

[54] **CONTROL AND SYNCHRONISATION OF CLOCKS**

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[58] Field of Search **58/4 R, 4 A, 24-26; 343/225**

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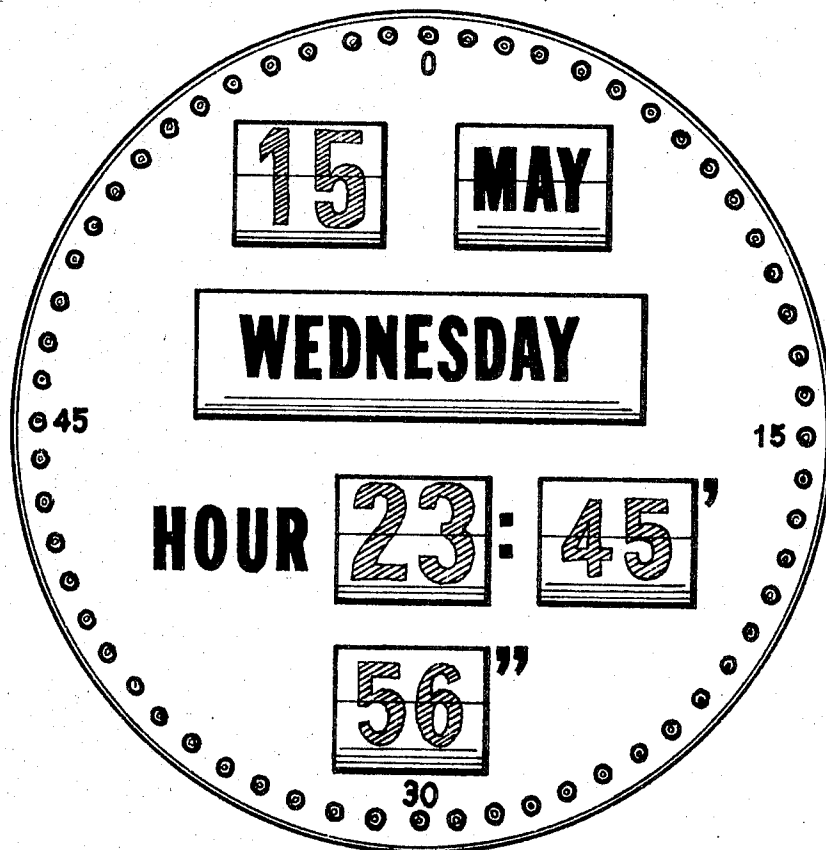
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[57]

ABSTRACT

A plurality of slave clocks are controlled and synchronised from a central station which transmits to each slave clock frequent coded signals each of which conveys in coded form complete information as to the time, and possibly also the date, to be displayed by each slave clock.

