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(54) **Paging receiver with a display**

Personenrufempfänger mit einer Anzeige

Récepteur d'appel avec affichage

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(56) References cited:
WO-A-89/06478

- **PATENT ABSTRACTS OF JAPAN vol. 11, no. 116 (P-566)11 April 1987**
- **PATENT ABSTRACTS OF JAPAN vol. 15, no. 355 (E-1109)9 September 1991**

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Description

BACKGROUND OF THE INVENTION

The present invention relates to a paging receiver having a display which is capable of displaying time information and day-of-week information.

A paging receiver extensively used today is usually provided with a liquid crystal display (LCD) or similar display. A display for this kind of application has a group of display elements assigned to numerical message information and another group of display elements assigned to errors which may occur in the numerical message information. Such display elements are controllably driven by a control unit, e.g., CPU which controls the entire paging receiver. One type of conventional paging receiver with a display is capable of displaying time information, e.g., the current time, the time when a message is received, and the time optionally set by the user. Another type of conventional paging receiver with a display is capable of displaying day-of-week information, i.e.. Sunday to Saturday in addition to time information. The paging receiver with such a day-of-week information displaying capability is provided with extra display elements for displaying a day of the week in addition to the display elements assigned to numerical message information and errors. However, the problem is that the capacity of the control unit or CPU for controlling the individual display units is limited. For this reason, it has been customary to reduce the number of numerical message information display elements and allocate the surplus CPU capacity to the control over the day-of-week information display elements. This, however, reduces the capacity of the numerical message information display elements, i.e., the number of figures that can appear on the display at a time. A CPU having a greater capacity would increase the production cost of the paging receiver.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a paging receiver having a display which is capable of displaying time information and day-of-week information without reducing the number of figures of numerical message information that can appear on the display at a time.

It is another object of the present invention to provide a paging receiver having a display which is capable of displaying time information and day-of-week information with high visibility.

It is another object of the present invention to provide a miniature and inexpensive a paging receiver having a display which is capable of displaying time information and day-of-week information.

A paging receiver capable of displaying time information and day-of-week information of the present invention comprises a display comprising a plurality of numerical message information display elements for displaying numerical message information, and a plurality of error display elements for displaying errors of the numerical message information, and a controller for causing the numerical message information display elements and the error display elements to display time information and day-of-week information, respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description taken with the accompanying drawings in which:

FIG. 1 is a block diagram schematically showing a conventional paging receiver;
FIG. 2 is a plan view showing the screen of an LCD included in the conventional paging receiver;
FIG. 3 is a block diagram schematically showing a paging receiver embodying the present invention;
FIG. 4 is a plan view of an LCD included in the embodiment;
FIG. 5 is a flowchart demonstrating a specific operation of the embodiment; and
FIGS. 6-10C show specific pictures which may appear on the screen of the LCD included in the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

To better understand the present invention, a brief reference will be made to a prior art paging receiver capable of displaying time information and day-of-week information, shown in FIGS. 1 and 2. As shown, the paging receiver, generally 10, has an antenna 12, a radio section 14, a DC power source 16, a decoder 18, a controller or CPU 20, a display driver 22, a liquid crystal display (LCD) 24, a DC/DC converter 26, a ROM 28, an alert device driver 30, and an alert device made up of a light emitting diode (LED) 32, a loudspeaker 34, and a vibrator 36.

In operation, a paging signal containing numerical message information and coming in through the antenna 12 is amplified and demodulated by the radio section 14. The demodulated signal is applied to the decoder 18 as a demod-

ulated signal. In response, the decoder 18 compares a address signal contained in the demodulated signal and an address assigned to the receiver 10 and stored in the ROM 28 to see if they are identical. If the address signal is not identical with the stored address, the decoder 18 returns to a standby state. If the address signal is identical with the stored address, the decoder 18 determines whether or not numerical message information exists in the demodulated signal. If the result of this decision is negative, the decoder 18 sends a status "NO MESSAGE" to the CPU 20; if it is positive, the decoder 18 sends a status "MESSAGE" to the CPU 20 together with numerical message information. On receiving the status "MESSAGE" and numerical message information, the CPU 20 controls the display driver 22 to display the numerical message information on the LCD 24. Further, on determining that the address signal is identical with the stored address, the decoder 18 sends a predetermined alert drive signal from the ROM 28 to the alert device driver 30. In response, the alert device driver 30 drives at least one of the LED 32, loudspeaker 34 and vibrator 36 so as to alert the user of the receiver 10 to the incoming call. The DC/DC converter 26 boosts the voltage of the power source 16 (1.4 volts) to the operation voltage of the decoder 18 and CPU 20.

As shown in FIG. 2, the LCD 24 includes a group of display elements assigned to numerical message information and a group of display elements adapted to indicate errors which may occur in the numerical message information. Specifically, the LCD 24 displays on the screen 24a an outside-area detection mark 38, a received address display mark 40, a receiving function display mark 42, a low voltage display mark 44, a switch position display mark 46, a repeat call reception mark 48, a message protection mark 50 and a message continuation mark which are symbol marks. The LCD 24 further displays a message reception number 54, numerical message information 56, errors 58, a colon 60, and a colon 62 for displaying time. In addition, the LCD 24 is capable of displaying day-of-week information (Sunday to Saturday) 64, i.e., it has day-of-week display elements. The day-of-week display elements are driven by the CPU 20 independently of the numerical message display elements. The problem with this kind of configuration is that the capacity of the CPU 20 has to be great enough to drive not only the numerical message information display elements and error display elements but also the day-of-week display elements, increasing the production cost of the receiver 10. The number of numerical message display elements may be reduced to implement the day-of-week information 64 without resorting to such a great CPU capacity. This, however, reduces the volume of the numerical message information 56, i.e., the number of figures that can be displayed at a time.

