(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 461 849 A2**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number : **91305237.9**

(51) Int. Cl.^{5} : **G04G 7/02**

(22) Date of filing : **11.06.91**

(30) Priority : **12.06.90 JP 153373/90**
24.05.91 JP 120502/90

(43) Date of publication of application :
18.12.91 Bulletin 91/51

(84) Designated Contracting States :
CH DE FR GB LI

(71) Applicant : **SEIKO EPSON CORPORATION**
4-1, Nishishinjuku 2-chome
Shinjuku-ku Tokyo (JP)

(72) Inventor : **Minowa, Yoshiki, c/o SEIKO EPSON CORPORATION**
3-5 Owa 3-chome
Suwa-shi, Nagano-ken (JP)

(74) Representative : **Miller, Joseph et al**
J. MILLER & CO. Lincoln House 296-302 High Holborn
London WC1V 7JH (GB)

(54) **Paging receiver with a time piece function.**

(57) A receiver for a paging system comprises time receiving means (1, 2) for receiving standard time information, time piece means (14) for counting a time indication, and time adjusting means (5) for adjusting the time indication on the basis of the standard time information. The receiver further comprises further time piece means (15) for counting a second time indication which represents a different time from the first time indication, and further time adjusting means (5) for adjusting the second time indication on the basis of the standard time information and of the deviation from the first time indication.

