

[54] **TIME SYSTEM**
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 [52] U.S. Cl. **58/24 A, 340/140 SY, 343/225**
 [51] Int. Cl. **G04c 13/02**
 [58] Field of Search..... **58/24.26; 343/225; 325/58; 340/147 SY**

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[57]

ABSTRACT

A time system having a time-generating station for generating coded time signals and for transmitting the signals at a specific radio frequency and a remote time-displaying station for receiving the coded time signals from the time-generating station and for displaying the coded time signals in standard time notation.

References Cited

UNITED STATES PATENTS

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14 Claims, 8 Drawing Figures

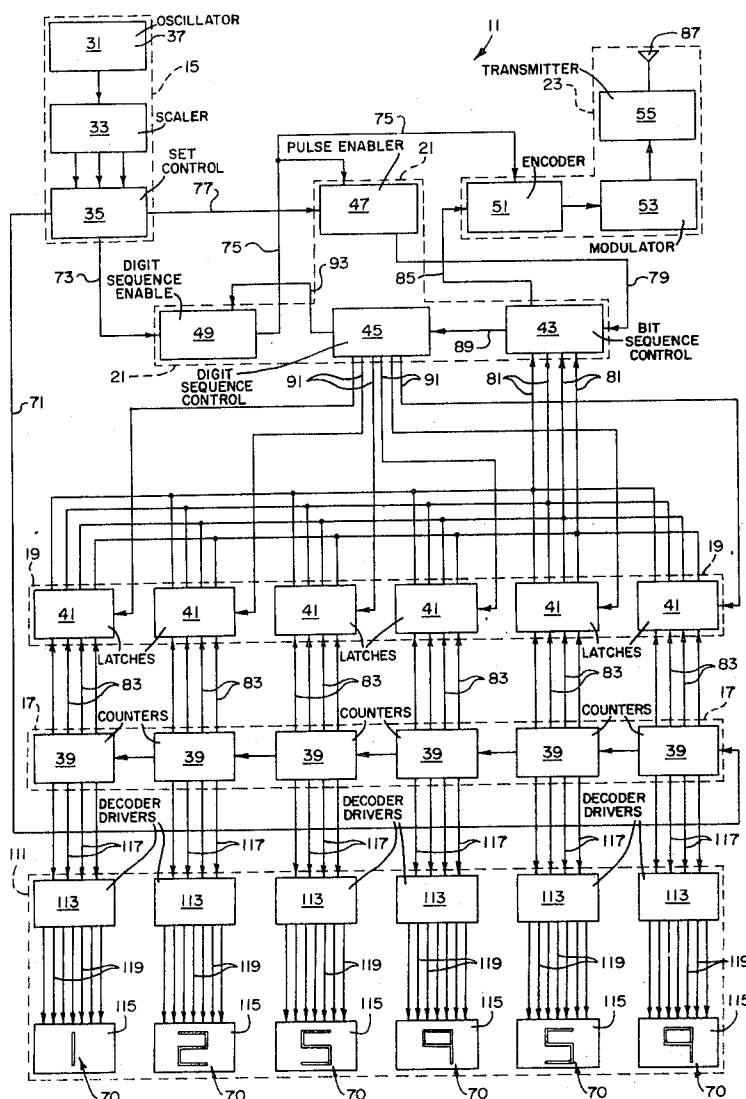
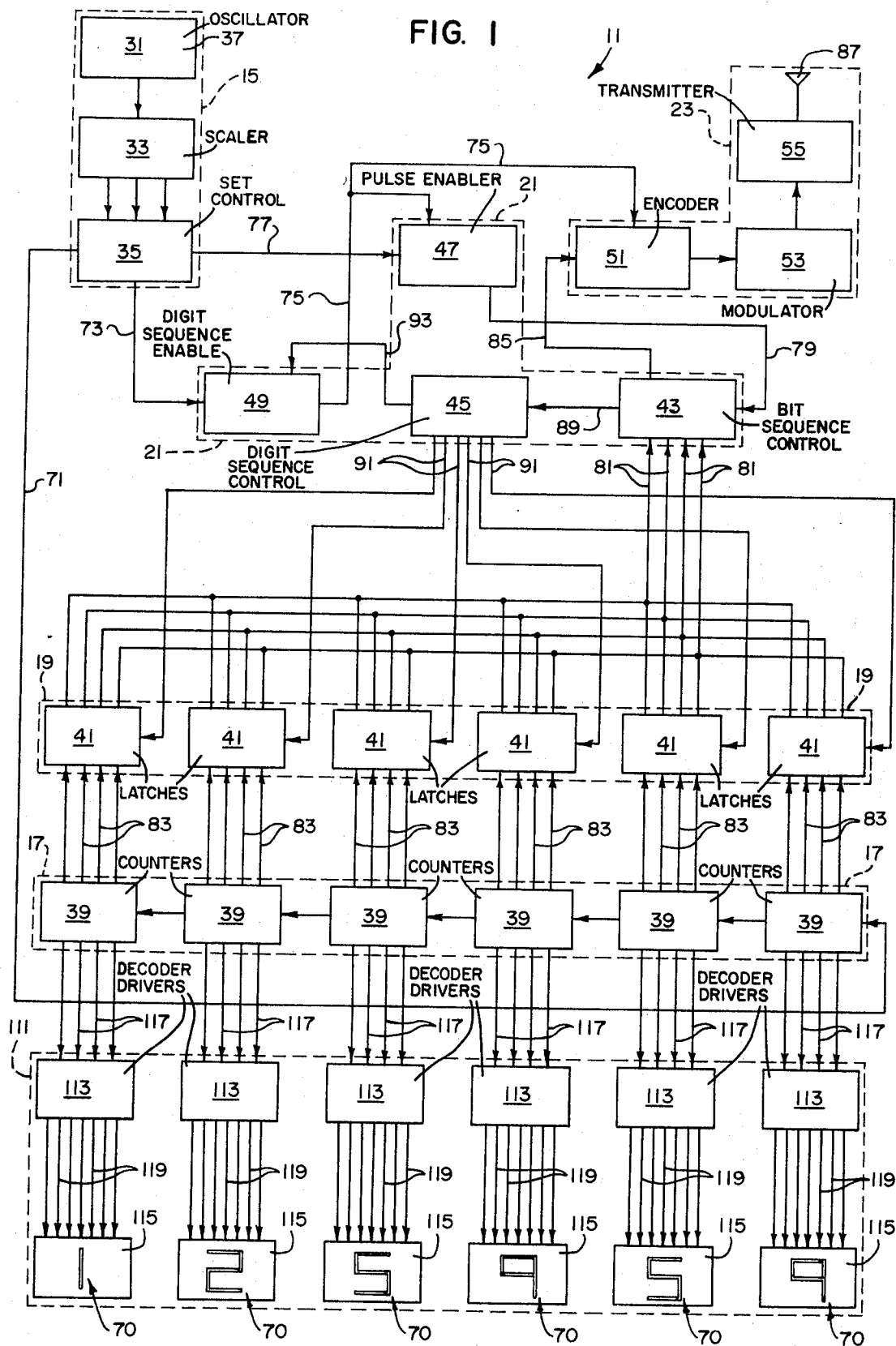


