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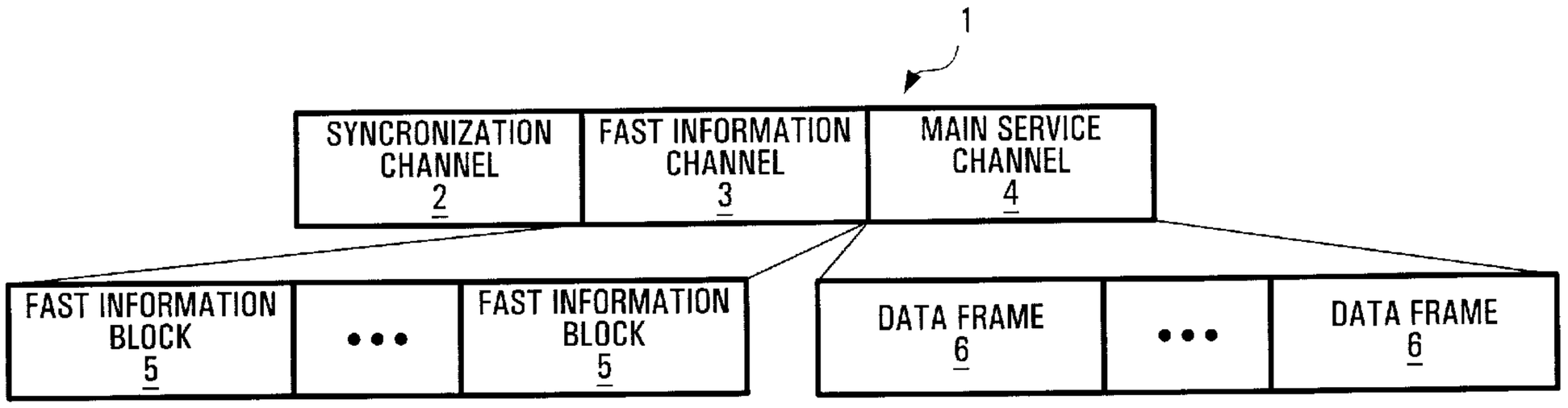
(54) Titre : PROCEDE DE TRANSMISSION DE DONNEES AUDIO NUMERISEES ET DE DONNEES SUPPLEMENTAIRES TRANSMISES PAR PAQUETS

(54) Title: A METHOD FOR TRANSMITTING DIGITAL DATA AND DIGITAL COMPLEMENTARY DATA, AND A METHOD FOR PLAYING BACK DIGITAL DATA AND DIGITAL COMPLEMENTARY DATA



(57) Abrégé/Abstract:
A process is disclosed for transmitting and playing back digital data and digital complementary data during a digital radio broadcast. Audio data are transmitted, as well as complementary data that may be selected to be broadcast together with the audio data. The complementary data may for example be images, texts and/or speech provided with control characters for broadcasting the complementary data at predetermined moments in time.

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(54) **Title:** PROCESS FOR TRANSMITTING DIGITAL AUDIO DATA AND PACKET-TRANSMITTED COMPLEMENTARY DATA

(54) **Bezeichnung:** VERFAHREN ZUR ÜBERTRAGUNG DIGITALER AUDIODATEN UND ALS DATENPAKETE ÜBERTRAGENER ZUSATZDATEN

(57) Abstract

A process is disclosed for transmitting and playing back digital data and digital complementary data during a digital radio broadcast. Audio data are transmitted, as well as complementary data that may be selected to be broadcast together with the audio data. The complementary data may for example be images, texts and/or speech provided with control characters for broadcasting the complementary data at predetermined moments in time.

(57) Zusammenfassung

Es wird ein Verfahren zur Übertragung und ein Verfahren zur Wiedergabe digitaler Daten und digitaler Zusatzdaten anhand eines digitalen Rundfunkprogrammes beschrieben, wobei Audiodaten übertragen werden und zusätzlich Zusatzdaten übertragen werden, die ausgewählt werden können, um mit den Audiodaten ausgegeben zu werden. Als Zusatzdaten werden beispielsweise Bilder und/oder Texte und/oder Sprache verwendet, die mit Steuerzeichen versehen sind, so daß die Zusatzdaten zu vorgegebenen Zeitpunkten ausgegeben werden.

A Method for Transmitting Digital Data and Digital Complementary Data, and a Method for Playing Back Digital Data and Digital Complementary Data

Prior Art

The present invention relates to a method for transmitting digital data and digital complementary data as set out in the principal patent claim. It is known from the article "Digital Audio Broadcasting, Radiohören in CD-Qualität [Digital Audio Broadcasting: CD-quality Radio Reception] that appeared in Funkschau, No. 16, 1992, that digital data in the form of audio data and digital complementary data that applies, for example, to the traffic or traffic management system can be transmitted. The complementary data are stored independently of the data and are output as desired, independently of the data.

"The MPEG Systems Coding Specification," (G. McInnes, Signal

Processing Image Communication, Volume 4, No. 2, pp. 155-259, states that the flow of digital data that are to be transmitted be divided into "video presentation units" or "audio presentation units." The presentation units result from association of an internal time marker in the system encoder. The assignment of time markers to the units is necessary in order to ensure that the image and audio data are played back in parallel to each other over time.

EP 0 577 329 A2 describes an arrangement for Asynchronous Transfer Mode (ATM-) networks that makes it possible to derive a system clock pulse from an asynchronously transmitted multiplexed audio and video signal, so that synchronization of the asynchronously transmitted useful data is achieved. The arrangement serves to reestablish the synchronicity of the data, lost because of asynchronous transmission.

(DE 43 35 271 A1) describes a data demultiplexer to which multiplexed audio and video data are passed from a storage medium, time markers for identifying the start points of the audio and video packets being assigned to the multiplexed signal.

Advantages of the Present Invention

In contrast to the foregoing, the method according to the present invention, having the features as set out in Patent Claim 1, entails the advantage that the digital complementary data, for example, image data, text data, or speech data, are divided up into fixed data groups as units.

As an example, a unit can contain an image or a part of an image, a song or a part of a song, or a page of text or a section of a text. A unit identifier and a control character for the unit are transmitted for each unit and when the unit is being selected these inform the receiver as to the time the playback or output of the unit begins, and how long the playback or the output of the unit lasts. This means that complementary data are available for data such as audio data, and these are output in the receiver, synchronized over time, by way of an appropriate selection. It is left up to the user of the receiver to call up the complementary data from the complementary data that is offered and which the user may have output. A multimedia data transfer method is made possible in this way.