EP 0 461 849 A2

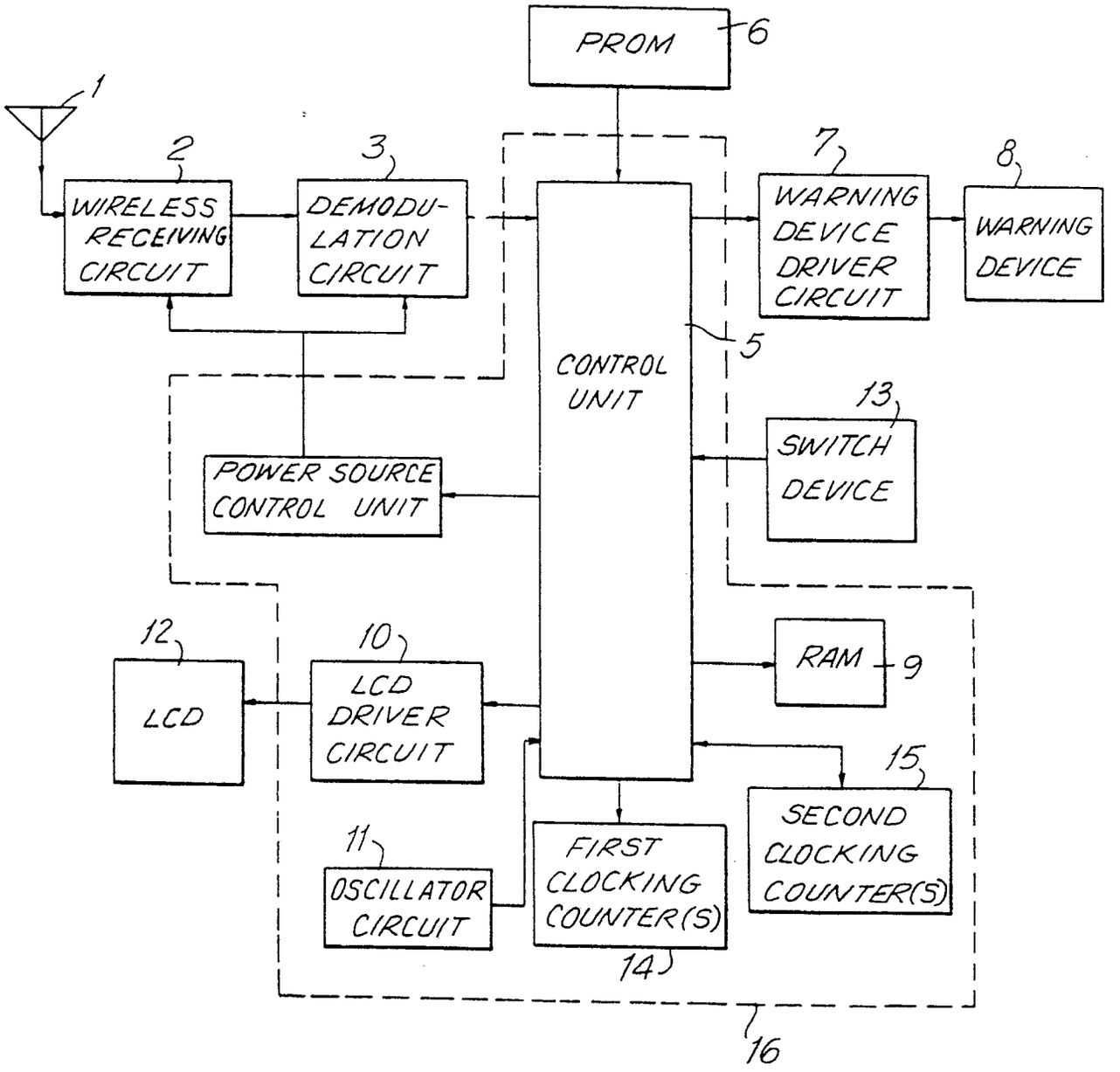

PROM
6
1
2
3
7
8
WIRELESS RECEIVING CIRCUIT
DEMODU-LATION CIRCUIT
WARNING DEVICE DRIVER CIRCUIT
WARNING DEVICE
CONTROL UNIT
5
13
SWITCH DEVICE
POWER SOURCE CONTROL UNIT
12
10
RAM
9
LCD
LCD DRIVER CIRCUIT
15
SECOND CLOCKING COUNTER(S)
11
OSCILLATOR CIRCUIT
FIRST CLOCKING COUNTER(S)
14
16

FIG. 1

The present invention relates to a receiver with a time piece function for use in a paging system.

An individual receiver for a paging system, which is capable of displaying the time and which has a manually adjustable time piece function is known and is in practical use. Furthermore, a transmission service for a receiver having a time piece, which may be adjusted on the basis of an electro-magnetic wave exclusively transmitted for time adjusting purposes, is likely to be available in the near future.

The existing individual paging receivers having a time piece, which may be adjusted by means of an electro-magnetic wave, are provided only with the capability of processing a single set of time information. Thus, if the receiver is to be used in a region where a time difference occurs, the time piece function must be manually adjusted.

On the other hand, even if the receiver was capable of receiving the time adjusting electro-magnetic wave in a region with a time difference, the time would be automatically adjusted in accordance with the time difference of the region only at specified intervals when the electro-magnetic wave was broadcast. In addition, because of the fact that time would be automatically adjusted, there might be cases where the time of the user's original or home region was temporarily lost. Then again, if adjustment by the electro-magnetic wave was prohibited, the time would have to be manually adjusted and the precision time display guaranteed to a electro-magnetic-wave-adjusted time piece would not be obtained.

Also, it has hitherto been impossible to set an electro-magnetic-wave-adjusted time piece in such a manner that the time is intentionally a little ahead, for example, in order to have the advantage of preparation for an activity or event.

It is an object of the present invention to provide a paging receiver with a time piece function which overcomes or avoids at least some of the problems indicated above.

According to the present invention, there is provided a receiver for a paging system comprising time receiving means for receiving standard time information, time piece means for counting a time indication, time adjusting means for adjusting the time indication on the basis of the standard time information and characterised by further time piece means for counting a second time indication which represents a different time from the first time indication, and further time adjusting means for adjusting the second time indication on the basis of the standard time information and of the deviation from the first time indication.

It is an advantage of the present invention that, even when the first time indication is adjusted on the basis of standard time information relating to the hour, the minute and the second, which is transmitted for example by electro-magnetic wave, the second time indication having been set with a time difference may be accurately adjusted also whilst maintaining the time difference as it is.

Adjustment of the second time indication is effected on the basis of the standard time information received by the time receiving means and also on the basis of the deviation from the first time indication, which itself is adjusted on the basis of the standard time information. In this way, the second time indication may be adjusted whilst maintaining the difference in time between the first and second time indications.

In other words, the first time indication is preferably adjusted by the first time adjusting means on the basis of the standard time information so that the first time indication means always represents time based on the standard time information. On the other hand, the second time indication is set to have a certain time difference relative to the first time indication, and is adjusted by the second time adjusting means both on the basis of the standard time information and on the basis of its set deviation from the first time indication.

