**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 3-[PART 1 OF 2]

COMPLAINT FOR PATENT INFRINGEMENT

US007734251B1

# (12) United States Patent
Harvey et al.

(10) **Patent No.: US 7,734,251 B1**
(45) **Date of Patent: Jun. 8, 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.: **08/470,571**

(22) Filed: **Jun. 6, 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 of application No. 06/317,510, filed on Nov. 3, 1981, now Pat. No. 4,694,490.

(51) **Int. Cl.**
*H04B 1/38* (2006.01)

(52) **U.S. Cl.** .......................... **455/39**; 348/460; 345/629

(58) **Field of Classification Search** ............... 348/6–13, 348/468; 455/3.1–6.3
See application file for complete search history.

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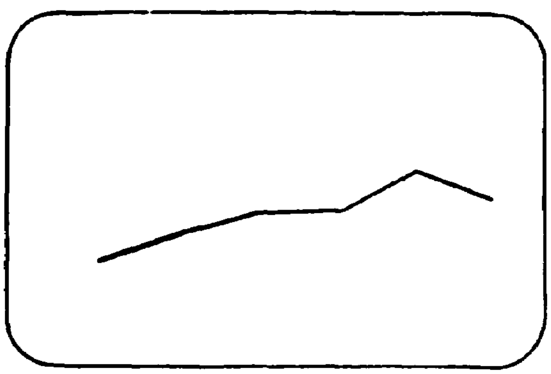
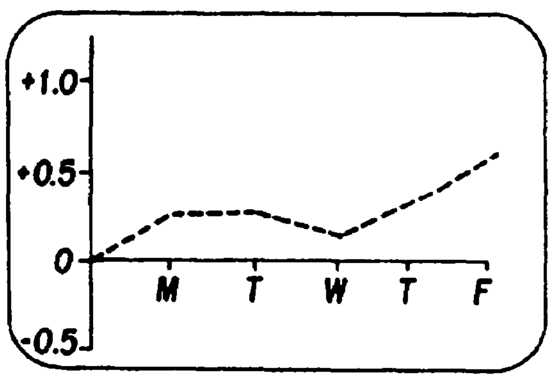
(74) *Attorney, Agent, or Firm*—Goodwin Procter, LLP

(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.

**39 Claims, 22 Drawing Sheets**





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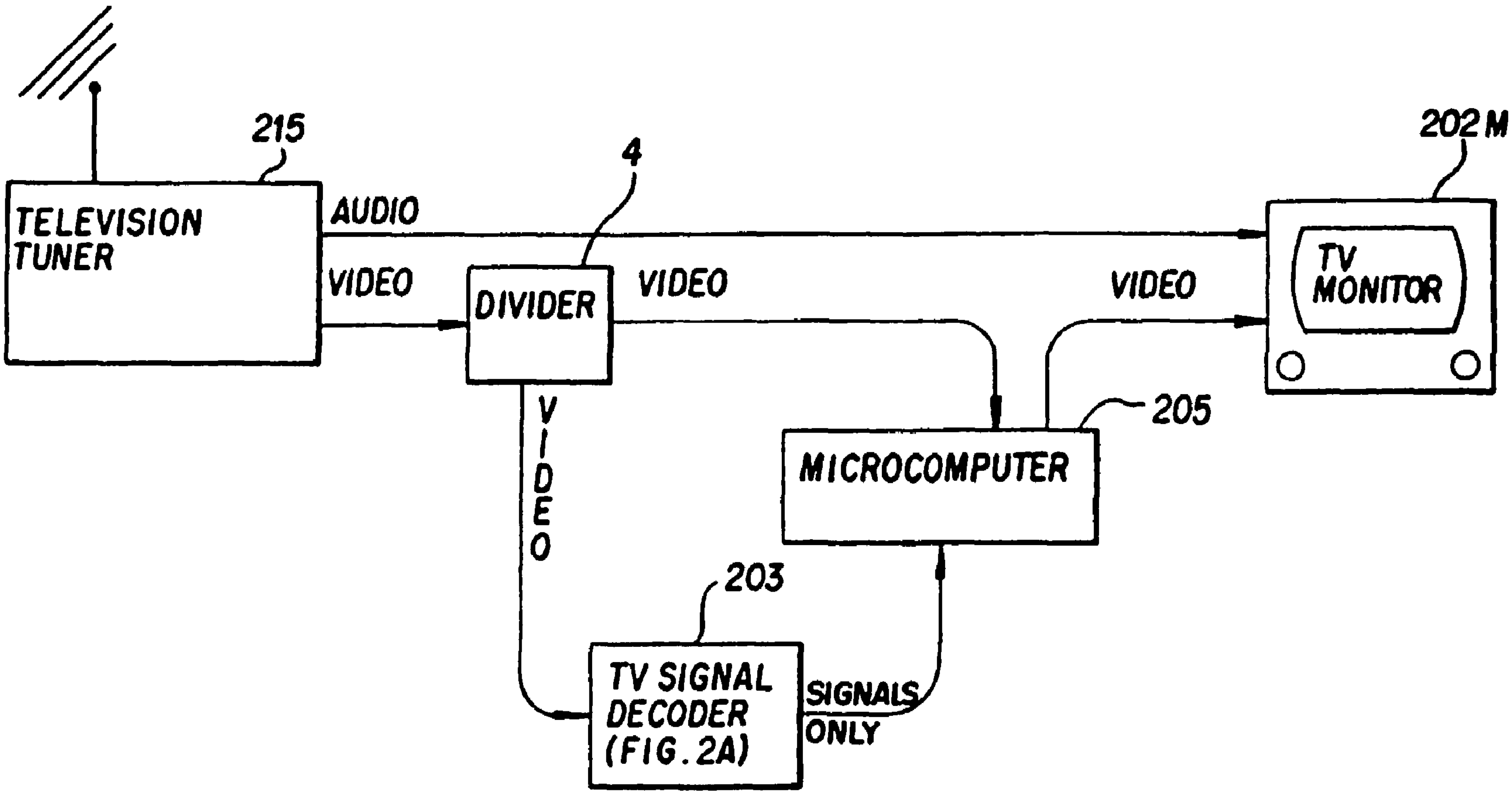

215
TELEVISION TUNER
AUDIO
VIDEO
4
DIVIDER
VIDEO
VIDEO
202M
TV MONITOR
VIDEO
205
MICROCOMPUTER
203
TV SIGNAL DECODER (FIG. 2A)
SIGNALS ONLY

FIG. 1

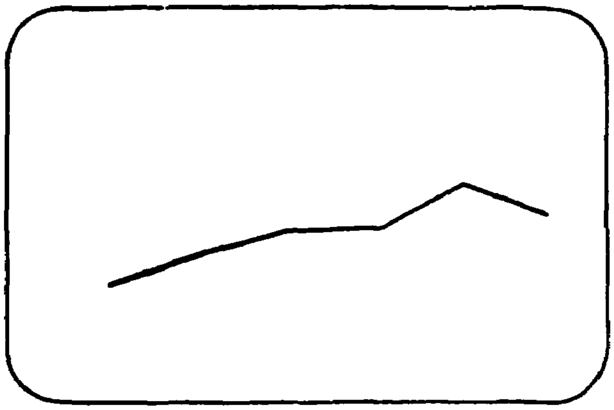


FIG. 1A

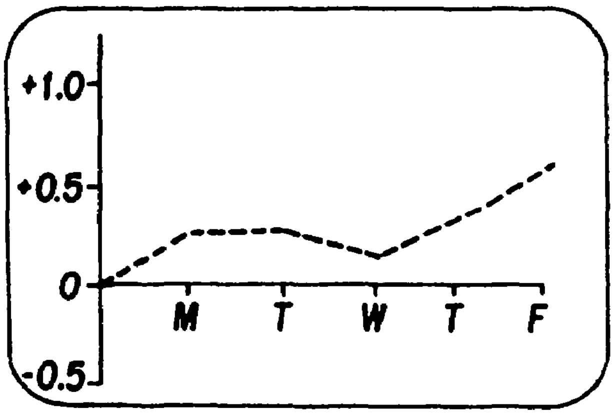



FIG. 1B

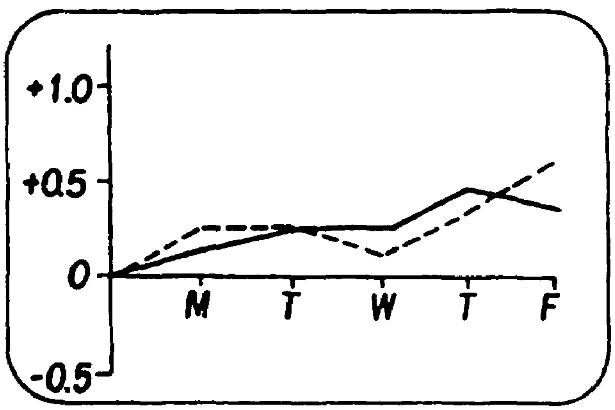



FIG. 1C

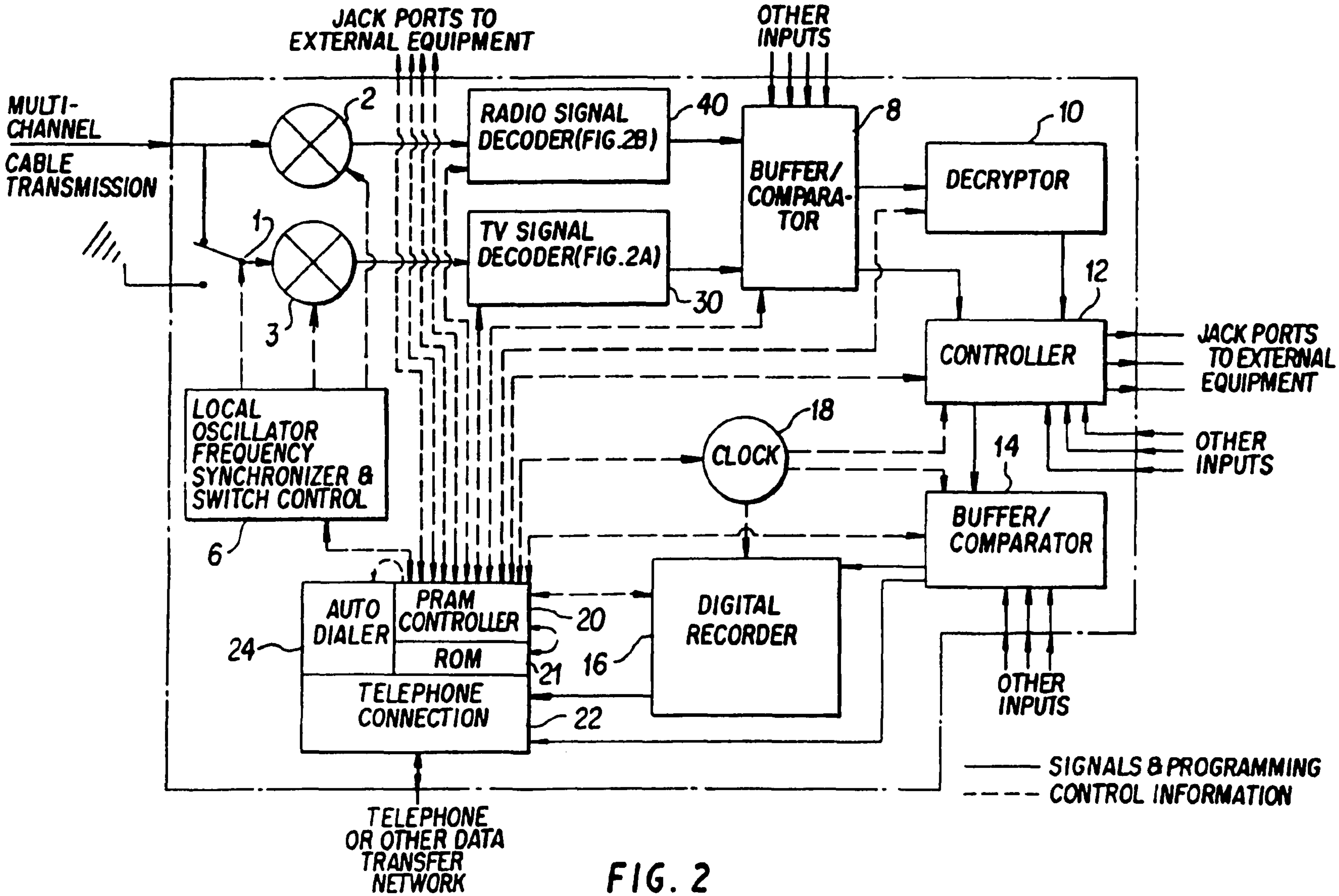

JACK PORTS TO EXTERNAL EQUIPMENT
OTHER INPUTS
MULTI-CHANNEL CABLE TRANSMISSION
2
1
3
RADIO SIGNAL DECODER(FIG.2B)
40
TV SIGNAL DECODER(FIG.2A)
30
BUFFER/ COMPARA-TOR
8
DECRYPTOR
10
12
CONTROLLER
12
JACK PORTS TO EXTERNAL EQUIPMENT
OTHER INPUTS
LOCAL OSCILLATOR FREQUENCY SYNCHRONIZER & SWITCH CONTROL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

FIG. 2

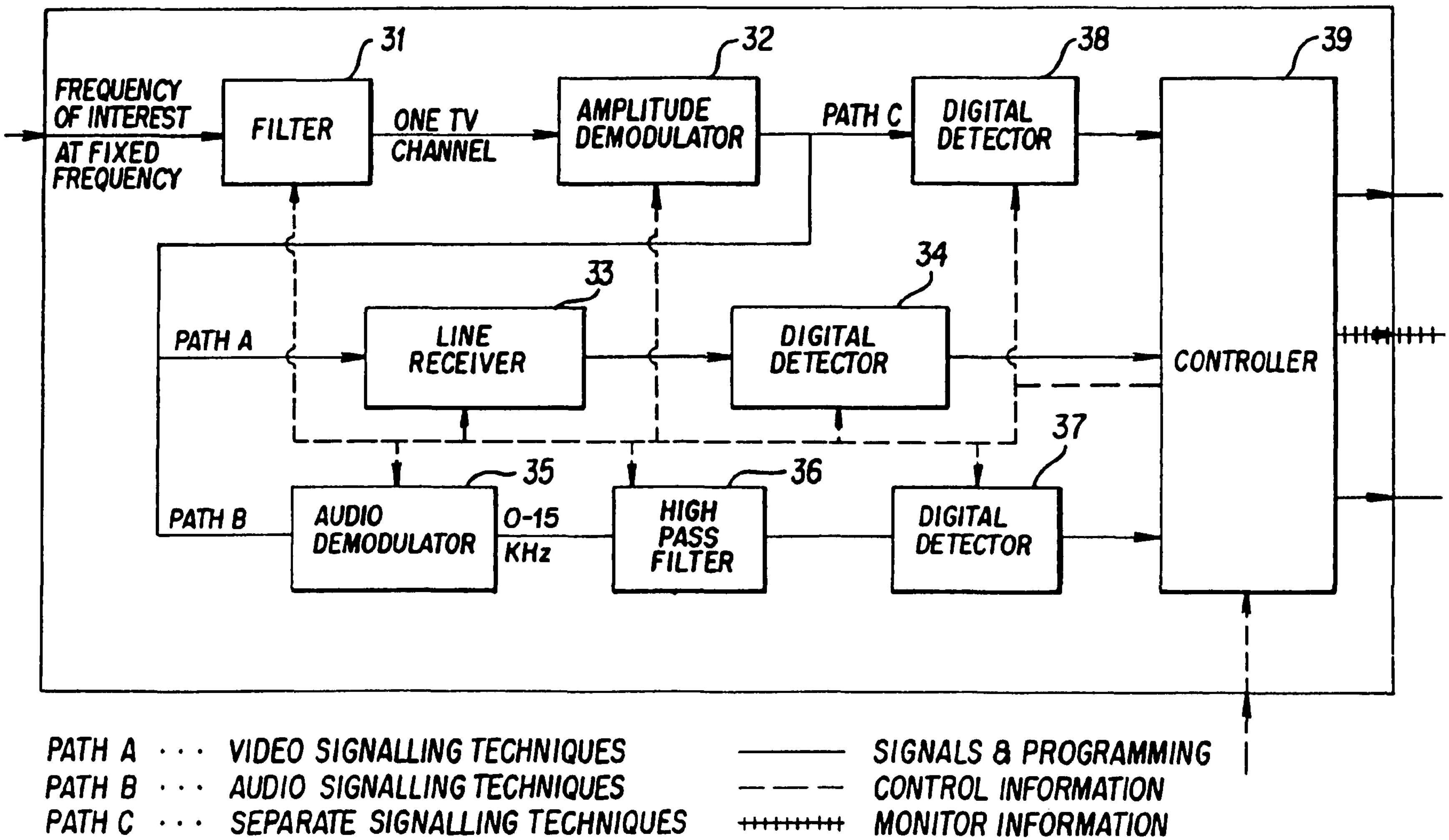

FREQUENCY OF INTEREST
AT FIXED FREQUENCY
31
FILTER
ONE TV CHANNEL
32
AMPLITUDE DEMODULATOR
PATH C
38
DIGITAL DETECTOR
39
CONTROLLER
PATH A
33
LINE RECEIVER
34
DIGITAL DETECTOR
PATH B
35
AUDIO DEMODULATOR
0-15 KHz
36
HIGH PASS FILTER
37
DIGITAL DETECTOR
PATH A · · · VIDEO SIGNALLING TECHNIQUES
PATH B · · · AUDIO SIGNALLING TECHNIQUES
PATH C · · · SEPARATE SIGNALLING TECHNIQUES
SIGNALS & PROGRAMMING
CONTROL INFORMATION
MONITOR INFORMATION

FIG. 2A

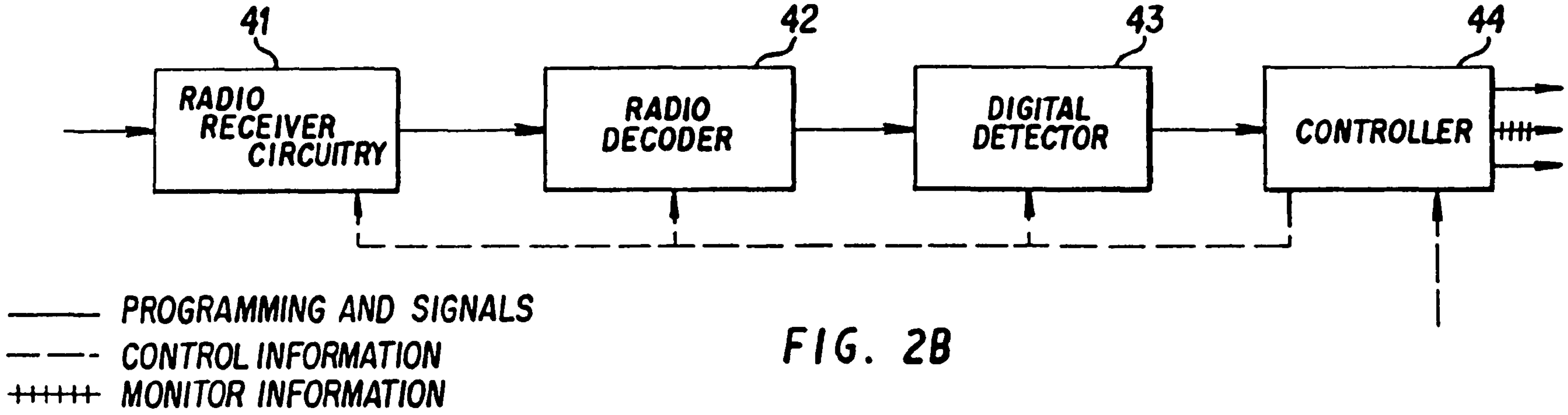
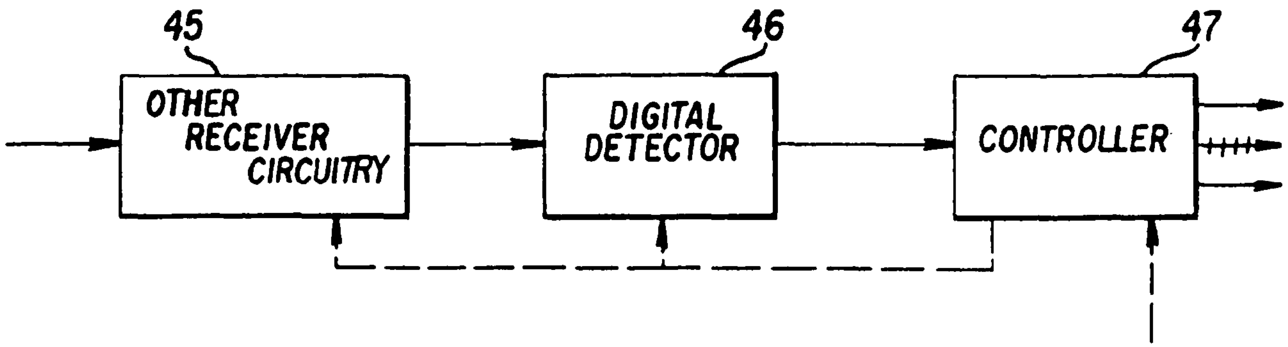

41
RADIO RECEIVER CIRCUITRY
42
RADIO DECODER
43
DIGITAL DETECTOR
44
CONTROLLER
PROGRAMMING AND SIGNALS
CONTROL INFORMATION
MONITOR INFORMATION

FIG. 2B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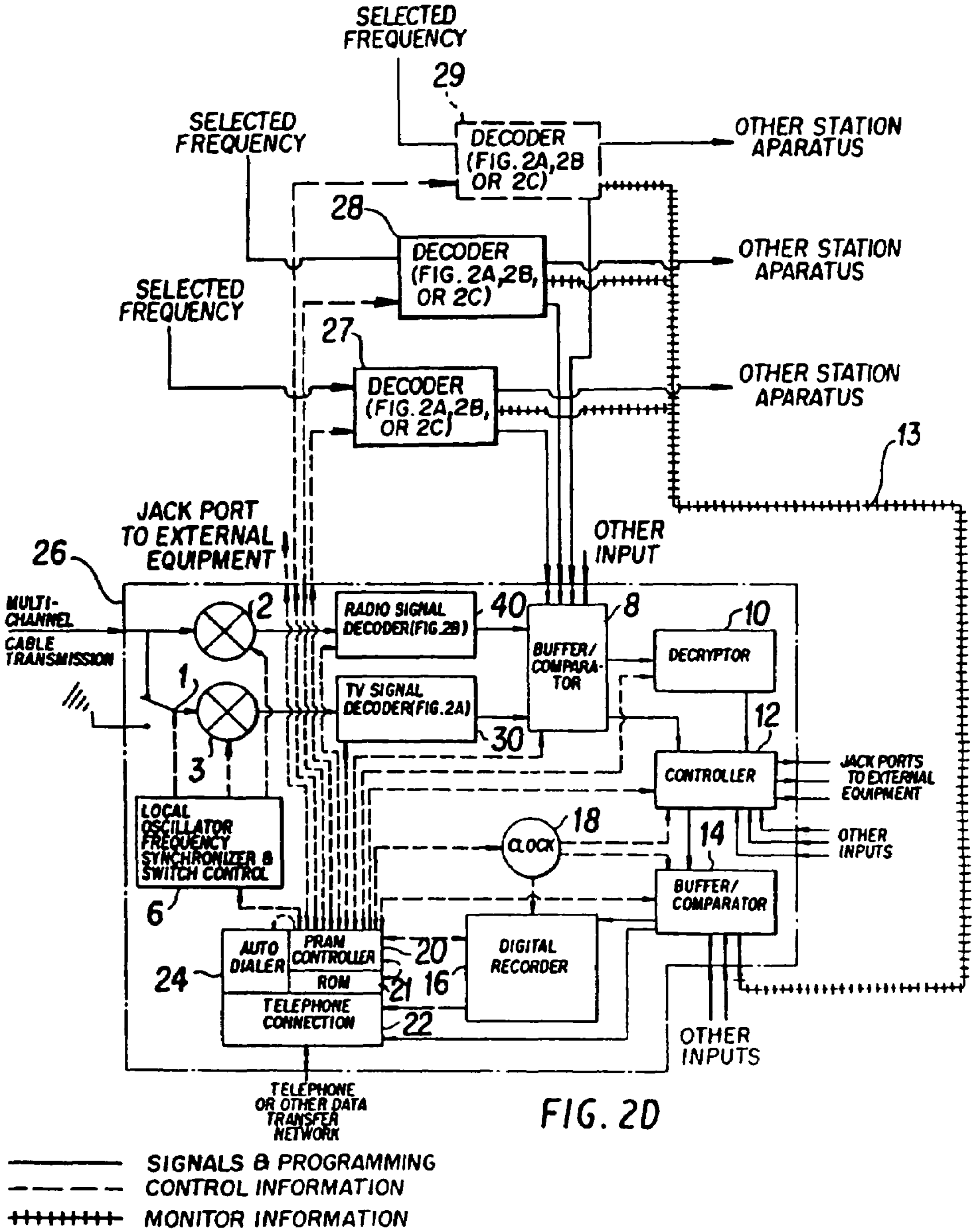
OTHER RECEIVER CIRCUITRY
46
DIGITAL DETECTOR
47
CONTROLLER

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
8
BUFFER/ COMPARATOR
10
DECRYPTOR
12
CONTROLLER
JACK PORTS TO EXTERNAL EQUIPMENT
OTHER INPUTS
LOCAL OSCILLATOR FREQUENCY SYNCHRONIZER & SWITCH CONTROL
6
18
CLOCK
14
BUFFER/ COMPARATOR
24
AUTO DIALER
PRAM CONTROLLER
ROM
TELEPHONE CONNECTION
20
21
16
22
DIGITAL RECORDER
OTHER INPUTS
TELEPHONE OR OTHER DATA TRANSFER NETWORK
SIGNALS & PROGRAMMING
CONTROL INFORMATION
MONITOR INFORMATION