In contrast to the foregoing, the method according to the present invention, with the features set out in Claim 11, entails the

advantage that digital data, for example, audio data and digital complementary data such as image data and/or text data and/or speech data can be selected for output and the output of the data and the complementary data is effected in a format that is synchronized over time. In this manner, the user of a receiver that is operated in accordance with the method described can select information that is of particular interest to him from a large quantity of data and complementary data, and then having this output individually.

Interactive and multimedia use of the receiver is achieved by this means.

Advantageous developments and improvements of the method described in Claim 1 are made possible by the measures set out in the secondary claims. An improvement to the method is achieved in that a storage time or a storage interval is transmitted for each unit, and this indicates how long the unit is stored in a receiver. By this means, it is possible to match the requirement for storage space to the demand. This results in a saving of storage space. If a plurality of transmission channels are used, it is particularly useful to transmit a channel word for each unit, this word indicating the transmission channel that is used. In this way, the transmission channel of the particular unit will

be found rapidly. Additionally, after selection of the units, it is thereby possible to restrict reception to the appropriate transmission channel. It is particularly advantageous that, because of this, a plurality of available transmission channels can be used to transmit the units, depending on the workload; this leads to more efficient utilization of the transmission capacities of the transmission channels.

It is also useful to transmit the beginning of the transmission of each unit and the number of the data bits that make up the unit. This informs the receiver of the time period within which a unit is transmitted, so that the receiver can make the storage space required to store the unit available on a timely basis. This results in a saving of storage space. The method described is improved in that a number of repetitions of the transmission of the unit is also transmitted. In this way, the receiver knows whether or not or how frequently the unit is repeated. This offers the advantage that in the event of incorrect transmission of the unit, the receiver receives the unit again during the next transmission of the unit and stores it. This results in increased reliability of the transmission of the data.

The flexibility with which the complementary data are represented is increased in that playback attributes for the

representation or the output of the units is transmitted. Thus, it is possible, to vary the representation or the output over time without retransmitting the units. In this way, more interesting representation or output of the data is made possible without additional, major transmission costs.

The use of a check sum for the transmission of the units makes it possible to carry out error checking of the transmission. This increases the reliability of the transmission method.

The use of the transmission method is further improved in that a plurality of units are combined to form components, and a plurality of components are combined to form a program. Thus, the user has the possibility of selecting the components of a program so that the units that are elements of the components can be output.

Various types of data, such as images, music, speech, and text, or different data contents such as political information, sports information, and stock-exchange information, can be used as components. This provides the advantage that not every unit has to be specially selected; rather, a number of units is determined by the selection of a component. This increases convenience when the transmission method is used.

The use of designators or names for the units and components that are represented or output with a receiver simplifies selection for the user of the receiver since it is more convenient to select designators or names instead of incomprehensible code words. This also increases convenience when the transmission method is used.

The method that has been described is particularly suitable for the transmission of a digital radio program, the data representing audio data, for example, and the complementary data representing image data and/or audio data and/or text data. This permits a multimedia interactive radio program that offers a greater information content, and the possibility of putting together an individual program.

The measures set out in the secondary claims are useful developments and improvements of the method described in Claim 11. In an advantageous manner, the method is improved in that for each unit a storage time that indicates how long a unit has being stored in a storage device is also stored. This means that the receiver has the possibility of optimal allocation of the storage space that is to be kept available. In this way, the amount of storage space that is to be kept available can be reduced to a minimum.

The method that has been described is further improved in that a channel word that is transmitted with every unit is also stored; this indicates the transmission channel by which the unit is transmitted. Thus, if a plurality of transmission channels is used, it is possible for the receiver to locate the units and only store the selected units.

It is particularly useful to store playback attributes for each unit. This will mean that the receiver will play back the data of a unit as a function of the stored playback attributes, differentiated over time. In this way, the functions of the method that has been described can be expanded without any major additional data costs. The playback of the units can thus be made more interesting, and this also increases convenience.

The method that has been described is particularly well suited for operating a digital radio broadcast receiver. The functionality of the method is expanded in that a plurality of units are combined to form a component, and a plurality of components are combined to form a program. In this way, an individual program can be assembled by a selection of components, without the need to select each individual unit. This increases convenience when the receiver is used.

It is particularly useful to erase the complementary data held in storage after expiry of the storage time that is transmitted with this complementary data, or else overwrite such complementary data with new complementary data that has been received. In this manner, it is possible to make better use of available storage space. Furthermore, it is an advantage that after the input of a selection of units and/or a components, only the selected units are put into intermediate storage in the receiver. This minimizes the amount of storage space that is required.

In accordance with the present invention, there is provided a method for the radio-broadcasting transmission of a unit of digital audio data or of digital additional data representing pictures, text, or announcements. The method comprises the steps of: transmitting information data; transmitting a unit identifier containing a name of the unit, by which a user can select the unit; and transmitting a plurality of control characters. The control characters include: a validity period, being a period of time over which the unit is to be stored in a receiver; a time at which the unit is to be presented at the receiver in the event that a user selects the unit with reference to the name of the unit; and a period of time over which the unit is to be displayed at the receiver.

Drawings

One embodiment of the present invention is shown in the drawings appended hereto, and this will be described in greater detail below. The drawings show the following:

Figure 1: a transmission frame;

Figure 2: a fast-information group

Figure 3: a Type 2 field; and

Figure 4: a second Type 2 field;

Figure 5 a third Type 2 field;

Figure 6: a Type 1 field;

Figure 7: a program field;

Figure 8: a component indicator;

Figure 9: a digital receiver.

Description of the exemplary embodiment

The transmission of the data, the classification of the transmission channels, the manner in which the data are transmitted, and synchronization of the data are controlled from a superior frame protocol that is not explicitly described. However, the overall transmission method is described by P. Ratliff, "EUREKA 147 Digital Audio Broadcasting - The System for Mobile, Portable, and Fixed Receivers," Second International Symposium on Digital Audio Broadcasting, Toronto, Canada, March 1994, p. 294 et seq.

