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(54) **Receiver for receiving multiplexed broadcast programmes, comprising audio data and supplementary broadcast data**

Empfänger für den Empfang von multiplizierten Rundfunkprogrammen, mit Tondaten und Zusatzdaten

Récepteur pour la réception de programmes radiophoniques multiplexés, comportant des données audiophoniques et des données supplémentaires

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WO-A1-93/09615

- "European Broadcasting Union EBU Union Européenne de Radio-Télévision UER Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers; DRAFT prETS 300 401" ETSI STANDARDS, EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE, SOPHIA-ANTIPO, FR, vol. BC, no. Second Edition, June 1996 (1996-06), XP002284225 ISSN: 0000-0001
- J.L. RILEY: "The DAB multiplex and system support features" EBU TECHNICAL REVIEW, no. 259, 1994, pages 11-23, XP000450541 Grand-Saconnex, CH

EP 0 833 468 B1

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a broadcasting receiver for receiving a broadcasting radio wave, for example, a digital audio broadcasting (DAB) radio wave, constituted of a plurality of multiplexed broadcasting programs each containing audio data and string data such as ensemble label data and service label data.

2. Description of the Related Art

[0002] Much attention has been paid to DAB as a radio broadcasting system which can deal with sound quality degradation to be caused by radio interference between an increased number of FM broadcasting stations or with difficulty of good quality reception at mobile terminals. DAB has been developed by EUREKA (European leading-edge technology development project) and some specifications have already been presented. DAB adopts n/4 shift DQPSK-OFDM as a modulation scheme and features in resistance against the influence of fading and multipath. DQPSK-OFDM is an abbreviation of Differential Quadrature Phase Shift Keying - Orthogonal Frequency Division Multiplex. DAB also adopts high efficiency audio coding MPEG layer II and can realize stereo broadcasting and data broadcasting of six programs at a transmission bandwidth of 1.5 MHz.

[0003] A DAB radio as a broadcasting receiver has speakers for reproducing audio signals and a display unit for displaying string data such as ensemble label data and service label data sent at the same time when audio data is transmitted. The ensemble label data indicates the name of each ensemble, and the service label data indicates the name of each broadcast station. One ensemble generally contains six stereo broadcasting radio waves. There is a small display unit with a small maximum display size and a large display unit. Even a large size display unit has a limited screen size so that a means is necessary for proper display various data on the display unit.

[0004] If a small display with a small maximum display size is used, the full contents of an ensemble label and service label cannot be displayed in some cases. Even if a large display unit with a large maximum display size is used, if other data such as the name of a music program is displayed in addition to the ensemble label and service label, it becomes necessary in some cases to reduce the display area for the ensemble and service labels in order to display such other data.

[0005] "Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers", Draft prETS 300 401, European Broadcasting Union EBU, June 1996, teaches a standard making it possible to design a broadcasting receiver capable of displaying

string data in an abridged representation.

[0006] "The DAB multiplex and system support features", Riley, J. L., EBU Technical Review, Spring 1994, No. 259, Grand-Saconnex, CH, pages 11 to 23, describes a method of abbreviating a string of characters for use in RDS devices arranged to display 8 character strings.

[0007] WO 93/09615 A1 describes that a plurality of different data can be displayed simultaneously in one and the same display unit, if they are received in an abridged form.

[0008] It is an object of the present invention to provide a broadcasting receiver for receiving a broadcasting radio wave of a plurality of multiplexed broadcasting programs each containing audio data, string data such as ensemble label data and service label data, and abridged representation information of the string data, the radio being capable of properly displaying the string data on a display unit.

[0009] According to the invention, the above object is achieved by a broadcasting receiver according to claim 1. Preferred embodiments are claimed in the subclaims.

[0010] In other words, what is provided according to the invention is the following:

A broadcasting receiver (10) of this invention receives a broadcasting radio wave of a plurality of multiplexed broadcasting programs each containing audio data, string data (character string as an aggregation of characters, numerals and symbols), and abridged representation information of the string data. This broadcasting radio (10) comprises the following two constituents (a) and (b):

- (a) abridged representation judging means (50) for judging whether the string data is displayed in an abridged representation; and
- (b) representation control means (52) for displaying the string data on a display unit (32) in the abridged representation in accordance with the abridged representation information, when the abridged representation judging means (50) judges that the string data is displayed in the abridged representation.

[0011] The abridged representation information may include not only abridgement judging information of each character of the string data, but also information indicating to display the string data up to its predetermined byte and omit the string data after this predetermined byte for the abridged representation.

[0012] The abridged representation judging means (50) judges from a predetermined judgement criterion whether the string data is displayed in the abridged representation. In accordance with the judgement results made by the abridged representation judging means (50), the representation control means (52) controls the display of the string data on the display unit (32), and if

the abridged representation judging means (50) judges that the string data is displayed in the abridged representation, the control means displays the string data on the display unit (32) in the abridged representation. As above, in accordance with the operation conditions, the representation of the string data on the display unit (32) is switched between an abridged representation and a full representation to thereby allow the string data to be properly displayed on the display unit (32).

[0013] According to another aspect of the broadcasting receiver (10) of the invention, the abridged representation judging means (50) judges in accordance with a display space for the string data on the display unit (32).

[0014] The string data is displayed on the display unit (32) in the abridged representation in the case wherein the display unit (32) has a small display space for the string data. This case corresponds to a small maximum display size of the display unit (32) and to a user request of displaying the string data in a small display space. Conversely, the string data is displayed on the display unit (32) in the full representation in the case wherein the display unit (32) has a large display space for the string data. This case corresponds to a large maximum display size of the display unit (32) and to a user request of displaying the string data in a large display space.