If the second time adjusting means is provided with both a seconds adjusting means and a minutes adjusting means, then the seconds or less of the second time indication may be adjusted by the seconds adjusting means on the basis of the standard time information and the minutes or more may be adjusted by the minutes adjusting means on the basis of the standard time information and the deviation in minutes or more from the first time indication. A possible carry over of a plus or minus unit equal to or larger than one minute which may occur in this case is adjusted by the minutes adjusting means. The adjusting of the second time indication is thus accurately effected at all times.

The present invention will be described further, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a block diagram showing an individual paging receiver with a time piece function according to an embodiment of the present invention;

Figure 2 is a flow chart representing a time adjusting operation of the receiver;

Figure 3 is a plan view of an example of a display of a first time indication of the receiver; and

Figure 4 is a plan view of an example of a display of a second time indication of the receiver.

Figure 1 shows the construction of an individual receiver for a paging system, having a time signal receiving function according to the present invention. The receiver comprises an antenna 1 incorporated into the receiver, a radio receiving circuit 2 and a demodulation circuit 3. It further includes a power source control circuit 4 for controlling the power supply to the radio receiving circuit 2 and the

demodulation circuit 3, and a control section 5 for controlling the circuit 4.

The receiver also includes: a PROM 6 (programmable read only memory) for storing an individual call number, which is to be compared in the control section 5; and a RAM 9 (random access memory) for storing information transmitted in association with a fixed call number and standard time information. An LCD driver circuit 10 is provided for driving an LCD 12 (liquid crystal display) for displaying information, and an oscillator circuit 11 containing a crystal oscillator generates a clock signal to be used in controlling the driver circuit 10. A first clock counter 14 for clocking a first time indication and a second clock counter 15 for clocking a second time indication are respectively connected to the control section 5.

In the present embodiment, the power source control circuit 4, the control section 5, the RAM 9, the LCD driver circuit 10, the oscillator circuit 11, the first clock counter 14 and the second clock counter 15 constitute a control unit 16. The LCD 12 respectively displays messages and the first or the second time indication which are stored in the RAM 9. A warning device driver circuit 7 operates a warning device 8 such as a buzzer, an LED or a vibrator for informing the fact that a message has been received. A switching device 13 is provided for manual operation of various functions of the receiver.

In this receiver, a standard time signal transmitted at a pre-determined radio frequency is received by the built in antenna 1 of the receiver and is supplied to the radio receiving circuit 2. The received signal is demodulated and wave shaped in the circuit 2, and is then converted into a digital signal. This digital signal is first error corrected in the demodulation circuit 3 and, after such error correction, a judgement is made as to whether it represents time information or not. If it is judged to be time information, the digital signal is supplied from the demodulation circuit 3 to the control unit 16.

Figure 2 is a flow chart for explanation of a time adjusting operation executed by the control unit 16 in the above receiver. In the adjusting operation of the present embodiment, the seconds or less value of the second time indication is adjusted on the basis of the standard time signal while the minutes or more value thereof is corrected on the basis of the standard time signal and a deviation from the first time indication.

An adjusting operation will be described below with reference to each of the steps shown in Figure 2.

In step ST1, first, a decision is made as to whether correct standard time information has been received. Since the effect of the standard time information being erroneous is substantial, the time information from the demodulation circuit 3 is judged again under stricter conditions. For example, when the number 15 is received as data for the month, it is considered to be erroneous information by the control unit 16, even though it constitutes data corrected by the demodulation circuit 3. If it is judged that correct standard time information has been received, the system proceeds to steps ST2 and ST5. If not, the system proceeds to "END" and the adjusting operation is terminated.

If correct standard time information containing at least an hour, a minute and a second value is obtained at step ST1, such information is written in step ST2 into the first clock counter 14 and the control unit 16.

When the standard time information is written into the first clock counter 14 in step ST2, a comparison is made in the control section 5 between such standard time information and the previous content of the first clock counter 14 so as to calculate whether the digit for the minutes in the first clock counter 14 is to be changed upwardly or downwardly or to be unchanged (step ST3). The adjusted value thus obtained is stored in the RAM 9.

The first clock counter 14, after having its contents up-dated in step ST2 according to the received standard time information, continues counting on the basis of the clock signal from the oscillator 11, serving as its own source for time reference (step ST4). Thus, the first time indication is counted accurately in the condition to which it has been adjusted most recently.

