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(54) **Radio pager tone alarm circuit for generating variable duty constant audio frequency pulses modulated with unique tone pattern**

Tonalarmschaltung für einen Personenrufempfänger zum Erzeugen von Impulsen einer konstanten Tastfrequenz mit variablem Tastverhältniss und moduliert mit einem eindeutigen Alarmenton signal

Circuit d'alarme sonore d'un recepteur d'appel pour la génération d'impulsions à frequence audible constante et à rapport cyclique variable et modulées par un unique signal d'avertissement

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Description

The present invention relates generally to radio pagers, and more specifically to a sound alarm circuit for such radio pagers which generates an alert tone of escalating sound levels.

A radio pager having the capability of successively escalating the sound level of an alert tone is described in Japanese Patent Publication 63-252030 (Tokkaisho). According to the prior art technique, constant audio frequency pulses are modulated with a variable duty tone pattern that identifies particular incoming pages. The duty ratio of the tone pattern is successively increased to increase the sound level of the tone.

One serious disadvantage of the prior art technique is that since the sound level is controlled by the duty ratio of a tone pattern, the alert tone patterns as standardized by the Post Office Code Standardization Advisory Group (POCSAG) cannot be employed for escalating alert tones.

It is therefore an object of the present invention to provide a radio pager that enables internationally standardized alert tone patterns to be employed for alerting users with an escalating sound level.

According to the present invention, the radio pager comprises a receiver for receiving a paging signal containing a unique identifier identifying the own radio pager and an alert tone pattern. A pulse generating circuit generates audio-frequency pulses having a duty ratio increasing as a function of time in response to receipt of the paging signal. A modulating means is provided for modulating the variable duty pulses with the alert tone pattern for applying the modulated pulses to a loudspeaker.

The present invention will be described in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a radio pager of the present invention;

Fig. 2 is a block diagram of a sound alarm circuit of this invention;

Fig. 3 is a waveform diagram associated with the sound alarm circuit of Fig. 2;

Fig. 4 is a waveform diagram of the tone pulses modulated with a POCSAG A-code tone pattern;

Fig. 5 is a block diagram of a modified form of the sound alarm circuit; and

Fig. 6 is a waveform diagram associated with the sound alarm circuit of Fig. 5.

A radio pager of the present invention as represented in Fig. 1 comprises a front end 2 for converting paging signals received by antenna 1 to baseband signals for coupling to a waveshaper 3. The output of waveshaper 3 is applied to a decoder 4 in which the received signal is checked for a coincidence between a pager identifier contained in it and the one stored in a PROM (program-

mable read only memory) 5. On detecting a coincidence, decoder 4 alerts a sound alarm circuit 6 with a POCSAG (Post Office Code Standardization Advisory Group) alert tone signal having one of predetermined tone patterns or cadences. For example, one such cadence is a cyclic sequence of 7/8-second ON and 1/8-second OFF. Sound alarm circuit 6 modulates the tone signal with a variable duty pulse sequence and activates a loudspeaker 7. A reset switch 8 is connected to the decoder 4 to be operated when the user answers an incoming page.

As shown in Fig. 2, sound alarm circuit 6 comprises an AND gate 10 that is responsive to an enable signal from decoder 4 to pass high-frequency clock pulses from a clock source 9 to frequency dividers 11 and 12, and further to an up-counter 13 during the time the pager is being alerted. As shown in Fig. 3, frequency divider 11 divides the frequency of the clock to produce an output whose frequency determines the pitch of the alert tone, typically at 2.6 kHz, and frequency divider 12 divides that clock frequency so that its output determines the rate at which the duty ratio of the 2.6-kHz pulse sequence is varied. Typically, the duty ratio is stepwisely varied at 6-second intervals. The output of frequency divider 11 is applied to the up-counter 13 as a reset pulse so that its output represents a digital count value which continuously increments in response to the clock pulse until it rapidly drops to zero in response to the reset pulse. On the other hand, the output of frequency divider 12 is applied to a down-counter 15 to produce a decremental binary count value which represents the varying rate of the duty ratio. A monostable multivibrator 14 is provided for producing a pulse for clearing the contents of down-counter 15 as soon as the pager is alerted.

