

INSERT/DELETE MODIFICATION OF INFORMATION SERVICE MESSAGE

Field of the Invention

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This invention relates in general to wireless communication systems, and more specifically to a method for modifying an information service message previously received by a selective call device.

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Background of the Invention

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A conventional selective call device, e.g., a selective call receiver, or a transmitter and a selective call receiver, is capable of receiving messages from more than one source. Sources are distinguished from each other typically by an address associated with each message. When the address correlates, or matches, a pre-determined address in the selective call device, the selective call device receives and stores the message from a particular source, such as, for example, an information service provider.

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Selective call service systems are capable of sending multiple types of messages including information service messages, such as, news, stock market data, weather forecasts, sport scores, and airline flight information periodically to a subscribing selective call device. Selective call systems that wirelessly transmit an information service message as a sub-message, or topic, embedded within a conventional transport-layer communication protocol are well known. However, there is usually a need to modify previously transmitted information service messages. In general, only a portion of a previously received information service message stored in a selective call device needs to be altered as a result of changed events. For example, an information service may be airline flight information listing current arrivals and departures at a particular airport. When an arrival time of one flight changes, only the arrival time for only that one flight need be updated. It is well known to revise an information service message by transmitting, within an embedded protocol update command, only the portion of the information service message that changed, such as the new arrival time of the flight. It is also well known for a selective call device, in response to such an update command, to replace a pre-existing portion of the information service message with a new portion on a substantially one-for-one basis.

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An information service message may comprise several lines of displayed information. Occasionally, a portion of an information service message needs to be radically modified, such as by decreasing the number of lines that comprise the message. For example, if a user of a selective call device subscribes to listings of current arrivals and departures at a particular airport, each line presented on the display of the device typically pertains to one flight. Each line may contain an airline name, a flight number, a gate number, an arrival or departure time, and other information. However, when an entire line, i.e., all data with respect to a particular flight, needs to be eliminated, known update commands require that the entire line be replaced with other characters such as carriage returns, space characters, or other undisplayable characters in order to maintain the format, or template, of the information service message. However, the prior art requirement of transmitting useless characters to maintain the template disadvantageously wastes memory in the selective call device and can also waste valuable airtime.

Thus, what is needed is a method of removing a portion of an information service message, without replacing the removed portion with any updated data.

Many information service messages are presented on several lines of a display of a selective call device such that each line is pre-sorted in a meaningful sequence according to one of the words or numbers on each line. For example, if a user of a selective call device subscribes to a listing current arrivals and departures at a particular airport, each line of the information service message is typically displayed in chronological order by arrival or departure time. Therefore, when an arrival time of a flight is changed, merely changing the arrival time may result in the listing no longer being in chronological order. To maintain the desired chronological order, an entire line of new data having the airline name, the flight number, the gate number, the new arrival time, and all other related information must be inserted within the message at the proper location. It may be necessary to insert the entire new line into a position within the message where a line had previously not existed. However, known update commands of embedded protocols lack the capability of inserting update data into a message other than by replacing pre-existing data with update data of comparable size.

Thus, what is needed is a method of inserting update data into any location of an information service message, while retaining all portions of the pre-existing message.

Brief Description of the Drawings

FIG. 1 is an electrical block diagram of a selective call system for providing information service messages in accordance with a preferred embodiment of the present invention.

FIGS. 2 - 5 are timing diagrams illustrating the transmission format of the signaling protocol utilized by the selective call system of FIG. 1 in accordance with the preferred embodiment of the present invention.

FIG. 6 is an electrical block diagram of a selective call device in accordance with the preferred embodiment of the present invention.

FIG. 7 is a flow diagram showing steps executed by the selective call device with regard to a delete command and an insert command in accordance with the preferred embodiment of the present invention.

FIG. 8 is an example of an information service message as presented on a display of a selective call device after transmission of an original message command, after transmission of a delete command, and after transmission of an insert command.

FIG. 9 is a flow diagram showing creation of the delete command used to modify an information service message shown in FIG. 8.

FIG. 10 is a flow diagram showing creation of the insert command used to modify an information service message shown in FIG. 8.

FIG. 11 is an example of another information service message as presented on a display of a selective call device after transmission of an original message command, after transmission of a delete command, and after transmission of an insert command.

FIG. 12 is a flow diagram showing creation of the delete command used to modify an information service message shown in FIG. 11.

FIG. 13 is a flow diagram showing creation of the insert command used to modify an information service message shown in FIG. 11.

FIG. 14 is an example of a graphical information service message as presented on a display of a selective call device after transmission of an original message command, after transmission of a delete command, and after transmission of an insert command.

FIG. 15 is a flow diagram showing creation of the delete commands used to modify a graphical information service message shown in FIG. 14.

FIG. 16 is a flow diagram showing creation of the insert commands used to modify a graphical information service message shown in FIG. 14.

FIG. 17 illustrates concatenation of the delete commands of FIG. 15 and the insert commands of FIG. 16.

Description of a Preferred Embodiment

FIG. 1 shows an electrical block diagram of a paging system, or selective call system 100, for generating and transmitting (or broadcasting) a signal, preferably a selective call signal, including a plurality of information services in accordance with a preferred embodiment of the present invention. The functions of the selective call system 100 are preferably implemented within software, for example within a CNET™ Selective Call Terminal that is manufactured by Motorola Inc., of Schaumburg, Illinois. Typically, a subscriber can send a message by using a telephone 102 to initiate a transmission of a selective call message. The telephone 102 couples to the selective call system 100 via a telephone network 104, the operation of which is well known to persons skilled in the art. Similarly, a computer/modem 106 is also coupled to the telephone network 104 to enter information, for example alphanumeric or numeric messages. The telephone network 104 couples to a message receiver 108 that receives the messages to be transmitted (broadcasted) to at least one of a plurality of selective call devices, typically from the public switched telephone network.

According to the preferred embodiment, a plurality of information services 140-146 are coupled to the telephone network 104 which is coupled to a processor 109 via the message receiver 108. Alternatively, the plurality of information services 140-146 can be received via radio frequency signals. At frequent intervals, a provider of an information service sends to the selective call system 100 modifications of previously sent information service messages when there is a need to update information contained in previously sent information service messages.

When the processor 109 receives a modification, it encodes the modification as a message in the form of a selective call signal. Specifically, the processor 109, coupled to the message receiver 108, determines an appropriate protocol, preferably the FLEX™ protocol, and an address to encode the information service. If the processor 109 determines that the message is to be sent via another signal format, it is passed to one of other protocol generators 116. When the processor has determined that the information service messages are to be transmitted on the FLEX protocol, the messages are then encoded and stored in a frame queue buffer 110 that has queues (Frame 0-N queues) for the corresponding frames of the signal. Preferably the number of frames N is one hundred twenty-eight (128). The pre-determined frame identification (ID) of the selective call device 130 corresponding to the message is entered and the message is stored in the corresponding frame queue.

A capacity analyzer and frame ID/cycle generator 112 determine the sequence of frame IDs to be transmitted and analyze the capacity of each frame to determine the cycle value to be used. The capacity analyzer and frame ID/cycle generator 112 is also responsive to other protocols being transmitted. For example, if the expected occurrence of a frame is to be replaced by the transmission of one of the other protocols (thereby diminishing the capacity of the frame), the capacity analyzer and frame ID/cycle generator 112 can account for this with the determined cycle value. A bit and frame sync generator 118 synchronously generates bit and frame synchronization signals. A message formatter 114 determines, in response to the address of a selective call device 130 and the frame queue, a frame in which the message is to be included. The messages are then formatted for transmission. A transmitter 120 accepts signals from message formatter 114, from other protocol generators 116 and from bit and frame sync generator 118, and transmits radio frequency selective call signals to selective call devices via antenna 122 in a manner well known to persons skilled in the art.

FIG. 2 shows a standard protocol format, the FLEX protocol, encoded into one hundred twenty-eight (128) message packets, or frames, 200. Each of the frames 200 is preferably 1.875 seconds in duration and has a preferred base data rate of 6400 bits per second.

Referring to FIG. 3, each frame is comprised of a Bit Sync 302 signal, preferably thirty-two (32) bits of alternating 1, 0 patterns, followed by a Frame Sync #1 304 signal preferably having a pre-determined thirty-two (32) bit word and its thirty-two (32) bit inverse, and a Frame Info 306 signal, preferably one thirty-two (32) bit word having twenty-one (21) variable information bits containing information such as a cycle number and a frame number. The Bit Sync 302 signal provides bit synchronization to the selective call device 130 while the Frame Sync #1 304 signal provides frame synchronization and includes a signal indicative of the data rate of the message information. Following the Frame Info 306 signal is a Frame Sync #2 308 signal. The word following the Frame Sync #2 308 signal is a Block Info 310 signal including information such as the number of priority addresses, an end of block information field, and a vector start field. The words within each of the frames 200 are preferably encoded as 31, 21 Bose-Chaudhuri-Hocquenghem (BCH) code words having twenty-one (21) information bits and ten (10) parity bits generated according to the well-known BCH algorithm. An additional even-parity bit extends the word to a 32, 21 code word. The addresses are located in field 312, the vectors pointing to the messages are located in field 314, and the messages are located in the remaining fields, such as field 316. Generally, all the address signals within the

frame are located in a first portion, or address portion, of the frame, such as in field 312, and all the message signals are located in a subsequent portion, or message portion, of the frame, such as in field 316. It is well known to persons skilled in the art how to locate addresses in a first portion and messages in a second portion of one of the frames 200. Fields 310, 312, 314 and 316 are shown in a vertical orientation to indicate that these words are preferably interleaved in order to improve the immunity of the transmission to burst errors. All binary, and selected alphanumeric, outbound messages in one-way selective call systems, and all binary, and selected alphanumeric, forward channel messages in two-way selected call systems comprise a protocol-defining header, or Status Information Field, followed by a data field. The FLEX protocol is more fully explained in U. S. Patent No. 5,555,183, entitled *Method and Apparatus For Synchronizing To A Synchronous Selective Call Signal*, issued September 10, 1996, to Willard, et al., which is assigned to the assignee of the present invention, and which is hereby fully incorporated by reference herein.

As is well known, a selective call device is pre-programmed with one or more transport-level communication protocol addresses for receiving messages. For example a selective call device 130 is pre-programmed with one FLEX address for receiving personal messages and with a plurality of additional, unique FLEX addresses for receiving each of the plurality of information services 140-146 to which the selective call device subscribes. It is also well known that each information service message received by the FLEX address corresponding to any one information service, e.g., Airport Information 140, of the plurality of information services 140-146 is formatted substantially similarly. A subscriber to one of the information services 140-146 receives original messages, and, thereafter, receives updates to the original messages. Typically, only a relatively small portion of the information within each original message changes with time; therefore, only the relatively small portion need be modified with time. For example, a person who subscribes to Airport Information 140 service usually pre-designates the airport for which the person wishes to receive airline flight information; alternatively, the person automatically receives information for the major airport within any service area to which the user travels. Each airport associated with the Airport Information 140 service is pre-assigned a sub-address, or Topic Number, for arrival flight information and another, different, Topic Number, for departure flight information. It is foreseeable that third and forth Topic Numbers are pre-assigned for international flights. The sub-address, or Topic Number, is separate from the FLEX address. Typically, a sub-message associated with each airport is presented on several lines of a display, each line

containing several types of information, in separate fields, such as: airline name, a flight number, a gate number, an arrival/or departure time, and other information. It is possible to update a portion of an Airport Information sub-message, such as an arrival time, by replacing an old arrival time with a new arrival time using one of the prior art update commands, such as a Sequential Topic Range Update Command or an Itemized Topic List Update Command. These update commands are described more fully in U. S. patent application Serial No. 08/870,048, entitled *Performing Updates To Multiple Information Service Topics Using A Single Command*, filed June 5, 1997, by Nelms et al., assigned to the assignee of the present invention and which is hereby fully incorporated by reference herein. While modification of an existing sub-message through use of the prior art commands is efficient under some circumstances, modification of an existing sub-message through use of a Delete Command in accordance with the invention is more efficient when an existing sub-message is to be shortened by eliminating or erasing therefrom a portion of the existing sub-message. Furthermore, modification of an existing sub-message through use of an Insert Command in accordance with the invention is more efficient than prior art commands when an existing sub-message is to be enlarged by adding thereto a new portion. Other information service messages, such as sport scores and weather, having different FLEX addresses, are modified in a similar fashion. Generally, there is a single FLEX address for each group of Topic Numbers sharing a similarly formatted sub-message.

Referring to FIG. 4, one of the messages, message 316, is illustrated in more detail in accordance with the preferred embodiment of the present invention. Information content from information services 140-146 is encoded within one of the messages, such as message 316, for transmission to a selective call device 130. There are various methods of communication and levels of communication passed to a selective call device 130 from a selective call system 100, and a procedure is needed to identify which application-layer, or embedded, protocol was used by an information service 140-146 to encode the information content contained in such transfers. A Status Information Field 402 identifies that an embedded protocol message 401, preferably a FLEXsuite™ embedded protocol message, as opposed to a regular selective call message, is being transmitted. The term "embedded protocol" means an application-layer communication protocol carried by a transport-layer communication protocol. FLEXsuite comprises several embedded protocols used to transfer applications, i.e., computer programs, and data for use by such applications, over a selective call system 100 that uses the FLEX protocol. When a transmission channel has limited capacity, it is advantageous to use a radio frequency-based

embedded protocol, such as one of the FLEXsuite protocols, rather than one of the more feature-rich, wireline based, prior art protocols. The Status Information Field 402 defines which method among several possible methods of transferring information to a selective call device from the selective call system 100 is used. The Status Information Field is defined as the first eight (8) bits of application-layer information in a FLEXsuite embedded protocol message 401. It should be understood that a message 316 can comprise one or more FLEXsuite embedded protocol messages 401, or sub-messages, in which case, each of the one or more embedded protocol messages has a separate Status Information Field 402. It should also be understood that a message 316 can comprise one or more FLEXsuite embedded protocol messages 401 and one or more regular selective call messages. The purpose of the Status Information Field 402 is to provide to the controller 210 the information needed by the software of the selective call device 130 to correctly process the information content of the associated message field that immediately follows the Status Information Field.