FIG. 2D

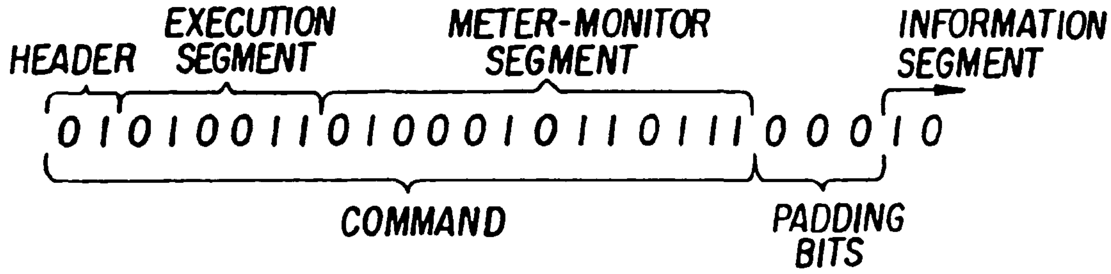



FIG. 2E

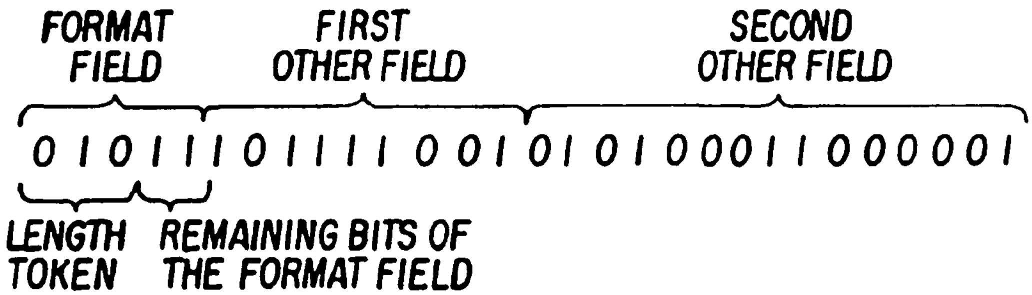



FIG. 2F

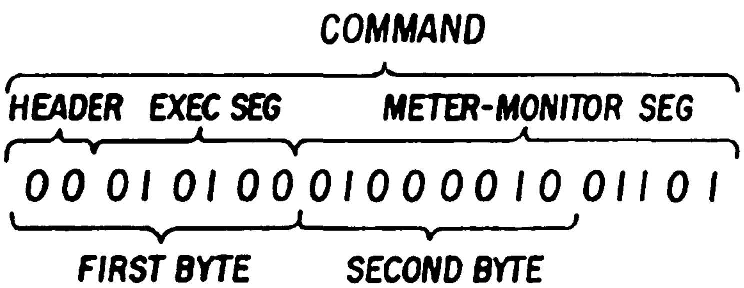



FIG. 2G

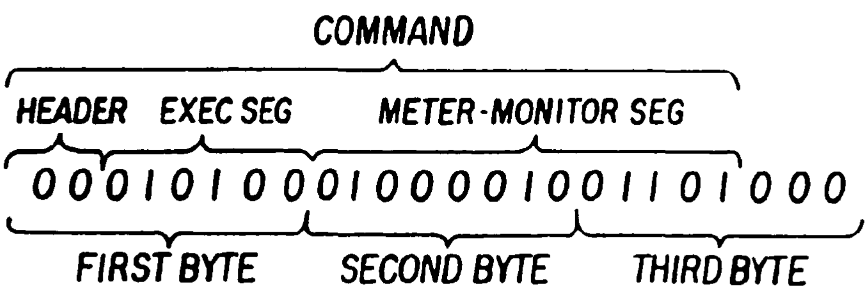



FIG. 2H

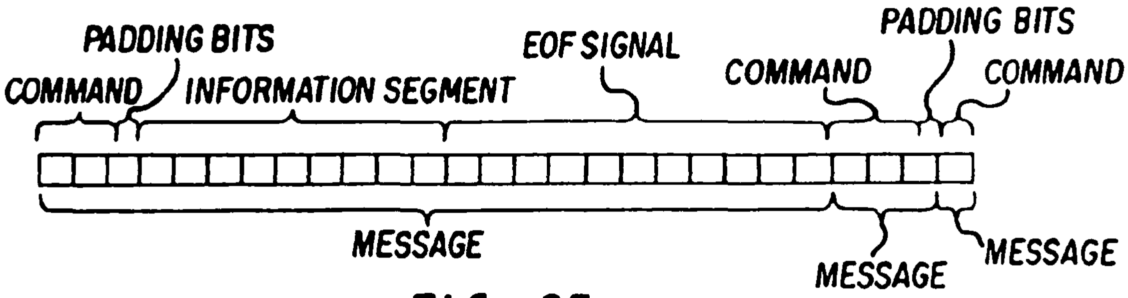



FIG. 2I

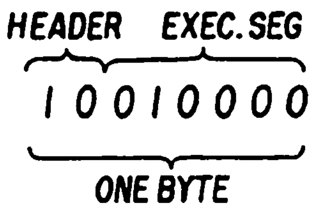



FIG. 2J

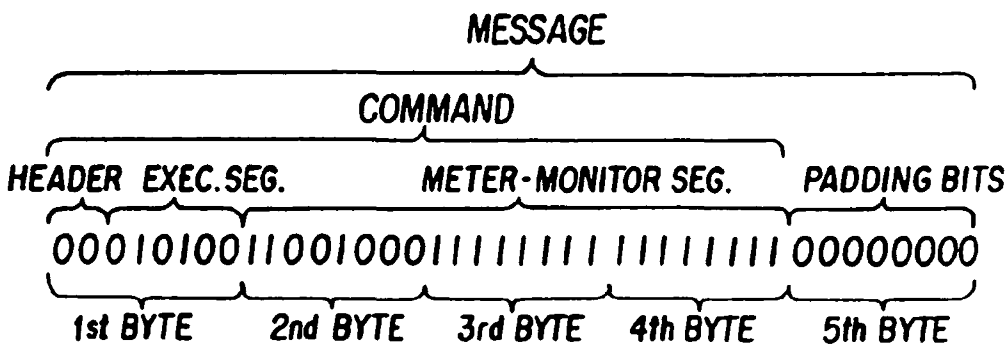
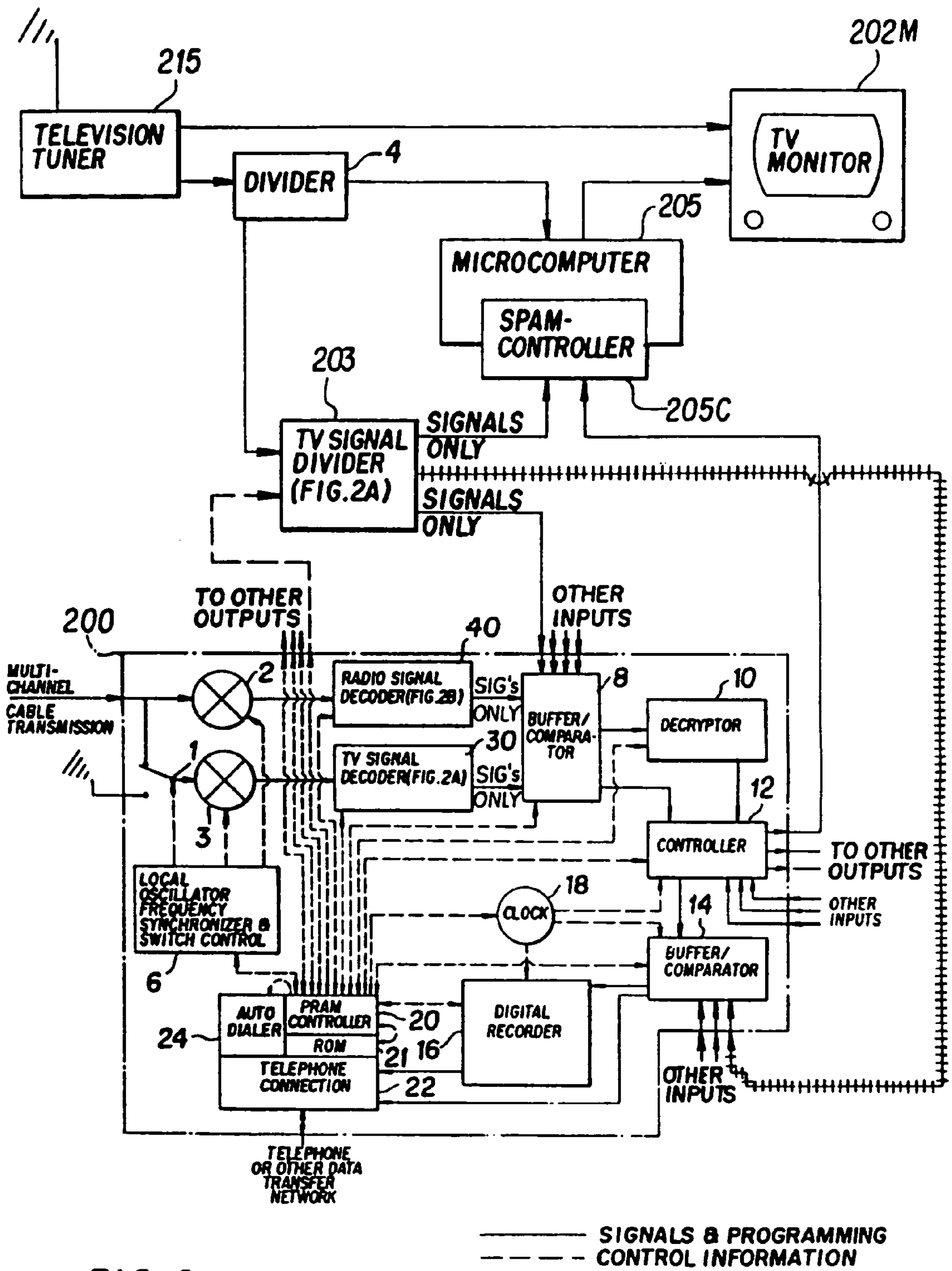



FIG. 2K



215
TELEVISION TUNER
DIVIDER
4
202M
TV MONITOR
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/COMPARATOR
10
DECRYPTOR
1
30
TV SIGNAL DECODER(FIG.2A)
SIG's ONLY
3
12
CONTROLLER
TO OTHER OUTPUTS
LOCAL OSCILLATOR FREQUENCY SYNCHRONIZER & SWITCH CONTROL
18
CLOCK
14
OTHER INPUTS
6
BUFFER/COMPARATOR
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

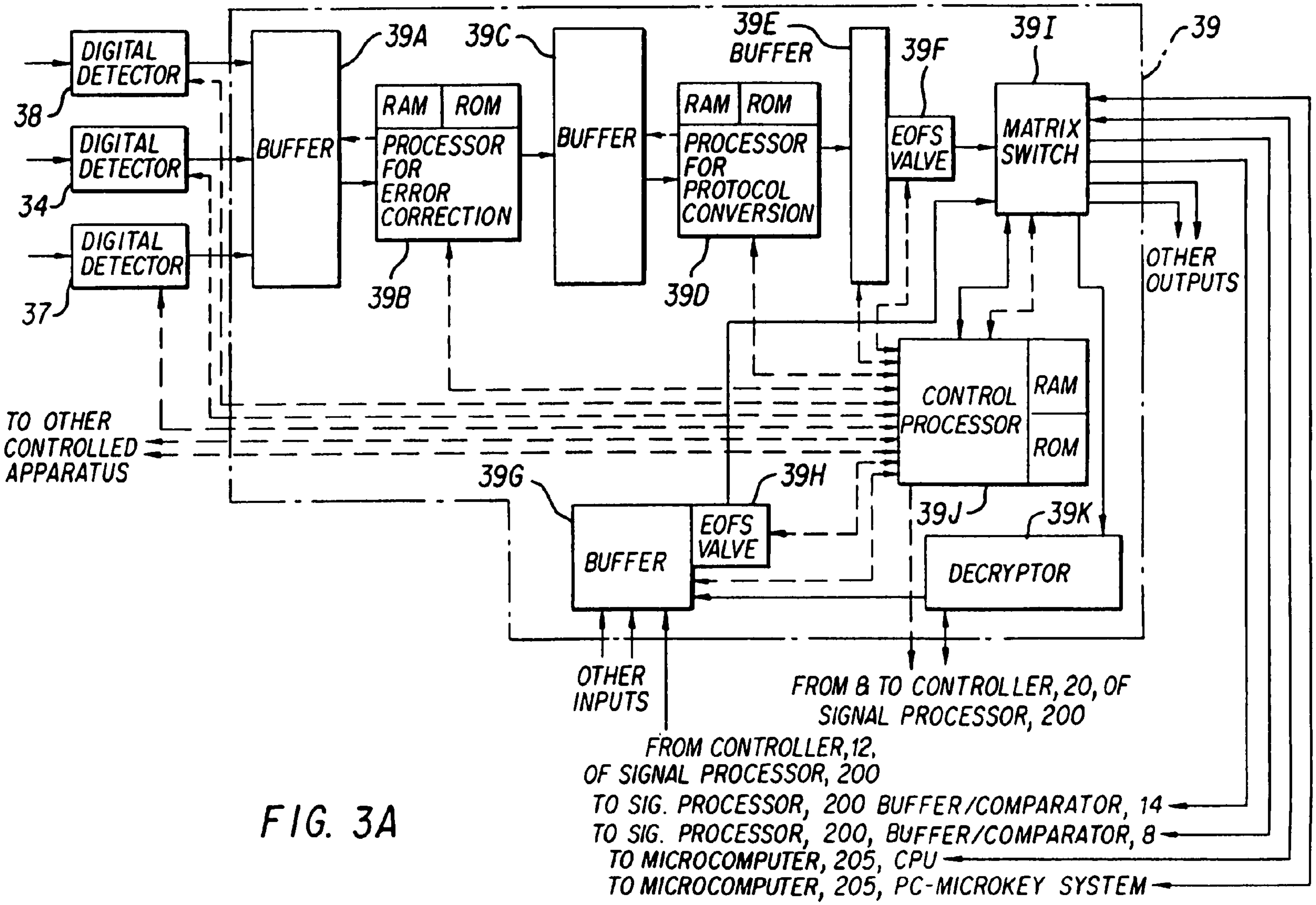
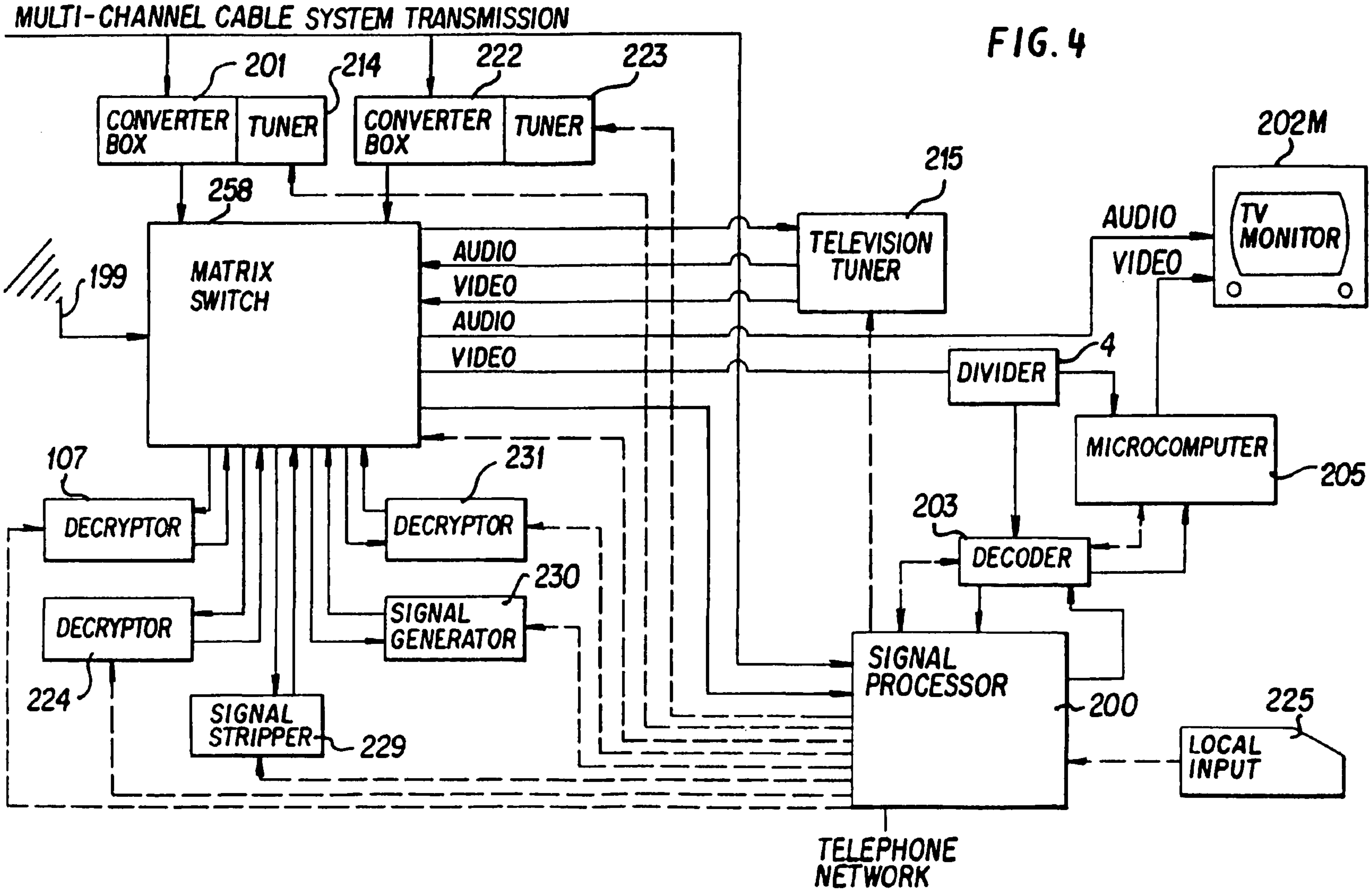

DIGITAL DETECTOR
38
DIGITAL DETECTOR
34
DIGITAL DETECTOR
37
BUFFER
39A
RAM
ROM
PROCESSOR FOR ERROR CORRECTION
39B
39C
BUFFER
39E
BUFFER
RAM
ROM
PROCESSOR FOR PROTOCOL CONVERSION
39D
39F
EOFS VALVE
39I
MATRIX SWITCH
39
OTHER OUTPUTS
CONTROL PROCESSOR
RAM
ROM
39J
TO OTHER CONTROLLED APPARATUS
39G
BUFFER
EOFS VALVE
39H
39K
DECRYPTOR
OTHER INPUTS
FROM 8 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

FIG. 4


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

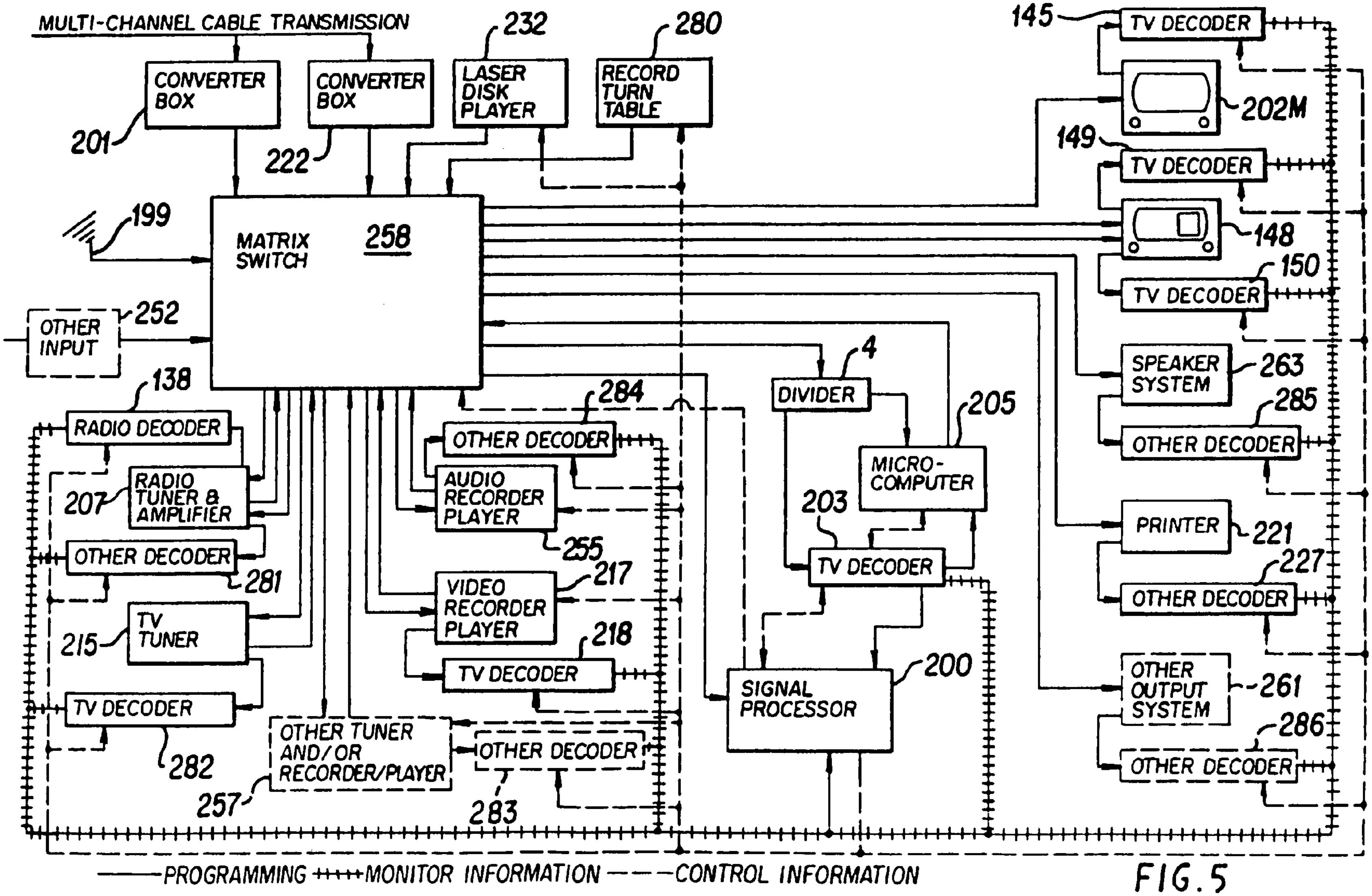

MULTI-CHANNEL CABLE TRANSMISSION
CONVERTER BOX
201
CONVERTER BOX
222
LASER DISK PLAYER
232
RECORD TURN TABLE
280
MATRIX SWITCH
258
199
OTHER INPUT
252
138
RADIO DECODER
RADIO TUNER & AMPLIFIER
207
OTHER DECODER
281
TV TUNER
215
TV DECODER
282
OTHER TUNER AND/OR RECORDER/PLAYER
257
OTHER DECODER
283
284
OTHER DECODER
AUDIO RECORDER PLAYER
255
VIDEO RECORDER PLAYER
217
TV DECODER
218
DIVIDER
4
MICRO-COMPUTER
205
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

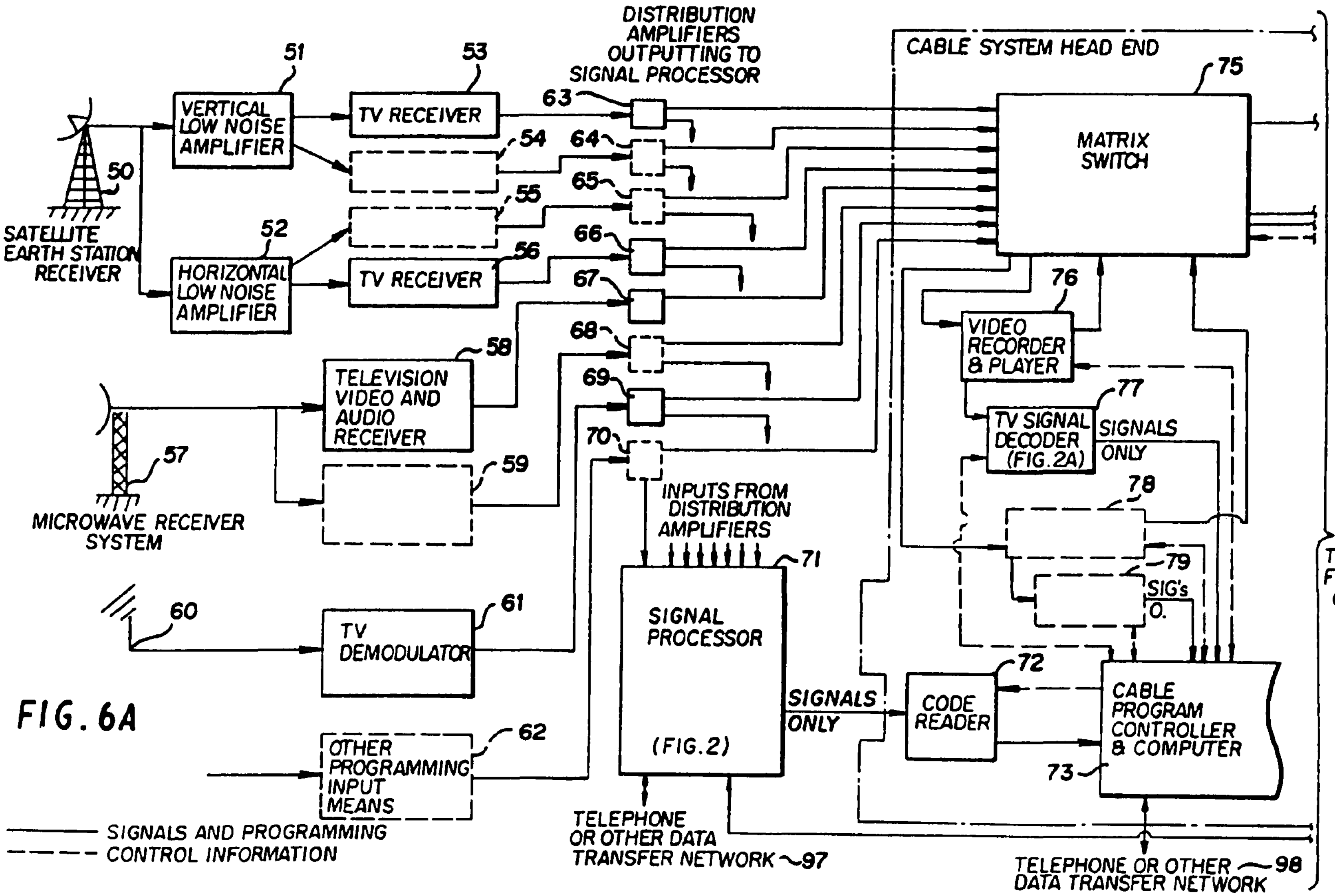

DISTRIBUTION AMPLIFIERS OUTPUTTING TO SIGNAL PROCESSOR
CABLE SYSTEM HEAD END
51
53
63
64
65
66
67
68
69
70
75
VERTICAL LOW NOISE AMPLIFIER
TV RECEIVER
54
55
56
MATRIX SWITCH
50
SATELLITE EARTH STATION RECEIVER
52
HORIZONTAL LOW NOISE AMPLIFIER
TV RECEIVER
76
VIDEO RECORDER & PLAYER
58
TELEVISION VIDEO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

FIG. 6A

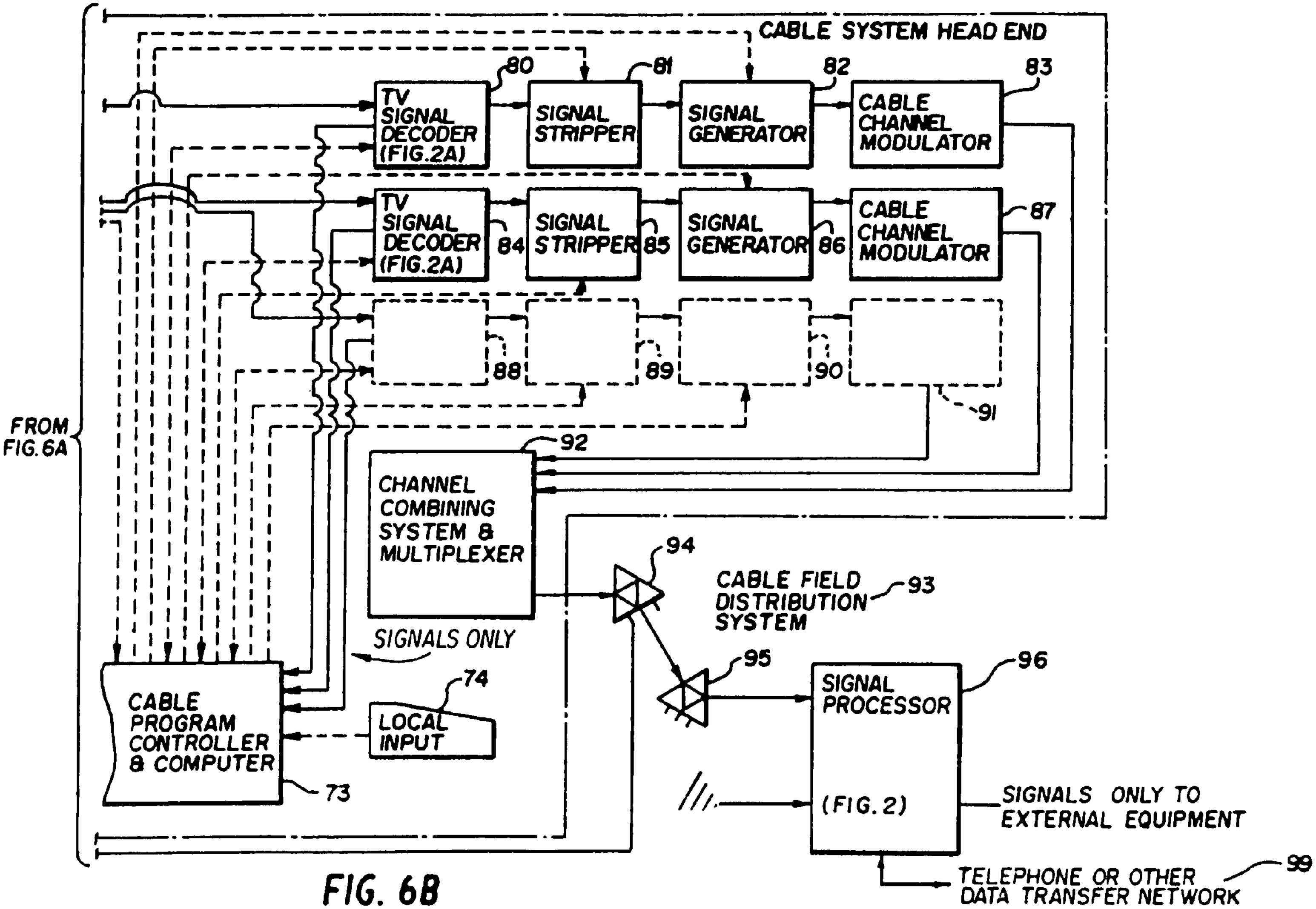

CABLE SYSTEM HEAD END
80
81
82
83
TV SIGNAL DECODER (FIG.2A)
SIGNAL STRIPPER
SIGNAL GENERATOR
CABLE CHANNEL MODULATOR
TV SIGNAL DECODER (FIG.2A)
84
SIGNAL STRIPPER
85
SIGNAL GENERATOR
86
CABLE CHANNEL MODULATOR
87
88
89
90
91
FROM FIG.6A
92
CHANNEL COMBINING SYSTEM & MULTIPLEXER
94
CABLE FIELD DISTRIBUTION 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

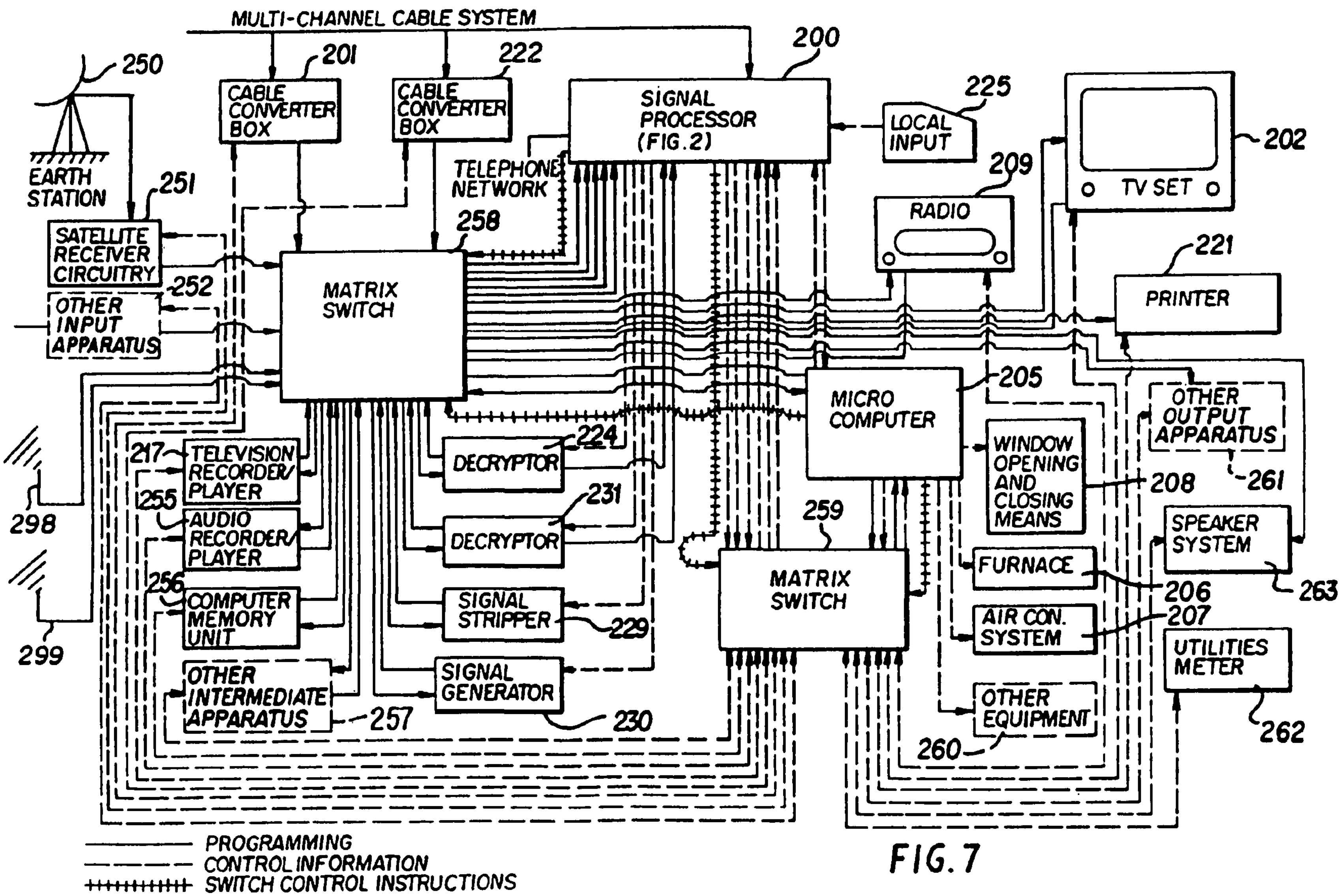

MULTI-CHANNEL CABLE SYSTEM
250
EARTH STATION
201
CABLE CONVERTER BOX
222
CABLE CONVERTER BOX
200
SIGNAL PROCESSOR (FIG. 2)
225
LOCAL INPUT
202
TV SET
209
RADIO
TELEPHONE NETWORK
251
SATELLITE RECEIVER CIRCUITRY
258
MATRIX SWITCH
252
OTHER INPUT APPARATUS
221
PRINTER
205
MICRO COMPUTER
OTHER OUTPUT APPARATUS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