The digital output of down-counter 15 is applied to a binary-to-duty converter 16 which converts it to a digital value representing the duty ratio of the 2.6-kHz pulse sequence for each 6-second interval. In a typical example, binary-to-duty converter 16 successively generates outputs representing duty ratios of 12.5 %, 25 %, 33 % and 50 %. The outputs of binary-to-duty converter 16 and up-counter 13 are applied to a digital comparator 17 in which they are compared with each other to produce a high-level output when the digital value of counter 13 is greater than the output of binary-to-duty converter 16. It is seen therefore that the output of comparator 17 is a sequence of constant-frequency pulses of a variable duty ratio which increases stepwisely at 6-second intervals as shown in Fig. 3. From the tone quality standpoint, the maximum duty ratio is set 50 % as described above.

The output of comparator 17 is applied to an AND gate 18 to which a POCSAG tone pattern, say A-code pattern, is also applied. In this way, the variable duty 2.6 kHz pulse sequence is modulated by the POCSAG A-code pattern as shown in Fig. 4 and applied through an amplifier 19 to the speaker 7. Loudspeaker 7 has a narrow band of frequency response characteristic. This

characteristic is sufficient to suppress the harmonic components of the modulated alert tone pulse which may otherwise cause changes in tone quality with variations of the duty ratio.

Therefore, the POCSAG tone pattern can be used for generating an alert tone with successively escalating sound levels.

Alternatively, the present invention can be further modified as shown in Fig. 5 in which the down-counter is replaced with an up-counter 31 and binary-to-duty converter 32 transforms the stepwisely incremental value of the output of counter 31 to a stepwisely incremental duty ratio. A flip-flop 30 is provided having a set input terminal connected to the output of frequency divider 11 and a reset input terminal connected to the output of programmable counter 34 whose program input is connected to the output of binary-to-duty converter 32. An AND gate 33 is responsive to the output of flip-flop 30 to pass the output of AND gate 10 to the clock input of programmable counter 34. The output of flip-flop 30 is further applied to the reset input of programmable counter 34 and one input of AND gate 18.

As shown in Fig. 6, flip-flop 30 is triggered into a high-level, set condition in response to each output pulse from frequency divider 11 to allow clock pulses from AND gate 10 to pass through AND gate 33 to the programmable counter 34. The latter produces a high-level output when the duty representing count value is reached and resets the flip-flop 30 to a low-level condition, producing a tone pulse having a stepwisely incremental duty ratio.

The foregoing description shows only one preferred embodiment of the present invention. Various modifications are apparent to those skilled in the art without departing from the scope of the present invention which is only limited by the appended claims. Therefore, the embodiment shown and described is only illustrative, not restrictive.

Claims

1. A radio pager comprising:
 - receive means (2,3,4) for receiving a paging signal containing a unique identifier identifying said radio pager and an alert tone pattern; pulse generating means (9-17) for generating constant audio frequency pulses having a duty ratio increasing as a function of time in response to receipt of said paging signal; modulating means (18) for modulating said pulses with said alert tone pattern; and sound generating means (7) activated by said modulated pulses.
2. A radio pager as claimed in claim 1, wherein said alert tone pattern is a POCSAG (Post Office Code Standardization Advisory Group) tone pattern.

3. A radio pager as claimed in claim 1, wherein said pulse generating means comprises:

a clock source (9) for generating pulses at a clock frequency; a first frequency divider (11) for dividing the clock frequency of said pulses to produce pulses at an audio frequency; a second frequency divider (12) for dividing the clock frequency of said pulses to produce pulses at a frequency much lower than said audio-frequency; means (13) responsive to each of the audio frequency pulses for generating a first digital value which increases synchronously with said clock frequency pulses; means (15,16) for generating a second digital value which successively decreases in response to said lower frequency pulses; means (17) for comparing said first and second digital values and applying an output signal to said modulating means when said first digital value is greater than said second digital value.

4. A radio pager as claimed in claim 1, wherein said pulse generating means comprises:

a clock source (9) for generating pulses at a clock frequency; a first frequency divider (11) for dividing the clock frequency of said pulses to produce pulses at an audio frequency; a second frequency divider (12) for dividing the clock frequency of said pulses to produce pulses at a frequency much lower than said audio-frequency; means (31,32) for generating a digital value which successively increases in response to said lower frequency pulses; bistable means (30) arranged to be triggered into a first output state in response to each of the audio frequency pulses and triggered into a second output state in response to a reset signal applied thereto, the output of said bistable means being connected to said modulating means; and presettable counter means (34) having a preset count value equal to said digital value, said presettable counter means being responsive to the first output state of said bistable means for counting said clock frequency pulses to produce an output pulse when the count of the clock frequency pulses reaches the preset value and applying the output signal to said bistable means as said reset signal.