The Status Information Field 402 comprises an application-layer protocol identifier, preferably represented by two hexadecimal digits. Preferably, the application-layer protocol is FLEXinfo™ and the application-layer protocol identifier for FLEXinfo is preferably hexadecimal "80". The absence of the application identifier indicates that the message is a regular selective call message. Alternatively, a different application identifier indicates that the message is a regular selective call message. As can be appreciated from FIG. 4, the Status Information Field is the first portion of the message 316.

Alternatively, a Global Status Information Field (not shown, but substantially similar to the Status Information Field 402) can precede the Status Information Field 402. A Global Status Information Field comprises bytes that form a global identifier and bytes that indicate the size of the global payload. Examples of Global Status Information Fields are compression and scrambling, i.e., encryption. The global identifier is preferably two hexadecimal digits. The global identifier for encryption is preferably "F0". The encryption for FLEXsuite is preferably carried out using the technique taught in U. S. Patent No. 5,283,832, entitled *Paging Message Encryption*, issued February 1, 1994, to Lockhart, Jr. et al., which is assigned to the assignee of the present invention, and which is hereby fully incorporated by reference herein. Multiple global protocols can be concatenated in a single transmission by transmitting successive Global Status Information Fields. Included within the Global Status Information Field is an indication of the FLEXsuite message size, or length, of the FLEXsuite payload (in number of bytes). The indication of the message size allows a

plurality of FLEXsuite messages to be transmitted within a single FLEX message, such as message 316. In the example pictorially represented in FIG. 4, the FLEXsuite message size comprises the bytes within fields 403-409, which, in this example, represent only one FLEXsuite message, i.e., a FLEXinfo command.

5 A selective call device 130 receives an original information service message in conventional ways, preferably through the use of a FLEXinfo Original Message Command (not shown). It should be understood that an information service provider computer 101, preferably located at each provider of the information services 140-146, is programmed to construct original messages using the Original Message
10 Command and modification messages, such as the Insert Command and the Delete Command. Although FIG. 1 shows a single information service provider computer 101 for seven information services 140-146, alternatively, there is a separate information service computer for each information service. Every Original Message Command is transmitted with a single Major Version Number. The information
15 service provider computer 101 sets the value of the Major Version Number. The actual value of the Major Version Number is arbitrary, but for purposes of more easily understanding the invention, it shall be assumed that a first Original Message Number has a Major Version Number of zero. For subsequent, different Original
20 Message Commands addressed to a particular selective call device 130, the information service provider computer 101 increments the Major Version Number by one. Preferably, the Original Message Command does not include any Minor Version Numbers; however, the absence of Minor Version Numbers is interpreted by the information service provider computer 101 and by the selective call device 130 as if
25 each Topic included within the Original Message Command has an associated Minor Version Number of zero. The use of the Major Version Number and the Minor Version Number is described more fully in U.S. patent application Serial No. 08/886,102, entitled *Reliably Updating An Information Service Message*, filed June 30, 1997, by Kampe et al., assigned to the assignee of the present invention, and which is hereby fully incorporated by reference herein.

30 The formatting of an information service message is more fully explained in U. S. patent application Serial No. 08/807,933, entitled *Selective Call Message Formatting*, filed February 28, 1997, by Nelms, et al., assigned to the assignee of the present invention, and which is hereby fully incorporated by reference herein. Battery saving by a selective call device 130 that subscribes to an information
35 service, and a description of FLEXinfo commands related thereto, are more fully described in U. S. patent application Serial No. 08/806,972, entitled *Selective Call Device And Method For Battery Saving During Information Services*, filed February

26, 1997, by Nelms et al., assigned to the assignee of the present invention, and which is hereby fully incorporated by reference herein.

Referring now to FIG. 4, following the FLEXsuite Status Information Field 402, each FLEXinfo command, such as a Delete Command 400, has a unique command identifier, preferably a Command Number 403. The Command Number 403 is preferably an expandable unsigned integer. A Command Content Length 404 specifies the size of the Delete Command, i.e., it specifies the number of bytes from field 405 through field 409, inclusive. The next field in the Delete Command 400 is a Data Translation Identifier 405. The Data Translation Identifier is preferably four (4) bits in length. The Data Translation Identifier 405 identifies which of several data translation algorithms, such as ASCII or Numeric, was used to encode the associated data which is to be erased by the Delete Command 400. The next field is the Major Version Number 406 having a size, or length, of one nibble. The method in accordance with the invention uses the Major Version Number of the Delete Command 400 in substantially the same manner as the Major Version Number is used in the prior art update commands. The controller 210 in the selective call device 130 obtains the sub-message address from a Topic Number 407. For example, if the topic number is ninety-eight (98), then the hexadecimal value "62" appears in the field for Topic Number 407. Each topic has a unique integer associated therewith. When the topic sub-address is not included among any topic sub-addresses of the information services to which the selective call device 130 is subscribed, the selective call device skips to the next command (if there is another command) or can immediately shutdown, i.e., battery save. A single FLEX address is generally pre-selected for each group of Topic Numbers (sub-addresses) sharing a similarly formatted sub-message. The Delete Command 400 is part of an embedded protocol, or application-layer protocol, transmitted by the selective call system 100 within the message portion, such as field 316 of FIG. 3, of a standard transport-layer communication protocol format. The next field in the Delete Command 400 is a Data Offset 408. The Data Offset field contains a number equal to the number of bytes from the beginning of the sub-message to the beginning of the portion that is to be deleted. The next field in the Delete Command is a Delete Length 409. The Delete Length 409 contains a number equal to the number of bytes in the portion that is to be deleted. Together, the Data Offset 408 and the Delete Length 409 form parameters describing a portion of an information service message.

Referring now to FIG. 5, another FLEXinfo command is shown following the FLEXsuite Status Information Field 502. In accordance with the invention, an Insert Command 500 (fields 503-510) has a unique command identifier, preferably a

Command Number **503**. The Command Number **503** is preferably an expandable unsigned integer. A Command Content Length **504** specifies a size of the Insert Command. The value of the Command Content Length is the number of bytes within fields **505-510**, inclusive. The next field in the Insert Command **500** is a Data Translation Identifier **505**. The Data Translation Identifier is preferably four (4) bits in length. The Data Translation Identifier **505** identifies which of several data translation algorithms, such as ASCII or Numeric, was used to encode the associated data which is to be added to the pre-existing sub-message by the Insert Command **500**. ASCII is the preferred data translation algorithm when sending the Insert Command **500** to a selective call device **130**, unless the data is all numeric, in which case Standard Numeric or Financial Numeric is used, or unless the data is graphical, in which case a graphical algorithm is used. The Insert Command **500** uses whichever of the popular four-bit numeric, seven and eight-bit alphanumeric, and eight-bit hexadecimal formats producing the most tightly packed data. Through the use of the Data Translation Identifier **505**, the selective call device **130** can properly convert the message to the format in which the message is stored in a memory element, such as message memory **226**. The next field is the Major Version Number **506** having a size, or length, of one nibble. The method in accordance with the invention uses the Major Version Number of the Insert Command **500** in substantially the same manner as the Major Version Number is used in the prior art update commands. The Topic Number **507** is a field that contains the topic number for the sub-message into which additional data is to be inserted. A Data Offset **508** field contains a number equal to the number of characters from the beginning of the sub-message to the position in the sub-message at which data is to be inserted. A Data Length **509** Field contains a number equal to the number of characters in the portion to be inserted. A Data To Insert **510** field contains the data that is to be inserted into the sub-message by the Insert Command **500**, after being packed according to the Data Translation Identifier **505**.

FIG. 6 shows an electrical block diagram of a selective call device **130** according to the preferred embodiment of the present invention. The selective call device **130** is powered by a battery **234** and operates to receive and to transmit radio frequency signals via an antenna **202**. A receiver **204** is coupled to the antenna **202** to receive the radio frequency signals. A demodulator **206** is coupled to the receiver **204** to recover any information signal present in the radio frequency signals using conventional techniques. The recovered information signal from the demodulator **206** is coupled to a controller **210** that decodes the recovered information in a manner well known to persons skilled in the art. In the preferred embodiment, the

controller **210** comprises a microcomputer, such as a Model MC68HC11PH8 microprocessor manufactured by Motorola, Inc., and comprises a signal processor performing the functions of a decoder that is normally implemented in both hardware and software. The signal processor comprises an address correlator **214** and a
5 decoder **212**, using methods and techniques known to persons skilled in the art. The address correlator **214** checks the recovered information signal from the output of the demodulator **206** for address information and correlates a recovered address with one of a plurality of pre-determined addresses that are stored in a non-volatile memory **220**. After the address correlator **214** determines that the received signal is directed
10 to the selective call device **130**, e.g., by correlating the address in the received signal to one of the pre-determined addresses in the non-volatile memory **220**, the decoder **212** decodes the signal for the application-layer protocol identifier to determine if the message contains a sub-message. Absence of the application-layer protocol identifier in the Status Information Field **402** and **502** (FIGS. 4 and 5) indicates that the
15 message being decoded is a regular selective call message. Conversely, when the application-layer protocol identifier (such as FLEXsuite) is present and when it correlates to an information service application (such as FLEXinfo), the message being decoded is an information service message. The transport-level communication protocol address for an information service is preferably stored in non-volatile
20 memory **220**, while the application-layer protocol identifier, the Command Number **403**, and the topic numbers (or sub-addresses), are preferably stored in a memory **222**.

When the user of the selective call device **130** subscribes to at least one information service, the memory **222** is programmed with the address of each
25 information service and with associated topic numbers (or sub-addresses). Each information service has a unique address and a plurality of unique topic numbers that allows the selective call device **130** to determine when the subscribed information service **140-146** is present within a particular transmission. A topic number can be a short form of an information service address, but preferably a topic number is totally
30 different from an information address while still being able to identify the presence of the information service topic within a particular transmission.

Status information is stored in memory **222** and identifies the information service(s) that the selective call device **130** is programmed to receive. Subsequent to the decoder **212** decoding the presence of an application-layer protocol identifier in
35 the Status Information Field **402**, the decoder decodes the Command Number **403** indicating, for example, that an Insert Command **500** was received.

After receiving, decoding, and storing the selected information service in the message memory 226, the selective call device 130 typically presents at least a portion of the stored message to a user, such as by a display 228, e.g., a liquid crystal display. Additionally, along with receiving, decoding, and storing the information, an alert is presented to the user via an output annunciator 232. The support circuitry 224 preferably comprises a conventional signal multiplexing integrated circuit, a voltage regulator and control mechanism, a current regulator and control mechanism, audio power amplifier circuitry, control interface circuitry, and display illumination circuitry. These elements are arranged to provide support for the functions of the selective call device 130 as requested by a user.

Additionally, the controller 210 determines from the enabled or disabled status information in the memory 222 whether to conserve power upon detection of an address. That is, when a received and recovered address correlates with a pre-determined address in non-volatile memory 220, the controller 210 checks the status information corresponding to the correlated pre-determined address information to determine whether that address is enabled. If the controller 210 determines that the correlated pre-determined address is not enabled, then the decoder 212 is not invoked. Input controls 230 are coupled to the memory 222 and to the user interface 216 for receiving user inputs, including but not limited to programming, manipulating data, and sending commands to the selective call device 130. A selective call device alternatively includes a transmitter 208 for responding to an information service sub-message.

In addition to battery saving when the transport-layer communication protocol address of an information service does not coincide with an address of the selective call device 130, the selective call device 130 can battery save when it determines that an information service message does not contain the particular topics subscribed to by the selective call device 130. In this way, an information service is identified by an information service address and by topic numbers (sub-addresses) that are transmitted with the information service messages to enable a selective call device 130 to determine when a transmission includes the topics (sub-messages) to which it subscribes. Since there are a large number of available information service topics, the battery life would be quickly depleted if the selective call device was required to search all transmissions for an information service 140-146 to which it subscribes. Therefore, by checking for the information service address and the topic number, the selective call device is able to initiate battery saving.

FIG. 7 is a flow diagram 700 showing steps executed by the selective call device with regard to a Delete Command 400 and an Insert Command 500 in

accordance with the preferred embodiment of the present invention. At step 701, the selective call device 130 receives a modification command, such as the Delete Command 400 or the Insert Command 500. Then, the selective call device decodes the Topic Number 407, 507. When the topic sub-address is not included among any topic sub-addresses of the information services to which the selective call device 130 is subscribed, the selective call device skips to the next command, step 706. Next, the selective call device decodes the Major Version Number 406, 506. At step 703, the controller compares the Major Version Number with a current Major Version Number stored in message memory 226. If the Major Version Number 406, 506 is equal to the current Major Version Number, the selective call device decodes the rest of the modification command at step 704; otherwise, the selective call device rejects the update data at step 706. At step 704, data is deleted from or inserted into an information service message, depending, of course, on which command is received. It should be made clear that if a deletion is made from some point other than at the end of a message, software stored in the non-volatile memory 220 will cause the controller 210 to move a remaining portion of the message within the message memory 226 so that the message can be presented contiguously on the display 228. At step 705, the Major Version Number 406, 506 of the sub-message is changed, preferably incremented and preferably incremented by one. Also at step 705, the Minor Version Number of the sub-message is changed, preferably reset to zero.

