image of this schedule which it transmits over one cable channel to viewers which permits them to see when they can view the programs they request and over what channels. Then, in accordance with the schedule, it actuates preloaded video tape, disc or film players and transmits the programming transmissions from these players to the designated cable channels by means of a controlled video switch.

This prior art, too, is limited. It has no capacity to schedule automatically or transmit any programming other than that loaded immediately at the play heads of the controlled video players. It has no capacity to load the video players or identify what programming is loaded on the players or verify that scheduled programs are played correctly. It has no capacity to cause the video players to record programming from any source. It has no capacity to receive programming transmissions or process received transmissions in any way. It has no capacity to operate under the control of instructions transmitted by broadcasters. It has no capacity to insert signals that convey information to or control, in any way, the automatic operation of ultimate receiver station apparatus other than television receivers.

As regards the automation of ultimate receiver stations, in the prior art, U.S. Pat. No. 4,337,480 to Bourassin et al. describes a dynamic interconnection system for connecting at least one television receiver to a plurality of television peripheral units. By means of a single remote keyboard, a viewer can automatically connect and disconnect any of the peripheral units without the need manually to switch systems or fasten and unfasten cabling each time. In addition, using a so-called "image-within-image" capacity, the viewer can superimpose a secondary image from a second peripheral unit upon the primary image on the television display. In this fashion, two peripheral units can be viewed simultaneously on one television receiver. U.S. Pat. No. 4,264,925 to Freeman et. al. describes a multi-channel programming transmission system wherein subscribers may select manually among related programming alternatives transmitted simultaneously on separate channels.

This prior art, too, is limited. It has no capacity for interconnecting or operating a system at any time other than the time when the order to do so is entered manually at the system or remote keyboard. It has no capacity for acting on instructions transmitted by broadcasters to interconnect, actuate or tune systems peripheral to a television receiver or to actuate a television receiver or automatically change channels received by a receiver. It has no capacity for coordinating the programming content transmitted by any given peripheral system with any other programming transmitted to a television receiver. It has no capacity for controlling two separate systems such as, for example, an automatic radio and television stereo simulcast. It has no capacity for selectively connecting radio receivers to radio peripherals such as computers or printers or speakers or for connecting computers to computer peripherals (except perhaps a television set). It has no capacity for controlling the operation of decryptors or selectively inputting transmissions to decryptors or outputting transmissions from decryptors to other apparatus. It has no capacity for monitoring and maintaining records regarding what programming is selected or played on any apparatus or what apparatus is connected or how connected apparatus operate.

The prior art includes a variety of systems for monitoring programming and generating so-called "ratings." One system that monitors by means of embedded digital signals is described in U.S. Pat. No. 4,025,851 to Haselwood, et al. Another that monitors by means of audio codes that are only "substantially inaudible" is described in U.S. Pat. No. 3,845,391 to Crosby. A third that automatically monitors a plurality of channels by switching sequentially among them and that includes capacity to monitor audio and visual quality is described in U.S. Pat. No. 4,547,804 to Greenberg.

This prior art, too, is limited. It has capacity to monitor only single broadcast stations, channels or units and lacks capacity to monitor more than one channel at a time or to monitor the combining of media. At any given monitor station, it has had capacity to monitor either what is transmitted over one or more channels or what is received on one or more receivers but not both. It has assumed monitored signals of particular format in particular transmission locations and has lacked capacity to vary formats or locations or to distinguish and act on the absence of signals or to interpret and process in any fashion signals that appear in monitored locations that are not monitored signals.

It has lacked capacity to identify encrypted signals then decrypt them. It has lacked capacity to record and also transfer information to a remote geographic location simultaneously.

As regards recorder/player systems, many means and methods exist in the prior art for recording television or audio programming and/or data on magnetic, optical or other recording media and for retransmitting prerecorded programming. Video tape recorders have capacity for automatic delayed recording of television transmissions on the basis of instructions input manually by viewers. So-called "interactive video" systems have capacity for locating prerecorded television programming on a given disc and transmitting it to television receivers and locating prerecorded digital data on the same disc and transmitting them to computers.

This prior art, too, is limited. It has no capacity for automatically embedding signals in and/or removing embedded signals from a television transmission then recording the transmission. It has no capacity for controlling the connection or actuation or tuning of external apparatus. It has no capacity for retransmitting prerecorded programming and controlling the decryption of said programming, let alone doing so on the basis of signals that are embedded in said programming that contain keys for the decryption of said programming. It has no capacity for operating on the basis of control signals transmitted to recorder/players at a plurality of subscriber stations, let alone operating on the basis of such signals to record user specific information at each subscriber station.

As regards decoders and decryptors, many different systems exist, at present, that enable programming suppliers to restrict the use of transmitted programming to only duly authorized subscribers. The prior art includes so-called "addressable" systems that have capacity for controlling specific individual subscriber station apparatus by means of control instructions transmitted in broadcasts. Such systems enable broadcasters to turn off subscriber station decoder/decryptor apparatus of subscribers who do not pay their bills and turn them back on when the bills are paid.

This prior art, too, is limited. It has no capacity for decrypting combined media programming. It has no capacity for identifying then selectively decrypting control instructions embedded in unencrypted programming transmissions. It has no capacity for identifying programming transmissions or control instructions selectively and transferring them to a decryptor for decryption. It has no capacity for transferring the output of a decryptor selectively to one of a plurality of output apparatus. It has no capacity for automatically identifying decryption keys and inputting them to a decryptor to serve as the key for any step of decryption. It has no capacity for identifying and recording the identity of what is input to or output from a decryptor. It has no capacity for decrypting a transmission then embedding a signal in the transmission—let alone for simultaneously embedding user specific signals at a plurality of subscriber stations. It has no capacity for distinguishing the absence of an expected signal or controlling any operation when such absence occurs.

Further significant limitations arise out of the failure to reconcile aspects of these individual areas of art—monitoring programming, automating ultimate receiver stations, decrypting programming, generating the programming itself, etc.—into an integrated system. These limitations are both technical and commercial.

For example, the commercial objective of the aforementioned monitoring systems of Crosby, Haselwood et. al., and Greenberg is to provide independent audits to advertisers and others who pay for programming transmissions. All require embedding signals in programming that are used only to identify programming. Greenberg, for example, requires that a digital signal be transmitted at a particular place on a select line of each frame of a television program. But television has only so much capacity for transmitting signals outside the visible image; it is inefficient for such signals to serve only one function; and broadcasters can foresee alternate potential for this capacity that may be more profitable to them. Furthermore, advertisers recognize that if the systems of Crosby, Haselwood and Greenberg distinguish TV advertisements by means of single purpose signals, television receivers and video tape recorders can include capacity for identifying said signals and suppressing the associated advertisements. Accordingly, no independent automatic comprehensive so-called "proof-of-performance" audit service has yet proven commercially viable.

As a second example, because of the lack of a viable independent audit system, each service that broadcasts encrypted programming controls and services at each subscriber station one or more receiver/decryptors dedicated to its service alone. Lacking a viable audit system, services do not transmit to shared, common receiver/decryptors.

These are just two examples of limitations that arise in the absence of an integrated system of programming communication.

It is an object of the present invention to overcome these and other limitations of the prior art.

SUMMARY OF THE INVENTION

The present invention consists of an integrated system of methods and apparatus for communicating programming. The term "programming" refers to everything that is transmitted electronically to entertain, instruct or inform, including television, radio, broadcast print, and computer programming as well as combined medium programming. The system includes capacity for automatically organizing multi-channel communications. Like television, radio, broadcast print, and other electronic media, the present invention has capacity for transmitting to standardized programming that is very simple for subscribers to play and understand. Like computer systems, the present invention has capacity for transmitting data and control instructions in the same information stream to many different apparatus at a given subscriber station, for causing computers to generate and transmit programming, and for causing receiver apparatus to operate on the basis of programming and information received at widely separated times.

It is the further purpose of this invention to provide means and methods whereby a simplex point-to-multipoint transmission (such as a television or radio broadcast) can cause simultaneous generation of user specific information at a plurality of subscriber stations. One advantage of the present invention is great ease of use. For example, as will be seen, a subscriber can cause his own information to be processed in highly complex ways by merely turning his television receiver on and tuning to a particular channel. Another advantage of the present invention is its so-called "transparency"—subscribers see none of the complex processing taking place. Another advantage is privacy. No private information is required at transmitting stations, and no subscriber's information is available at any other subscriber's station.

It is the further purpose of this invention to provide means and methods whereby a simplex broadcast transmission can cause periodic combining of relevant user specific information and conventional broadcast programming simultaneously at a plurality of subscriber stations, thereby integrating the broadcast information with each user's own information. One advantage of the present invention is its use of powerful communication media such as television to reveal the meaning of the results of complex processing in ways that appear clear and simple. Another advantage is that receiver stations that lack said capacity for combining user specific information into television or radio programming can continue, without modification, to receive and display the conventional television or radio and without the appearance of any signals or change in the conventional programming.

It is the further purpose of this invention to provide means and methods for the automation of intermediate transmission stations that receive and retransmit programming. The programming may be delivered by any means including over-the-air, hard-wire, and manual means. The stations may transmit programming over-the-air (hereinafter, "broadcast") or over hard-wire (hereinafter, "cablecast"). They may transmit single channels or multiple channels. The present invention includes capacity for automatically constructing records for each transmitted channel that duplicate the logs that the Federal Communications Commission requires broadcast station operators to maintain.

It is the further purpose of this invention to provide means and methods for the automation of ultimate receiver stations, especially the automation of combined medium and multichannel presentations. Such ultimate receiver stations may be private homes or offices or commercial establishments such as theaters, hotels, or brokerage offices.

It is the further purpose of this invention to provide means and methods for identifying and recording what television, radio, data, and other programming is transmitted at each transmission station, what programming is received at each receiver station, and how programming is used. In the present invention, certain monitored signals may be encrypted, and certain data collected from such monitoring may be automatically transferred from subscriber stations to one or more remote geographic stations.

It is a further purpose of this invention to provide means and methods for recording combined media and/or multichannel programming and for playing back prerecorded programming of such types.

It is a further purpose of this invention to provide a variety of means and methods for restricting the use of transmitted communications to only duly authorized subscribers. Such means and methods include techniques for encrypting programming and/or instructions and decrypting them at subscriber stations. They also include techniques whereby the pattern of the composition, timing, and location of embedded signals may vary in such fashions that only receiving apparatus that are preinformed regarding the patterns that obtain at any given time will be able to process the signals correctly.

