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(54) **Digital paging system having bit rate switching means and digital paging receiver therefor.**

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Description

Background of the invention

The present invention relates to a digital paging system, and more particularly to a digital paging system permitting both transmission and reception of a paging code including an address code and a message code.

In digital paging systems, there are both higher and lower limits to the rate of transmission because of the need for efficient use of frequencies and because of the fear of a decrease in paging code reception probability due to the deterioration of the bit error rate (BER). Meanwhile, there are many proposals for paging systems in which message codes expressed in numerals or letters are transmitted besides address or calling codes and paging receivers receive and display such message code. One of the known examples of such proposals is the "Digital Radio Paging Communication System", disclosed in GB—A—2,061,582. The transmission of message codes by such a system requires a transmission capacity twice or three times as great as that for mere address codes because each message code usually contains a large quantity of information. Therefore, the length of time during which the communication line is occupied by each subscriber tends to be extended, and inevitably the subscriber capacity of the whole system is correspondingly limited. This shortcoming could be overcome by raising the transmission rate, but it would again entail, as stated above, a decrease in paging code reception probability. Particularly, the decrease of the address code reception probability is fatal to the paging system because the paging receiver starts processing the message codes following its address code only after the latter has been correctly detected.

Summary of the invention

Therefore, an object of the present invention is to provide a paging system capable of effectively transmitting and receiving message codes without adversely affecting the paging code (especially, address code) reception probability.

Another object of the invention is to provide a paging system capable of transmitting paging codes, including sync codes and address codes, at a lower bit rate and message codes at a higher bit rate.

Still another object of the invention is to provide a paging receiver capable of receiving address or calling codes transmitted at the lower bit rate and message codes transmitted at the higher bit rate.

The invention is characterized by the features of the claims.

Brief description of the drawings

Other objects, features and advantages of the present invention will become more apparent from the detailed description hereunder taken in conjunction with the accompanying drawings, wherein:

Fig. 1 shows the BER-to-C/N characteristic where the transmission rate is taken as the parameter:

Figs. 2A to 2F show the formats of paging signals applicable to the paging system according to the present invention;

Fig. 3 is a block diagram illustrating the structure of a paging terminal station of the paging system according to the present invention;

Fig. 4 shows the control flow in the controller section referred to in Fig. 3.

Figs. 5A to 5C illustrate the registration forms of paging codes at the paging terminal of Fig. 3, with Fig. 5A showing the composition of each code word, Fig. 5B the state in which a message is registered and Fig. 5C that in which an address number is registered;

Fig. 6 is a block diagram of a paging receiver of the paging system according to the present invention;

Figs. 7A and 7B respectively are a schematic circuit diagram and a frequency characteristic diagram of the LPF of the receiver referred to in Fig. 6;

Figs. 8A to 8D are time charts illustrating the operation of the paging receiver illustrated in Fig. 6 to detect a paging signal; and

Fig. 9 is a chart showing the word number designating bits, together with the functions thereof, of paging signals to be used by the paging system according to the present invention.

Detailed description of preferred embodiment

Fig. 1 shows that, as stated above, the transmission rate and the BER are in a conflicting relationship. Thus, to obtain the same BER, a high carrier-to-noise (C/N) ratio, i.e., a greater transmission power is needed at a transmission rate of 400 bits/sec than at one of 200 bits/sec. In other words, if signals are transmitted with the same transmission power, the BER will be greater at the higher transmission rate (400 bits/sec) than at the lower (200 bits/sec), resulting in a correspondingly lower paging code reception probability in the paging receiver.

Fig. 2A shows how groups of paging codes are put together, and each receiver is assigned to one or another of these groups. Fig. 2B shows how each group is composed of different codes, and Fig. 2C illustrates the composition of a sync code for achieving word synchronization and group synchronization. In Fig. 2B, data portions #1—#8 contain either an address or a message code. Fig. 2D shows the structure of an address or calling code for selectively calling each receiver, where a BCH (31, 16) code is used. The bit rate of the address code is 200 bits/sec in this instance. Fig. 2E illustrates the composition of a message code, wherein raising the bit rate to double that for the address code would make it possible to use the BCH (63, 45) code. The message code used here, however, is one bit shorter than the BCH (63, 45) code because of frame synchronization. Fig. 2F shows an example of the composition of transmitted paging codes, wherein S and S' are sync codes; A1 to A5 are address codes for selectively calling individual receivers, and M1 to M3 are message codes for which alone the transmission rate is raised to 400 bits/sec.

Referring to Fig. 3, each element of a paging terminal 100 will be briefly described below. The paging terminal 100 is connected to a common telephone exchange network 102 including a telephone set 101 of the push-button or some other type. A multi-frequency (MF) receiver 104 receives MF signals sent over a trunk 103, and supplies them to a register 105. Similarly, a push-button (PB) receiver 108 receives PB tones sent over the trunk 103, and supplies them to a register 109. A tone generating circuit 106 is used for sending both valid and invalid tones from the paging terminal 100 to the telephone set 101 or the like. A timer 126 is intended for providing an input/output (I/O) port 107 with I/O timing, and a level converter circuit 114 is for so converting the level of codes supplied from a controller 110 as to be suitable for a modulator 115. A transmitter 117 radiates over a radio frequency by way of an antenna 119 paging signals transmitted from the modulator 115 via a transmission line 118 and demodulated by a demodulator 116. For further details on this paging terminal, reference is made to the aforementioned GB—A—2 061 582.

Now referring to Fig. 4, it will be described how the controller 110, referred to in Fig. 3, takes in an address number and message data from the common telephone network. The controller 110 waits until an address number is entered in the register 105 (see Step 200 in Fig. 4). Upon entry of the address number at Step 200, the controller 110 shifts to Step 201 to take data in from the register 105 through the I/O port 107, and compares it with subscribers' file data stored in a random-access memory (RAM) 111. As stated at Step 202, the operational flow then follows either one of two branches, depending on the result of comparison. If the address number is found not registered in the subscribers' file, the flow will go on to Step 203 or, if it is registered, to Step 204. At Step 203, an invalid tone is generated from the tone generator circuit 106 and, at the same time, takes a termination procedure to return to Step 200, which is a waiting action.

At Step 204, the controller 110 sends out a valid tone, in response to which the exchange network 102 directly connects the paging terminal 100 to the telephone set 101. In such a direct connection, the paging terminal 100 can receive PB tones from the telephone set 101 with the PB tone receiver 108. Next, controller 110 proceeds to Step 205, where it waits for the entry of the input start tone of message data. The input start tone is entered with, e.g., the # mark key of the PB telephone set 101. If the start tone fails to be entered within a prescribed length of time, the flow moves on to Step 206, where an address code is prepared for performing the so-called tone-only paging service and the code so prepared is registered in the send-out code area of the RAM 111. Each digit of address number is changed to 4-bit binary code, so that the address number can be transmitted by 4 digits per one data portion, as shown in Fig. 2D.