FIG. 7

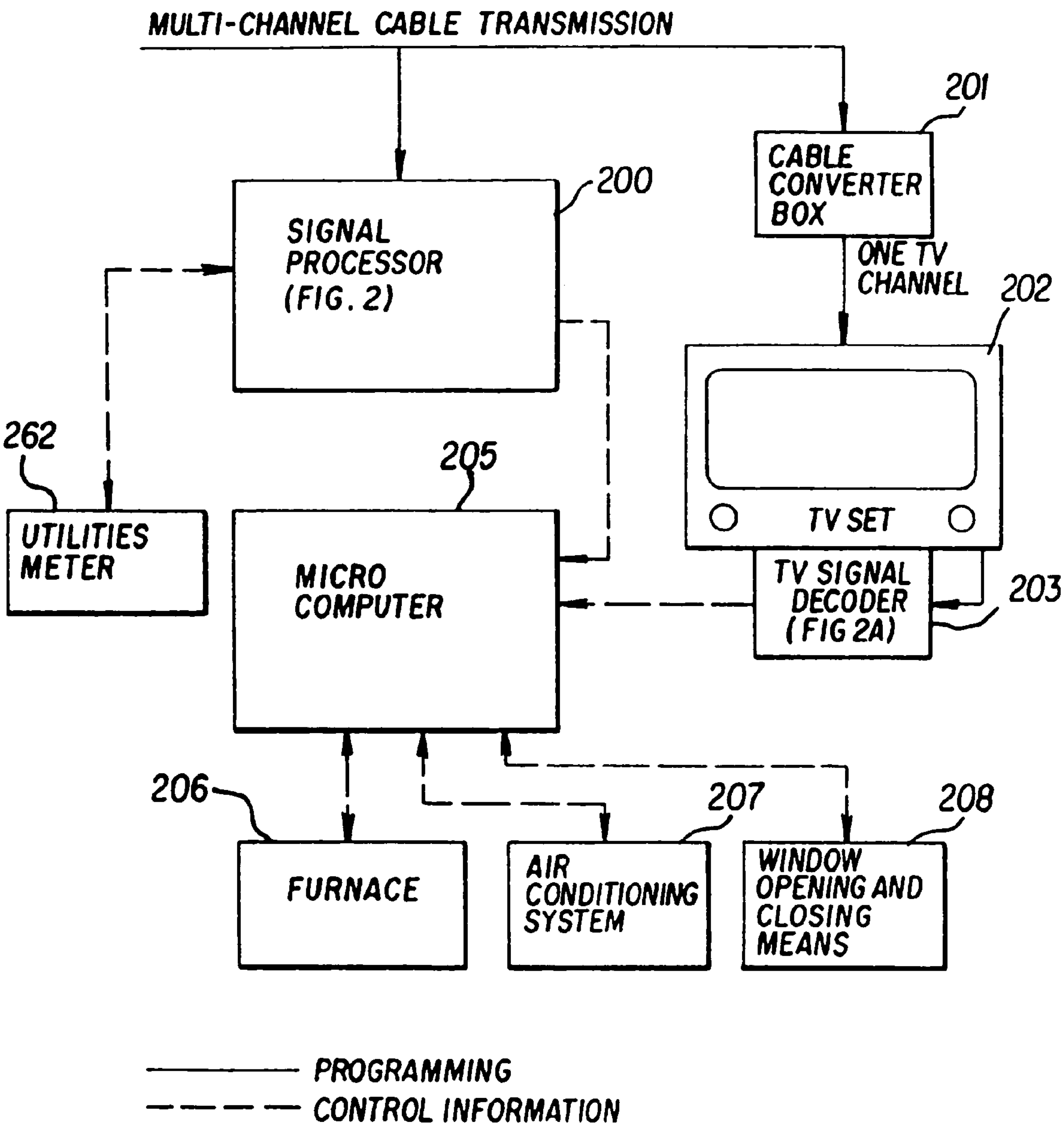

MULTI-CHANNEL CABLE TRANSMISSION
201
CABLE CONVERTER BOX
ONE TV CHANNEL
202
200
SIGNAL PROCESSOR (FIG. 2)
262
205
UTILITIES METER
MICRO COMPUTER
TV SET
TV SIGNAL DECODER (FIG 2A)
203
206
207
208
FURNACE
AIR CONDITIONING SYSTEM
WINDOW OPENING AND CLOSING MEANS
PROGRAMMING
CONTROL INFORMATION

FIG. 7A

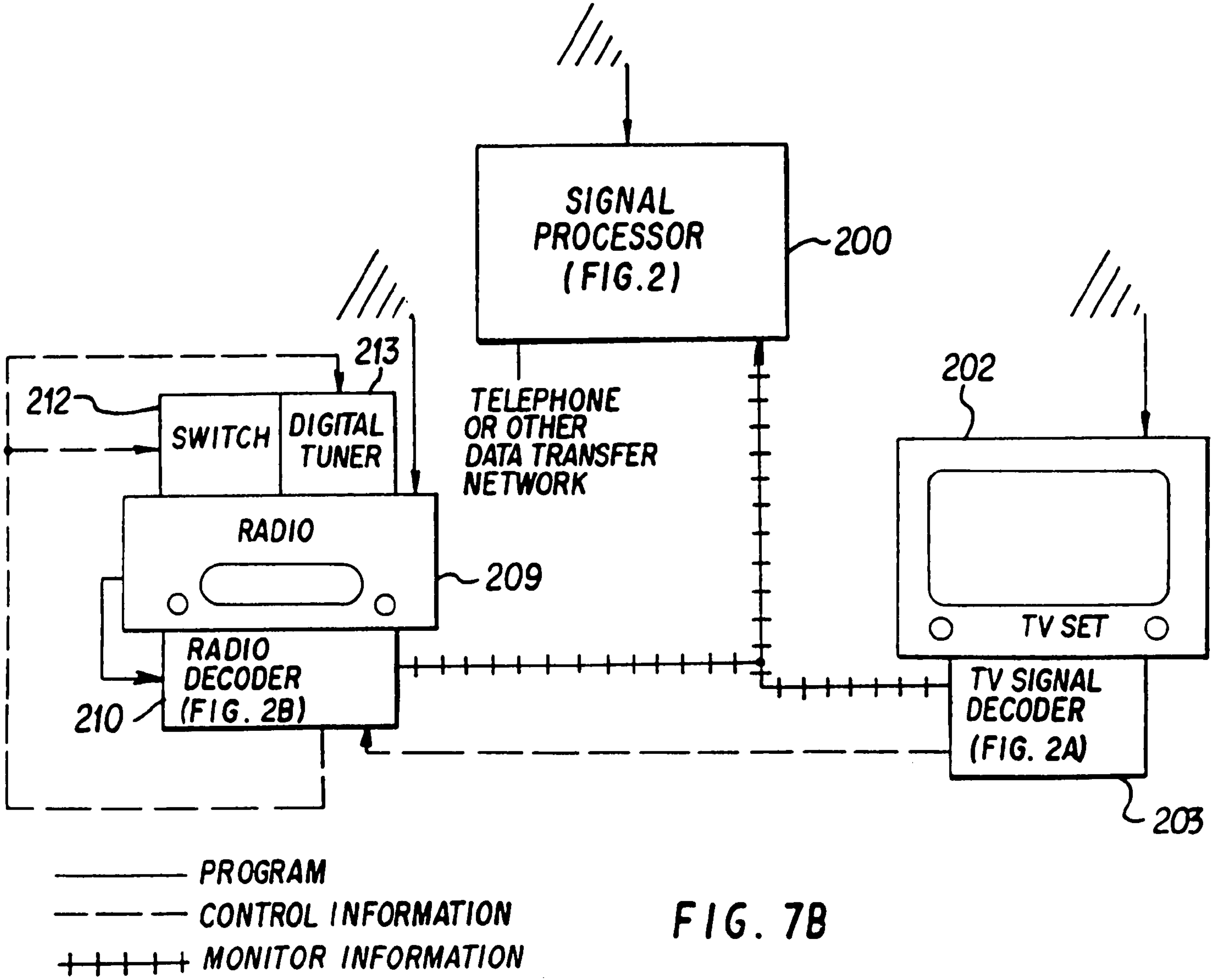

SIGNAL PROCESSOR (FIG.2)
200
TELEPHONE OR OTHER DATA TRANSFER NETWORK
212
213
SWITCH
DIGITAL TUNER
RADIO
209
RADIO DECODER (FIG. 2B)
210
202
TV SET
TV SIGNAL DECODER (FIG. 2A)
203
PROGRAM
CONTROL INFORMATION
MONITOR INFORMATION

FIG. 7B

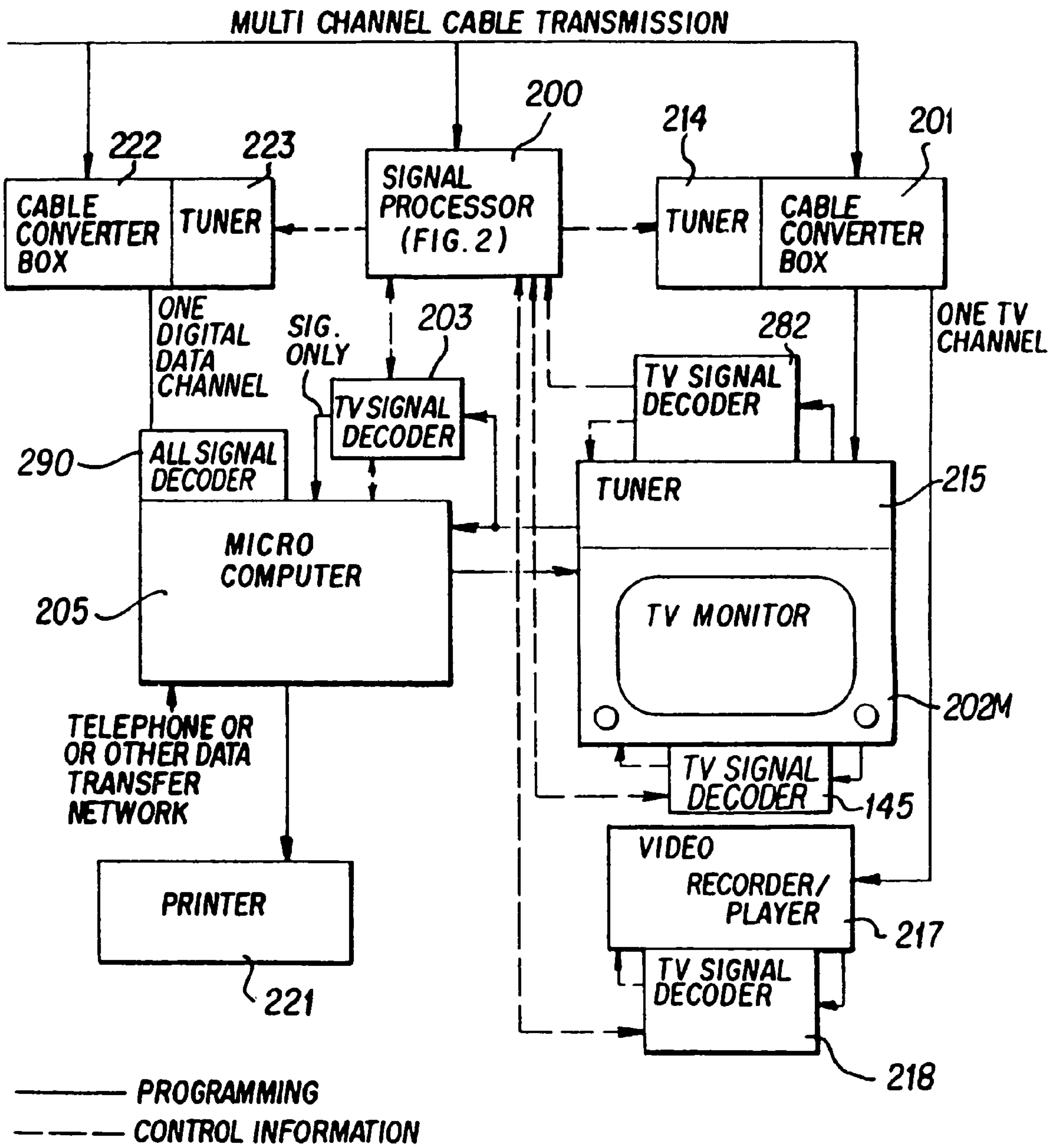

MULTI CHANNEL CABLE TRANSMISSION
200
214
201
222
223
CABLE CONVERTER BOX
TUNER
SIGNAL PROCESSOR (FIG. 2)
TUNER
CABLE CONVERTER BOX
ONE DIGITAL DATA CHANNEL
SIG. ONLY
203
282
ONE TV CHANNEL
TV SIGNAL DECODER
TV SIGNAL DECODER
290
ALL SIGNAL DECODER
TUNER
215
MICRO COMPUTER
205
TV MONITOR
202M
TELEPHONE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

FIG. 7C

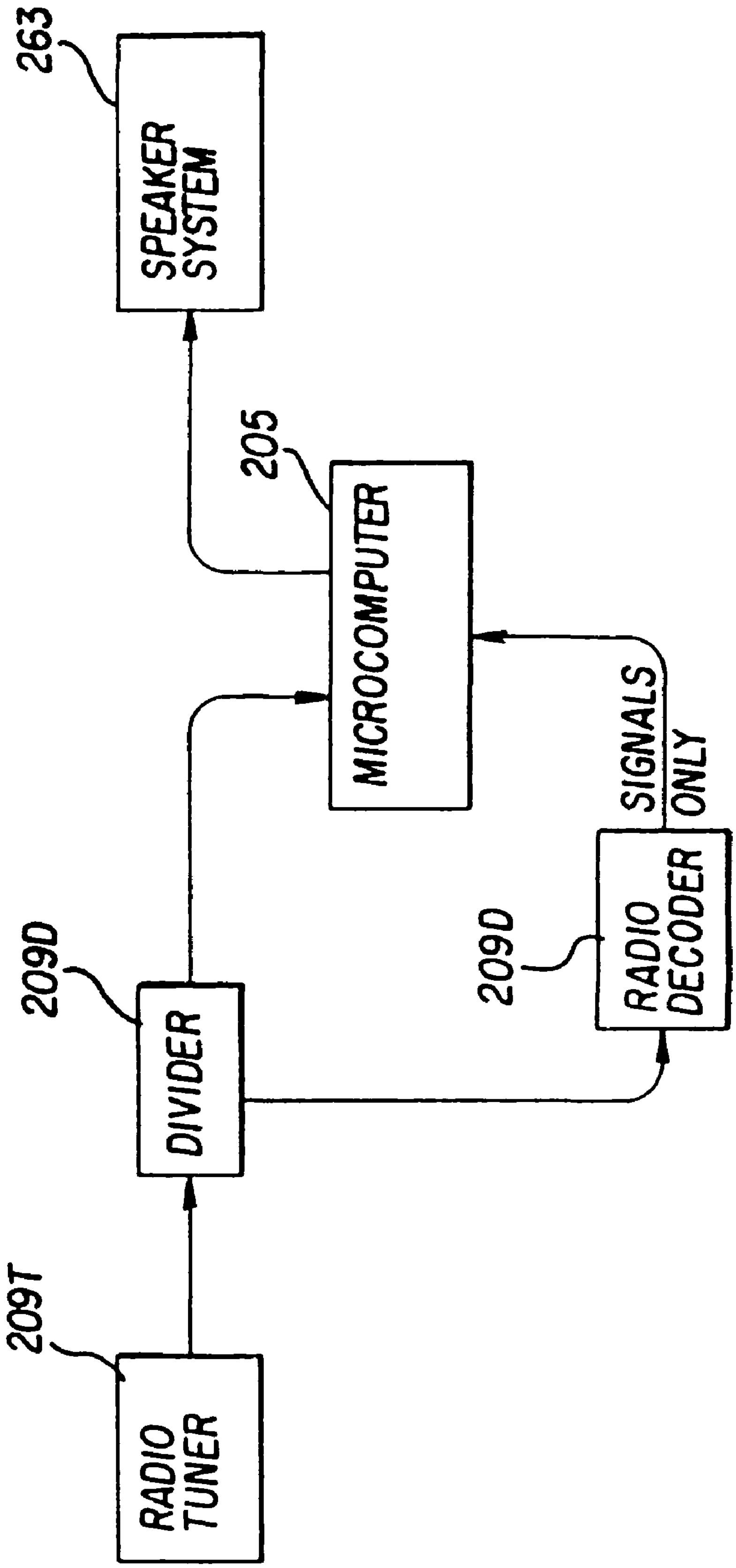

263
SPEAKER SYSTEM
205
MICROCOMPUTER
SIGNALS ONLY
209D
DIVIDER
209D
RADIO DECODER
209T
RADIO TUNER

FIG. 7D

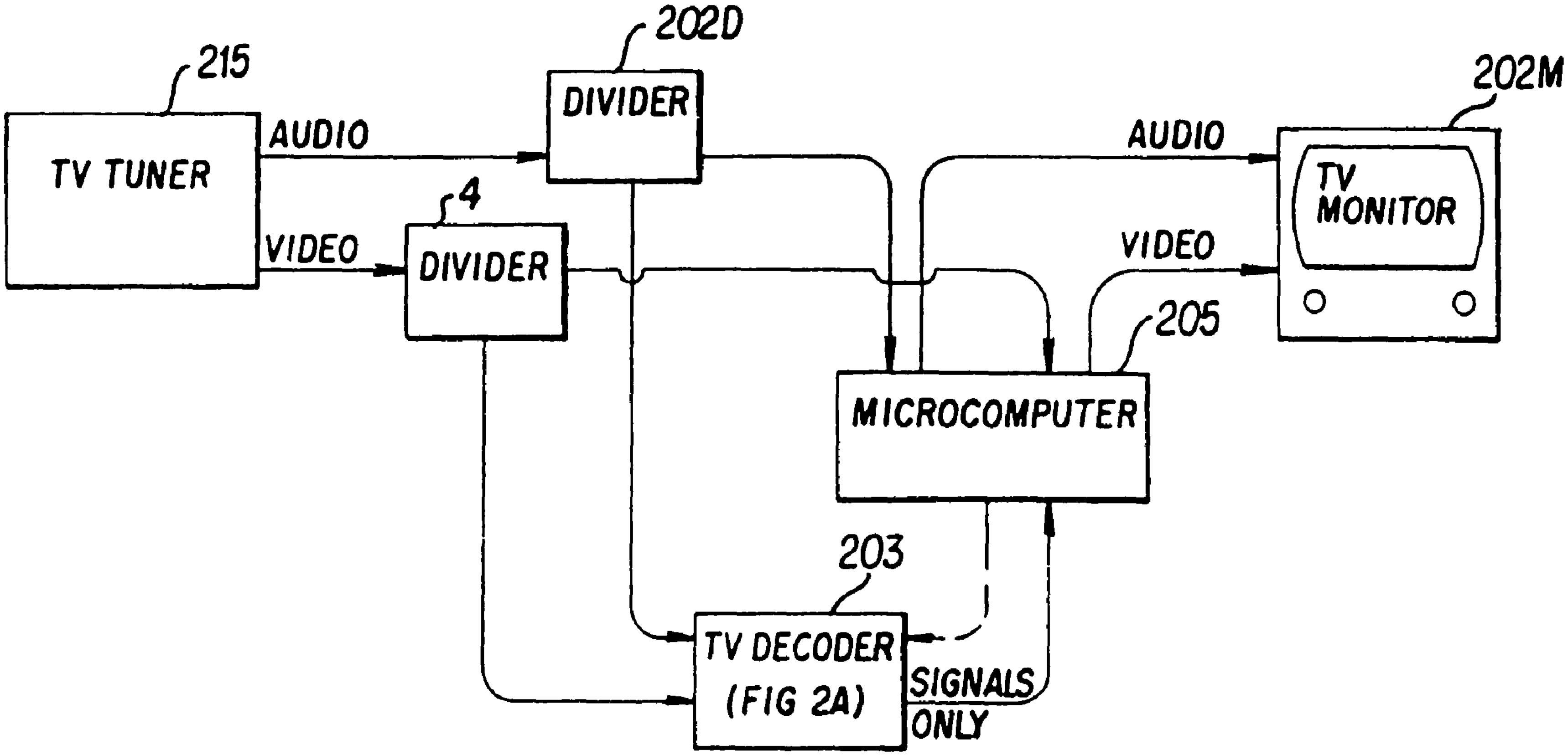

215
TV TUNER
AUDIO
VIDEO
202D
DIVIDER
4
DIVIDER
AUDIO
VIDEO
202M
TV MONITOR
205
MICROCOMPUTER
203
TV DECODER (FIG 2A)
SIGNALS ONLY

FIG. 7E

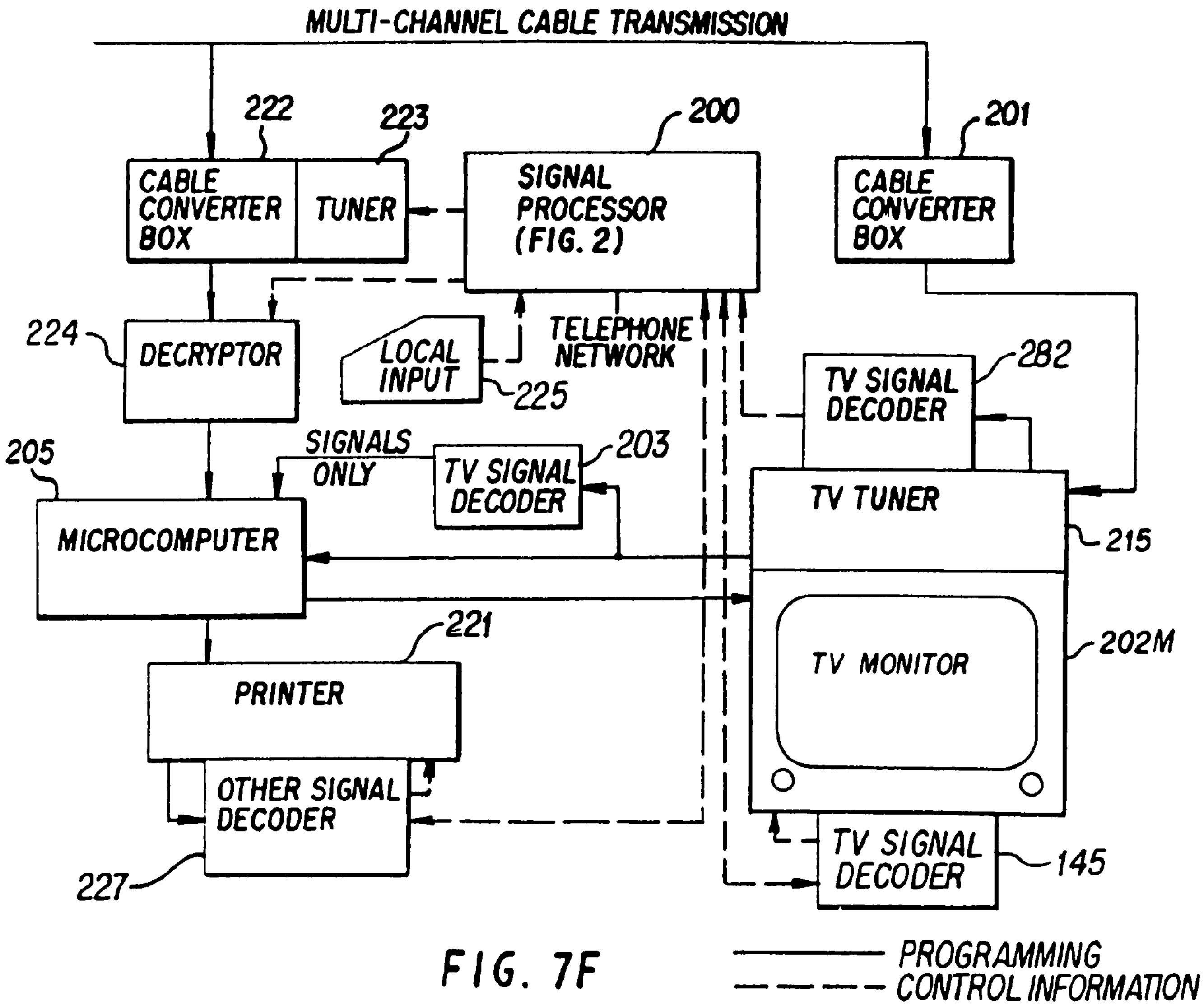

MULTI-CHANNEL CABLE TRANSMISSION
222
223
200
201
CABLE CONVERTER BOX
TUNER
SIGNAL PROCESSOR (FIG. 2)
CABLE CONVERTER BOX
224
DECRYPTOR
LOCAL INPUT
225
TELEPHONE NETWORK
TV SIGNAL DECODER
282
205
SIGNALS ONLY
TV SIGNAL DECODER
203
MICROCOMPUTER
TV TUNER
215
221
PRINTER
TV MONITOR
202M
OTHER SIGNAL DECODER
227
TV SIGNAL DECODER
145
PROGRAMMING
CONTROL INFORMATION

FIG. 7F

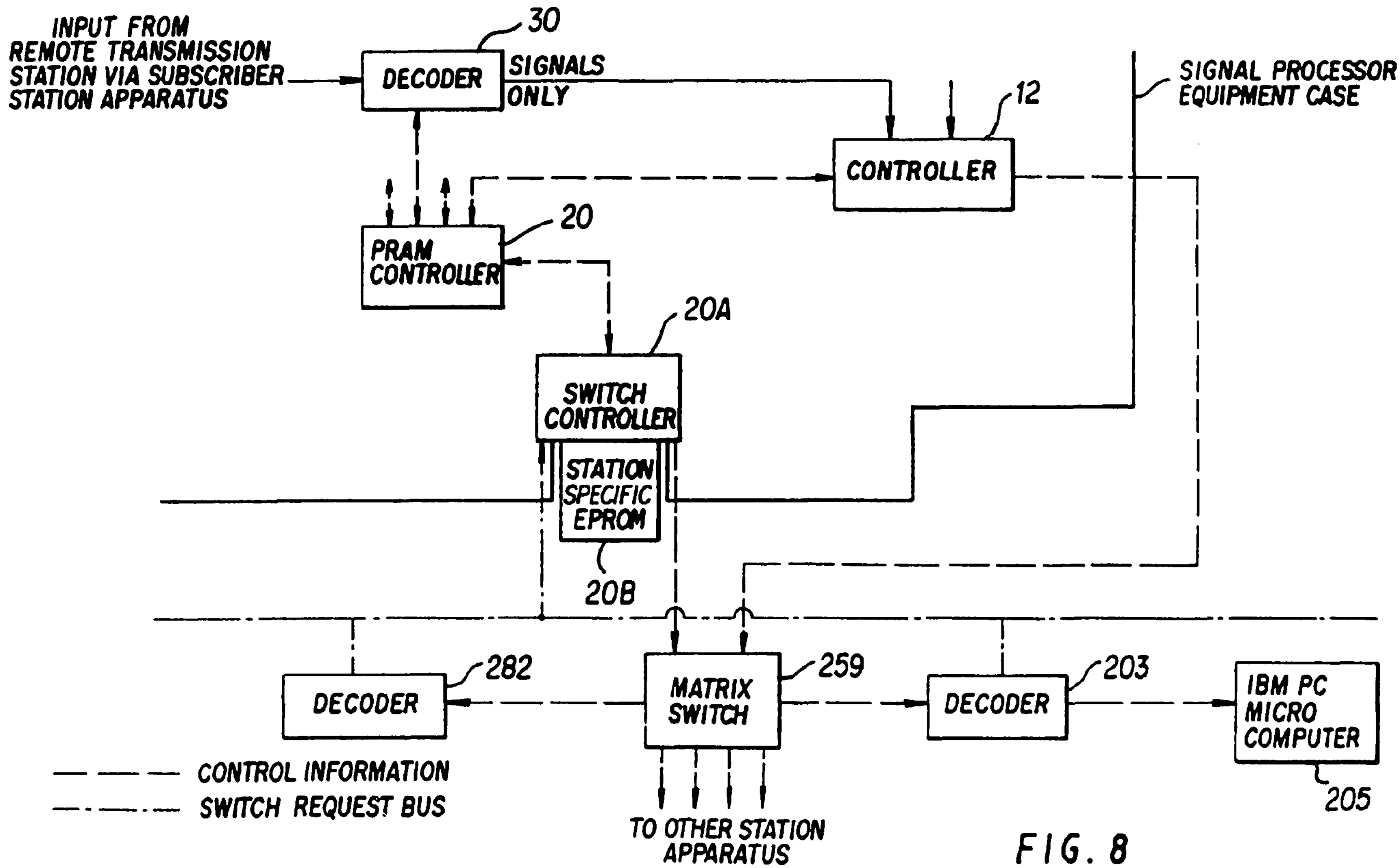

INPUT FROM REMOTE TRANSMISSION STATION VIA SUBSCRIBER STATION APPARATUS
30
DECODER
SIGNALS ONLY
12
CONTROLLER
SIGNAL PROCESSOR EQUIPMENT CASE
20
PRAM CONTROLLER
20A
SWITCH CONTROLLER
STATION SPECIFIC EPROM
20B
282
DECODER
MATRIX SWITCH
259
DECODER
203
IBM PC MICRO COMPUTER
205
TO OTHER STATION APPARATUS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

FIG. 8

# SIGNAL PROCESSING APPARATUS AND METHODS

This is a continuation of application Ser. No. 08/113,329, filed Aug. 30, 1993, 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 Kimura U.S. Pat. No. 3,891,792. Baer U.S. Pat. No. 4,310,854 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, Lambert U.S. Pat. No. 4,381,522 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, Bourassin et al. U.S. Pat. No. 4,337,480 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. Freeman et. al. U.S. Pat. No. 4,264,925 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 Haselwood, et al. U.S. Pat. No. 4,025,851. Another that monitors by means of audio codes that are only "substantially inaudible" is described in Crosby U.S. Pat. No. 3,845,391. 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 Greenberg U.S. Pat. No. 4,547,804.