Referring to FIG. 3, a paging receiver embodying the present invention will be described. As shown, the paging receiver, generally 70, has an antenna 72, a radio section 74, a DC power source 76, a decoder 78, a controller or CPU 80, an LCD 82, a DC/DC converter 84, a ROM 86, an alert device driver 88, and an alert device made up of an LED 90, a loudspeaker 92, and a vibrator 94. As shown in FIG. 4, the LCD 82 has a screen 82a for displaying an outside-area detection mark 96, a received address display mark 98, a receiving function display mark 100, a low voltage display mark 102, a switch position display mark 104, a same call display mark 106, a message protection mark 108, and a message continuation mark 110 which are symbol marks. Further, the LCD 82 displays on the screen 82a a message reception number 112, numerical message information 114, errors 116, colons 118 and 120, and day-of-week information 122. The numerical message information appears on a seven segment basis. The errors 116 each appears when numerical message information associated therewith has an error. The colon 118 divides the message reception number 112 and the numerical message information 114 while the colon 120 turns on or repetitively flashes when time is displayed. The day-of-week information is directly printed on a glass covering the front of the LCD 82 or on, for example, a transparent seal provided on the glass. One of the segments which are assigned to the errors 116 turns on in response to day-of-week information, as described in detail later. It should be noted that the day-of-week information may be located outside of the screen 82a of the LCD 82, as shown in FIG. 2.

A specific operation of the paging receiver 70 will be described with reference to FIGS. 5-10C.

When the receiver 70 is in a standby state (step S1, FIG. 5), time 124 appears on the screen 82a of the LCD 82, as shown in FIG. 6. A paging receiver with a numerical message come in through the antenna 72 is demodulated by the radio section 74 and then applied to the decoder 78, as stated earlier. The decoder 78 determines whether or not an address signal contained in the demodulated signal is coincident with the address stored in the ROM 86 (S2). If the result of decision is negative, the decoder 78 returns to the standby state; if it is positive, the decoder 78 determines whether or not numerical message information exists in the demodulated signal (S3). If numerical message information is absent, the decoder 78 sends a status "NO MESSAGE" to the CPU 80; if it is present, the decoder 78 sends a status "MESSAGE" to the CPU 80 together with the message information. The CPU 80 controls the entire paging receiver 70 and drives the LCD 82. For the CPU 80, use may be made of 4-bit microprocessor μPD75308G or μPD7514G (trade name) available from NEC (Japan).

On receiving the status "NO MESSAGE", the CPU 80 causes the LCD 82 to display a tone-only call on the screen 82a thereof, as shown in FIG. 7. In FIG. 7, the reference numeral 126 designates a message reception number. On the other hand, as the CPU 80 receives the status "MESSAGE" and numerical message information, it determines the number of figures which the message has (S4) and, if it not greater than five, displays the message information on the LCD screen 82a, as shown in FIG. 8. In FIG. 8, the reference numeral 128 designates a message. When the number of figures is six to seventeen, the message appears in two consecutive pictures on the screen 82a, as shown in FIGS.

9A and 9B. In FIGS. 9A and 9B, the reference numerals 130 and 132 designate a message and a continuation mark, respectively. Further, when the number of figures is greater than seventeen, the message appears in three consecutive pictures on the screen 82a, as shown in FIGS. 10A-10C. In FIGS. 10A-10C, the reference numeral 134 designates the message.

In the illustrative embodiment, the time when a paging signal is received is displayed by seven numerical message display elements, including "[ ] (bracket)". Hence, the seven error display elements associated with such seven numerical message display elements do not have to show whether or not the associated numerical message display elements are correct. That is, the seven error display elements can each be used to display a day of the week when the message is received.

The numerical message and other information appearing on the LCD screen 82a disappear (S7) when an exclusive reset switch, not shown, is pressed (S5) or when a predetermined period of time, e.g., twenty seconds expires as counted by a timer. In this condition, the paging receiver 70 awaits a call. The key scanning of the reset switch and the counting operation of the timer are implemented by the CPU 80.

When the decoder 78 determines that the address signal is identical with the stored address (S2), it sends a predetermined alert drive signal from the ROM 86 to the alert device driver 88. The driver 88 amplifies the alert drive signal to thereby drive at least one of the LED 90, loudspeaker 92 and vibrator 94, alerting the user of the receiver 70 to the incoming call. The DC/DC converter 84 boosts the voltage of the power source 76 (1.4 volts) to the operation voltage of the decoder 78 and CPU 80.

The CPU 80 has a function of controllably driving the LCD 82, as stated earlier. The previously mentioned 4-bit microprocessor μPD75308G or μPD7514G available from NEC has four common lines and twenty-eight segment lines. Theoretically, therefore, such a microprocessor is capable of controlling each of $4 \times 28 = 128$ LCD segments independently of the other segments.