On the other hand, if the input start tone of message data is received, the controller 110 goes on to Step 207 to take in message data. Decision is made at Step 208 as to whether or not a message-end tone is contained in the data taken in at Step 207, and Step 207 is repeated until this end tone is detected, eventually to fully receive the whole message. The end tone is, similar to the start tone, entered with the * mark key of the telephone set 101. Upon detection of the message-end tone at Step 208, the flow proceeds to Step 209 to prepare an address code and a message code from the received address number and message, respectively. Each digit of message data is encoded to 4-bit binary code, with a result that the message can be transmitted by 11 digits per one data portion, as shown in Fig 2E. After the encoding, the controller 110 registers these codes in the send-out code area. At this time, a discrimination (DS) code (to be described below) to distinguish between an address number and message is inserted as the most significant bit (MSB). One DS bit is used in the address number and two DS bits in the message. Upon completion of the registration, the controller 110 goes to Step 210 to take the termination procedure, and then returns to Step 200.

Next will be described the form of code registration at Step 206 or 209 in Fig. 4 with reference to Figs. 5A to 5C. Each word or code word for registration which corresponds to the data portion of Fig. 2B, consists of 62 bits as illustrated in Fig. 5A. Message code bits are registered, as shown in Fig. 5B, in a one-to-one correspondence with the bits of the code word, so that 62 bits of information are registered per code word. On the other hand, address code bits are registered, as shown in Fig. 5C, in a ratio of one to every two bits of the code word, so that only 31 address code bits are registered per code word.

Codes are transmitted from the controller 110 at the same rate as that of messages (400 bits/sec in this particular instance). Accordingly, each bit of the address code is equivalent to two bits of message code, and the transmission rate of address codes is half that of message codes, or 200 bits/sec.

In Fig. 6, the paging receiver includes an antenna 1, and r.f. receiver section 2, a frequency discriminator 3, a low-pass filter (LPF) 4 capable of selecting its cut-off frequency, and a data processing section 12. The data processing section further comprises a slicer or waveform shaping circuit 5, a decoder 6, a read-only memory (ROM) 7 for storing address codes, a message controller 8, a speaker driving buffer 9, a speaker 10 and a liquid crystal display device (LCD) 11.

A radio frequency carrier wave frequency-modulated by paging codes and transmitted from the transmitting side in Fig. 3 is picked up by the antenna 1, and amplified and frequency-converted by the receiver section 2, whose output is demodulated by the frequency discriminator 3 into a baseband signal. After being extracted by the LPF 4, the baseband signal is waveform-shaped by the slicer 5 and supplied to the decoder 6 as a digital signal. The decoder 6 decodes the output of the slicer 5 and, upon detection of the sync code illustrated in Fig. 2C, achieves frame synchronization and group synchronization.

After that, an address number code assigned to the receiver is read out of the ROM 7, and compared with the received address code. If the received address code is found identical with the address code read out of the ROM 7, the decoder 6 provides a control signal S2 to switch the cut-off frequency of the LPF 4, thereby to make possible data reception at a rate of 400 bit/sec and, at the same time, the message controller 8 is actuated. The message controller 8 receives and decodes message codes, and alerts the subscriber by either emitting an alert tone from the speaker 10 through the buffer 9 or displaying the decoded message codes on the LCD 11.

Fig. 7A illustrates the circuitry of the LPF 4 referred to in Fig. 6, which is a secondary Butterworth LPF using an operational amplifier 41. In the figure, switching circuits SW1 and SW2 are operated by the control signal S2, while resistors R1 through R4 and capacitors C1 and C2 are for determining the cut-off frequency. The cut-off frequency used when the switching circuits SW1 and SW2 are open being represented by f_{c1}, and that used when the two switching circuits are closed being represented by f_{c2}, the two cut-off frequencies will be given by the following equations, respectively:

$$f_{c1}=\frac{1}{2\pi(R1+R2)C1}$$

$$f_{c2}=\frac{1}{2\pi R1\ C1}$$

provided that R1=R4, R2=R3, and C1=C2.

These cut-off frequencies f_{c1} and f_{c2} are those used when signals are received at transmission rates of 200 bits/sec and 400 bits/sec, respectively. At the cut-off frequency f_{c1} (120 Hz), the LPF 4 extracts an address code from the output S1 of the discriminator 3, as an output S3. At f_{c2} (240 Hz), the LPF 4 also extracts a message code from the output S1, as an output signal S3. The resultant S3 is applied to the slicer 5. Fig. 7B shows the frequency characteristic of the LPF 4 illustrated in Fig. 7A.

The LPF permitting the selection of its cut-off frequency, referred to above, may consist of some other kind of filter as well, such as a switched capacitor filter (SCF) or a digital filter. Also, the LPF may comprise two LPF's whose cut-off frequencies differ from each other.

Thus by switching the cut-off frequency of the LPF, signals transmitted at a low transmission rate can be received with an LPF having the optimal cut-off frequency, and noise can be thereby eliminated. As can be seen from Fig. 7B, when the transmission rate is 200 bit/sec, the level of output noise from the LPF can be 3 dB lower than when the rate is 400 bits/sec, resulting in a corresponding improvement in code reception probability.

Figs. 8A through 8D illustrate an example of the operation of the paging receiver of Fig. 6 according to the present invention when it receives the codes shown in Figs. 2A through 2F. The decoder 6, until it receives the address code Ai, keeps the control signal S2 at the "L" level as shown in Fig. 8C to receive signals at the transmission rate of 200 bits/sec. Upon receipt of the address code Ai for the receiver as represented by Fig. 8B, the decoder 6 sends an address detection pulse (ADP) referred to in Fig. 8B to the message controller 8. At the same time, it raises the control signal S2 to the "H" level as shown in Fig. 8C to switch the cut-off frequency of the LPF 4 to what corresponds to the transmission rate of 400 bits/sec, and starts receiving message codes.

The message controller 8 is actuated by the ADP pulse, and receives and stores demodulated baseband signals from the slicer 5. Upon receipt of a word of message code, the message controller 8 judges, according to the first two bits of the word, whether or not the received word is a message code and, if it is, according to the word designating information of the next two bits, whether or not the word will be followed by another message code, and sends a message reception end pulse (MRP), referred to in Fig. 8D, to the decoder 6. The relationship between word designation information bits and the number of following message words is shown in Fig. 9. In response to the MRP pulse, the decoder 6 changes the control signal S2 to the "L" level (Fig. 8C), returns the LPF 4 to the cut-off frequency corresponding to signals transmitted at the rate of 200 bits/sec, and resumes the reception of address codes.

Fig. 8A shows an instance in which the two MSBs are used as the discrimination (DS) code to distinguish message codes from others. If it is "11", the code will be a message code. Therefore, the MSB has to be "0" for the received code to be an address code. Further, in this instance, the next two bits in the message code are used for word number designating information as stated above. It is possible to judge according to this information whether or not the next code word is a message code so that the cut-off frequency of the LPF can be controlled accordingly.

In another conceivable code composition, information regarding the transmission rate of every next signal, 200 or 400 bits/sec, is incorporated into the sync code shown in Fig. 2C. This composition makes it possible to eliminate the message descrimination code and word number designation code, both referred to above, and thereby to utilize codes more efficiently.