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 was well as combined medium programming. The system includes capacity for automatically organizing multichannel 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 multi-channel 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 multi-channel 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 wand 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.

FIGS. **6***a* and **6***b* 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 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, **44**, or **47**, for erasing said EPROM, and said RAM and said EPROM are reprogrammable.

Controller, **39**, **44**, or **47**, is preprogrammed to receive words of signal information, to assemble said words into signal units that subscriber station apparatus can receive and process, and to transfer said units 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. Beside's 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. 2I shows the information of FIG. 2E organized in eight-bit bytes. While the information of the execution segment in FIG. 2I 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. 2I 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 bit of any given instance of a message with a "10" or a "00" header are described above.) In a fashion that is described more fully below, said locate-last-message-bit instructions cause said apparatus to determine whether the signal word in which said last segment information bit occurs contains one or more MOVE bits. If said signal word contains MOVE bit information, the last information bit of said signal word is the last information bit of said message. If said signal word does not contain MOVE bit information, the last information bit of said message is last information bit of the next signal word immediately following said signal word in which said last segment information bit occurs. (For reasons that relate to detecting end of file signals and are discussed more fully below, in the preferred embodiment a complete signal word of padding bits is transmitted after any given instance of a signal word that contains no MOVE bit information and in which occurs the last bit of command information of the message of said instance.)

Messages that contain lowest priority segment information end with end of file signals, and the header information of said messages do not cause subscriber station apparatus to execute particular preprogrammed locate-last-message-bit instructions. End of file signals define the ends of messages that contain lowest priority segment information. In the simplest preferred embodiment, such messages begin with "10" or "00" headers. The last information bit of the end of file signal immediately following any given "10" or "00" header information message is the last information bit of the message of said "10" or "00" header, and subscriber station apparatus are preprogrammed to locate said bit in a fashion that is described below.

After locating any given instance of a last information bit of a message, subscriber station apparatus are preprogrammed to process automatically as header information the first information bits, following said bit, that are in number the particular number of bits in an instance of header information.

In this fashion, cadence information—header information, the length tokens of messages that contain intermediate priority segment information but no lowest priority segment information, and end of file signals—enables subscriber station apparatus to distinguish each instance of header information—and, hence, each message—in any given stream of SPAM messages.

Detecting End of File Signals

In the present invention, any microprocessor, buffer/comparator, or buffer can be adapted and preprogrammed to detect end of file signals. At any given SPAM apparatus that is so adapted and preprogrammed, particular dedicated capacity exists for said detecting. Said capacity includes standard register memory or RAM capacity, well known in the art, including three particular memory locations for comparison purposes, one particular memory location to serve as a counter, and three so-called "flag bit" locations to hold particular true/false information. (Hereinafter, said three particular memory locations, said one particular memory location, and said three flag bit locations are called the "EOFS Word Evaluation Location," "EOFS Standard Word Location," and "EOFS Standard Length Location"; the "EOFS WORD Counter"; and the "EOFS WORD Flag," "EOFS Empty Flag," and "EOFS Complete Flag" all respectively.) All operating instructions required to control said memory or RAM capacity in detecting end of file signals are preprogrammed as so-called "firmware" at said apparatus. (In this specification, said dedicated capacity is called an "EOFS valve" because, in addition to detecting end of file signals, said capacity also regulates the flow of SPAM information in fashions that are described more fully below.)

At any given EOFS valve, the EOFS Word Evaluation Location and EOFS Standard Word Location are conventional dynamic memory locations each capable of holding one full signal word of binary information. The EOFS Standard Length Location and the EOFS WORD Counter are each conventional dynamic memory locations capable of holding, at a minimum, eight binary bits—that is, one byte—of information. The EOFS WORD Flag, EOFS Empty Flag, and EOFS Complete Flag are each conventional dynamic memory locations capable of holding, at a minimum, one bit of binary information.

At any given time, said valve holds particular information. At said EOFS Word Evaluation Location is one signal word of received SPAM information. At said EOFS Standard Word Location is one signal word of EOFS bits. (Hereinafter, one signal word of EOFS bits is called an "EOFS WORD.") At said EOFS Standard Length Location is information of the total number of EOFS WORDs in the particular end of file signal that applies at said time on the particular transmission received at said valve. Information of the decimal value, eleven, is at said Standard Length Location unless information of a number is placed at said Location in a fashion described below. At the EOFS WORD Counter is information of the number of EOFS WORDs that said valve has received in uninterrupted sequence. And all said Flag locations contain binary "0" or "1" information to reflect true or false conditions in relation to particular comparisons.

At any given time, any given EOFS valve receives inputted binary information of one selected SPAM transmission from one particular external transferring apparatus that is external to said valve. Said information consists of a series of discrete signal words. And said valve outputs information to one particular external receiving apparatus.

Receiving any given signal word of said transmission, causes said EOFS valve to commence, in respect to said given signal word, a particular word evaluation sequence that is fully automatic. Automatically said valve places information of said word at said EOFS Word Evaluation Location and compares the information at said Location to the EOFS WORD information at said EOFS Standard Word Location. Whenever said comparison is made, resulting in a match causes said valve automatically to set the information of said EOFS WORD Flag to "0". (Resulting in a match means that said given signal word is an EOFS WORD and may be a part of an end of file signal.) Not resulting in a match causes said valve automatically to set the information of said EOFS WORD Flag to "1". Then automatically said valve determines the value of said information at said EOFS WORD Flag, in a fashion well known in the art, and executes one of two sets of word evaluation sequence instructions on the basis of the outcome of said determining.

One set, the process-EOFS-WORD instructions, is executed whenever the information at said EOFS WORD Flag indicates that said given signal word is an EOFS WORD. Determining a value of "0" at said EOFS WORD Flag causes said valve to execute said set. Automatically the instructions of said set cause said valve to retain count information of said given signal word by increasing the value of the information at said EOFS WORD Counter by an increment of one. (Incrementing said Counter by one documents the fact that, in receiving said given signal word, said valve has received, in uninterrupted sequence, one signal word that may be part of an end of file signal more than it had received before it received said given signal word.) Then automatically said valve compares the information at said EOFS WORD Counter to the information at said EOFS Standard Length Location. Resulting in a match causes said valve automatically to set the information of said EOFS Complete Flag to "0". (A match of the information at said Counter with the information at said Location means that said given signal word is the last EOFS WORD in an uninterrupted sequence of EOFS WORDS that equals in length the length of an end of file signal; in other words, said match means that an end of file signal has been detected.) Not resulting in a match causes said valve automatically to set the information of said EOFS Complete Flag to "1". (Not resulting in a match means said EOFS WORD is not the last EOFS WORD of an end of file signal and that insufficient information has been received to determine whether or not said given signal word is part of an end of file signal.) Then automatically said valve determines the value of said information at said EOFS

Complete Flag. Determining a value of "0" at said Flag, which means that an end of file signal has been detected, causes said valve to operate in a fashion described more fully below. Determining a value of "1" at said Flag causes said valve, in a fashion described more fully below, to complete said word evaluation sequence, in respect to said given signal word, without transferring any information of said given signal word to said external receiving apparatus.

The other set, the transfer-all-word-information instructions, is executed whenever the information at said EOFS WORD Flag indicates that said given signal word is not an EOFS WORD. Whenever said valve detects a signal word that is not an EOFS WORD, detecting said word means not only that said word is not part of an end of file signal but also that any EOFS WORDs retained in an uninterrupted sequence immediately prior to said word are also not part of an end of file signal. Determining a value of "1" at said EOFS WORD Flag causes said valve to execute said other set. Automatically the instructions of said other set cause said valve to compare the information at said EOFS WORD Counter to particular zero information that is among the preprogrammed information of said valve. (Not having been incremented by one under control of said process-EOFS-WORD instructions, said Counter contains information of the number of EOFS WORDs received in an uninterrupted sequence and retained at said valve at the time when said given signal word is received.) Resulting in a match causes said valve automatically to set the information of said EOFS Empty Flag to "0". (Resulting in a match means that said valve is empty of retained EOFS WORD information.) Not resulting in a match causes said valve automatically to set the information of said EOFS Empty Flag to "1". (Not resulting in a match means that said valve contains information of EOFS WORDs that have not been transferred to said external receiving apparatus.) Then automatically said valve determines the value of said information at said EOFS Empty Flag. A determining of "1" causes said valve to execute particular transfer-counted-information instructions that are not executed if the information at said Flag is "0". Under control of said instructions, said valve automatically outputs one instance of said EOFS WORD information at said EOFS Standard Word Location a particular number of times which particular number is the numerical value of the information at said EOFS WORD Counter. (In so doing, said valve transfers information of all of the signal words received before said given signal word and not transferred to said external receiving apparatus.) Then said transfer-counted-information instructions cause said valve to set the value at said EOFS WORD Counter to zero (to reflect that said valve is now empty of information of untransferred signal words). Then, whether or not said valve has executed said transfer-counted-information instructions, said valve outputs information of said given signal word at said EOFS Word Evaluation Location and completes said word evaluation sequence, in respect to said given signal word.

Whenever said valve completes said word evaluation sequence, in respect to any given signal word, said valve informs said external transferring apparatus (in a so-called "handshaking" fashion, well known in the art, or in such other flow control fashion as may be appropriate) that said valve is ready to receive next signal word information. Whenever, after transferring a given signal word, said apparatus is so informed, said apparatus transfers to said decoder the next signal word of said transmission immediately following said given signal word. Receiving said next signal word causes said valve to commence said word evaluation sequence, in respect to said next signal word. Automatically said valve places information of said next signal word at said EOFS Word Evaluation Location, and in so doing, overwrites and obliterates information of said given word at said EOFS Word Evaluation Location.

In this fashion, said valve processes each successive signal word to detect those particular uninterrupted series of EOFS WORDs that constitute end of file signals.

As described above, determining, under control of said process-EOFS-WORD instructions, that the value of the information at said EOFS Complete Flag is "0" means that an end of file signal has been detected. Determining, under control of said instructions, that said value is "0" causes said valve to execute particular complete-signal-detected instructions. Said instructions cause said valve to inform said external receiving apparatus of the presence of an end of file signal in a fashion that is the preprogrammed fashion of the microprocessor, buffer/comparator, or buffer of which said valve is an adapted component.

As one example of said fashion, for a buffer or buffer/comparator apparatus that operates under control of a controller to process received signal words and transfer signal information to a microprocessor (which may be a component of said controller), said instructions cause said valve to cause said apparatus to transmit particular EOFS-signal-detected information to said controller then to wait, in a waiting fashion well known in the art, for a control instruction from said controller. Said EOFS-signal-detected information causes said controller to determine, in a preprogrammed fashion, how to process the particular EOFS information at said valve and to transmit either a particular transmit-and-wait instruction or a particular discard-and-wait instruction to said valve. (Examples of controller operations are presented below.) Said transmit-and-wait instruction causes said valve to transfer one complete end of file signal. More precisely, said instruction causes said valve automatically to output one instance of said EOFS WORD information at said EOFS Standard Word Location a particular number of times which particular number is the numerical value of the information at said EOFS Standard Length Location. Then automatically said valve sets the information at said EOFS WORD Counter to zero (thereby signifying that no EOFS WORDs are retained), completes said word evaluation sequence, in respect to the signal word of the information at said EOFS Word Evaluation Location, and transmits particular complete-and-waiting information to said controller. Alternatively, said discard-and-wait instruction causes said valve merely to set the information at said EOFS WORD Counter to zero (thereby discarding information of said end of file signal), to complete said word evaluation sequence, in respect to said signal word of the information at said EOFS Word Evaluation Location, and to transmit said complete-and-waiting information to said controller. Subsequently, said complete-and-waiting information causes said controller to transmit further instructions that control said apparatus and said valve in the processing of further information and the detecting of further end of file signals.

In the preferred embodiment, said EOFS-signal-detected information and said complete-and-waiting information are control signals that are transmitted by said valve and said apparatus to said controller as interrupts to the CPU of said controller.

An example illustrates the operation of an EOFS valve.

FIG. **2** shows one message that is of a particular command composed of a "00" header, an execution segment, and a meter-monitor segment. The information of said command fills four bytes of binary precisely. The last bit of said meter-monitor segment is the last bit of the fourth byte of said command. But because the byte in which said last bit occurs contains no MOVE bit information, according to the rules of message composition of the preferred embodiment, one full signal word of padding bits follows said command.

When the message of FIG. **2** is transmitted, a given EOFS valve receives the transmission of said message from a particular transferring apparatus and transfers information to a particular receiving apparatus. Said valve is adapted and preprogrammed to process eight-bit bytes as signal words. The information at the EOFS Standard Word Location of said valve is the EOFS WORD of the preferred embodiment: "11111111". The EOFS Standard Length Location and EOFS WORD Counter of said valve each hold one byte of binary information. The binary information at said EOFS Standard Length Location is "00001011", a binary number whose decimal equivalent is eleven. The binary information at said EOFS WORD Counter is "00000000", a binary number whose decimal value is zero.

Receiving the first byte of said message causes said valve to place information of said byte at said EOFS Word Evaluation Location and to compare the information at said Location, "10010100", to the EOFS WORD information at said EOFS Standard Word Location, "11111111". No match results which causes said valve automatically to set the information of said EOFS WORD Flag to "1". Automatically said valve determines the value of said information at said Flag is "1" which causes said valve to execute said transfer-all-word-information instructions. Automatically said valve compares the information at said EOFS WORD Counter, zero, to said zero information that is among the preprogrammed information of said valve. (The binary value of each instance of zero information is "00000000".) A match results which causes said valve automatically to set the information of said EOFS Empty Flag to "0". Automatically said valve determines that the value of said information at said EOFS Empty Flag is "0" and skips executing said transfer-counted-information instructions. Automatically said valve continues executing conventional ones of said transfer-all-word-information instructions; transfers information of said first byte at said EOFS word evaluation location—which information is "10010100"—to said receiving apparatus; completes said word evaluation sequence, in respect to said first byte; and transfers handshake information to said transferring apparatus that informs said apparatus that said valve is ready to receive next signal word information.

Receiving said handshake information causes said transferring apparatus to transfer the next byte of said message to said valve.

Receiving said next byte, which is the second byte, causes said valve to place information of said byte at said EOFS Word Evaluation Location and to compare the information at said Location, "11001000", to the EOFS WORD information at said EOFS Standard Word Location, "11111111". No match results which causes said valve to set the information of said EOFS WORD Flag to "1". Automatically said valve determines that the information at said Flag is "1" which causes said valve to execute said transfer-all-word-information instructions. Automatically said valve compares the information at said EOFS WORD Counter, zero, to said zero information that is among the preprogrammed information of said valve. A match results which causes said valve to set the information of said EOFS Empty Flag to "0". Automatically said valve determines that the information at said EOFS Empty Flag is "0". Automatically said valve continues executing conventional transfer-all-word-information instructions; transfers information of said second byte at said EOFS word evaluation location—which information is "11001000"—to said receiving apparatus; completes said word evaluation sequence, in respect to said second byte; and informs said transferring apparatus that said valve is ready to receive next signal word information which causes said apparatus to transfer to said valve the next byte of said message.

Receiving said next byte, which is the third byte, causes said valve to place information of said byte at said EOFS Word Evaluation Location and to compare the information at said Location, "11111111", to the EOFS WORD at said EOFS Standard Word Location, "11111111". A match results, causing said valve to set the information of said EOFS WORD Flag to "0". Automatically said valve determines that the information at said Flag is "0" which causes said valve to execute said process-EOFS-WORD instructions. Automatically, in a fashion well known in the art, said valve increases the value of the information at said EOFS WORD Counter by an increment of one from "00000000" to "00000001". Automatically said valve compares the information at said EOFS WORD Counter, "00000001", to the information at said EOFS Standard Length Location, "00001011". No match results which causes said valve automatically to set the information of said EOFS Complete Flag to "1". Automatically said valve determines that the value of said information at said EOFS Complete Flag is "1" which causes said valve automatically to complete said word evaluation sequence, in respect to said third byte, without transferring any information of said byte to said receiving apparatus. Automatically said valve then informs said transferring apparatus that said valve is ready to receive next signal word information which causes said apparatus to transfer to said valve the next byte of said message.

Receiving said next byte, which is the fourth byte, causes said valve to place information of said byte at said EOFS Word Evaluation Location, which information is "11111111". In so placing said information at said Location, said valve automatically overwrites and obliterates the information of the third byte that had been at said Location. Automatically said valve then compares the information at said Location, "11111111", to the EOFS WORD information at said EOFS Standard Word Location, "11111111". A match results, causing said valve to set the information of said EOFS WORD Flag to "0". Automatically said valve determines that the information at said Flag is "0", which causes said valve to increase the value of the information at said EOFS WORD Counter from "00000001" to "00000010", a binary number whose decimal equivalent is two. Automatically said valve compares said "00000010" to the information at said EOFS Standard Length Location, "00001011". No match results which causes said valve to set the information of said EOFS Complete Flag to "1". Automatically said valve determines that the value of said information at said EOFS Complete Flag is "1" which causes said valve to complete said word evaluation sequence, in respect to said fourth byte, without transferring any information of said byte to said receiving apparatus. Automatically said valve then informs said transferring apparatus that said valve is ready to receive next signal word information which causes said apparatus to transfer to said valve the next byte of said message.

Receiving said next byte, which is the fifth and last byte, causes said valve to place information of said byte at said EOFS Word Evaluation Location, which information is "00000000". In so placing said information at said Location, said valve automatically overwrites and obliterates the information of the fourth byte at said Location. Automatically said valve then compares the information at said Location, "00000000", to the EOFS WORD information at said EOFS Standard Word Location, "11111111". No match results which causes said valve to set the information of said EOFS WORD Flag to "1". Automatically said valve determines that the information at said Flag is "1" which causes said valve to execute said transfer-all-word-information instructions. Automatically said valve compares the information at said EOFS WORD Counter, "00000010", to said zero information, "00000000", that is among the preprogrammed information of said valve. No match results which causes said valve to set the information of said EOFS Empty Flag to "1". Automatically said valve determines that the information at said EOFS Empty Flag is "1" which causes said valve to execute said transfer-counted-information instructions. Said instructions cause said valve automatically to transfer one instance of said EOFS WORD information at said EOFS Standard Word Location, "11111111", to said receiving apparatus then decrease the value of the information at said EOFS WORD Counter by a decrement of one—that is, from "00000010" to "00000001"—then compare the information at said EOFS WORD Counter to said zero information, "00000000". Because no match occurs, said valve automatically transfers one more instance of said EOFS WORD information, "11111111", to said receiving apparatus then decreases the value of the information at said EOFS WORD Counter by an additional decrement of one—that is, from "00000001" to "00000000"—then compares said information to said zero information, "00000000". A match occurs. In a fashion well known in the art, the fact of said match causes said valve automatically to continue executing transfer-all-word-information instructions. Automatically said valve transfers information of said fifth byte at said EOFS word evaluation location—which information is "00000000"—to said receiving apparatus; completes said word evaluation sequence, in respect to said fifth and last byte of the message of FIG. **2**K; and informs said transferring apparatus that said valve is ready to receive next signal word information which causes said apparatus to transfer to said valve the next byte of said message as soon as said apparatus receives and is prepared to transfer said byte.

The example of FIG. **2**K illustrates how receiving each signal word causes an EOFS valve to evaluate the information content of said word; to transfer words that are not EOFS WORDs; to retain count information of words that are EOFS WORDs so long as said words occur in uninterrupted sequences of EOFS WORDs which sequences are shorter than the number of EOFS WORDs in an instance of end of file signal information; and when receiving any given signal word that is not an EOFS WORD interrupts such a sequence, to transfer information of each retained EOFS WORD before transferring information of said given signal word. The example of FIG. **2**K does not illustrate the detecting of an end of file signal; however, an example of such detecting is provided below.

In this specification, MOVE bits are called "MOVE" bits because MOVE bit information in any given signal word causes each EOFS valve that processes the information of said word to "move"—that is, to transfer—information of said word to receiving apparatus external to said valve during the word evaluation sequence of said word rather than retaining said information.

Reasons should now be clear why padding bits are always MOVE bits and why, in a SPAM message, a full signal word of padding bits follows a signal word that is the last signal word in which command information occurs and that contains no MOVE bits. The command of FIG. **2**K is such a command, and the fourth byte is such a word. In its automatic fashion for identifying end of file signals, no EOFS valve that receives said fourth byte transfers said byte until it receives a subsequent signal word that contains a MOVE bit. In the present invention there is no assurance that every EOFS valve immediately receives a next signal word as soon as it completes the word evaluation sequence, in respect to any given signal word. Thus to ensure that all apparatus to which messages are addressed process message information in the fastest possible fashion, all messages that do not end with end of file signals do end with signal words that contain at least one MOVE bit.

One final rule of message composition remains. In order to define end of file signals precisely, a signal word that contains at least one MOVE bit is always transmitted immediately before the uninterrupted sequence of EOFS WORDS of any given end of file signal. Were a given signal word that contained no MOVE bits to be transmitted immediately before the uninterrupted sequence of a given end of file signal, said word would contain only EOFS bits and would be an EOFS WORD. Any EOFS valve processing said word and said signal would process said word as one of the EOFS WORDs of said uninterrupted sequence. Said valve would count said word erroneously as part of said sequence rather than as part of the information preceding said sequence and would count at least the last EOFS WORD of said sequence erroneously as part of the message following said signal rather than as part of said signal. In order to avoid such erroneous processing, any given instance of the uninterrupted sequence of EOFS WORDS of an end of file signal is preceded by signal word that is not an EOFS WORD.

This final rule may be satisfied in a number of different ways. For example, end of file signals could include the signal word preceding said uninterrupted sequence. Rather than being an uninterrupted sequence of eleven EOFS WORDs, an end of file signal could be twelve words long with the first word containing MOVE bit information. And subscriber station apparatus could be adapted and preprogrammed for detecting such signals.

As related above, in the preferred embodiment, end of file signals are composed just of the uninterrupted sequence of EOFS WORDs described above, and the signal words that precede said sequences are part of the last segment information preceding said signals. To prevent erroneous processing while satisfying the final rule of message composition, in any given pre-transmission evaluation of an instance of SPAM message information, if the EOFS valve of said evaluation retains information the last signal word of said information in the course of the word evaluation sequence of said word rather than transferring information of said word, the binary information of said instance is rewritten, in a fashion well known in the art that may be manual, before being embedded and transmitted. Said binary information is rewritten to end with a final signal word that contains MOVE bit information and still cause substantively the same information processing at subscriber stations.

In this fashion, the signal information of any given end of file signal is distinctive, and EOFS detectors detect end of file signals precisely.

Despite the fact that the use of end of file signals involves time consuming processing, the preferred embodiment's system for distinguishing individual messages from one another in message streams has significant advantages over alternate techniques.

By comparison with systems that process fixed length and/or fixed format messages, the use of end of file signals permits great flexibility. Messages can be of any length and can contain any information that digital receiver station apparatus can process.

By comparison with systems that distinguish messages from one another by means of distinctive signals that separate the end of each message from the beginning of the next, end of file signals are used in the preferred embodiment only with some messages. Many messages, such as the second and third messages of the message stream of FIG. **2**I, do not require end of file signals. Furthermore, as will become more apparent in the course of this specification, messages that consist of commands alone often have higher priority for processing speed than do the messages that contain last segment information. Since only messages that contain last segment information require end of file signals, end of file signals are often transmitted and processed at times when speed of processing is of relative unimportance.

Finally, because long cadence signals are processed at ends of messages rather than at beginnings, the preferred embodiment reduces the relative importance of the processing speed associated with such signals even further. In the preferred embodiment, subscriber station apparatus have capacity for commencing to process received command and information segment information before receiving the end of file signal associated with said information. The commencement of processing of the command and information segment information of any given message need never be delayed until after an end of file signal, associated with said message, is detected.

The preferred embodiment has the advantage of requiring that long cadence signals that require time consuming processing be transmitted only with some messages and then only at times when processing speed is of relatively low priority. In so doing, the preferred embodiment makes it possible to transmit in the shortest, simplest formats messages that have high priority for processing speed and to process said messages the fastest fashion.

The Normal Transmission Location

SPAM signals are generated at original transmission stations or intermediate transmission stations and embedded in television or radio or other programming transmissions by conventional generating and embedding means, well known in the art. Said signals may be embedded in transmissions at said stations immediately prior to transmitting said transmissions via conventional broadcast or cablecast means, well known in the art. Alternatively, said signals may be embedded in transmissions that are then recorded, in a fashion well known in the art, on an appropriate conventional video, audio or other record media. Playing back said media on appropriate player apparatus will cause said apparatus to retransmit said transmissions with said SPAM signals embedded precisely as they were embedded when said transmissions were recorded.

SPAM signals can be embedded in many different locations in electronic transmissions. In television, SPAM signals can be embedded in the video portion or in the audio portion of the transmission. In the video portion, SPAM signals can be embedded in each frame on one line 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. SPAM signals can be embedded in radio audio transmissions. In the audio of television and radio transmissions, SPAM signals will probably be embedded 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, SPAM signals can accompany conventional print or data programming in the conventional transmission stream.

In television, the normal transmission location of the preferred embodiment is in the vertical interval of each frame of the television video transmission. Said location begins at the first detectable part of line **20** of the vertical interval and continues to the last detectable part of the last line of the vertical interval that is not visible on a normally tuned television set.

In radio, the preferred normal transmission location is in the audio above the range of the radio transmission that is normally audible to the human ear.

In broadcast print or data communications, the preferred normal transmission location for SPAM signals is in the same location as the conventional information. More precisely, conventional print of data information is transmitted in SPAM transmissions. Any given instance of conventional print or data information is transmitted in a SPAM information segment that is preceded by a "01" header SPAM command or a "11" header, which command or header addresses conventional print or data processing apparatus at subscriber stations and causes said apparatus to process said conventional information in the conventional fashion. In said transmissions, other SPAM commands and information address and control subscriber station apparatus in other SPAM functioning.

(Hereinafter, the preferred normal location for transmitting signals in any given communication medium is called, the "normal transmission location".)

In the preferred embodiment, while receiver station decoder apparatus may be controlled, in fashions described below, to detect information segment information outside the normal transmission locations, SPAM commands and cadence information are always transmitted in normal transmission locations. In the present invention, the object of many decoders is to detect only command information such as meter-monitor segment information. Having one unchanging location for the transmission of command information in any given television, radio; broadcast print, or data transmission permits decoder apparatus to search just one unchanging portion of said transmission to detect commands. Having the same fixed location for cadence information enables said decoder apparatus to distinguish all command information in said transmission.

Operating Signal Processor Systems . . . Introduction

Five examples illustrate methods of operating signal processing system apparatus. Each focuses on subscriber stations where the signal processor system of FIG. **2**D and the combined medium apparatus of FIG. **1** share apparatus and operate in common.

FIG. **3** shows one such subscriber station. In FIG. **3**, the decoder, **203**, of FIG. **1** is also an external decoder of the signal processor system of signal processor, **200**. Like decoders, **27**, **28**, and **29**, in FIG. **2**D, decoder, **203**, has capacity for transferring SPAM information to buffer/comparator, **8**, of signal processor, **200**, and to buffer/comparator, **14**. In addition, signal processor, **200**, has capacity for transferring SPAM signals from a particular jack port of controller, **12**, to microcomputer, **205**.

FIG. 3 also shows SPAM-controller, **205**C, to which signals that are addressed to URS microcomputers, **205**, are transferred from decoder, **203**, and from signal processor, **200**. SPAM-controller, **205**C, is a control unit like controller, **39**, of decoder, **203**, with buffer capacity for receiving multiple inputs; RAM and ROM for holding operating instructions and other information; EOFS valve capacity for detecting end of file signals and regulating the flow of SPAM signals; microprocessor capacity for processing; capacity for transferring information to and receiving information from the central processor unit (hereinafter, "CPU") of microcomputer, **205**; and capacity for transferring information to one or more input buffers of microcomputer, **205**. SPAM-controller, **205**C, operates independently of said CPU although said CPU has capacity to interrupt SPAM-controller, **205**C, in an interrupt fashion well known in the art. SPAM-controller, **205**C, also has capacity to control directly to the aforementioned PC-MicroKey 1300 System without affecting the operation of said CPU.

All five examples describe signal processing, variations that relate to the FIG. **1**C combining of "One Combined Medium."

The first focuses on the basic operation, in "One Combined Medium," of decoder, **203**; SPAM-controller, **205**C; and microcomputer, **205**. No signals require decryption. No meter information is collected. No monitor information is processed. Combined information is displayed at each subscriber station.

In the second example, the combining of FIG. **1**C occurs only at selected subscriber stations. The second combining synch command is partially encrypted, and said stations are preprogrammed with particular information that is necessary to decrypt said command. At said stations, said command causes its own decryption and the combining of FIG. **1**C. In addition, said command causes signal processor apparatus at said stations to retain meter information that a remote billing agency can use as a basis for charging the subscribers of said stations for displaying the combined information of said combining. At all other stations, no information is decrypted, no combining occurs, and no meter information is collected.

In the third example, combined information is displayed at each subscriber station just as in the first example. In addition, monitor information is processed at selected stations for one or more so-called "ratings" agencies (such as the A. C. Nielsen Company) that collect statistics on viewership and programming usage.

The fourth example provides a second illustration of restricting the combining of FIG. **1**C to selected subscriber stations through the use of encryption/decryption techniques and metering. In addition, the fourth example shows how monitor information is collected at selected ones of said selected stations.

The fifth example adds program unit identification signals identified at decoders, **30** and **40**, of signal processor, **200**.

In the last three examples, the first combining synch command causes selected subscriber stations to transfer recorded meter information and monitor information to one or more remote computer stations of said billing agencies and ratings agencies and causes computers at said remote agencies to receive and process said transferred information.

Each example focuses on the processing of the three signal messages of the FIG. **1**C combining. The information of said messages include three combining synch commands and one program instruction set.

The first message is of the information associated with the first combining synch command. Said first command has a "01" header, an execution segment, and a meter-monitor segment of six fields. Said command is followed by an information segment that contains said program instruction set, and said information segment is followed by an end of file signal. Said first command addresses URS microcomputers, **205**, and causes said computers, **205**, to load and run the program instruction set transmitted in the information segment. Each meter-monitor segment field of said command contains information that identifies one of the following:

- the origin of said "Wall Street Week" transmission,
- the subject matter of said "Wall Street Week" program,
- the program unit of said program,
- the day of said transmission within a particular one hundred year period,
- the supplier of the program instruction set in the information segment following said first combining synch command, and
- the format of said meter-monitor segment information.

(Hereinafter, meter-monitor information that identifies the program unit of a given program may also be called the "program unit identification code".)