FIG. 1



SHEET 2 OF 6

FIG. 2

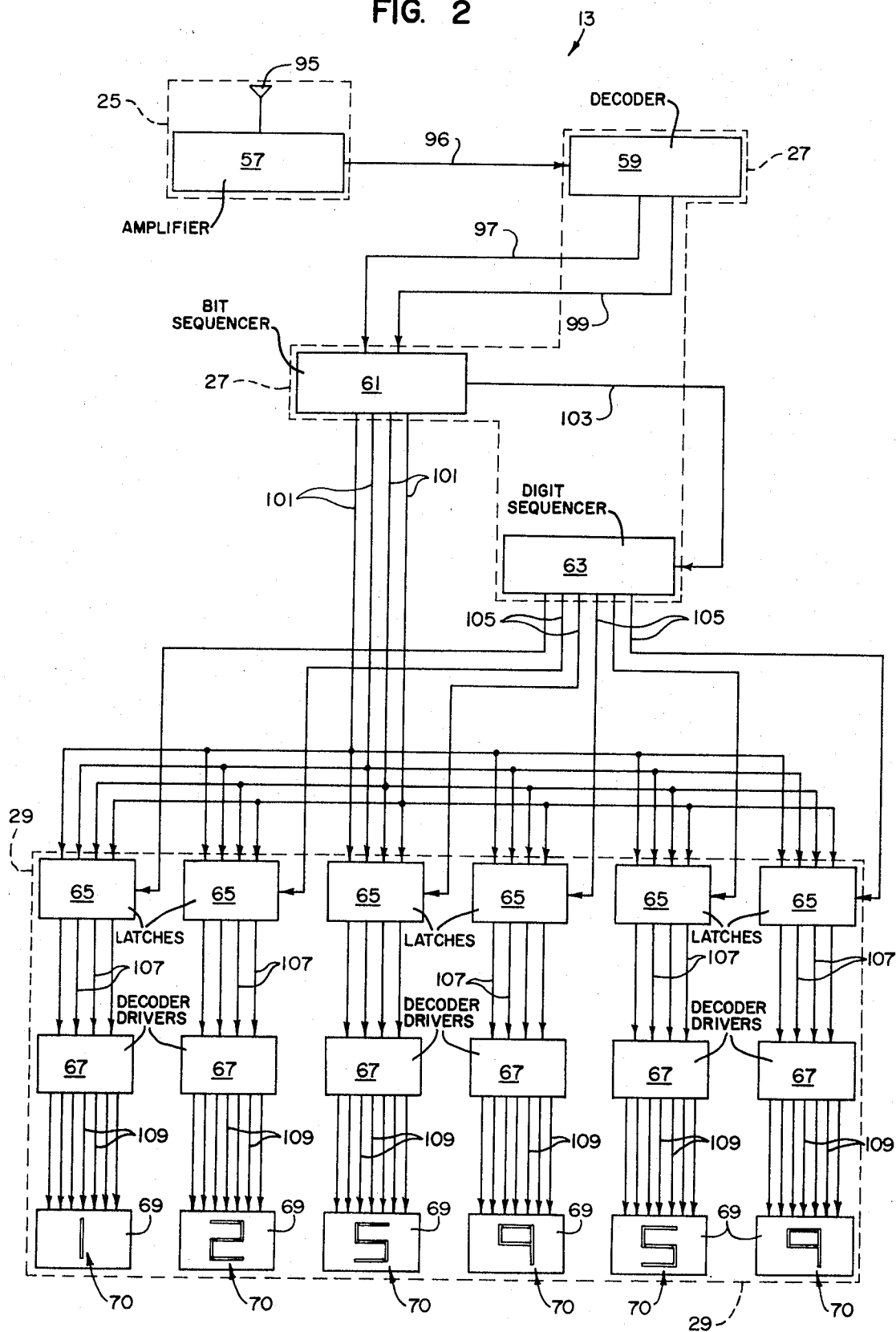