The present invention employs signals embedded in programming. Embedded signals provide several advantages. They cannot become separated inadvertently from the programming and, thereby, inhibit automatic processing. They occur at precise times in programming and can synchronize the operation of receiver station apparatus to the timing of programming transmissions. They can be conveniently monitored.

In the present invention, the embedded signals contain digital information that may include addresses of specific receiver apparatus controlled by the signals and instructions that identify particular functions the signals cause addressed apparatus to perform.

In programming transmissions, given signals may run and repeat, for periods of time, continuously or at regular intervals. Or they may run only occasionally or only once. They may appear in various and varying locations. In television they may appear on one line in the video portion of the transmission such as line **20** of the vertical interval, or on a portion of one line, or on more than one line, and they will probably lie outside the range of the television picture displayed on a normally tuned television set. In television and radio they may appear in a portion of the audio range that is not normally rendered in a form audible to the human ear. In television audio, they are likely to lie between eight and fifteen kilohertz. In broadcast print and data communications transmissions, the signals may accompany conventional print or data programming in the conventional transmission stream but will include instructions that receiver station apparatus are preprogrammed to process that instruct receiver apparatus to separate the signals from the conventional programming and process them differently. In all cases, signals may convey information in discrete words, transmitted at separate times or in separate locations, that receiver apparatus must assemble in order to receive one complete instruction.

(The term "signal unit" hereinafter means one complete signal instruction or information message unit. Examples of signal units are a unique code identifying a programming unit, or a unique purchase order number identifying the proper use of a programming unit, or a general instruction identifying whether a programming unit is to be retransmitted immediately or recorded for delayed transmission. The term "signal word" hereinafter means one full discrete appearance of a signal as embedded at one time in one location on a transmission. Examples of signal words are a string of one or more digital data bits encoded together on a single line of video or sequentially in audio. Such strings may or may not have predetermined data bits to identify the beginnings and ends of words. Signal words may contain parts of signal units, whole signal units, or groups of partial or whole signal units or combinations.)

In the present invention, particular signal processing apparatus (hereinafter called the "signal processor") detect signals and, in accordance with instructions in the signals and preprogramming in the signal processor, decrypt and/or record and/or control station apparatus by means of the signals and/or discard the signals. The apparatus include one or more devices that can selectively scan transmission frequencies as directed and, separately, capacity to receive signals from one or more devices that continuously monitor selected frequencies. The frequencies may convey television, radio, or other programming transmissions. The input transmissions may be received by means of antennas or from hard-wire connections. The scanners/switches, working in parallel or series or combinations, transfer the transmissions to receiver/decoder/detectors that identify signals encoded in programming transmissions and convert the encoded signals to digital information; decryptors that may convert the received information, in part or in whole, to other digital information according to preset methods or patterns; and one or more processor/monitors and/or buffer/comparators that organize and transfer the information stream. The processors and buffers can have inputs from each of the receiver/detector lines and evaluate information continuously. From the processors and buffers, the signals may be transferred to external equipment such as computers, videotape recorders and players, etc. And/or they may be transferred to one or more internal digital recorders that receive and store in memory the recorded information and have connections to one or more remote sites for further transmission of the recorded information. The apparatus has means for external communication and an automatic dialer and can contact remote sites and transfer stored information as required in a predetermined fashion or fashions. The apparatus has a clock for determining and recording time as required. It has a read only memory for recording permanent operating instructions and other information and a programmable random access memory controller ("PRAM controller") that permits revision of operating patterns and instructions. The PRAM controller may be connected to all internal operating units for full flexibility of operations.

Signal processing apparatus that are employed in specific situations that require fewer functions than those provided by the signal processor described above may omit one or more of the specific operating elements described above.

A central objective of the present invention is to provide flexibility in regard to installed station apparatus. At any given time, the system must have capacity for wide variation in individual station apparatus in order to provide individual subscribers the widest range of information options at the least cost in terms of installed equipment. Flexibility must exist for expanding the capacity of installed systems by means of transmitted software and for altering installed systems in a modular fashion by adding or removing components. Flexibility must exist for varying techniques that restrict programming to duly authorized subscribers in order to identify and deter pirates of programming.

Other objects, features, and advantages of this invention will appear in the following descriptions and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a video/computer combined medium receiver station.

FIG. **1**A shows a representative example of a computer generated, user specific graphic as it would appear by itself on the face of a display tube.

FIG. **1**B shows a representative example of a studio generated graphic displayed on the face of a display tube.

FIG. **1**C shows a representative example, on the face of a display tube, of a studio graphic combined with a user specific graphic.

FIG. **2** is a block diagram of one embodiment of a signal processor.

FIG. **2**A is a block diagram of a TV signal decoder apparatus.

FIG. **2**B is a block diagram of a radio signal decoder apparatus.

FIG. **2**C is a block diagram of an other signal decoder apparatus.

FIG. **2**D is a block diagram of one embodiment of a receiver station signal processing system.

FIG. **2**E illustrates one example of the composition of signal information and shows the initial binary information of a message that contains execution, meter-monitor, and information segments.

FIG. **2**F shows one instance of a meter-monitor segment.

FIG. **2**G shows one instance of a command that fills a whole number of byte signal words incompletely.

FIG. **2**H shows one instance of a message that contains execution and meter-monitor segments and consists of the command of FIG. **2**G with three padding bits added at the end to complete the last byte signal word.

FIG. **2**I shows one instance of a SPAM message stream.

FIG. **2**J shows one instance of a message that consists of just a header and an execution segment and fills one byte signal word completely.

FIG. **2**K shows one instance of a message that contains execution and meter-monitor segments and fills a whole number of byte signal words completely but ends with one full byte signal word of padding bits because the last byte signal word of command information is an EOFS word.

FIG. **3** is a block diagram of a video/computer combined medium receiver station with a signal processing system.

FIG. **3**A is a block diagram of the preferred embodiment the controller apparatus of a SPAM decoder.

FIG. **4** is a block diagram of one example of a signal processing programming reception and use regulating system.

FIG. **5** is a block diagram of one example of a signal processing apparatus and methods monitoring system installed to monitor a subscriber station.

FIG. **6** is a block diagram of one example of signal processing apparatus and methods at an intermediate transmission station, in this case a cable system headend.

FIG. **7** is a block diagram of signal processing apparatus and methods at an ultimate receiver station.

FIG. **7**A is a block diagram of signal processing apparatus and methods with external equipment regulating the environment of the local receiver site.

FIG. **7**B is a block diagram of signal processing apparatus and methods used to control a combined medium, multichannel presentation and to monitor such viewership.

FIG. **7**C is a block diagram of signal processing apparatus and methods selecting receivable information and programming and controlling combined medium, multi-channel presentations.

FIG. **7**D is a block diagram of a radio/computer combined medium receiver station.

FIG. **7**E is a block diagram of a television/computer combined medium receiver station.

FIG. **7**F is a block diagram of an example of controlling television and print combined media.

FIG. **8** is a block diagram of selected apparatus of the station of FIG. **7** with a station specific EPROM, **20**B, installed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One Combined Medium

FIG. **1** shows a video/computer combined medium subscriber station. Via conventional antenna, the station receives a conventional television broadcast transmission at television tuner, **215**. The Model CV510 Electronic TV Tuner of the Zenith Radio Corporation of Chicago, Ill., which is a component of the Zenith Video Hi-Tech Component TV system, is one such tuner. This tuner outputs conventional audio and composite video transmissions. The audio transmission is inputted to TV monitor, **202**M. The video transmission is inputted to video transmission divider, **4**, which is a conventional divider that splits the transmission into two paths. One is inputted continuously to TV signal decoder, **203**, and the other to microcomputer, **205**. TV signal decoder, **203**, which is described more fully below, has capacity for receiving a composite video transmission; detecting digital information embedded therein; correcting errors in the received information by means of forward error checking techniques, well known in the art; converting the received information, as may be required, by means of input protocol techniques, well known in the art, into digital signals that microcomputer, **205**, can receive and process and that can control the operation of microcomputer, **205**; and transferring said signals to microcomputer, **205**. Microcomputer, **205**, is a conventional microcomputer system with disk drives that is adapted to have capacity for receiving signals from decoder, **203**; for generating computer graphic information; for receiving a composite video transmission; for combining said graphic information onto the video information of said transmission by graphic overlay techniques, well known in the art; and for outputting the resulting combined information to a TV monitor, **202**M, in a composite video transmission. One such system is the IBM Personal Computer of International Business Machines Corporation of Armonk, N.Y. with an IBM Asynchronous Communications Adapter installed in one expansion slot and a PC-MicroKey Model 1300 System with Techmar Graphics Master Card, as supplied together by Video Associates Labs of Austin, Tex., installed in two other slots. Microcomputer, **205**, receives digital signals from decoder, **203**, at its asynchronous communications adapter and the video transmission from divider, **4**, at its PC-MicroKey 1300 System. It outputs the composite video transmission at its PC-MicroKey System. Microcomputer, **205**, has all required operating system capacity—eg., the MS/DOS Version 2.0 Disk Operating System of Microsoft, Inc. of Bellvue, Wash. with installed device drivers. TV monitor, **202**M, has capacity for receiving composite video and audio transmissions and for presenting a conventional television video image and audio sound. One such monitor is the Model CV1950 Color Monitor of the Zenith Radio Corporation.

In the example, the subscriber station of FIG. **1** is in New York City and is tuned to the conventional broadcast television transmission frequency of channel 13 at 8:30 PM on a Friday evening when the broadcast station of said frequency, WNET, commences transmitting a television program about stock market investing, "Wall Street Week." Said WNET station is an intermediate transmission station for said program which actually originates at a remote television studio in Owings Mills, Md. (Hereinafter, a studio or station that originates the broadcast transmission of programming is called the "program originating studio.") From said program originating studio said program is transmitted by conventional television network feed transmission means, well known in the art, to a large number of geographically dispersed intermediate transmission stations that retransmit said program to millions of subscriber stations where subscribers view said program. Said network transmission means may include so-called landlines, microwave transmissions, a satellite transponder, or other means.