11 Claims, 2 Drawing Figures



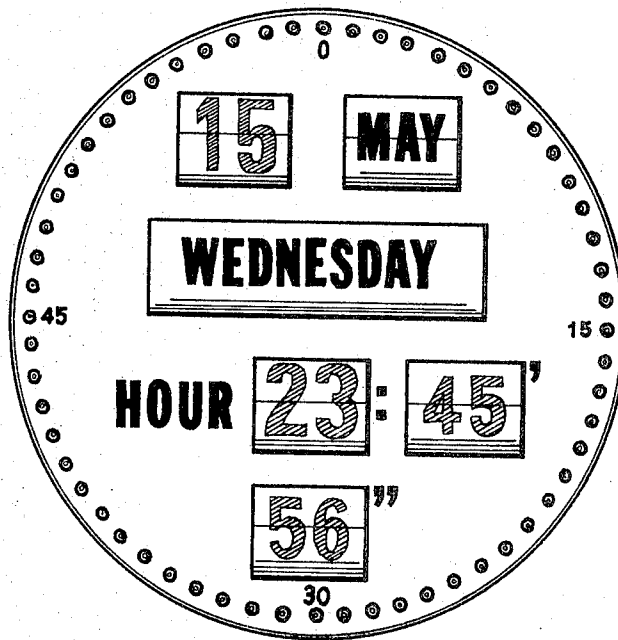


Fig. 1

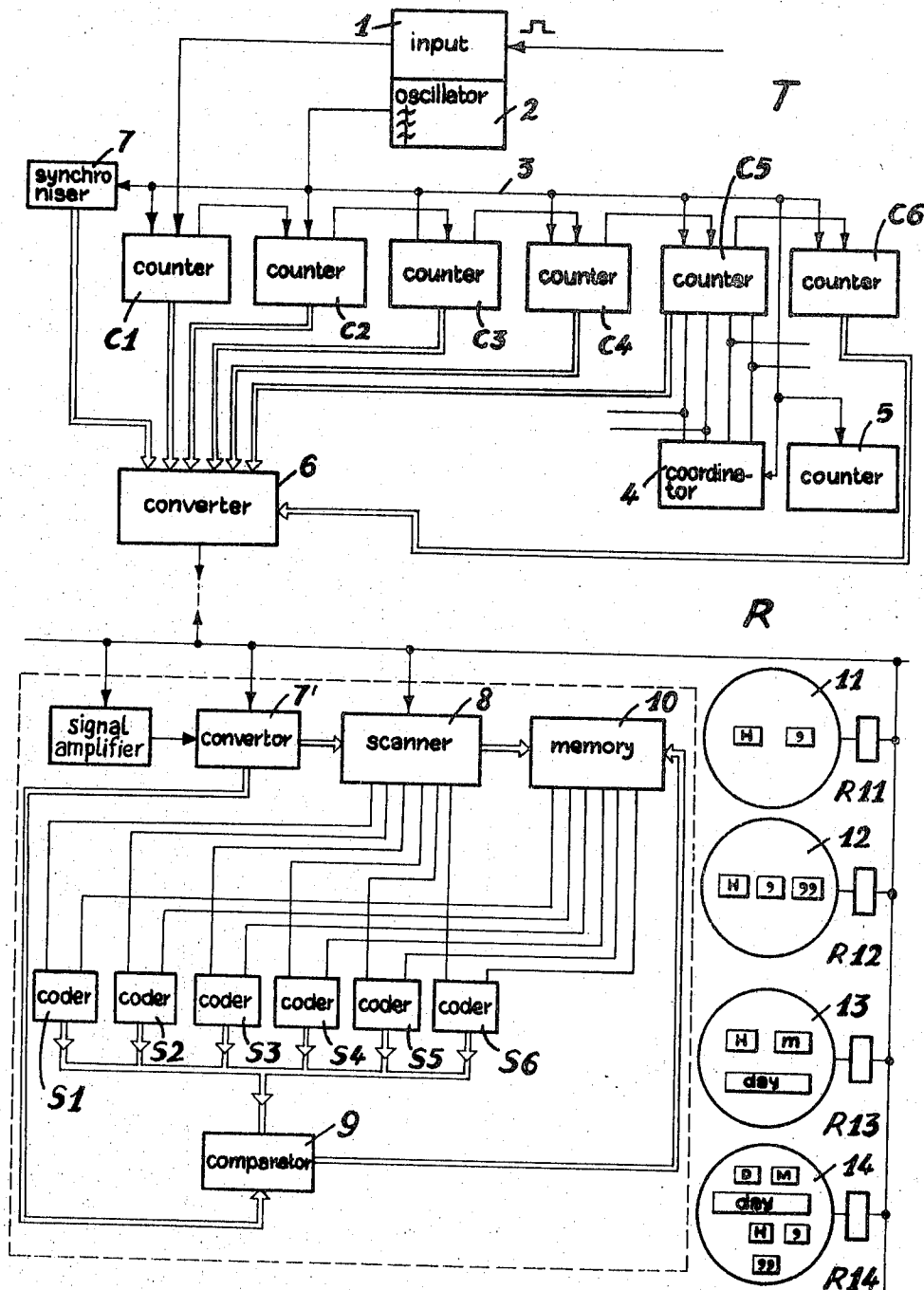


Fig. 2

CONTROL AND SYNCHRONISATION OF CLOCKS

BACKGROUND OF THE INVENTION

Systems for the control and synchronisation of a plurality of slave clocks are well known, and generally operate by the transmission to each slave clock from a central station of pulses at predetermined intervals of say one second. On the reception of each pulse each slave clock is advanced by the predetermined interval.