As hitherto described, the present invention enables address codes to be composed at a lower bit rate and message codes, at a higher bit rate. Therefore, the invention can provide a paging receiver which contributes to curbing the decrease of subscriber capacity and to efficiently transmitting message information without adversely affecting the calling code reception probability.

Claims

1. A paging receiver comprising receiver means (2, 3) for receiving a paging signal and data processing means for decoding said paging signal, characterized in that

said paging signal includes a first code (A1, A2, ...) having a first transmission rate, a second code (M1, M2 ...), having a second transmission rate and a discrimination code (DS) for distinguishing the first and second codes (A1, A2, ...; M1, M2, ...), and

said receiver comprises low-pass filter means (4) connected to the output of said receiver means (2, 3) for switching its cut-off frequency in response to a control signal (S2) and selectively extracting said first and second codes (A1, A2, ...; M1, M2, ...); and data processing section means (12) coupled to the output of said low-pass filter means (4) for generating said control signal (S2) in response to the received discrimination code (DS), supplying the control signal (S2) to said low-pass filter means (4), and decoding the extracted first and second codes (A1, A2, ...; M1, M2, ...).

2. A paging receiver, as claimed in Claim 1, wherein said first code is an address code (A1, A2, ...), said second code is a message code (M1, M2, ...) and said second transmission rate is higher than said first transmission rate.

3. A paging receiver, as claimed in Claim 2, wherein said first transmission rate is 200 bits/sec and said second transmission rate is 400 bits/sec.

4. A paging receiver, as claimed in any of Claims 1 to 3, wherein said low-pass filter means (4) is so set as to have Butterworth characteristics and includes:

an operational amplifier (41) coupled to an output terminal and to the input of said low-pass filter means (4) and having inverting and non-inverting input terminals (I; N);

a plurality of resistors (R1 to R4) connected in series between the input of said low-pass filter means (4) and said inverting input terminal (I);

a first capacitor (C1) connected between said inverting and non-inverting input terminals (I; N);

a second capacitor (C2) connected between said output terminal and one of said plurality of resistors (R1 to R4); and

a switching element (SW1, SW2) for short-circuiting any desired one of said plurality of resistors (R1 to R4) in response to said control signal (S2).

5. A paging receiver, as claimed in Claim 2, wherein said discrimination code (DS) is inserted into the most significant bits of said address code (A1, A2, ...) and message code (M1, M2, ...).

6. A paging receiver, as claimed in Claim 2, wherein said data processing section means (12) comprises: means (5) for waveform-shaping the output of said low-pass filter means (4); a decoder section (6), coupled to the output of said waveform shaping means (5), for generating said control signal (S2) in response to the detection of said discrimination code (DS), if said paging signal is judged to be an address code (A1, A2, ...), said decoder section (6) comparing this address code and an address code assigned to said receiver, if the two address codes are found identical, said decoder section (6) sending out an alert signal, if said paging signal is judged to be a message, said decoder section (6) sending out a message detection pulse; and a message processing section (8), connected to said waveform shaping means (5) and said decoder section (6), for receiving and processing messages (M1, M2, ...) from said waveform shaping means (5) in response to said message detection pulse.

7. A method for receiving a paging signal, comprising the steps of: receiving said paging signal; and decoding the received paging signal, characterized in that

said paging signal includes a first code (A1, A2, ...) having a first transmission rate, and second code (M1, M2, ...) having a second transmission rate and a discrimination code (DS) for distinguishing the first and second codes (A1, A2, ...; M1, M2, ...),

said method comprises the steps of: selectively receiving and passing said first and second codes (A1, A2, ...; M1, M2, ...) in response to a control signal (S2); generating said control signal (S2) in response to the received discrimination code (DS); and decoding said first and second codes (A1, A2, ...; M1, M2 ...) which have been passed.

8. A method, as claimed in Claim 7, wherein said step of selectively receiving and passing comprises the step of switching the cut-off frequency of a low pass-filter (4) to selectively pass said first and second codes (A1, A2, ...; M1, M2, ...).

9. A method, as claimed in Claim 7, wherein said first code is an address code (A1, A2, ...), said second code is a message code (M1, M2, ...) and said second transmission rate is higher than said first transmission rate.

10. A method, as claimed in Claim 9, wherein the first transmission rate is 200 bits/sec and the second transmission rate is 400 bits/sec.

11. A method, as claimed in Claim 9 or 10, wherein said discrimination code (DS) is inserted into the most significant bits of said address code (A1, A2, ...) and said message code (M1, M2, ...).

12. A method, as claimed in Claim 7, further comprising the step of transmitting said first code (A1, A2, ...) at said first transmission rate, said second code (M1, M2, ...) at said second transmission rate and said discrimination code (DS)

placed at the leading edge of each of said first and second codes (A1, A2, ...; M1, M2 ...).

Patentansprüche

1. Rufempfänger mit einer Empfangseinrichtung (2, 3) zum Empfangen eines Rufsignals und einer Datenverarbeitungseinrichtung zum Decodieren des Rufsignals, dadurch gekennzeichnet, daß das Rufsignal einen ersten Code (A1, A2, ...) mit einer ersten Übertragungsgeschwindigkeit, einen zweiten Code (M1, M2, ...) mit einer zweiten Übertragungsgeschwindigkeit und einen Diskriminierungscode (DS) zum Unterscheiden des ersten und des zweiten Codes (A1, A2, ...; M1, M2, ...) enthält, und

daß der Empfänger ein mit dem Ausgang der Empfangseinrichtung (2, 3) verbundenes Tiefpaßfilter (4) zum Schalten einer Grenzfrequenz als Antwort auf ein Startsignal (S2) und zum wahlweisen Extrahieren des ersten und zweiten Codes (A1, A2, ...; M1, M2, ...) und einen mit dem Ausgang des Tiefpaßfilters (4) gekoppelten Datenverarbeitungsteil (12) aufweist, der das Steuersignal (S2) als Antwort auf den empfangenen Diskriminierungscode (DS) erzeugt, das Steuersignal (S2) zum Tierpaßfilter (4) liefert und die extrahierten ersten une zweiten Codes (A1, A2, ...; M1, M2, ...) decodiert.

2. Rufempfänger nach Anspruch 1, wobei der erste Code ein Adressencode (A1, A2, ...) und der zweite Code ein Nachrichtencode (M1, M2, ...) ist, und die zweite Übertragungsgeschwindigkeit höher ist als die erste Übertragungsgeschwindigkeit.

3. Rufempfänger nach Anspruch 2, wobei die erste Übertragungsgeschwindigkeit 200 Bits/s und die zweite Übertragungsgeschwindigkeit 400 Bits/s beträgt.