Patentansprüche

1. Drahtloser Personenrufempfänger mit:
 - einer Empfangseinrichtung (2, 3, 4) für den Empfang eines Personenrufsignals, das einem eindeutigen Identifikator, der den drahtlosen Personenrufempfänger identifiziert und ein Alarmtonmuster enthält; einer Impulserzeugungseinrichtung (9 bis 17) zum Erzeugen von Tonimpulsen konstanter Frequenz mit einem Tastverhältnis, das als eine Funktion der Zeit als Reaktion auf den Empfang des Personenrufsignals ansteigt; einer Modulationsein-

richtung (18) zum Modulieren der Impulse mit dem Alarmtonmuster, und einer Tonerzeugungseinrichtung (7), die durch die modulierten Impulse aktiviert wird.

2. Drahtloser Personenrufempfänger nach Anspruch 1, wobei das Alarmtonmuster ein POCSAG-(Post Office Code Standardization Advisory Group)-Tonmuster ist.

3. Drahtloser Personenrufempfänger nach Anspruch 1, wobei die Impulserzeugungseinrichtung aufweist:

eine Taktquelle (9) zum Erzeugen von Impulsen bei einer Taktfrequenz; einen ersten Frequenzteiler (11) zum Teilen der Taktfrequenz der Impulse, um Impulse bei einer Tonfrequenz zu erzeugen; einen zweiten Frequenzteiler (12) zum Teilen der Taktfrequenz der Impulse zum Erzeugen von Impulsen bei einer Frequenz wesentlich niedriger als der Tonfrequenz; eine Einrichtung (13), die auf jeden Tonfrequenzimpuls reagiert, um einen ersten digitalen Wert zu erzeugen, welcher synchron mit den Taktfrequenzimpulsen größer wird; eine Einrichtung (15, 16) zum Erzeugen eines zweiten digitalen Wertes, welcher sukzessiv als Reaktion auf die Impulse niedriger Frequenz kleiner wird; eine Einrichtung (17) zum Vergleichen des ersten und zweiten digitalen Wertes und zum Anlegen eines Ausgangssignals an die Modulationseinrichtung, wenn der erste digitale Wert größer als der zweite digitale Wert ist.

4. Drahtloser Personenrufempfänger nach Anspruch 1, wobei die Impulserzeugungseinrichtung aufweist:

eine Taktquelle (9) zum Erzeugen von Impulsen bei einer Taktfrequenz; einen ersten Frequenzteiler (11) zum Teilen der Taktfrequenz der Impulse, um Impulse bei einer Tonfrequenz zu erzeugen; einen zweiten Frequenzteiler (12) zum Teilen der Taktfrequenz der Impulse zum Erzeugen von Impulsen bei einer Frequenz wesentlich niedriger als der Tonfrequenz; eine Einrichtung (31, 32) zum Erzeugen eines digitalen Wertes, welcher sukzessiv als Reaktion auf die Impulse niedriger Frequenz größer wird; eine bistabile Einrichtung (30), die so angeordnet ist, daß sie in einen ersten Ausgabezustand als Reaktion auf jeden Tonfrequenzimpuls versetzt wird, und in einen zweiten Ausgabezustand als Reaktion auf ein daran angelegtes Rücksetzsignal versetzt wird, wobei der Ausgang der bistabilen Einrichtung mit der Modulationseinrichtung verbunden ist; und eine voreinstellbare Zählereinrichtung (34) mit einem zu dem digitalen Wert gleichen voreingestellten Zählwert, wobei die voreinstellbare Zählereinrichtung auf den ersten Ausgabezustand der bistabilen Einrichtung mit einem Zählen der Taktfre-

quenzimpulse, um einen Ausgangsimpuls zu erzeugen, wenn der Zählstand der Taktfrequenzimpulse den voreingestellten Wert erreicht und mit dem Anlegen des Ausgangssignals an die bistabile Einrichtung als dem Rücksetzsignal reagiert.