Such systems have many defects. Thus if a slave clock gets out of synchronism, it is a matter of some difficulty to correct it. Moreover the spatial distribution of the slave clocks is limited by the need to connect each one to the central station by a cable. Also a power failure not only disrupts the system, but results in a difficult problem of restoring correct time displays when power is restored.

SUMMARY OF THE INVENTION

One object of the present invention is to provide a method of controlling and synchronising a plurality of slave clocks which method overcomes the above-mentioned defects.

Another object of the present invention is to provide an improved system for controlling a plurality of slave clocks.

Another object of the present invention is to provide a system for controlling a plurality of slave clocks wherein synchronism is automatically maintained.

Another object of the present invention is to provide a system for controlling a plurality of slave clocks wherein all the slave clocks will display the correct time on restoration of power after a failure.

According to the present invention there is provided a method of controlling and synchronising a plurality of slave clocks wherein a central station transmits to each slave clock coded signals, each said signal conveying in coded form complete information as to the time to be displayed by the slave clocks, the display of each slave clock being up-dated on reception of each said signal.

According to the present invention there is also provided a system for controlling and synchronising slave clocks; the system comprising a plurality of slave clocks; and a central station for transmitting to each slave clock coded signals, each said signal conveying in coded form complete information as to the time to be displayed by the slave clocks; each slave clock comprising means to display time, a receiver for receiving said signals, means to derive information as to the time displayed by said slave clock, means to compare said derived information with said information conveyed by each said signal, and means to up-date the time displayed by said slave clock when said compared information does not correspond.

Thus any loss of synchronism is automatically corrected on reception of the next said coded signal, because the display resulting from reception of that signal is not in any way dependent on the display prior to reception of that signal. The signals may be transmitted by cable or by radio, so that in the later case the system can extend to a very substantial geographical area.

The control station may derive said coded signals in dependence on a central clock using a stable frequency generator or from timing information derived from an astronomical observatory or a radio station. Said sig-

nals are preferably transmitted at a frequency of one per second.

Each slave clock may display the time in seconds, minutes and hours, and the date in days of the week, days of the month and months. In this case the code used for said coded signals must be such as to provide individual coded signals for each second of a four year time cycle; that is to say including a leap year day. The code may be the so-called ASCII code or a form of binary-coded decimal.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 shows the dial of a slave wall clock, displaying the time and the date; and

FIG. 2 shows in schematic form part of a system according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, the dial of a slave wall clock is shown, the dial displaying hours, minutes and seconds, and furthermore days of the week, days of the month and the month. The time and the day of month is displayed digitally using the well known flap type digital indicators, each of which is driven for example by an electric motor. As such indicators are known they will not be described further herein. Alternatively the time can if desired be displayed by hands. Moreover the date can of course be omitted if a time display only is required.

Referring to FIG. 2, the complete system includes a central station transmitter T and for each slave clock a receiver R. The transmitter T is located such that it can be used for an unlimited number of receivers R located remote from the transmitter T.

The transmitter T includes an input at which timing signals arrive by radio or cable, with a frequency of one signal each second. The timing signal can arrive from any suitable source. The source can be an astronomical observatory or a radio transmitter which transmits signals at one second intervals, or the source can be local and derive the required time information from a stable frequency generator.

An oscillator 2 generates a carrier frequency which is supplied to a line 3 and thence to a set of six binary counters C1, C2, C3, C4, C5 and C6. In each signal transmitted by the transmitter T this carrier frequency is modulated by seven words each of eight bits.

The counter C1 relates to seconds and steps once each second; a complete cycle is 60 steps. For each step it supplies a binary output in ASCII code or in some other binary code, such as binary-coded decimal.

The counter C2 relates to minutes and it is activated each sixtieth step of the counter C1. For each minute it supplies a binary output.

The counter C3 relates to hours and it is activated each sixtieth step of the counter C2. The counter C4 relates to the days of the week and it is activated each twenty-fourth step of the counter C3.