4. Rufempfänger nach einem der Ansprüche 1 bis 3, wobei das Tiefpaßfilter (4) so einegestellt ist, daß es Butterworth-Charakteristika hat und folgende Bestandteile aufweist:

einen Operationsverstärker (41), der mit einem Ausgangsanschluß und dem Eingang des Tiefpaßfilters (4) verbunden ist und invertierende und nicht-invertierende Eingangsanschlüsse (I; N) aufweist;

mehrere Widerstände (R1 bis R4), die in Serie zwischen dem Eingang des Tiefpaßfilters (4) und dem invertierenden Eingangsanschluß (I) geschaltet sind;

einen ersten Kondensator (C1), der zwischen die invertierenden und nicht-invertierenden Eingangsanschlüsse (I; N) geschaltet ist;

einen zweiten Kondensator (C2), der zwischen dem Ausgangsanschluß und einen der Widerstände (R1 bis R4) geschaltet ist; und

ein Schaltelement (SW1, SW2) zum Kurzschließen eines beliebigen Widerstandes (R1 bis R4) als Antwort auf das Steuersignal (S2).

5. Rufempfänger nach Anspruch 2, wobei der Diskriminerungscode (DS) in die höchstwertigen Bits des Adressencodes (A1, A2, ...) und des Nachrichtencodes (M1, M2, ...) eingefügt ist.

6. Rufempfänger nach Anspruch 2, wobei der Datenverarbeitungsteil (12) folgende Bestandteile aufweist: eine Einrichtung (5) zum Formen der Wellenform des Ausgangs des Tiefpaßfilters (4); einen mit dem Ausgang der Wellenformeinrichtung (5) verbundenen Decoderteil (6) zum Erzeugen des Steuersignals (S2) als Antwort auf die Erkennung des Diskriminirungscodes (DS), falls das Rufsignal als Adressencode (A1, A2, ...) eingestuft wird, wobei der Decoderteil (6) diesen Adressencode und einen dem Empfänger zugeordneten Adressencode vergleicht und ein Alarmsignal aussendet, wenn die beiden Adressencodes identisch sind, und wobei der Decoderteil (6) einen Nachrichtenerkennungsimpuls aussendet, wenn das Rufsignal als Nachricht eingestuft wird; und einen mit der Wellenformeinrichtung (5) und dem Decoderteil (6) verbundenen Nachrichtenverarbeitungsteil (8) zum Empfangen und Verarbeiten von Nachrichten (M1, M2, ...) von der Wellenformeinrichtung (5) als Antwort auf den Nachrichtenerkennungsimpuls.

7. Verfahren zum Empfangen eines Rufsignals, mit den folgenden Verfahrensschritten: Empfangen des Rufsignals und Decodieren des empfangenen Rufsignals, dadurch gekennzeichnet,

daß das Rufsignal einen ersten Code (A1, A2, ...) mit einer ersten Übertragungsgeschwindigkeit, einen zweiten Code (M1, M2, ...) mit einer zweiten Übertragungsgeschwindigkeit und einen Diskriminierungscode (DS) zum Unterscheiden des ersten und zweiten Codes (A1, A2, ... M1, M2, ...) aufweist,

daß das Verfahren die folgenden Verfahrensschritte aufweist: wahlweises Empfangen und Passieren des ersten und zweiten Codes (A1, A2, ...; M1, M2, ...) als Antwort auf ein Steuersignal (S2), Erzeugen des Steuersignals (S2) als Antwort auf den empfangenen Diskriminierungscode (DS), und Decodieren der durchgelassenen ersten und zweiten Codes (A1, A2, ...; M1, M2, ...).

8. Verfahren nach Anspruch 7, wobei der Verfahrensschritt des wahlweisen Empfangens und Passierens den Verfahrensschritt aufweist, daß die Grenzfrequenz eines Tiefpaßfilters (4) umgeschaltet wird, um den ersten und zweiten Code (A1, A2, ...; M1, M2, ...) wahlweise durchzulassen.

9. Verfahren nach Anspruch 7, wobei der erste Code ein Adressencode (A1, A2, ...) und der zweite Code ein Nachrichtencode (M1, M2, ...) ist, und die zweite Übertragungsgeschwindigkeit höher als die reste Übertragungsgeschwindigkeit.

10. Verfahren nach Anspruch 9, wobei die erste Übertragungsgeschwindigkeit 200 Bits/s und die zweite Übertragungsgeschwindigkeit 400 Bits/s beträgt.

11. Verfahren nach Anspruch 9 oder 10, wobei der Diskriminerungscode (DS) in die höchstwertigen Bits des Adressencodes (A1, A2, ...) und des Nachrichtencodes (M1, M2, ...) eingefügt ist.

12. Verfahren nach Anspruch 7, das ferner den Verfahrensschritt umfaßt, daß der erste Code (A1, A2, ...) mit der ersten Übertragungsgeschwindigkeit und der zweite Code (M1, M2, ...) mit der zweiten Übertragungsgeschwindigkeit übertra-

gen wird, und daß der Diskriminierungscode (DS) an der Vorderseite sowohl des ersten als auch des zweiten Codes (A1, A2, ...; M1, M2, ...) angeordnet ist.

Revendications

1. Récepteur d'appel comprenant un moyen de récepteur (2, 3) pour recevoir un signal d'appel et un moyen de traitement de données pour décoder le signal d'appel, caractérisé en ce que:

— le signal d'appel comporte un premier code (A1, A2 ...) ayant une première vitesse de transmission un second code (M1, M2 ...) ayant une seconde vitesse de transmission et un code de discrimination (DS) pour distinguer les premier et second codes (A1, A2 ...); M1, M2 ...), et
— le récepteur comprend un moyen de filtre passebas (4) connecté à la sortie du moyen de récepteur (2, 3) pour commuter sa fréquence de coupure en réponse à un signal de commande (S2) et extraire sélectivement les premier et second codes (A1, A2 ...; M1, M2 ...); et un moyen (12) de section de traitement des données couplé à la sortie du moyen de filtre passe-bas (4) pour produire le signal de commande (S2) en réponse au code de discrimination reçu (DS), pour fournir le signal de commande (S2) au moyen de filtre passe-bas (4), et pour décoder les premier et second codes extraits (A1, A2 ...; M1, M2 ...).

2. Récepteur d'appel selon la revendication 1, dans lequel le premier code est un code d'adresse (A1, A2 ...), le second code est un code de message (M1, M2 ...) et la seconde vitesse de transmission est supérieure à la première vitesse de transmission.

3. Récepteur d'appel selon la revendication 2, dans lequel la première vitesse de transmission est 200 bits/seconde et la seconde vitesse de transmission est 400 bits/seconde.

4. Récepteur d'appel selon l'une quelconque des revendications 1 à 3, dans lequel le moyen de filtre passe-bas (4) est réglé de façon à avoir une caractéristique Butterworth, et comporte:

— un amplificateur opérationnel (41) couplé à une borne de sortie et à l'entrée du moyen de filtre passe-bas (4) et ayant des bornes d'entrée d'inversion et de non-inversion (I, N);
— une multitude de résistances (R1 à R4) connectées en série entre l'entrée du moyen de filtre passe-bas (4) et la borne d'entrée d'inversion (I);
— un premier condensateur (C1) monté entre les bornes d'entrée d'inversion et de non-inversion (I; N);
— un second condensateur (C2) branché entre la borne de sortie et une résistance de la multitude de résistances (R1 à R4); et
— un élément de commutation (SW1, SW2) pour court-circuiter une résistance désirée quelconque de la multitude de résistances (R1 à R4) en réponse au signal de commande (S2).