Revendications

1. Installation radioélectrique d'appel comprenant :
des moyens de réception (2,3,4) pour recevoir un signal d'appel contenant un identificateur unique identifiant ladite installation radioélectrique d'appel et une configuration sonore d'alerte ; des moyens générateurs d'impulsions (9-17) pour générer des impulsions constantes à fréquence audible ayant un rapport cyclique qui s'accroît en fonction du temps en réponse à la réception dudit signal d'appel ; des moyens de modulation (18) pour moduler lesdites impulsions avec ladite configuration sonore d'alerte ; et des moyens générateurs de son (7) activés par lesdites impulsions modulées.
2. Installation radioélectrique d'appel selon la revendication 1, dans lequel ladite configuration sonore d'alerte est une configuration sonore POCSAG (Commission de Standardisation des Codes des Postes).
3. Installation radioélectrique d'appel selon la revendication 1, dans lequel lesdits moyens générateurs d'impulsions comprennent :
une source d'horloge (9) pour générer des impulsions à une fréquence d'horloge ; un premier diviseur de fréquence (11) pour diviser la fréquence d'horloge desdites impulsions de manière à produire des impulsions à une fréquence audible ; un second diviseur de fréquence (12) pour diviser la fréquence d'horloge desdites impulsions de manière à produire des impulsions à une fréquence bien inférieure à ladite fréquence audible ; des moyens (13) sensibles à chacune des impulsions à fréquence audible pour générer une première valeur numérique qui s'accroît de manière synchrone avec lesdites impulsions à fréquence d'horloge ; des moyens (15,16) pour générer une seconde valeur numérique qui décroît successivement en réponse aux dites impulsions à fréquence inférieure ; des moyens (17) pour comparer lesdites première et seconde valeurs numériques et appliquer un signal de sortie aux dits moyens de modulation lorsque ladite première valeur numérique est supérieure à ladite seconde valeur numérique.
4. Installation radioélectrique d'appel selon la revendication 1, dans lequel lesdits moyens générateurs d'impulsions comprennent :
une source d'horloge (9) pour générer des im-

pulsions à une fréquence d'horloge ; un premier diviseur de fréquence (11) pour diviser la fréquence d'horloge desdites impulsions de manière à produire des impulsions à une fréquence audible ; un second diviseur de fréquence (12) pour diviser la fréquence d'horloge desdites impulsions de manière à produire des impulsions à une fréquence bien inférieure à ladite fréquence audible ; des moyens (31,32) pour générer une valeur numérique qui décroît successivement en réponse aux dites impulsions à fréquence inférieure ; des moyens bistables (30) conçus pour être basculés dans un premier état de sortie en réponse à chacune des impulsions à fréquence audible et être basculés dans un second état de sortie en réponse à un signal de remise à 0 qui leur est appliqué, la sortie desdits moyens bistables étant connectée aux dits moyens de modulation ; et des moyens à compteur à présélection (34) ayant une valeur de comptage présélectionnée préaffichée qui est égale à ladite valeur numérique, lesdits moyens à compteur à présélection étant sensibles au premier état de sortie desdits moyens bistables pour compter lesdites impulsions à fréquence d'horloge de manière à produire une impulsion de sortie lorsque le comptage des impulsions à fréquence d'horloge atteint la valeur présélectionnée et pour appliquer le signal de sortie aux dits moyens bistables en tant que ce dit signal de remise à 0.