The second message is of the information associated with the second combining synch command. Said second command has a "00" header, an execution segment, and a meter-monitor segment of five fields and addresses URS microcomputers, **205**. Said second command causes said computers, **205**, to combine the FIG. **1**A information of each microcomputer, **205**, with the information of FIG. **1**B and transmit the combined information to monitors, **202**M. Each meter-monitor segment field of the second command contains information of one of the following:

- the subject matter of said "Wall Street Week" program,
- the program unit of said program,
- the unique code of said overlay given said program unit information,
- the minute of said transmission within a particular one month period, and
- the format of said meter-monitor segment information.

The third message is of the information associated with the third combining synch command. Said third command has only a "10" header and an execution segment and addresses URS microcomputers, **205**. Said command causes said computers, **205**, to cease combining and transmit only the received composite video transmission to monitors, **202**M, and to continue processing in a predetermined fashion (which fashion may be determined by the aforementioned program instruction set).

In those examples that focus on encrypted commands, the meter-monitor segments of each encrypted command includes an additional meter-monitor field:

- meter instructions.

In said examples, the meter-monitor format field information of said commands reflects the presence of said additional field.

As described above, said signals are of binary information with error correcting bit information and are embedded, transmitted, and received in the normal transmission pattern of the "Wall Street Week" television transmission.

All subscriber station apparatus are fully preprogrammed to perform automatically each step of each example. No manual step is required at any station.

In each example, the apparatus of FIG. **3** are preprogrammed to detect embedded signal information, to transfer said information to addressed apparatus, and, to operate under control of said information. Apparatus of decoder, **203**, are preprogrammed to detect signal information embedded in the normal transmission pattern and to correct, convert, and transfer said information to its addressed apparatus. Apparatus of signal processor, **200**, are preprogrammed to decrypt information upon instruction and to transfer information to its addressed apparatus. For one or more remote services that meter and charge subscribers for the use of information or that audit such remote metering services, apparatus of signal processor, **200**, are preprogrammed to select, process, and record meter information and to transfer recorded meter information to one or more remote station computers.

In each example, the EOFS valves located at controller, **39**, of decoder, **203**; at buffer/comparator, **8**, of signal processor, **200**; and at SPAM-controller, **205**C, are preprogrammed to detect end of file signals that consist of eleven sequentially transmitted EOFS WORDs. Thus the binary information of eleven—"00001011"—is at the EOFS Standard Length Location of each of said EOFS valves.

In the third, fourth, and fifth examples, appropriate apparatus of FIG. **3** are also preprogrammed to assemble, record, and transmit to one or more remote locations monitor information for one or more services that sample selected subscriber stations (said stations being preprogrammed for this purpose) to collect statistical data on programming and information usage and/or to audit selectively the customer accounting of remote meter services.

In each example, receiving SPAM signal information at each apparatus of FIG. **3** causes subscriber station apparatus automatically to process said information in the preprogrammed fashions of said apparatus.

At the outset of each example, particular meter record information of prior programming exists at a particular location at buffer/comparator, **14**, of signal processor, **200**. Said record information documents the fact that before receiving the "Wall Street Week" program, tuner, **215**, transmitted to monitor, **202**M, particular programming that contained contained embedded SPAM commands and information with particular meter instructions. Information of said commands and information caused buffer/comparator, **14**, to retain said meter record information. In the third and subsequent examples, monitor record information of said prior programming also exists at a particular location at said buffer/comparator, **14**, associated with the source mark of decoder, **203**.

In each example, the recorder, **16**, of signal processor, **200**, has reached a level of fullness where the recording of the next signal record received from the buffer/comparator, **14**, of signal processor, **200**, will cause the quantity of signal records recorded at recorder, **16**, to equal or exceed the particular fullness information of said recorder, **16**. Whenever said quantity equals or exceeds said fullness information, recorder, **16**, is preprogrammed to commences a particular telephone signal record transfer sequence that is fully automatic for which recorder, **16**; controller, **20**; auto dialer, **24**; and telephone connection, **22**, are each preprogrammed. Under control of the preprogrammed instructions of said sequence, signal processor, **200**, telephones one or more remote billing station computers and/or one or more remote monitor information collection station computers and transfers selected record information to said computers.

In each example, all receiver station apparatus is on and fully operational.

Operating Signal Processor Systems

Example #1

The first example elaborates on the FIG. **1**C combining described above in "One Combined Medium" and focuses on the operation of decoder, **203**, SPAM-controller, **205**C, and microcomputer, **205**, on the execution of controlled functions, and on the use of cadence information to organize signal processing. The example begins as divider, **4**, starts to transfer to decoder, **203**, in its outputted composite video transmission, the embedded binary information of the first message. At the outset of example #1, controller, **39**, of decoder, **203**, and SPAM-controller, **205**C, have each identified an end of file signal and await header information. Receiving said embedded binary information at decoder, **203**, (which does not include a filter, **31**, or a demodulator, **32**, because its input is a composite video transmission) causes line receiver, **33**, automatically to detect and transfer said embedded information to digital detector, **34**, which automatically detects the binary information with correcting information in said embedded information and transfers said binary information with correcting information to controller, **39**. Using forward error correction techniques, well known in the art, and employing particular correcting information, controller, **39**, automatically checks said information, as it is received, and corrects it as necessary then discards said particular correcting information retaining only the corrected information. Using conversion protocol techniques, well known in the art, controller, **39**, then automatically converts said corrected information into binary information that receiver station apparatus can receive and process. In this fashion, the binary information of the first message—more precisely, the first combining synch command and its associated program instruction set and end of file signal—are received and converted at decoder, **203**.

Once the information of any given point-to-multipoint SPAM transmission has been checked, corrected, and converted in the foregoing fashion, subscriber station apparatus communicate said information point-to-point using flow control and error correction techniques, well known in the art, that include handshaking and requesting retransmission. Thereafter, any given transmission of SPAM information, so corrected and converted, contains not only bits of communicated SPAM information but also so-called "parity bits" that convey error correcting information. At present, the conventional practice is for every ninth bit to be a parity bit that is used, in a fashion well known in the art, to check the correctness of the preceding eight bits, or "byte," of communicated data.

Frequently in this disclosure, specific quantities of bits and bit locations are cited. Said bits are often specified as being "sequential" and "in their order after conversion," and said bit locations are often "contiguous." Unless otherwise stated, said quantities refer only to bits of communicated SPAM information and bit locations that hold communicated SPAM information. No attempt is made to account for the presence of parity bits among transmitted bits of SPAM information or at particular memory locations because techniques for distinguishing bits of communicated data from parity bits and for processing bits of communicated information separately from parity bits are well known in the art.

Automatically, after said binary information is converted, said information is inputted to the EOFS valve of controller, **39**, which processes said information in the fashion described above, comparing each signal word of said information to EOFS WORD information and transferring said binary information, signal word by signal word, until an end of file signal is detected.

Receiving the header and execution segment of said first message causes controller, **39**, to determine that said message is addressed to URS microcomputers, **205**, and to transfer said message to microcomputer, **205**. So transferring said message is the controlled function that the information said header and execution segment cause controller, **39**, to perform. Automatically, as said EOFS valve transfers converted binary information of said first message, controller, **39**, selects and records at particular SPAM-header register memory a particular preprogrammed constant number of the first converted bits of said binary information. Said constant number is the number of bits in a SPAM command header. (Hereinafter, said constant number is called "H".) From the first bit of said binary information, H bits are selected and recorded, in their order after conversion, at said SPAM-header memory. Then, automatically, controller, **39**, determines that said information at SPAM-header memory (which is the "01" header of the first combining synch command and designates a SPAM command that is followed by an information segment) does not match particular 11-header-invoking information that is "11". (In other words, the header of said message does not designate a SPAM message that consists of a header followed immediately by an information segment.) Not resulting in a match causes controller, **39**, automatically to select a second preprogrammed constant number of next bits and record said bits, in their order after conversion, at particular SPAM-exec register memory. Said second constant number is the particular number of bits in a SPAM execution segment. (Hereinafter, said second constant number is called "X".) Beginning with the next bit of said binary information immediately after said H bits, controller, **39**, selects X bits and records said bits, in their order after conversion, at said SPAM-exec memory. Then, automatically, by comparing the information at said SPAM-exec memory (which information is the execution segment of the first combining synch command) with preprogrammed controlled-function-invoking information, controller, **39**, determines that said information at memory matches particular this-message-addressed-to-205 information that causes controller, **39**, to execute particular preprogrammed transfer-to-205 instructions. Said instructions cause controller, **39**, to transfer to SPAM-controller, **205**C, the SPAM message associated with the particular information at SPAM-header memory. Automatically, said instructions cause controller, **39**, to activate the output port that outputs to SPAM-controller, **205**C, then compare said information at SPAM-header memory to preprogrammed header-identification information. Automatically, controller, **39**, determines that said information matches particular "01" information. Said match causes controller, **39**, automatically to execute particular transfer-a-01-or-an-11-header-message instructions.

A "01" header distinguishes a message that contains lowest priority information. Any given instance of a message with a "01" header ends with an end of file signal. Accordingly, said instructions cause controller, **39**, to transfer, from the start of said message, all information received from said valve until said valve detects and transfers the information of an end of file signal. Automatically controller, **39**, commences transferring said binary information, starting with said first H bits and transferring said information in its order after conversion, signal word by signal word, as said binary information is outputted by said EOFS valve. In due course, the EOFS valve of controller, **39**, receives the last signal word of the information segment of said first message. To satisfy the final rule of message composition cited above, said word, being an instance of a final signal word preceding an end of file signal, contains MOVE bit information and is not an EOFS WORD. Said valve transfers said word which causes controller, **39**, to transfer said word to SPAM-controller, **205**C. (When said valve receives information of the next signal word after said word, the information of the EOFS WORD Counter of said valve is "00000000" because said word contained MOVE bit information.)

Immediately after embedding and transmitting said last IP word, the aforementioned program originating studio that is the original transmission station of the programming of "One Combined Medium" generates and embeds an end of file signal in said programming and transmits said signal. More precisely, said studio generates, embeds, and transmits eleven consecutive EOFS WORDs of binary information.

Receiving said first EOFS WORD causes said valve to place information of said WORD at the EOFS Word Evaluation Location of said valve and to compare the information at said Location to the EOFS WORD at the EOFS Standard Word Location of said valve. A match results, causing said valve, in the fashion described above, to increase the value of the information at said EOFS WORD Counter by an increment of one from "00000000" to "00000001". Automatically said valve determines, in the fashion described above, that the "00000001" at said EOFS WORD Counter does not match the "00001011" at said EOFS Standard Length Location which causes said valve to cause the apparatus that inputs signal words to said valve to transfer to said valve the next signal word of said message.

In this fashion, said valve processes sequentially the inputted information of each of the next ten EOFS WORDs, each time increasing the value of the information at said EOFS WORD Counter by an increment of one. When, in the course of the word evaluation sequence of the eleventh and last EOFS WORD, said valve so increases said value, the information at said Counter is "00001011". Automatically said valve determines that said "00001011" matches the "00001011" at said EOFS Standard Length Location which causes said valve to execute the complete-signal-detected instructions described above in "Detecting End of File Signals." Said instructions cause said valve to initiate the transmission of the aforementioned EOFS-signal-detected information to the CPU of controller, **39**, as an interrupt signal then to wait for a control instruction from controller, **39**, before processing inputted information further.

Receiving said EOFS-signal-detected information at said CPU causes controller, **39**, to determine, in a predetermined fashion, that said end of file signal is part of a SPAM message being transferred under control of instructions invoked by transfer-to-addressed-apparatus information. Said determining causes controller, **39**, automatically to transmit the aforementioned transmit-and-wait instruction to said valve which causes said valve to transfer one complete end of file signal (which signal is automatically transferred by controller, **39**, to SPAM-controller, **205**C). Automatically, said valve outputs, sequentially, the binary information of eleven instances of an EOFS WORD; then sets the information at said EOFS WORD Counter to "00000000"; initiates transmission of the aforementioned complete-and-waiting information to the CPU of controller, **39**, as an interrupt signal; and commences waiting for a control instruction from controller, **39**, before processing next inputted information. In so doing, controller, **39**, transfers an end of file signal as a part of said first message and ensures that apparatus to which said message is transferred receive all cadence information necessary to process said message.

Having transferred the binary information of said first message, controller, **39**, prepares all apparatus of decoder, **203**, as required, to receive the next instance of SPAM message information. Automatically, controller, **39**, deactivates all output ports; compares the information at said SPAM-header register memory to particular preprogrammed cause-retention-of-exec information that is "01" and determines a match which causes controller, **39**, to transfer information of said information at SPAM-exec register memory to particular SPAM-last-01-header-exec register memory (thereby placing information of the execution segment of the first combining synch command at said SPAM-last-01-header-exec memory); then causes all apparatus of decoder, **203**, to delete from memory all information of said binary information except information at said SPAM-last-00-header-exec memory. Then, after receiving said complete-and-waiting information, controller, **39**, transmits particular reopen-flow instructions that cause said EOFS valve to recommence processing and transferring inputted signal words in its preprogrammed fashion, and controller, **39**, commences waiting to receive from said valve the binary information of a subsequent SPAM header.

(If said information at SPAM-exec memory had failed to match any controlled-function-invoking information at the aforementioned comparing, said failure to match would have signified that the subscriber station of FIG. **3** did not have capacity to execute the controlled function of said command. Whenever comparing execution segment information of any given command to preprogrammed controlled-function-invoking information at any given subscriber station SPAM apparatus results in a failure to match, said failure to match causes said apparatus to discard all received information of the message of said execution segment. In the case of a "01" header message such as said first message, said apparatus discards all received information, except information at register memory, until the EOFS valve of said apparatus, operating in the aforementioned fashion, transfers said EOFS-signal-detected information to the CPU of said apparatus. Said apparatus discards said information, in a fashion described more fully below, by placing each successively received signal word at a particular memory location, and in so doing, overwriting and obliterating the information of the prior signal word. Then receiving said EOFS-signal-detected information causes said apparatus to transmit the aforementioned discard-and-wait instruction to said valve causing said valve, in its preprogrammed discard-and-wait fashion, to discard all information of the end of file signal of said message, set the information of the EOFS WORD Counter of said valve to "00000000", then transmit said complete-and-waiting information to said apparatus. Said complete-and-waiting information causes said apparatus to perform all functions performed by controller, **39**, in the foregoing paragraph.)

At SPAM-controller, **205**C, of the subscriber station of FIG. **3** (and at SPAM-controllers, **205**C, of URS microcomputers, **205**, at other subscriber stations), receiving said transferred binary information of the first message causes all apparatus automatically to process the information of said message in the preprogrammed fashions of said apparatus.

Automatically the EOFS valve of SPAM-controller, **205**C, commences processing and transferring said information until an end of file signal is detected.

Receiving the header and execution segment of said first message causes SPAM-controller, **205**C, to determine the controlled function or functions that said message instructs URS microcomputers, **205**, to perform and to execute the instructions of said functions. Automatically, as said valve transfers information, SPAM-controller, **205**C, selects the first H converted bits of said information and records said bits at particular SPAM-header-@205 register memory, then determines that said information at SPAM-header-@205 memory (which is the "01" header of the first message) does not match particular 11-header-invoking-@205 information that is "11". Not resulting in a match causes controller, **39**, automatically to select the next X bits of said transferred binary information and record said bits at particular SPAM-exec-@205 register memory. Automatically SPAM-controller, **205**C, compares the information at said SPAM-exec-@205 memory (which information is the execution segment of the first combining synch command) with preprogrammed controlled-function-invoking-@205 information. Said comparing results in a match with particular execute-at-205 information that causes SPAM-controller, **205**C, to invoke particular preprogrammed load-run-and-code instructions that control the loading of particular binary information at the main RAM of microcomputer, **205**; the running of the information so loaded; and the placing of particular identification code information at particular SPAM-controller memory. Said binary information that is loaded and run is the information that begins at the first bit of the information segment that follows said X bits, continues through the last bit of said segment, and is, in the "One Combined Medium" application, the information of said program instruction set. Automatically, SPAM-controller, **205**C, executes said load-run-and-code instructions.



(No change takes place between controller, **39**, and SPAM-controller, **205**C, in the information of the execution segment of the first combining synch command. Thus the binary image of the particular controlled-function-invoking information that said information matches at controller, **39**—more precisely, the aforementioned particular this-message-addressed-to-205 information—is identical to the binary image of the particular controlled-function-invoking-@205 information that said information matches at SPAM-controller, **205**C—said particular execute-at-205 information. While said this-message-addressed-to-205 information and said execute-at-205 information are identical in image, they bear different names in this specification because they invoke different controlled functions. This is but one of many instances in this specification where a given SPAM command invokes different controlled functions at different apparatus because the apparatus are preprogrammed differently.)

To load and run said information, SPAM-controller, **205**C, must locate the position, in said transferred binary information, of said first bit and said last bit. Under control of said load-run-and-code instructions, SPAM-controller, **205**C, compares the information at said SPAM-header-@205 memory with particular preprogrammed header-identification-@205 information and determines that said information at memory matches particular "01" information. In other words, to locate said first bit, SPAM-controller, **205**C, must process the command information of an "01" header message including the length token of a meter-monitor segment.

Under control of said load-run-and-code instructions, said match causes SPAM-controller, **205**C, automatically to execute particular preprogrammed process-length-token-@205 instructions. Automatically, said instructions cause SPAM-controller, **205**C, to select a third preprogrammed constant number of next bits and record said bits at particular memory. Said third constant number is the particular number of bits in an instance of SPAM meter-monitor format field length token information. (Hereinafter, said third constant number is called "L".) Beginning with the bit of said transferred binary information immediately after the last of said X bits, SPAM-controller, **205**C, selects L bits and records said bits, in their order after conversion, at particular SPAM-length-info-@205 register memory. Automatically SPAM-controller, **205**C, compares the information at said SPAM-length-info-@205 memory with preprogrammed token-comparison-@205 information and determines that said information at memory matches particular token-comparison-@205 information (which particular information is called, hereinafter, "W-token information"). Said match causes SPAM-controller, **205**C, to place particular preprogrammed bit-length-number information at said SPAM-length-info-@205 memory. (Said particular bit-length-number information is called, hereinafter, "w-bits information".) Said information is the precise number of bits, following the last of said L bits, that remain in the meter-monitor segment of the command associated with said length token. Said number is not a preprogrammed constant value such as H, X, and L that is the same for every SPAM command with a meter-monitor segment. Rather, said number is a variable that may differ from one SPAM meter-monitor segment to the next. More precisely, it is, for any given meter-monitor segment, a selected one of several preprogrammed bit-length-number information alternatives. (Hereinafter, the number of the particular selected bit-length-number alternative associated with any given length token is called "MMS-L" to signify that said number is L bits less than the number bits in the meter-monitor segment in which said length token occurs.)

Having executed said process-length-token-@205 instructions and continuing under control of said load-run-and-code instructions, automatically SPAM-controller, **205**C, adds L to the information (of MMS-L) at said SPAM-length-info-@205 memory and, in so doing, determines the exact number of bits in the meter-monitor segment of said command (which is also the exact number of bits from the first bit after the last of said X bits to the last bit of said command). (Hereinafter, the exact number of bits in any given meter-monitor segment is called, "MMS".) Then SPAM-controller, **205**C, causes information of the first MMS bits of said transferred binary information that begin immediately after the last of said X bits to be stored at particular MMS-memory of SPAM-controller, **205**C. In so doing, SPAM-controller, **205**C, retains information of the meter-monitor segment of said first message. Then, automatically, SPAM-controller, **205**C, executes particular preprogrammed instructions, including assess-padding-bit-@205 instructions, that are described more fully elsewhere in this specification and that cause said SPAM-controller, **205**C, to identify the particular signal word, associated with the command information of said first message, that is the last signal word before the first signal word of the information segment of said message.

Then SPAM-controller, **205**C, commences loading information at the main RAM of microcomputer, **205**. Automatically, under control of said load-run-and-code instructions, SPAM-controller, **205**C, instructs microcomputer, **205**, to commence receiving information from SPAM-controller, **205**C, and loading said information at particular main RAM, in a fashion well known in the art. Automatically SPAM-controller, **205**C, commences transferring information to microcomputer, **205**, beginning with said selected signal word. Automatically, as microcomputer, **205**, receives said information, microcomputer, **205**, loads said information at particular main RAM.

In due course, the EOFS valve of SPAM-controller, **205**C, receives the aforementioned last signal word of the information segment of said first message, which is the last signal word of said program instruction set, and transfers said word which causes SPAM-controller, **205**C, to transfer said word to microcomputer, **205**, and microcomputer, **205**, to load said word at said RAM. (After transferring said word, the information of the EOFS WORD Counter of said valve is "00000000".)

Then said valve commences receiving information of the eleven EOFS WORDs sequentially outputted by the EOFS valve of controller, **39**, which information constitutes the end of file signal in said transferred binary information. Receiving the first EOFS WORD of said eleven causes the EOFS valve of SPAM-controller, **205**C, to commence retaining information of said WORD in the fashion described above. Said retaining causes SPAM-controller, **205**C, to stop transferring information to microcomputer, **205**, and microcomputer, **205**, to stop loading information at said RAM. As said valve receives all said EOFS WORD information, said valve detects said end of file signal just as the EOFS valve of controller, **39**, detected the end of file signal in the binary information inputted to said valve. When, in the course of the word evaluation sequence of the eleventh and last EOFS WORD in said information, the EOFS valve of SPAM-controller, **205**C, determines that the information at the EOFS WORD Counter of said valve matches the information at the EOFS Standard Length Location of said valve, said valve initiates the transmission of the aforementioned EOFS-signal-detected information to the CPU of SPAM-controller, **205**C, as an interrupt signal and commences waiting for a control instruction from said CPU.

Receiving said EOFS-signal-detected information at said CPU while under control of said load-run-and-code instructions causes SPAM-controller, **205**C, to cease loading and execute the remainder of said load-run-and-code instructions. Automatically SPAM-controller, **205**C, causes microcomputer, **205**, to cease loading information at said RAM and execute the information so loaded as so-called "machine executable code" of one so-called "job." Because information of said end of file signal is no longer needed, said instructions cause SPAM-controller, **205**C, to transmit the aforementioned discard-and-wait instruction to said valve. Said instruction causes said valve to set the information at said EOFS WORD Counter to "00000000" without transferring any information of said detected end of file signal; to initiate transmission of the aforementioned complete-and-waiting information to the CPU of SPAM-controller, **205**C, as an interrupt signal; and to wait for a control instruction from SPAM-controller, **205**C, before processing next inputted information.

Then SPAM-controller, **205**C, commences executing the code portion of said load-run-and-code instructions. The instructions of said portion cause SPAM-controller, **205**C, to compare the information at said SPAM-header memory to particular load-run-and-code-header information that is "01". A match results (which indicates that said first message contains meter-monitor information). Said match causes SPAM-controller, **205**C, to execute particular preprogrammed evaluate-meter-monitor-format instructions and locate-program-unit instructions. Under control of said instructions and in a fashion that is described more fully below, SPAM-controller, **205**C, locates the "program unit identification code" information in the information of the meter-monitor segment stored at said MMS-memory. Then said code portion instructions cause SPAM-controller, **205**C, to place said code information at particular SPAM-first-precondition register memory. In so doing, SPAM-controller completes said load-run-and-code instructions and completes the controlled functions executed by the execution segment information of said first message.

Having completed said controlled functions, automatically SPAM-controller, **205**C, prepares to receive the next instance of SPAM message information. Automatically, SPAM-controller, **205**C, compares the information at said SPAM-header-@205 register memory to particular preprogrammed cause-retention-of-exec-@205 information that is "01" and determines a match which causes SPAM-controller, **205**C, to transfer information of said information at SPAM-exec-@205 register memory to particular SPAM-last-00-header-exec-@205 register memory. Then SPAM-controller, **205**C, causes all apparatus of SPAM-controller, **205**C, to delete from memory all information of said transferred binary information except information at said SPAM-first-precondition and SPAM-last-01-header-exec-@205 memories. Finally, after receiving said complete-and-waiting information, SPAM-controller, **205**C, transmits particular instructions that cause said EOFS valve to commence processing and transferring inputted signal words, in its preprogrammed detecting fashion, and SPAM-controller, **205**C, commences waiting to receive from said valve the binary information of a subsequent SPAM header.

As described in "One Combined Medium" above, loading and running said program instruction set causes microcomputer, **205**, (and URS microcomputers, **205**, at other subscriber stations) to place appropriate FIG. **1**A image information at particular video RAM. In addition, running said set also causes microcomputer, **205**, after completing placing said image information at said RAM, to transfer particular number-of-overlay-completed information and instructions to SPAM-controller, **205**C. Said information and instructions cause SPAM-controller, **205**C, to place the number "00000001" at particular SPAM-second-precondition register memory at SPAM-controller, **205**C, signifying that said image information represents the first overlay of its associated video program.

(Had said information at SPAM-exec-@205 memory failed to match any execute-at-205 information at the aforementioned comparing, SPAM-controller, **205**C, would have discarded discard all received information of the message of said information at SPAM-exec-@205 in the fashion described above.)

## Operating S. P. Systems

### Example #1

### Second Message

Subsequently, the embedded information of the second message, which conveys the second combining synch command, is transferred from divider, **4**, to decoder, **203**.

In the same fashion that applied to the first message, receiving said embedded information causes the apparatus of decoder, **203**, to detect, check, correct as necessary, and convert said information, into binary information of said second message. Automatically the EOFS valve of controller, **39**, processes and transfers said information, signal word by signal word.

As with the first message, receiving the header and execution segment of said second message causes controller, **39**, to determine that said message is addressed to URS microcomputers, **205**, and to transfer said second message accordingly. Automatically, as said valve transfers said binary information, controller, **39**, selects the first H converted bits and records said bits, in their order after conversion, at said SPAM-header register memory. Automatically controller, **39**, determines that the information at said memory (which is the "00" header of the second combining synch command and signifies a SPAM command with a meter-monitor segment but no information segment) does not match said 11-header-invoking information that is "11". Not resulting in a match causes controller, **39**, automatically to select the next X bits of said binary information immediately after said H bits, the execution segment of the second combining synch command, and record said X bits, in their order after conversion, at said SPAM-exec register memory. Then, automatically, by comparing the information at said SPAM-exec memory with said controlled-function-invoking information, controller, **39**, determines that said information at memory matches particular preprogrammed this-message-addressed-to-205 information that invokes said transfer-to-205 instructions. Automatically, controller, **39**, executes said instructions; activates the output port that outputs to SPAM-controller, **205**C; compares said information at SPAM header memory to header-identification information; and determines that said information matches particular "00" information. (In other words, the header of said second message is "00".) Said match causes controller, **39**, automatically to invoke particular preprogrammed transfer-a-00-header-message instructions.

A "00" header distinguishes a message that contains intermediate priority information but no lowest priority information. To identify the length and last bit of a "00" header message, controller, **39**, must process length token information and may need to execute the aforementioned assess-padding-bit instructions to determine whether a full signal word of padding follows the last signal word in which command information occurs.

Automatically, said transfer-a-00-header-message instructions cause controller, **39**, to execute particular preprogrammed process-length-token instructions. Said instructions cause controller, **39**, to select the first L bits of said binary information immediately after the last of said X bits and record said selected bits, in their order after conversion, at particular SPAM-length-info register memory. Said L bits are the bits of the length token of said "00" header message. Automatically controller, **39**, compares the information at said SPAM-length-info memory to preprogrammed token-comparison information and determines that said information at memory matches particular X-token information. (Said X-token information is different token-comparison information from the W-token information matched by the length-token of the first message of example #1.) Said match causes controller, **39**, automatically to select particular preprogrammed x-bits information that is bit-length-number information associated on a one to one basis with said X-token information and to place said x-bits information at said SPAM-length-info memory. The numeric value of said x-bits information is the MMS-L, the precise number of bits, after the last of said L bits, that remain in the meter-monitor segment associated with said L bits.

Then said transfer-a-00-header-message instructions cause controller, **39**, to execute particular preprogrammed determine-command-information-word-length instructions. Said instructions cause controller, **39**, to add a particular preprogrammed constant number that is the sum of H plus X plus L to the x-bits information at said SPAM-length-info memory. (Hereinafter, said constant is called "H+X+L".) In so doing, controller, **39**, determines the number of bits in the command information of said "00" header message. Then controller, **39**, divides the numeric information at said memory by the number of bits in one signal word and stores the quotient of said dividing at said SPAM-length-info memory. By determining said quotient, controller, **39**, determines the number of signal words in said command information. (Said quotient may be an integer or a so-called "floating point number" that is a whole number plus a decimal fraction.)

Having determined said number of signal words, controller, **39**, can determine whether or not the possibility exists that an instance of the aforementioned full signal word of padding bits follows the last signal word of said number of signal words. If said command information fills a whole number of signal words plus a decimal fraction, the last signal word in which command information occurs is not completely filled by command information bits. Padding bits that are MOVE bits fill out said signal word, and no possibility exists that a full signal word of padding bits follows said signal word. On the other hand, if said command information fills a whole number of signal words exactly, the last signal word in which command information occurs is completely filled by command information bits. The possibility exists that said signal word may contain no MOVE bit information and that a full signal word of padding bits may follow said signal word.

To determine whether said possibility exists, said transfer-a-00-header-message instructions cause controller, **39**, to execute particular preprogrammed evaluate-end-condition instructions. In a fashion well known in the art, said instructions cause controller, **39**, to identify the largest integer that is less than or equal to the information at said SPAM-length-info memory and place information of said integer at particular working register memory. Then controller, **39**, compares the information at said working memory to the information at said SPAM-length-info memory. (For the information of said largest integer to equal the information of said quotient means that said quotient is an integer, that said command information fills a whole number of signal words exactly, and that the possibility exists that a full signal word of padding bits does follow the last signal word in which command information occurs.) If the information at said working memory is equal to the information at said SPAM-length-info memory, said instructions cause controller, **39**, to place "0" information at particular SPAM-Flag-working register memory. Otherwise said instructions cause controller, **39**, to place "1" information at said memory.

Then said transfer-a-00-header-message instructions cause controller, **39**, to execute particular preprogrammed calculate-number-of-words-to-transfer instructions. Automatically, controller, **39**, compares the information at said SPAM-Flag-working memory to particular end-condition-comparison information that is "0". (If the information at said SPAM-Flag-working memory is "0", said command information fills a whole number of signal words exactly; said whole number is the integer information at said working memory; but the last signal word of command information must be evaluated to ascertain whether it contains MOVE bit information.) Under control of said instructions, resulting in a match with said "0" information causes controller, **39**, to subtract one (1) from the numeric value of the integer information at said working memory. (On the other hand, if the information at said SPAM-Flag-working memory is "1", said command information only partially fills the last of a whole number of signal words exactly; MOVE bits fill the remainder of the last of said words; and said whole number is one greater than said largest integer information that is at said working memory.) Under control of said instructions, not resulting in a match with said "0" information causes controller, **39**, to add one to the numeric value of the integer information at said working memory.