5. Récepteur d'appel selon la revendication 2, dans lequel le code de discrimination (DS) est inséré dans les bits de poids fort du code d'adresse (A1, A2 ...) et du code de message (M1, M2 ...).

6. Récepteur d'appel selon la revendication 2, dans lequel le moyen de section de traitement des données (12) comprend: un moyen (5) pour la mise en forme d'onde de la sortie du moyen de filtre passe-bas (4); une section à décodeur (6), couplée à la sortie du moyen de mise en forme d'onde (5), pour produire le signal de commande (S2) en réponse à la détection du code de discrimination (DS), si le signal d'appel est jugé être un code d'adresse (A1, A2 ...), la section à décodeur (6) comparant ce code d'adresse et un code d'adresse affecté au récepteur, si les deux codes d'adresse sont trouvés identiques, la section à décodeur (6) envoyant un signal d'alarme, si le signal d'appel ets jugé être un message, la section à décodeur (6) émettant une impulsion de détection de message; et une section de traitement de message (8), connectée au moyen de mise en forme d'onde (5) et à la section à décodeur (6), pour recevoir et traiter des messages (M1, M2 ...) provenant du moyen de mise en forme d'onde (5) en réponse à l'impulsion de détection de message.

7. Procédé pour recevoir un signal d'appel, comprenant les étapes consistant: à recevoir le signal d'appel, et à décoder le signal d'appel reçu, caractérisé en ce que:

— le signal d'appel comprend un premier code (A1, A2 ...) ayant une première vitesse de transmission, un second code (M1, M2 ...) ayant une seconde vitesse de transmission, et un code de discrimination (DS) pour distinguer les premier et second codes (A1, A2 ..., M1, M2 ...);
— le procédé comprend les étapes consistant: à recevoir sélectivement et laisser passer les premier et second codes (A1, A2 ..., M1, M2 ...) en réponse à un signal de commande (S2); à produire le signal de commande (S2) en réponse au code de discrimination reçu (DS) et à décoder les premier et second codes (A1, A2 ..., M1, M2 ...) qui sont passés.

8. Procédé selon la revendication 7, dans lequel l'étape consistant à recevoir sélectivement et laisser passer comporte l'étape de commutation de la fréquence de coupure d'un filtre passe-bas (4) afin de laisser passer sélectivement les premier et second codes (A1, A2 ...; M1, M2 ...).

9. Procédé selon la revendication 7, dans lequel le premier code est un code d'adresse (A1, A2 ...), le second code est un code de message (M1, M2 ...), et la seconde vitesse de transmission est supérieure à la première vitesse de transmission.

10. Procédé selon la revendication 9 dans lequel la première vitesse de transmission est 200 bits/

seconde et la second vitesse de transmission est 400 bits/seconde.

11. Procédé selon la revendication 9 ou la revendication 10, dans lequel le code de discrimination (DS) est inséré dans les bits de poids fort du code d'adresse (A1, A2 ...) et du code de message (M1, M2 ...).

12. Procédé selon la revendication 7, comprenant en outre l'étape consistant à transmettre le premier code (A1, A2 ...) à la première vitesse de transmission, le second code (M1, M2 ...) à la seconde vitesse de transmission, et le code de discrimination (DS) placé au front de chacun des premier et second codes (A1, A2 ...; M1, M2 ...).

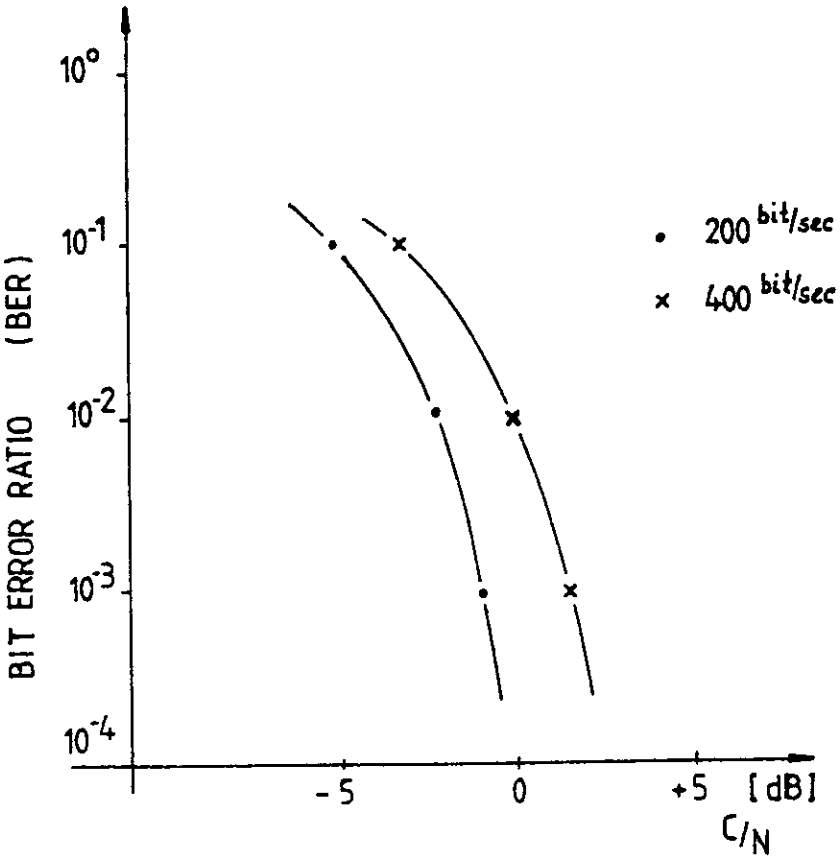

10°
10-1
10-2
10-3
10-4
BIT ERROR RATIO (BER)
• 200 bit/sec
× 400 bit/sec
-5
0
+5
[dB]
C/N