At said subscriber station, microprocessor, **205**, contains a conventional 5¼" floppy disk at a designated one of its disk drives that holds a data file recorded in a fashion well known in the art. Said file contains information on the portfolio of financial instruments owned by the subscriber that identifies the particular stocks in the portfolio, the number of shares of each stock owned at the close of business of each business day from the end of the previous week, and the closing share prices applicable each day. Decoder, **203**, is preprogrammed to detect digital information on a particular line or lines (such as line **20**) of the vertical interval of its video transmission input; to correct errors in said information; to convert said corrected information into digital signals usable by microcomputer, **205**; and to input said signals to microcomputer, **205**, at its asynchronous communications adapter. Microcomputer, **205**, is preprogrammed to receive said input of signals at its asynchronous communications adapter and to respond in a predetermined fashion to instruction signals embedded in the "Wall Street Week" programming transmission.

Other similarly configured and preprogrammed subscriber stations also tune to the transmission of said "Wall Street Week" program by given intermediate transmission stations. At each subscriber station, the records in the contained financial portfolio file hold, in identical format, information on the particular investments of that station's subscriber.

At the start of the transmission of said "Wall Street Week" program, all subscriber station apparatus is on and fully operational.

At said program originating studio, at the outset of said program transmission, a first series of control instructions is generated, embedded sequentially on said line or lines of the vertical interval, and transmitted on the first and each successive frame of said television program transmission, signal unit by signal unit and word by word, until said series has been transmitted in full. The instructions of said series are addressed to and control the microcomputer, **205**, of each subscriber station.

In said series in full—and in any one or more subsequent series of instructions—particular instructions are separated, as may be required, by time periods when no instruction that controls the microcomputer, **205**, of any station is transmitted which periods allow sufficient time for the microcomputer, **205**, of each and every subscriber station to complete functions controlled by previously transmitted instructions and commence waiting for a subsequent instruction, in a waiting fashion well known in the art, before receiving a subsequent instruction.

Tuner, **215**, receives this television transmission, converts the received television information into audio and composite video transmissions, and transmits the audio to monitor, **202**M, and the video via divider, **4**, to microcomputer, **205**, and decoder, **203**. Decoder, **203**, detects the embedded instruction information, corrects it as required, converts it into digital signals usable by microcomputer, **205**, and transmits said signals to microcomputer, **205**.

With each step occurring in a predetermined fashion or fashions, well known in the art, this first set of instructions commands microcomputer, **205**, (and all other subscriber station microcomputers simultaneously) to interrupt the operation of its central processor unit (hereinafter, "CPU") and any designated other processors; then to record the contents of the registers of its CPU and any other designated processors either at a designated place in random access memory (hereinafter, "RAM") or on the contained disk; then to set its PC-MicroKey 1300 to the "GRAPHICS OFF" operating mode in which mode it transmits all received composite video information to monitor, **202**M, without modification; then to record all information in RAM with all register information in an appropriately named file such as "INTERUPT.BAK" at a designated place on the contained disk; then to clear all RAM (except for that portion of RAM containing the so-called "operating system" of said microcomputer, **205**) and all registers of said CPU and any other designated processors; then to wait for further instructions from decoder, **203**.

Operating in said preprogrammed fashion under control of said first set of instructions, microcomputer, **205**, reaches a stage at which the subscriber can input information only under control of signals embedded in the broadcast transmission and can reassume control of microcomputer, **205**, (so long as microcomputer, **205**, remains on and continues, in a predetermined fashion, to receive said embedded transmitted signals) only by executing a system reset (or so-called "warm boot") which on an IBM PC is accomplished by depressing simultaneously the "Ctrl", "Alt" and "Del" keys on the console keyboard.

(Hereinafter, this first set of instructions is called the "control invoking instructions," and the associated steps are called "invoking broadcast control.")

After completing all steps of invoking broadcast control, the microcomputer at each subscriber station (including microcomputer, **205**) is preprogrammed (1) to evaluate particular initial instructions in each distinct series of received input instructions to ascertain how to process the information of said series and (2) to operate in a predetermined fashion or fashions in response to said initial instructions.

Subsequently, a second series of instructions is embedded and transmitted at said program originating studio. Said second series is detected and converted into usable digital signals by decoder, **203**, and inputted to microcomputer, **205**, in the same fashion as the first series. Microcomputer, **205**, evaluates the initial signal word or words which instruct it to load at RAM (from the input buffer to which decoder, **203**, inputs) and run the information of a particular set of instructions that follows said word or words just as the information of a file named FILE.EXE, recorded on the contained floppy disk, would be loaded at RAM (from the input buffer to which the disk drive of said disk inputs) and run were the command "FILE" entered from the console keyboard to the system level of the installed disk operating system. (Hereinafter, such a set of instructions that is loaded and run is called a "program instruction set.") In a fashion well known in the art, microcomputer, **205**, loads the received binary information of said set at a designated place in RAM until, in a predetermined fashion, it detects the end of said set, and it executes said set as an assembled, machine language program in a fashion well known in the art.

Under control of said program instruction set and accessing the subscriber's contained portfolio data file for information in a fashion well known in the art, microcomputer, **205**, calculates the performance of the subscriber's stock portfolio and constructs a graphic image of that performance at the installed graphics card. The instructions cause the computer, first, to determine the aggregate value of the portfolio at each day's close of business by accumulating, for each day, the sum of the products of the number of shares of each stock held times that stock's closing price. The instructions then cause microcomputer, **205**, to calculate the percentage change in the portfolio's aggregate value for each business day of the week in respect to the final business day of the prior week. Then in a fashion well known in the art, the instructions cause microcomputer, **205**, to enter digital bit information at the video RAM of the graphics card in a particular pattern that depicts the said percentage change as it would be graphed on a particular graph with a particular origin and set of scaled graph axes. Upon completion of these steps, the instructions cause microcomputer, **205**, to commence waiting for a subsequent instruction from decoder, **203**.

If the information at video RAM at the end of these steps were to be transmitted alone to the video screen of a TV monitor, it would appear as a line of a designated color, such as red, on a background color that is transparent when overlaid on a separate video image. Black is such a background color, and FIG. **1**A shows one such line.

As each subscriber station completes the steps of calculation and graphic imaging performed under control of said program instruction set, information of such a line exists at video RAM at said station which information reflects the specific portfolio performance of the user of said station. Said information results from much computation, but the meaning of said information is hardly clear. FIG. **1**A shows just a line.

While microcomputer, **205**, performs these steps, TV monitor, **202**M, displays the conventional television image and the sound of the transmitted "Wall Street Week" program. During this time the program may show the so-called "talking head" of the host as he describes the behavior of the stock market over the course of the week. Then the host says, "Now as we turn to the graphs, here is what the Dow Jones Industrials did in the week just past," and a studio generated graphic is transmitted. FIG. **1**B shows the image of said graphic as it appears on the video screen of TV monitor, **202**M. Then the host says, "And here is what your portfolio did." At this point, an instruction signal is generated at said program originating studio, embedded in the programming transmission, and transmitted. Said signal is identified by decoder, **203**; transferred to microcomputer, **205**; and executed by microcomputer, **205**, at the system level as the statement, "GRAPHICS ON". Said signal instructs microcomputer, **205**, at the PC-MicroKey 1300 to overlay the graphic information in its graphics card onto the received composite video information and transmit the combined information to TV monitor, **202**M. TV monitor, **202**M, then displays the image shown in FIG. **1**C which is the microcomputer generated graphic of the subscriber's own portfolio performance overlaid on the studio generated graphic. And microcomputer, **205**, commences waiting for another instruction from decoder, **203**.

By itself, the meaning of FIG. **1**A is hardly clear. But when FIG. **1**A is combined and displayed at the proper time with the conventional television information, its meaning becomes readily apparent. Simultaneously, each subscriber in a large audience of subscribers sees his own specific performance information as it relates to the performance information of the market as a whole.

(Hereinafter, an instruction such as the above signal of "GRAPHICS ON" that causes subscriber station apparatus to execute a combining operation in synchronization is called a "combining synch command." Said initial signal word or words that preceded the above program instruction set provide another example of a combining synch command in that said word or words synchronized all subscriber station computers in commencing loading and running information for a particular combining.)

While the TV monitor at this particular subscriber station displays this particular subscriber's own overlay information, each other subscriber station displays the specific overlay information applicable at that station.

As the program proceeds, in the same fashion a further instruction signal is generated at said studio; transmitted; detected; inputted from decoder, **203**, to microcomputer, **205**; and executed as "GRAPHICS OFF." Then said studio ceases transmitting the graphic image, and transmits another image such as the host's talking head. Simultaneously, the GRAPHICS OFF command causes microcomputer, **205**, to cease overlaying the graphic information onto the received composite video and to commence transmitting the received composite video transmission unmodified. Thereafter the "Wall Street Week" program proceeds, and microcomputer, **205**, continues to operate under control of received instructions.

This combined medium example is of a television based medium. Like conventional television, said combined medium transmits the same signals to all subscriber stations. But unlike conventional television where each subscriber views only programming viewed by every other subscriber and where said programming is known to and available at the program originating studio, each subscriber of said combined medium views programming that is personalized and private. The programming he views is his own—in the example, his own portfolio performance—and his programming is not viewed by any other subscriber nor is it available at the program originating studio. In addition, personalized programming is displayed only when it is of specific relevance to the conventional television programming of said combined medium. In the example, each subscriber views a graphic presentation of his own portfolio performance information as soon as it becomes specifically relevant to graphic information of the performance of the market as a whole. Prior to its time of specific relevance, no personalized information is displayed (despite the fact that said graphic information of the performance of the market as a whole is displayed). And said personalized information is displayed only for so long as it remains specifically relevant. As soon as its specific relevance terminates, its display terminates.

This "Wall Street Week" portfolio performance example provides but one of many examples of television based combined medium programming.

This television based combined medium is but one example of many combined media.

The Signal Processor

In the present invention, the signal processor—**26** in FIG. **2**; **26** in the signal processor system of FIG. **2**D; in the signal processor system, **71**, of FIG. **6**; **200** in FIG. **7**; and elsewhere—is focal means for the controlling and monitoring subscriber station operations. It meters communications and enables owners of information to offer their information to subscribers in many fashions on condition of payment. It has capacity for regulating communications consumption by selectively decrypting or not decrypting encrypted programming and/or control signals and capacity for assembling and retaining meter records at each subscriber station that document the consumption of specific programming and information at said station. It has capacity for identifying the subject matter of each specific unit of programming available on each of many transmission channels at each subscriber station as said unit becomes available for use and/or viewing which enables subscriber station apparatus to determine automatically whether the subject matter of said unit is of interest and, if so, to tune automatically to said programming. It has capacity, at each station, for receiving monitor information that identifies what programming is available, what programming is used, and how said programming is used and capacity for assembling and retaining monitor records that document said availability and usage. It has capacity for transferring said meter records automatically to one or more remote automated billing stations that account for programming and information consumption and bill subscribers and said monitor records automatically to one or more remote so-called "ratings" stations that collect statistical data on programming availability and usage. It has capacities for processing information in many other fashions that will become apparent in this full specification.