The number of LCD segments of the LCD 82, FIG. 4, to be controllably turned on is as follows:

Content of Display	Number of Segments
outside-area mark 96	1
reception address display mark 98	7
receiving function display mark 100	4
low voltage display mark 102	1
switch position display mark 104	2
same call reception mark 106	1
message protection mark 108	1
message continuation mark 110	1
message reception number 112	8
numerical message information 114	7×12
error 116	12
colon 118 (subordinate to mark 110)	0
colon 120 for time	1
total	123

Hence, the 4-bit microprocessor μPD75308G or μPD7514G is capable of controlling the LCD 82 having 123 segments to be selectively turned on.

On the other hand, the conventional LCD 24, FIG. 2, has the following segments to be controlled independently of one another:

Content of Display	Number of Segments
outside-area detection mark 38	1
reception address display mark 40	7
receiving function display mark 42	4
low voltage display mark 44	1
switch position display mark 46	2
same call reception mark 48	1
message protection mark 50	1
message continuation mark 62	1

(continued)

Content of Display	Number of Segments
message reception number 54	8
numerical message information 56	7 × 12
error 58	12
colon 60 (subordinate to mark 110)	0
colon for time 62	1
day-of-week information 62	7
total	130

The LCD 24, therefore, has 130 segments which have to be controlled independently of one another. It follows that the number of control lines available with the microprocessor μPD75308 or μPD7514G is short. Specifically, the LCD 24 shown in FIG. 2 has to have the number of figures assigned to the numerical message information 56 and errors 58 reduced or, as shown in FIG. 1, the LCD driver 22 for driving the LCD 24 is indispensable.

In summary, it will be seen that the present invention provides a paging receiver having an LCD in which a numerical message display section and an error display section serve respectively as a time display section and a day-of-week display section at the same time. This allows the size of each LCD display element in the numerical message display section to be increased and allows the number of figures which can appear at a time to be increased, enhancing visibility to a considerable degree. Moreover, since the paging receiver is miniature and low cost since it does not need an exclusive driver for driving the LCD.

Various modifications will become possible for those skilled in the art after receiving the teachings of the present disclosure without departing from the scope thereof.

Claims

1. A paging receiver capable of displaying time information and day-of-week information, comprising:

   display means comprising a plurality of numerical message information display elements for displaying numerical message information, and a plurality of error display elements for displaying errors of said numerical message information; and
   control means for causing said numerical message information display elements and said error display elements to display time information and day-of-week information, respectively.

2. A paging receiver as claimed in claim 1, wherein said display means comprises a liquid crystal display.

3. A paging receiver as claimed in claim 1, wherein said numerical message information display elements each comprises seven segments to appear on the screen of said display means, said error display elements each comprising a single segment to appear on said screen.

4. A paging receiver as claimed in claim 1, wherein said control means comprises a control device for controlling said paging receiver.

5. A paging receiver as claimed in claim 4, wherein said control device comprises a CPU.

Patentansprüche

1. Rufempfänger, der Zeitinformationen und Wochentaginformationen anzeigen kann, mit:

   einer Anzeigeeinrichtung mit mehreren Anzeigeelementen für numerische Nachrichteninformationen zum Anzeigen numerischer Nachrichteninformationen und mehreren Fehleranzeigeelementen zum Anzeigen von Fehlern der numerischen Nachrichteninformationen; und
   einer Steuereinrichtung zum Veranlassen der Anzeigeelemente für numerische Nachrichteninformationen und der Fehleranzeigeelemente, Zeitinformationen bzw. Wochentaginformationen anzuzeigen.

2. Rufempfänger nach Anspruch 1, wobei die Anzeigeeinrichtung eine Flüssigkristallanzeige aufweist.

3. Rufempfänger nach Anspruch 1, wobei die Anzeigeelemente für numerische Nachrichteninformationen jeweils sieben Segmente aufweisen, um auf dem Bildschirm der Anzeigeeinrichtung zu erscheinen, und die Fehleranzeigeelemente jeweils ein einzelnes Segment aufweisen, um auf dem Bildschirm zu erscheinen.

4. Rufempfänger nach Anspruch 1, wobei die Steuereinrichtung eine Steuervorrichtung zum Steuern des Rufempfängers aufweist.

5. Rufempfänger nach Anspruch 4, wobei die Steuervorrichtung eine CPU aufweist.

Revendications

1. Récepteur d'appels capable d'afficher des informations sur l'heure et des informations sur le jour de la semaine, comprenant :

   des moyens d'affichage comprenant une pluralité d'éléments d'affichage d'informations de messages numériques pour afficher des informations de messages numériques, et une pluralité d'éléments d'affichage d'erreurs pour afficher des erreurs desdites informations de messages numériques ; et
   des moyens de commande pour amener lesdits éléments d'affichage d'informations de messages numériques et lesdits éléments d'affichage d'erreurs à afficher des informations sur l'heure et des informations sur le jour de la semaine, respectivement.

2. Récepteur d'appels selon la revendication 1, dans lequel lesdits moyens d'affichage comprennent un affichage à cristaux liquides.

3. Récepteur d'appels selon la revendication 1, dans lequel lesdits éléments d'affichage d'informations de messages numériques comprennent chacun sept segments devant apparaître sur l'écran desdits moyens d'affichage, lesdits éléments d'affichage d'erreurs comprenant chacun un unique segment devant apparaître sur ledit écran.

4. Récepteur d'appels selon la revendication 1, dans lequel lesdits moyens de commande comprennent un dispositif de commande destiné à commander ledit récepteur d'appels.

5. Récepteur d'appels selon la revendication 4, dans lequel ledit dispositif de commande comprend une unité centrale de traitement.