FIG. 8 shows a sub-message as presented on a display of a selective call device 130 after transmission of an original message command, after transmission of a Delete Command 400, and after transmission of an Insert Command 500. Presentations 801, 802 and 803 are a chronological sequence of presentations on the display of the same selective call device 130 showing current arrivals at a particular airport, similar to what is typically displayed on cathode ray tube monitors at an airport. Presentation 801 is the first or oldest display, typically produced by an Original Message Command sent as a sub-message embedded within a conventional message, alternatively, presentation 801 resulted from an information service message having been previously altered one or more times by one of the prior art update commands or by an Insert Command 500 or by a Delete Command 400. Alternatively, the information service message shown in presentation 801 is sent to the selective call device 130 as a conventional message, not as an embedded sub-message. Presentations 801, 802 and 803 show eleven (11) lines, each line showing twenty-five (25) alphanumeric characters. It should be noted that the information service provider computer 101 has pre-sorted the information shown in presentation 801 according to time, with the earliest arrival time at the top. The fact

that the information service message shown in presentation 801 comprises eleven lines is arbitrary. It is foreseen that the information service message shown in presentation 801 and the other information service message shown herein can comprise any reasonable number of lines consistent with the available message

5 memory 226 of the selective call device 130. For simplicity of illustration purposes only, it is assumed that the display 228 of the selective call device 130 is capable of showing eleven lines. A display of a selective call device would show all lines of an information service message without scrolling only if the display was sufficiently large; otherwise, a lesser number of lines would be shown at any given time.

10 However, the size of the display 228 plays no role in the invention. It is the sub-message stored in the message memory 226 that is of primary important in understanding the invention. The Delete Command 400 and the Insert Command 500 modify the sub-message stored in the message memory, including the size of the sub-message. By assuming the size of the display 228 is sufficiently large to show

15 the entire information service message, as originally sent and after any deletions and insertions, a pedagogical benefit is gained by allowing changes to the sub-message, as it is stored in the message memory 226, to be visualized through the display 228.

Subsequent to the information service message which had produced presentation 801 is received by the selective call device, the information service

20 provider computer 101 constructs a Delete Command 904 (FIG. 9) that will delete the top three (3) lines pertaining to flights "ABC 131", "NOP 79" and "ABC 253" from the pre-existing information service message (presentation 801) because these flights had landed long ago and the information about these flights is stale. Referring now to FIG. 9, the steps followed by the information service provider computer 101

25 to construct, or generate, the Delete Command 904 are illustrated in flow diagram 900. At step 901, the Topic Number "77" of the particular sub-message is set. The value of this Topic Number is arbitrary and distinguishes current airline arrivals at a particular airport from current departures at the same airport and from arrivals at another airport, etc. Also at step 901, the parameters sufficient to identify the portion

30 of the message that is to be deleted are set. In this example, the portion to be deleted is "ABC 131 G1 11:45AM Landed NOP 79 A5 11:51AM Landed ABC 253 G3 11:59AM Landed". There are seventy-five (75) characters in the portion to be deleted. In this example, the first character of the portion to be deleted is twenty-five (25) characters from the beginning of the pre-existing message. At step 902, the

35 value hexadecimal "28", is used as the Command Number 403; however, this is an arbitrary value used to distinguish Delete Commands from other embedded protocol commands. The hexadecimal value "19" is used for the Data Offset 408. The

hexadecimal value "4B" is used for the Delete Length 409. At step 902, the Data Translation Identifier 405 is set to "2", indicating that the portion to be deleted is alphanumeric. The current Major Version Number 406 is set to "1" which must match the Major Version Number of the stored message from which a portion of data is to be deleted. It should be noted that after the selective call device 130 receives and decodes the Delete Command 400, software stored in the non-volatile memory 220 in the selective call device causes the controller 210 to increment the value of the Major Version Number 406 stored in the memory 222 of the selective call device. Preferably, the Major Version Number 406 will be incremented to the value "2".

After the values of all the other fields of the command are determined at step 902, then the Command Content Length 404 is determined, step 903. In this example, there are four (4) bytes in the command after the Command Content Length field; therefore, the value of the Command Content Length 404 is "04" and the complete Delete Command 904 is "28042177194B". The addition of a FLEXsuite Status Information Field 402 value of hexadecimal "80" to the beginning of the Delete Command 904 allows the message "8028042177194B" to be recognized as a FLEXinfo message as opposed to a conventional message. The method in accordance with the invention allows this single Delete Command 904 to be forwarded to the selective call system 100 for wireless transmission to the selective call device 130 as a sub-message embedded within a FLEXsuite message. Presentation 802 shows the information service message after having been acted upon by the Delete Command 904.

Referring now to FIG. 10, the steps followed by the information service provider computer 101 to construct, or generate, an Insert Command are illustrated in flow diagram 1000. At some time subsequent to the transmission of the original information service message, the information service provider computer 101 receives data from one of the information feeds 103 about flights "XYZ 941", "XYZ 875" and "NOP 83", and, as a result, the information service provider computer 101 produces an Insert Command 1005 to cause the insertion of the following alphanumeric data into a specified location in current information service message (presentation 802): "XYZ 941 D1 12:49PM OnTime XYZ 875 D4 12:53PM OnTime NOP 83 A2 12:57PM OnTime". At step 1001, three fields are defined. The Insert Command 1005 has hexadecimal "77" as the Topic Number 507. The Data Offset 508 has a value of two hundred (200) because the first character of the portion to be inserted is two hundred characters from the beginning of the message. In this example, the data length is seventy-five (75) because there are seventy-five characters in the portion to be inserted. At step 1002, the command is composed by the

information service provider computer **101**. The Command Number **503** is preferably hexadecimal "29" for all Insert Commands, although this number is arbitrary. The Command Content Length **504** cannot be determined until the data that is to be inserted is packed at step **1003**. The Data Translation Identifier **505** is "2" indicating that the portion that is to be inserted is alphanumeric. The Major Version Number **506** is "2", indicating that the information service message had been previously modified by another command such as by a Delete Command **400** or by one of the prior art commands. The Topic Number **507** is hexadecimal "77", which corresponds to Arrivals at the particular airport. The Data Offset **508** of two hundred (200) bytes is converted to hexadecimal "C8" which, in turn, is converted into an expandable integer "8148". The Data Length **509** of seventy-five (75) characters is converted to hexadecimal "4B". The Data To Insert **510** is set forth as "XYZ 941 D1 12:49PM OnTime XYZ 875 D4 12:53PM OnTime NOP 83 A2 12:57PM OnTime". At step **1003**, the data that is to be inserted is packed and the Command Content Length is determined to be seventy-one (71) characters. At step **1004**, the Command Content Length is set to a value of hexadecimal "47" and the Insert Command **1005** is completely generated.

Although the Delete Command **904** and the Insert Command **1005** can be transmitted within separate messages, preferably, the Delete Command **904** and the Insert Command **1005** are transmitted together as two sub-messages embedded within one FLEXsuite message. At step **1006**, the two commands are concatenated. The Delete Command **904**, preceded by the FLEXsuite Status Information Field **402**, is placed at the beginning of the Insert Command **1005** and a concatenated message **1007** is produced. Referring again to FIG. 8, presentation **803** shows the information service message after having been acted upon by the Insert Command **1005**.

FIG. 11 is an example of an information service message listing arrivals at an airport that further demonstrate the use of the Delete Command **400** and the Insert Command **500**. Presentation **1101** is shown as presented on a display **228** of a selective call device **130**. It should be noted that the message is pre-sorted according to departure time. Subsequent to the construction of the message that produced presentation **1101**, the information service provider computer **101** receives from one of the information feeds **103** information that flight "XYZ 13" is delayed and is now scheduled to arrive at 12:31 PM. As a result, software in the information service provider computer **101** constructs a Delete Command **1204** (FIG. 12) to delete the entire line "XYZ 13 D4 12:05PM OnTime" from an intermediate position within the message. The construction of the Delete Command **1204** is described in FIG. 12.

At step 1201, the Topic Number 407 is defined as hexadecimal "78". The Data Offset 408 is defined as one hundred twenty-five (125) because the first character of the portion that is to be deleted is one hundred twenty-five characters from the beginning of the message. The data length is defined as twenty-five (25) because the portion that is to be deleted is twenty-five characters long. At step 1202, the command is composed. The Command Number 403 is hexadecimal "28". The Data Translation Identifier 405 is "2". The Major Version Number 406 is "1". The Data Offset k is hexadecimal "7D". The Delete Length 409 is found to be hexadecimal "19". At step 1203, the Command Content Length 404 is found to be "04", meaning that there are four bytes in the part of the command following the Command Content Length field. The completed Delete Command 1204, six (6) bytes in length, is "280421787D19". The information service provider computer 101 forwards Delete Command 1204 to the selective call system 100. The selective call system 100 wirelessly transmits Delete Command 1204 to a selective call device 130 as an embedded sub-message, preferably with an Insert Command and other sub-messages, within a conventional message of a standard transport-layer communication protocol format. After receiving and decoding the Delete Command 1204, the selective call device 130 deletes the line "XYZ 13 D4 12:05PM OnTime" and moves the succeeding lines from their former memory locations to new locations so that the memory locations formerly occupied by the deleted line are now occupied by one of the succeeding lines of the message, thereby producing presentation 1102 (FIG. 11). In addition, the selective call device 130 changes (preferably increments by one) the value of the Major Version Number stored in memory 222. Therefore, in this example, the value of the Major Version Number is changed from "1" to "2" as a result of Delete Command 1204. Software in the selective call device 130 prevents the selective call device from responding to any subsequent modification commands, such as an Insert Command, unless the subsequent modification command has the same value Major Version Number as the value stored in memory 222.

Referring now to FIG. 13, subsequent to the construction of the message that produced presentation 1101, the information service provider computer 101 constructs an Insert Command 1305 to cause the insertion of the line "XYZ 13 D4 12:31PM Delayd" at an appropriate position in the message. At step 1301, the fields are defined. The Topic Number 507 is hexadecimal "78". The Data Offset 508 is one hundred fifty (150) because the first character of the portion that is to be inserted is one hundred fifty characters from the beginning of the message. The data length is twenty-five (25) because there are twenty-five characters in the portion that is to be inserted. At step 1302, the command is composed. The Command Number 503 is

hexadecimal "29" for all Insert Commands. The Data Translation Identifier 505 is "2". The Major Version Number is "2". The selective call device 130 will accept this command because in this example it is assumed that the current value of the Major Version Number is "2". The Data Offset 508 of one hundred fifty (150) bytes is hexadecimal "96" which, in turn is converted into an expandable integer "8116". The Data Length 509 of twenty-five (25) bytes is converted to hexadecimal "19". The Data To Insert 510 is "XYZ 13 D4 12:31PM Delayd". At step 1303, the Data To Insert 510 is packed as

"B166D2040C59A088D103164E99B1A135044CBB30F9C8"

and the Command Content Length 504 is determined to be twenty-seven (27) bytes. At step 1304, the Command Content Length 504 is set to a value of hexadecimal "1B", and the Insert Command 1305, twenty-nine (29) bytes, is completely generated. At step 1306, the Delete Command 1204 and the Insert Command 1305 are concatenated. The Delete Command 1204, preceded by the FLEXsuite Status Information Field 402, is placed at the beginning of the Insert Command 1305 and concatenated sub-message 1307 is produced. Referring again to FIG. 11, presentation 1103 shows the information service message after having been acted upon by the Insert Command 1305. Modifying presentation 1101 using a Delete Command and an Insert Command to produce presentation 1103 advantageously uses fewer bytes as compared to performing the same modification using a prior art command. Using a prior art Sequential Topic Range Update Command would disadvantageously require one command having a size of fifty-one (51) bytes. Using the concatenated Delete Command 1204 and Insert Command 1305 in accordance with the invention uses only thirty-six (36) bytes. Preferably, after receiving a communication from one of the information feeds 103 necessitating a modification, the information service provider computer 101 constructs, using software instructions, all commands utilized in each of the possible methods of producing the desired modification from a repertoire of stored FLEXinfo commands. Then, the information service provider computer 101 compares the total number of bytes used in each method, and chooses the method with the fewest bytes.

The method in accordance with the invention is also applicable to graphical messages. Referring now to FIG. 14, an example of a graphical information service message, as presented on a display 228 of a selective call device 130, is the chart shown in presentations 1401, 1411 and 1421. The jagged line 1402, 1412 and 1422 within the chart may, for example, represent variations in a price of a stock over a period of time, with the horizontal axis representing time, and with the numbers representing hours, i.e., "11" represents 11:00 AM. The distances between

each hash mark on the horizontal axis represent five-minute periods. The vertical axis represents the price of the stock, with the numbers representing a money quantity, such as dollars, i.e., "75" represents \$75.00. For the purpose of easily understanding the invention, it is assumed that the image area of the chart is forty-eight (48) pixels vertically and one hundred forty (140) pixels horizontally. Therefore, the chart can be shown on a display of size 48 x 140 pixels. The chart can also be shown on a display having a larger number of pixels, however, in such case the chart retains the size of 48 x 140 pixels and does not fill such display.