Other detailed explanations are contained in Pommier, "High quality digital sound broadcasting to mobile, portable and fixed receivers," IEEE International Broadcasting Conference, No. 293, Brighton, September, 1988; in ETSI, "Radio Broadcasting System; Digital Audio Broadcasting (DAB) to mobile portable and fixed receivers," European Telecommunications Standard Draft prETS300401, Sophia Antipolis, January 1994; in Chambers, J.P.,"DAB system multiplex organization," Proc. First International Symposium on DAB, EBU, Montreux, June, 1992, pp. 111-120; and in Le Floch, "Channel coding and modulation for DAB," Proc. First International Symposium on DAB, EBU, Montreux, June, 1992, pp. 99-110.

In this embodiment, all that will be described are the data formats that are needed to transmit the control data. Figure 1 shows a transmission frame 1 that is used for transmitting the data in digital radio broadcast transmission (digital audio broadcasting, DAB). The transmission frame 1 consists of a synchronization channel 2, a fast information channel 3, and a main service channel 4. The transmission frame 1 consists of a fixed number of data bits. The fast information channel 3 is, in its turn, divided into fast information blocks 5. A number of fixed data bits are arranged in the synchronization channel and these are used for synchronizing the transmission frame 1.

Information data in the form of data frames (common interleaved frame, CIF) 6 are transmitted in the main service channel 4. Information data is understood to be the digital data such as audio data and the digital complementary data such as image data, audio data, or text data. The data of the main service channel 4 are time-interleaved. The data frames 6 are individually fold coded, with identical or different error protection being used.

The fast information channel 3 is used to transmit information rapidly to a receiver. In particular, the multiplex arrangement of the main service channel 4 is transmitted by way of the fast information channel. Additionally, the data required for controlling the complementary data are transmitted on the fast information channel 3. These data are understood to include those needed to represent the complementary data. This takes place in the form of the fast information blocks 5. The fast information channel 3 is not time-interleaved, and it incorporates fixed error protection.

The synchronization channel 2 is used within the transmission system for basis demodulation functions, such as the synchronization of the transmission frame 1, automatic frequency control, channel status assessment, and for identification of the

sender. Each fast information block is divided into fast information groups.

Figure 2 shows a first fast information group 7 that represents a fast information group of Type 2. The first fast information group 7 has a header 8 that consists of a first data word 10 and a second data word 11. The first data word 10 indicates the type of the fast information group, in this case, Type 2. The data bit sequence 010 is used for this.

The fast information group 7 also has a data field 9. The second data word 11 indicates the length of this data field 9. The data field 9 is divided into a first data word 13, an extension field 14, and a Type 2 field The third data field 13 has a length of 4 bits and is free for use for future applications. The extension field 14 is 4 bits long and makes it possible to assign a specific value to the Type 2 field.

Figure 3 shows a first Type 2 field 12 with the extension 0, which is to say that the character 0 is stored in the extension field 14. The first Type 2 field 12 is divided into a program identifier field 15, a unit identifier field 16, a first and a second start field 17, 18, a validity field 19, a free data field 20, a transmission route field 21, and a transmission field 22.

The program identifier field 15 indicates the program with which the unit is associated. The unit identifier field 16 provides an identifier number for the unit with which the unit for which the first Type 2 field 12 is transmitted is uniquely characterized. A specific bit sequence is used as the identifier number. The first start field 17 indicates the beginning of the validity period of the unit in the form of the modified Julian date. The second start field 18 indicates the beginning of the validity period of the unit in Coordinated Universal Time Code (UTC).

The modified Julian date and the Coordinated Universal Time Code are fixed and established time calculations that are described, for example, in "Specification of the Radio Data System (RDS)," European Standard, EN 50067, Geneva, April 1992, Chapter 8.1.3.

It is, of course, possible to use other time calculations. The validity field 19 indicates the duration of the validity period of the unit in hours, minutes, and seconds, calculated from the beginning of the validity period, coded in Coordinated Universal Time Code (UTC). The validity period indicates how long a unit is kept in storage. The free data field 20 remains free and available for future use. As a channel word, the transmission identifier field 21 indicates the transmission channel by which the unit is transmitted. When this is done, for example, the data

bits 00 indicate a continuous data flow [stream mode) as the transmission channel; the data bits 01 indicate a data flow that is divided into data packets (packet mode) as the transmission channel; 10 indicates a data flow in the form that is closely connected with the audio data (program associated data), and this is transmitted in an ancillary data field based on ISO standard 11172/3 as the transmission channel.

The transport field 22 indicates where in the corresponding transmission channel the particular unit is to be found. The first Type 2 field 12 thus indicates the start time, the duration of representation of a unit, and the transmission channel by which the unit is transmitted.

Figure 4 shows a second Type 2 field 25 with the extension 1 that incorporates a program field 15, a unit identifier field 16, a third start field 23, and an attribute word 24. The program identifier field 15 has 16 bits and indicates the program with which the unit is associated. The unit identifier field 16 also has 16 bits and indicates the identifier of the unit. The third start field 23 has eight bits and provides a CIF count from which the appropriate unit is played back or the playback of the appropriate unit is ended. The CIF count is a counter pulse that

is emitted from the sender and synchronized with that of the receiver.

The CIF count permits exact synchronization of the playback, or the ending of the playback or a change in the manner of playback of the units. The attribute word 24 also has eight bits, and by way of playback attributes indicates how the output or representation of the units is to be effected. When this is done, for example, eight null bits indicates that the playback of the unit is ended, when a playback apparatus is set to the status that applied to the playback apparatus prior to the start of playback.

A string of seven null bits and a one bit indicates that playback is beginning in the form that is optimal for the playback apparatus. Use of the third start field 23 fixes the time from which a change in the type of playback is effected, and the manner of the change of playback of the unit is fixed by way of the attribute word 24.

Figure 5 shows a third Type 2 field 26 with the extension 2. The third Type 2 field indicates the beginning of transmission of a unit. The third Type 2 unit 26 has a unit identifier field 16, a third start field 23, a length field 27, a repetition field 28, a

free data field 20, a CRC flag 29, and a CRC field 13. The unit identifier field 16 indicates the identifier of the unit for which the third Type 2 field 26 is determined. The unit identifier field 16 has 16 bits. The third start field 23 is eight bits long and indicates the CIF count from which the transmission of the unit begins. The length field 27 is 32 bits long and indicates the number of data bytes in the unit.