FIG. 3

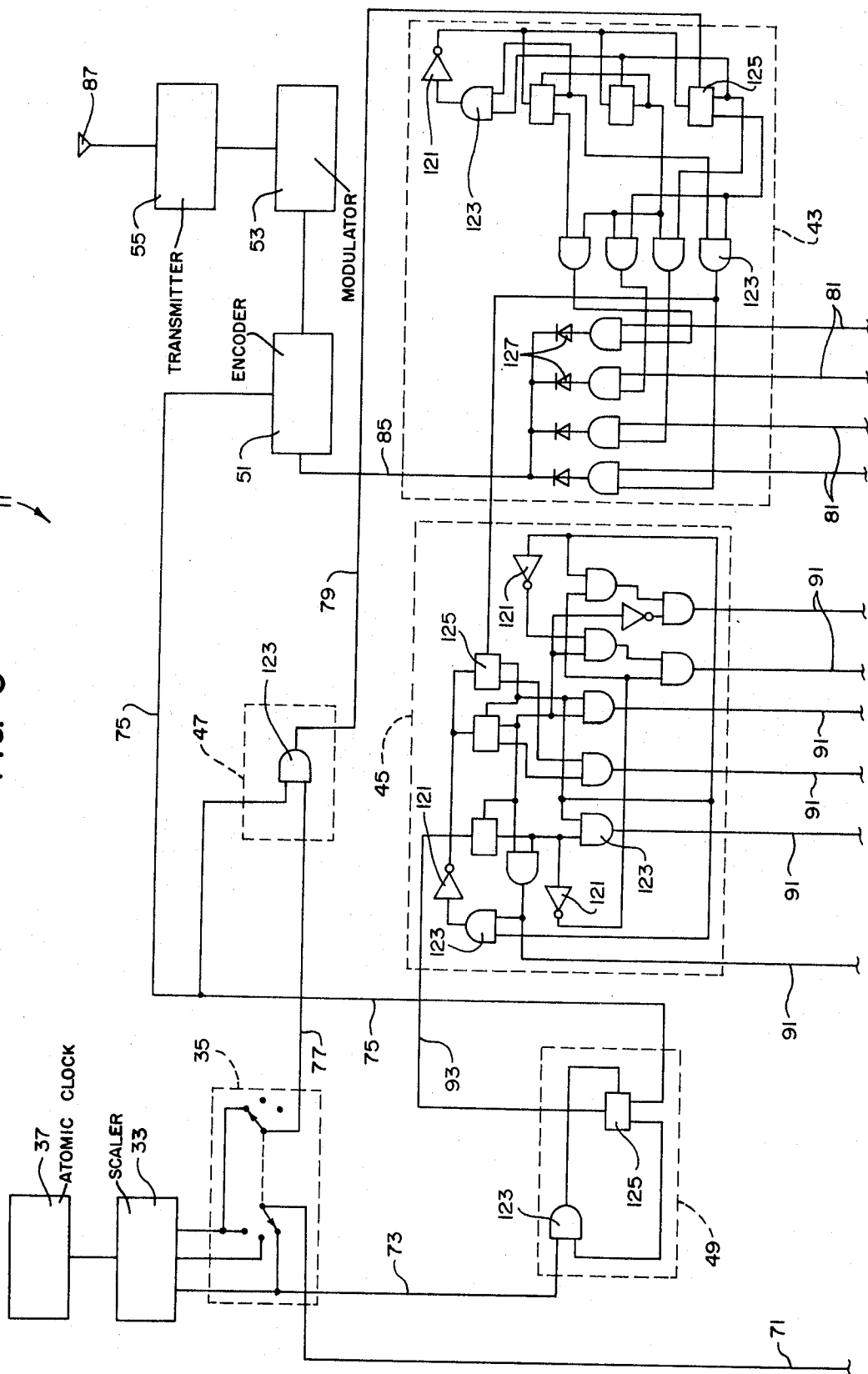


FIG. 4