Alternatively, a display 228 of any size, having any number of pixels, is used, and a chart of any convenient size is selected.

Each dotted-line box shown within the chart has a size of eight (8) pixels vertically by fifteen (15) pixels horizontally, except that the six (6) dotted-line boxes on the far left of the chart each has a size of eight (8) pixels vertically by twenty (20) pixels horizontally. The dotted-line boxes show pre-defined portions of the chart that can be deleted or inserted by the Delete Command 400 and by the Insert Command 500, respectively, in accordance with the invention. It should be understood that the dotted-line boxes are not shown on the display 228 of a selective call device 130 when the chart is presented. The dotted-line boxes are shown in the drawing solely as an aid to understanding the invention. It should be noted that the six (6) larger dotted-line boxes on the far left of the chart contain the vertical axis and vertical axis numerals, which generally will not change as the presentations 1401, 1411 and 1421 change, because the jagged line 1402, 1412 and 1422 is always to the right of the larger dotted-line boxes. The size and number of dotted-line boxes are selected for convenience; the method in accordance with the invention is applicable to other sizes and numbers of dotted-line boxes.

Preferably, a Motorola Paging Graphical Format is used, and the data required for determining the size of the chart, and other miscellaneous data, are in a graphic header having a size of six (6) bytes. Preferably, each pixel is one bit, although the method in accordance with the invention can be used where each pixel is composed of more than one bit. The first visible pixel in a graphical information service message, such as the chart of presentations 1401, 1411 and 1421, is conveyed in a seventh byte of message data of an information service sub-message. Accordingly, insertion or deletion of the first visible pixel of a graphical information service message would have a Data Offset 408, 508 of value "6". Indeed, the first eight (8) pixels would have a Data Offset value of "6", as pixels are inserted or deleted by bytes of eight (8) vertical pixels. Preferably, the byte of eight vertical pixels having a Data Offset 408, 508 of value "6" is located in the upper-left corner of the display 228.

It shall be assumed that the shape of the jagged line **1402**, **1412** and **1422** is updated every five (5) minutes. Typically, a chart (not shown) can be produced by a prior art Original Message Command, and then modified at five minute intervals by prior art update commands to produce the chart shown in presentation **1401**. It

5 should be appreciated that the jagged line **1402** reflects variations in a stock price from 10:15 AM until 12:15 PM. It should also be appreciated that only a limited space in a selective call device memory element, such as message memory **226**, is allocated for storing any one information service message, such as the graphical information service shown in presentation **1401**, **1411** and **1421**. The chart shown
10 in presentation **1401** represents a full allocation of space in the message memory **226** for this Topic Number **407**, **507**. Therefore, an oldest portion of the chart shown in presentation **1401** must be deleted before a newest portion can be stored.

Advantageously, the Delete Command **400** in accordance with the invention is used to erase the left portion **1403** of the chart, including the three left-most segments of
15 the jagged line **1402**, representing the oldest fifteen (15) minutes of stock prices.

FIG. 15 is a flow diagram **1500** showing creation of the Delete Commands **1504-1509** used to modify the information service message shown in presentation **1401** of FIG. 14. At step **1501**, it can be seen that the Topic Number **407** for the information service message of FIG. 14 is hexadecimal "99". The steps **1501-1503**
20 are substantially similar to steps **901-903** in flow diagram **900** of FIG. 9 and to steps **1201-1203** in flow diagram **1200** of FIG. 12. It should be appreciated that six (6) Delete Commands are used to erase the left portion **1403**. Each of the six Delete Commands corresponds to one of the six dotted-line boxes within the left portion **1403**. For reasons not needed to be fully explained to understand this
25 invention, the bottom dotted-line box is deleted first; therefore, Delete Command **1504** is generated first. Secondly, the dotted-line-box above the bottom dotted-line box is deleted by Delete Command **1505**, etc. Finally, the top dotted-line box is deleted by Delete Command **1509**. After receiving and decoding Delete Commands **1504-1509**, the selective call device erases from message memory **226** the data
30 corresponding to the left portion **1403** of the chart. Presentation **1411** shows the graphic information service message of presentation **1401** (reflecting the contents of message memory **226**) after having been acted upon by the Delete Commands **1504-1509**.

Advantageously, the Insert Command **500** in accordance with the invention is
35 used to add a right portion **1413** of the chart, including a right segment **1423** of the jagged line **1422** representing a newest five (5) minutes of stock prices. FIG. 16 is a flow diagram **1600** showing creation of the Insert Commands **1605-1610** used to

modify the information service message shown in presentation 1411 of FIG. 14. The steps 1601-1604 are substantially similar to steps 1001-1004 in flow diagram 1000 of FIG. 10 and to steps 1301-1304 in flow diagram 1300 of FIG. 13. It should be appreciated that six (6) Insert Commands are used to add the right portion 1413. Each of the six Insert Commands corresponds to one of the six dotted-line boxes within the right portion 1423. For reasons beyond the scope of this invention, the top dotted-line box is added first; therefore, Insert Command 1605 is generated first. Secondly, Insert Command 1606 is generated, and the dotted-line-box below the top dotted-line box is added, etc. Finally, the bottom dotted-line box is added by Insert Command 1610. After receiving and decoding Insert Commands 1605-1610, the selective call device 130 adds to message memory 226 the data corresponding to the right portion 1413 of the chart. Presentation 1421 shows the graphic information service message of presentation 1411 after having been acted upon by the Insert Commands 1605-1610. In accordance with the invention, one Delete Command and one Insert Command is used for removing and adding, respectively, the portion of the chart within each dotted-line box.

FIG. 17 illustrates a step 1701 which concatenates the Delete Commands 1504-1509 of FIG. 15 and the Insert Commands 1605-1610 of FIG. 16 to form a concatenated command 1702. The step 1701 is substantially similar to step 1006 of FIG. 10 and to step 1306 of FIG. 13.

Advantageously, the method in accordance with the invention does not require any change in pre-existing selective call systems or in the pre-existing transport-level paging protocols.

While a detailed description of the preferred embodiments of the invention has been given, it should be appreciated that many variations can be made thereto without departing from the scope of the invention as set forth in the appended claims. For example, because a single FLEX address is generally pre-selected for each group of Topic Numbers (sub-addresses) sharing a similarly formatted sub-message, the Delete Command 400 (and analogously, the Insert Command 500) can be revised such that only one Delete Command is needed to modify multiple fields of multiple sub-messages, that is, multiple fields of multiple information service topics. In addition, although the Motorola Paging Graphical Format was used in the example, the Delete Command 400 and the Insert Command 500 can be used with other uncompressed graphical formats, such as the Windows Bitmap Format (.BMP), the Graphics Interchange Format (.GIF), the Tag Image File Format (.TIF or .TIFF), and the

X Pixmap Format (.XPM). Moreover, the invention is not limited for use with the FLEX transport-level radio paging protocol, but can be used with other paging protocols. Also, the invention is not limited for use with a wireless selective call protocol, but can be used with any wireless protocol. Further, the invention is not
5 limited for use with wireless protocols, but can be used with wireline protocols.

We claim:



CLAIMS

1. In a selective call device comprising a processor coupled to a memory element, the selective call device configured to receive signals transmitted in a standard transport-layer communication protocol format, each signal comprising an address portion and a message portion, the message portion comprising at least one information service message, a method of modifying information service messages stored in the memory element comprising the steps of:

(a) receiving a signal comprising an information service message and storing the information service message in the memory element;

(b) subsequent to step (a), receiving an insert command as a sub-message within the message portion of said standard transport-layer communication protocol format, the insert command comprising an addition to the information service message and also comprising parameters specifying a location in the information service message;

(c) determining whether the selective call device is permitted to receive the addition; and

(d) in response to the step of determining, modifying the memory element in a manner dependent upon the addition and upon the insert command, such that the size of the information service message is increased by an amount substantially equal to the size of the addition.

2. The method of claim 1, in which the step of modifying comprises inserting the addition into a location of the information service message specified by the parameters, and storing the addition in the memory element.



3. In a selective call device comprising a processor coupled to a memory element, the selective call device configured to receive signals transmitted in a standard transport-layer communication protocol format, each signal comprising an address portion and a message portion, the message portion comprising at least one information service message, a method of modifying information service messages stored in the memory element comprising the steps of:

(a) receiving a signal comprising an information service message and storing the information service message in the memory element;

(b) subsequent to step (a), receiving a delete command within the message portion of said standard transport-layer communication protocol format, the delete command comprising parameters describing a portion of the information service message, the portion having a size;

(c) determining whether the selective call device is permitted to receive the delete command; and

(d) in response to the step of determining, modifying the memory element in a manner dependent upon the parameters and upon the delete command, such that the size of the information service message is decreased by an amount substantially equal to the size of the portion.

4. The method of claim 3 in which the step of modifying comprises erasing from the memory element the portion of the information service message described by the parameters.



5. In a selective call device comprising a processor coupled to a memory element, the selective call device configured to receive a signal transmitted in a standard transport-layer wireless selective call communication protocol format, the signal comprising an address portion and a message portion, a method of modifying a message stored in the memory element comprising the steps of:

(a) receiving a signal comprising a message and a major version number and storing the message and the major version number in the memory element;

(b) subsequent to step (a), receiving a delete command within the message portion of said standard transport-layer wireless selective call communication protocol format, the delete command comprising parameters for deleting a portion of the message;

(c) determining from the major version number of the signal whether the selective call device is permitted to receive the delete command, including comparing the major version number received in step (a) with the major version number received in step (b); and

(d) erasing a portion of the memory element in a manner dependent upon the parameters, wherein a portion of the memory element is erased only when the major version number received in step (a) equals the major version number received in step (b).



6. In a selective call device comprising a processor coupled to a memory element, the selective call device configured to receive a signal transmitted in a standard transport-layer wireless selective call communication protocol format, the signal comprising an address portion and a message portion, a method of modifying a message stored in the memory element comprising the steps of:

5 (a) receiving a signal comprising a message and a major version number and storing the message and the major version number in the memory element;

(b) subsequent to step (a), receiving an insert command within the message portion of said standard transport-layer wireless selective call communication protocol format, the insert command comprising an addition to the message;

10 (c) determining from the major version number of the signal whether the selective call device is permitted to receive the insert command, including comparing the major version number received in step (a) with the major version number received in step (b); and

15 (d) adding the addition to the memory element in a manner dependent upon the insert command, wherein the addition is added to the memory element only when the major version number received in step (a) equals the major version number received in step (b).



7. In a selective call device comprising a processor coupled to a memory element, the selective call device configured to receive a signal transmitted in a standard transport-layer wireless selective call communication protocol format, the signal comprising an address portion and a message portion, the message portion comprising at least one sub-message and at least one associated sub-address, a method of modifying sub-messages stored in the memory element comprising the steps of:

(a) receiving a signal comprising a sub-message and an associated sub-address and storing the sub-message and the associated sub-address in the memory element;

(b) subsequent to step (a), receiving an insert command within the message portion of said standard transport-layer wireless selective call communication protocol format, the insert command comprising a major version number, a sub-address, and an addition to the sub-message, the sub-address corresponding to a corresponding sub-message;

(c) determining from the major version number of the insert command whether the selective call device is permitted to receive the addition; and

(d) in response to the step of determining, changing the value of the major version number, and modifying the memory element in a manner dependent upon the associated sub-address of the sub-message, and the insert command.



8. In a selective call device comprising a processor coupled to a memory element, the selective call device configured to receive a signal transmitted in a standard transport-layer wireless selective call communication protocol format, the signal comprising an address portion and a message portion, the message portion comprising at least one sub-message and at least one associated sub-message, a method of modifying sub-messages stored in the memory element comprising the steps of:

(a) receiving a signal comprising a sub-message and an associated sub-address and storing the sub-message and the associated sub-address in the memory element;

(b) subsequent to step (a), receiving a delete command within the message portion of said standard transport-layer wireless selective call communication protocol format, the delete command comprising a major version number, a sub-address and parameters describing a portion of the sub-message, the sub-address corresponding to a corresponding sub-message;

(c) determining from the major version number of the delete command whether the selective call device is permitted to receive the delete command; and

(d) in response to the step of determining, changing the value of the major version number, and modifying the memory element in a manner dependent upon the associated sub-address of the sub-message, and the delete command.

9. In an information service provider computer transmitting messages to a selective call system, the selective call system forwarding the messages to a selective call device as sub-messages, a method of transmitting a series of modification messages from the information service provider computer to the selective call system, each modification message modifying a sub-message stored in a memory element of the selective call device, the sub-message having a version number, each modification message having a version number, comprising the steps of:

(a) pre-setting a current value of the version number;

(b) transmitting to the selective call system a modification message comprising the current value of the version number;

(c) changing the current value of the version number; and

(d) repeating step (b) and then step (c) until each modification message in the series of modification messages is transmitted.