[0015] According to another aspect of the broadcasting receiver (10) of this invention, if a plurality of data sets of the string data are to be displayed on the display unit (32), the abridged representation judging means (50) judges that at least one data set affixed with the abridged representation information is omitted in displaying.

[0016] Even if the maximum display size of the display unit (32) is large, the display space of the display unit (32) may become insufficient for the display of a plurality of data sets of the string data. In such a case, the abridged representation judging means (50) judges that at least one data set affixed with the abridged representation information among the plurality of data sets to be displayed is omitted in displaying. In accordance with this judgement, the representation control means (52) controls to display the string data on the display unit (32) in the abridged representation. Accordingly, the display space of the string data can be reduced and the reserved display space is allocated to the display of other data. In this manner, the limited display space of the display unit (32) can be efficiently used and a plurality of data sets can be displayed on the display unit (32) at a time.

[0017] According to another aspect of the broadcasting receiver (10) of this invention, the abridged representation information includes abridgement judging data of each character of the string data, and the representation control means (52) forms an abridged representation of the string data in accordance with the abridgement judging data, if the abridged representation is to be performed.

[0018] A discriminator as above is affixed to each character of the string data for the judgement whether the character can be omitted in the abridged representation.

Accordingly, the representation control means (52) can easily form an abridged representation of the string data in accordance with the discriminator.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig. 1 is a flow chart illustrating a service label representation switching routine.

Fig. 2 is a flow chart illustrating a service label representation switching routine when a 16-digit display unit is used.

Fig. 3 is a diagram showing examples of a service label displayed on a display unit.

Fig. 4 is a diagram showing examples of specific character string and character flag set loaded in a character field and a character flag field shown in Fig. 9.

Fig. 5 shows the configuration of a vehicle mount DAB radio system.

Fig. 6 is a diagram showing the format of a DAB transmission frame.

Fig. 7 is a diagram showing the structure of FIB.

Fig. 8 is a diagram showing the structure of FIG shown in Fig. 7 and having a FIG type 1.

Fig. 9 is a diagram showing the structure of a type 1 field of FIG shown in Fig. 8 and having an extension number 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] An embodiment of the invention will be described with reference to the accompanying drawings.

[0021] Fig. 5 is a diagram showing the system configuration of a vehicle mount DAB radio 10. This DAB radio 10 has a main system 12 and a separate remote controller including a DAB control microcomputer 26 and the like. The main system 12 has a DAB system microcomputer 14 and its memory 16, and operates to designate one ensemble among a plurality of multiplexed radio broadcasting waves (ensembles) and to send designated information to a radio frequency (RF) block 18. An ensemble stands for a radio broadcasting wave modulated through DQPSK-OFDM, has a bandwidth of 5 MHz and generally contains six broadcasting programs. If each ensemble is called a main channel, each broadcasting radio wave is called a subchannel. The RF block 18 derives RF signals from the ensemble designated by

the DAB system microcomputer 14, and sends the derived RF signals to a demodulating block 20. The demodulating block 20 demodulates the RF signals sent from the RF block 18, and the demodulated signals are decoded by a channel decoding block 22. In the above manner, the channel decoding block 22 acquires all digital signals of one ensemble designated by the DAB system microcomputer 14 and sent to the RF block 18. Of digital signals decoded by the channel decoding block 22, audio data is sent from the channel decoding block 22 to an audio decoding block 24, and data other than the audio data, including PTY data (corresponding to program type data), ensemble label data, sample label data and the like, is sent from the channel decoding block 22 to the DAB system microcomputer 14. The audio decoding block 24 decodes audio data of a subchannel designated by the DAB system microcomputer 14 among the audio data input from the channel decoding block 22, and drives right and left speakers (not shown) by the decoded audio data. The DAB control microcomputer 26 has a memory 28 to transfer data to and from the DAB system microcomputer 14 of the main system 12. The DAB control microcomputer 26 receives a user instruction from a key unit 30, and supplies predetermined data to a display unit 32 to display necessary information and present it to a user.

[0022] Fig. 6 shows the format of a transmission frame of DAB. A transmission frame is constituted of a synchronization channel, a fast information channel (FIC) and a main service information channel (MSC) in this order from the top of the frame. FIC has a plurality of fast information blocks (FIB). MSC has a plurality of common interleaved frames (CIF). DAB is provided with specifications from mode 1 to mode 3. Each mode has a different duration of one transmission frame and different numbers of FIB's and CIF's per one transmission frame. For example, in the mode 1, the duration of one transmission frame is 96 ms and the numbers of FIB's and CIF's per one transmission frame are 12 and 4, respectively.

[0023] Fig. 7 shows the structure of FIB. Each FIB has 256 bits in total, including a FIB data field of 30 bytes in a front area and a cyclic redundancy check (CRC) word of 6 bits in a back area. The FIB data field includes, in the order from the top of this field, a plurality of first information groups (FIG), one end marker and one padding field (bits 0 are inserted so as to completely fill the FIG data field of 30 bytes). Each FIG is a useful data field which is constituted of a FIG type field, a length field (indicating the bit length of the next FIG data field) and the FIG data field in this order from the top of FIG. The FIG type and length constitute a FIG header.