FIG. **2** shows one embodiment of a signal processor. Said processor, **26**, is configured for simultaneous use with a cablecast input that conveys both television and radio programming and a broadcast television input.

At switch, **1**, and mixers, **2** and **3**, signal processor, **26**, monitors all frequencies or channels available for reception at the subscriber station of FIG. **2** to identify available programming. The inputted information is the entire range of frequencies or channels transmitted on the cable and the entire range of broadcast television transmissions available to a local television antenna of conventional design. The cable transmission is inputted simultaneously to switch, **1**, and mixer, **2**. The broadcast transmission is inputted to switch, **1**. Switch, **1**, and mixers, **2** and **3**, are all controlled by local oscillator and switch control, **6**. The oscillator, **6**, is controlled to provide a number of discrete specified frequencies for the particular radio and television channels required. The switch, **1**, acts to select the broadcast input or the cablecast input and passes transmissions to mixer, **3**, which, with the controlled oscillator, **6**, acts to select a television frequency of interest that is passed at a fixed frequency to a TV signal decoder, **30**. Simultaneously, mixer, **2**, and the controlled oscillator, **6**, act to select a radio frequency of interest which is inputted to a radio signal decoder, **40**.

At decoders, **30** and **40**, signal processor, **26**, identifies specific programming and its subject matter as said programming becomes available for use and/or viewing. Decoder, **30**, which is shown in detail in FIG. **2**A, and decoder, **40**, which is shown in FIG. **2**B, detect signal information embedded in the respective inputted television and radio frequencies, render said information into digital signals that subscriber station apparatus can process, modify particular ones of said signals through the addition and/or deletion of particular information, and output said signals and said modified signals to buffer/comparator, **8**. Said decoders are considered more fully below.

Buffer/comparator, **8**, receives said signals from said decoders and other signals from other inputs and organizes the received information in a predetermined fashion. Buffer/comparator, **8**, has capacity for comparing a particular portions or portions of inputted information to particular preprogrammed information and for operating in preprogrammed fashions on the basis of the results of said comparing. It has capacity for detecting particular end of file signals in inputted information and for operating in preprogrammed fashions whenever said information is detected.

The process of communication metering commences at buffer/comparator, **8**. In a predetermined fashion, buffer/comparator, **8**, determines whether a given instance of received signal information requires decryption, either in whole or in part. In a fashion described more fully below, buffer/comparator, **8**, and a controller, **20**, which, too, is described more fully below, determine whether signal processor, **26**, is enabled to decrypt said information. If signal processor, **26**, is so enabled, buffer/comparator, **8**, transfers said information to decryptor, **10**. If signal processor, **26**, is not so enabled, buffer/comparator, **8**, discards said information in a predetermined fashion. Buffer/comparator, **8**, transfers signals that do not require decryption directly to processor or controller, **12**.

Decryptor, **10**, is a standard digital information decryptor, well known in the art, that receives signals from buffer/comparator, **8**, and under control of said controller, **20**, uses conventional decryptor techniques, well known in the art, to decrypt said signals as required. Decryptor, **10**, transfers decrypted signals to controller, **12**.

Controller, **12**, is a standard controller, well known in the art, that has microprocessor and RAM capacities and one or more ports for transmitting information to external apparatus. Said microprocessor capacity of controller, **12**, is of a conventional type, well known in the art, but is specifically designed to have particular register memories, discussed more fully below. Controller, **12**, may contain read only memory (hereinafter, "ROM").

Controller, **12**, receives the signals inputted from buffer/comparator, **8**, and decryptor, **10**; analyzes said signals in a predetermined fashion; and determines whether they are to be transferred to external equipment or to buffer/comparator, **14**, or both. If a signal or signals are to be transferred externally, in a predetermined fashion controller, **12**, identifies the external apparatus to which the signal or signals are addressed and transfers them to the appropriate port or ports for external transmission. If they contain meter and/or monitor information and are to be processed further, controller, **12**, selects, assembles, and transfers the appropriate information to buffer/comparator, **14**. Controller, **12**, has capacity to modify received signals by adding and/or deleting information and can transfer a given signal to one apparatus with one modification and to another apparatus with another modification (or with no modification). Controller, **12**, receives time information from clock, **18**, and has means to delay in a predetermined fashion the transfer of signals when, in a predetermined fashion, delayed transfer is determined to be required.

Buffer/comparator, **14**, receives signal information that is meter information and/or monitor information from controller, **12**, and from other inputs; organizes said received information into meter records and/or monitor records (called, in aggregate, hereinafter, "signal records") in a predetermined fashion or fashions; and transmits said signal records to a digital recorder, **16**, and/or to one or more remote sites. With respect to particular simple or frequently repeated instances of signal information, buffer/comparator, **8**, has capacity to determine, in a predetermined fashion or fashions, what received information should be recorded, how it should be recorded, and when it should be transmitted to recorder, **16**, and/or to said remote sites and to initiate or modify signal records and to discard unnecessary information accordingly. To avoid overloading digital recorder, **16**, with duplicate data, buffer/comparator, **14**, has means for counting and/or discarding duplicate instances of particular signal information and for incorporating count information into signal records. Buffer/comparator, **14**, receives time information from clock, **18**, and has means for incorporating time information into signal records. Buffer/comparator, **14**, also has means for transferring received information immediately to a remote site or sites via telephone connection, **22**, and for communicating a requirement for such transfer to controller, **20**, which causes such transfer. Buffer/comparator, **14**, operates under control of controller, **20**, and has capacity whereby controller, **20**, can cause modification of the formats of and information in signal records at buffer/comparator, **14**. (In circumstances where information collecting and processing functions are extensive—for example, when a given buffer/comparator, **14**, must collect monitor information at a subscriber station with apparatus and/or communications flows that are extensive and complex—buffer/comparator, **14**, may operate under control of a dedicated, so-called "on-board" controller, **14**A, at buffer/comparator, **14**, which is preprogrammed with appropriate control instructions and is controlled by controller, **20**, similarly to the fashion in which controller, **12** is controlled by controller, **20**.)

Digital recorder, **16**, is a memory storage element of standard design that receives information from buffer/comparator, **14**, and records said information in a predetermined fashion. In a predetermined fashion, recorder, **16**, can determine how full it is and transmit this information to controller, **20**. Recorder, **16**, may inform controller, **20**, automatically when it reaches a certain level of fullness.

Signal processor, **26**, has a controller device which includes programmable RAM controller, **20**; ROM, **21**, that may contain unique digital code information capable of identifying signal processor, **26**, and the subscriber station of said processor, **26**, uniquely; an automatic dialing device **24**; and a telephone unit, **22**. A particular portion of ROM, **21**, is erasable programmable ROM (hereinafter, "EPROM") or other forms of programmable nonvolatile memory. Under control particular preprogrammed instructions at that portion of ROM, **21**, that is not erasable, signal processor, **26**, has capacity to erase and reprogram said EPROM in a fashion that is described more fully below. Controller, **20**, has capacity for controlling the operation of all elements of the signal processor and can receive operating information from said elements. Controller, **20**, has capacity to turn off any element or elements of controlled subscriber station apparatus, in whole or in part, and erase any or all parts of erasable memory of said controlled apparatus.

As an apparatus in the unified system of programming communication of the present invention, a signal processor can monitor any combination of inputs and transmission frequencies, and the signal processor of FIG. **2** is but one embodiment of a signal processor. Other embodiments can receive and monitor available programming in transmission frequencies other than radio and television frequencies through the addition of one or more other signal decoders such as that of FIG. **2**C described below. Embodiments can receive one or more fixed frequencies continuously at one or more decoders that monitor for available programming. For certain applications, one particular embodiment (hereinafter, "signal processor alternative #1") can be configured to receive only other inputs at buffer/comparator, **8**, in which case said embodiment has no oscillator, **6**; switch, **1**; mixers, **2** and **3**; or decoders, **30** or **40**. For other particular applications, another particular embodiment (hereinafter, "signal processor alternative #2") can be configured to receive only inputs at buffer/comparator, **14**, in which case said embodiment has only buffer/comparator, **14**; recorder, **16**; clock, **18**; and the control device apparatus associated with controller, **20**. Other signal processor embodiments will become apparent in this full specification. Which particular embodiment of signal processor is preferred at any given subscriber station depends on the particular communications requirements of said station.

Signal Decoders

Signal decoder apparatus such as decoder, **203**, in FIG. **1** and decoders, **30** and **40**, in FIG. **2** are basic in the unified system of this invention.

FIG. **2**A shows a TV signal decoder that detects signal information embedded in an inputted television frequency, renders said information into digital signals that subscriber station apparatus can process, identifies the particular apparatus to which said signals are addressed, and outputs said signals to said apparatus. Decoder, **203**, in FIG. **1** is one such TV signal decoder; decoder, **30**, in FIG. **2** is another.

In FIG. **2**A, a selected frequency is inputted at a fixed frequency to said decoder at filter, **31**, which defines the particular channel of interest to be analyzed. The television channel signal then passes to a standard amplitude demodulator, **32**, which uses standard demodulator techniques, well known in the art, to define the television base band signal. This base band signal is then transferred through separate paths to three separate detector devices. The apparatus of these separate paths are designed to act on the particular frequency ranges in which embedded signal information may be found. The first path, designated A, detects signal information embedded in the video information portion of said television channel signal. Path A inputs to a standard line receiver, **33**, well known in the art. Said line receiver, **33**, receives the information of one or more of the lines normally used to define a television picture. It receives the information only of that portion or portions of the overall video transmission and passes said information to a digital detector, **34**, which acts to detect the digital signal information embedded in said information, using standard detection techniques well known in the art, and inputs detected signal information to controller, **39**, which is considered in greater detail below. The second path, designated B, detects signal information embedded in the audio information portion of said television channel signal. Path B inputs to a standard audio demodulator, **35**, which uses demodulator techniques, well known in the art, to define the television audio transmission and transfers said audio information to high pass filter, **36**. Said filter, **36**, defines and transfers to digital detector, **37**, the portion of said audio information that is of interest. The digital detector, **37**, detects signal information embedded in said audio information and inputs detected signal information to controller, **39**. The third path, designated C, inputs the separately defined transmission to a digital detector, **38**, which detects signal information embedded in any other information portion of said television channel signal and inputs detected signal information to controller, **39**. Line receiver, **33**; high pass filter, **36**; detectors, **34**, **37**, and **38**; and controller, **39**, all operate under control of controller, **39**, and in preprogrammed fashions that may be changed by controller, **39**.