10. The method of claim 9, in which the modification message is at least one of a delete command and an insert command.

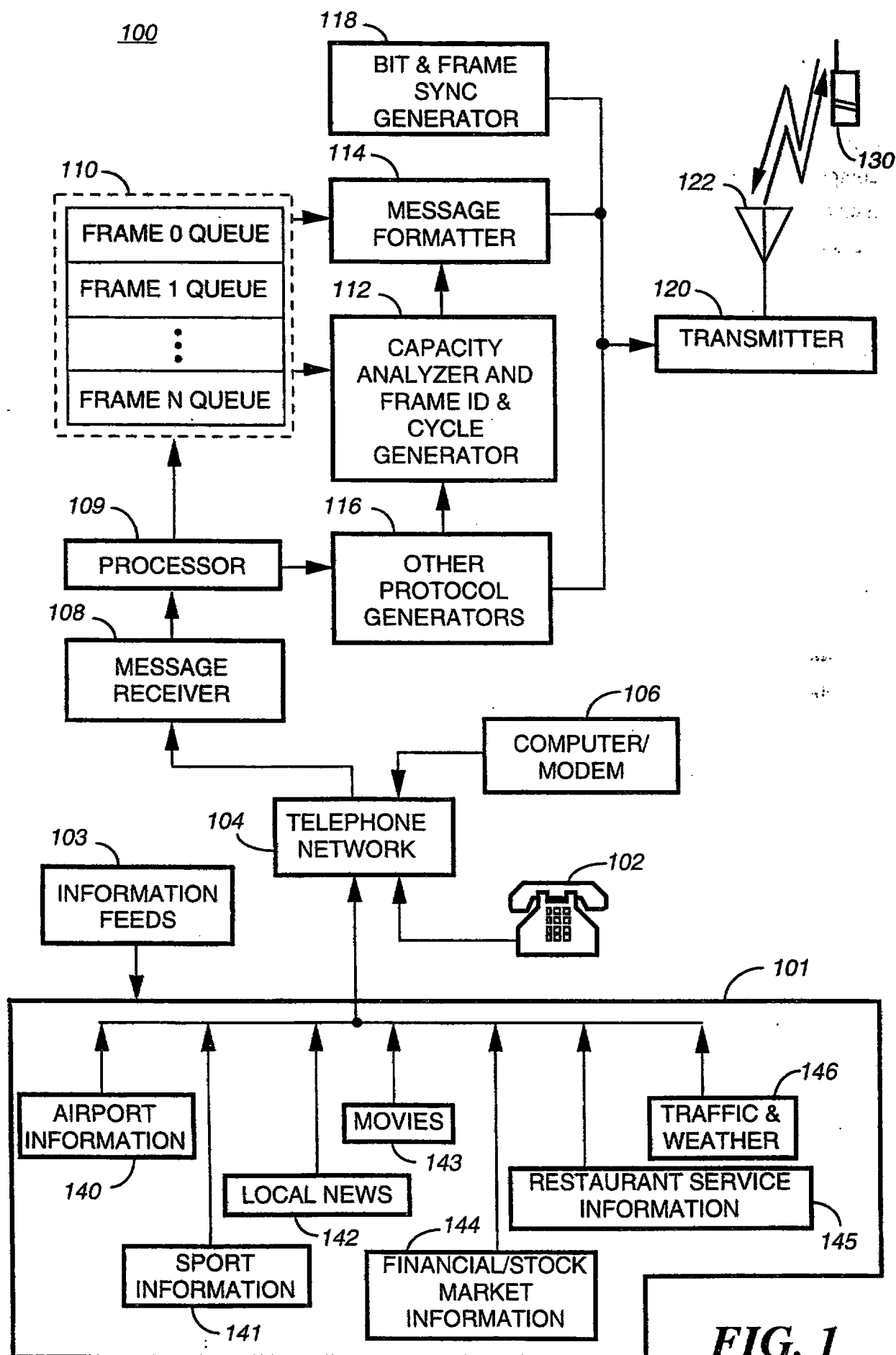
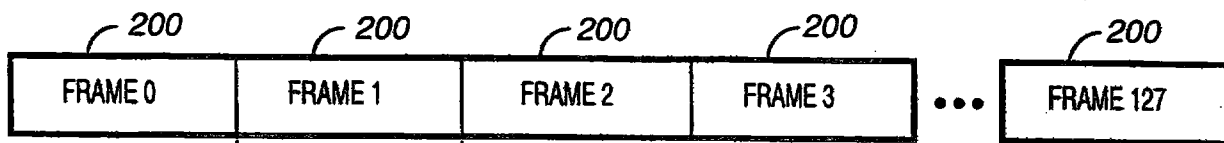
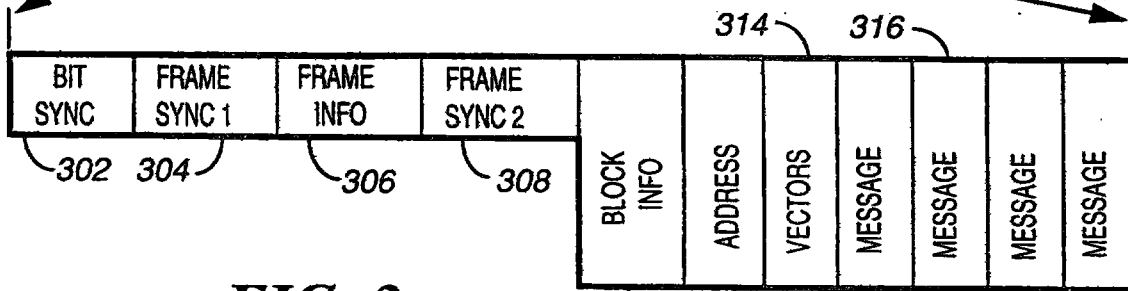
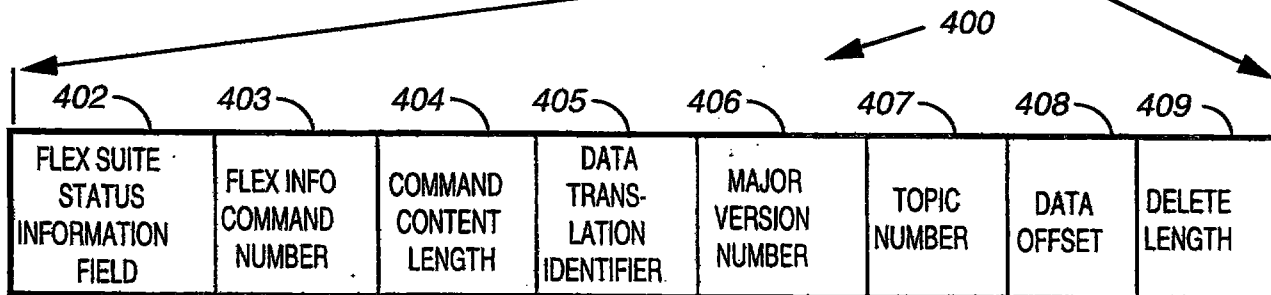


FIG. 1

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**FIG. 2****FIG. 3****FIG. 4** 401

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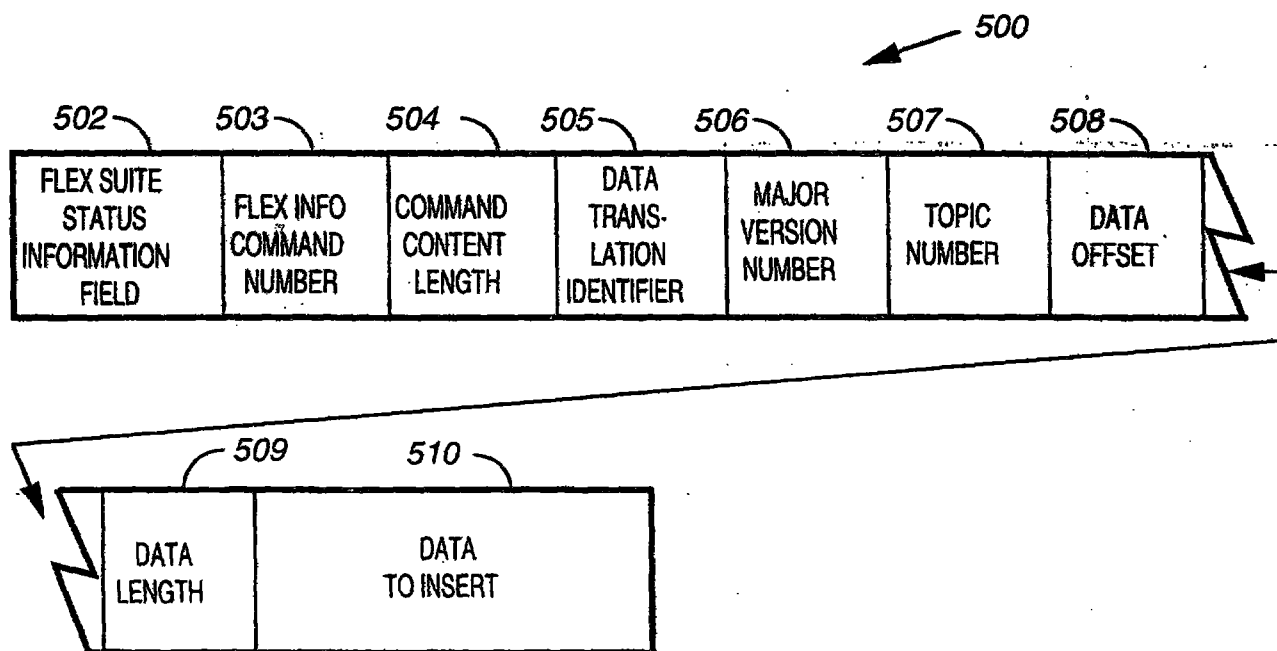
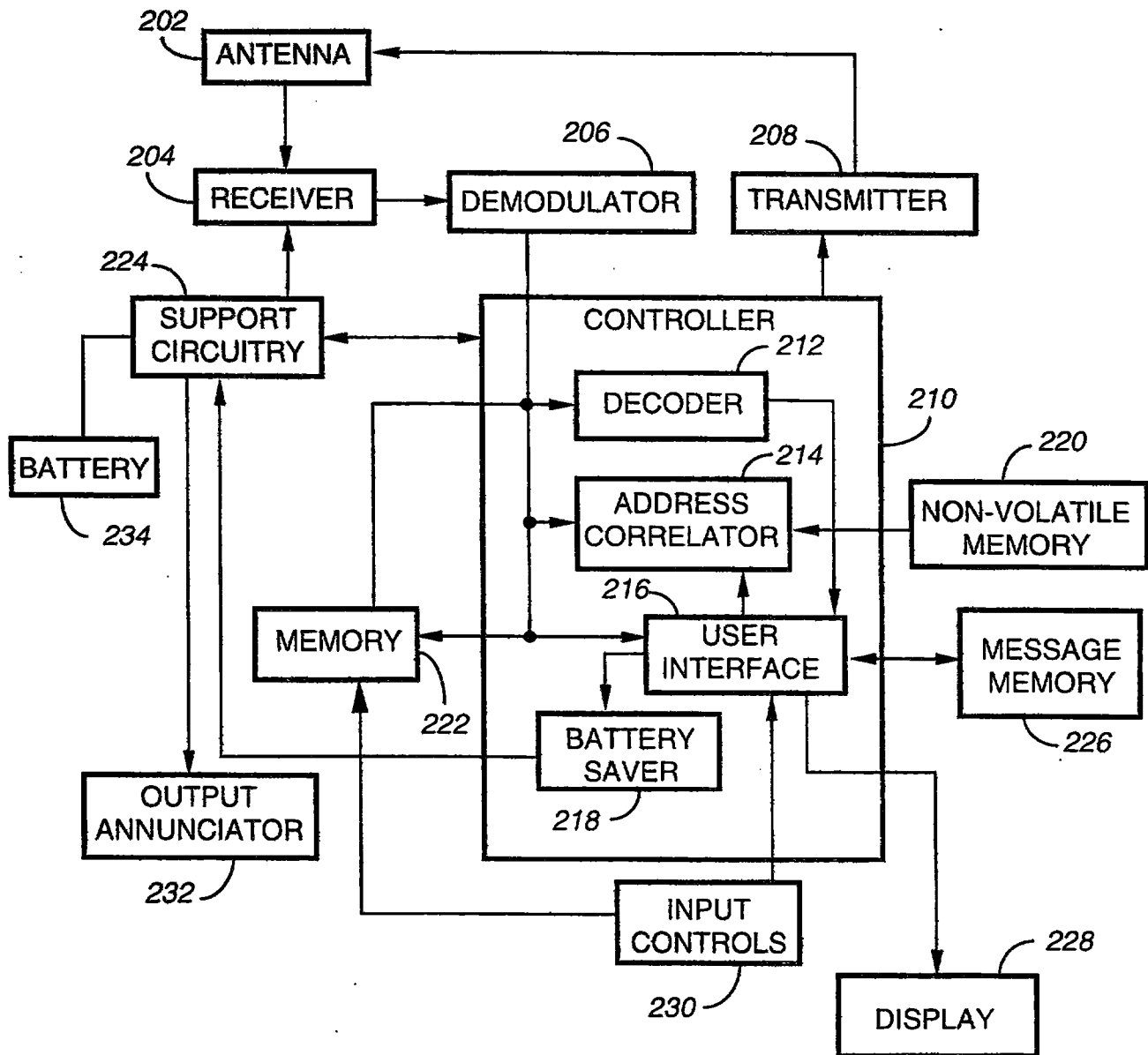


