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(54) ELECTRONIC CHRONOGRAPH

(71) We, KABUSHIKI KAISHA DAINI SEIKOSHA, a Japanese Company of 31-1 6-chōme Kameido, Koto-ku, Tokyo, Japan do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:

This invention relates to electronic chronographs, for example, electronic stop-watches.

In conventional, mechanical or electronic stop-watches elapsed time is indicated by operation of either hands, and/or an alphanumeric display. However, since elapsed time is indicated only visibly, it is not possible to measure a continuously elapsing time without continuously or intermittently watching the stop-watch during the event being timed. To eliminate this disadvantage measurement of lap time is employed, however, it is still very difficult to check elapsed time together with watching the event being timed.

According to the present invention there is provided an electronic chronograph comprising: a first timekeeping circuit for producing a time of day indication; a second timekeeping circuit for producing an elapsed time indication; visual display means for selectively displaying the time of day indication and the elapsed time indication; audible warning means; and time counter means for causing the audible warning means to be periodically and momentarily energised with passage of the elapsed time indication.

In the preferred embodiment the time counter means comprises a plurality of time counters each arranged to cause the audible warning means to be momentarily energised periodically, the period between audible warnings being different for each time counter.

The electronic chronograph preferably

includes switch means for selectively rendering the time counters operative.

Preferably the electronic chronograph includes means for producing a standard time signal which is fed to both the first and second timekeeping circuits.

The electronic chronograph may include a selecting circuit connected to receive output signals from the first and second timekeeping circuits to cause a display means selectively to display the time of day indication and the elapsed time indication.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:—

Figure 1 is a block diagram of an embodiment of an electronic chronograph according to the present invention;

Figures 2 and 3 are more detailed circuit diagrams of parts of the electronic chronograph of Figure 1; and

Figure 4 is a circuit diagram of three counters forming part of the electronic chronograph of Figure 1.

Referring now to Figure 1, an embodiment of an electronic chronograph, e.g. a stop-watch, according to the present invention is illustrated in block diagram form. An output signal from an oscillator circuit OSC is frequency divided by a frequency dividing circuit 1 whose output is a standard time signal S1 having a frequency of 1Hz. The standard time signal from the dividing circuit 1 is fed both to a normal timing circuit 2 and a stop-watch timing circuit 3. The output signals from the timing circuit 2, 3 are applied to a display device 7 via a selecting circuit 4, a decoder circuit 5 and a driver 6.

The standard time signal S1 from the dividing circuit 1 is selectively supplied to first, second, and third counters 12, 13, 14 via a switch group 11 composed of first, second, and third switches 8, 9, 10. The output signals from the counters 12, 13 and 90

14 are applied to an oscillator circuit 15, the output signal from which is fed to audible alarm device 17 via an amplifying circuit 16.

5 The contents of the timing circuit 2 is displayed by the display device 7 via the selecting circuit 4, the decoder circuit 5 and the driver 6 when the selecting circuit 4 is in a normal time display condition.

10 Further, the content of the timing circuit 3 is displayed by the display device 7 via the selecting circuit 4, the decoder circuit 5 and the driver 6. The counter 12 is a 5-seconds counter and is rendered operative when the switch 8 is ON. The oscillator circuit 15 is operated momentarily by the output signal from the counter 12 when each period of 5 seconds has elapsed and thus the alarm device 17 is energised via the amplifying circuit 16.

20 The counter 13 is a 10-seconds counter and the counter 14 is a 15-seconds counter and energise the alarm device selectively after periods of 10 seconds and 15 seconds connected by an AND gate 56 an output signal S2 from which is fed to the counters 12, 13 and 14.

25 The seconds counter 50 is composed of a 1-seconds counter 78 and a 10-seconds counter 79. The 1-seconds counter 78 is a set-reset flip-flop 74 consisting of T-flip-flop circuits 50a, 50b, 50c, 50d, an inverter 58, an AND gate 59 and NOR gates 60, 61. The 10-seconds counter 79 is a set-reset flip-flop 75 consisting of T-flip-flop circuits 50e, 50f, 50g, an inverter 62, and AND gate 63 and NOR gates 64, 65. The minutes counter 51 is of the same construction as the seconds counter 50 and therefore a detailed description is omitted.

40 The hours counter 52 is composed of a 1-hours counter 80 and a 10-hours counter 81. The 1-hours counter 80 consists of an OR gate 70, and a set-reset flip-flop 76 comprising T-flip-flop circuits 52a, 52b, 52c, an inverter 66, an AND gate 67 and NOR gates, 68, 69. The 10-hours counter 81 is a set-reset flip-flop 77 composed of a T-flip-flop circuit 52e, an AND gate 71 and NOR gates 72, 73.

50 The standard time signal S1 from the dividing circuit 1 is applied to one input of the AND gate 56. The start/stop signal (start=logic 1 and stop=logic 0) is applied to the other input terminal of the AND gate 56. The output of the AND gate 56 is applied to the seconds counter 53 and to the counters 12, 13 and 14. The construction of the seconds counter 53 is the same as the seconds counter 50. Further the respectively. However, the counters 12, 13, and 14 may be 1-second, 2-seconds and 3-seconds counters respectively.