The counter C5 relates to days of the month and it also is activated each twenty-fourth step of the counter C3. The counter C5 is controlled by a co-ordinator which takes into account the variable number of days

in each month, and by a counter 5 which takes into account the leap year day.

The counter C6 relates to months and is activated at the end of each variable cycle of the counter C5.

The counters C1 to C6 therefore provide a four year time cycle, updated each second.

The data from the counters C1 to C6 is prepared for transmission by a parallel-to-serial converter 6 or a scanner which derives for transmission six eight bit words in series each second. Before each train of six words is placed a seventh word for synchronisation purposes, this being derived from a synchroniser 7. This word indicates the beginning of each train.

The complete train of words is then transmitted by the transmitter T to each receiver R by a cable, such as a two-wire cable or, preferably, by radio.

The receiver R includes a serial-to-parallel convertor 7' to convert the data to parallel form, and an electronic sweeping scanner 8 which directs each eight bit word to a respective coder associated with a component display unit of the complete display. There are six coders S1, S2, S3, S4, S5 and S6 relating respectively to seconds, minutes, hours, days of the week, days of the month and months. The serial-to-parallel convertor 7' supplies the data to a comparator 9 whereby the incoming data is compared with data representing the current display of the various display units. When the incoming data corresponds to the data representing the current display, the display is left undisturbed. However, if there is not correspondance, a memory 10 is activated and operates a motor of the relevant display unit until correspondance is again detected. There is thus updating of the display each second, and if lack of correspondance in any component part of the display is detected the relevant motor is operated until there is correspondance.

This manner of operation has the effect that if for any reason a slave clock loses synchronism, for example, due to a temporary power failure, then the return to synchronism is automatic, because each transmitted signal conveys in coded form complete information as to the time and date to be displayed.

It is not of course necessary for all the slave clocks in a system to be identical. Thus one slave clock 11 might display only hours and minutes, the relevant data being selected and processed by its own receiver R11 comprising the hour and minute coders. Another slave clock 12 might additionally display seconds, the data being derived by a receiver R12. Another slave clock 13 might additionally display the day of the month, the data being derived by a receiver R13; whilst a slave clock 14 with a receiver R14 might display all the data.

Systems in accordance with the invention can be modified or extended to take in other time-dependent functions such as controlling working times of staff. If associated with an attendance card system and a calcu-

lator then payments due to staff can be calculated. Reminder dates can be pre-set up to four years ahead, working cycles can be registered and the meeting of delivery dates can be checked.

What I claim is:

1. A system for controlling and synchronising slave clocks, the system comprising a plurality of slave clocks; and a central station for transmitting to each slave clock coded signals, each said signal conveying in coded form complete information as to the time to be displayed by the slave clocks; each slave clock comprising means to display time, a receiver for receiving said signals, means to derive information as to the time displayed by said slave clock, means to compare said derived information with said information conveyed by each said signal, and means to up-date the time displayed by said slave clock when said compared information does not correspond.

2. A system according to claim 1 wherein each said signal additionally conveys in coded form complete information as to the date to be displayed by the slave clocks; and wherein at least one of said plurality of slave clocks further comprises means to display the date, means to derive information as to the date displayed by said slave clock, means to compare said derived date information with said date information conveyed by each said signal, and means to up-date the date displayed by said slave clock when said compared date information does not correspond.

3. A system according to claim 2 wherein each said signal comprises a train of words in ASCII code.

4. A system according to claim 2 wherein each said signal comprises a train of words in binary-coded decimal.

5. A system according to claim 2 wherein said signals are transmitted at a frequency of one per second.

6. A system according to claim 2 wherein said central station derives timing information from an astronomical observatory.

7. A system according to claim 2 wherein said central station derives timing information from a radio station.

8. A system according to claim 2 wherein said central station derives timing information from a local, stable frequency generator.

9. A system according to claim 2 wherein said central station comprises a counter for each component part of the time.

10. A system according to claim 2 wherein said central station comprises a counter for each component part of the date.

11. A system according to claim 10 wherein said central station comprises means to control the counter corresponding to days of the month to include leap year days.

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