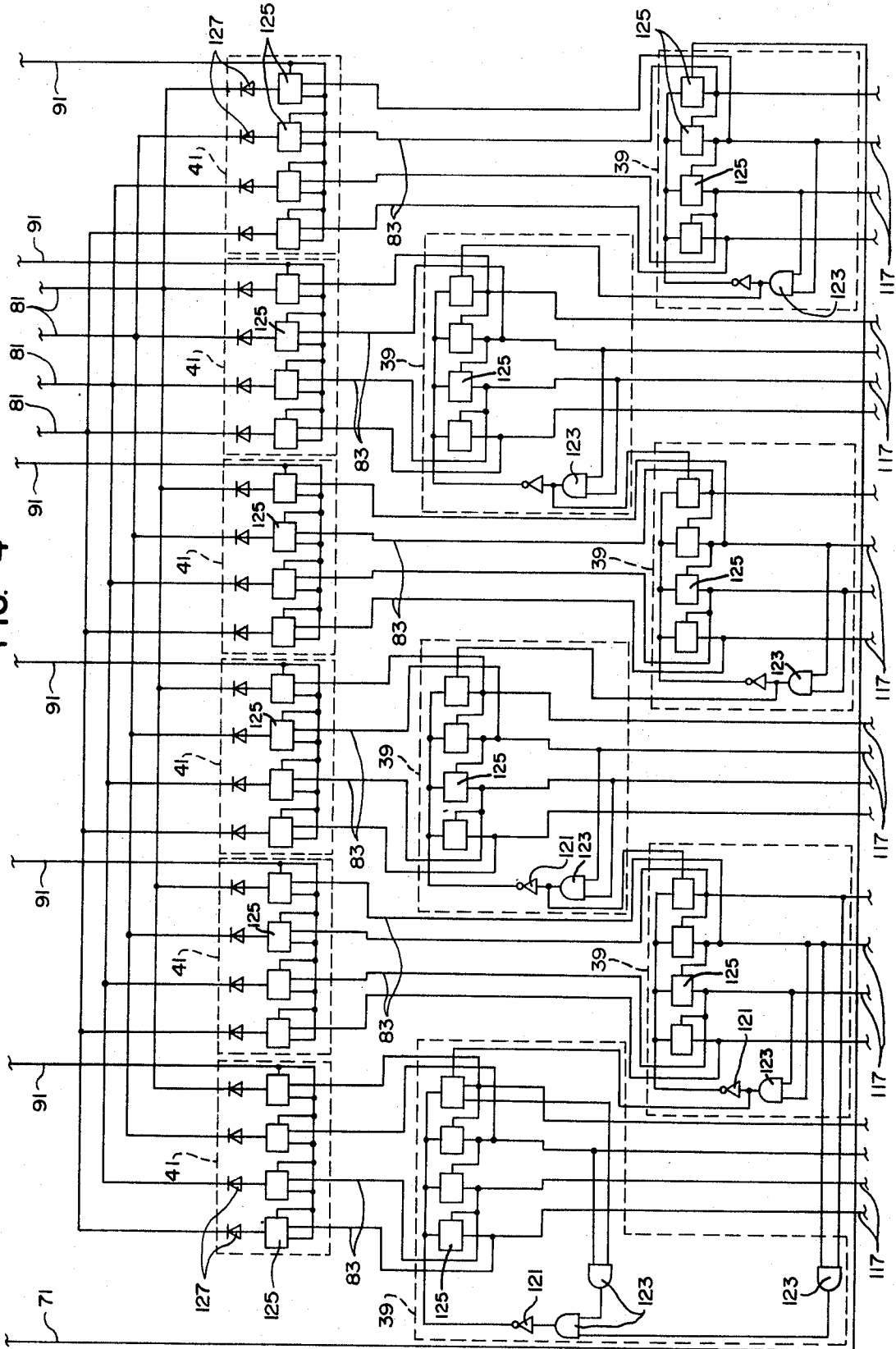
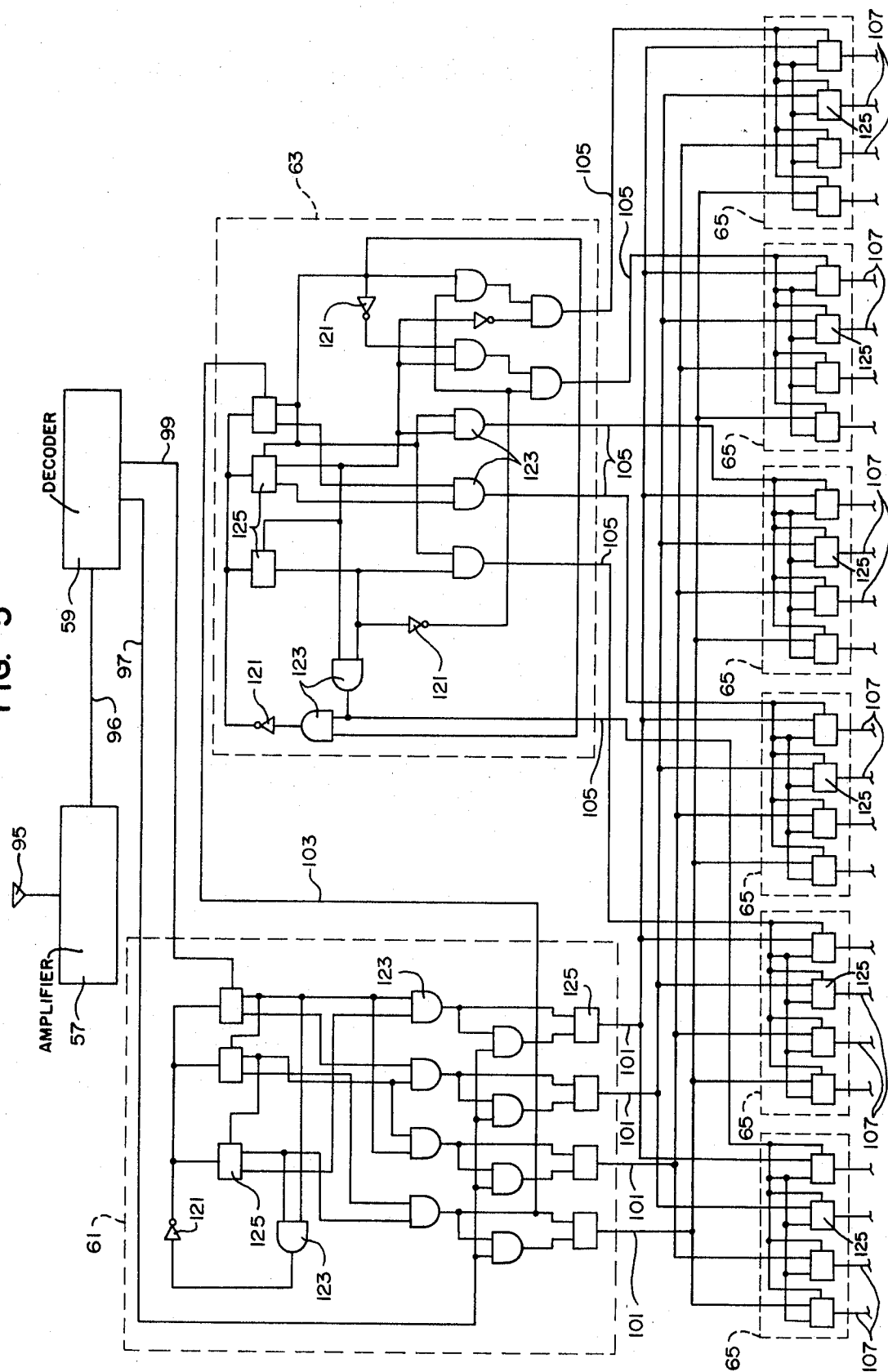