65 With the electronic chronograph described above, it is possible to indicate

elapsed time audibly by energising the alarm device 17 periodically. Thus elapsed time is indicated both visibly and audibly.

Figures 2 and 3 are more detailed circuit diagrams of parts of the electronic chronograph of Figure 1.

The timing circuit 2 is composed of a second counter 50 a minutes counter 51 and an hours counter 52. The timing circuit 3 is composed of a seconds counter 53, a minutes counter 54 and a hours counter 55. The timing counters, 2, 3 are minutes counter 54 and the hours counter 55 are of the same constructed as the minutes counter 51 and the hours counter 52 respectively. The seconds counter 50 counts the standard time signal S1 received from the dividing circuit 1 and produces a 1-minutes signal which is supplied to the minutes counter 51. The 1-minutes signal has a frequency of 1/60Hz. The minutes counter 51 counts the 1-minutes signal and produces a 1-hours signal which is fed to the hours counter 52. The 1-hours signal has a frequency of 1/3600Hz.

When a start signal S3 of logic 1 is applied to the AND gate 56 via an input line 57, the AND gate 56 goes ON to pass the standard time signal S1 from the dividing circuit 1 to the seconds counter 53, the minutes counter 54 and the hours counter 55. When a stop signal S3 of logic 0 is applied to the line 57, the AND gate 56 goes OFF so that the standard time signal S1 from the dividing circuit 1 is not applied to the seconds counter 53.

Figure 4 is a circuit diagram of the counters 12, 13 and 14. When the counter 12 is selected by closing the switch 8 an AND gate 100 goes ON whilst AND gates 105, 110 of the counters 13, 14 respectively remain OFF. The standard time signal S1 from the dividing circuit 1, passed by the AND gate 56 is applied to the counter 12. The counter 12 is a 5-counter whereby a pulse is generated at an output terminal 115 thereof after 5 seconds has elapsed. The terminal 115 is connected to the oscillator circuit 15.

In the same way, when the counter 13 is selected by closing the switch 9, the AND gate 105 goes ON so that the standard time counter whereby a pulse is produced at an output terminal 116, connected to the oscillator circuit 15 after 10 seconds has elapsed.

The counter 15 is operated in a similar manner to the counters 12, 13 and the signal S1 from the dividing circuit 1 passed by the AND gate 56 is applied to the counter 13 only. The counter 13 is a 10-counter whereby a pulse is produced at an output terminal 117 connected to the oscillator circuit 15 after 15 seconds has elapsed.

Attention is directed to our co-pending applications Nos. 46800/76, 46802/76 and 130

(11)

47704/76 which claim related subject matter.

WHAT WE CLAIM IS:—

1. An electronic chronograph comprising: a first timekeeping circuit for producing a time of day indication; a second timekeeping circuit for producing an elapsed time indication; visual display means for selectively displaying the time of day indication and the elapsed time indication; audible warning means; and time counter means for causing the audible warning means to be periodically and momentarily energised with passage of the elapsed time indication.
2. An electronic chronograph as claimed in claim 1 in which the time counter means comprises a plurality of time counters each arranged to cause the audible warning means to be momentarily energised periodically, the period between audible warnings being different for each time counter.
3. An electronic chronograph as claimed in claim 2 including switch means for

selectively rendering the time counters operative.

4. An electronic chronograph including means for producing a standard time signal which is fed to both the first and second timekeeping circuits.

5. An electronic chronograph as claimed in any preceding claim including a selecting circuit connected to receive output signals from the first and second timekeeping circuits to cause a display means selectively to display the time of day indication and the elapsed time indication.

6. An electronic chronograph as claimed in any preceding claim and substantially as herein described with reference to and as shown in the accompanying drawings.

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WHAT WE CLAIM IS:—

- 5 1. An electronic chronograph comprising:
10 ing: a first timekeeping circuit for producing a time of day indication; a second time-
keeping circuit for producing an elapsed
15 time indication; visual display means for selectively displaying the time of day indi-
cation and the elapsed time indication;
audible warning means; and time counter
20 means for causing the audible warning means to be periodically and momentarily energised with passage of the elapsed time
15 indication.
2. An electronic chronograph as claimed
in claim 1 in which the time counter means
comprises a plurality of time counters each
arranged to cause the audible warning
20 means to be momentarily energised periodically, the period between audible warnings
being different for each time counter.
3. An electronic chronograph as claimed
in claim 2 including switch means for

selectively rendering the time counters 25
operative.

4. An electronic chronograph including
means for producing a standard time signal
which is fed to both the first and second
timekeeping circuits.

5. An electronic chronograph as claimed
in any preceding claim including a select-
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nals from the first and second timekeeping
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tively to display the time of day indication
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6. An electronic chronograph as claimed
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