[0024] Fig. 8 shows the structure of FIG shown in Fig. 1, this FIG being of a type 1 (001 in 3-bit binary notation). The FIG data field includes, in the order from the top, a character set (Charset) field, an OE field (storing a flag indicating whether information in the next type 1 field belongs to the subject ensemble or another ensemble), an extension field (storing one of eight extension numbers

of the FIG type 1) and the type 1 field.

[0025] Fig. 9 shows the structure of the type 1 field shown in Fig. 8, the type 1 field having the extension number 1. The type 1 field having the extension number 1 is service label data, and includes from the top of this field a service identifier (Sid) field of 16 bits, a character field of 16 bytes (= 16 x 8 bits) and a character flag field of 16 bits.

[0026] Fig. 4 shows specific data of a character string and a character flag set loaded in the character field and the character flag field shown in Fig. 9. In this example, the character string is "BBC_Radio_1_DAB_" wherein "_" is a space. Each character is made of an ASCII code of one byte. The character flag set is "1111100000110001". Each bit of the character flag set indicates whether or not the character at the same byte number as the bit number of the character flag can be omitted when an abridged representation is used. A bit "1" indicates that the corresponding character cannot be omitted in the abridged representation, and a bit "0" indicates that the corresponding character can be omitted in the abridged representation. Therefore, the character string in a 16-digit full representation is "BBC_Radio_1_DAB_", and that in an 8-digit abridged representation, the character string is "BBC_R1_". The above description for the service label can also be applied to the ensemble label.

[0027] Fig. 1 is a flow chart illustrating a service label representation switching routine. Although the description for Figs. 1 and 2 is applied to the service label, the ensemble label can be processed in a similar manner. At Step S100 it is checked whether an operation mode is a service label display mode. If YES, the flow advances to Step S102, whereas if NO, the flow escapes from this routine. At Step S102 it is checked whether the number of selected digits for the display of a service label on the display unit 32 is 8 or 16. In this case, if an 8-digit small display unit 32 is used, there is no room to select the representation type, but the service label is displayed on the display unit in 8 digits by all means. On the other hand, if a 16-digit large display unit 32 is used, switching between the 8-digit and 16-bit representations becomes possible depending upon a user selection and a predetermined condition. If the 16-bit representation is selected, the flow advances from Step S102 to Step S106, whereas if the 8-bit representation is selected, the flow advances from Step S102 to Step S104. At Step S104 a 16-digit service label is converted into an 8-digit service label in accordance with its character flag set. At Step S106, the service label is output to the display unit 32. An abridged representation judging means 50 judges whether a service label as string data is displayed in the abridged representation or in the full representation, and this operation corresponds to Step S102. In accordance with the judgement results made by the abridged representation judging means 50, a representation control means 52 converts, in the case of the abridged representation, the service label as string data into the 8-digit

service label, for example, "BBC_R1___", in accordance with its character flag set, and outputs it to the display unit 32. In the case of the full representation, the service label is not converted but this label itself, for example, "BBC_Radio_1_DAB_", is output to the display device 32. The operation of the representation control means 52 corresponds to Steps 102, 104 and 106.

[0028] Fig. 2 is a flow chart illustrating a service label representation switching routine when a 16-digit large display unit 32 is used. Instead of Step S102 shown in Fig. 1, Step S110 is used. At Step S110 it is judged whether data other than the full-representation data is displayed on the display unit 32. The other data may be a present time, the name of a music program presently produced from the speakers of the DAB radio 10, and the like. If the other data is also displayed, the flow advances to Step 104, whereas if not, the flow advances to Step S106. Fig. 3 shows examples of various service labels displayed on the display unit 32. If data other than the service label is not displayed on the display unit 32, the service label is displayed in the full representation at the digit numbers 1 to 16. If a present time is displayed (Example 1) or the name of a music program is displayed (Example 2), the abridged service label is displayed on the display unit 32 at the digit numbers 1 to 8 and the other data such as a present time or a music program name is displayed at the digit numbers 9 to 16. In the example shown in Fig. 2, the abridged representation means 50 determines either the full representation or abridged representation of the service label, in accordance with whether data other than the service label is displayed on the display unit 32. The operation of the abridged representation means 50 corresponds to Step S110. In accordance with the judgement results made by the abridged representation judging means 50, a representation control means 52 converts, in the case of the abridged representation, the service label as string data into the 8-digit service label, for example, "BBC_R1___", in accordance with its character flag set, and outputs it to the display unit 32. In the case of the full representation, the service label is not converted but this label itself, for example, "BBC_Radio_1_DAB_", is output to the display device 32. The operation of the representation control means 52 corresponds to Steps 102, 104 and 106.

Claims

1. A broadcasting receiver (10) for receiving a broadcasting radio wave of a plurality of multiplexed broadcasting programs each containing audio data, string data and abridged representation information of the string data, comprising:

representation control means (52) for displaying the string data on a display unit (32) in an abridged representation in accordance with the abridged representation information, said

abridged representation information differing from a full representation by at least one character of the respective string being omitted,

characterized in that

an abridged representation judging means (50) is provided for judging from a predetermined judgement criterion including a user request whether the string data is to be displayed in an abridged representation, wherein said representation control means (52) performs said abridged representation, when said abridged representation judging means (50) judges that the string data is to be displayed in the abridged representation and said abridged representation judging means (50) drives said representation control means (52) to switch between said full representation and said abridged representation of said string data together with other data instead of the at least one omitted character, in accordance with the operation conditions.