FIG. 5



SHEET 6 OF 6

FIG. 6

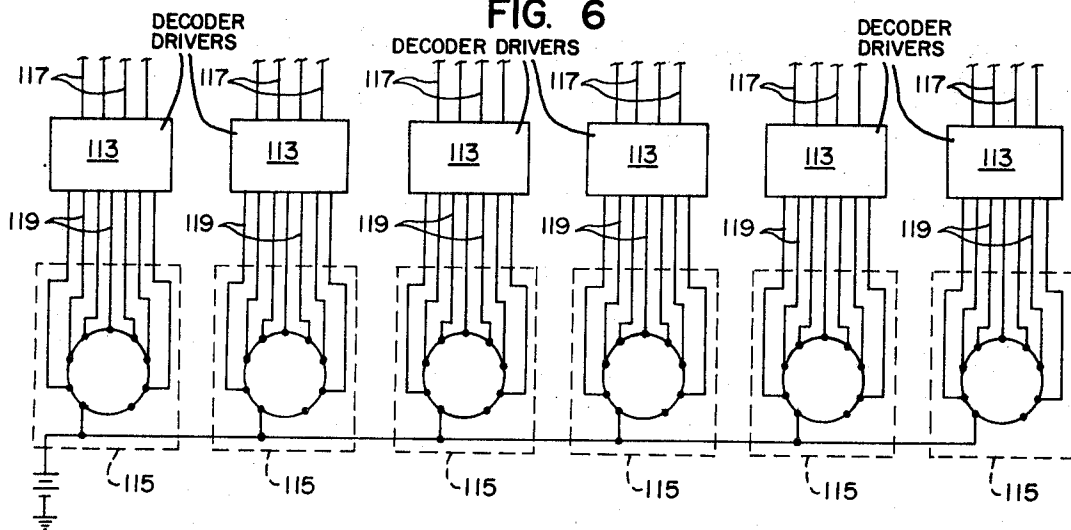


FIG. 7

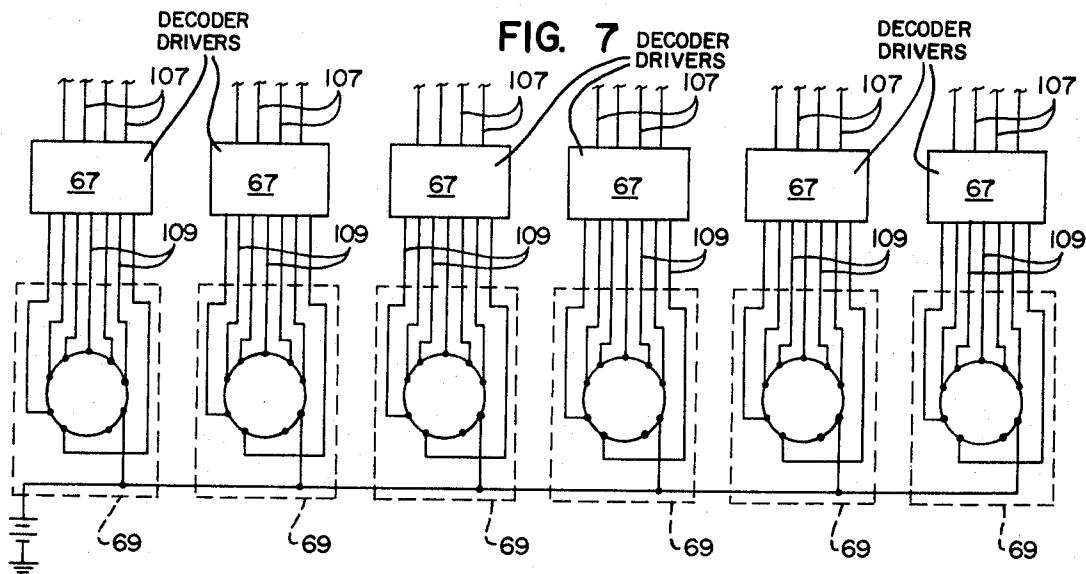
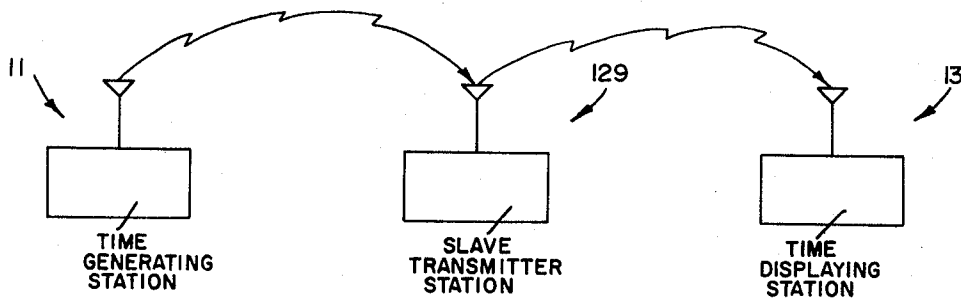