Next said transfer-a-00-header-message instructions cause controller, **39**, to execute particular preprogrammed commence-transfer instructions. Said instructions cause controller, **39**, to transfer a particular number of signal words of said command information, starting with the signal word in which the first of said first H bits occurs and transferring said information in its order after conversion, signal word by signal word. Said number is the numeric value of the integer information at said working memory.

Finally, said transfer-a-00-header-message instructions cause controller, **39**, to execute particular preprogrammed evaluate-padding-bits-? instructions that cause controller, **39**, to compare the information at said SPAM-Flag-working memory to particular continue-? information that is "0".

Not resulting in a match means that, under control of said commence-transfer instructions, controller, **39**, has transferred all command information of said "00" header message and no possibility exists that a full signal word of padding bits ends said message. Accordingly, not resulting in a match causes controller, **39**, to complete said transfer-a-00-header-message instructions.

On the other hand, resulting in a match means that controller, **39**, has transferred all but the last signal word of command information, and said word must be evaluated to ascertain whether it contains MOVE bit information. Accordingly, resulting in a match causes controller, **39**, to execute the aforementioned assess-padding-bit instructions. Said instructions cause controller, **39**, to compare said last word to particular preprogrammed end?-EOFS-WORD information that is the information of one EOFS WORD. If no match results, said word is the last word of said message. Otherwise, one full signal word of padding bits follows said word and ends said message. Accordingly, when said last word is compared to said EOFS WORD information, not resulting in a match causes controller, **39**, to transfer just said last signal word, but resulting in a match causes controller, **39**, to transfer said last signal word then the signal word, in said binary information, that is immediately after said signal word. In so doing, controller, **39**, transfers the complete binary information of the message of the instance of header information at said SPAM-header memory and completes said transfer-a-00-header-message instructions.

Two specific cases illustrate the operation of said transfer-a-00-header-message instructions. One focuses on the "00" header message of FIG. **2**H. The other focuses on the message of FIG. **2**K. In either case, the signal words are eight-bit bytes, H equals two, X equals six, L equals two, and H+X+L equals ten. In both cases, controller, **39**, is preprogrammed with token-comparison information, including particular 01-token information that is "01" and is associated, on a one to one basis, with particular preprogrammed 01011-bits information that is the binary representation of eleven and particular 11-token information that is "11" and is associated, on a one to one basis, with particular preprogrammed 10110-bits information that is the binary representation of twenty-two. In both cases, when said instructions are invoked, information of the first H (that is, the first two) bits of the message being processed has been recorded at SPAM-header memory and information of the next X (that is the next six, the third through the eight bits) has been recorded at SPAM-exec memory. Thus said instructions process binary information that commences at the bit that is located immediately after the eighth bit of said message which eighth bit is the last of said X bits.

FIG. **2**H shows one instance of a message that contains command information that fills a whole number of signal words plus a decimal fraction. Said command information fills two bytes plus five bits (that is, 2.625 bytes). Three padding bits that are MOVE bits have been added to the third byte of said message to fill out said byte.

When said transfer-a-00-header-message instructions are executed in the course of the processing of the message of FIG. **2**H, said instructions cause processing to proceed in the following fashion.

Said process-length-token instructions are executed and cause controller, **39**, to select the first two bits of said binary information immediately after said eighth bit and record said bits at said SPAM-length-info memory. Said two bits are "01", the length-token of said message. (After said bits are recorded at said memory, the information at said memory is “0000000000000001”.) Automatically controller, **39**, commences comparing the information at said SPAM-length-info memory to said token-comparison information. In the course of said comparing, controller, **39**, automatically places at particular working register memory said 01-token information that is “01”. (After said information is placed at said memory, the information at said memory is “0000000000000001”.) Automatically, controller, **39**, compares the information at said SPAM-length-info memory to the information at said working memory, and a match results. Said match causes controller, **39**, automatically to select, said 01011-bits information that is the binary representation of eleven and place said information at said SPAM-length-info memory. (Eleven, which is the numeric value of said 01011-bits information, is the MMS-L of said message.)

Then automatically said determine-command-information-word-length instructions are executed. Said instructions cause controller, **39**, to add H+X+L, which is the binary representation of ten, to the information at said SPAM-length-info memory. In so doing, controller, **39**, places at said SPAM-length-info memory the numeric value of the number of bits in the command information of said message—twenty-one (which is eleven plus ten). Then controller, **39**, divides the numeric value information at said memory (twenty-one) by the number of bits in one byte (eight) and stores the quotient of said dividing (which quotient is 2.625 and is stored in a floating point fashion) at said SPAM-length-info memory. In so doing, controller, **39**, determines that said command information occupies 2.625 bytes.

Next said evaluate-end-condition instructions are executed. Said instructions cause controller, **39**, to identify the integer two (2) as the largest integer that is less than or equal to the 2.625 information that is at said SPAM-length-info memory and to place binary information of said integer, two (2), at said working register memory. Automatically controller, **39**, compares said two (2) information at working memory to said 2.625 information at SPAM-length-info memory. Because the information at said working memory is not equal to the information at said SPAM-length-info memory, controller, **39**, automatically places “1” information at said SPAM-Flag-working register memory.

Then said calculate-number-of-words-to-transfer instructions are executed. Automatically, controller, **39**, compares the information at said SPAM-Flag-working memory to said end-condition-comparison information that is “0”, and no match results. (The fact that the information at said SPAM-Flag-working memory is “1”, means that said command information only partially fills the last byte of said message, that MOVE bits fill the remainder of said byte, and that the number of bytes in said message is one greater than said integer information at said working memory.) Not resulting in a match causes controller, **39**, to add one (1) to the numeric value two (2) that is the information at said working memory, thereby increasing the numeric value of said information at working memory to three (3).

Next said commence-transfer instructions are executed. Said instructions cause controller, **39**, to transfer three (3) eight-bit bytes. (which three (3) is the numeric value of the integer information at said working memory) of binary information, starting with the byte in which the first bit of said message occurs and transferring said information in its order after conversion, byte by byte. In so doing, controller, **39**, transfers all information of said message to the addressed apparatus of said message.

Finally, said evaluate-padding-bits-? instructions are executed and cause controller, **39**, to compare the “1” information at said SPAM-Flag-working memory to said continue-? information that is “0”, and no match results. Not resulting in a match causes controller, **39**, to complete said transfer-a-00-header-message instructions.

In this fashion, said transfer-a-00-header-message instructions cause controller, **39**, to transfer the message of FIG. **2**H to the addressed apparatus of said message.

By contrast, the second illustrative case of FIG. **2**K shows a message that contains command information that fills a whole number of signal words exactly and is followed by a full signal word of padding bits. The command information of said message fills four bytes. The last of said bytes contains only EOFS bits and is an EOFS WORD. Accordingly said last byte is followed by one full byte of padding bits which one byte is the fifth and last byte of said message.

Said transfer-a-00-header-message instructions cause the message of FIG. **2**K, to be processed in the following fashion.

Said process-length-token instructions cause controller, **39**, to select the ninth and tenth bits of said binary information and record said bits at said SPAM-length-info memory. Said two bits are the “11” length-token of said message, and after said bits are so recorded, the information at said memory is “0000000000000011”. Automatically controller, **39**, commences comparing said information at SPAM-length-info memory to said token-comparison information. Automatically controller, **39**, places said 11-token information that is “11” at said working register memory, after which the information at said memory is “0000000000000011”. Automatically, controller, **39**, compares said information at SPAM-length-info memory to said information at said working memory, and a match results. Said match causes controller, **39**, automatically to select said 10110-bits information that is the binary representation of twenty-two and place said information at said SPAM-length-info memory. (Twenty-two, which is the decimal equivalent value of said 10110-bits information, is the MMS-L of said message.)

Then said determine-command-information-word-length instructions cause controller, **39**, to add H+X+L, which is the binary representation of ten, to the information at said SPAM-length-info memory, making the information at said SPAM-length-info memory the binary representation of thirty-two. Then controller, **39**, divides information at said memory (thirty-two) by the number of bits in one byte (eight) and stores the quotient of said dividing (which quotient is 4 and is stored in an integer fashion) at said SPAM-length-info memory. In so doing, controller, **39**, determines that said command information occupies 4 bytes exactly.

Next said evaluate-end-condition instructions cause controller, **39**, to identify the integer four (4) as the largest integer that is less than or equal to the 4 information at said SPAM-length-info memory and to place binary information of said integer, four (4), at said working register memory. Automatically controller, **39**, determines that said four (4) information at working memory matches said 4 information at SPAM-length-info memory. Said match causes controller, **39**, automatically to place “0” information at said SPAM-Flag-working register memory.

Then said calculate-number-of-words-to-transfer instructions cause controller, **39**, to determine that the information at said SPAM-Flag-working memory matches said end-condition-comparison information that is “0”. Said match causes controller, **39**, to subtract one (1) from the numeric value, four (4), that is the information at said working memory, thereby decreasing the numeric value of said information at working memory to three (3).

Next said commence-transfer instructions cause controller, **39**, to transfer three (3) eight-bit bytes (which three (3) is the numeric value of the integer information at said working memory) of binary information, starting with the byte in which the first bit of said message occurs and transferring said information in its order after conversion, byte by byte. In so doing, controller, **39**, transfers all but the last byte of command information. Controller, **39**, transfers the first, second, and third bytes. But the fourth byte, which is said last byte, remains untransferred.

Finally, said evaluate-padding-bits-? instructions cause controller, **39**, to determine that the "0" information, at said SPAM-Flag-working memory matches said continue-? information that is "0". Resulting in a match causes controller, **39**, to execute said assess-padding-bit instructions. Said instructions cause controller, **39**, to compare said last byte to said end-? EOFS WORD information. Because the fourth byte of the message of FIG. **2**K is an EOFS WORD, a match results. Said match means that a full byte of padding bits follows said last byte of command information. Said match causes controller, **39**, to transfer two bytes of binary information which bytes are the fourth and fifth bytes of said message (which fifth byte is the last signal word of said message). Then said instructions cause controller, **39**, to complete said transfer-a-00-header-message instructions.

In this fashion, said transfer-a-00-header-message instructions cause controller, **39**, to transfer the message of FIG. **2**K to the addressed apparatus of said message.

In applicable fashions of said transfer-a-00-header-message instructions, controller, **39**, transfers to SPAM-controller, **205**C, the complete binary information of the message that contains the second combining synch command.

When controller, **39**, completes said transfer-a-00-header-message instructions, automatically controller, **39**, prepares all apparatus of decoder, **203**, to receive a next SPAM message. Controller, **39**, deactivates all output ports; determines that the information at said SPAM-header register memory does not match said cause-retention-of-exec information that is "11"; causes all apparatus of decoder, **203**; to delete from memory all information of said binary information; then commences to wait for the binary information of a subsequent SPAM header.

At SPAM-controller, **205**C, (and at the SPAM-controllers, **205**C, of other URS microcomputers, **205**), receiving the transferred binary information of said second message causes all apparatus automatically to process the information of said message in their preprogrammed fashions.

Automatically the EOFS valve of SPAM-controller, **205**C, processes said information and transfers said information, signal word by signal word.

Receiving the header and execution segment of said second message causes SPAM-controller, **205**C, to determine the controlled function or functions that said message instructs URS microcomputers, **205**, to perform and to execute the instructions of said functions. Automatically, as said valve transfers information, SPAM-controller, **205**C, selects the H first converted bits of said information, records said bits at said SPAM-header-@205 register memory, and determines that the information at said memory (which is the "00" header of said second message) does not match said 11-header-invoking-@205 information. No match results which causes controller, **39**, automatically to select the next X bits of said transferred binary information and record said bits at particular SPAM-exec-@205 register memory. Automatically SPAM-controller, **205**C, compares the information at said SPAM-exec-@205 memory with said controlled-function-invoking-@205 information. Said comparing results in a match with particular execute-conditional-overlay-at-205 information that causes SPAM-controller, **205**C, to execute particular preprogrammed conditional-overlay-at-205 instructions.

Said instructions cause SPAM-controller, **205**C, to execute "GRAPHICS ON" at the PC-MicroKey System of microcomputer, **205**, if particular specified conditions are satisfied. To satisfy said conditions, the instance of image information at the video RAM of microcomputer, **205**, (FIG. **1**A) must be relevant to particular broadcast video programming transmitted immediately after the instance of broadcast programming in which said second message is embedded (FIG. **1**B). More precisely, particular program unit and overlay number information specified for each instance must match. In the meter-monitor segment of the second combining synch command, said command conveys specified unit and number information for said instance of broadcast programming. If, in a fashion described below, said specified information matches particular other unit and number information, said conditional-overlay-at-205 instructions cause SPAM-controller, **205**C, so to execute "GRAPHICS ON". Accordingly, said second command is one example of a specified condition command.

In order to determine whether said specified information matches said other information, SPAM-controller, **205**C, must locate said specified information. More precisely, SPAM-controller, **205**C, must locate two particular information fields of the meter-monitor segment of said second command. One is the program unit field whose information identifies uniquely the program unit of said "Wall Street Week" program. The other is the overlay number field whose information identifies uniquely the particular one of the overlays of said program that said command specifies and causes to be overlayed.

To locate said information, said conditional-overlay-at-205 instructions cause SPAM-controller, **205**C, to execute the aforementioned evaluate-meter-monitor-format instructions. (Because said conditional-overlay-at-205 instructions are executed only by SPAM commands with "00" headers, comparing information at said SPAM-header-@205 memory with header-identification-@205 information is unnecessary.) Said evaluate-meter-monitor-format instructions cause SPAM-controller, **205**C, to select particular bits at particular predetermined locations in said transferred binary information and record said bits at particular SPAM-format register memory. Said bits are the bits of the meter-monitor format field of said command. Then, automatically, by comparing the information at said SPAM-format memory with preprogrammed format-specification information, SPAM-controller, **205**C, determines that said information at memory matches particular information that invokes particular process-this-specific-format instructions. Automatically SPAM-controller, **205**C, executes said instructions, and said instructions cause one particular offset-address number to be placed at particular SPAM-mm-format-@205 register memory at SPAM-controller, **205**C. Said number specifies the address/location at the RAM of SPAM-controller, **205**C, of the first bit of information that identifies the specific format of the meter-monitor segment of said second command.

Then said conditional-overlay-at-205 instructions cause SPAM-controller, **205**C, to execute the aforementioned locate-program-unit instructions. Making reference to the information at said SPAM-mm-format memory, said instructions cause SPAM-controller, **205**C, to selects two particular preprogrammed binary numbers located at said RAM at two particular predetermined program-unit distances from said address/location and places said numbers, respectively, at the aforementioned first- and second-working register memories.

Said numbers are respectively (1) the bit distance from the first bit of said transferred binary information to the first bit of said program unit field and (2) the bit length of said program field. Automatically SPAM-controller, **205**C, selects particular information that begins at a bit distance after the first bit of said binary information, which bit distance is equal to the information at said first-working memory, and that is of a bit length equal to the information at said second-working memory. SPAM-controller, **205**C, places said selected information at said first-working memory (thereby overwriting and obliterating the information previously there). In so doing, SPAM-controller, **205**C, selects from the bits of said transferred binary information and records at said first-working memory the information of said program unit field.

Then said conditional-overlay-at-205 instructions cause SPAM-controller, **205**C, to compare the information at said first-working memory, which is the unique "program unit identification code" that identifies the program unit of said "Wall Street Week" program, to the information at the aforementioned SPAM-first-precondition register memory, which is the same unique code (having been transmitted to SPAM-controller, **205**C, in the program unit field of the meter-monitor segment of the first combining synch command and so selected and recorded at said register memory under control of said evaluate-meter-monitor-format instructions and said locate-program-unit instructions when said instructions were executed by said load-run-and-code instructions in the course of the processing of said first message). A match results (which indicates that SPAM-controller, **205**C, executed said load-run-and-code instructions under control of said first message.)

(At any subscriber station where information at first-working register memory fails to match information at SPAM-first-precondition register memory [indicating that the SPAM-controller, **205**C, had not executed said instructions], said failing to match causes the SPAM-controller, **205**C, of said station to execute particular preprogrammed instructions that cause the microcomputer, **205**, of said station to clear all SPAM information from main and video RAMs and commence waiting for subsequent control instructions. Then the preprogrammed instructions of said SPAM-controller, **205**C, cause SPAM-controller, **205**C, to discard all information of transferred binary information of said second message and commence waiting for the binary information of a subsequent SPAM header.)

At the subscriber station of FIG. **3**, said match of information at said first-working memory and information at SPAM-first-precondition memory, causes SPAM-controller, **205**C, to continuing executing particular conditional-overlay-at-205 instructions. Said instructions cause SPAM-controller, **205**C, to execute particular preprogrammed locate-overlay-number instructions. Making reference to the information at said SPAM-mm-format memory, said instructions cause SPAM-controller, **205**C, to selects two particular preprogrammed binary numbers located at said RAM at particular predetermined overlay-number distances from said address/location and places said numbers, respectively, at said first-an second-working register memories. Said numbers are respectively (1) the bit distance from the first bit of said transferred binary information to the first bit of said overlay number field and (2) the bit length of said overlay field. Automatically SPAM-controller, **205**C, selects particular information that begins at a bit distance after the first bit of said binary information, which bit distance is equal to the information at said first-working memory, and that is of a bit length equal to the information at said second-working memory. SPAM-controller, **205**C, places said selected information at said first-working memory (thereby overwriting and obliterating the information previously there). In so doing, SPAM-controller, **205**C, selects from the bits of said transferred binary information and records at said first-working memory the information of said overlay number field. (After the information of said overlay field is placed at said memory, the information at said memory is "00000001".)

Then said conditional-overlay-at-205 instructions cause SPAM-controller, **205**C, to compare the information at said first-working memory to the "00000001" information at the aforementioned SPAM-second-precondition register memory. A match results (indicating that microcomputer, **205**, has completed placing appropriate FIG. **1**A image at video RAM).

(At any subscriber station where information at first-working register memory fails to match information at SPAM-second-precondition memory [indicating that the microcomputer, **205**, has failed to complete so placing information at video RAM], said failing to match causes the SPAM-controller, **205**C, of said station to execute particular preprogrammed instructions that cause said SPAM-controller, **205**C, to interrupt the operation of the CPU of said microcomputer, **205**, in an interrupt fashion well known in the art, and transmit particular restore-efficiency instructions to said CPU that include information of the information at said first-working memory and that cause said microcomputer, **205**, in a preprogrammed fashion discussed more fully below, to restore efficient operation.)

At the subscriber station of FIG. **3** (and at URS microcomputers, **205**, at other subscriber stations where information at first-working memory matches information at SPAM-second-precondition memory), said match causes SPAM-controller, **205**C, to continue executing particular conditional-overlay-at-205 instructions at a particular instruction. Said instruction causes SPAM-controller, **205**C, to execute "GRAPHICS ON" at said PC-MicroKey System. In so doing, SPAM-controller, **205**C, completes said conditional-overlay-at-205 instructions and the controlled functions of the second combining synch command.

Having completed said controlled functions, automatically SPAM-controller, **205**C, prepares to receive the next instance of SPAM message information. Automatically, SPAM-controller, **205**C, determines that the information at said SPAM-header-@205 register memory does not match said cause-retention-of-exec information that is "01"; causes all apparatus of SPAM-controller, **205**C, to delete from memory all information of said transferred binary information; and commences waiting to receive the binary information of a subsequent SPAM header.

In the foregoing fashion and as described in "One Combined Medium" above, said transferred information of the second combining synch command causes microcomputer, **205**, to combine the programming of FIG. **1**A and of FIG. **1**B and transmit said combined programming to monitor, **202**M, where FIG. **1**C is displayed.

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Example #1

Third Message

Subsequently, the embedded information of the third message, which conveys the third combining synch command, is transferred from divider, **4**, to decoder, **203**.

In the same fashion that applied to the first and second messages, receiving said embedded information causes decoder, **203**, automatically to detect, check, correct as necessary, convert said information into binary information of said third message; to process and transfer said binary information at the EOFS valve of controller, **39**; and then to process the header and execution segment information in said binary information at controller, **39**.

Receiving said header and execution segment information causes controller, **39**, to determine that said message is addressed to URS microcomputers, **205**, and to transfer said message accordingly. Receiving the first H converted bits of said binary information from said valve causes controller, **39**, to select and record said H bits (the "10" header of the third combining synch command which designates a SPAM command with only an execution segment) at said SPAM-header register memory then determine that the information at said SPAM-header memory does not match said "11" information. Not resulting in a match causes controller, **39**, to process the next X received bits as the execution segment of a SPAM command. Receiving the next X bits of said binary information from said valve causes controller, **39**, to select and record said next X bits (the execution segment of the third combining synch command) at said SPAM-exec register memory, compare the information at said SPAM-exec memory to said controlled-function-invoking information, determine that said information at memory matches particular preprogrammed this-message-addressed-to-205 information that invokes the aforementioned transfer-to-205 instructions, and execute said instructions. Automatically controller, **39**, activates the output port that outputs to SPAM-controller, **205**C; compares said information at SPAM-header memory to said header-identification information; and determines that said information at memory matches particular "10" information. Said match causes controller, **39**, automatically to execute particular preprogrammed transfer-a-10-header-message instructions.

A "10" header distinguishes a message that is constituted only of first priority segments. At any given time, any given instance of "10" header message command information is of one constant binary length—the aforementioned header+exec constant length. (Hereinafter, said length is called "H+X" and is the sum of H plus X.) No length token information is processed, but it may be necessary to execute the aforementioned assess-padding-bit instructions to determine whether a full signal word of padding follows the last signal word in which command information occurs.

Said transfer-a-10-header-message instructions transfer a "10" header message by executing many of the preprogrammed instructions executed by the aforementioned transfer-a-00-header-message instructions that controlled the transferring of the "00" header second message of example #1.

Because length token information is not processed, said transfer-a-10-header-message instructions do not cause execution of said process-length-token instructions. Because each instance of "10" header message command information is of said one constant binary length, H+X, said transfer-a-10-header-message instructions do not cause execution of said determine-command-information-word-length instructions. Instead, said transfer-a-10-header-message instructions include particular preprogrammed 10-header-word-length information that is described more fully below.

Just as with "00" header messages, the possibility can exist that a full signal word of padding bits may follow the last signal word of command information of a "10" header message. If H+X bits of binary information fill a whole number of signal words plus a decimal fraction, the last signal word of command information of any given instance of a "10" header message is not completely filled by command information bits. Padding bits that are MOVE bits fill out said word, and no possibility exists that a full word of padding bits follows said word. But if H+X bits fill a whole number of signal words exactly, the last signal word of command information is completely filled by command information bits. Said word may contain no MOVE bit information, and a full signal word of padding bits may follow said word.

Because each instance of "10" header message command information is of said one length, said transfer-a-10-header-message instructions do not cause execution of said evaluate-end-condition instructions to determine whether said possibility exists. Instead, said transfer-a-10-header-message instructions include particular preprogrammed 10-header-end-condition information. At those times when H+X bits of binary information fill a whole number of signal words exactly, said information is the binary value of zero. At all other times, said information is the binary value of one.

Likewise, because each instance of "10" header message command information is of said one length, said transfer-a-10-header-message instructions do not cause execution of said calculate-number-of-words-to-transfer instructions. Instead, at any given time said 10-header-word-length information is preprogrammed number information that applies to every instance of "10" header message information. At those times when H+X bits of binary information fill an integer number of signal words exactly and a full signal word of padding bits may follow the last signal word in which command information occurs, said 10-header-word-length information is, itself, and integer that equals said integer number minus one. In the preferred embodiment where signal words are eight-bit bytes said 10-header-word-length information equals (H+X/8)−1. At those times when H+X bits of binary information do not fill a whole number of signal words exactly and the quotient of H+X divided by the number of bits in a signal word is a whole number plus a decimal fraction, said 10-header-word-length information equals the smallest integer larger than said quotient.

The first set of preprogrammed instructions that said transfer-a-10-header-message instructions and said transfer-a-00-header-message instructions have in common are said commence-transfer instructions. But before said transfer-a-10-header-message instructions can execute said commence-transfer instructions, said 10-header-word-length information and said 10-header-end-condition information must be at particular locations. Accordingly, when executed said transfer-a-10-header-message instructions cause controller, to place information of said 10-header-word-length information at the aforementioned particular working register memory and information of said 10-header-end-condition information at the aforementioned SPAM-Flag-working register memory.

Next said transfer-a-10-header-message-instructions cause controller, **39**, to execute said commence-transfer instructions. Said instructions cause controller, **39**, to transfer a particular number of signal words of said command information, starting with the signal word in which the first of said first H bits occurs and transferring said information in its order after conversion, signal word by signal word. Said number is the numeric value of the integer information at said working memory.

Finally, said transfer-a-10-header-message instructions cause controller, **39**, to execute said evaluate-padding-bits-? instructions that cause controller, **39**, to compare the information at said SPAM-Flag-working memory to said continue-? information that is "0".

Not resulting in a match means that the last signal word in which command information occurs contains at least one MOVE bit of padding and that said 10-header-word-length information is the length of every instance of a "10" header message. Accordingly, not resulting in a match causes controller, **39**, to end execution of said transfer-a-10-header-message instructions.

On the other hand, resulting in a match means that controller, **39**, has transferred all but the last signal word of command information, and said word must be evaluated to ascertain whether it contains MOVE bit information. Accordingly, resulting in a match causes controller, **39**, to execute said assess-padding-bit instructions. Said instructions cause controller, **39**, to compare said last word to said end-?-EOFS-WORD information. If no match results, said word is the last word of said message. Otherwise, one full signal word of padding bits follows said word and ends said message. Accordingly, not resulting in a match causes controller, **39**, to transfer just said last signal word, but resulting in a match causes controller, **39**, to transfer said last signal word then the signal word, in said binary information, that is immediately after said signal word. In so doing, controller, **39**, transfers the complete binary information of the message of the instance of header information at said SPAM-header memory and completes said transfer-a-10-header-message instructions.

The case of the "10" message of FIG. **2**J illustrates the operation of said transfer-a-10-header-message instructions. As with the "00" messages of FIG. **2**H and FIG. **2**K, signal words are eight-bit bytes, H equals two, and X equals six. Hence, H+X equals eight. Accordingly, controller, **39**, is preprogrammed with 10-header-word-length information that is integer information of (8/8)−1. More precisely, said 10-header-word-length information is integer information of zero. And because H+X bits of binary information fill a whole number of signal words exactly, controller, **39**, is preprogrammed with 10-header-end-condition information that is the binary value of zero.

Like FIG. **2**K, FIG. **2**J shows a message that contains command information that fills a whole number of signal words exactly. The command information of said message fills one byte, and said byte is the last byte of said command information. As FIG. **2**J shows, said last byte contains MOVE bit information. Accordingly said last byte is not followed by one full byte of padding bits. The one byte of said message is the last byte of said command information and the last byte of said message.

Said transfer-a-10-header-message instructions cause the message of FIG. **2**J, to be processed in the following fashion.

Executing said instructions causes controller, **39**, to place information of said 10-header-word-length information at said particular working register memory and information of said 10-header-end-condition information at said SPAM-Flag-working register memory. (After said 10-header-end-condition information is placed at said SPAM-Flag-working memory, the information at said memory may be "0" or "00000000".)

Next said commence-transfer instructions cause controller, **39**, to transfer zero (0) eight-bit bytes (which zero (0) is the numeric value of the integer information at said working memory) of binary information. (In other words, controller, **39**, transfers no information.) In so doing, controller, **39**, transfers all but the last byte of command information. The one byte of said message, which is said last byte, remains untransferred.

Then said evaluate-padding-bits-? instructions cause controller, **39**, to determine that the zero information at said SPAM-Flag-working memory matches said continue-? information that is "0". Resulting in a match causes controller, **39**, to execute said assess-padding-bit instructions. Said instructions cause controller, **39**, to compare said last byte to said end-?-EOFS-WORD information. Because the one byte of the message of FIG. **2**J contains MOVE bit information, no match results. Not resulting in a match means that said one byte is the last byte of said message. Automatically, not resulting in a match causes controller, **39**, to transfer one byte of binary information which byte is said one byte. Then said instructions cause controller, **39**, to complete said transfer-a-10-header-message instructions.

In this fashion, said transfer-a-10-header-message instructions cause controller, **39**, to transfer the message of FIG. **2**J to the addressed apparatus of said message.

In applicable fashions of said transfer-a-10-header-message instructions, controller, **39**, transfers to SPAM-controller, **205**C, the complete binary information of the message that contains the third combining synch command.

When controller, **39**, completes said transfer-a-10-header-message instructions, automatically controller, **39**, prepares all apparatus of decoder, **203**, to receive a next SPAM message. Controller, **39**, deactivates all output ports; determines that the information at said SPAM-header register memory does not match said cause-retention-of-exec information that is "01"; causes all apparatus of decoder, **203**, to delete from memory all information of said binary information; then commences to wait for the binary information of a subsequent SPAM header.

At SPAM-controller, **205**C, (and at the SPAM-controllers, **205**C, at other URS microcomputers, **205**), receiving the transferred binary information of said third message causes all apparatus automatically to process the information of said message in their preprogrammed fashions.

Automatically the EOFS valve of SPAM-controller, **205**C, processes said information and transfers said information, signal word by signal word.

Receiving the header and execution segment of said third message causes SPAM-controller, **205**C, to identify and execute the controlled function or functions that said message instructs URS microcomputers, **205**, to perform. Receiving the first H converted bits of said transferred binary information from said valve causes SPAM-controller, **205**C, to select and record said H bits at said SPAM-header-@205 register memory; determine that the information at said memory does not match said 11-header-invoking information; then process the next X received bits of said binary information as the execution segment of a SPAM command. Receiving said next X bits causes SPAM-controller, **205**C, to select and record said X bits at said SPAM-exec-@205 register memory; compare the information at said memory with said controlled-function-invoking-@205 information; determine that said information at memory matches particular cease-overlay information that causes SPAM-controller, **205**C, to execute particular preprogrammed cease-overlaying-at-205 instructions; and execute said instructions.

Said instructions cause SPAM-controller, **205**C, to execute "GRAPHICS OFF" at said PC-MicroKey System then transmit a particular clear-and-continue instruction to the CPU of microcomputer, **205**, the function of which instruction is described more fully below. In so doing, SPAM-controller, **205**C, completes said cease-overlaying-at-205 instructions.

(Because said cease-overlaying-at-205 instructions are executed only by SPAM commands with "10" headers, comparing information at said SPAM-header-@205 memory with header-identification-@205 information is unnecessary.)

Having completed the controlled functions of said second message, automatically SPAM-controller, **205**C, prepares to receive the next instance of SPAM message information.