FIG. 5

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130**FIG. 6**

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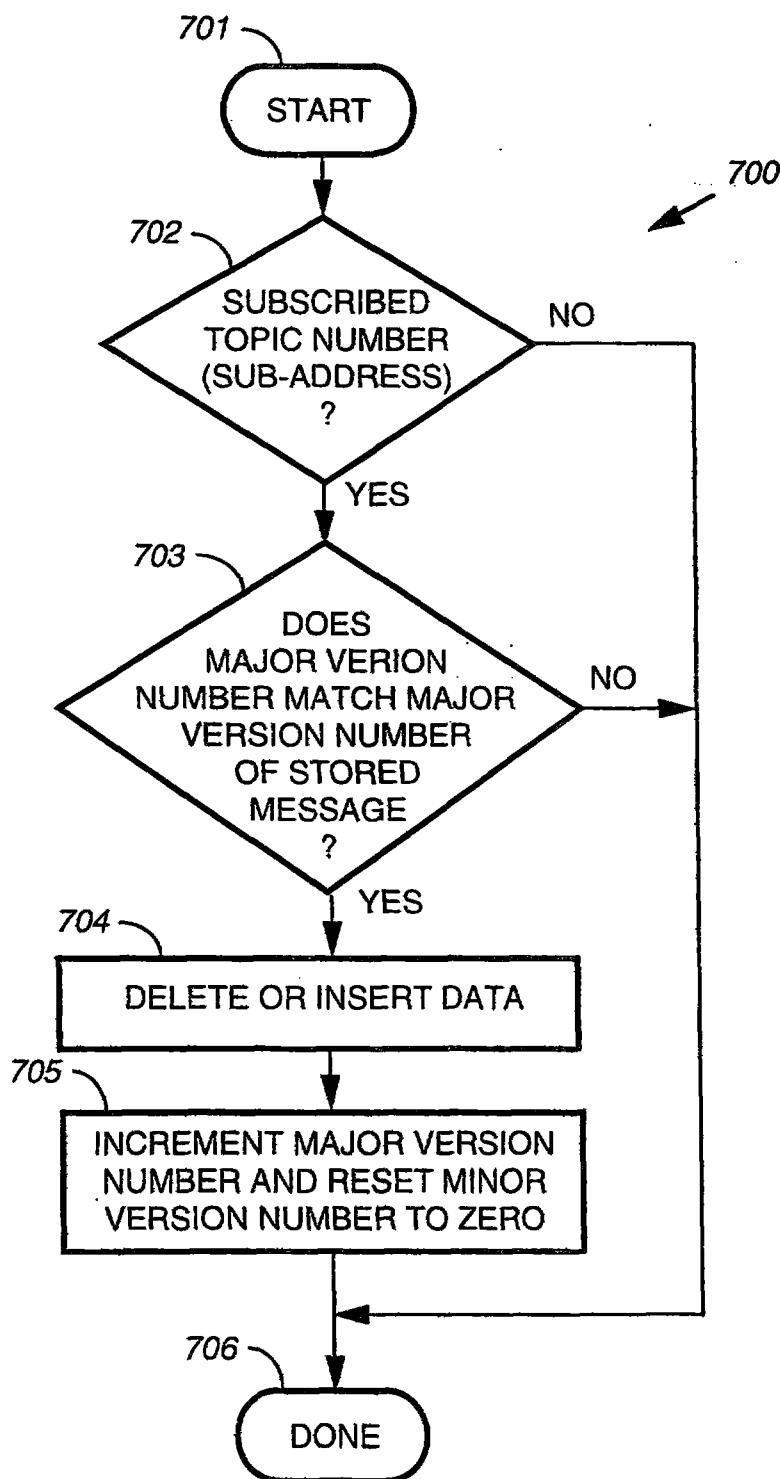


FIG. 7

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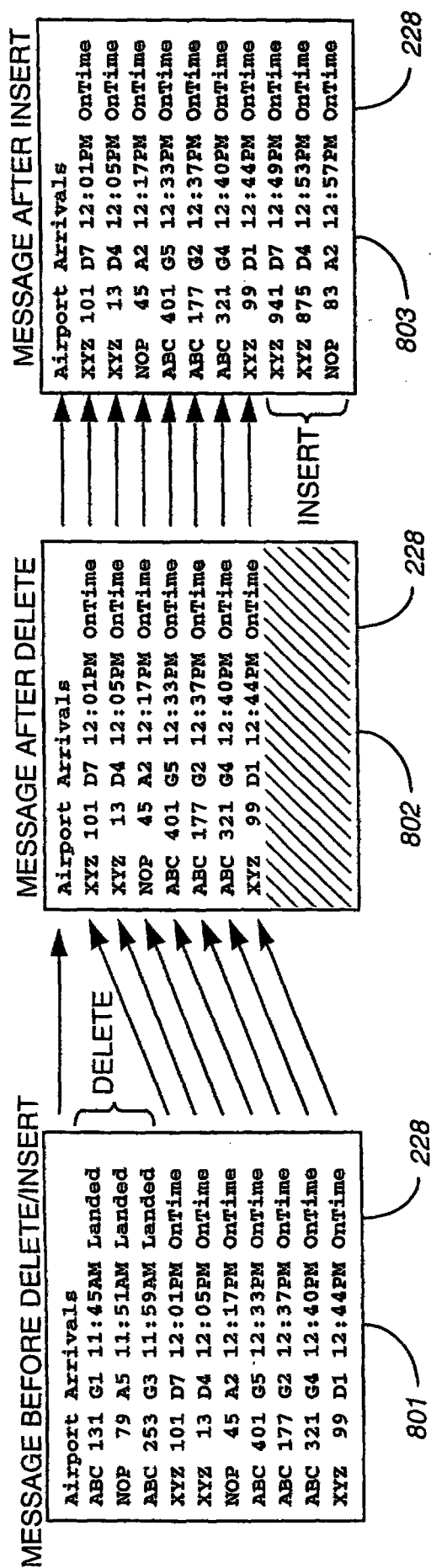
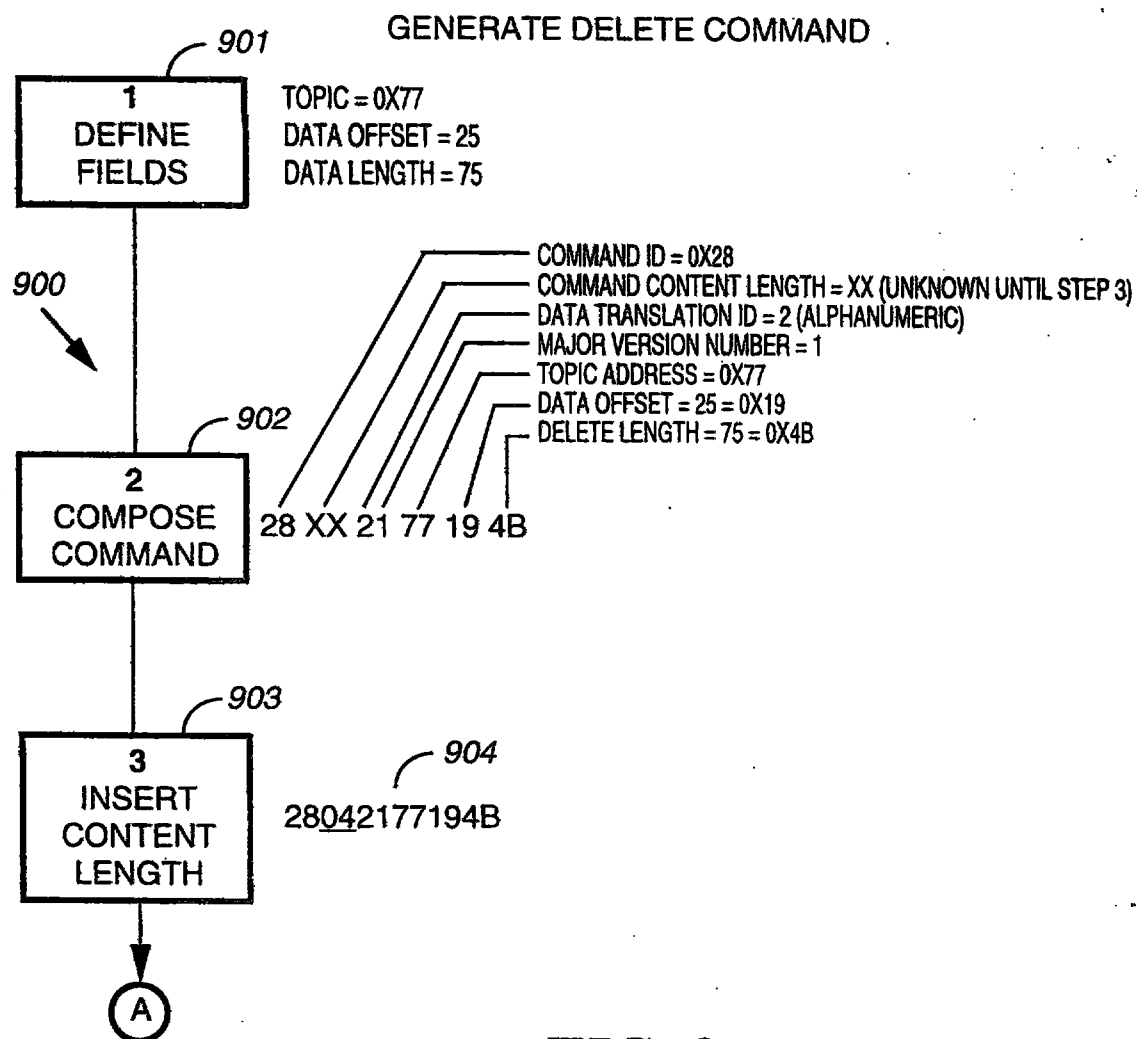