FIG. 8



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TIME SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to time systems and, more specifically, to time systems having a time-generating station and a remote time-displaying station.

2. Description of the Prior Art

A preliminary patentability search revealed the following U. S. Pats.: McCann No. 1,881,818; Nicolson No. 2,005,158; Schweitzer No. 3,004,381; Brilliant No. 3,128,465; Halaby No. 3,506,791; Lee No. 3,508,391; Marti No. 3,530,663; Carlson No. 3,541,552; Walton No. 3,576,099; and Walton No. 3,613,351. None of the above patents disclose or suggest the present invention. More specifically, none show a time system having a time-generating station and a remote time-displaying station.

SUMMARY OF THE INVENTION

The concept of the present invention is to provide a time-generating station for generating coded time signals and transmitting the signals at a specific radio frequency and to provide a time-displaying station for receiving the coded time signals from the time-generating station and for displaying the signals in standard time notation.

The time-generating station includes means for determining the characteristics of the signals, means for accumulating the signals, means for sensing how many signals have been accumulated at any point in time, means for arranging the sensed signals into a functional sequence of digital ones and zeroes, and means for transmitting the functional sequence of digital ones and zeroes at a specific radio frequency. The time-displaying station includes means for receiving the signals from the time-generating station, means for decoding the received signals from the specific radio frequency into a functional sequence of digital ones and zeroes, and readout means for displaying the functional sequence of digital ones and zeroes in standard time notation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic drawing of the time-generating station.

FIG. 2 is a diagrammatic drawing of the time-displaying station.

FIG. 3 is a schematic drawing of a portion of the time-generating station.

FIG. 4 is a schematic drawing of a second portion of the time-generating station.

FIG. 5 is a schematic drawing of a portion of the time-displaying station.

FIG. 6 is a schematic drawing of a third portion of the time-generating station.

FIG. 7 is a schematic drawing of a second portion of the time-displaying station.

FIG. 8 is a diagrammatic drawing of the time-generating station, the time-displaying station, and an intermediate slave transmitter station.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The time system of the present invention includes a time-generating station 11 for generating coded time signals and for transmitting the signal at a specific radio

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frequency, and includes a time-displaying station 13 for receiving the coded time signals from the time-generating station 11 and for displaying the signals in standard time notation.

The time-generating station 11 (see FIG. 1) includes means 15 for determining the characteristics of the coded time signals, means 17 for accumulating the signals, means 19 for sensing how many signals have been accumulated, means 21 for arranging the sensed signals into a functional sequence of digital ones and zeroes, and means 23 for transmitting the arranged signals at a specific radio frequency. The time-displaying station 13 (see FIG. 2) includes means 25 for receiving the signals from the time-generating station 11, means 27 for time-displaying decoding and arranging the received signals into a functional sequence of digital ones and zeroes, and readout means 29 for displaying the arranged signals in standard time notation.

Means 15 for determining the characteristics of the signals includes a high frequency oscillator 31, a scaler 33 for converting the high frequency of the oscillator 17 into a lower frequency, and a set control 35 for adjustably controlling the scaler. To provide the most stable frequency source available, the oscillator 31 is preferably an atomic clock 37. The set control 35 has three positions: a normal position for normal operation, a fast set position for fast sequencing through the hour and minute digits at approximately 1,000 times faster than the normal rate, and a slow set position for slower sequencing through the second digits at approximately three times faster than the normal rate. Means 17 for accumulating the signals comprise digital counters 39. Means 19 for sensing how many signals have been accumulated comprise latches 41. Means 21 for arranging the sensed signals into a functional sequence of digital ones and zeroes comprise a bit sequence control 43 for receiving bit information from the latches 41, a digital sequence control 45 for receiving digit information from the latches 41, a pulse enabler 47 for enabling the bit sequence control 43 to receive bit information from the latches 41 in a functional sequence, and a bit and digit sequence enable 49 for enabling the digit sequence control 45 to receive digit information from the latches 41 in a functional sequence and for enabling the bit sequence control 43 to pass the functional sequence of bit information in a functional sequence of digital ones and zeroes to means 23 for transmitting the arranged signals. Means 23 for transmitting the arranged signals comprise an encoder 51, a modulator 53, and a transmitter 55.