FIG. **2**B shows a radio signal decoder that detects and processes signal information embedded in an inputted radio frequency. Decoder, **40**, in FIG. **2** is one such radio signal decoder. A selected frequency of interest is inputted at a fixed frequency to standard radio receiver circuitry, **41**, which receives the radio information of said frequency using standard radio receiver techniques, well known in the art, and transfers said radio information to radio decoder, **42**. Radio decoder, **42**, decoders the signal information embedded in said radio information and transfers said decoded information to a standard digital detector, **43**. Said detector, **43**, detects the binary signal information in said decoded information and inputs said signal information to controller, **44**, discussed more fully below. Circuitry, **41**; decoder, **42**; and detector, **43**, all operate under control of controller, **44**, and in predetermined fashions that may be changed by controller, **44**.

FIG. **2**C shows a signal decoder that detects and processes signal information embedded in a frequency other than a television or radio frequency. A selected other frequency (such as a microwave frequency) is inputted to appropriate other receiver circuitry, **45**, well known in the art. Said receiver circuitry, **45**, receives the information of said frequency using standard receiver techniques, well known in the art, and transfers said information to an appropriate digital detector, **46**. Said detector, **46**, detects the binary signal information in said information and inputs said signal information to controller, **47**, considered more fully below. Circuitry, **45**, and detector, **46**, operate under control of controller, **47**, and in predetermined fashions that may be changed by controller, **47**.

Each decoder is controlled by a controller, **39**, **44**, or **47**, that has buffer, microprocessor, ROM, and RAM capacities. Said buffer capacity of controller, **39**, **44**, or **47**, includes capacity for receiving, organizing, and storing simultaneous inputs from multiple sources while inputting information, received and stored earlier, to said microprocessor capacity of controller, **39**, **44**, or **47**. Said microprocessor capacity of controller, **39**, **44**, or **47**, is of a conventional type, well known in the art, and is specifically designed to have particular register memories, discussed more fully below, including register capacity for detecting particular end of file signals in inputted information. The ROM capacity of controller, **39**, **44**, or **47**, contains microprocessor control instructions of a type well known in the art and includes EPROM capacity. Said ROM and/or said EPROM may also contain one or more digital codes capable of identifying its controller, **39**, **44**, or **47**, uniquely and/or identifying particular subscriber station functions of said controller, **39**, **44**, or **47**. The RAM capacity of controller, **39**, **44**, or **47**, constitutes workspace that the microprocessor of said controller, **39**, **44**, or **47**, can use for intermediate stages of information processing and may also contain microprocessor control instructions. Capacity exists at said controller, **39**, **44**, or **47**, for erasing said EPROM, and said RAM and said EPROM are reprogrammable.

Controller, **39**, **44**, or **47**, is preprogrammed to receive units of signal information, to assemble said units into signal words that subscriber station apparatus can receive and process, and to transfer said words to said apparatus. In each decoder, the controller, **39**, **44**, or **47**, receives detected digital information from the relevant detector or detectors, **34**, **37**, **38**, **43**, and **46**. Upon receiving any given instance of signal information, controller, **39**, **44**, or **47**, is preprogrammed to process said information automatically. Controller, **39**, is preprogrammed to discard received duplicate, incomplete, or irrelevant information; to correct errors in retained received information by means of forward error correction techniques well known in the art; to convert, as may be required, the corrected information, by means of input protocol techniques well known in the art, into digital information that subscriber station apparatus can receive and process; to modify selectively particular corrected and converted information in a predetermined fashion or fashions; to identify in a predetermined fashion or fashions subscriber station apparatus to which said signal information should be transferred; and to transfer said signals to said apparatus. Said controller, **39**, **44**, or **47**, has one or more output ports for communicating signal information to said apparatus.

Controller, **39**, **44**, or **47**, has capacity for identifying more than one apparatus to which any given signal should be transferred and for transferring said signal to all said apparatus. It has capacity for recording particular signal information in particular register memory and for transferring a given signal to one apparatus, modifying it and transferring it to a second apparatus, and modifying it again and transferring it to a third apparatus.

As described above, said controller, **39**, **44**, or **47**, controls particular apparatus of its signal decoder and has means for communicating control information to said apparatus. Said controller, **39**, **44**, or **47**, also has means for communicating control information with a controller, **20**, of a signal processor, **26**. (Said communicating means is shown clearly in FIG. **2**D which is discussed below.) Via said communicating means and under control of instructions and signals discussed more fully below, said controller, **20**, has capacity to cause information at said EPROM to be erased and to reprogram said microprocessor control instructions at said RAM and said EPROM.

The Signal Processor System

Signal processing apparatus and methods involve an extended subscriber station system focused on the signal processor. Said system includes external signal decoders.

FIG. **2**D shows one embodiment of a signal processing system. Said system contains signal processor, **26**, and external decoders, **27**, **28**, and **29**. Each said external decoder may be a TV signal decoder (FIG. **2**A) or a radio signal decoder (FIG. **2**B) or an other signal decoder (FIG. **2**C) depending on the nature of the selected frequency inputted. As FIG. **2**D shows, each decoder, **27**, **28**, and **29**, receives one selected frequency and has capacity for transferring detected, corrected, converted, and possibly modified signals to signal processor, **26**, at buffer/comparator, **8**, and also to other station apparatus. Each decoder, **27**, **28**, and **29**, also has capacity for transferring detected, corrected, converted, and possibly modified monitor information to signal processor, **26**, at buffer/comparator, **14**. As FIG. **2**D shows, controller, **20**, has capacity to control all decoder apparatus, **27**, **28**, **29**, **30**, and **40**. Controller, **20**, has capacity to preprogram (or reprogram) all said decoder apparatus, **27**, **28**, **29**, **30**, and **40**, and thereby controls the fashions of detecting, correcting, converting, modifying, identifying, transferring, and other functioning of said decoders.

Not every installed decoder in said signal processor system requires all the apparatus and system capacity of FIGS. **2**A, **2**B, and **2**C. For example, because a television base band signal is inputted to decoder, **203** of FIG. **1**, said decoder does not require filter, **31**, and demodulator, **32**, of FIG. **2**A. Likewise, because decoders, **30** and **40** of FIG. **2**, transfer signals only to buffer/comparator, **8**, said decoders do not require capacity to transfer signals to any other apparatus, and controllers, **39** and **44**, of said decoders are preprogrammed only to identify whether or not any given signal should be transferred to buffer/comparator, **8**. The precise apparatus and operating fashions of any given decoder is commensurate with the operating requirements of the installation and subscriber station of said decoder.

FIG. **2**D shows decoders, **27**, **28**, and **29**, communicating monitor information to buffer/comparator, **14**, of signal processor, **26**, by means of bus, **13**. Said bus, **13**, communicates information in a fashion well known in the art, and said decoders, **27**, **28**, and **29**, gain access to the shared transmission facility of said bus, **13**, using access methods, such as contention, that are well known in the art. Controllers, **12** and **20** of FIG. **2**, **39** of FIG. **2**A, **44** of FIG. **2**B, and **47** of FIG. **2**C, all have capacity to transfer signal information by bus means. Buffer/comparator, **8** and **14**, and controller, **12**, of FIG. **2** all have capacity to receive other input information from bus means. Furthermore, all apparatus of FIG. **2** and of FIG. **2**D can have capacity to communicate control information by one or more bus means.

Introduction to the Signals of the Integrated System

The signals of the present invention are the modalities whereby stations that originate programming transmissions control the handling, generating, and displaying of programming at subscriber stations.

(The term, "SPAM," is used, hereinafter, to refer to signal processing apparatus and methods of the present invention.)

SPAM signals control and coordinate a wide variety of subscriber stations. Said stations include so-called "local affiliate" broadcast stations that receive and retransmit single network transmissions; so-called "cable system headends" that receive and retransmit multiple network and local broadcast station transmissions; and so-called "media centers" in homes, offices, theaters, etc. where subscribers view programming. (Hereinafter, stations that originate broadcast transmissions are called "original transmission stations," stations that receive and retransmit broadcast transmissions are called "intermediate transmission stations", and stations where subscribers view programming are called "ultimate receiver stations.")

At said stations, SPAM signals address, control, and coordinate diverse apparatus, and the nature and extent of the apparatus installed at any given station can vary greatly. SPAM signals control not only various kinds of receivers and tuners; transmission switches and channel selectors; computers; printers and video and audio display apparatus; and video, audio, and digital communications transmission recorders but also signal processor system apparatus including decoders; decryptors; control signal switching apparatus; and the communications meters, called signal processors, of the present invention. Besides apparatus for communicating programming to viewers, SPAM signals also address and control subscriber station control apparatus such as, for example, furnace control units whose operations are automatic and are improved with improved information and subscriber station meter apparatus such as, for example, utilities meters that collect and transmit meter information to remote metering stations.

The information of SPAM signals includes data, computer program instructions, and commands. Data and program instructions are often recorded in computer memories at subscriber stations for deferred execution. Commands are generally for immediate execution and often execute computer programs or control steps in programs already in process. Often said data, programs, and commands control subscriber station apparatus that automatically handle, decrypt, transmit, and/or present program units of conventional television, radio, and other media.

In combined medium communications, SPAM signals also control subscriber station apparatus in the generating and combining of combined medium programming. At ultimate receiver stations, particular combined medium commands and computer programs cause computers to generate user specific programming and display said programming at television sets, speaker systems, printers, and other apparatus. (Hereinafter, instances of computer program information that cause ultimate receiver station apparatus to generate and display user specific information are called "program instruction sets.") At intermediate transmission stations, other commands and computer programs cause computers to generate and transmit program instruction sets. (Hereinafter, instances of computer program information that cause intermediate transmission station apparatus to generate program instruction set information and/or command information are called "intermediate generation sets.")