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FIG. 1

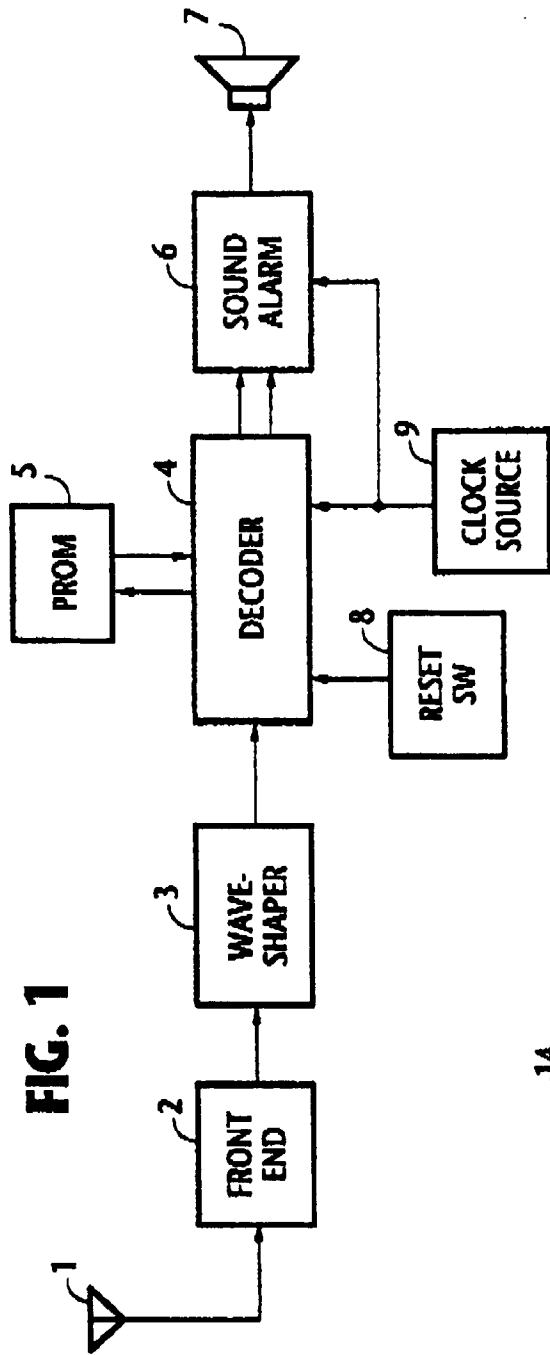


FIG. 2