As an example, a free data field 20 has a length of 3 bits and is available for future use. At present, for example, null bits are transmitted in a free data field 20. The CRC flag 29 is one bit long and indicates whether a check sum is transmitted. If a zero bit is stored in the CRC flag, no check sum is used. A 1 bit indicates that a check sum is transmitted. In this instance, for example, a 16 bit long check sum is used and this is based on the following polynomial:

$$G(x) = x^{16} + x^{12} + x^5 + 1$$

The check sum (cyclic redundancy check word) is stored in the CRC field 30.

A first, second, and third Type 2 field 12, 25, 26 is transmitted for each unit.

Figure 6 shows a Type 2 field 31 with the extension 3. The Type 2 field has a 16 bit long unit identifier field 16. In addition, there is a 16 * 8 bit long character field 32 and a 16 bit long character flag field 33. The character field 32 contains a designator or a name for the units designated by the unit identifier field 16. The character flag field 33 contains a short form of the designator or of the name.

A name of a unit is transmitted with the help of the Type 2 field 31. The name of the unit is clearly associated with a unit by way of the unit identifier field 16. The name can be displayed in a receiver on a display or else enunciated through a loud speaker, so that a user of the receiver can select the unit with the help of the name. If only a small number of characters or letters are available to represent the designation, the short form that is stored in character flag field 33 is displayed. A Type 2 field 31 is transmitted for every unit.

Figure 7 shows a program field 39 that is divided into a program identifier field 16, a number field 60, a first, a second, and a third component field 61, 62, and 63. The program identifier

field 15 indicates the program; the number field 60 is 4 bits long and indicates the number of components associated with the program, in this instance, three. The first component group 61 is 16 bits long and contains an identifier that clearly indicates the components, a designation, or a name for the component and information to the effect that this is an image component, i.e., all units that belong to the first component 61 contain image data.

The second component field 62 is 16 bits long and contains an identifier that clearly shows the components, a designator, or a name for the components, and the fact that these components are audio data. All units that belong to the second component 62 represent audio data.

The third component field 63 is 16 bits long and contains an identifier that clearly indicates a designator or a name for the component and the fact that this component involves text data. This establishes that all units that belong to this component contain text data. A program field 59 is transmitted for each program.

Figure 8 shows a component indicator 64 that is 24 bits long and indicates the components to which a unit belongs. To this end,

the component indicator 64 has a unit identifier field 16 that indicates the unit and a component date 65 that indicates the identifier of the component to which the unit belongs. A component indicator 64 is transmitted for each unit so that for each unit it is known to which component it belongs. This also makes clear what type of data, e.g., image data, audio data, or text data, the units contain.

Figure 9 is a diagrammatic representation of the digital broadcast receiver (DAB receiver). The data that is transmitted passes from an antenna 44 to a front end 58 and from the front end 58 to a channel decoder 32. The channel decoder 32 is connected by data lines 66 to a fast information decoder 33, a data decoder 34, a PAD decoder 55, a memory 37, and to a first audio decoder 36. An output of the fast information decoder 33 is connected to a system controller 38. An output of the data decoder 34 is connected to the memory 37. In the same way, an output of the PAD decoder 35 is connected to the memory 37. The memory 37 is connected via data outputs 56 to a second audio decoder 14, a video decoder 41, and a text decoder 42.

An output of the second audio decoder 40, an output of the video decoder 41, an output of the text decoder 42 and an output of the first audio decoder 36 are connected with inputs of a multimedia

terminal 43. The system controller 38 is connected by a first control line 49 to the channel decoder 32, through a second control line 45 to the fast information decoder 33, through a third control line 46 to the data decoder 34, through a fourth control line 47 with the PAD decoder 35, and through a fifth control line 48 with the first audio decoder 36.

In addition, the system controller 38 is connected by a seventh control line 51 with the second audio decoder 40, by an eighth control line 52 to the video decoder 41, and by a ninth control line 53 to the text decoder 42. In addition, a control and data connection 54 runs from the system controller 38 to the multimedia terminal 43. Control and data signals are exchanged between the system controller 38 and the multimedia terminal 43 by way of the control and data line 54. The system controller 30 is connected through a tenth control line 55 with the memory 37.

The method for transmitting digital data and digital complementary data will be described below using the transmission of a digital radio broadcast program as an example. This method can also be used for other digital data transmission systems such as television transmission. In the digital radio broadcast program that is described, audio data is transmitted as digital data and images and/or audio data and/or text or any other forms

of data are transmitted as digital complementary data, the data formats shown in Figure 1 to Figure 8 being used for transmission of the data. Other data formats can also be used, depending on the particular transmission method.

The transmission of the data and of the complementary data is effected in the transmission frame 1. When this is done, the data and the complementary data itself are transmitted in the main service channel 4 that is divided into the data frames 6 (CIF). The control data that are required to represent the complementary data are transmitted in the fast information channel 3, which is divided into fast information blocks 5. The control data are the control data that are shown in Figure 2 to Figure 8.

A program that is transmitted consists of various components that are divided into time and/or content units. The components are represented by music, images, or text units. The components are divided into units in accordance with preset time intervals. Thus, it is possible that a program consist of a music components that in its turn is divided into a plurality of music units, a music unit representing a time section of a piece of music, for example. In addition, the same program has an image component that is also divided into a plurality of image units that represent one and the same image in different forms, or different

images. In addition, a third component, a text component, is an element of the program, and this is also divided into text units. The text units can represent different texts or parts of a text, for example.

The division of the components can also be used to distinguish between complementary data with respect to content; as an example, news can be divided into political news, sports news, or economic news segments which are, in each instance, associated with different components.

In the simplest case, an identifier for the unit is transmitted for each unit that is transmitted. This means that each unit can be unmistakably identified. In addition, the CIF count is transmitted for every unit, and this indicates when the unit is output. The transmission of a designator for the unit is necessary in order to inform a user of a sender which units can be selected.

In an improved method, for every unit there is an indication as to the time at which the validity period of the unit begins. In addition, the duration of the validity period is also transmitted at the beginning of the validity period. The validity period

indicates the point in time at which the units is stored in the memory 37 of a receiver.

A further addition during the transmission of the unit provides information as to the transmission channel by which the unit is transmitted, and where within the transmission channel the data for the units are to be found.

The first Type 2 field 12 shown in Figure 3 is used to transmit the program identifier, the identifier of the unit, the beginning and the data of the validity period, the transmission channel, and the location in which the unit is transmitted within the transmission channel.