In combined medium communications, particular SPAM commands control the execution of intermediate generation sets and program instruction sets and the transmission and display of information generated by said sets. Whether said commands control apparatus at intermediate transmission stations, ultimate receiver stations, or both, the function of said commands is to control and synchronize disparate apparatus efficiently in the display of combined medium programming at ultimate receiver stations. (Accordingly, all said commands are called "combining synch commands" in this specification.) Most often, combining synch commands synchronize steps of simultaneous generating of station specific information at pluralities of stations and/or steps of simultaneous combining at pluralities of stations (which steps of combining are, more specifically, steps of simultaneous transmitting at each station of said pluralities of separate information into combined transmissions), all of which steps are timed to control simultaneous display of user specific combined medium information at each station of pluralities of ultimate receiver stations.

The present invention provides a unified signal system for addressing, controlling, and coordinating all said stations and apparatus. One objective of said system is to control diverse apparatus in the speediest and most efficient fashions. A second objective is to communicate control information in forms that have great flexibility as regards information content capacity. A third objective is to communicate information in compact forms, thereby maximizing the capacity of any given transmission means to communicate signal information.

Yet another objective is expandability. As the operating capacities of computer hardware have grown in recent decades, increasingly sophisticated software systems have been developed to operate computers. Often incompatibilities have existed between newly developed operating system software and older generations of computer hardware. It is the objective of the system of signal composition of the present invention to have capacity for expanding to accommodate newly developed subscriber station hardware while still serving older hardware generations. In practice this means that the unified system of signals does not consist, at any one time, of one fixed and immutable version of signal composition. Rather it is a family of compatible versions. At any given time, some versions communicate signal information to only the newest or most sophisticated subscriber station apparatus while at least one version communicates to all apparatus. Accordingly, this specification speaks of "simple preferred embodiments" and "the simplest preferred embodiment" rather than just one preferred embodiment. How the various versions and embodiments relate to and are compatible with one another is made clear below.

The Composition of Signal Information . . . Commands, Information Segments, and Padding Bits

SPAM signals contain binary information of the sort well know in the art including bit information required for error correction using forward error correction techniques, well known in the art, in point to multi-point communications; request retransmission techniques, well known in the art, in point to point communications; and/or other error correction techniques, as appropriate.

FIG. **2**E shows one example of the composition of signal information (excluding bit information required for error detection and correction). The information in FIG. **2**E commences with a header which is particular binary information that synchronizes all subscriber station apparatus in the analysis of the information pattern that follows. Following said header are three segments: an execution segment, a meter-monitor segment, and an information segment. As FIG. **2**E shows, the header and execution and meter-monitor segments constitute a command.

A command is an instance of signal information that is addressed to particular subscriber station apparatus and that causes said apparatus to perform a particular function or functions. A command is always constituted of at least a header and an execution segment. With respect to any given command, its execution segment contains information that specifies the apparatus that said command addresses and specifies a particular function or functions that said command causes said apparatus to perform. (Hereinafter, functions that execution segment information causes subscriber station apparatus to perform are called "controlled functions.")

Commands often contain meter-monitor segments. Said segments contain meter information and/or monitor information, and the information of said segments causes subscriber station signal processor systems to assemble, record, and transmit meter records to remote billing stations and monitor records to remote ratings stations in fashions that are described more fully below.

Particular commands (called, hereinafter, "specified condition commands") always contain meter-monitor segments. Said commands cause addressed apparatus to perform controlled functions only when specified conditions exist, and meter-monitor information of said commands specifies the conditions that must exist.

In simple preferred embodiments, at any given time the number of binary information bits in any given instance of header information is a particular constant number. In other words, every header contains the same number of bits. In the simplest preferred embodiment, said constant number is two, all headers consist of two bits binary information, and commands are identified by one of three binary headers:

10—a command with an execution segment alone;

00—a command with execution and meter-monitor segments; and

01—a command with execution and meter-monitor segments that is followed by an information segment.

Execution segment information includes the subscriber station apparatus that the command of said segment addresses and the controlled functions said apparatus is to perform. ("ITS" refers, hereinafter, to intermediate transmission station apparatus, and "URS" refers to ultimate receiver station apparatus.) Examples of addressed apparatus include:

ITS signal processors (in **71** in FIG. **6**),
ITS controller/computers (**73** in FIG. **6**),
URS signal processors (**200** in FIG. **7**),
URS microcomputers (**205** in FIG. **7**),
URS printers (**221** in FIG. **7**), and
URS utilities meters (**262** in FIG. **7**).

Examples of controlled functions include:

Load and run the contents of the information segment.

Decrypt the execution segment using decryption key G.

Decrypt the execution and meter-monitor segments using decryption key J.

Commence the video overlay combining designated in the meter-monitor segment.

Modify the execution segment to instruct URS microcomputer, **205**, to commence overlay designated in meter-monitor segment, record the contents of the execution and meter-monitor segments, and transfer command to URS microcomputer, **205**.

Print the contents of the information segment.

Record the contents of the execution and meter-monitor segments; transfer them to URS decryptors, **224**, and execute the preprogrammed instructions that cause URS decryptors, **224**, to commence decrypting with said contents as decryption key; execute preprogrammed instructions that cause URS cable converter boxes, **222**, to switch to cable channel Z; execute preprogrammed instructions that cause URS matrix switches, **258**, to configure its switches to transfer the input from converter boxes, **222**, to decryptors, **224**, and the output from decryptors, **224**, to microcomputers, **205**; modify the execution segment to instruct URS microcomputers, **205**, to commence loading and executing the information received from URS decryptors, **224** via URS switches, **258**.

Commands can address many apparatus and execute many controlled functions. The apparatus and functions listed here are only examples. Other addressable apparatus and controlled functions will become apparent in this full specification.

Execution segment information operates by invoking preprogrammed operating instructions that exist at each subscriber station apparatus that is addressed. For example, a command to URS microcomputers, **205**, to load and run the contents of the information segment following said command causes each URS microcomputer, **205**, to commence processing particular instructions for loading and running that are preprogrammed at each URS microcomputer, **205**.

For each appropriate addressed apparatus and controlled function combination a unique execution segment binary information value is assigned. Said command to URS microcomputers, **205**, to load and run is, for example, one appropriate combination and is assigned one particular binary value that differs from all other execution segment information values. In the assignment process, no values are assigned to inappropriate combinations. For example, URS signal processors, **200**, have no capacity to overlay, and no execution segment information value exists to cause URS signal processors, **200**, to overlay.

For any given command, the execution segment information of said command invokes, at each relevant subscriber station apparatus, the preprogrammed operating instructions uniquely associated with its particular binary value in particular comparing and matching fashions that are described more fully below.

The determination of appropriate addressed apparatus and controlled function combinations takes into account the facts that different apparatus, at any given subscriber station, can be preprogrammed to interpret any given instance of execution segment information differently and that subscriber station apparatus can be preprogrammed to automatically alter execution segment information. For example, if signal processors, **200**, are preprogrammed to process commands received at controller, **12**, differently from commands received at buffer/comparator, **8**, the assignment system can reduce the number of required binary values. As a more specific example, buffer/comparator, **8**, receives a hypothetical command with a particular execution segment (e.g., "101110") which means "URS signal processors, **200**, decrypt the execution and meter-monitor segments using decryption key J." After being decrypted and transferred to controller, **12**, the particular execution segment information that controller, **12**, receives (e.g., "011011") means "URS microcomputers, **205**, commence overlay designated in meter-monitor segment." The controlled functions that signal processor, **200**, performs are the same as those listed above in the example that begins, "Modify the . . . ," and no separate binary value is necessary for invoking these controlled functions at URS microcomputers, **200**.

The preferred embodiment includes one appropriate command (hereinafter called the "pseudo command") that is addressed to no apparatus and one command that is addressed to URS signal processors, **200**, (hereinafter, the "meter command") but does not instruct said processors, **200**, to perform any controlled function. These commands are always transmitted with meter-monitor segment data that receiver station apparatus automatically process and record. By transmitting pseudo command and meter command signals, transmission stations cause receiver station apparatus to record meter-monitor segment information without executing controlled functions. The pseudo command enables a so-called ratings service to use the same system for gathering ratings on conventional programming transmissions that it uses for combined media without causing combined media apparatus to execute controlled functions at inappropriate times (eg., combine overlays onto displays of conventional television programming). The meter command causes apparatus such as controller, **12**, of FIG. **2**D to transmit meter information to buffer/comparator, **14**, without performing any controlled function.

In the preferred embodiment, at any given time the number of binary information bits in any given instance of execution segment information is a particular constant number. In other words, every execution segment contains the same number of bits. Said constant number is the smallest number of bits capable of representing the binary value of the total number of appropriate addressed apparatus and controlled function combinations. And each appropriate combination is assigned a unique binary value within the range of binary numbers thus defined.

Meter-monitor segments contain meter information and/or monitor information. Examples of categories of such information include:

- meter instructions that instruct subscriber station meter apparatus to record particular meter-monitor segment information and maintain meter records of said information;
- origins of transmissions (eg., network source stations, broadcast stations, cable head end stations);
- dates and times;
- unique identifier codes for each program unit (including commercials);
- codes that identify uniquely each combining in a given combined medium program unit;
- codes that identify the subject matter of a program unit;
- unique codes for programming (other than programming identified by program unit codes) whose use obligates users to make payments (eg., royalties and residuals); and
- unique codes that identify the sources and suppliers of computer data.

The categories listed here provide only examples. Other types of information can exist in meter information and/or in monitor information, as will become apparent in this full specification.

For each category of information, a series of binary bits (hereinafter, a "field" or "meter-monitor field") exists in the meter-monitor segment to contain the information. In any given category such as origins of transmissions, each distinct item such as each network source, broadcast, or cable head end station has a unique binary information code. In the preferred embodiment, the number of information bits in that category's meter-monitor field is the smallest number of bits capable of representing the binary value of the total number of distinct items. And the information code of each distinct item is within the range of binary numbers thus defined. In the preferred embodiment, date and time fields have sixteen bits.

Few commands require meter-monitor information of every information category. Often commands require no more than the identification codes of a specific combined medium program unit and of a specific combined medium combining within said program unit.

Because the amount of information in meter-monitor segments varies from command to command, in the preferred embodiment more than one format exists at any given time for meter-monitor segment information. For example, one meter-monitor segment may contain origin of transmission, transmission date and time, and program unit information. A second may contain program unit and combining identification information. The first is transmitted in a format of three specific fields. The second is transmitted in a different format. It is even possible for different formats to exist for the same meter-monitor field. For example, one instance of date and time information designates a particular day in a particular one hundred year period. Another designates a particular hour in a particular ninety day period.