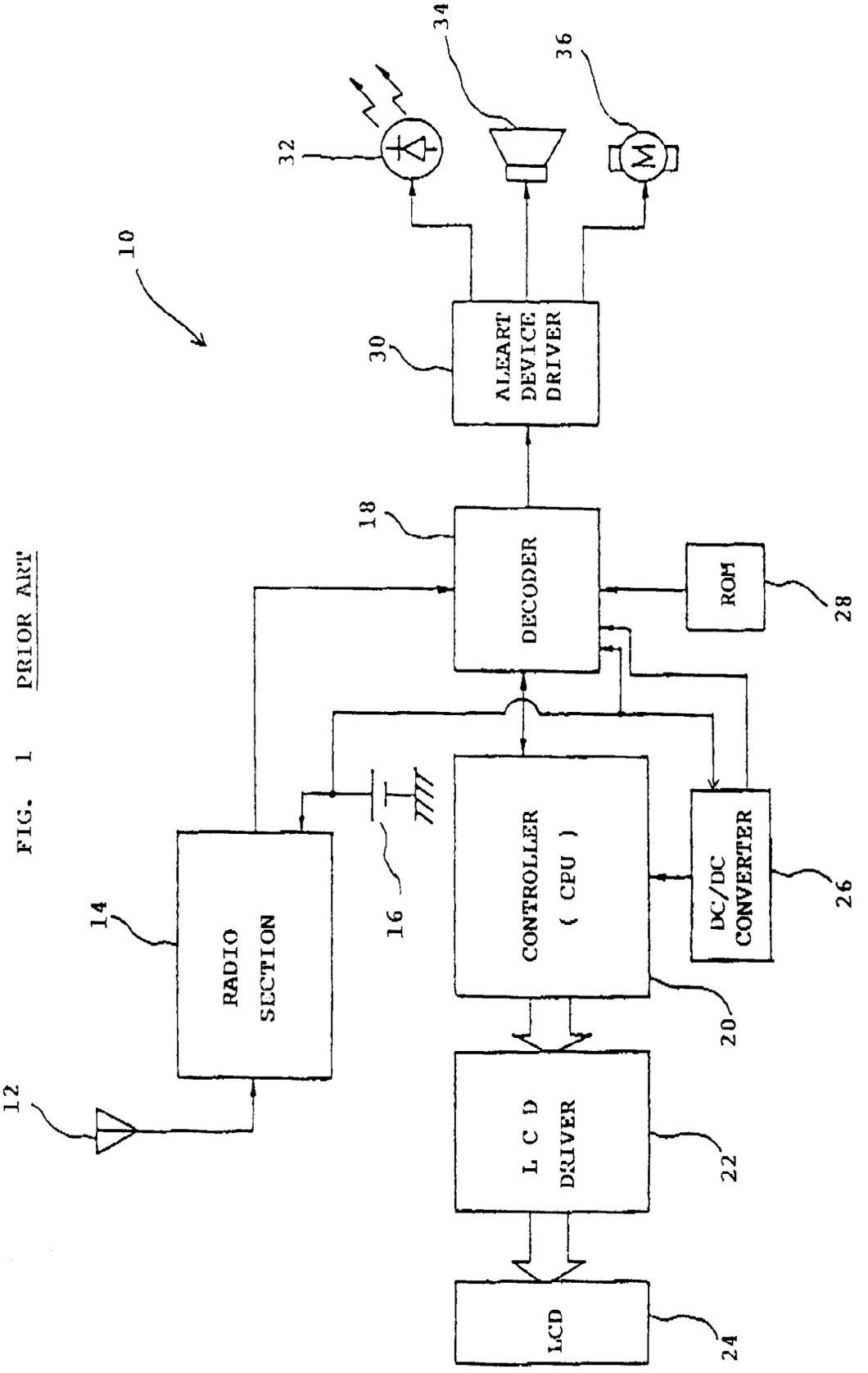


FIG. 1 PRIOR ART

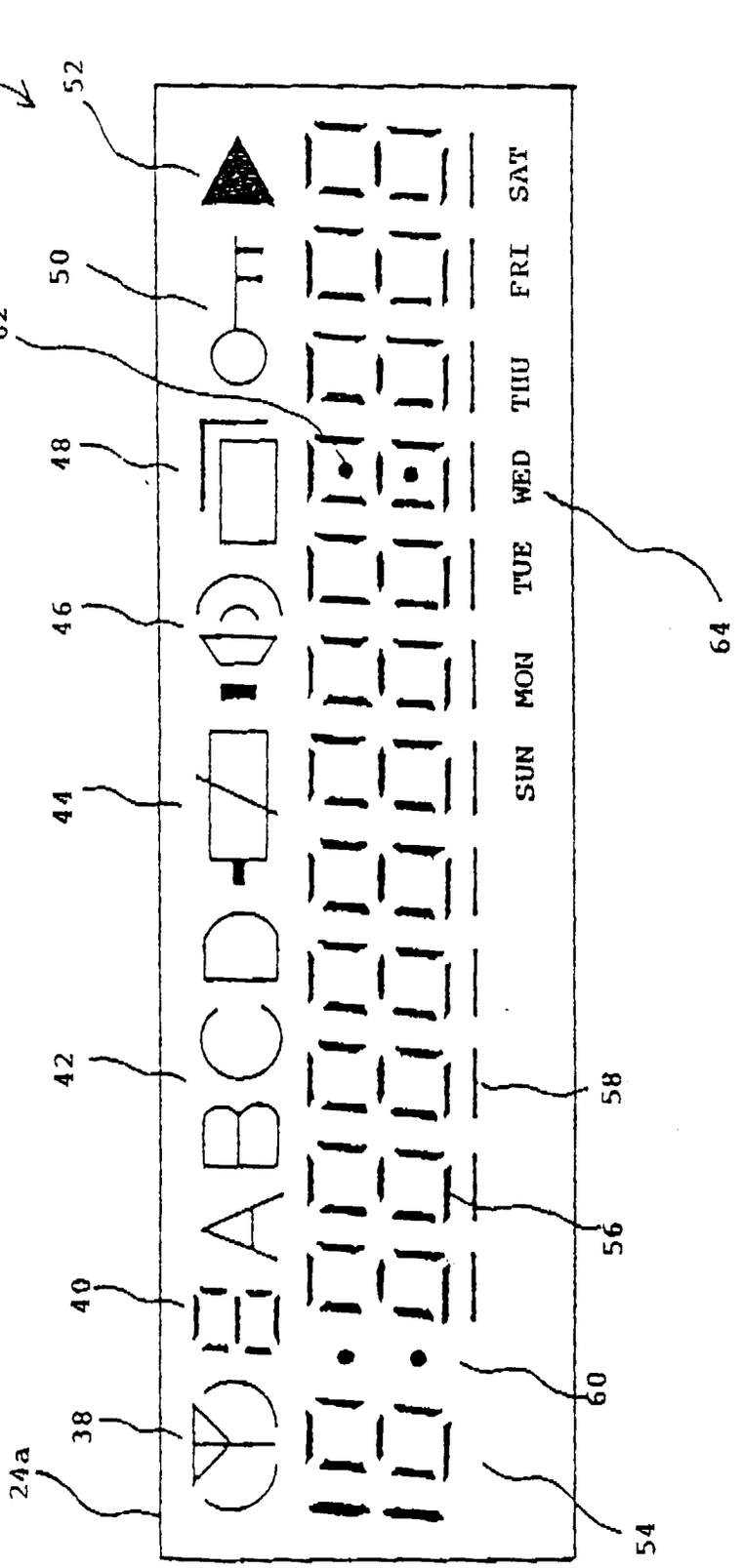


FIG. 2 PRIOR ART

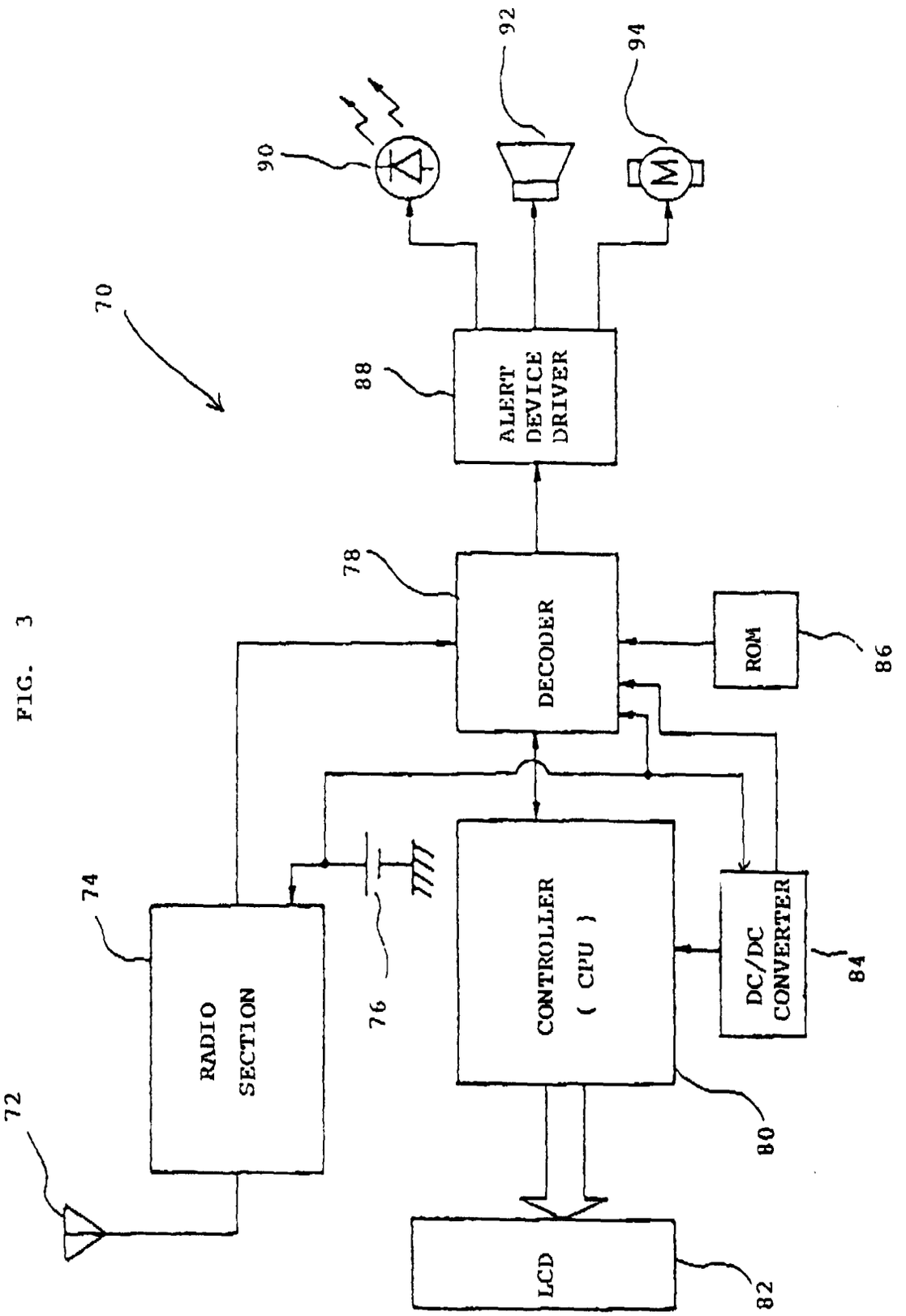

70
72
74
RADIO SECTION
76
78
DECODER
80
CONTROLLER (CPU)
82
LCD
84
DC/DC CONVERTER
86
ROM
88
ALERT DEVICE DRIVER
90
92
94