2. A broadcasting receiver according to claim 1, wherein said abridged representation judging means (50) judges in accordance with a display space for the string data on the display unit (32).
3. A broadcasting receiver according to any one of claims 1 to 2, wherein the abridged representation information includes abridgement judging data of each character of the string data, and said representation control means (52) forms an abridged representation of the string data in accordance with the abridgement judging data, when the abridged representation is to be performed.

Patentansprüche

1. Rundfunkempfänger (10) zum Empfangen einer Rundfunkradiowelle von einer Mehrzahl von multiplexten Rundfunkprogrammen, von den jedes Audiodaten, Zeichenkettendaten und Kurzdarstellungsinformationen der Zeichenkettendaten enthält, umfassend:

Darstellungssteuerungseinrichtung (52) zum Anzeigen der Zeichenkettendaten auf einer Anzeigeeinheit (32) in einer Kurzdarstellung in Übereinstimmung mit den Kurzdarstellungsinformationen, die Kurzdarstellungsinformationen sich von einer Voldarstellung dadurch unterscheiden, dass mindestens ein Zeichen der entsprechenden Zeichenkette weggelassen ist; **dadurch gekennzeichnet, dass** eine Kurzdarstellungsbeurteilungseinrichtung (50) zum Beurteilen von einem vorherbestimmten Beurteilungskriterium her, das eine Nutzer-

- anfrage beinhaltet, ob die Zeichenkettendaten in einer Kurzdarstellung anzuzeigen sind, vorgesehen ist, worin die Darstellungssteuerungseinrichtung (52) die Kurzdarstellung durchführt, wenn die Kurzdarstellungsbeurteilungseinrichtung (50) beurteilt, dass die Zeichenkettendaten in der Kurzdarstellung anzuzeigen sind und die Kurzdarstellungsbeurteilungseinrichtung (50) die Darstellungssteuerungseinrichtung (52) lenkt, zwischen der Volldarstellung und der Kurzdarstellung der Zeichenkettendaten zusammen mit anderen Daten anstatt des mindestens einen weggelassenen Zeichens in Übereinstimmung mit den Betriebsbedingungen zu schalten.
2. Rundfunkempfänger nach Anspruch 1, worin die Kurzdarstellungsbeurteilungseinrichtung (50) Beurteilung in Übereinstimmung mit einem Anzeigeraum für die Zeichenkettendaten in der Anzeigeeinheit (32) vornimmt.
3. Rundfunkempfänger nach einem der Ansprüche 1 oder 2, worin die Kurzdarstellungsinformationen die Kürzungsbeurteilungsdaten jedes Zeichens der Zeichenkettendaten beinhalten und die Darstellungssteuerungseinrichtung (52) eine Kurzdarstellung der Zeichenkettendaten in Übereinstimmung mit den Kürzungsbeurteilungsdaten bildet, wenn die Kurzdarstellung durchzuführen ist.
- représentation (52) effectuent ladite représentation abrégée, lorsque lesdits moyens de jugement de représentation abrégée (50) jugent que les données de chaîne doivent être affichées dans une représentation abrégée et lesdits moyens de jugement de représentation abrégée (50) pilotent lesdits moyens de commande de représentation (52) pour commuter entre ladite représentation complète et ladite représentation abrégée desdites données de chaîne avec d'autres données à la place du au moins un caractère omis, selon les conditions d'opération.
2. Récepteur de radiodiffusion selon la revendication 1, dans lequel lesdits moyens de jugement de représentation abrégée (50) jugent selon un espace d'affichage pour les données de chaîne sur l'unité d'affichage (32).
3. Récepteur de radiodiffusion selon l'une quelconque des revendications 1 à 2, dans lequel l'information de représentation abrégée comporte des données de jugement d'abrégement de chaque caractère des données de chaîne, et lesdits moyens de commande de représentation (52) forment une représentation abrégée des données de chaîne selon les données de jugement d'abrégement, lorsque la représentation abrégée doit être effectuée.

Revendications

1. Récepteur de radiodiffusion (10) pour recevoir une onde de radiodiffusion d'une pluralité de programmes de radiodiffusion multiplexés contenant chacun des données audio, des données de chaîne et de l'information de représentation abrégée des données de chaîne, comprenant:
- des moyens de commande de représentation (52) pour afficher des données de chaîne sur l'unité d'affichage (32) dans une représentation abrégée selon l'information de représentation abrégée, ladite information de représentation abrégée différant d'une représentation complète avec au moins un caractère de la chaîne respective étant omis,
- caractérisé en ce que**
- des moyens de jugement de représentation abrégée (50) sont délivrés pour juger à partir d'un critère de jugement prédéterminé comportant une demande d'utilisateur pour savoir si les données de chaîne seront affichées en une représentation abrégée, dans lequel lesdits moyens de commande de