Because the number of categories of meter-monitor information varies from one command to the next, the length of meter-monitor segments varies. Unlike execution segments which, at any given time, all contain the same number of information bits, the bit length of meter-monitor segments varies. One segment may contain five fields, totaling 275 bits in length. Another may contain two fields and 63 bits. A third may contain three fields and 63 bits. Bit length is not necessarily tied to the number of fields. And at any given time, a number of different meter-monitor segment bit length alternatives exists.

In the preferred embodiment, each instance of a meter-monitor segment includes a format field that contains information that specifies the particular format of the meter-monitor segment of said instance. Within said field is a particular group of binary information bits (hereinafter, the "length token") that identifies the number of bits in a meter-monitor segment of said format. Each alternate length token has a unique binary information code. The number of information bits in each instance of a length token is the smallest number of bits capable of representing the binary value of the total number of meter-monitor segment bit length alternatives. And the unique code of each different alternative is within the range of binary numbers thus defined.

In the preferred embodiment, each distinct meter-monitor segment format (including each distinct field format) also has a unique binary information code. In cases where a given format is the only format that contains a given length token, the unique code of said token is sufficient to identify said format uniquely. For example, if a particular format is the only format that is 197 binary bits long, information that said format is 197 bits long is sufficient information to identify said format uniquely. But two or more formats that contain the same length token information require additional binary information to distinguish them uniquely. Thus the number of information bits in any given instance of a format field is the total of the number of bits in the length token plus the smallest number of bits capable of representing the number of formats that share in common the one particular length token datum that occurs most frequently in different formats. And the format code of each distinct format is within the range of binary numbers thus defined except that only length token information exists in the bits of the length token.

FIG. **2**F illustrates one instance of a meter-monitor segment (excluding bit information required for error detection and correction). FIG. **2**F shows three fields totaling thirty sequential bits. The format field is transmitted first followed by two fields of nine and sixteen bits respectively, and the bits of the length token are the first bits of said format field. The SPAM system that uses said format field has capacity for no more than eight alternate meter-monitor segment lengths and thirty-two formats. A three bit length token can specify no more than eight length alternatives, and a five bit format field can specify no more than thirty-two. Said SPAM system has no fewer than five alternate lengths because four or fewer length alternatives would be represented in a length token of two or fewer bits. In said system, three or four formats share in common the particular length token that occurs most frequently in different formats. Two formats sharing the most commonly shared length token datum would be specified in one bit; five or more sharing said datum would be represented in three or more bits. Accordingly, the format field of FIG. **2**F must represent at least eight alternate formats.

In the preferred embodiment, the bits of the length token are the first bits in each meter-monitor segment. In any given command containing meter-monitor information, said bits follow immediately after the last bit of the execution segment. The remaining bits of the format field are included in each meter-monitor segment in particular locations that lie within the format of the shortest meter-monitor segment (excluding bit information required for error detection and correction). Thus if the shortest meter-monitor segment (including the format field of said segment) is thirty two bits, the bits of the format field in every instance of a meter-monitor segment lie among the first thirty two bits of said segment.

Information segments follow commands and can be of any length. Program instruction sets, intermediate generation sets, other computer program information, and data (all of which are organized in a fashion or fashions well known in the art) are transmitted in information segments. An information segment can transmit any information that a processor can process. It can transmit compiled machine language code or assembly language code or higher level language programs, all of which are well known in the art. Commands can execute such program information and cause compiling prior to execution.

A command with a "01" header is followed by an information segment. But a command with an "01" header is not the only instance of signal information that contains an information segment. In the simplest preferred embodiment, a fourth type of header is:

11—an additional information segment transmission following a "01" header command and one or more information segments which additional segment is addressed to the same apparatus and invokes the same controlled functions as said "01" command.

An instance of signal information with a "11" header contains no execution segment or meter-monitor segment information. Said instance is processed, in fashions described more fully below, by subscriber station apparatus that receive said instance as if said instance contained the execution segment information of the last "01" header command received at said apparatus prior to the receipt of said instance.

In determining the composition of signal information in the preferred embodiment, the present invention must take into account the fact that most computer systems communicate information in signal words that are of a constant binary length that exceeds one bit. At present, most computer information is communicated in so-called "bytes," each of which consists of eight digital bits. Failure to recognize this fact could result in incomplete signals and/or in erroneous processing in signal information. For example, FIG. **2**G shows a command with a header, an execution segment, and a meter-monitor segment, each of which is of particular bit length. However, the command of FIG. **2**G is only twenty-one bits long. As FIG. **2**G shows, said command constitutes two bytes of eight bits each with five bits are left over. In a system that communicates information only in words that are multiples of eight, a signal whose information is represented in twenty-one information bits is incomplete. To constitute a complete communication, said signal must be transmitted in twenty-four bits. To the command of FIG. **2**G, three bits must be added.

In the preferred embodiment, at the original transmission station of any given signal transmission, particular bits are added at the end of any command that is not already a multiple of the particular signal word bit length that applies in signal processor system communications at the subscriber stations to which said transmission is transmitted. (Hereinafter, said bits are called "padding bits.") Padding bits communicate no command information nor are padding bits part of any information segment. The sole purpose of padding bits is to render the information of any given SPAM command into a bit length that is, by itself, complete for signal processor system communication. Padding bits are added to command information prior to the transmission of said information at said station, and all subscriber station apparatus are preprogrammed to process padding bits. The particular number of padding bits that are added to any given command is the smallest number of bits required to render the bit length of said command into a multiple of said signal word bit length. FIG. **2**H shows three padding bits added at the end of the twenty-one command information bits of the command of FIG. **2**G. to render the information of said command into a form that can be communicated in three eight-bit bytes.

In the preferred embodiment, the information of each information segment is composed and transmitted in a bit length that is, itself, exactly a multiple of the particular signal word bit length that applies in computer communications at said subscriber stations. The information of each information segment commences at the first information bit location of the first signal word of said segment and ends at the last information bit location of the last signal word. Each information segments follow a command or "11" header. More precisely, the first signal word of each information segment is the first complete signal word that follows the last information bit of said command or "11" header or the last padding bit following said command or "11" header if one or more padding bits follow.

As one example, FIG. **2**I shows the information of FIG. **2**E organized in eight-bit bytes. While the information of the execution segment in FIG. **2**I follows immediately after the header and the information of the meter-monitor segment follows immediately after the execution segment, the information of the information segment does not follow immediately after the meter-monitor segment. Rather three padding bits are inserted following the command information of FIG. **2**I to complete the signal word in which the last bit of command information occurs, and the information of the information segment begins at the first bit of the first complete byte following said meter-monitor segment.

The method of the preferred embodiment for composing the information of SPAM signals has significant advantages.

In signal processing, speed of execution is often of critical importance, and the preferred embodiment has significant speed advantages. Most commands require the fastest possible processing. By minimizing the bit length of headers, execution segments, and meter-monitor segments, the preferred embodiment provides compact information and control messages that are transmitted, detected, and executed, in general, in the fastest possible fashion.

In signal processing, flexibility of message structure is also of critical importance. The single, unified system of the present invention must have capacity for communicating to many different apparatus messages that vary greatly in complexity, length, and priority for speed of processing. By providing first priority segment capacity—in the simplest preferred embodiment, execution segments—that is short, rigid in format, and can communicate information to many different addressed apparatus, the preferred embodiment provides capacity to communicate a select number of high priority control messages to many alternate apparatus in the fastest possible time. By providing intermediate priority segment capacity—in the simplest preferred embodiment, meter-monitor segments—that is flexible in length, format, and information content, the preferred embodiment provides more flexible capacity to communicate control messages of slightly lower priority. By providing lowest priority segment capacity—in the simplest preferred embodiment, information segments—that can contain any binary information and be any length, the preferred embodiment provides complete flexibility to communicate any message that can be represented in digital information to any apparatus at the lowest processing priority. By transmitting message components in their order of priority—in the simplest preferred embodiment, headers and execution segments then meter-monitor segments then information segments—the preferred embodiment enables priority message instructions to affect subscriber station operations in the fastest possible fashion. By providing capacity for alternating the structure of individual messages—here alternate header capacity—so that individual control messages can be constituted only of the highest priority information or high and intermediate priority information or can be focused on the lowest priority, the preferred embodiment provides additional valuable flexibility.

Speed and flexibility are essential considerations not only in the composition of individual messages but also in the composition of message streams. In this regard, the use of "11" headers in the preferred embodiment brings valuable benefits.

Often in the course of a combined medium presentation, a series of control messages is transmitted each of which contains an information segment, addresses the same apparatus (for example, URS microcomputers, **205**), and causes said apparatus to invoke the same controlled function or functions (for example, "load and run the contents of the information segment"). Often, interspersed in said series, are other control messages that address said apparatus, contain no information segments, and cause said apparatus to invoke other controlled functions (for example, "commence the video overlay combining designated in the meter-monitor segment"). By including capacity whereby, without containing execution or meter-monitor information, a given message can cause information segment information to be processed at subscriber station apparatus just as preceding information segment information was processed, the present invention increases processing efficiency. Because no execution or meter-monitor segment is transmitted, more information segment information can be transmitted in a given period of time. Because no execution or meter-monitor segment is received and processed at subscriber stations, information segment information can be received and processed faster.

In signal processing, efficiency in the control of subscriber station apparatus is yet another factor of critical importance. By composing lowest priority segment information—in the simplest preferred embodiment, information of information segments—to commence at a bit location that subscriber station apparatus are preprogrammed to define as the first location of a signal word of the form that control said apparatus in processing and to continue to a bit location that is the last location of a signal word of said form, the present invention communicates said information to said apparatus in a form that can commence the control functions communicated in said information immediately. Were information segment information communicated in any form other than that of the preferred embodiment—more specifically, were said information to be in a length other than a whole number of signal words or to commence immediately after the command or header preceding said segment rather than at the first bit of a signal word—subscriber station apparatus would need to process said information into information of a form that could control said apparatus before the information of said segment could commence the particular control functions communicated in said information.

The Organization of Message Streams . . . Messages, Cadence Information, and End of File Signals

All of the information transmitted with a given header is called a "message." Each header begins a message, and each message begins with a header. More specifically, a message consists of all the SPAM information, transmitted in a given transmission, from the first bit of one header to the last bit transmitted before the first bit of the next header.

A SPAM message is the modality whereby the original transmission station that originates said message controls specific addressed apparatus at subscriber stations. The information of any given SPAM transmission consists of a series or stream of sequentially transmitted SPAM messages.

Each instance of a header synchronizes all subscriber station apparatus in the analysis of the internal structure of the message that follows.