FIG. 3

FIG. 4

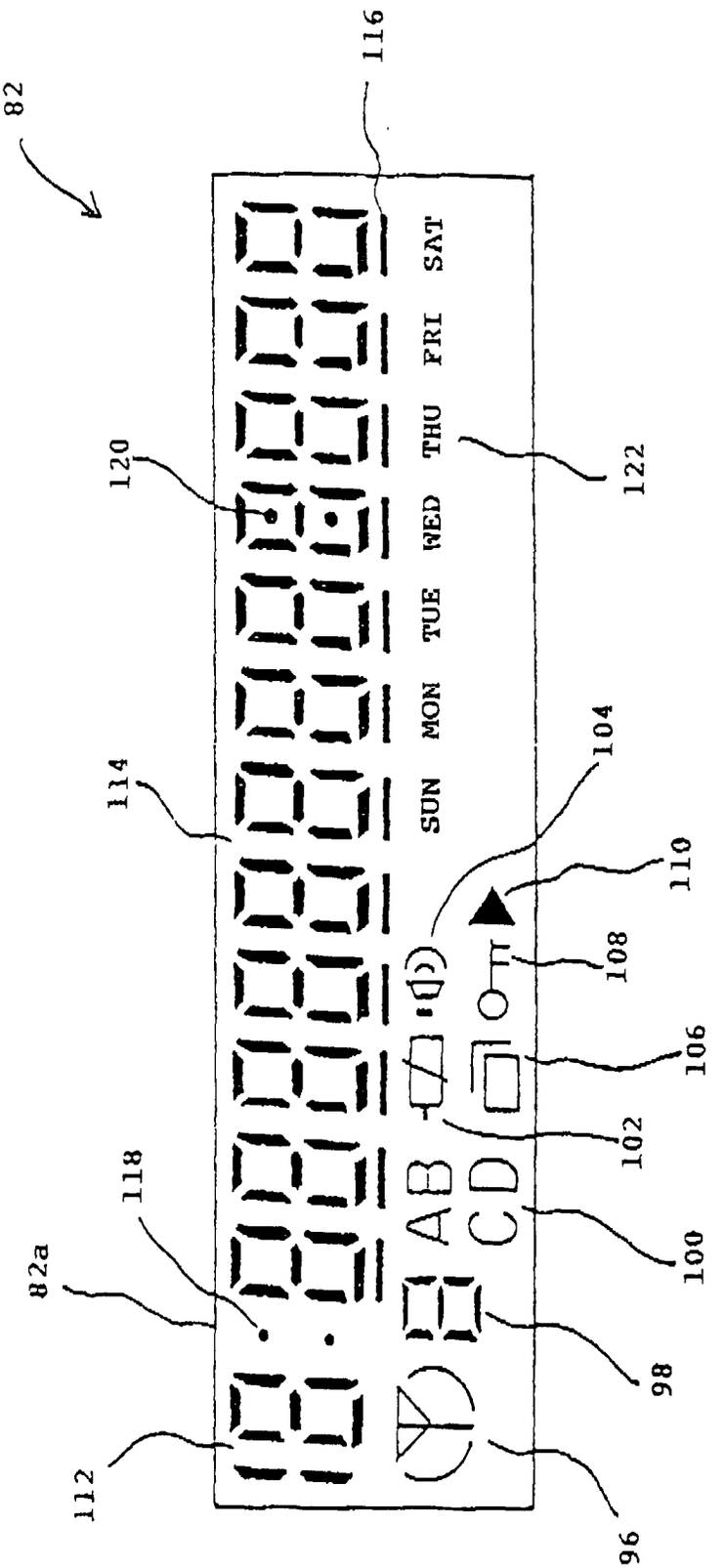

82
116
120
122
114
104
110
108
106
102
100
98
96
118
82a
112
SUN MON TUE WED THU FRI SAT
AB
CD

FIG. 5

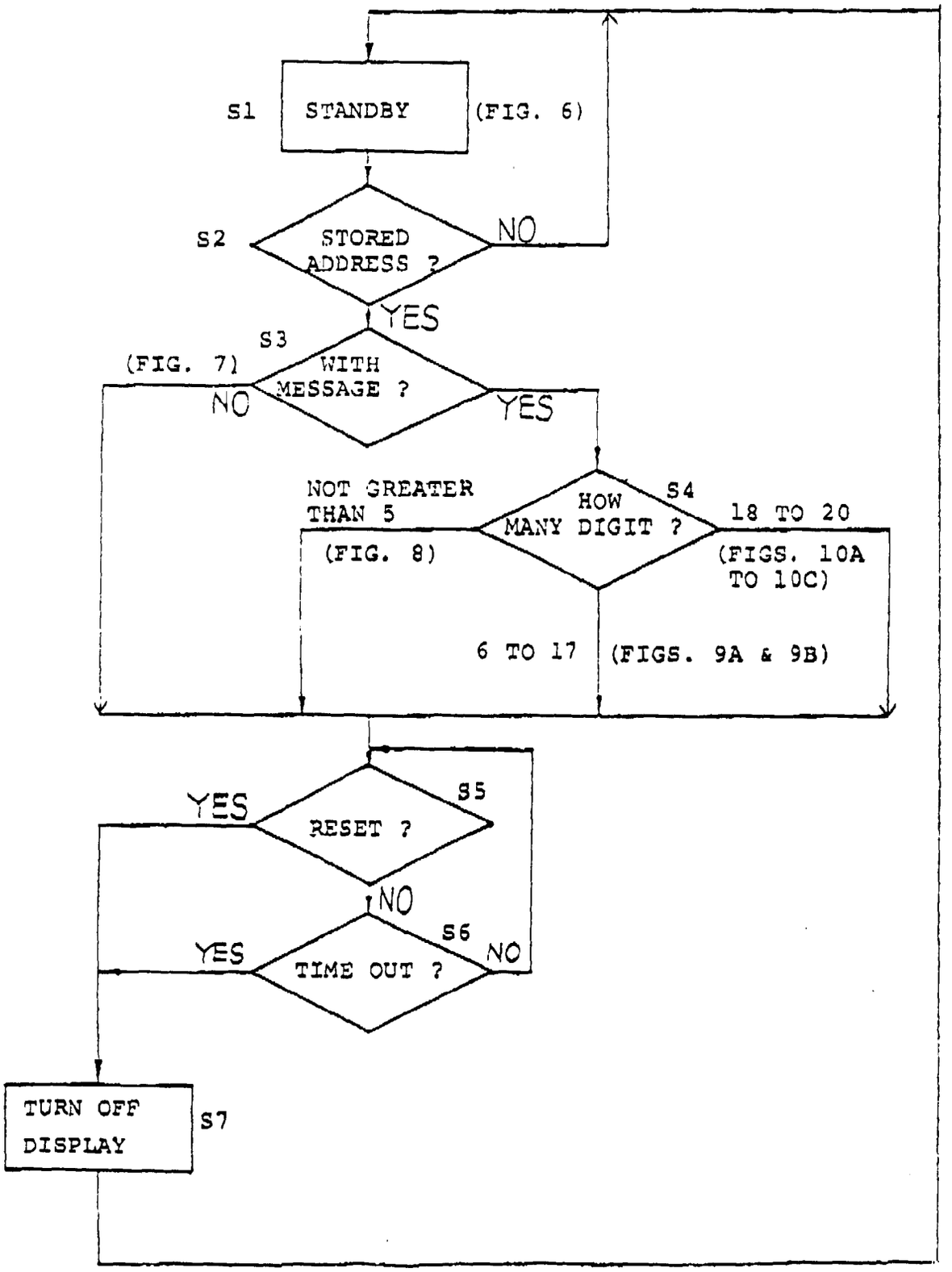

S1
STANDBY
(FIG. 6)
S2
STORED ADDRESS ?
NO
YES
S3
(FIG. 7)
WITH MESSAGE ?
NO
YES
NOT GREATER THAN 5
(FIG. 8)
S4
HOW MANY DIGIT ?
18 TO 20
(FIGS. 10A TO 10C)
6 TO 17
(FIGS. 9A & 9B)
YES
S5
RESET ?
NO
YES
S6
TIME OUT ?
NO
TURN OFF DISPLAY
S7