Means 25 for receiving the radio frequency signals from the transmitter 55 comprises a radio frequency receiver and amplifier 57. Means 27 for decoding and arranging the received signals into a functional sequence of digital ones and zeroes comprise a decoder 59 for converting the signals into digital ones and zeroes, a bit sequencer 61 for determining the functional bit sequence, and a digit sequencer 63 for determining the functional digit sequence. Readout means 29 comprises latches 65 for accepting and holding the functional sequence of digital ones and zeroes, binary coded decimal seven segment decoder/drivers 67 for converting the functional sequence of digital ones and zeroes into seven segment decimal display output, and a display device 69 for displaying the decimal display output in standard time notation as shown diagrammatically at 70.

During normal operation of the time generating station 11, set control 35 relays a signal through line 71 to the digital counters 39 at the rate of one every second. The counters 39 add this signal to the already existing count in a method well known to those skilled in the art. The same signal is also relayed through line 73 to the bit and digit sequence enable 49. The bit and digit sequence enable 49 relays an enabling signal through line 75 to both the pulse enable 47 and the encoder 51. Set control 35 relays a second signal through line 77 to the first enable 47 at the rate of one every 1/100,000th of a second. An enabling signal is then relayed from the pulse enabler 47 through line 79 to the bit sequence control 43 for allowing the bit sequence control 43 to accept signals through one of the lines 81 from one of the latches 41. The latch 41 senses the signals that have accumulated in one of the counters 39 through lines 83. Each time the bit sequence control 43 receives a signal from the latches 41, it relays the signal through line 85 to the encoder 51. The encoder 51 encodes the signals and impresses the encoded signals onto the modulator 53 for transmission by the transmitter 55 through an antenna 87. After the bit sequence control 43 has received four signals from a single latch 41, it relays a signal through line 89 to the digit sequence control 45. When the digit sequence control 45 receives the signals from the bit sequence control 43, it sends a disenable signal through one of the lines 91 to the latch 41 that sent the signals to the bit sequence control 43 and sends an enabling signal through one of the lines 91 to a subsequent latch 41. In this manner, all six latches 41 relay signals through the bit sequence control 43 concerning all of the signals accumulated in counters 39. After the bit sequence control 43 has relayed six signals to the digit sequence control 45, the digit sequence control 45 relays a signal through line 93 to the bit and digit sequence enable 49 which clears all received information from the bit and digit sequence enable 49. The next sequence enable 49 at the rate of one every second starts the process over again.

The radio frequency amplifier 57 receives through antenna 95 the signals sent out by the transmitter 55, amplifies the signals, and relays the amplified signals through line 96 to the decoder 59. The signals are decoded into digital ones and zeroes. The decoded signals are relayed through lines 97, 99 to the bit sequencer 61. The bit sequencer 61 relays the signal to one of the latches 65 through line 101. After the bit sequencer 61 has received four signals from the decoder 59, it relays a signal through line 103 to the digit sequencer 63 which disenable through one of the lines 105 the latch 65 that received the signals from the bit sequencer 61 and enables through another line 105 a subsequent latch 65. In this manner, all six latches 65 receive signals from the bit sequencer 61. The latches 65 relay the signals through lines 107 to the decoder/drivers 67. The decoder/drivers 67 convert the digital ones and zeroes into seven segment decimal display signals and relay the signals through lines 109 to the display devices 69.

The time-generating station 11 may include readout means 111 for displaying the digital ones and zeroes and standard time notation. The readout means 111 include binary coded decimal to seven segment decoder/drivers 113 for converting the digital ones and zeroes into seven segment decimal display output signals, and display devices 115 for displaying the decimal display

output signals in standard time notation as shown diagrammatically at 70. The decoder/drivers 113 receive signals through lines 117 from the digital counters 39. The signals are then converted into seven segment decimal display output signals by the decoder/drivers 113 and are relayed through lines 119 to the display devices 115.

FIGS. 3, 4, 5, 6, and 7 show the time-generating station 11 and the time-displaying station 13 schematically and are easily understood by a person skilled in the art. The electrical components used include inverters 121, AND gates 123, flip-flops 125, and diodes 127.

A slave transmitter station 129 may be positioned intermediate the time-generating station 11 and the time-displaying station 13 for extending the range of the time system. The slave transmitter station 129 is of identical function to the time-generating station 11 and is synchronized with the time-generating station 11 by a method well known to those skilled in the art.

The time-displaying station 13 may have the appearance of a standard wrist-watch, table clock, wall clock or the like. It should be clearly understood that the time-displaying station 13 has only the appearance of a wrist-watch or the like since it is not self-contained like a standard wrist-watch or the like but depends on the time-generating station 11 to furnish it with accurate time information. It is this aspect of having a dependent time-displaying station 13 that makes the present time system economically feasible. There is no available self-contained time piece that can economically provide the accuracy of an atomic clock. The time system of the present invention is unique in that everyone having a time-displaying station 13, whether in the form of a wrist-watch, a wall clock, a table clock or the like, can have access to very accurate time information as supplied by an atomic clock 37.