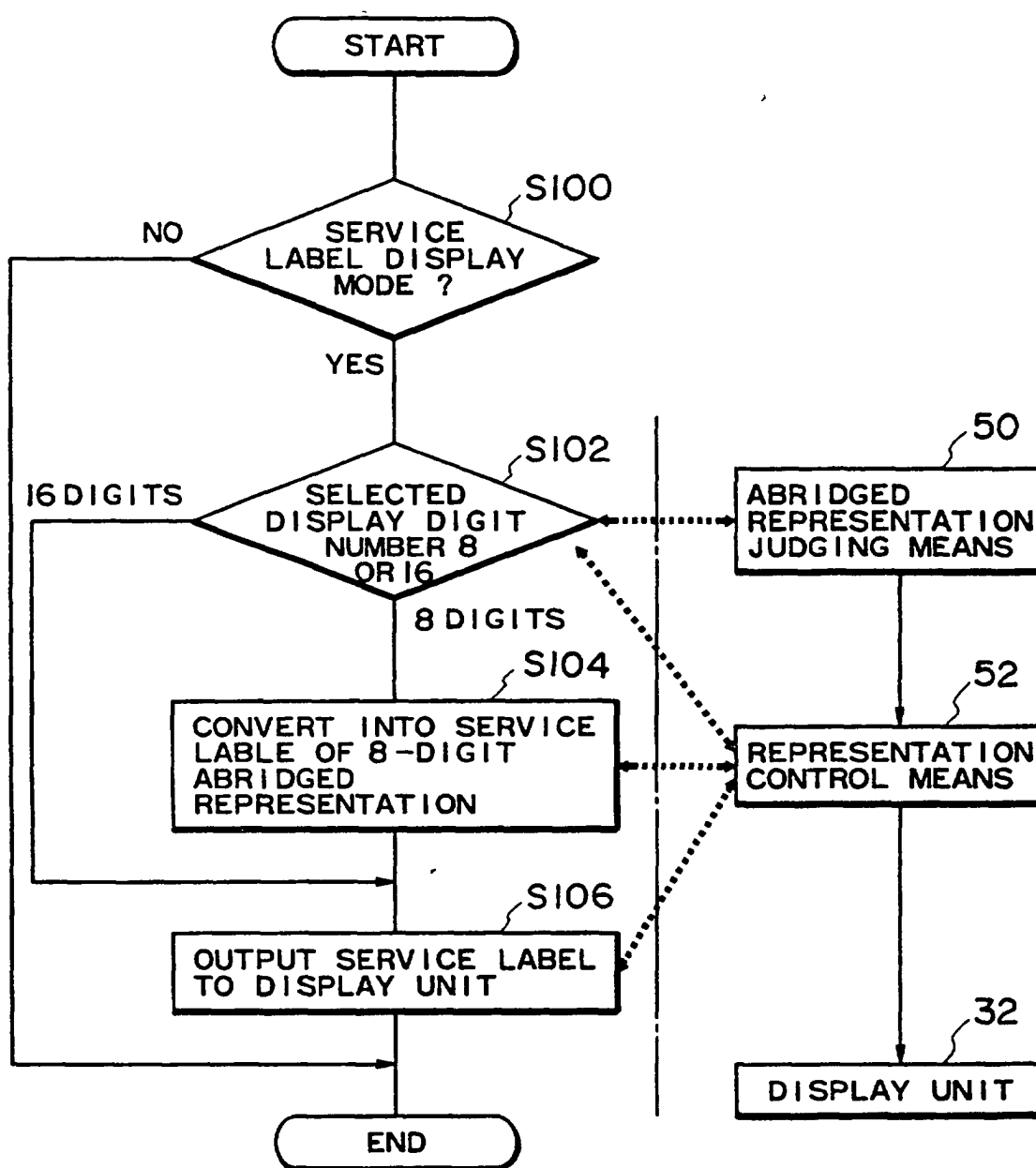


FIG. 1

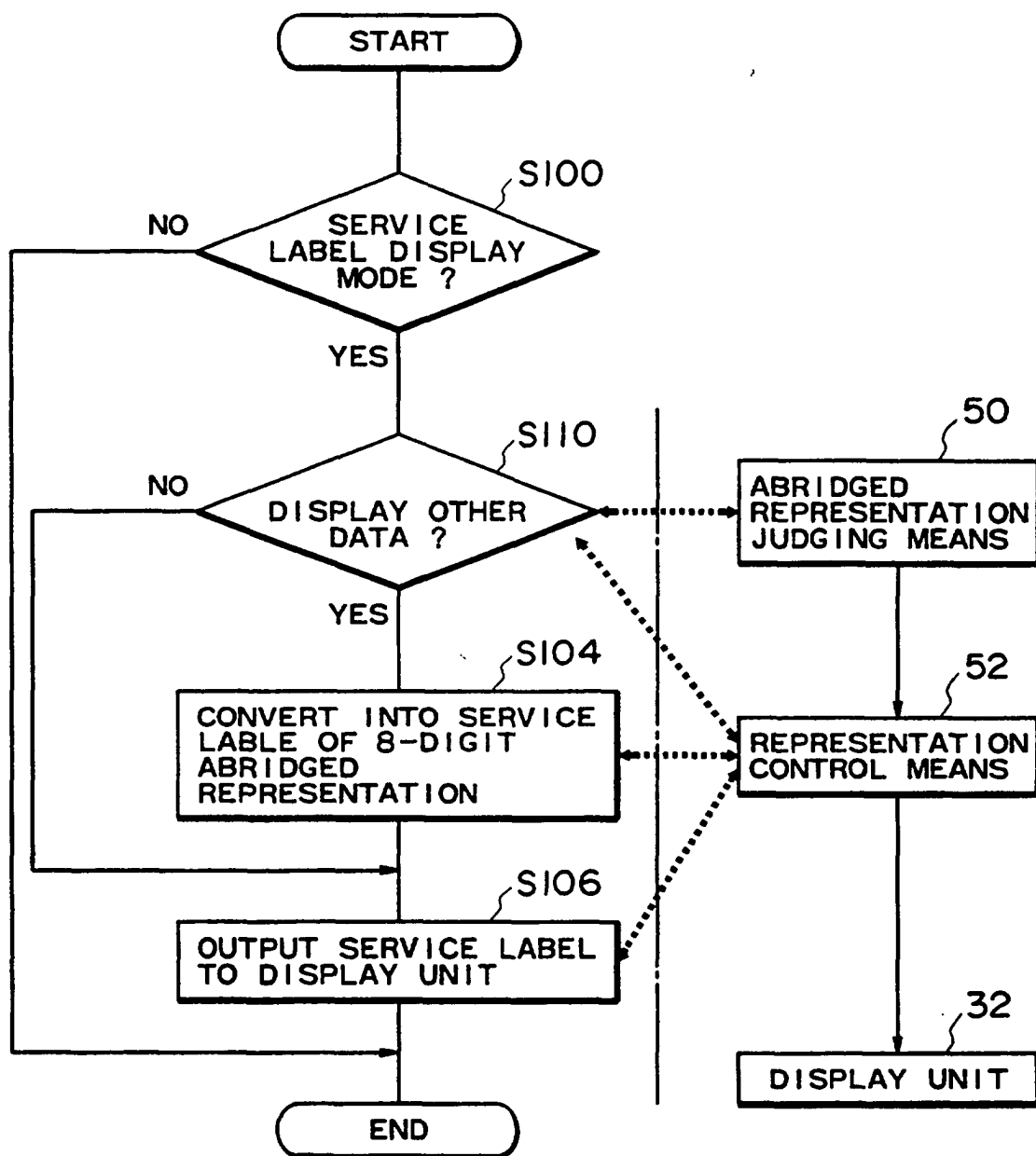


FIG. 2

DIGIT NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FULL REPRESENTATION	B B C R A D I O								, 1 D A B							

ABRIDGED
REPRESENTATION:
EXAMPLE 1

B B C R 1	1 0 : 3 4
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ABRIDGED
REPRESENTATION:
EXAMPLE 2

B B C R 1	L E T I T B
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FIG. 3

BYTE OR BIT NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CHARACTER	B	B	C		R	A	D	I	O		1		D	A	B	
CHARACTER FLAG	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1