Automatically, SPAM-controller, **205**C, determines that the information at said SPAM-header-@205 register memory does not match said cause-retention-of-exec-@205 information that is "01"; causes all apparatus of SPAM-controller, **205**C, to delete from memory all information of said transferred binary information; and commences waiting to receive the binary information of a subsequent SPAM header.

In the foregoing fashion and as described in "One Combined Medium" above, said transferred information of the third combining synch command causes microcomputer, **205**, to cease combining the programming of FIG. **1**A and of FIG. **1**B and commence transmitting to monitor, **202**M, only the composite video programming received from divider, **4**, (which causes monitor, **202**M, to commence displaying only said video programming) and to continue processing in a predetermined fashion (which fashion may be determined by the aforementioned program instruction set).

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Example #1

A Fourth Message

The "One Combined Medium" example does not include an instance of a SPAM message with a "11" header, but decoder, **203**, is preprogrammed to process such messages.

A fourth message of example #1 illustrates the processing of a "11" header message. Immediately after transmitting the third message of example #1, the program originating studio of the "Wall Street Week" program embeds and transmits a fourth message. Said message consists of an "11" header followed immediately by an information segment containing a second program instruction set. More precisely, the first two bits of the first signal word of said message are said "11" header, and the remaining bits of said signal word are padding bits. The first signal word of said information segment is the signal word immediately after said first word. And immediately after the last signal word of said segment, an end of file signal is transmitted that ends said message.

Subsequently, the embedded information of said fourth message is transferred from divider, **4**, to decoder, **203**.

Receiving the embedded information of said message causes decoder, **203**, automatically to detect, check, correct as necessary, and convert said information into binary information of said fourth message; to process and transfer said binary information at the EOFS valve of controller, **39**; then to process the header in said binary information.

Receiving said header causes controller, **39**, to determine that said message is addressed to URS microcomputers, **205**, and to transfer said message accordingly. Receiving the first H converted bits of said binary information from said valve causes controller, **39**, to select and record said H bits (said "11" header) at said SPAM-header register memory then determine that the information at said SPAM-header memory matches said 11-header-invoking information that is "11". Said match causes controller, **39**, to execute particular preprogrammed process-11-header-message instructions.

Said instructions cause controller, **39**, to execute controlled functions as if the information at said SPAM-last-01-header-exec register memory were the execution segment information of said "11" header message. Automatically, said instructions cause controller, **39**, to compare the information at said SPAM-last-01-header-exec memory (which information is the execution segment of the first combining synch command) with said controlled-function-invoking information. Automatically, controller, **39**, determines that said information at memory matches particular preprogrammed this-message-addressed-to-205 information that invokes the aforementioned transfer-to-205 instructions. Automatically controller, **39**, executes said instructions; activates the output port that outputs to SPAM-controller, **205**C; and determines that said information at SPAM-header memory matches particular "11" information. Said match causes controller, **39**, automatically to execute said transfer-a-01-or-a-11-header-message instructions.

An "11" header distinguishes a message that contains lowest priority information. Just like an "01" header message, each instance of a message with a "11" header ends with an end of file signal. Accordingly, said instructions cause controller, **39**, to transfer said fourth message in precisely the same fashion that applied to the transfer of the first message of example #1. Automatically controller, **39**, commences transferring the binary information of said fourth message, starting with said first H bits, and continues so transferring, as said binary information is outputted by said EOFS valve, until said valve detects the end of file signal of said message and causes EOFS-signal-detected information to be inputted to the CPU of controller, **39**.

In due course and in precisely the fashion of the first message of example #1, said valve detects the eleven EOFS WORDs of said end of file signal and causes transmission of said EOFS-signal-detected information to controller, **39**, which causes controller, **39**, to transmit said transmit-and-wait instruction to said valve. Said instruction causes said valve to perform all the functions caused by the corresponding instruction of said first message, including transferring one complete end of file signal (which information is automatically transferred to SPAM-controller, **205**C). In this fashion, controller, **39**, transfers the complete information of said fourth message to the addressed apparatus of said message—the SPAM-controller, **205**C.

Having transferred the binary information of said fourth message, controller, **39**, prepares all apparatus of decoder, **203**, to receive the next instance of SPAM message information in precisely the fashion of said first message with one exception. Unlike said first message which had an "01" header and contained a command with an execution segment, said fourth message has an "11" header and contains no execution segment information. Accordingly, receiving said fourth message does not cause controller, **39**, to record information at said SPAM-last-01-header-exec memory. When controller, **39**, compares the information at said SPAM-header register memory to said cause-retention-of-exec information that is "01", no match results. The information that was at said memory when said message was received—specifically, the execution segment of the first message—remains at said memory.

(If no information were to exist at said SPAM-last-01-header-exec memory when information at said memory is compared with said controlled-function-invoking information, controller, **39**, would detect the absence of said information in a predetermined fashion and, in the fashion described above in the description of the first message, would cause all apparatus of decoder, **203**, to discard all message information until an end of file signal were received and discarded then would process the first H converted bits of the next received binary information as a subsequent SPAM header.)

At SPAM-controller, **205**C, (and at SPAM-controllers, **205**C, of URS microcomputers, **205**) receiving the transferred binary information of said fourth message causes all apparatus automatically to process the information of said message in the preprogrammed fashions of said apparatus.

Automatically the EOFS valve of SPAM-controller, **205**C, processes and transfers said information until an end of file signal is detected.

Receiving the header of said fourth message causes SPAM-controller, **205**C, to determine the controlled function or functions that said message instructs URS microcomputers, **205**, to perform and to execute the instructions of said functions. Receiving the first H bits of said transferred binary information from said valve causes SPAM-controller, **205**C, to select and record said first H bits (said "11" header) at said SPAM-header-@205 register memory then determine that said information at SPAM-header-@205 memory matches said 11-header-invoking-@205 information that is "11". Said match causes SPAM-controller, **205**C, to execute particular preprogrammed process-11-header-message-@205 instructions.

Said instructions cause SPAM-controller, **205**C, to execute controlled functions as if the information at said SPAM-last-00-header-exec-@205 register memory (which information is the execution segment of the first combining synch command) were the execution segment information of said "11" header message. Automatically, said instructions cause SPAM-controller, **205**C, to compare the information at said memory with said controlled-function-invoking information-@205. A match results with said execute-load-run-and-code information, causing SPAM-controller, **205**C, automatically to execute said load-run-and-code instructions. As with said first message, said instructions control the loading, at the main RAM of microcomputer, **205**, and running of the information segment information that follows said H bits, which information is said second program instruction set.

To locate, in said transferred binary information, the first bit of said information, said instructions cause SPAM-controller, **205**C, to compare the information at said SPAM-header-@205 memory with said header-identification-@205 information and determine that said information at memory matches particular "11" information. In other words, to locate said bit, SPAM-controller, **205**C, must process only the information associated with an "11" header. Accordingly, said match causes SPAM-controller, **205**C, automatically to execute particular preprogrammed prepare-to-load-11-header-message instructions.

At any given time, each instance of header information is of one constant binary length—H bits—that either does or does not fill a whole number of signal words exactly. If H bits do not, the last signal word of any given instance of a "11" header message header is not completely filled with header information, and padding bits that are MOVE bits fill out said signal word. But if H bits do fill a whole number of signal words exactly, the last signal word in which header information may contain no MOVE bit information, in which case one full word of padding bits follows said signal word and precedes the first information segment signal word of said message.

To locate said first bit, said prepare-to-load-11-header-message instructions include particular preprogrammed 11-header-word-length information and particular preprogrammed 11-header-end-condition information. At those times when H bits of binary information fill a whole number of signal words exactly, said 11-header-word-length information is the largest integer that is less than said whole number, and said end-condition information is the binary value of zero. At those times when H bits do not fill a whole number of signal words exactly, said 11-header-word-length information is the smallest integer larger than the number of signal words that said H bits do fill, and said header-end-condition information is the binary value of one.

When executed, said prepare-to-load-11-header-message instructions cause SPAM-controller, **205**C, to place information of said 11-header-word-length at particular first-working-@205 register memory then compare said 11-header-end-condition information to particular preprogrammed information that is "0".

Not resulting in a match means that the last signal word in which header information occurs contains at least one MOVE bit of padding and that said 11-header-word-length information is the length of every instance of a "11" header information. Accordingly, not resulting in a match causes SPAM-controller, **205**C, to execute of particular preprogrammed commence-loading-11-header-message instructions.

On the other hand, resulting in a match means that the last signal word of header information must be evaluated to ascertain whether it contains MOVE bit information. Accordingly, resulting in a match causes SPAM-controller, **205**C, starting with the first signal word of said transferred binary information, to skip a number of signal words of said information, which number is the number of the integer information at said first-working-@205 memory. In so doing, SPAM-controller, **205**C, skips every signal word of header information but said last word. Then, automatically, said instructions cause SPAM-controller, **205**C, to compare said last word to said particular preprogrammed EOFS-WORD information. If no match results, said word is the last word of said message. Otherwise, one full signal word of padding bits follows said word and ends said message. Accordingly, not resulting in a match causes SPAM-controller, **205**C, to add binary information of one to said integer information at said first-working-@205 memory, but resulting in a match causes SPAM-controller, **205**C, to add binary information of two to said integer information at said first-working-@205 memory. Then, automatically, SPAM-controller, **205**C, executes said commence-loading-11-header-message instructions.

When executed, said commence-loading-11-header-message instructions cause SPAM-controller, **205**C, starting with the first signal word of said transferred binary information, to skip a number of signal words, which number is the number of the integer information at said first-working-@205 memory. In so doing, SPAM-controller, **205**C, skips every signal word of header information. Then said instructions instruct SPAM-controller, **205**C, to commence loading information at the main RAM of microcomputer, **205**, starting with the first signal word after the last skipped signal word, and cause SPAM-controller, **205**C, to commence executing said load-run-and-code instructions at a particular instruction.

Starting at said instruction, said load-run-and-code instructions cause SPAM-controller, **205**C, to instruct microcomputer, **205**, to commence receiving information from SPAM-controller, **205**C, and loading said information at particular main RAM, in a fashion well known in the art.

Thereafter, said instructions cause SPAM-controller, **205**C, to process said fourth message in precisely the same fashion that applied to the first message of example #1.

Said load-run-and-code instructions cause SPAM-controller, **205**C, to commence transferring information to microcomputer, **205**, beginning with said first signal word, and transfer the remaining signal words of said transferred binary information, signal word by signal word, until said valve detects the end of file signal of said message and causes EOFS-signal-detected information to be inputted to the CPU of SPAM-controller, **205**C. As microcomputer, **205**, receives said information, it loads said information at particular main RAM.

In due course, said valve transfers the last signal word of the information segment of said fourth message, which is the last signal word of said program instruction set, which causes SPAM-controller, **205**C, to transfer said word to microcomputer, **205**, and microcomputer, **205**, to load said word at said RAM.

In this fashion, receiving the information of said fourth message causes the apparatus of the subscriber station of FIG. **3** to load said program instruction set at the main RAM of microcomputer, **205**, (and other stations to load said set at other main RAMs).

Then, in precisely the fashion of the first message of example #1, said valve detects the eleven EOFS WORDs of said end of file signal and causes transmission of said EOFS-signal-detected information to SPAM-controller, **205**C which causes SPAM-controller, **205**C, to cause microcomputer, **205**, to cease loading information at said RAM and execute the information so loaded as the machine executable code of one job. Continuing in said fashion, SPAM-controller, **205**C, transmits said discard-and-wait instruction to said valve which causes said valve to set the information at said EOFS WORD Counter to "00000000" and to process no next inputted information until a control instruction is received from SPAM-controller, **205**C.

Then the code portion of said load-run-and-code instructions cause SPAM-controller, **205**C, to operate in a fashion that differs from the fashion of said first message. The instructions of said portion cause SPAM-controller, **205**C, to compare the information at said SPAM-header memory to said load-run-and-code information that is "01". No match results because the header of said fourth message is "11" (which means that said message contains no meter-monitor information). Not resulting in a match causes SPAM-controller, **205**C, automatically to skip the remaining instructions of said code portion and complete said load-run-and-code instructions without placing any program unit field information at said SPAM-first-precondition register memory. Accordingly, the program unit information of said "Wall Street Week" program that was caused to be placed at said SPAM-first-precondition memory by the first combining synch command remains at said memory.

Having processed the binary information of said fourth message, SPAM-controller, **205**C, prepares all apparatus of decoder, **203**, to receive the next instance of SPAM message information in precisely the fashion of said first message with one exception. Receiving said fourth message does not cause SPAM-controller, **205**C, to record information at said SPAM-last-01-header-exec memory-@205. When SPAM-controller, **205**C, compares the information at said SPAM-header-@205 memory to said cause-retention-of-exec-@205 information that is "01", no match results. The information that was at said memory when said message was received—specifically, the execution segment of the first message—remains at said memory.

In this fashion, the subscriber station of FIG. **3** processes a message with an "11" header.

Operating Signal Processor Systems

Example #2

In example #2, the first and third messages of the "Wall Street Week" combining are transmitted just as in example #1, but the second message is partially encrypted. The second message conveys the second combining synch command. In example #2, before said message is embedded at the program originating studio and transmitted, the execution segment of said command and all of the meter-monitor segment except for the length-token are encrypted, using standard encryption techniques, well known in the art, that encrypt binary information without altering the number of bits in said information. Partially encrypting the second message in this fashion leaves the cadence information of said message unencrypted. In other words, the "00" header, the length-token, and any padding bits added at the end of said message remain unencrypted. Said message is only partially encrypted in order to enable subscriber stations that lack capacity to decrypt said message to process the cadence information of said message accurately.

In example #2, the encryption of said execution segment is done in such a fashion that, after encryption, said segment is identical to a particular execution segment that addresses URS signal processors, **200**, and instructs said processors, **200**, to use a particular decryption key J and decrypt the message in which said segment occurs.

Because said message is encrypted, its meter-monitor segment contains a sixth field, a meter instruction field. Accordingly, the length of the second message, the number of bits in its meter-monitor segment and the numeric value of MMS-L is greater in example #2 than in example #1.

As described above in "One Combined Medium," before any messages of the "Wall Street Week" programming are transmitted, control invoking instructions are embedded at said program originating studio and transmitted to all subscriber stations. Among said instructions are particular ones that command URS microcomputers, **205**, to set their PC-MicroKey Model 1300 Systems to the "Graphics Off" mode. Thus, at the outset of example #2, all PC-MicroKey 1300s are in the "Graphics Off" mode, and no microcomputer, **205**, is transmitting combined information of video RAM and received composite video to its associated monitor, **202**M. As will be seen, this fact has particular relevance in example #2.

In example #2, the first message of the "Wall Street Week" program is transmitted precisely as in the example #1 and causes precisely the same activity at subscriber stations. At each station, a microcomputer, **205**, enters appropriate FIG. **1**A image information at particular video RAM.

When decoder, **203**, receives the embedded information of the second message of example #2, decoder, **203**, processes and transfers said information in the same fashion that applied to the second message of example #1 with three exceptions.

First, controller, **39**, determines that the second message of example #2 is addressed to URS signal processors, **200**, rather than URS microcomputers, **205**, and transfers the binary information of said message accordingly. When controller, **39**, compares the information at SPAM-exec memory, which is the encrypted execution segment information of the second message of example #2, with controlled-function-invoking information, said information at memory does not match the this-message-addressed-to-205 information matched in example #1. Rather said information at memory matches particular preprogrammed this-message-addressed-to-200 information that invokes preprogrammed transfer-to-200 instructions. Controller, **39**, executes said instructions, and rather than activating the output port that outputs to SPAM-controller, **205**C, said instructions cause controller, **39**, to activate the output port that outputs to buffer/comparator, **8**, of signal processor, **200**.

Then, subsequently, when said process-length-token instructions cause controller, **39**, to compare the information at SPAM-length-info memory, which is the length-token information of said second message of example #2, to token-comparison information, said information at memory does not match the X-token information matched by the length-token of the second message of example #1. Rather, said information at memory matches particular preprogrammed Y-token information associated with particular preprogrammed y-bits information whose numeric value is the MMS-L of the second message of example #2. Said match causes controller, **39**, automatically to select said y-bits information and place said information at said SPAM-length-info memory. Thus controller, **39**, processes a value of MMS-L that is different from the value processed in example #1.

Finally, because the second message of example #2 is longer than the second message of example #1 and the MMS-L of example #2 is greater than the MMS-L of example #1, when said transfer-a-00-header-message instructions control the transfer of the second message of example #2 to signal processor, **200**, said instructions transfer a longer message.

In all other respects, controller, **39** processes and transfers the second message of example #2 just as it processed and transferred the second message of example #1. And when the transfer of the second message of example #2 is complete, controller, **39**, automatically deactivates all output ports, deletes all received information of said message from memory, and commences waiting for the binary information of a subsequent SPAM header.

Receiving the binary signal information of said second message causes buffer/comparator, **8**, automatically to execute a decryption sequence at signal processor, **200**, that is fully automatic and for which all apparatus are preprogrammed.

Receiving said information causes buffer/comparator, **8**, first, to place said information at a particular received signal location at buffer/comparator, **8**, then to compare a particular portion the first X bits immediately after the first H bits of said binary information (which X bits are the executions segment of said message) to particular preprogrammed comparison information in its automatic comparing fashion. (Buffer/comparator, **8**, is preprogrammed with information that identifies said portion.) A match results with particular comparison information that is the bit image of particular SPAM execution segment information that instructs URS signal processors, **200**, to decrypt. Said match causes buffer/comparator, **8**, to transfer to controller, **20**, particular decrypt-this-message information that includes the memory position of the first bit location of said particular received signal location and information of the header and execution segment in said binary signal information. Receiving said information causes controller, **20**, to compare the information of said execution segment to particular preprogrammed controlled-function-invoking-@200 information and determine a match with particular decrypt-with-key-J information that instructs controller, **20**, to decrypt the received binary signal information with decryption key J.

(At subscriber stations whose URS signal processors, **200**, are not preprogrammed with information of said key J, the information of said execution segment fails to match any controlled-function-invoking-@200 information. Said failures to match cause the controllers, **20**, of said stations automatically to discard all information transferred by the buffer/comparators, **8**; to cause said buffer/comparators, **8**, to discard all received information of said second message; and to cause said controllers, **20**, and said buffer/comparators, **8**, to commence processing in the conventional fashion.)

(It is to facilitate SPAM processing at said stations that are not preprogrammed with necessary decryption key information that the cadence information of an otherwise encrypted SPAM message must remain unencrypted. Were either the header or length-token or any padding bits of said second message encrypted, the decoders, **203**, and signal processors, **200**, of said stations could process the information of the execution segment correctly but would be unable to locate the last bit of said second message and the header of the following message. Effective SPAM processing would cease and not resume until the apparatus at said stations detected an unencrypted end of file signal. Until that time, converted binary information could continue to invoke processing at said stations but said processing would be haphazard and almost certainly undesirable.)

Because the subscriber station of FIG. **3** is preprogrammed with all information needed to decrypt said second message, the aforementioned match with said decrypt-with-key-J information causes controller, **20**, to execute particular preprogrammed decrypt-with-J instructions. Among said preprogrammed instructions is key information of J, and said instructions cause controller, **20**, automatically to select and transfer said key information to decryptor, **10**.

Decryptor, **10**, receives said key information and automatically commences using it as its key for decryption.

Then said decrypt-with-J instructions cause controller, **20**, to activate the output capacity of buffer/comparator, **8**, that outputs to decryptor, **10**; to compare said information of the header transferred from buffer/comparator, **8**, to particular preprogrammed header-identification-@200 information; and to determine that said information of the header matches particular "00" header information. Said match causes controller, **20**, automatically to invoke particular preprogrammed decrypt-a-00-header-message instructions. Controller, **20**, is preprogrammed with information of H, X, L, and H+X; with process-length-token, determine-command-information-word-length, evaluate-end-condition, calculate-number-of-words-to-transfer, evaluate-padding-bits-? instructions; and with token-comparison, W-token, X-token, Y-token, w-bits, x-bits, and y-bits information. Using preprogrammed information and instructions as required, said decrypt-a-00-header-message instructions transfer the received binary information of said second message from buffer/comparator, **8**, to decryptor, **10**, in the same fashion that the aforementioned transfer-a-00-header-message instructions controlled the transfer of the information of said message from controller, **39**, to buffer/comparator, **8**.

Under control of said decrypt-a-00-header-message instructions, said process-length-token instructions cause controller, **20**, to select the L bits of said binary signal information that begin at the first bit location that is H+X bit locations following the memory position of the first bit location of said particular received signal location at buffer/comparator, **8**. Said L bits are the length token of said second message. Automatically controller, **20**, compares the information of said L bits to token-comparison information and determines a match with preprogrammed Y-token information. Said match causes controller, **20**, automatically to select y-bits information and process said information as the numeric value of MMS-L. Next said determine-command-information-word-length instructions cause controller, **20**, to determine the number of signal words in the command information of said second message by adding H+X+L to said y-bits information of MMS-L and dividing the resulting sum by the number of bits in one signal word. Then said evaluate-end-condition instructions cause controller, **20**, to place a "0" at particular SPAM-Flag-@20 register memory if said command information fills a whole number of signal words exactly and "1" at said memory if it does not. And said calculate-number-of-words-to-transfer instructions cause controller, **20**, to determine a particular number of signal words to transfer and place information of said number at particular working-@20 register memory.

Then said decrypt-a-00-header-message instructions cause controller, **20**, to transmit to controller, **12**, a particular transfer-decrypted-message instruction and particular decryption mark information of key J that identifies J as the decryption key.

Receiving said instruction and information causes controller, **12**, to execute particular preprogrammed transfer-and-meter instructions then record said mark of key J at particular decryption-mark-@12 register memory.

Next said decrypt-a-00-header-message instructions cause controller, **20**, to cause buffer/comparator, **8**, to transfer to decryptor, **10**, a quantity of signal words of said binary information of the second message which quantity is the number at said working-@20 register memory.

Buffer/comparator, **8**, responds by transferring to decryptor, **10**, binary information that begins at the first bit at said particular received signal location and transfers said information, signal word by signal word, until it has transferred said quantity of signal words.

Decryptor, **10**, commences receiving said information, decrypting it using said key J information and transferring it to controller, **12**, as quickly as controller, **12**, accepts it. The process of decryption proceeds in a particular fashion. Said decrypt-a-00-header-message instructions cause controller, **20**, to cause decryptor, **10**, to transfer the first H bits without decrypting or altering said bits in any fashion, to decrypt and transfer the next X bits, to transfer the next L bits without decrypting or altering said bits, to decrypt and transfer the next MMS-L bits, and finally, to transfer any bits remaining after the last of said MMS-L bits without decrypting or altering said bits. In this fashion, the cadence information in said message, which is not encrypted, is transferred by decryptor, **10**, to controller, **12**, without alteration.

Under control of said transfer-and-meter instructions, controller, **12**, commences receiving decrypted information of the second message from decryptor, **10**. Having been decrypted, said information is identical to the binary information of the second message of example #1 (except that the meter-monitor information contains the aforementioned meter instruction information that is not in example #1 and the length token information of the meter-monitor format field reflects the presence of said instruction information).

Automatically controller, **12**, processes said information of the second message of example #2 as a SPAM command. Receiving the header and execution segment causes controller, **12**, to determine that said message is addressed to URS microcomputers, **205**, and to transfer said message accordingly. Automatically, controller, **12**, selects the first H converted bits and records said bits at particular SPAM-header-@12 register memory then selects the next X bits and records said bits at particular SPAM-exec-@12 register memory. Then, automatically, by comparing the information at said SPAM-exec memory with preprogrammed controlled-function-invoking-@12 information, controller, **12**, determines that-said information at memory matches preprogrammed transfer-this-message-to-205-@12 information. Automatically, controller, **12**, executes preprogrammed transfer-to-205-@12 instructions; activates the output port that outputs to SPAM-controller, **205**C; then commences transferring information of said decrypted information of the second message under control of said transfer-and-meter instructions commencing with the first of said H bits and transferring information, signal word by signal word, in the order in which it is received from decryptor, **10**. In addition, controller, **12**, is preprogrammed with all instructions and information necessary for processing the length-token and determining the length of the meter-monitor segment of said second message, does so, and records at particular SPAM-meter register memory the first L plus MMS-L bits of said decrypted information immediately after the last of said X bits which is the information of the meter-monitor segment of said message.

When buffer/comparator, **8**, completes transferring to decryptor, **10**, the quantity of signal words that is the number at said working-@20 register memory, said decrypt-a-00-header-message instructions cause controller, **20**, to execute said evaluate-padding-bits-? instructions, determine which signal word is the last word of the second message of example #2, and ensure that said word is transferred to decryptor, **10**. Following the transfer of said word, controller, **20**, causes decryptor, **10**, to transmit particular decryption-complete information to controller, **20**, when decryptor, **10**, completes the transfer to controller, **12**, of said word following its decryption.

Receiving said word at controller, **12**, causes controller, **12**, to transfer said word to SPAM-controller, **205**C, and in so doing, complete the transfer of the decrypted information of said second message.

At microcomputer, **205**, (and at the URS microcomputers, **205**, at other stations where the second message of example #2 is decrypted) in the fashion described in example #1, said information, which is the unencrypted binary information of the second combining synch command, executes "GRAPHICS ON" causing microcomputer, **205**, to combine the programming of FIG. **1**A and of FIG. **1**B and transmit said combined programming to monitor, **202**M, where FIG. **1**C is displayed.

(Meanwhile, no second combining synch command reaches the URS microcomputers, **205**, at those subscriber stations whose URS signal processors, **200**, are not preprogrammed with information of decryption key J because all received information of the second message of example #2 has been discarded. No combining occurs at said microcomputers, **205**. And at the time when FIG. **1**C is displayed at subscriber stations preprogrammed with said key J, the monitors, **202**M, of said subscriber stations display FIG. **1**B.)

Then receiving said decryption-complete information from decryptor, **10**, causes controller, **20**, to cause buffer/comparator, **8**, to discard any information of said second message that may remain at buffer/comparator, **8**, and commence processing in the conventional fashion; to cause decryptor, **10**, to discard said key information of decryption key J and any information of said second message that may remain at decryptor, **10**; to transmit to controller, **12**, a preprogrammed complete-transfer-phase instruction; and, itself, to commence processing in the conventional fashion.

Receiving said complete-transfer-phase instruction causes controller, **12**, to cease transferring information, under control of said transfer-and-meter instructions, to deactivate all output ports, and to commence executing the meter instructions of said transfer-and-meter instructions. Said meter instructions cause controller, **12**, to compare the information at said SPAM-header-@12 memory with particular collect-meter-info information and determine that said H bits match particular "00" information. (In other words, said SPAM command information contains meter-monitor information.) Said match causes controller, **12**, automatically to transfer to buffer/comparator, **14**, particular header identification information that identifies controller, **12**, as the source of said transfer the information recorded at said SPAM-meter memory then the information recorded at said decryption-mark-@12 register memory, which information is the decryption mark of key J. (Hereinafter, said meter information generated by the second combining synch command in example #2 is called the "2nd meter information (#2).") Following said transferring, controller, **12**, automatically deletes from register memory all information of said second message and commences processing in the conventional fashion. Receiving the 2nd meter information (#2) causes buffer/comparator, **14**, automatically to execute a meter sequence that is fully automatic and for which all apparatus are preprogrammed and have capacity to perform.

Receiving said information causes buffer/comparator, **14**, to compare a particular portion of the meter-monitor format field of said 2nd meter information (#2) to particular distinguishing comparison information that identifies meter-monitor format fields that denote the presence of meter instruction fields. A match results which causes buffer/comparator, **14**, to select information of bits at particular predetermined locations (which bits contain the information of the meter instruction field of said 2nd meter information (#2)) and compare said selected information to preprogrammed metering-instruction-comparison information and to determine that said field matches particular increment-by-one information that instructs buffer/comparator, **14**, to add one incrementally to each meter record maintained at buffer/comparator, **14**, that is associated with decryption key information that matches the decryption mark of the instance of meter information being processed. Accordingly, buffer/comparator, **14**, compares the decryption mark of said 2nd meter information (#2) with preprogrammed decryption-key-comparison information. Said comparing results in more than one match, and buffer/comparator, **14**, increments by one the meter record associated with each particular decryption-key-comparison datum that matches the decryption mark of said 2nd meter information (#2). Because the information of said meter instruction field instructs signal processor, **200**, only to perform said incrementing, upon completing the last step of incrementing or comparing, automatically buffer/comparator, **14**, discards all information of said 2nd meter information (#2) except the incremented record information and commences processing in the conventional fashion.

Thus, not only does the second message of example #2 cause the combining of FIG. **1**A and FIG. **1**B and the display of FIG. **1**C only at selected subscriber stations that are preprogrammed with decryption key J, it also causes the retaining of meter information associated with its own decryption at said selected stations.

Subsequently, decoder, **203**, receives the third message of the "Wall Street Week" program which conveys the third combining synch command.

In example #2, all signal processing apparatus process the third combining synch command precisely as in the first example. Said command reaches all URS microcomputers, **205**, and causes each to execute the aforementioned "GRAPHICS OFF" command. But only at those selected ones of said URS microcomputers, **205**, that are preprogrammed with decryption key J does the third combining synch command actually cause combining to cease. At all other URS microcomputers, **205**, executing "GRAPHICS OFF" has no effect because each of said other URS microcomputers, **205**, is already in "Graphics Off" mode when said "GRAPHICS OFF" is executed. Because the aforementioned particular ones among said control invoking instructions that preceded the first message of the "Wall Street Week" program caused all URS microcomputers, **205**, to set their PC-MicroKey 1300s to the "Graphics Off" mode and because no information of the second combining synch command reached said other microcomputers, **205**, and executed "GRAPHICS ON", the PC-MicroKey 1300 of each of said other URS microcomputers, **205**, is in "Graphics Off" mode when the third message of example #2 is transmitted.

Thus in example #2, not only does the second combining synch command cause the combining and the display of FIG. **1**C only at selected subscriber stations and the retaining of meter information at (and only at) said stations, it also causes selective processing—for example, the selecting of information of decryption key J at selected stations—that enables the third combining synch command to have effect only at selected stations without any selective processing of said third command. Placing particular so-called "soft switches," one of which exists at each subscriber station, all into one given original position, "off" or "on", then transmitting a command that is processed selectively at selected stations and places said switches at said stations into the opposite position, "on" of "off", makes it possible to transmit a subsequent command that returns said switches at said selected stations (and only said switches) to said original position without any additional selective processing.