In the second clock counter 15, the second time indication is counted on the basis of the clock signal from the oscillator circuit 11, serving as its own source for time reference. This time indication is counted on the basis of at least hours and minutes, which have been input manually by means of the switching device 13. The seconds or less of this second clock counter 15 are adjusted to the same value as in the standard time information evaluated in step ST1 (step ST5). If a time interval is required between the execution of step ST5 and the execution of step ST2, it is desirable that the information for seconds or less for the second clock counter 15 is up-dated by corresponding information from the first clock counter 14, which has already been up-dated according to the standard time information and is clocked continuously after that point in time.

In the step ST5, in addition to making an adjustment of the value for seconds or less as described, the value for minutes or more is also adjusted on the basis of the adjusted value obtained in step ST3.

For example, supposing the first time indication is to be adjusted to 12 hours 00 minutes and 00 seconds p.m. when the first time indication is 11 hours 59 minutes and 59 seconds a.m. and the second time indication is 10 hours 59 minutes and 59 seconds a.m. If only the seconds or less of the second time indication is adjusted, the second time indication becomes 10 hours 59 minutes and 00 seconds a.m. Thus, the minutes value of the second time indication

loses one minute in relation to the first time indication when compared with the times before the adjustment.

On the other hand, supposing the first time indication is 12 hours 00 minutes and 00 seconds p.m. and the second time indication is 11 hours 00 minutes and 00 seconds a.m. In this case, if the first time indication is adjusted by means of an electro-magnetic wave to 10 hours 59 minutes and 59 seconds a.m., the second time indication becomes 11 hours 00 minutes and 59 seconds a.m. if only the value for the seconds or less of the second time indication is adjusted. Thus, by comparison with the times before correction, the minutes value of the second time indication gains one minute in relation to the first time indication.

To avoid such an error, the contents of the clock counter 15 for the second time indication are adjusted on the basis of the judgement made in step ST3 as to whether to carry over a gain or a reduction of one minute. If such a judgement is not performed, an occurrence of a one minute error may in the worst case be caused for each electro-magnetic wave adjustment. When such an error occurs, the relative difference between the digit for the minutes of the first time indication and the digit for the second time indication changes.

In step ST6, the second time indication, which has been adjusted and includes the carry over of up to one minute, is clocked continuously thereafter on the basis of the clock signal from the oscillator circuit 11, serving as its own source of time reference in a manner similar to the first time indication.

In step ST7, the first and second time indications, which have been adjusted, are selected for display by the switching device 13.

The first or second time indication which has been selected is then displayed in step ST8 by the LCD 12 by way of the LCD driver circuit 10.

Figure 3 shows an example of a display for the first time indication. The month, day and year are displayed in the upper row while the hours, minutes and seconds of the first time indication are displayed in the lower row.

Figure 4 shows an example of a display for the second time indication. In the present embodiment, only the hours, minutes and seconds of the second time indication are shown in the lower row. In addition, the month, day and year may also be displayed in a similar manner as shown in Figure 3.

Further, the display arrangement may voluntarily be changed, for example, by inter-changing the upper row and the lower row and by inter-changing the month, day and year. In the displayed state, the second time indication can have the hours and minutes manually set, and the setting of a time differential relative to the first time indication is also possible. And the display of the seconds for the second time indication matches the display of the seconds for the first time indication.

Although in the present embodiment there is only the second time indication which can be set with a time difference, it is also possible to have two or more time indications which may be set in this way.

Also, the invention may be applied to a time piece function in which electro-magnetic wave adjustment is effected not only to the second but also to 1/10 or 1/100 of a second.

As described, an individual paging receiver with a time piece function according to the present invention is capable of setting both a first time indication and a second time indication having a time difference from the first time indication such that the second time indication is up-dated on the basis of received standard time information while maintaining such a time difference. According to the present invention, therefore, even in a region where a time differential exists, the standard time information in that region may be used to keep the time in the original region of the user accurately.

Even when a time indication is used which is set with a certain time difference from an original time, such time is not automatically adjusted to the original time by the receiver of the present invention, and the set time difference may be kept. Furthermore, by using standard time information associated with the original time, the time set with a time difference may be kept highly accurately.