FIG. 8

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**FIG. 9**

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GENERATE INSERT COMMAND

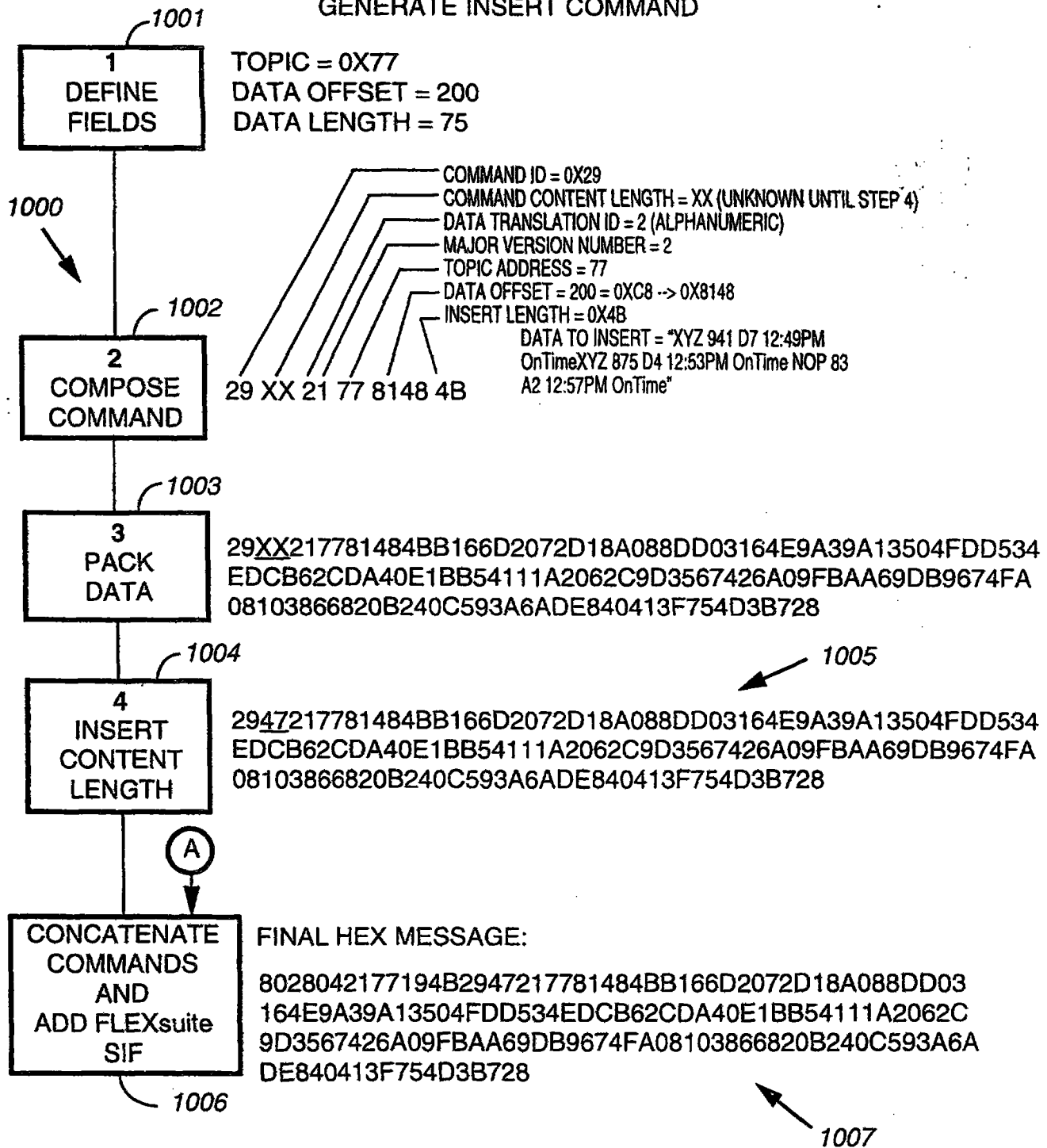


FIG. 10

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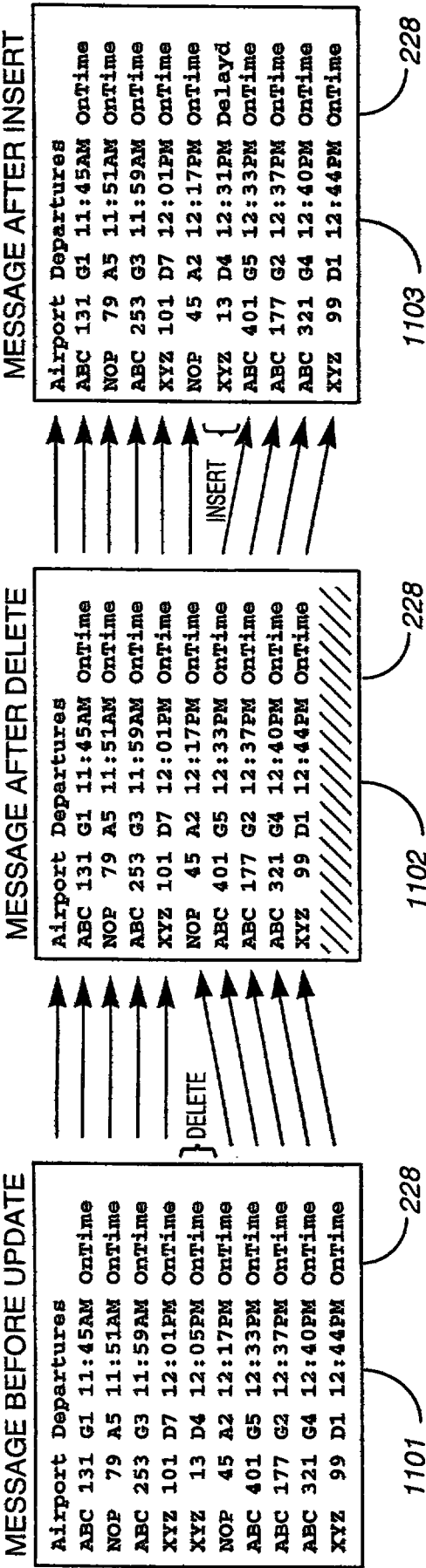
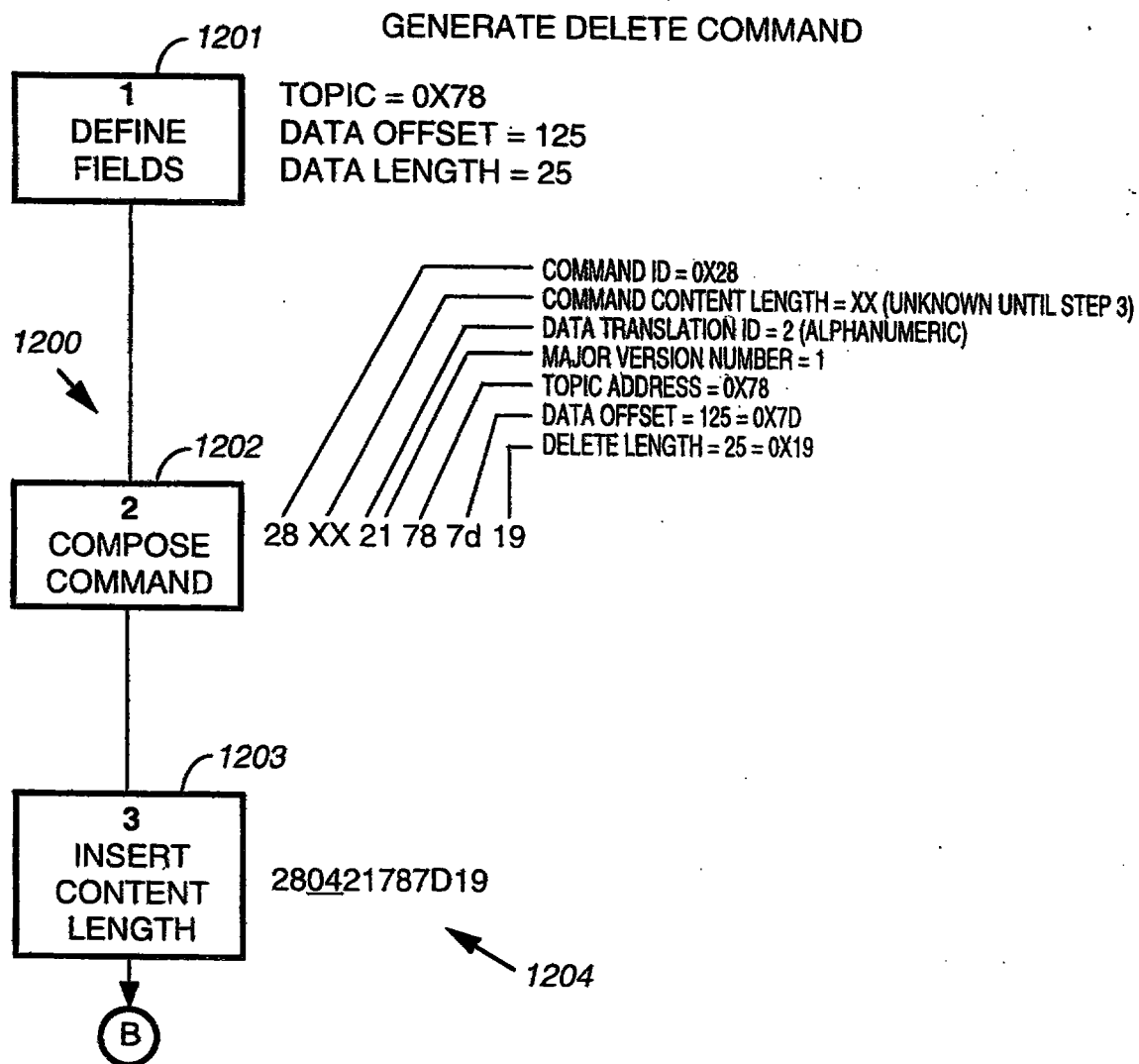
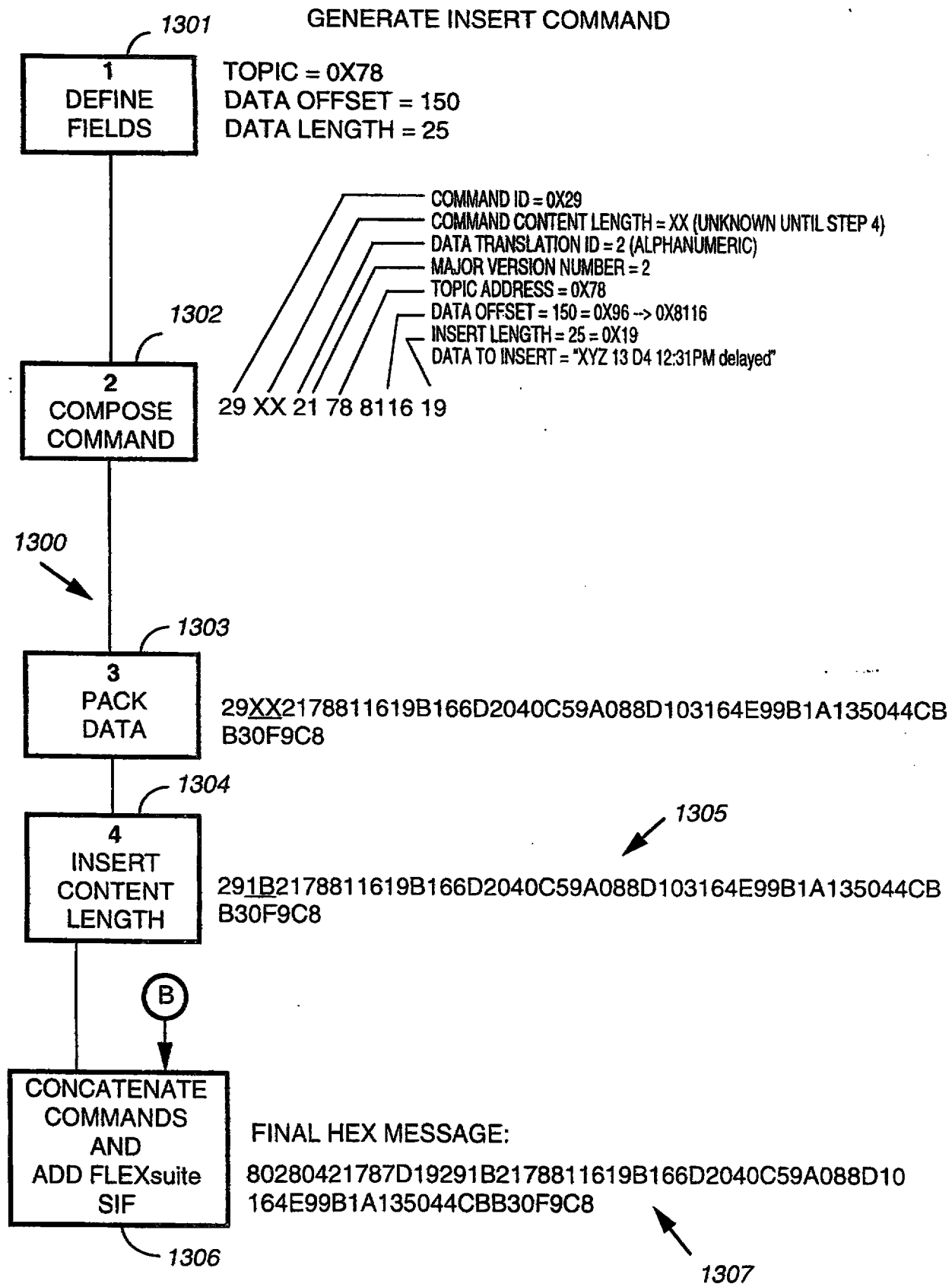