In addition, the beginning and the end of the playback of a unit within the validity period is transmitted in the second Type 2 field 25 that is shown in Figure 4. To this end, the program identifier, the identifier of the unit, and the CIF count that indicates the time from which the playback is to begin or end, and the playback attributes are also transmitted.

In this way, a receiver is kept informed by the playback attributes as to whether the playback is to begin or end, and how the playback is to be effected. When this is done, the beginning

of a playback or the end of the playback is indicated by the CIF count. The manner in which the playback is to be effected is established by the playback attributes. For example, in the case of images, the size of the image section, the resolution, the selected colour or, in the case of text output, for example, the size of the text, or in the case of speech output, the volume, can be established, for example.

In addition to the information described above, other information with respect to the transmission of a unit is transmitted. This is done in the third Type 2 field 26, as is shown in Figure 9. By providing the identifier of the unit and the CIF count, the length of the unit, the number of repetitions of the transmission of the unit, and information as to whether a check sum is also transmitted, as well as the check sum itself, are transmitted.

In this way, a receiver obtains information as to when the transmission of the corresponding unit begins (CIF count), the length of the unit data field, whether and how many repetitions of the transmissions of the unit follow, and whether or not a check sum, and which check sum, has been transmitted. In this way, a receiver has the possibility of filtering out the transmission of the unit or, in the case of an incorrect transmission, receiving the repetition of the transmission of the

unit and evaluating the check sum to check for error-free transmission by evaluating the check sum.

In addition to the data described above, a designator or a name for every unit is also transmitted. This is effected by way of the Type 2 field 31 that is shown in Figure 6. The name or an abbreviation for the name of the unit is transmitted with the help of an alphabetic field 32 and an alphabetic flag field 33, when quoting the identifier of the unit.

The data that are shown in Figure 2 to Figure 8 are transmitted on the fast information channel 3. The data of the unit itself are transmitted on the main service channel 4, within the data frame 6. The transmission is so configured that the control data that belong to the units of the data that are transmitted on the fast information channel 3 are transmitted prior to transmission of the data of the units and are thus available to a receiver in a timely manner.

In order to provide for more convenient use of the receiver, a plurality of units are combined to form a component. This is effected by the transmission of a component indicator 64 for each unit; this provides information as to the component to which the unit belongs. In addition, a plurality of components are combined

to form a program and a program field is transmitted, this indicating which components belong to the program and which type of data the units of the components contain. Since an indicator for every component is transmitted with the component field, both the components and the units can be displayed in the receiver, by displaying the designator of the components or of the unit for selection.

The method of playing back digital data and digital complementary data will be described below on the basis of the digital radio broadcast receiver that is shown diagrammatically in Figure 9. The method that is described can also be used for any digital receiver. A receiver as shown in Figure 9 receives channel-coded data and complementary data by way of an antenna 44. The data and complementary data are converted by a front end 58 into digital data and digital complementary data. Then the data and the complementary data are passed to a channel decoder 32. The channel decoder 32 decodes the control data that is stored in the fast information channel 3 and sends this to the fast information decoder 33. The fast information decoder 53 decodes this control data and passes it onto the system controller 38. Thus, the system controller 38 is informed of an identifier for the unit, the program to which the unit is associated, the validity period, and the transmission channel for each unit. In addition, the

system controller is also informed as to the CIF count from which the playback of the unit is to begin or end. In addition, the system controller is informed by way of the playback attributes as to how the unit is to be represented by way of the playback attributes.

In addition, there is information as to when the transmission of the unit begins, the length of the unit, whether or not there will be a repetition of the transmission of the unit and whether or not or which check sum is transmitted. In addition, a name for each unit is passed to the system controller 38. In addition, the system controller 38 also receives information as to which components are combined to form a program, which type of data is contained in the components, and which units belong to which components. In addition, a designator or a name is received for each component. The system controller compilers a table in which the control data required to receive and/or select and/or output the units or components are stored.

The channel decoder 32 decodes the transmission channel by which the digital data are transmitted in the form of audio data and passes this to the first audio decoder 36.

In this embodiment, three different transmission channels are used to transmit the complementary data in the form of units. However, other and more or fewer transmission channels can be used. In the first instance, the data are transmitted in the form of a serial data flow; in the second instance, the data are transmitted in packets; and in the third instance, the data are transmitted in the form of data 1 that are closely linked with the audio data (program associated data) and which are transmitted in an ancillary data field based on ISO-standard 11172/3. Further details are described in P. Ratliff, "EUREKA 147 Digital Audio Broadcasting - The System for Mobile, Portable and Fixed Receivers," Second International Symposium on Digital Audio Broadcasting, Toronto, Canada, March 1994, pp.294 et seq.

Three decoders for the three different types of transmission are arranged within the receiver. The channel decoder 32 for the serial data, the data decoder 34 for the data that is transmitted in packets, and the PAD decoder 35 for the data that are transmitted in the ancillary data field. The decoders 32, 34, 35 can be controlled from the system controller 38. The decoders 32, 33, 34, and 35 are so configured that the data of the corresponding transmission channels are decoded.

Since the system controller 38 has the information as to the particular transmission channel by which the units are to be transmitted and at which time, the system controller 38 switches the channel decoder 32 to the appropriate channel, so that the channel decoder 32 then reads the channel decoded complementary data either to the data decoder 34 or to the PAD decoder 35 or decodes it directly and reads it into the memory 37. The channel coded control data are passed on after triggering from the system controller 38 from the channel decoder 32 to the FIC decoder 33.

The data decoder 34 and the PAD decoder 35 decode the complementary data and read the decoded complementary data into the memory 37. The system controller 38 is connected by the tenth control line 55 to the memory 37, so that read-in of the decoded complementary data from the system can additionally be controlled by the system controller via a write line.

The system controller 38 compiles the table which contains information as to which units belong to which components and which components belong to which programs. In addition, the designators for each unit and for each component of also stored in the table. In addition, the table also contains the validity periods of the units, so that storage of the complementary data that represent the data of the units in the memory 37 is only

effected for the validity period. After the expiration of the validity period, the unit is erased on a selective basis, or the unit is overwritten with data of a new unit once the validity period has expired.