Fig. 1

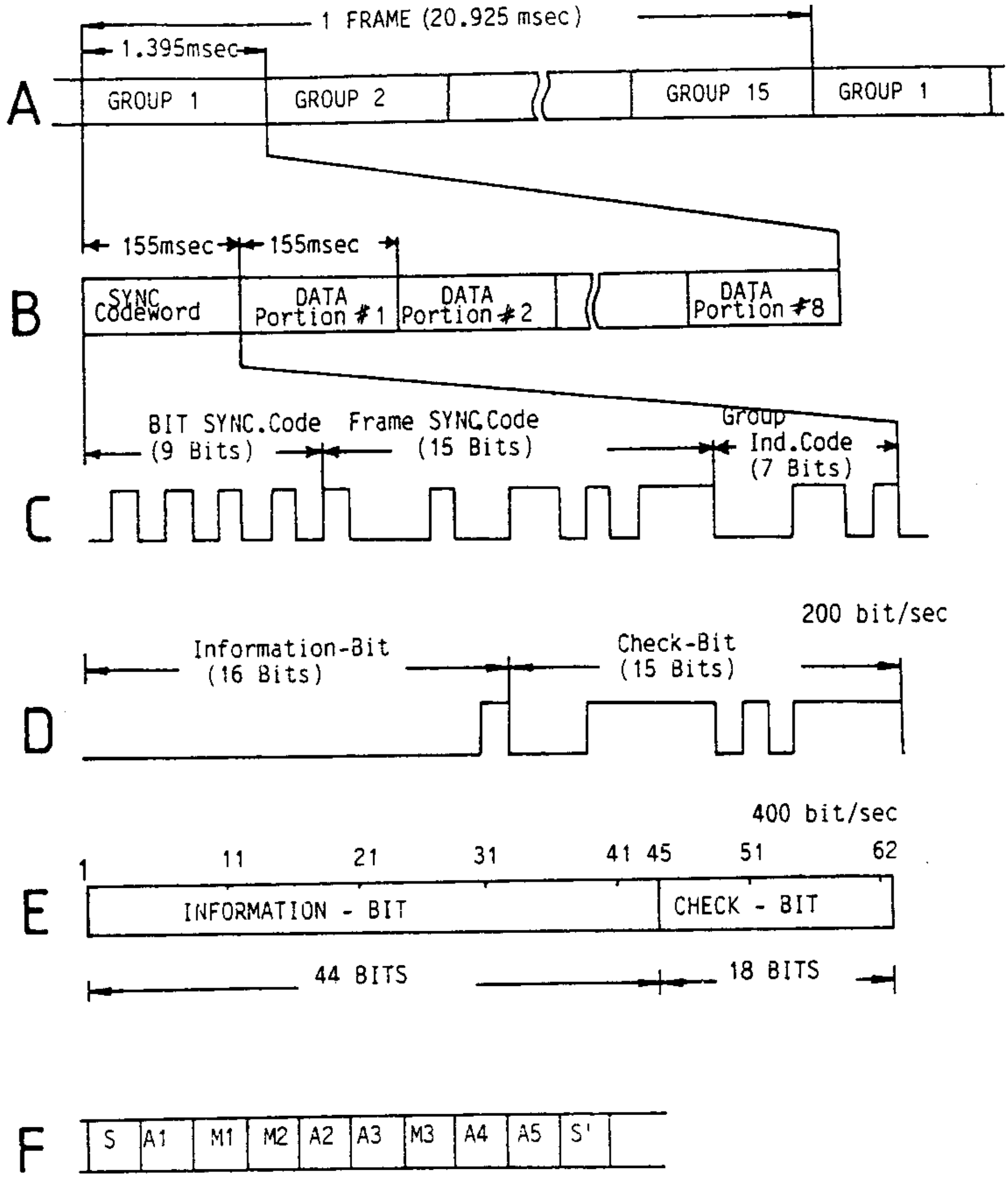
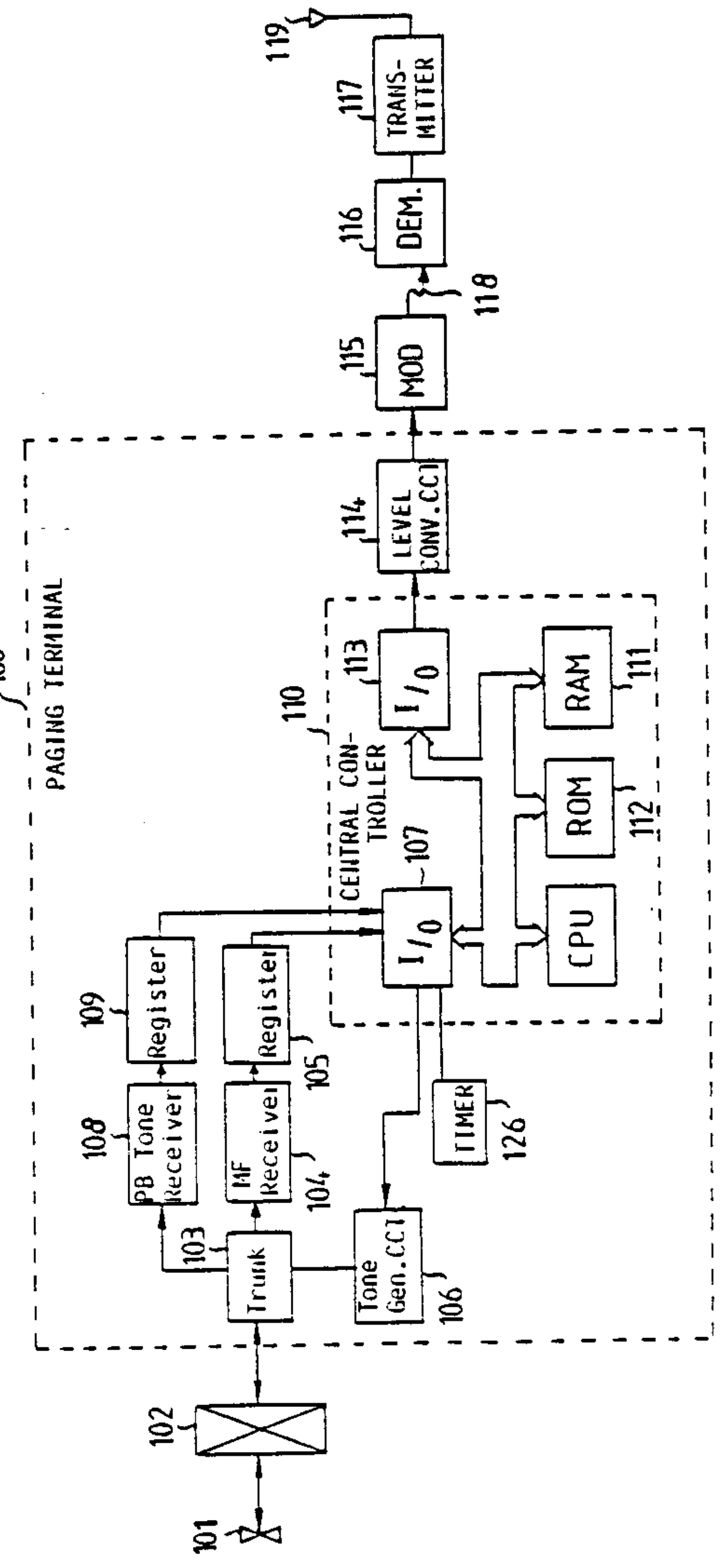

1 FRAME (20.925 msec)
1.395msec
A
GROUP 1
GROUP 2
GROUP 15
GROUP 1
155msec
155msec
B
SYNC Codeword
DATA Portion #1
DATA Portion #2
DATA Portion #8
BIT SYNC.Code (9 Bits)
Frame SYNC.Code (15 Bits)
Group Ind.Code (7 Bits)
C
200 bit/sec
Information-Bit (16 Bits)
Check-Bit (15 Bits)
D
400 bit/sec
1
11
21
31
41
45
51
62
E
INFORMATION - BIT
CHECK - BIT
44 BITS
18 BITS
F
S
A1
M1
M2
A2
A3
M3
A4
A5
S'