Significant advantages of simplicity and speed are achieved by devising signal processing apparatus and methods that minimize the need for selective processing. With regard to said third combining synch command, for example, no step of decrypting is required to affect only those stations that are preprogrammed with decryption key J. Accordingly, no possibility exists that an error in decrypting may occur at one or more of said stations, causing the combining of video RAM information and received video information, at said one or more, not to cease at the proper time and to continue beyond said time (until such time as some subsequent command may execute "GRAPHICS OFF" or clear information from said video RAM at said stations). Because no time is required for decrypting, no possibility exists that some station may take longer (or shorter) than proper to perform decrypting causing the image of FIG. **1**A to be displayed at some monitor, **202**M, longer (or shorter) than proper. Perhaps most important, because no time is required for selective processing of said third command, the time interval that separates the time of embedding said third command at said remote station that originates the "Wall Street Week" program and the time of ceasing caused by said command at URS microcomputers, **205**, can be the shortest possible interval. Making it possible for said time interval to be the shortest possible interval minimizes the chance that an error may occur in the timing of the embedding of said third command at said remote station causing all URS microcomputers, **205**, to cease combining at a time that is other than the proper time.

The Preferred Configuration of Controller, **39**, and Spam-Controller, **205**C.

Heretofore, this specification has treated the controller of decoder, **203**, (which is controller, **39**) and the SPAM input controller of microcomputer, **205**, (which is SPAM-controller, **205**C) as separate controllers. This treatment has served to show how SPAM messages are transferred from one controller to another, at any given subscriber station.

But, in the preferred embodiment, the controller of the decoder that detects the SPAM signals of a combined medium transmission, at any given subscriber station, and the controller that executes the information of said signals at the microcomputer that combines the local and broadcast programming, at said station, are one and the same. More precisely, controller, **39**, of decoder, **203**, and SPAM-controller, **205**C, are one and the same (and are called, hereinafter, "controller, **39**"). Thus the preferred embodiment of controller, **39**, is configured and preprogrammed not only to control the detecting, correcting, converting, and executing of controlled functions at decoder, **203**, but also to input to and execute at microcomputer, **205**, the information of any given detected SPAM message that is addressed to URS microcomputers, **205**.

FIG. **3**A shows one such preferred controller, **39**. One aspect of the preferred embodiment of controller, **39**, is a series of buffers and processors at which forward error correction, protocol conversion, and the invoking of controlled functions take place in series. Buffer, **39**A, and processor, **39**B, are the first buffer and processor of the series and perform the forward error correcting functions of controller, **39**. Buffer, **39**C, and processor, **39**D, are the second buffer and processor and perform protocol conversion functions. Buffer, **39**E, and control processor, **39**J, are the third buffer and processor. All controlled functions invoked at controller, **39**, by received SPAM signals are invoked at control processor, **39**J.

Performing forward error correction and protocol conversion and invoking the controlled functions at a series of processors, in this fashion, rather than sequentially at one processor has significant advantages as regards speed. Inputting the information of each SPAM signal word to three processors does take longer than inputting said information to just one processor. But this is more than offset by the fact that having three processors rather than just one enables controller, **39**, to process the information of three signal words simultaneously. Control processor, **39**J, can invoke and process the controlled function of a first signal word while processor, **39**D, converts the information of a second signal word and processor, **39**B, corrects the information of a third signal word.

A second aspect of the preferred embodiment of controller, **39**, is a matrix switch, **39**I, that operates under control of control processor, **39**J, and can transfer information of received SPAM signals from buffer, **39**E, directly to addressed apparatus. Transferring said information in this fashion rather than through control processor, **39**J, has the advantage of freeing control processor, **39**J, to perform other functions while said information is transferred.

As FIG. **3**A shows, each processor, **39**B, **39**D, and **39**J, has associated RAM and ROM and, hence, constitutes a programmable controller in its own right. Each processor, **39**B, **39**D, and **39**J, controls its associated buffer, **39**A, **39**C, and **39**E respectively. Each buffer, **39**A, **39**C, and **39**E, is a conventional buffer that receives, buffers, and transfers binary information in fashions well known in the art. Each buffer, **39**A and **39**C, transfers its received and buffered information to its associated processor, **39**B and **39**D respectively, for processing. Buffer, **39**E, transfers its received and buffered information, via EOFS Valve, **39**F, to matrix switch, **39**I.

The preferred embodiment of controller, **39**, also has a buffer, **39**G, that is a conventional buffer with means for receiving information from other inputs external to decoder, **203**. Among said inputs is, in particular, an input from controller, **12**, of signal processor, **200** (which input performs the functions of the input from controller, **12**, to SPAM-controller, **205**C, shown in FIG. **3**). Buffer, **39**G, outputs its received and buffered information, via EOFS Valve, **39**H, to matrix switch, **39**I. Buffer, **39**G, is configured, in a fashion well known in the art, with capacity to identify to control processor, **39**J, which input is the source of any given instance of information received and buffered at buffer, **39**G, and capacity to output selectively, under control of control processor, **39**J, any given instance of received information.

EOFS Valves, **39**F and **39**H, are EOFS valves of the type described above and transfer the buffered information of buffers, **39**E and **39**G respectively, to matrix switch, **39**I. Said valves operate under control of control processor, **39**J, and monitor all information, so transferred, continuously for end of file signals in the fashion described above.

Matrix switch, **39**I, is a conventional digital matrix switch, well known in the art of telephone communication switching, that is configured for the small number of inputs and outputs required at controller, **39**. Matrix switch, **39**I, operates under control of control processor, **39**J, and has capacity to receive SPAM signal information from a multiplicity of inputs, including EOFS Valves, **39**E and **39**F, and from control processor, **39**J, and to transfer said information to a multiplicity of outputs, including control processor, **39**J; the CPU of microcomputer, **205**; buffer/comparator, **8**, of signal processor, **200**; buffer/comparator, **14**, of signal processor, **200**; and other outputs. Among such other outputs is one or more (hereinafter called, "null outputs") with capacity for accepting binary information and merely recording said information at particular memory associated with matrix switch, **39**I, thereby overwriting and obliterating information previously recorded at said memory. The purpose of such a null output is to provide means whereby said switch can automatically cause information of any selected SPAM message to be discarded rather than transferred to addressed apparatus. (Other examples of other outputs are cited below.) Matrix switch, **39**I, also has capacity to receive control information from control processor, **39**J, and transfer said information to the CPU and/or the PC-MicroKey 1300 system of microcomputer, **205**, and to receive control information from the CPU and/or the PC-MicroKey 1300 system of microcomputer, **205**, and transfer said information to control processor, **39**J. Matrix switch, **39**I, transfers information in such a way that information inputted at any given input is transferred to a selected one or ones of said outputs without modification, and a multiplicity of information transfers can take place simultaneously.

Control processor, **39**J, has capacity for computing information and processing all control information necessary for controlling all apparatus of decoder, **203** (or such other decoder as the controller of a given control processor, **39**J, may be installed in). In keeping with the function of control processor, **39**J, as the processor at which all controlled functions of controller, **39**, are invoked, all aforementioned particular register memories of controller, **39**, are located at control processor, **39**J. The register memories of control processor, **39**J, include (but are not limited to) particular SPAM-input-signal register memory whose length in bit locations is sufficient to contain the longest possible instance of SPAM command information with associated padding bits; the aforementioned SPAM-header and SPAM-exec register memories; particular SPAM-Flag-monitor-info, SPAM-Flag-at-secondary-control-level, SPAM-Flag-executing-secondary-command, SPAM-Flag-secondary-level-incomplete, SPAM-Flag-primary-level-2nd-step-incomplete, SPAM-Flag-primary-level-3rd-step-incomplete, SPAM-Flag-secondary-level-2nd-step-incomplete, SPAM-Flag-secondary-level-3rd-step-incomplete, SPAM-Flag-first-condition-failed, SPAM-Flag-second-condition-failed, SPAM-Flag-do-not-meter, and SPAM-Flag-working register memories each of which are one bit location in length; the aforementioned SPAM-length-info, SPAM-mm-format, SPAM-first-precondition, SPAM-second-precondition, SPAM-last-01-header-exec register memories; particular SPAM-decryption-mark, SPAM-primary-input-source, SPAM-secondary-input-source, SPAM-next-primary-instruction-address, SPAM-next-secondary-instruction-address, SPAM-executing-secondary-command, SPAM-last-secondary-01-header-exec, SPAM-address-of-next-instruction-upon-primary-interrupt, and SPAM-address-of-next-instruction-upon-secondary-interrupt register memories whose functions are described below; and a plurality of working register memories that include first-working and second-working register memories. (With the exception of the memories whose names include the word "working," all the aforementioned register memories are dedicated strictly to the functions described below and are not used for any other functions.) All preprogrammed information associated with the identification and execution of controlled functions and the aforementioned conventional instructions that control controller, **39**, are preprogrammed at the RAM and/or ROM associated with control processor, **39**J. Examples of said preprogrammed information include relevant information of the aforementioned controlled-function-invoking information, process-length-token instructions, and execute-conditional-overlay-at-205 information (that is part of the aforementioned controlled-function-invoking-@205 information).

Besides being the processor at which all controlled functions of controller, **39**, are invoked, control processor, **39**J, is the processor that controls all controlled apparatus of decoder, **203**, (except for a decryptor, **39**K, described more fully below) and controls all apparatus described above as being controlled by SPAM-controller, **205**C. Control processor, **39**J, controls not only buffers, **39**E and **39**G, valves, **39**F and **39**H, and switch, **39**I, but also processors, **39**B and **39**D, as well as all other apparatus of decoder, **203**, controlled by controller, **39**. Control processor, **39**J, has all required transmission capacity for transmitting control instructions to and receiving control information from all such controlled apparatus. In addition, control processor, **39**J, controls the CPU and the PC-MicroKey 1300 system of microcomputer, **205**, in certain SPAM functions and has capacity, via matrix switch, **39**I, to transmit control information to and receive control information from said CPU and said PC-MicroKey 1300 system. In certain SPAM functions, controller, **20**, of signal processor, **200**, controls control processor, **39**J, and as FIG. **3**A shows, control processor, **39**J, has means for communicating control information directly with said controller, **20**. The RAM and/or ROM associated with control processor, **39**J, are preprogrammed with all information necessary for controlling all such controlled apparatus.

As FIG. **3**A shows, the preferred embodiment of controller, **39**, also has a decryptor, **39**K. Said decryptor, **39**K, is a conventional decryptor that is identical to decryptor, **10**, of signal processor, **200**. Decryptor, **39**K, receives inputted information from matrix switch, **39**I; outputs its information to buffer, **39**H; has means for communicating control information directly with controller, **20**, of signal processor, **200**; and is controlled by said controller, **20**. Decryptor, **39**K, is preprogrammed with relevant SPAM information (e.g., information of H, X, and L) and has capacity for processing SPAM message information if fashions described more fully below.

In the preferred embodiment, to maximize the speed of information transmission, all apparatus of controller, **39**, are located physically on one so-called silicon microchip and communicate with one another, in fashions well known in the art, by means of the circuits of said chip. All apparatus of said chip function, in a fashion well known in the art, at the same clock speed. Said speed may be the speed of the control clock of microcomputer, **205**, communicated to controller, **39**, in an appropriate fashion, well known in the art. Or said speed may be the control clock speed of signal processor, **200**.

Examples #3 and #4 of the combining of the "Wall Street Week" program described above, which relate elaborations of examples #1 and #2, illustrate in detail the operation of the preferred embodiment of controller, **39**.

Operating S. P. Systems

Example #3

First Word

Example #3 differs from example #1 in just two respects.

First, example #3 focuses on selected subscriber stations where signal processing apparatus and methods are used to collect monitor information for so-called "program ratings" (such as so-called "Nielsen ratings") that estimate the sizes of television (or radio) program audiences. In the present invention, subscriber stations can be preprogrammed to process and record monitor information of SPAM commands and transfer said information to one or more remote data collection stations where computers process the monitor information to generate such ratings. In example #3, all apparatus of the subscriber station of FIG. **3** are so preprogrammed, and buffer/comparator, **14**, of signal processor, **200**, operates, in fashions described more fully below, under control of the aforementioned on-board controller, **14**A.

Second, the controller, **39**, of example #3 is the preferred embodiment of controller, **39**, and replaces the controller, **39**, and SPAM-controller, **205**C, of example #1. Insofar as messages addressed to URS microcomputers, **205**, are concerned, the preferred embodiment of controller, **39**, is preprogrammed to perform the controlled functions of the SPAM-controller, **205**C, of example #1. Thus the preprogrammed information at the RAM and/or ROM associated with control processor, **39**J, includes, for example, the execute-at-205, execute-conditional-overlay-at-205, and cease-overlay information and the load-run-and-code, conditional-overlay-at-205, and cease-overlaying-at-205 instructions preprogrammed at SPAM-controller, **205**C, in example #1.

In all other respects example #3 is identical to example #1.

Example #3 begins, like example #1, with divider, **4**, transferring the embedded information of the first message to decoder, **203**. In the same fashion that applied in example #1, receiving said embedded information at decoder, **203**, causes the binary information of said first message to be received, with error correcting information, at decoder, **203**, and detected at digital detector, **34**. Detector, **34**, inputs the detected information to controller, **39**, at buffer, **39**A.

The first step of processing at controller, **39**, takes place at processor, **39**B, where error correction occurs. As said detected information is inputted, buffer, **39**A, receives, buffers, and transfers said information, signal word by signal word, an to processor, **39**B, in a fashion well in the art. Processor, **39**B, receives each word, in turn, with its associated error correcting information and uses the error correcting information, in its forward error correcting fashion, to check the binary information of said word and correct the information of said word, as required, then transfers the correct information of said word to buffer, **39**C, and discards said error correcting information.

The second step of processing is protocol conversion and takes place at processor, **39**D. Buffer, **39**C, receives and buffers the corrected information of each word, in turn, and transfers said information to processor, **39**D. As processor, **39**D, receives said information, in its protocol conversion fashion, processor, **39**B, converts the corrected binary information of each word into converted information that all appropriate subscriber station apparatus can receive and process and transfers the converted information of each word to buffer, **39**E.

As buffer, **39**E, receives the corrected information of each word, buffer, **39**E, buffers and transfers said information to EOFS valve, **39**F, as quickly as said valve, **39**F, is prepared to receive said information. EOFS valve, **39**F, processes said information, in its end of file signal detecting fashion described above, to detect information of an end of file signal and outputs said information to matrix switch, **39**I, as quickly as the apparatus to which said switch, **39**I, transfers said information is prepared to receive said information. As matrix switch, **39**I, receives the converted information of each word, said switch, **39**I, transfers said information to a selected output port of said switch, **39**I. Said selected port is the particular port to which control processor, **39**J, causes said switch, **39**I, to transfer said information.

At the outset of example #3, matrix switch, **39**I, is configured to input the output of EOFS Valve, **39**F, to control processor, **39**J, and control processor, **39**J, awaits header information:

When EOFS valve, **39**F, commences transferring the SPAM information of the first message of example #3, control processor, **39**J, executes a first step of receiving SPAM message information and receives the header information in said first message. Control processor, **39**J, accepts, receives in turn, and records in sequence at particular SPAM-input-signal register memory a particular first quantity of said words. Said first quantity is the smallest number of signal words that can contain one instance of header information (that is, H bits). In the simplest preferred embodiment where a SPAM header is two bits long and signal words are eight-bit bytes, said first quantity is one. Then, automatically, control processor, **39**J, ceases accepting SPAM signal information transferred from EOFS valve, **39**F, and said valve, **39**F, commences holding the next processed signal word of said first message until control processor, **39**J, becomes prepared, once again, to accept and receive SPAM signal information.

Then control processor, **39**J, processes said header information. Automatically, control processor, **39**J, selects information of the first H bits at said SPAM-input-signal memory and records said information of H bits at said SPAM-header memory then compares the information at said SPAM-header memory to the aforementioned 11-header-invoking information that is "11". No match results.

Because control processor, **39**J, and the RAM and ROM associated with said processor, **39**J, are preprogrammed to process the monitor information of SPAM commands to provide viewership data for remote computer processing, not resulting in a match with said 11-header-invoking information causes control processor, **39**J, to execute particular preprogrammed evaluate-message-content instructions before receiving and processing the execution segment information in said first message. Automatically, said instructions cause control processor, **39**J, to compare the information at said SPAM-header memory with preprogrammed invoke-monitor-processing information. A match results with particular "01" information. Said match signifies the presence of meter-monitor information in said first message and causes control processor, **39**J, to enter "0" at particular SPAM-Flag-monitor-info register memory that is normally "1".

Then automatically control processor, **39**J, executes a second step of receiving SPAM signal information and receives the execution segment information in said first message. Automatically, control processor, **39**J, commences accepting and EOFS valve, **39**F, commences transferring additional SPAM signal words. Automatically, control processor, **39**J, receives and records said words in sequence at said SPAM-input-signal memory immediately following the last of said first quantity of signal words until the total quantity of SPAM signal words recorded at said memory equals a particular second quantity. Said second quantity is the smallest number of signal words that can contain one instance of header and execution segment information (that is, H+X bits). (If H+X bits can be contained in one signal word, said second quantity equals said first quantity, and control processor, **39**J, records no additional SPAM signal words in the course of said second step of receiving SPAM signal information.) Automatically, control processor, **39**J, ceases accepting SPAM signal information transferred from EOFS valve, **39**F.

Then control processor, **39**J, processes said execution segment information. Automatically, control processor, **39**J, selects information of the first X bits of information at said SPAM-input-signal memory immediately after the first H bits, records said information of X bits at said SPAM-exec memory, and compares the information at said SPAM-exec memory with controlled-function-invoking information that is preprogrammed at the RAM and/or ROM associated with said processor, **39**J. A match results with the aforementioned execute-at-205 information that is identical to the execute-at-205 information preprogrammed at SPAM-controller, **205**C, of example #1. Said match causes control processor, **39**J, to execute the aforementioned load-run-and-code instructions. Said instructions cause control processor, **39**J, to place "0" at the aforementioned SPAM-Flag-primary-level-2nd-step-incomplete register memory and, separately, at SPAM-Flag-primary-level-3rd-step-incomplete register memory, which information signifies that specific load-run-and-code controlled functions have not been completed, and to place information of a particular reentry-address at the aforementioned SPAM-address-of-next-instruction-upon-primary-interrupt register memory which reentry-address specifies the location of the next decrypt-process-and-meter-current-message instruction to be executed when interrupt information of a detected end of file signal is received by control processor, **39**J, from EOFS valve, **39**F. Then said instructions cause control processor, **39**J, to compare the information at said SPAM-header memory with preprogrammed header-identification information and determine a match with particular preprogrammed "01" information.

Under control of said instructions, said match causes control processor, **39**J, automatically to execute a third step of receiving SPAM signal information and receive the length token information in said first message. Automatically, control processor, **39**J, commences accepting and EOFS valve, **39**F, commences transferring additional SPAM signal words. Automatically, control processor, **39**J, receives and records said words in sequence at said SPAM-input-signal memory immediately following the last of said second quantity of signal words until the total quantity of SPAM signal words recorded at said memory equals a particular third quantity. Said third quantity is the smallest number of signal words that can contain one instance of header, execution segment, and length token information (that is, H+X+L bits). Then, automatically, control processor, **39**J, ceases accepting SPAM signal information transferred from EOFS valve, **39**F.

Automatically, control processor, **39**J, processes said length token information. The RAM and ROM associated with control processor, **39**J, are preprogrammed with all information necessary to determine the length of SPAM commands including information of H, X, L, and H+X; process-length-token, determine-command-information-word-length, evaluate-end-condition, calculate-number-of-words-to-transfer, evaluate-padding-bits-? instructions; and token-comparison, W-token, X-token, Y-token, Z-token, w-bits, x-bits, y-bits, z-bits, A-format, B-format, C-format, and D-format information. Said preprogrammed instructions and information cause control processor, **39**J, to determine the number of signal words of command information in said first message in precisely the same fashion that controller, **39**, determined the number of signal words of command information in the second message in example #2. Automatically, control processor, **39**J, selects information of the first L bits of information at said SPAM-input-signal memory immediately after the first H+X bits and records said information of L bits at SPAM-length-info memory. Said L bits are the length token of said message. Automatically control processor, **39**J, determines that the information at said SPAM-length-info memory matches said W-token information, selects said w-bits information, and processes said information as the numeric value of MMS-L. Automatically, control processor, **39**J, determines the number of signal words in the command information of said second message by adding H+X+L to said w-bits information of MMS-L and dividing the resulting sum by the number of bits in one signal word. Automatically control processor, **39**J, places a "0" at particular SPAM-Flag-working register memory if said command information fills a whole number of signal words exactly and "1" at said memory if it does not. Automatically, control processor, **39**J, then determines a particular number of signal words to transfer and place information of said number at particular working register memory.

Next said load-run-and-code instructions cause control processor, **39**J, to execute a fourth step of receiving SPAM signal information and commence receiving all remaining command information and padding bits in said first message. Automatically, control processor, **39**J, commences accepting and EOFS valve, **39**F, commences transferring additional SPAM signal words. Automatically, control processor, **39**J, receives and records said words in sequence at said SPAM-input-signal memory immediately following the last of said third quantity of signal words until the total quantity of SPAM signal words recorded at said memory equals a particular fourth quantity. Said fourth quantity is the number at said working register memory. Then, automatically, control processor, **39**J, compares the information at said SPAM-Flag-working register memory to particular information that is "0".

Not resulting in a match means that EOFS valve, **39**F, has transferred and control processor, **39**J, has recorded all command information of said first message together with any associated padding bits. Accordingly, not resulting in a match causes control processor, **39**J, to cease accepting SPAM signal information from EOFS valve, **39**F.

On the other hand, resulting in a match means that one full signal word of padding bits may follow the last signal word of said message that contains command information and that said last word must be evaluated to ascertain whether it contains MOVE bit information. Accordingly, under control of said preprogrammed instructions, resulting in a match causes control processor, **39**J, to receive one additional signal word from EOFS valve, **39**F, to compare said word to particular preprogrammed information of one EOFS WORD, and to record said word at said SPAM-input-signal memory immediately following the last of said fourth quantity of signal words. Said word is the last signal word of said message that contains command information. If said word matches said information of one EOFS WORD, one full signal word of padding bits follows said word, and said preprogrammed instructions cause control processor, **39**J, to receive one more signal word from EOFS valve, **39**F, and to record said word at said SPAM-input-signal memory immediately following said last signal word that contains command information. Then, whether or not a match has occurred with said information of one EOFS WORD, said preprogrammed instructions cause control processor, **39**J, to cease accepting SPAM signal information from EOFS valve, **39**F.

By receiving all command information and padding bits in said first message in the course of said four steps of receiving SPAM signal information, control processor, **39**J, causes EOFS valve, **39**F, to transfer every signal word in said first message prior to the first word of the information segment of said first message. Accordingly, the next signal word transferred by said valve, **39**F, is the first word of said information segment, which is the first word of the program instruction set of the "Wall Street Week" combining.

Then said load-run-and-code instructions cause control processor, **39**J, to commence loading information at the main RAM of microcomputer, **205**. Automatically, under control of said instructions, control processor, **39**J, causes matrix switch, **39**I, to cease transferring information from EOFS valve, **39**F, to control processor, **39**J, and to commence transferring information from control processor, **39**J, to the CPU of microcomputer, **205**; transmits an instruction to said CPU that causes said CPU to commence receiving information from matrix switch, **39**I, and loading said information at particular main RAM in a fashion well known in the art; and causes matrix switch, **39**I, to commence transferring information from EOFS valve, **39**F, to said CPU. Automatically, microcomputer, **205**, commences receiving the information of the program instruction set in said first message, beginning with the first signal word of said set, and loads said information at particular main RAM.

Then, while EOFS valve, **39**F, processes the information of the information segment of said first message to detect the end of file signal and while microcomputer, **205**, loads the information of said program instruction set at RAM, said load-run-and-code instructions cause control processor, **39**J, to commence executing the code portion of said instructions. The instructions of said portion cause control processor, **39**J, to compare the information at said SPAM-header memory to particular load-run-and-code-header information that is "01". A match results (which indicates that said first message contains meter-monitor information). Control processor, **39**J is preprogrammed with evaluate-meter-monitor-format, process-this-specific-format, and locate-program-unit instructions and with format-specification information and offset-address information, and said match control processor, **39**J, to locate the "program unit identification code" information in the information at said SPAM-input-signal memory and record information of said "code" information at SPAM-first-precondition register memory in the same fashion that SPAM-controller, **205**C, performed these functions in example #1.

To locate said "code" information, said code portion instructions cause control processor, **39**J, to execute said evaluate-meter-monitor-format instructions. Said instructions cause control processor, **39**J, to select information of bits at particular predetermined locations at said SPAM-input-signal memory and record said information at SPAM-mm-format register memory. Said bits are the bits of the meter-monitor format field in said first message. Then said instructions cause control processor, **39**J, to compare the information at said SPAM-mm-format memory with said format-specification information, determine a match with particular A-format information that invokes particular process-A-format instructions, and execute said instructions. Said instructions cause control processor, **39**J, to place a particular A-offset-address number at said SPAM-mm-format memory (thereby overwriting and obliterating the information previously at said memory) which number specifies the address/location at the RAM associated with control processor, **39**J, of the first bit of information that identifies the specific format of the meter-monitor segment in said first message.

Then said code portion instructions cause control processor, **39**J, to execute the aforementioned locate-program-unit instructions. Said instructions cause controller, **39**J, to add a particular preprogrammed program-unit-field-start-datum-location number to information of said A-offset-address number and record the resulting first sum then add a particular preprogrammed program-unit-field-length-datum-location number to information of said A-offset-address number and record the resulting second sum. Next said instructions cause control processor, **39**J, to select preprogrammed binary information of a particular preprogrammed datum-cell-length number of contiguous bit locations that begin at said first sum number of bit locations after a particular predetermined first-bit location at said RAM and place said binary information at first-working register memory and to select preprogrammed binary information of said datum-cell-length number of contiguous bit locations that begin at said second sum number of locations after said first-bit location and place said binary information at second-working register memory. In so doing, control processor, **39**J, places at said first-working memory information of the bit distance from the first bit location of said SPAM-input-signal memory to the first bit location of said program unit field and places at said second-working memory information of the bit location length of said program unit field. Automatically, control processor, **39**J, selects binary information of the second-working memory information number of contiguous bit locations at said SPAM-input-signal memory that begin at the first-working memory information number of bit locations after the first bit location at said memory. Automatically, control processor, **39**J, places said binary information at said first-working memory. In so doing, control processor, **39**J, selects information of the unique "program unit identification code" that identifies said "Wall Street Week" program.

Then said code portion instructions cause control processor, **39**J, to place at the aforementioned SPAM-first-precondition memory information of said information at first working memory. In so doing, control processor, **39**J, places said "code" at said memory. Then the final instructions of said portion cause control processor, **39**J, place "1" at SPAM-Flag-primary-level-3rd-step-incomplete register memory (thereby overwriting and obliterating the "1" information at said memory), which "1" signifies the completion of the code step executed by said load-run-and-code instructions.

(At stations that are not preprogrammed to collect monitor information, each control processor, **39**J, commences waiting for interrupt information of the end of file signal at the end of said first message from EOFS valve, **39**F, when each completes the code portion of said load-run-and-code instructions.)

The station of FIG. **3** is preprogrammed to collect monitor information, and at any point where the control processor, **39**J, of a station that is not so preprogrammed commences waiting, the control processor, **39**J, of the station of FIG. **3** is preprogrammed automatically to execute particular preprogrammed collect-monitor-info instructions. Said instructions cause control processor, **39**J, of the station of FIG. **3** to compare the information at said SPAM-Flag-monitor-info memory with particular preprogrammed "0" information. A match results. Under control of said instructions, said match causes control processor, **39**J, to cause matrix switch, **39**I, to commence transferring information from control processor, **39**J, to buffer/comparator, **14**, of signal processor, **200**, (while said switch is simultaneously transferring information from control processor, **39**J, to the CPU of microcomputer, **205**); to transfer to said buffer/comparator, **14**, header information that identifies a transmission of monitor information then particular decoder-203 information that is the source mark of said decoder, **203**, (which source mark is binary information that is preprogrammed at control processor, **39**J) then all of the received binary information of said first message that is recorded at said SPAM-input-signal memory; then to cause matrix switch, **39**I, to cease transferring information from control processor, **39**J, to said buffer/comparator; 14. (Said received information is complete information of the first combining synch command, and said information transmitted to buffer/comparator, **14**, is called, hereinafter, the "1st monitor information (#3).") Then control processor, **39**J, enters "1" at said SPAM-Flag-monitor-info memory, signifying completion of the transfer of said 1st monitor information (#3); completes said collect-monitor-info instructions; and commences waiting for interrupt information of end of file signal, transmitted by control transmission means.

In due course, EOFS valve, **39**F, receives the last signal word of the information segment of said first message, which is the last signal word of said program instruction 7 set, and transfers said word, via matrix switch, **39**I, to microcomputer, **205**, which causes microcomputer, **205**, to load said word at said RAM.

Then said valve, **39**F, commences receiving information of the eleven EOFS WORDs that constitute the end of file signal at the end of said first message. Receiving the first EOFS WORD of said eleven causes EOFS valve, **39**F, to commence retaining information of said WORD, in the fashion described above, and to cease transferring information to microcomputer, **205**. Accordingly, microcomputer, **205**, ceases loading information at said RAM. Said valve, **39**F, detects and retains information of the next nine EOFS WORDs in its end of file signal detection fashion. Then, receiving the eleventh and last EOFS WORD of said end of file signal causes EOFS valve, **39**F, to increment the information at the EOFS WORD Counter of said valve, **39**F, by one then determine that the information at said Counter matches the information at the EOFS Standard Length Location of said valve, **39**F, which causes EOFS valve, **39**F, to transmit EOFS-signal-detected information to control processor, **39**J, as an interrupt signal then commence waiting for a control instruction from control processor, **39**J.

Receiving an interrupt signal of EOFS-signal-detected information from an EOFS valve, **39**F or **39**H, while under control of any given set of preprogrammed controlled function instructions causes control processor, **39**J, to execute a so-called "machine language jump" to a predesignated portion of said instructions, in a fashion well known in the art, and execute the instructions of said portion.

In the case of said load-run-and-code instructions, receiving an EOFS-signal-detected interrupt signal causes control processor, **39**J, to jump to and execute the run portion of said instructions. Receiving the EOFS-Signal-detected interrupt signal that the eleventh EOFS WORD of the end of file signal at the end of said first message causes EOFS valve, **39**F, to transmit causes control processor, **39**J, to jump to and execute instructions that begin with that particular one whose locatiOn is identified by the reentry-address information at the aforementioned SPAM-address-of-next-instruction-upon-primary-interrupt register memory. Said instructions are the instructions of said run portion. Automatically, said instructions cause control processor, **39**J, to cause matrix switch, **39**I, to cease transferring information from EOFS valve, **39**F,