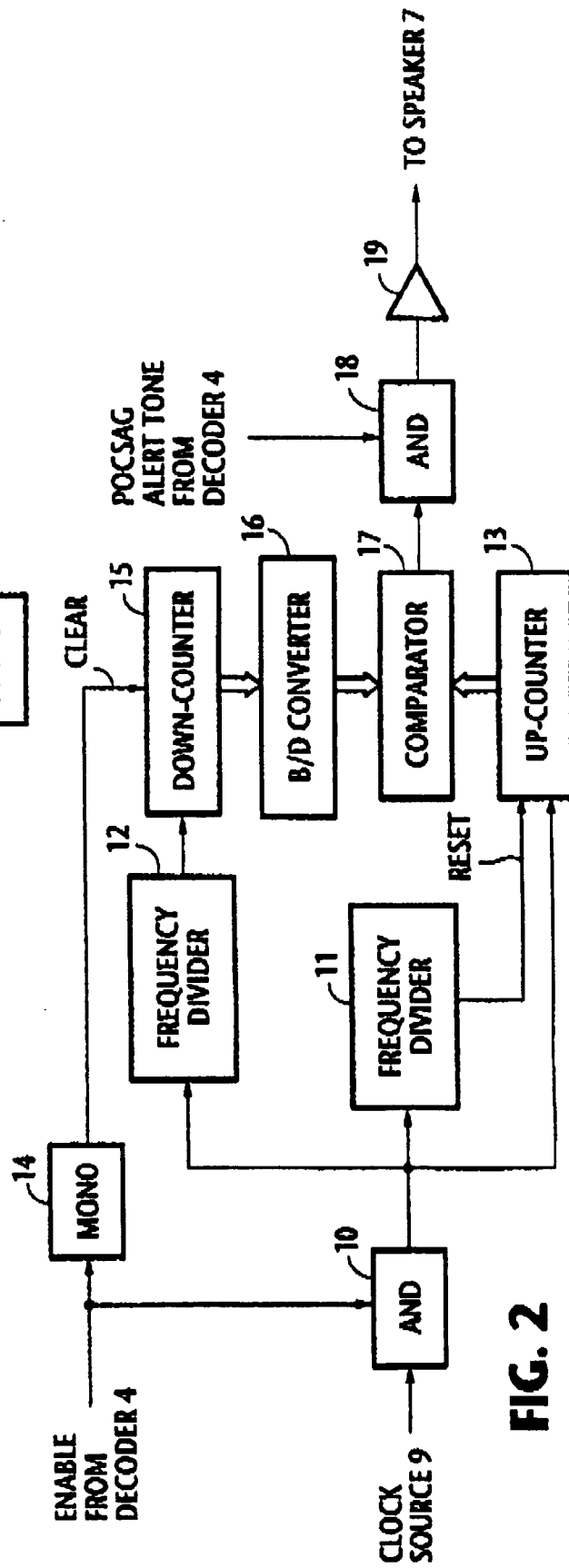


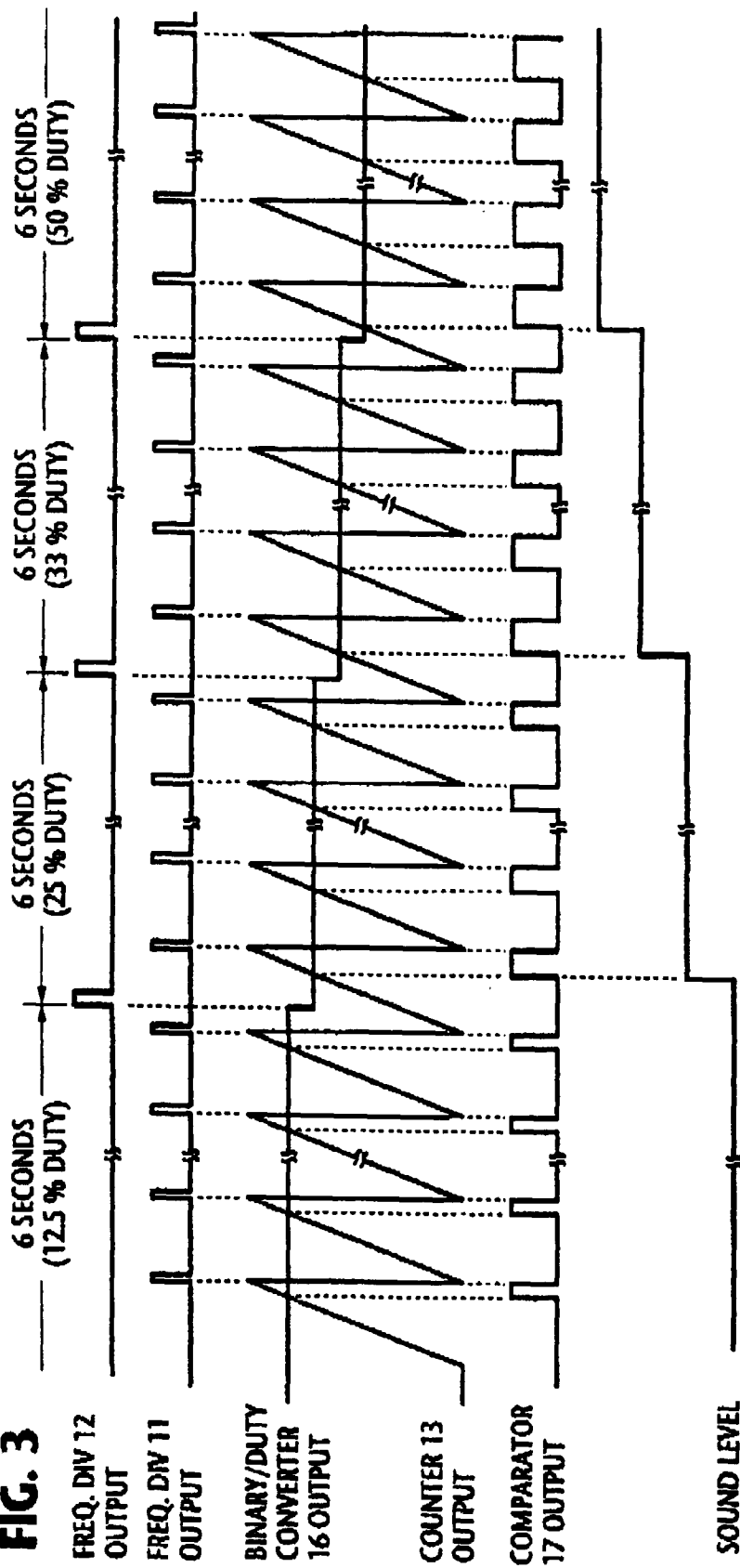
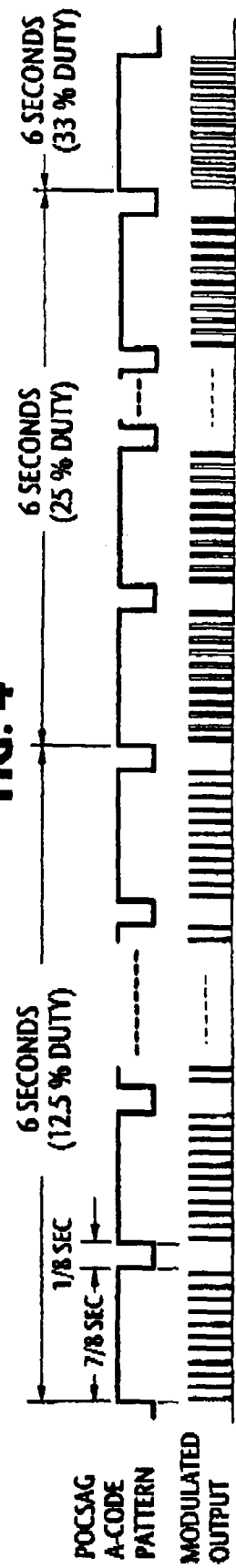
FIG. 3**FIG. 4**