Fig. 2



101
102
100
PAGING TERMINAL
103
Trunk
108
PB Tone Receiver
104
MF Receiver
109
Register
105
Register
106
Tone Gen. CCT
110
CENTRAL CON-TROLLER
107
I/O
126
TIMER
CPU
ROM
112
RAM
111
113
I/O
114
LEVEL CONV. CCT
115
MOD
118
116
DEM.
117
TRANS-MITTER
119

Fig. 3

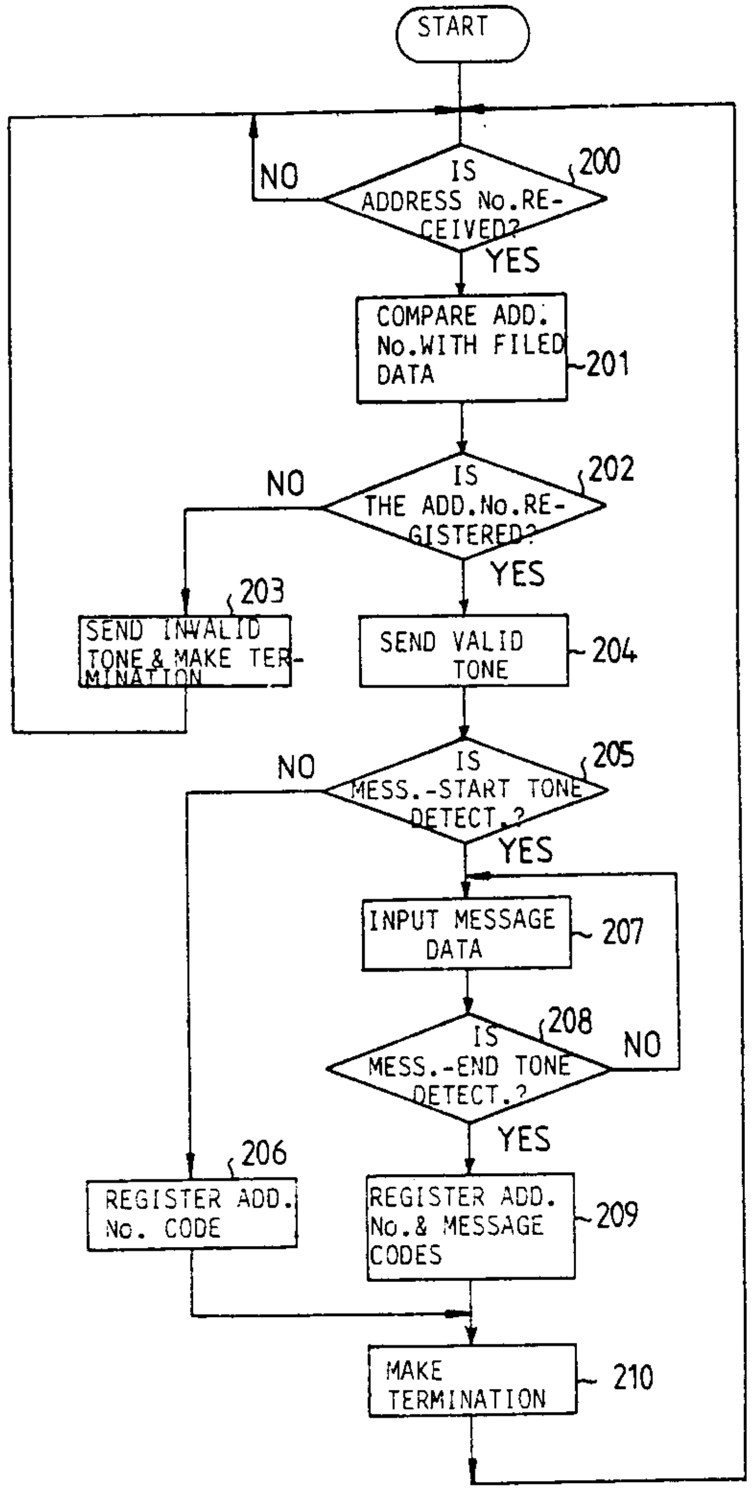

START
IS ADDRESS No.RE-CEIVED?
200
NO
YES
COMPARE ADD. No.WITH FILED DATA
201
IS THE ADD.No.RE-GISTERED?
202
NO
YES
SEND INVALID TONE & MAKE TER-MINATION
203
SEND VALID TONE
204
IS MESS.-START TONE DETECT.?
205
NO
YES
INPUT MESSAGE DATA
207
IS MESS.-END TONE DETECT.?
208
NO
YES
REGISTER ADD. No. CODE
206
REGISTER ADD. No.& MESSAGE CODES
209
MAKE TERMINATION
210