The receiver is thus capable of correcting an internally measured time according to an externally measured standard time, and more particularly is capable of clocking two or more internally measured times, which may be set with a time difference, and of adjusting said times according to standard time information transmitted e.g. by an electro-magnetic wave.

Claims

1. A receiver for a paging system comprising time receiving means (1, 2) for receiving standard time information, time piece means (14) for counting a time indication, time adjusting means (5) for adjusting the time indication on the basis of the standard time information and characterised by further time piece means (15) for counting a second time indication which represents a different time from the first time indication, and further time adjusting means (5) for adjusting the second time indication on the basis of the standard time information and of the deviation from the first time indication.

2. A receiver according to claim 1 characterised in that the further time adjusting means comprise a seconds adjusting means for adjusting values for

the seconds or less of the second time indication on the basis of the standard time information, and a minutes adjusting means for adjusting values for the minutes or more of the second time indication on the basis of the deviation between the standard time information and the first time indication.

3. A receiver according to claim 1 or 2 characterised in that a time display (12) is provided for selectively displaying the first time indication and the second time indication.

4. A receiver according to any of claims 1 to 3 characterised in that time inter-change means (13) are provided to inter-change the first time indication and the second time indication.

5. An individual selective call receiver characterised by time receiving means (1, 2) for receiving a standard time information, first time piece means (14) for clocking a first showing of time, second time piece means (15) for clocking a second showing of time which has a time differential from said first showing of time, first time adjusting means (5) for adjusting said first showing of time on the basis of said standard time information, and second time adjusting means (5) for adjusting said second showing of time on the basis of said standard time information and of the deviation from said first showing of time.