The system controller 38 indicates the designator or names of the units and/or the components by way of the multimedia terminal 43. The multimedia terminal has an optical and/or acoustic display and also has a keyboard for inputting numbers and/or letters and/or a name or a designator by way of a speech computer for acoustic input.

A user of the receiver selects which components or units of a program are to be output by inputting the designator or the name using the multimedia terminal 43. This information is passed on to the system controller 38. According to the data supplied by the user, the system controller 38 reads the selected units out from the memory 37 and, depending on the type of unit data of the unit, i.e., whether it is audio data, video data, or text data, passes it onto the second audio decoder 40, to the video decoder 41, or to the text decoder 42. The audio decoder 40, the video decoder 41, and the text decoder 42 are controlled in the appropriate manner from the system controller 38 and convert the digital complementary data into analog signals.

The data of the units or of the components are passed on to the multimedia terminal 43. The multimedia terminal 43 is similarly controlled from the system controller 38. Playback of the data of the units or components in the form of audio data and/or video data and/or text data is effected with the help of the multimedia terminal 43. The units are output in keeping with the control data that is also transmitted.

The multimedia terminal 43 passes information to the system controller 38 on the control and data line 54 and this data indicates which playback, e.g., image, speech, or text, is possible, so that the system controller 38 only passes on the units that can also be output to the multimedia terminal.

The digital data that have been transmitted, in this case, the audio data decoded by the first audio decoder 36, are always received or are received limited by time depending on the triggering of the system controller 38, and are output by way of the multimedia terminal 43.

The method that has been proposed makes it possible to designate all components of a program, for example, and output other components during each playback.

22386-2646

CLAIMS:

1. A method for the radio-broadcasting transmission of a unit of digital audio data or of digital additional data representing pictures, text, or announcements, the method comprising the steps of:

transmitting information data;

transmitting a unit identifier containing a name of the unit, by which a user can select the unit; and

transmitting a plurality of control characters, the control characters including:

a validity period, being a period of time over which the unit is to be stored in a receiver;

a time at which the unit is to be presented at the receiver in the event that a user selects the unit with reference to the name of the unit; and

a period of time over which the unit is to be displayed at the receiver.

2. The method of claim 1 comprising the further step of transmitting a transmission channel identifier, which identifies a transmission channel by which the unit is transmitted.

3. The method of any of claims 1 to 2 comprising the further steps of:

transmitting a beginning of transmission of the unit; and

transmitting a number of data bytes in the unit.

4. The method of claim 3 further comprising the further step of transmitting a number of repetitions of transmission of the unit.

5. The method of any of claims 1 to 4 comprising the further step of transmitting at least one playback attribute of the unit, the at least one playback attribute indicating to the receiver how the unit is to presented.

6. The method of any of claims 1 to 5 comprising the further step of transmitting a check sum of the unit, thereby allowing error detection.

7. The method of any of claims 1 to 6 whereby the unit is one of a plurality of units which may be combined to form a component, the component being one of a plurality of components which may be combined to form a program.