Fig. 4

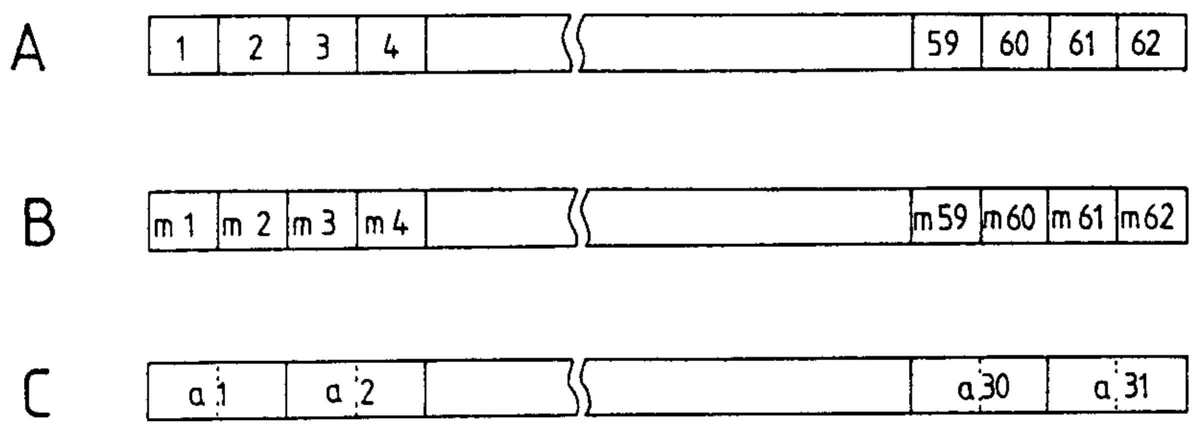


Fig. 5

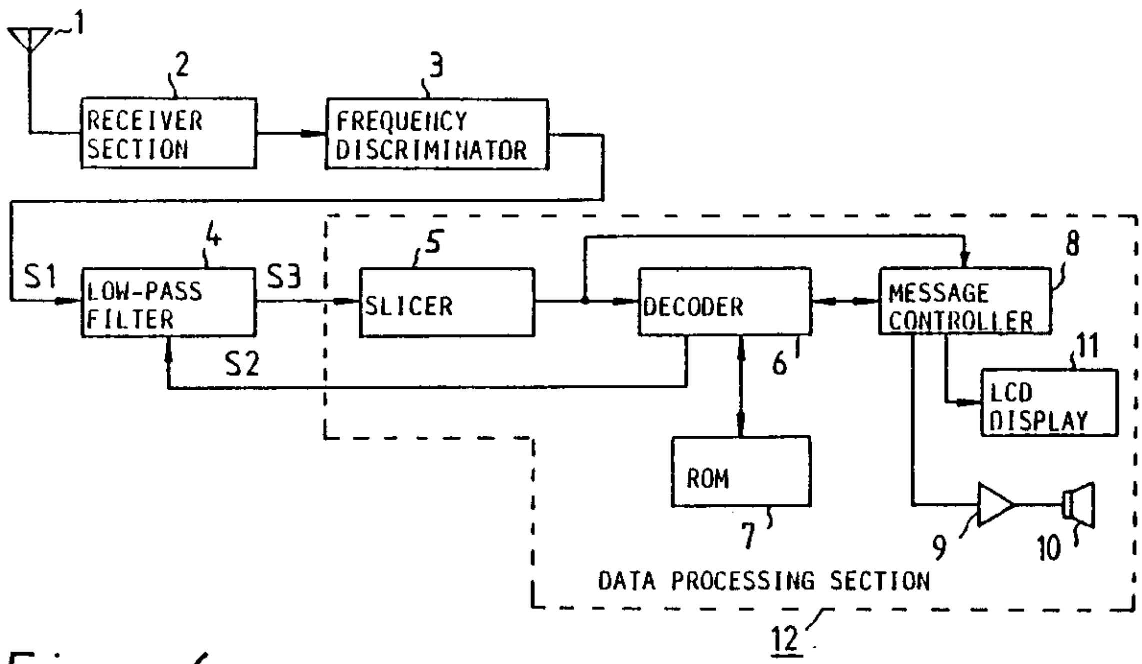

1
2
3
RECEIVER SECTION
FREQUENCY DISCRIMINATOR
S1
4
LOW-PASS FILTER
S3
S2
5
SLICER
DECODER
6
8
MESSAGE CONTROLLER
11
LCD DISPLAY
ROM
7
9
10
DATA PROCESSING SECTION
12

Fig. 6

A

B

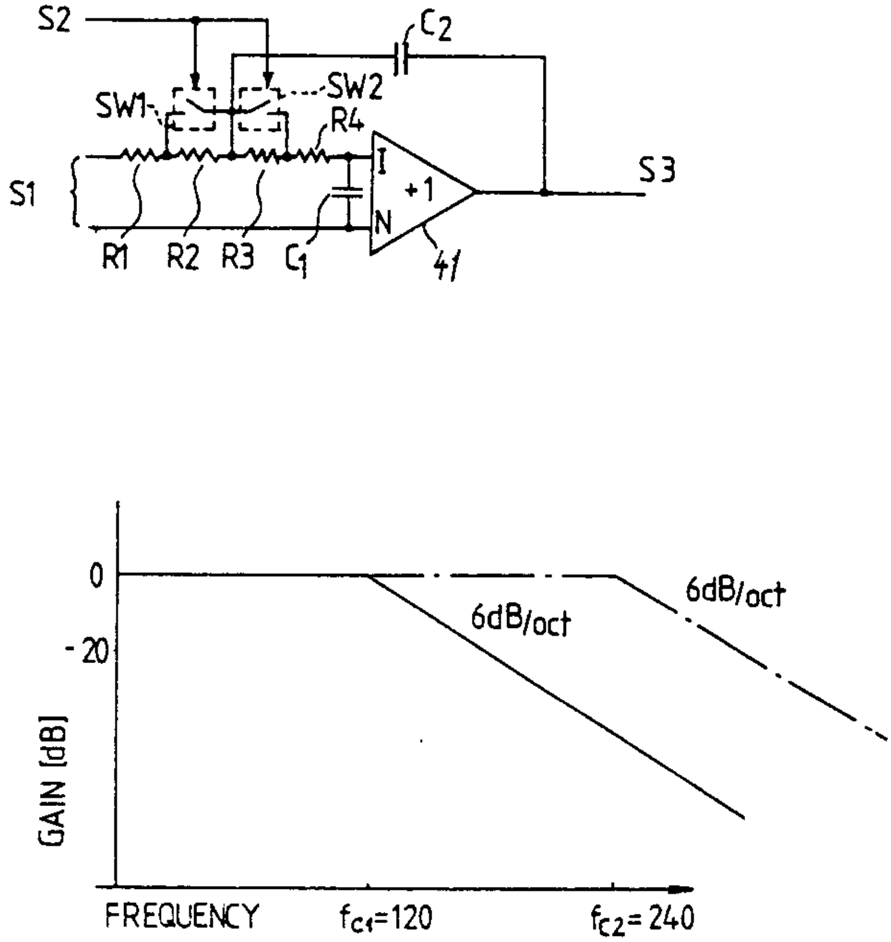

S2
C2
SW1
SW2
R4
S1
I
+1
N
S3
R1
R2
R3
C1
41
0
-20
6dB/oct
6dB/oct
GAIN [dB]
FREQUENCY
fc1=120
fc2= 240

Fig. 7

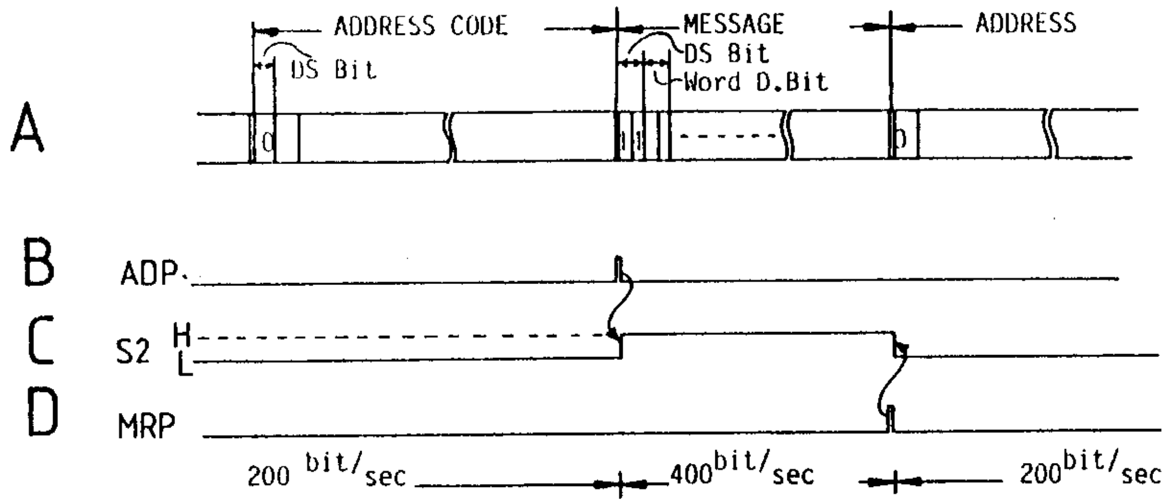


Fig. 8

WORD DESIGN. BITS (2 BITS)	NOS. OF FOLLOWING WORDS
0 0	0
0 1	1
1 0	2
1 1	3

Fig. 9

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**** END OF REGISTER ENTRY ****