FIG. 4

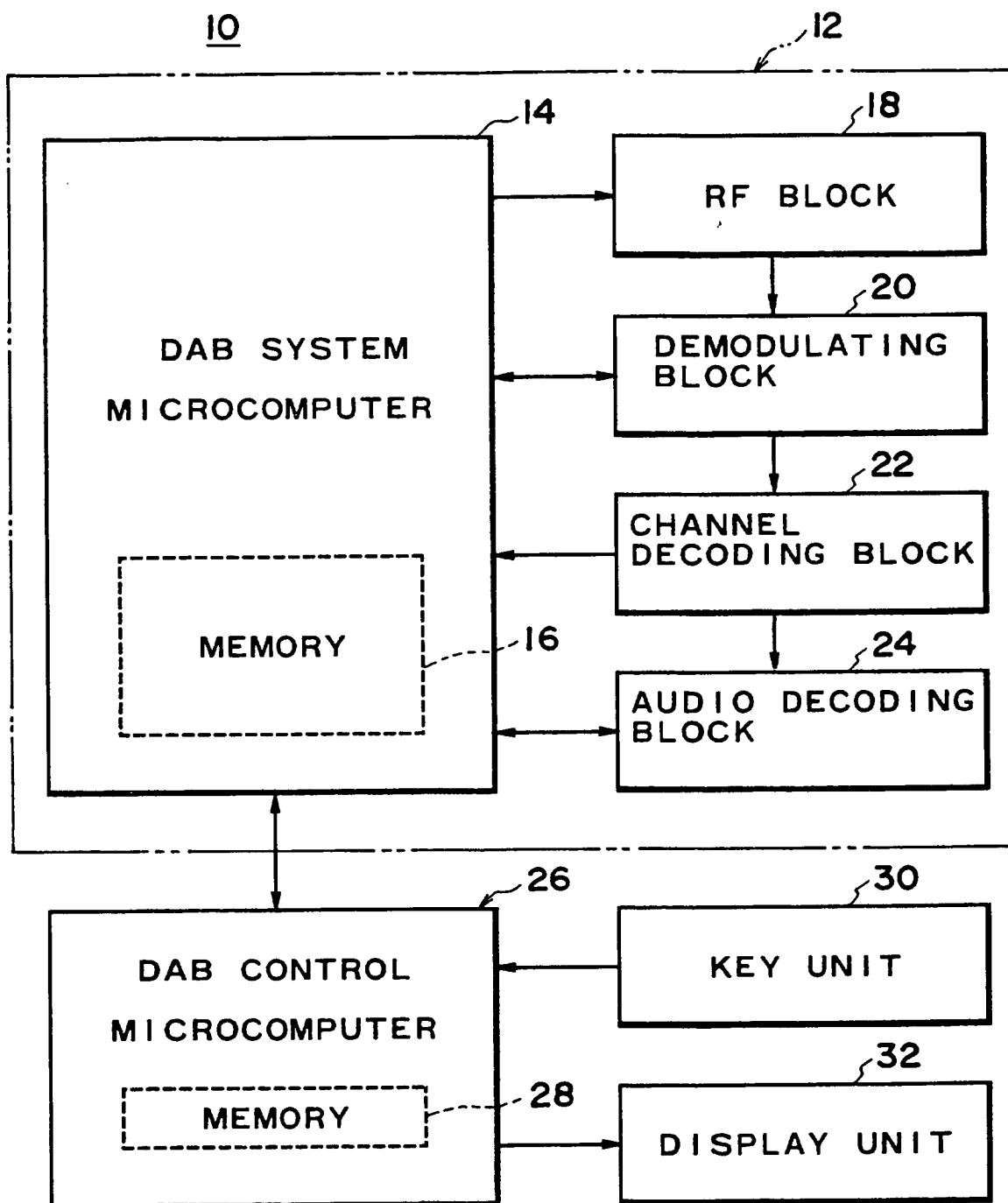


FIG. 5

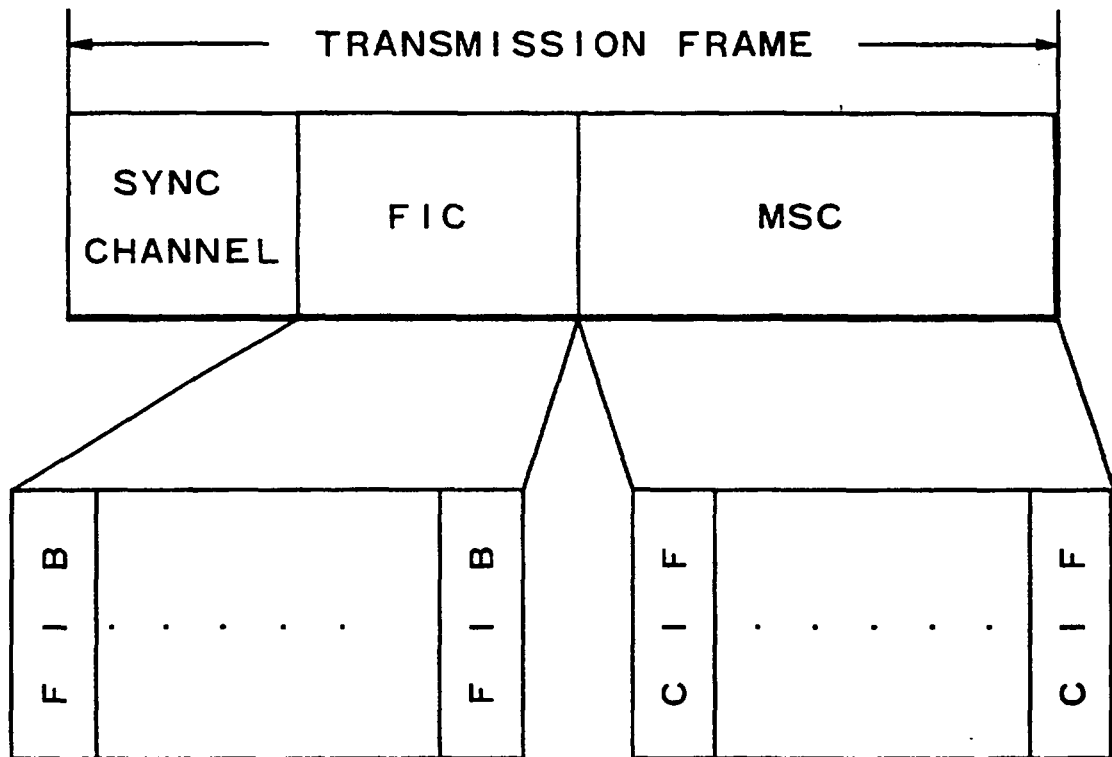