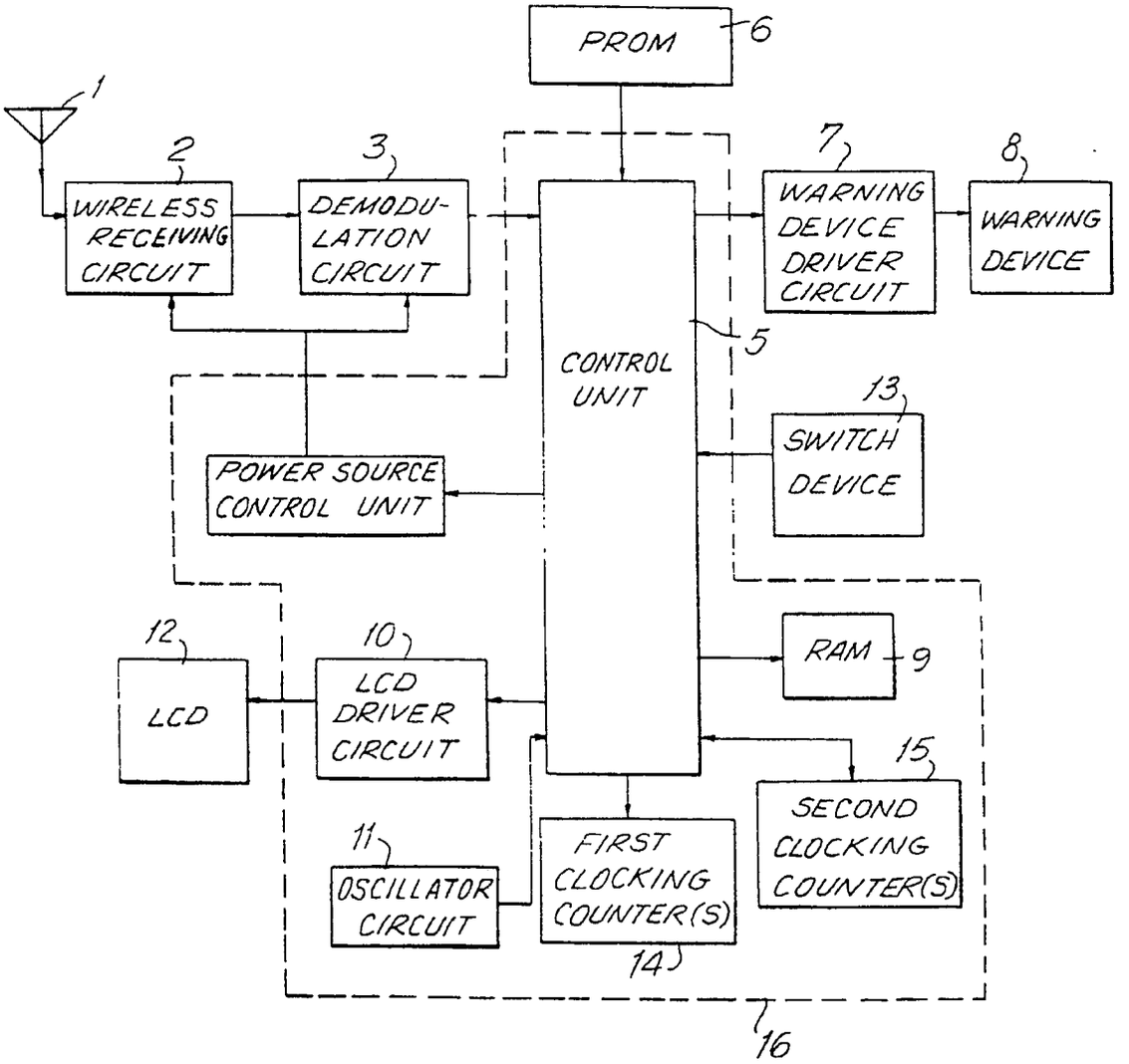

PROM
6
1
2
3
7
8
WIRELESS RECEIVING CIRCUIT
DEMODULATION CIRCUIT
WARNING DEVICE DRIVER CIRCUIT
WARNING DEVICE
CONTROL UNIT
5
13
SWITCH DEVICE
POWER SOURCE CONTROL UNIT
12
10
RAM
9
LCD
LCD DRIVER CIRCUIT
15
SECOND CLOCKING COUNTER(S)
11
OSCILLATOR CIRCUIT
FIRST CLOCKING COUNTER(S)
14
16