If the time-displaying station 13 is of the wrist-watch type, it is recommended that in order to conserve battery power the station 13 only display time information on demand in a manner well known to those skilled in the art. Table and wall clock models, having access to electrical outlets, can display continuous time information. The display of time information may be of the conventional hours, minutes, and seconds type in 12 or 24 hour periods or may be of the hours and decimal hour type.

Although the invention has been described and illustrated with respect to a preferred embodiment thereof, it is not to be so limited since changes and modifications may be made therein which are within the full intended scope of the invention.

I claim:

1. A time system comprising time-generating means for generating coded time signals and for transmitting the signals at a specific radio frequency, and time-displaying means for receiving the coded time signals from said time-generating means and for displaying the signals in standard time notation; said time-generating means comprising means for determining the characteristics of the signals, means for accumulating the signals, means for sensing the number of signals in said means for accumulating, means for arranging the sensed signals into a functional sequence of digital ones and zeroes, and means for transmitting the signals at the specific radio frequency; said time-displaying means comprising means for receiving the signals from said time-generating means, means for decoding the re-

ceived radio-frequency signals into a functional sequence of digital ones and zeroes, and readout means for displaying the digital ones and zeroes in standard time notation.

2. The time system of claim 1 in which said means for determining the characteristics of the signals comprise high frequency oscillator means and scaler means for converting the high frequency of said oscillator to a lower frequency.

3. The time system of claim 2 in which said oscillator means comprises an atomic clock.

4. The time system of claim 2 in which said means for determining the characteristics of the signals include set control means for adjustably controlling said scaler means; said set control means having three positions: a normal position for normal operation, a fast set position for fast sequencing through the hour and minute digits, and a slow set position for slower sequencing through the second digits.

5. The time system of claim 1 in which said means for accumulating comprise digital counter means.

6. The time system of claim 1 in which said means for sensing comprise latch means.

7. The time system of claim 1 in which said means for arranging the sensed signals into a functional sequence of digital ones and zeroes comprise bit sequence control means for receiving bit information from said sensing means, digit sequence control means for receiving digit information from said sensing means, a pulse enable means for enabling said bit sequence control to receive bit information from said sensing means in a functional sequence, and a bit and digit sequence enable means for enabling said digit sequence control means to receive digit information from said sensing means in a functional sequence and for enabling said bit sequence control means to pass the functional sequence of bit information in a functional sequence of digital ones and zeroes to said means for transmitting.

8. The time system of claim 1 in which said means for transmitting comprise an encoder, a modulator, and a transmitter.

9. The time system of claim 1 in which said means for receiving the signals from said time-generating means comprises a radio frequency amplifier.

10. The time system of claim 1 in which said means for decoding the signals into a functional sequence of digital ones and zeroes comprise a decoder for converting the signals into digital ones and zeroes, digit sequencer means for determining the functional digit sequence, and bit sequencer means for determining the functional bit sequence.

11. The time system of claim 1 in which said readout means comprises latch means for accepting and holding the functional sequence of digital ones and zeroes, a binary coded decimal to seven segment decoder/driver means for converting the functional sequence of digital ones and zeroes into seven segment decimal display output, and display means for displaying the deci-

mal display output in standard time notation.

12. A time system comprising time-generating means for generating coded time signals and for transmitting the signals at a specific radio frequency, and time-displaying means for receiving the coded time signals from said time-generating means and for displaying the signals in standard time notation; said time-generating means comprising means for determining the characteristics of the signals including an atomic clock, scaler means for converting the high frequency of said atomic clock into a lower frequency, and a set control for adjustably controlling said scaler means; digital counter means for accumulating the signals; latch means for sensing the number of signals in said counter means; means for arranging the sensed signals into a functional sequence including bit sequence control means for receiving bit information from said latch means, digit sequence control means for receiving digit information from said latch means, a pulse enable means for enabling said bit sequence control means to receive bit information from said latch means in a functional sequence, and a bit and digit sequence enable means for enabling said digit sequence control means to receive digit information from said latch means in a functional sequence and for enabling said bit sequence control means to release the functional sequence of bit information; and means for transmitting the functional sequence of bit information received from said bit sequence control means at a specific radio frequency, said means for transmitting including an encoder, a modulator, and a transmitter; said time-displaying means comprising a radio frequency amplifier for receiving the signals from said time-generating means; decoding means for converting the received signals into a functional sequence of ones and zeroes, said decoding means including a decoder for converting the signals into digital ones and zeroes, digit sequencer means for determining the functional digit sequence, and bit sequencer means for determining the functional bit sequence; and readout means including latch means for receiving and holding the functional sequence of digital ones and zeroes, a binary coded decimal to seven segment decoder/driver means for converting functional sequence of digital ones and zeroes into seven segment the decimal display output, and display means for displaying the decimal display output in standard time notation.

13. The time system of claim 12 in which said time-generating means includes readout means having decoder/driver means for converting the binary coded input from said counters into seven segment display output, and display means for displaying the decimal display output in standard time notation.

14. The time system of claim 12 in which is included slave transmitter means intermediate said time-generating means and said time-displaying means for extending the range of said time system.

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