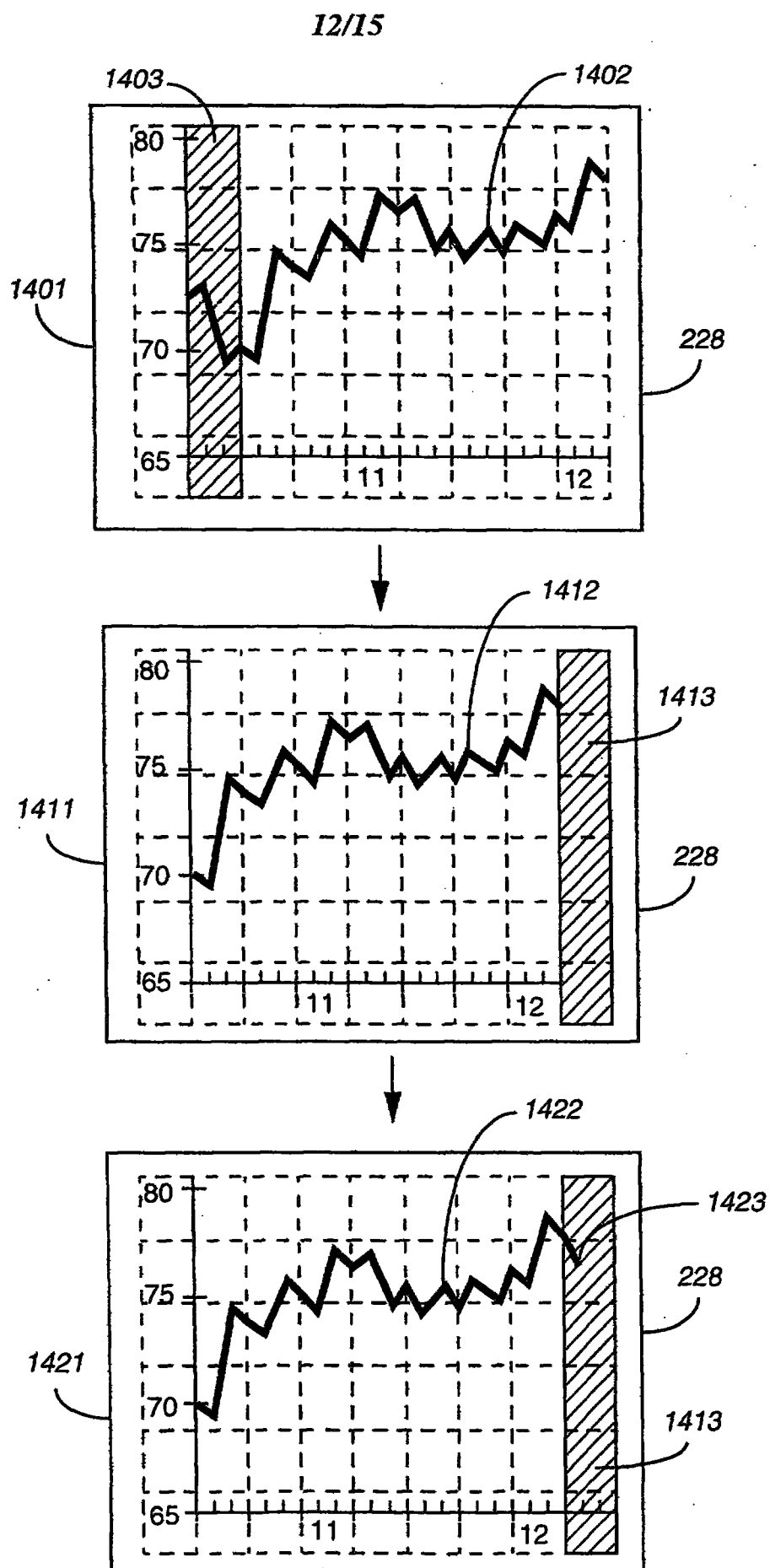
FIG. 11

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**FIG. 12**

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**FIG. 13**

**FIG. 14**

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GENERATE DELETE COMMANDS

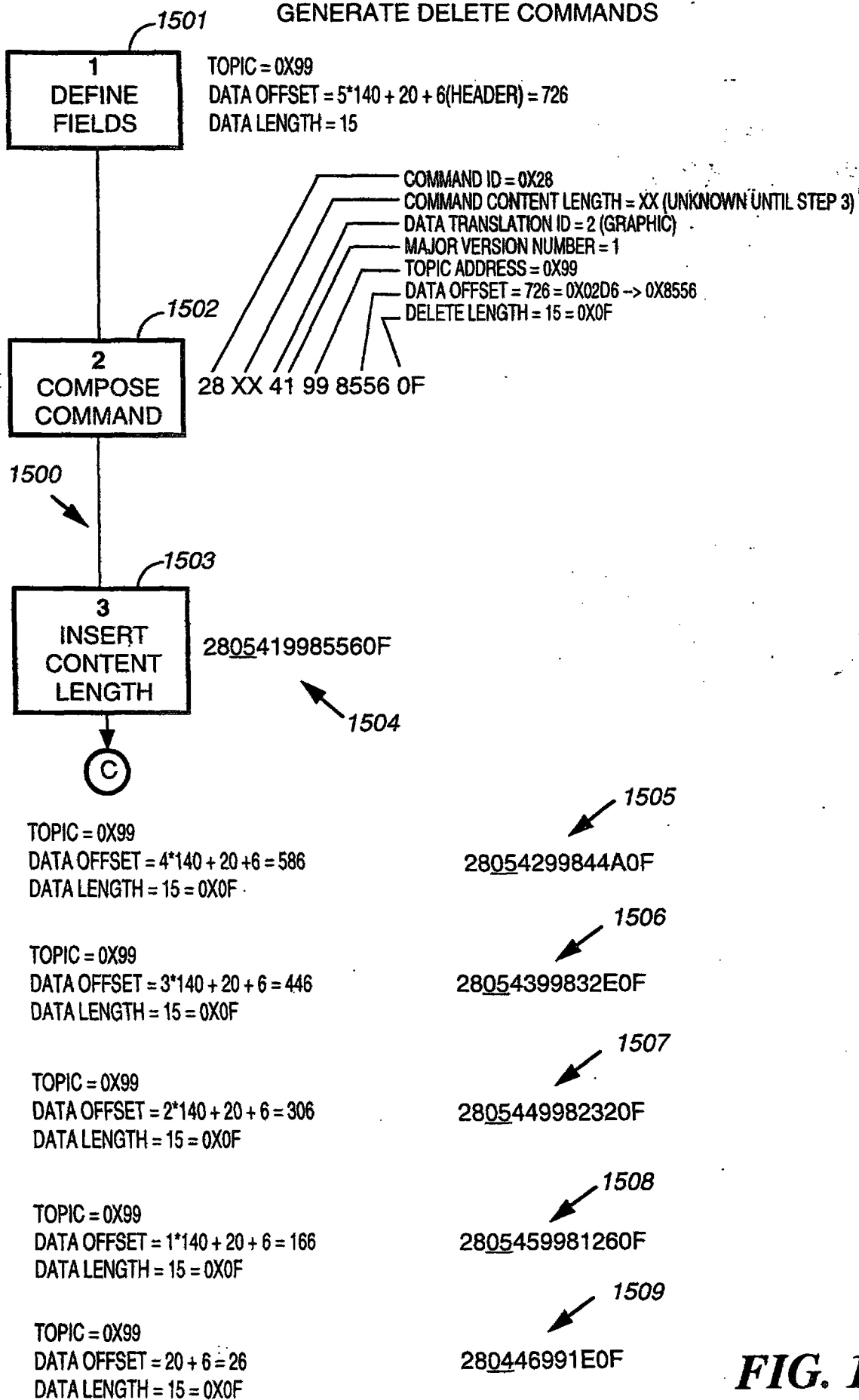


FIG. 15

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GENERATE INSERT COMMANDS

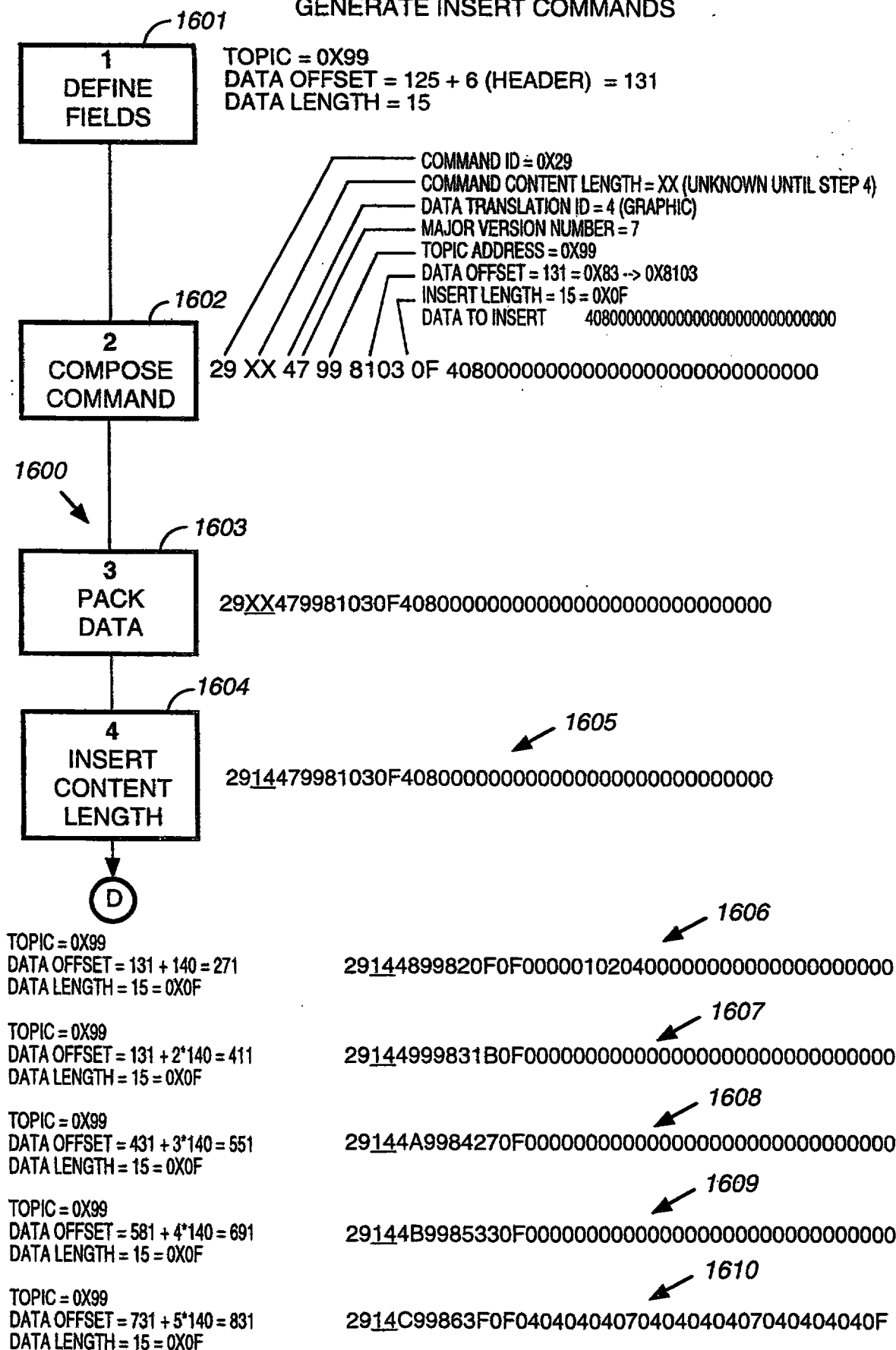


FIG. 16

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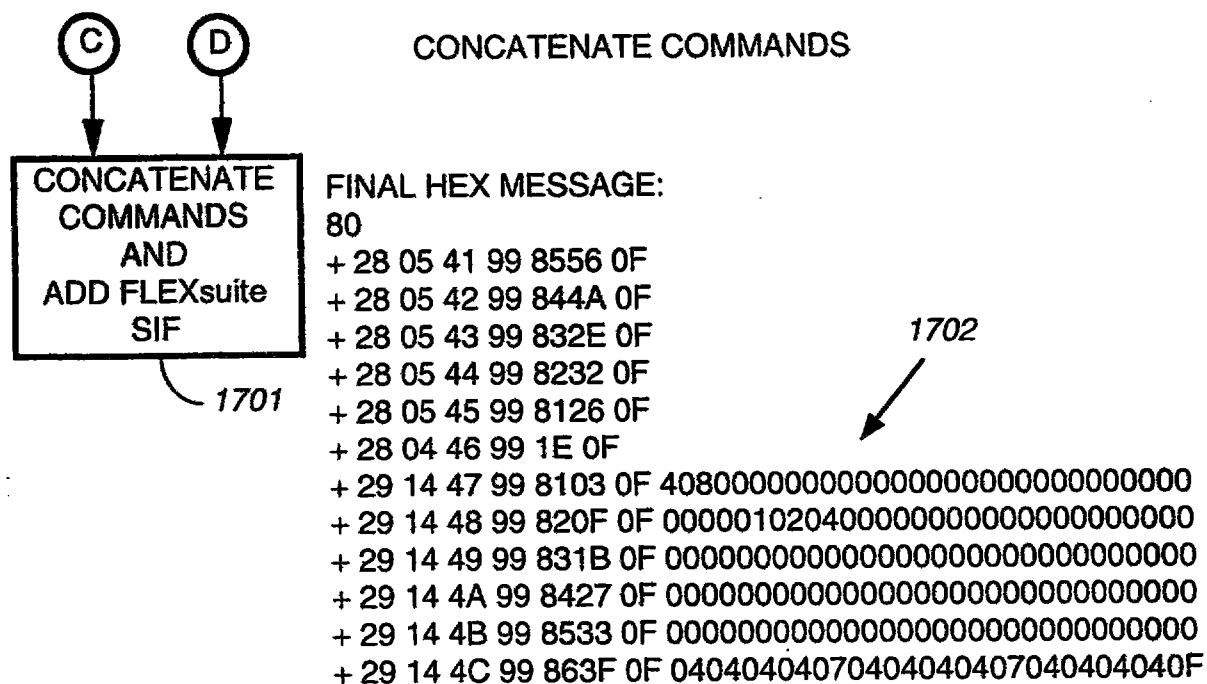


FIG. 17



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(71) Applicant: MOTOROLA INC. [US/US]; 1303 East Algonquin Road, Schaumburg, IL 60196 (US).

(72) Inventors: SMITH, Christopher, S.; 2604 Sulphur, St. Louis, MO 63139 (US). KAMPE, Frederick, L.; 10673 Mandya Court, Boynton Beach, FL 33437 (US). DORENBOSCH, Jheroen; Route 1, Box 79F, Paradise, TX 76037 (US).

(74) Agents: NICHOLS, Daniel, K. et al.; Motorola Inc., Intellectual Property Dept., 1500 Gateway Boulevard/MS96, Boynton Beach, FL 33426 (US).

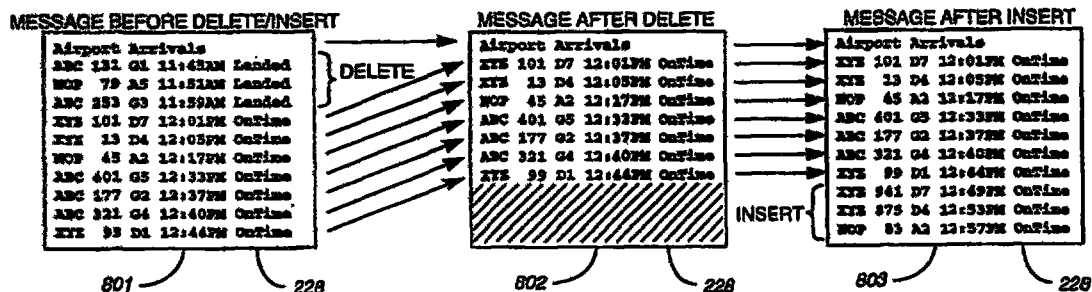
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(54) Title: INSERT/DELETE MODIFICATION OF INFORMATION SERVICE MESSAGE



(57) Abstract

A selective call device for receiving a signal having an address portion and a message portion, the message portion having sub-messages, includes a receiver, a message memory for storing sub-messages, and address correlator and a decoder for determining whether the signal is directed to the selective call device and whether the signal includes a Delete Command having parameters that identify a portion of a sub-message, or an Insert Command having an additional portion and parameters that identify a location in a sub-message. In response to a Delete Command, the selective call device decreases size of a sub-message (801) stored in the message memory by erasing the identified portion of the sub-message (802). In response to an Insert Command, the selective call device increases size of a sub-message (803) stored in message memory by adding the additional portion to the sub-message at the identified location (803).