FIG. 1

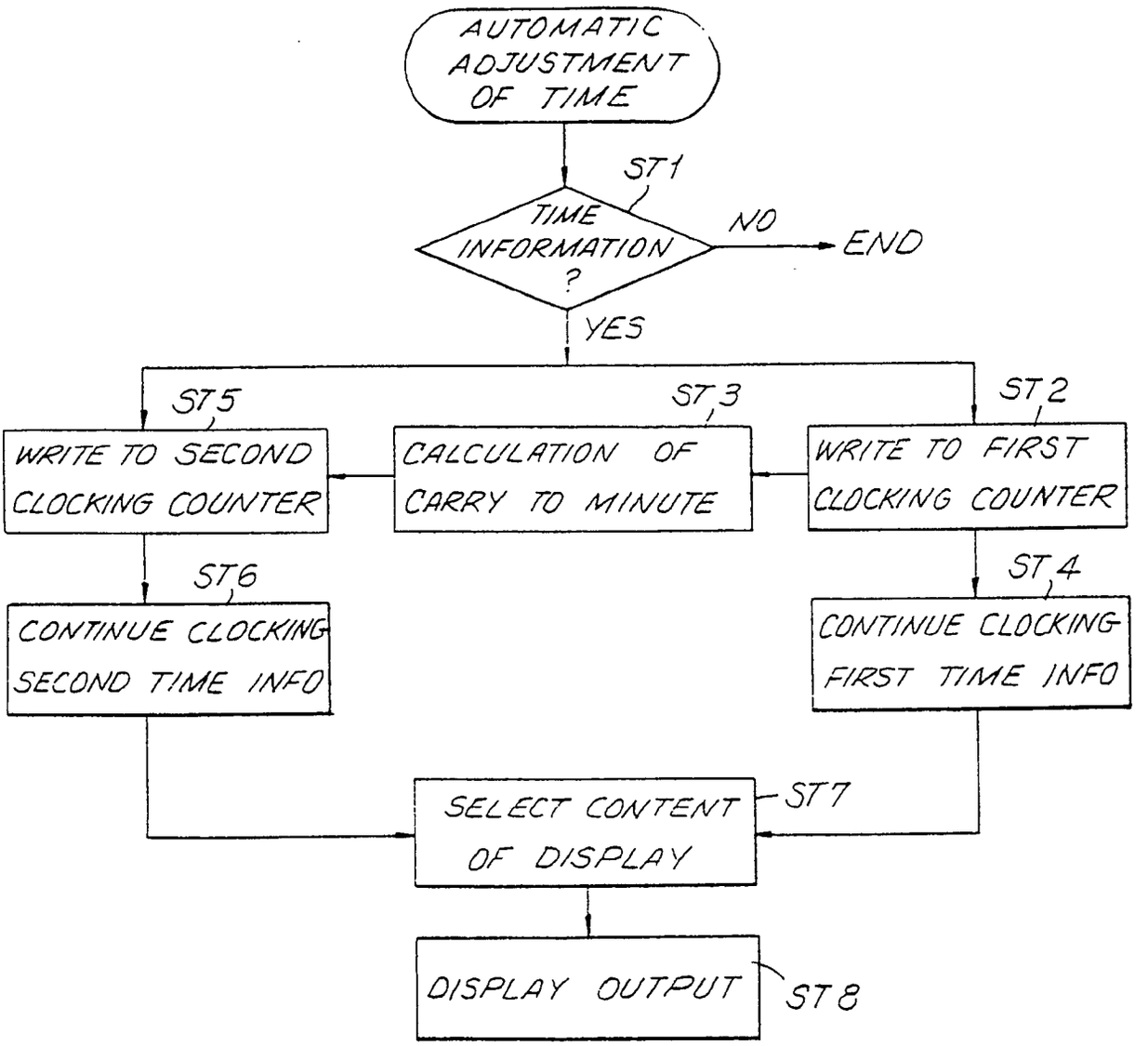

AUTOMATIC ADJUSTMENT OF TIME
ST1
TIME INFORMATION ?
NO
END
YES
ST5
WRITE TO SECOND CLOCKING COUNTER
ST3
CALCULATION OF CARRY TO MINUTE
ST2
WRITE TO FIRST CLOCKING COUNTER
ST6
CONTINUE CLOCKING SECOND TIME INFO
ST4
CONTINUE CLOCKING FIRST TIME INFO
SELECT CONTENT OF DISPLAY
ST7
DISPLAY OUTPUT
ST8

FIG. 2

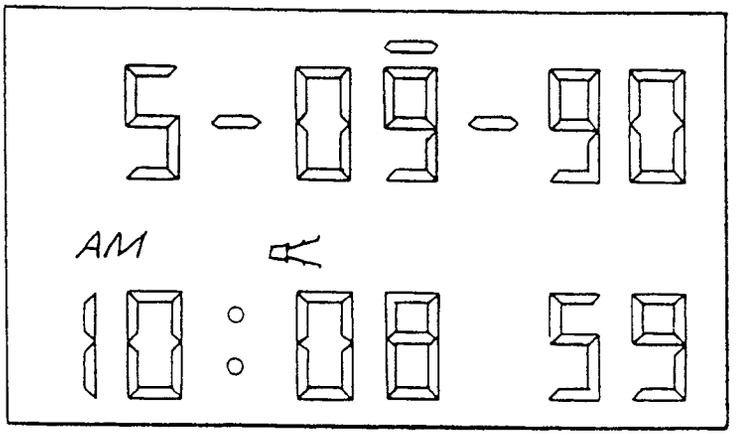


FIG. 3

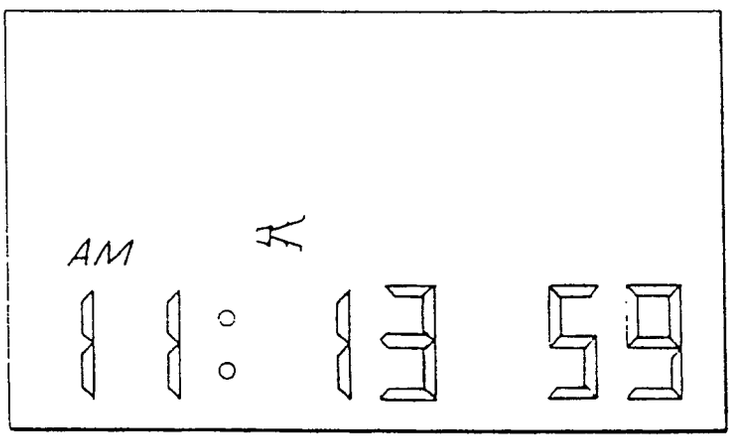


FIG. 4