FIG. 6

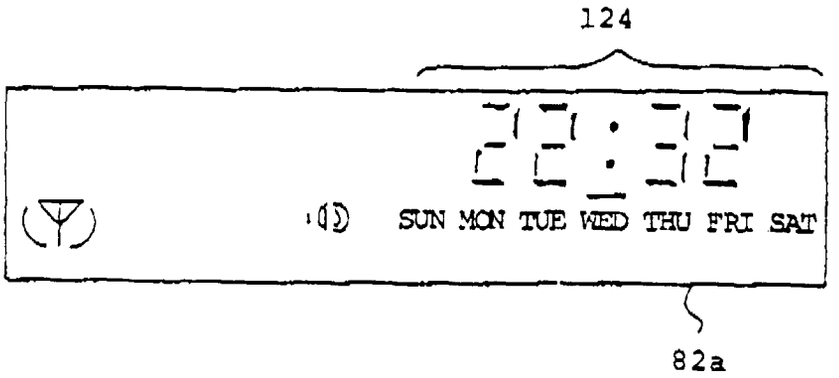


FIG. 7

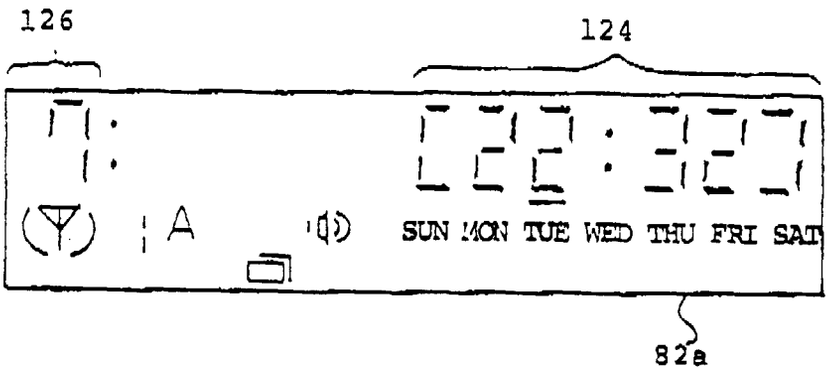


FIG. 8

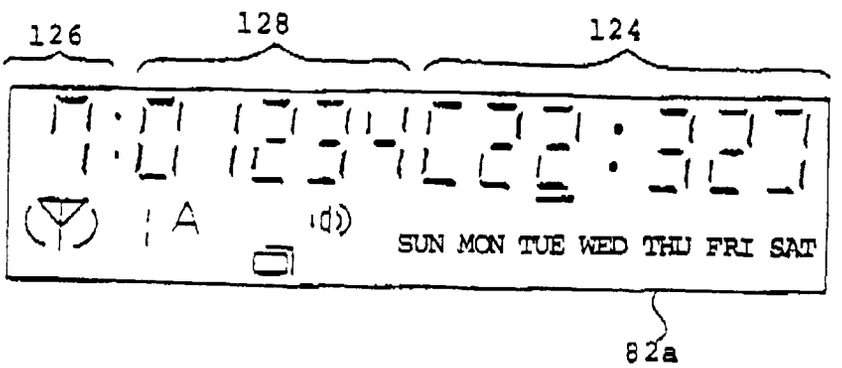


FIG. 9A

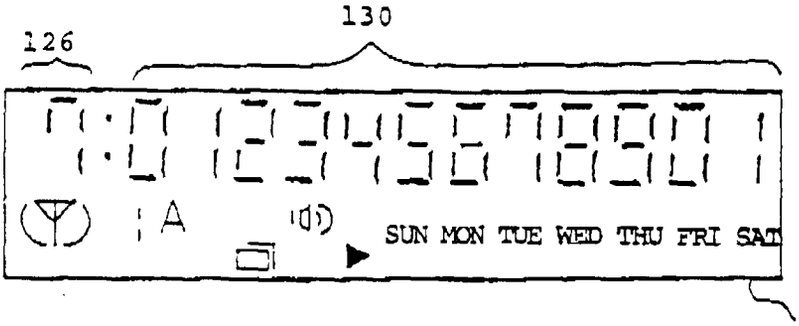


FIG. 9B

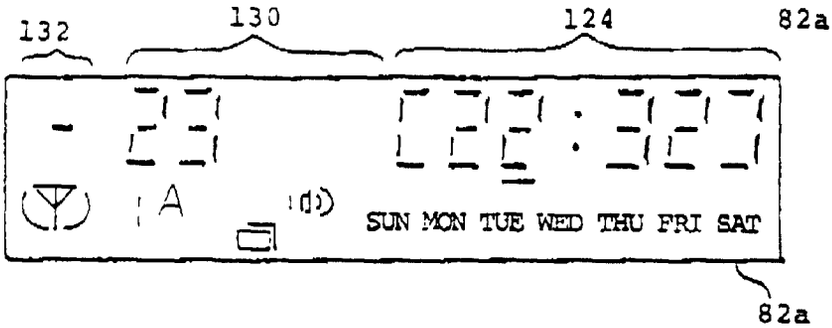


FIG. 10A

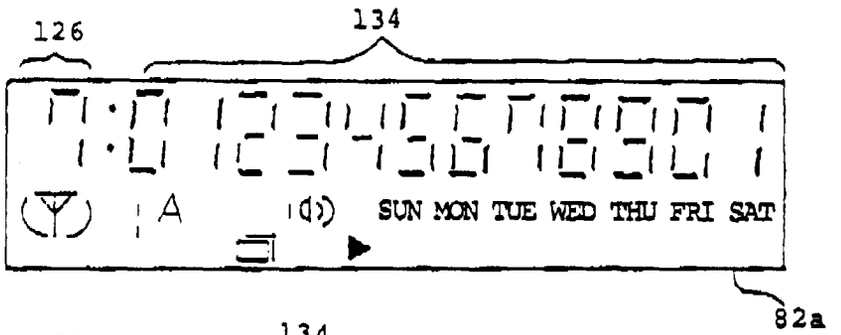


FIG. 10B

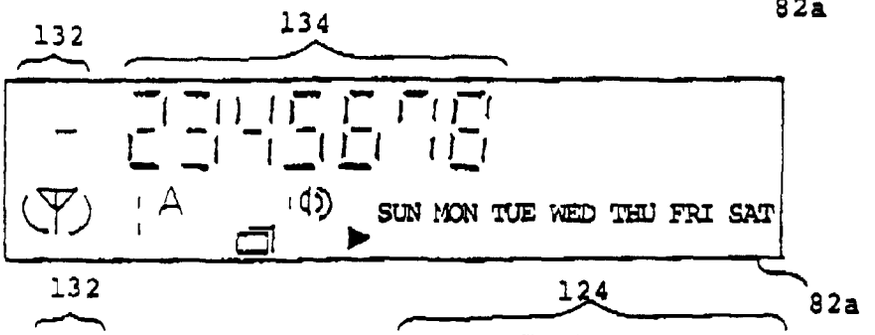


FIG. 10C