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OTTAWA, CANADA

PATENT AGENTS

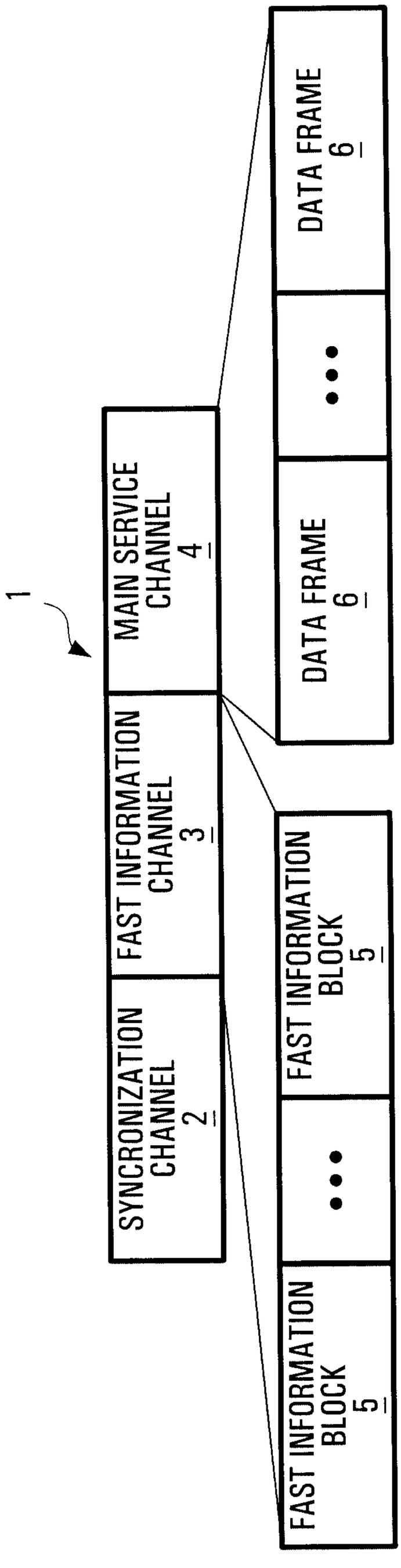


FIG. 1

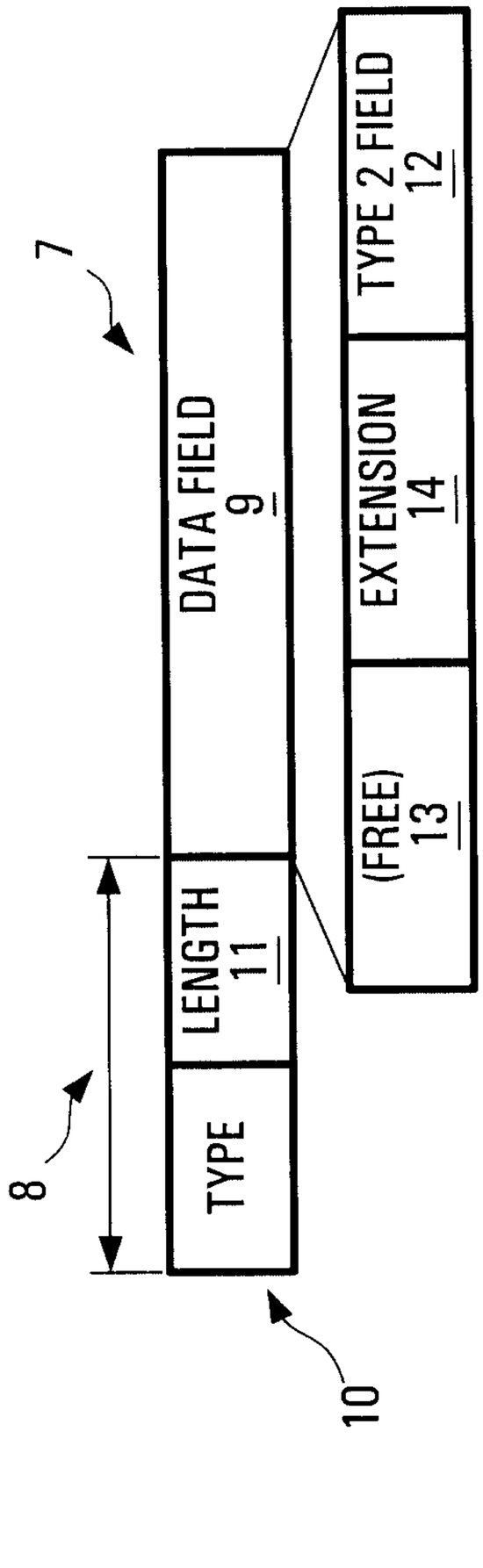


FIG. 2

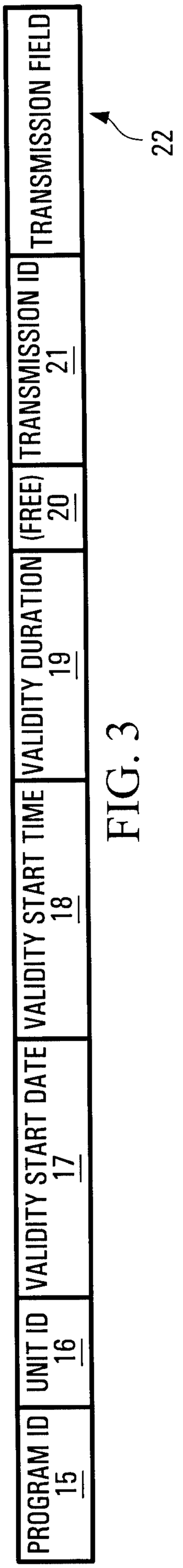


FIG. 3

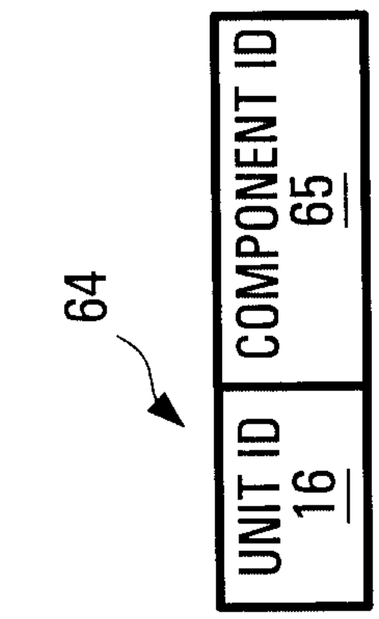


FIG. 8

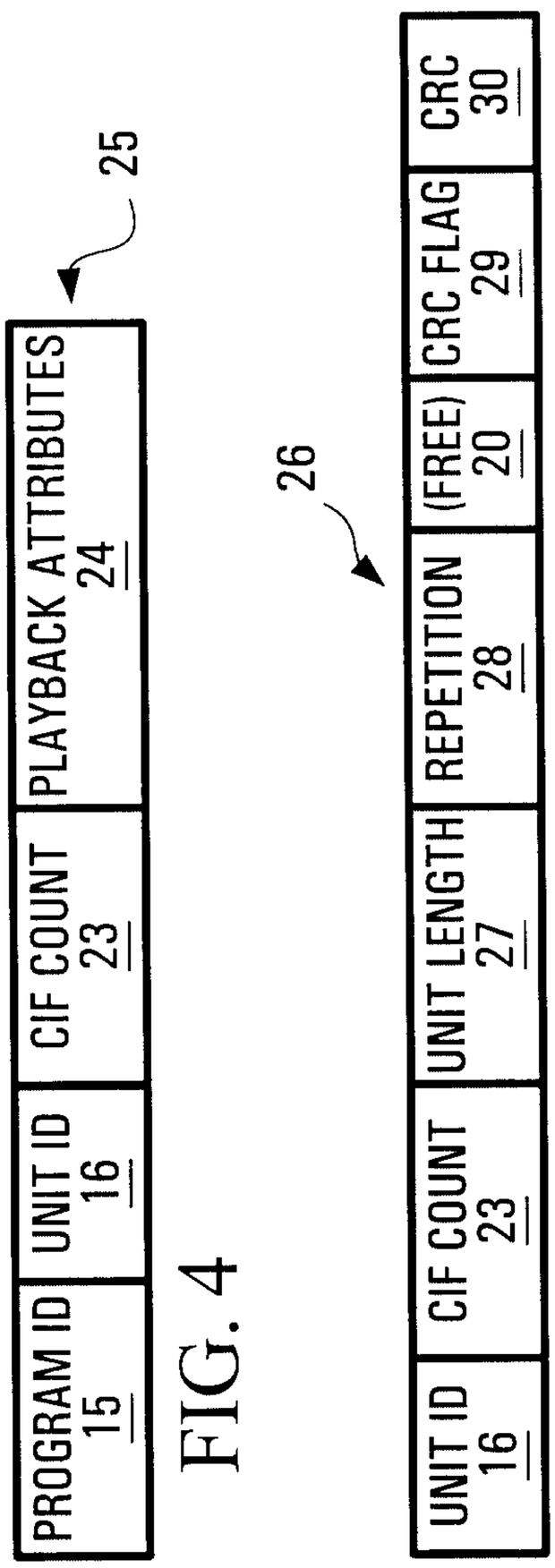


FIG. 4

FIG. 5

FIG. 6

FIG. 7

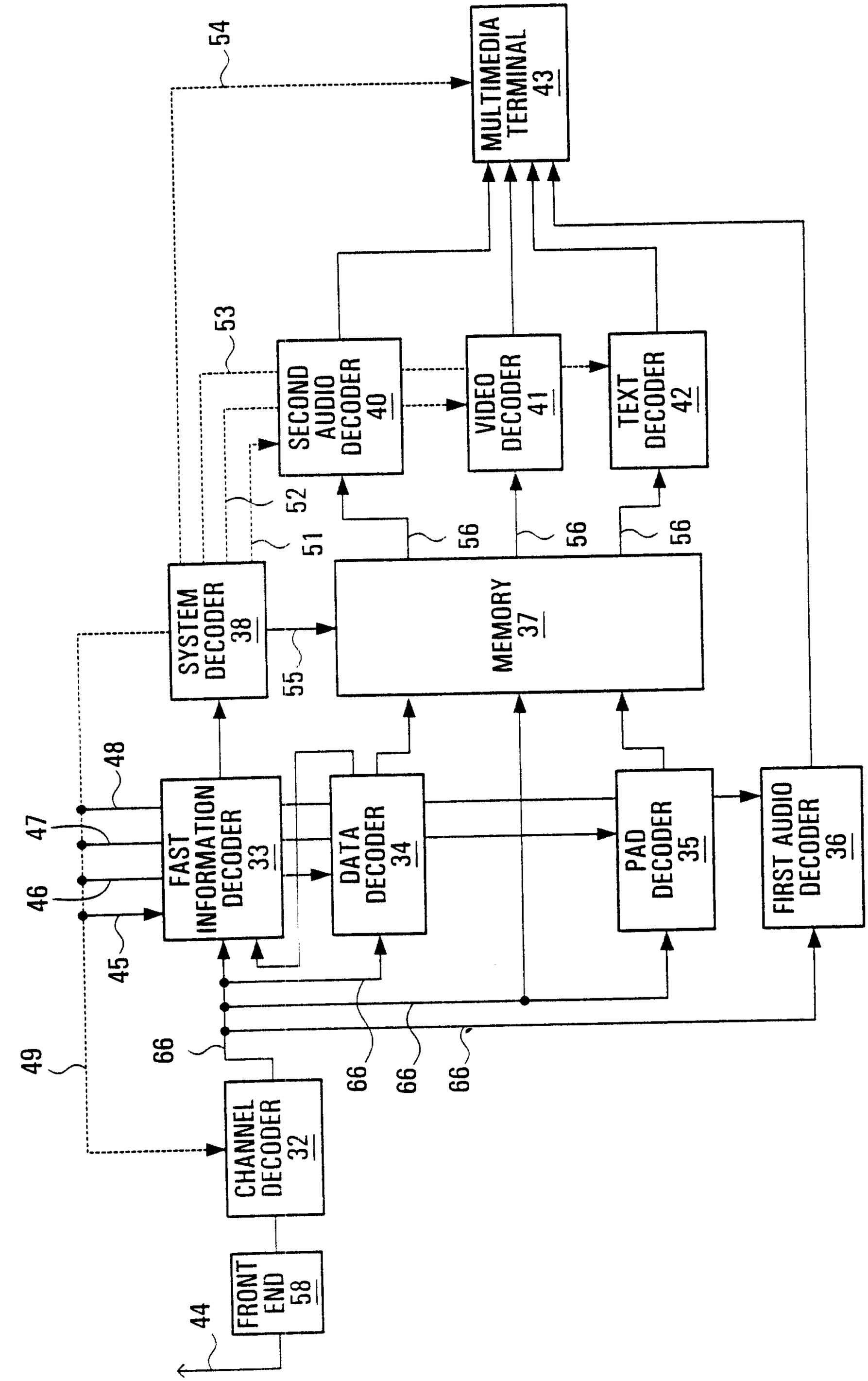
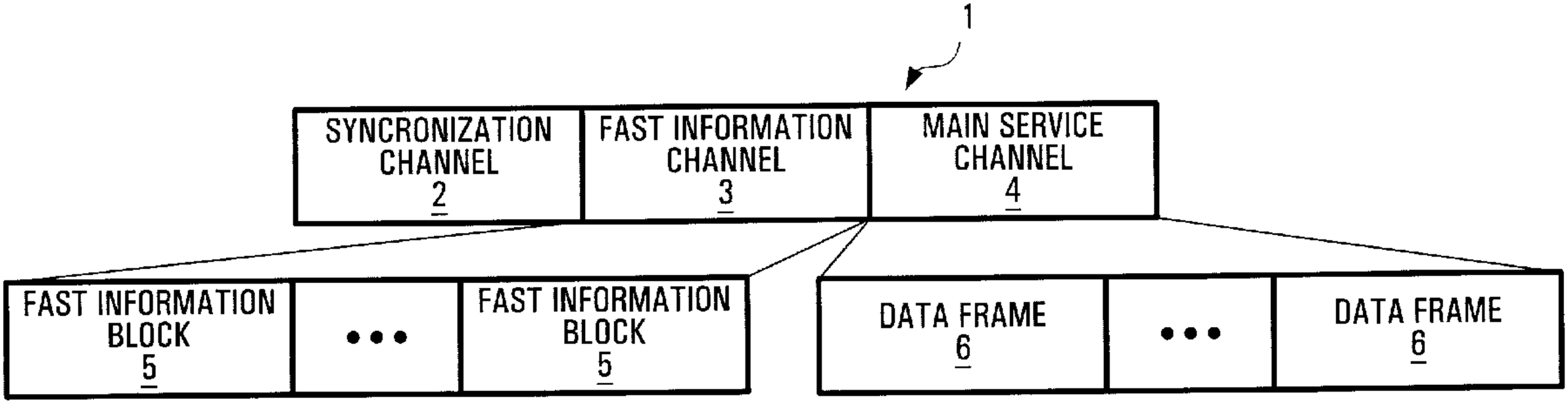

MULTIMEDIA TERMINAL 43
54
SECOND AUDIO DECODER 40
VIDEO DECODER 41
TEXT DECODER 42
53
52
51
56
56
56
SYSTEM DECODER 38
MEMORY 37
55
48
47
46
45
FAST INFORMATION DECODER 33
DATA DECODER 34
PAD DECODER 35
FIRST AUDIO DECODER 36
49
66
66
66
66
CHANNEL DECODER 32
FRONT END 58
44

FIG. 9


1
SYNCRONIZATION CHANNEL 2
FAST INFORMATION CHANNEL 3
MAIN SERVICE CHANNEL 4
FAST INFORMATION BLOCK 5
• • •
FAST INFORMATION BLOCK 5
DATA FRAME 6
• • •
DATA FRAME 6