However, for the unified system of the present invention to work, subscriber station apparatus must have capacity for distinguishing more than the internal structure of individual messages. Said apparatus must also have capacity for processing streams of SPAM messages and distinguishing the individual messages in said streams from one another. More precisely, said apparatus must have capacity for processing streams of binary information that consist only of "0" and "1" bits and distinguishing which information, among said bits, is header information.

Cadence information which consists of headers, certain length tokens, and signals that are called "end of file signals" enables subscriber station apparatus to distinguish each instance of header information in any given message stream and, hence, to distinguish the individual messages of said stream. In the present invention, subscriber station apparatus are preprogrammed to process cadence information.

SPAM messages are composed of elements—headers, execution segments, meter-monitor segments, and information segments—whose bit lengths vary. SPAM apparatus determine the bit length of said elements in different fashions, and the particular fashion that applies to any given element relates to the priority of said element for subscriber station speed of processing. First priority segment information has the highest priority for speedy processing and is of fixed binary bit length. A SPAM header is one example of a first priority segment. An execution segment is another example. Intermediate priority segment information has lower priority, varies in bit length, but contains internal length information. A Meter-monitor segment is one example of an intermediate priority segment. Lowest priority segment information has the lowest priority, varies in length, and contains no internal information for determining segment length. Each information segment is an example of a lowest priority segment.

For a message that is constituted only of first priority segments, the information of the header is sufficient to distinguish not only the structure of the message but also the location of the next header. In the simplest preferred embodiment, a message with a "10" header is one example of a message constituted only of first priority segments. Commands with "10" headers consist of header information and execution segment information. At any given time, all instances of header information are of one constant length, and all instances of execution segment information are of a second constant length. Thus all "10" commands are, themselves, of a particular header+exec constant length, said header+exec constant being the sum of said one constant plus said second constant. Because "10" messages have constant length and header information always occurs at a specific location in every instance of message information, by preprogramming subscriber station apparatus with information of said header+exec constant, the unified system of the present invention enables subscriber station apparatus to automatically identify the last command information bit of "10" messages. Said bit is always the bit that is located a particular quantity of bits after the first header bit which particular quantity equals said header+exec constant minus one. Being able to locate said last bit, said apparatus can automatically locate the next instance of header information in a fashion described below.

For messages whose elements include intermediate priority segment information but no lowest priority segment information, the information of said messages is also sufficient to distinguish message structure and the location of the next header. In the simplest preferred embodiment, each message associated with an "00" header is one such message. Messages with "00" headers consist of header and execution segment information that are, together, of said header+exec constant length plus meter-monitor segment information that contains length token information. By preprogramming subscriber station apparatus with information for processing length token information, the present invention enables said apparatus to determine the particular information bit, following any instance of a "00" header, that is the last bit of the command of said header. Said bit is always the bit that is located a particular quantity of bits after the first header bit which quantity equals said header+exec constant minus one plus the particular preprogrammed quantity that said apparatus associates, in a preprogrammed fashion described more fully below, with the particular length token of said instance. By locating said last bit, said apparatus can automatically locate the next instance of header information in the fashion described below.

For messages whose elements include lowest priority segment information, particular end of lowest priority segment information is required to distinguish full message structure and the location of the next header. In the simplest preferred embodiment, each message associated with a "01" or a "11" contains an information segment header and is one such message. Information segments vary in length, and no internal information of a command or information segment enables subscriber station apparatus to determine the length of an information segment. Thus distinctive end of file signals are required to communicate the locations of the ends of information segments to subscriber station apparatus. In the present invention, each end of file signal is transmitted immediately after the end of an information segment; said signal is part of the information of the message in which said segment occurs; and said signal is located at the end of said message. By preprogramming subscriber station apparatus to detect and process end of file signals in a fashion described more fully below, the present invention enables said apparatus to determine not only the particular information bit, following any instance of a "01" or "11" header, that is the last bit of the information segment of the message of said header but also the particular information bit, following said header, that is the last bit of said message. By locating said last bit of said message, said apparatus can automatically locate the next instance of header information in the fashion described below.

At any given time, subscriber station apparatus are preprogrammed to process only one distinct signal as an end of file signal. In order for said apparatus to distinguish an instance of said signal from all other signal information, an end of file signal must differ distinctly from all other information. Signal information, especially information transmitted in an information segment, can vary greatly in composition. Accordingly, to be distinctive, an end of file signal must be long and complex to detect.

An end of file signal consists of a particular sequence of bits of binary information. In the preferred embodiment each bit is identical to every other bit; that is, disregarding error correction information, an end of file signal consists of a sequence of "1" bits (eg. "11111111") or "0" bits (eg. "00000000"). In the preferred embodiment, end of file signals are composed of "1" bits rather than "0" bits. Zero is a value that occurs frequently in data and in mathematics, and however many bits may occur in a binary data word that consists of a series of "0" bits, the numeric value of said word remains zero. Numeric values that are represented in binary form by a sequence of "1" bits, especially a sequence that is long, occur in data and mathematics far less frequently than zero. Thus the preferred composition bit is "1" because the chance of data being joined in a given signal in such a way that two or more instance of information combine inadvertently and create the appearance of an end of file signal is far smaller if the preferred bit is "1" than if it is "0". (Hereinafter, the preferred binary end of file signal composition bit, "1", is called an "EOFS bit," and for reasons that are explained below, the alternate binary bit, "0", is called a "MOVE bit.")

In the preferred embodiment, the length of said sequence (disregarding error correction information) is the minimum reasonable length necessary to distinguish said sequence from all other sequences of transmitted signal information of said length. In the preferred embodiment, the number of bits in said sequence is greater than the number of information bits in the data words that subscriber station computers use to process data. At present, most computers are so-called "thirty-two bit machines" that process information in four-byte data words, and some high precision microprocessors such as the 8087 mathematics coprocessor distributed by the Intel Corporation of Santa Clara, Calif., U.S.A. process information internally in eighty bit registers which means that they process in 10-byte data words. Thus said sequence may be greater than eighty bits long and is probably greater than thirty-two bits. Also in the preferred embodiment, said sequence uses the full information capacity of the signal words used to communicate said sequence at subscriber stations. In computer systems that communicate information in eight-bit bytes, forty bits is the number of bits in the sequence next larger than thirty-two bits that uses the full communication capacity of the signal words in which it is communicated, and eighty-eight is the number of bits in the sequence next larger than eighty bits. In the preferred embodiment, at any given time alternate end of file signal lengths exist. One potential end of file signal length can be forty (40) bits which is five bytes of EOFS bits. Another can be eighty-eight (88) bits which is eleven bytes of EOFS bits. Which end of file signal is used for any given transmission depends on the nature of the information of the transmission in which said signal occurs and the apparatus to which said transmission is transmitted.

Being the minimum "reasonable" length means that an instance of said sequence may actually be generated, in the system of the preferred embodiment, which instance is generated as information of a command or an information segment rather than an end of file signal. Were the information of said instance to be embedded in a SPAM transmission of said system and transmitted, said instance would cause erroneously processing at subscriber station apparatus by causing itself to be detected as an end of file signal and information transmitted subsequent to said instance to be interpreted as a new SPAM message. To prevent such erroneous processing, in the preferred embodiment, after the initial generation of any given instance of SPAM message information (not including end of file signal information) and before the embedding and transmitting of said instance, said information is transmitted through an apparatus, called an "EOFS valve," that detects end of file signals and is described below. If said valve detects in said information particular information that constitutes an end of file signal, before being embedded and transmitted, the binary information of said instance is rewritten, in a fashion well known in the art that may be manual, to cause substantively the same information processing at subscriber stations without containing an instance of information that is identical to the information of an end of file signal. (Hereinafter, such pre-transmission processing of a message is called a "pre-transmission evaluation.")

FIG. **2**I shows a series of connected rectangles and depicts one instance of a stream of SPAM messages. Each rectangle represents one signal word of binary information. FIG. **2**I shows a series of three messages. Each message is composed in a whole number of signal words. The first message consists of a command followed by padding bits followed by an information segment followed by an end of file signal. The form of the command, padding bits, and the first information segment bits of said message is identical to the form of the information of FIG. **2**E, given eight-bit bytes as the signal words of FIG. **2**I. The second message consists of a command followed by padding bits. The form of said second message is identical to the form of the information of FIG. **2**H, given eight-bit bytes as the signal words of FIG. **2**I. The third message consists of a command alone. The form of said third message is identical to the form of the information of FIG. **2**J, given eight-bit bytes as the signal words of FIG. **2**I. FIG. **2**J shows a message that is composed just of a "10" header and an execution segment. Said execution segment contains the same number of binary bits that the executions segments of FIGS. **2**E and **2**H contain. Said header and execution segment of FIG. **2**J fill one byte of binary information precisely, and given the signal word of an eight-bit byte, no padding bits are required in the message of FIG. **2**J. FIG. **2**H does not show an instance of a message that starts with a "11" header. Were it to do so, said message would be comprised of said header followed by six padding bits, given eight-bit bytes as the signal words of FIG. **2**I, followed by an information segment, like the information segment of the first message of FIG. **2**H, followed by an end of file signal, like the end of file signal of said first message.

As FIG. **2**I shows, in any given SPAM transmission, no binary information separates the binary information of one SPAM message from the next message. As soon as the information of one SPAM message ends (including all error correction information associated with said information), the next received binary information is information of the next message. Because the first information bits (as distinct from error correction bits) of any given SPAM message constitute the header information of said message, subscriber station apparatus locate the next instance of header information after any given message by locating the last information bit of the last signal word of said message. Automatically the first information bits that follow said last bit and total in number the particular number of bits in an instance of header information constitute the next instance of header information.

Subscriber station apparatus locate the last information bit of any given SPAM message in one of two fashions. One fashion applies to messages that do not end with end of file signals. The other applies to messages that do. The header information of any given message determines which fashion applies for said message.

Messages that are constituted only of first priority segment elements and messages whose elements include intermediate priority segment information but no lowest priority segment information do not end with end of file signals. In the preferred embodiment, the header information of any given one of said messages cause subscriber station apparatus to execute particular preprogrammed locate-last-message-bit instructions at a particular time. In the simplest preferred embodiment, such messages begin with "10" or "00" headers.

Receiving any given instance of said header information causes subscriber stations processing message information of said instance to execute said locate-last-message-bit instructions after locating the last segment information bit of said instance and upon completing the processing of the segment information of said instance. (The fashions whereby subscriber station apparatus locate the last command information