FIG. 6

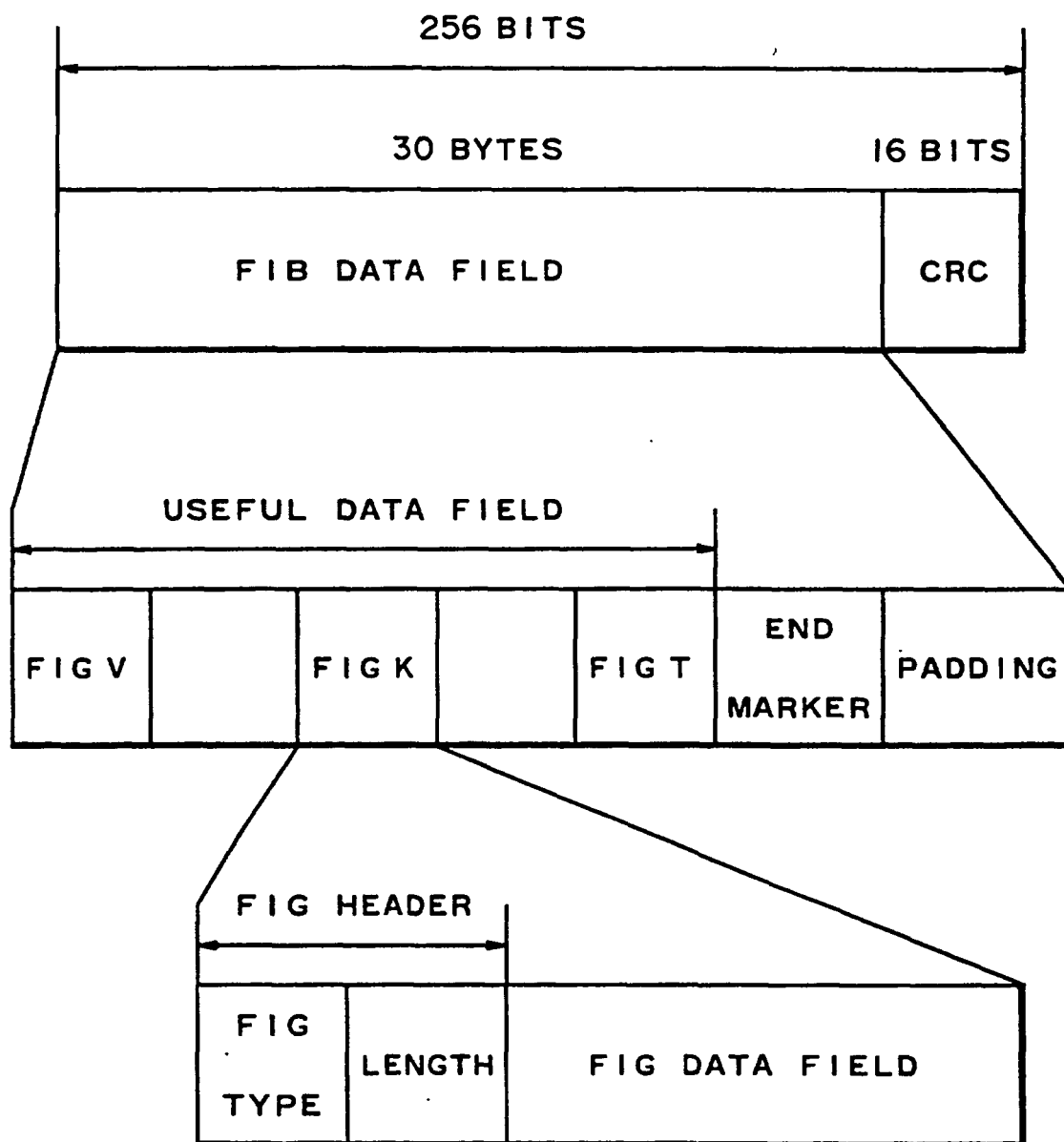


FIG. 7