FIG. 5

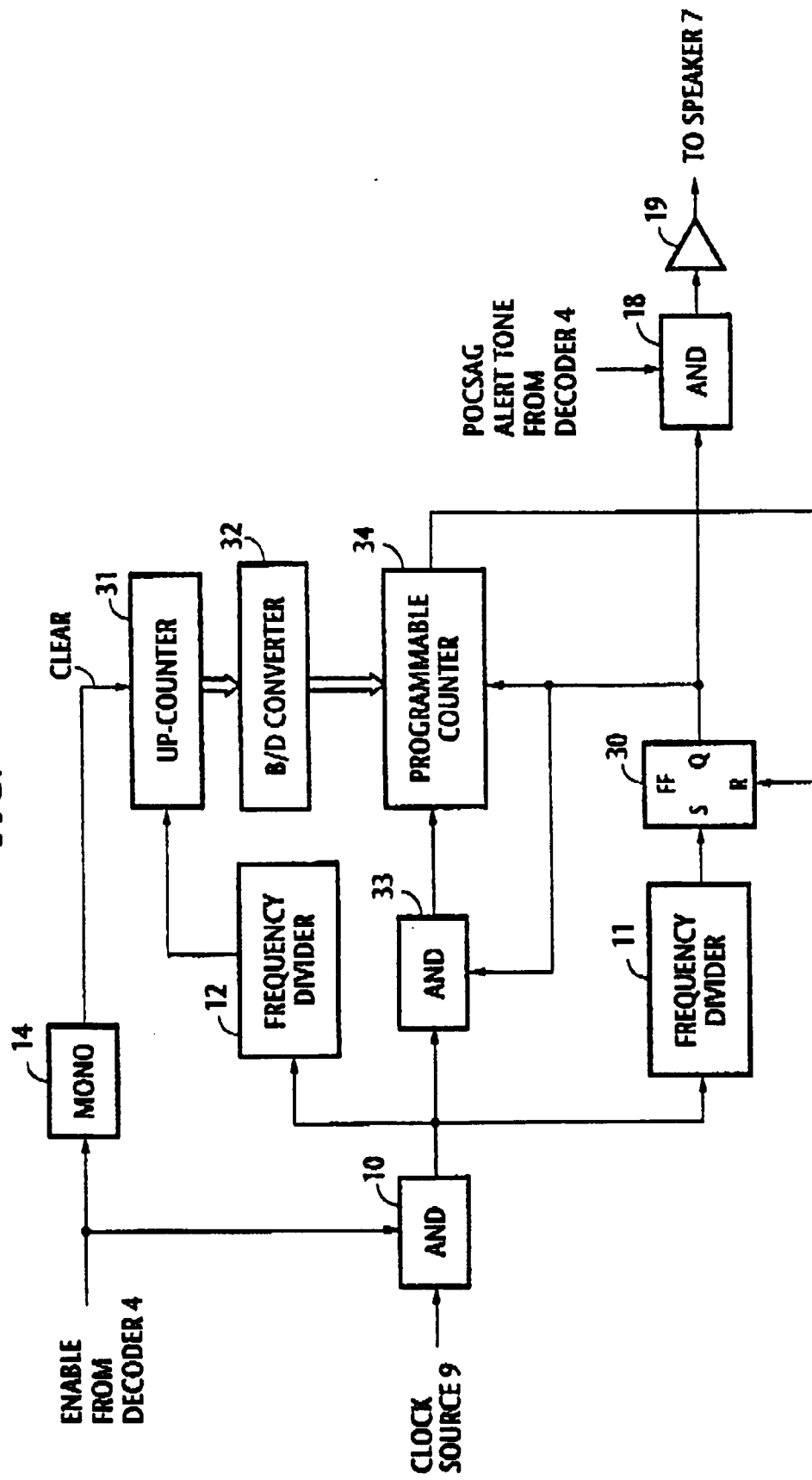


FIG. 6