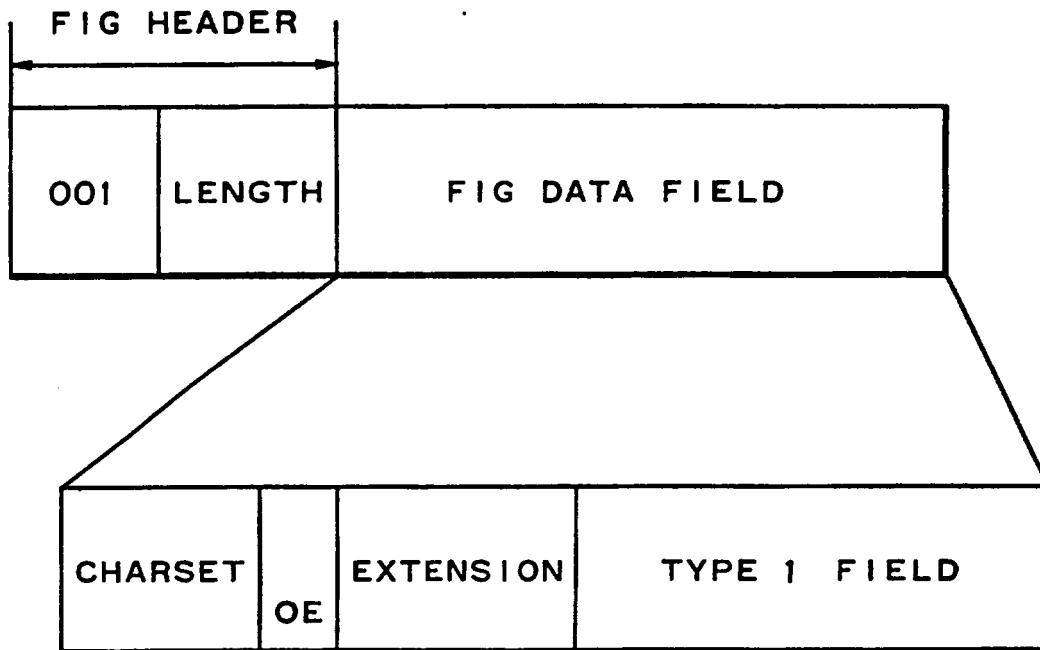


FIG. 8

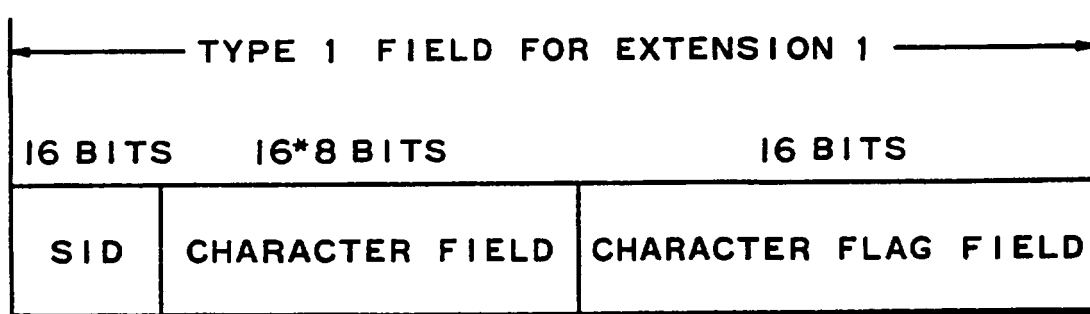


FIG. 9