(54) Title: A PROGRAMMABLE TIMER

In a programmable electric timer with a display (18) for digital displaying (28) of the actual time the display has been extended by a symbol field (24) including a plurality of symbols and a movable symbol field cursor (26). This cursor can be moved by means of a manually operated function shift means (40, 50). The display comprises furthermore a time scale (20) covering a number of the 24 hours of the day, optionally all of them, and associated with a movable cursor (22). This cursor (22) can be moved quickly or slowly by means of a manually operated advancing means (44, 46, 50, 54). Finally a manually operated advancing means (42, 44, 46, 52, 54) is provided for the storing of encoded switching times and switching intervals and for a simultaneous graphic indication by way of the time scale (20) on the display (18) of said times and intervals. In this manner the timer is easy to use and the user achieves a graphic view of actual switching times and intervals.
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Title: A programmable timer.

Technical Field

The invention relates to an electric timer for an automatic time-control of the switching on and off of one or more electrically powered apparatuses and comprising an electronic clock having a time scale with a graphic indication and a digital display and connected to a control circuit capable of actuating switching means so as to open and close an electric circuit and with memory means connected to the control circuit and a keyboard for setting the electronic clock and for setting the on and off times.

Background Art

Several different embodiments of timers automatically switching on and off electric apparatuses at specific predetermined times are known. Historically the progress of technology started with mechanical clocks comprising riders circumferentially arranged on a movable dial closing and opening a circuit, and developed into purely electronic, microprocessor controlled clocks whereby the open/close-programme is encoded in a memory and run while controlled by a digital clock (clock-unit). Timers are manufactured in very great numbers and used in many ways for automatically controlling light, heat, and ventilation systems, in plug-connected apparatuses as well as in machinery controls of various kinds. The various control programmes may furthermore be based on a day and night, a week or an annual cycle as well as comprise one or more channels.

The development within the electronic field has, of course, also been utilized in the above field for achieving more precise opening and closing times, a greater programme capacity, and more channels in the same unit. The latter
development has, however, taken place on the terms of the electronics, which has implied that the control programme encoded was not directly available to the user. As examples thereof reference can be made to the international patent applications Nos. PCT/US79/0980 (WO 80/01120) and PCT/US81/00346 (WO 81/02808) as well as to the German Offenlegungsschrift No. 28 04 079. Unlike the latter the control programme for mechanical timers was directly readable through the positioning of the various riders, which also applies today. Most known electronic timers merely show the actual time by way of digits. In case the user wants to know the encoded programme in details it is necessary to "leaf through" the programme by manipulating a keyboard as well as to make a note of the hours revealed thereby of the various switching on and off procedures. The latter "leafing through" must be carried out day by day in a week programme, and in case of several channels channel by channel.

The above procedure facilitates in no way the work of the user.

In addition the programming of known electronic timers can often be complicated and involve frequent consultations of the associated directions for use.

It is known to provide a time scale with a graphic indication of the switching times, cf. for instance the British Patent Application No. 55-63788 and the European Patent Application No. 119 312. None of these publications include, however, directions of how a timer must be built up in order to allow a user to use the timer immediately without particular instructions and without the use of the directions for use.

Disclosure of Invention
A timer of the type stated in the introduction to the specification is according to the invention characterised in that the keyboard comprises a combination of a) a function shift key allowing the user to choose between a number of various mode functions of the control circuit, b) a switching on and off key allowing a switching on and off of the electric apparatus, and c) an advancing key for the time-setting, said keys being adapted to actuate the control circuit, and that the control circuit is adapted in such a manner that the user can transfer the control circuit into a so-called programming mode by pressing the function shift key one or more times whereby the control circuit is adapted simultaneously to provide a graphic indication of said mode, that the control circuit is adapted so as to provide a graphic indication on the time scale of a time and simultaneously display said time on the digital display, that the control circuit is adapted in such a manner that the user can advance the time shown on the time scale to a desired switching on time, said time being displayed during the entire setting procedure both "analogously" on the time scale and digitally on the digital display, that the control circuit is adapted in such a manner that the user can transfer data for the set switching on time to the memory means of the control circuit by pressing the switching on and off key, the switching on time still being displayed on the time scale, that the control circuit is adapted in such a manner that the user can advance the time appearing on the time scale further to a desired switching off time by pressing the advancing key until the desired switching off time has been reached, and that the control circuit is adapted in such a manner that by activating the switching on and off key the user can imply that the switching off time set is transferred to the memory, both the previously set switching on time and the just set switching off time being displayed on the time scale, that the control circuit is adapted in such a manner that the time interval between
the set switching on time and the set switching off time is graphically shown on the associated time scale, and that the control circuit is adapted in such a manner that correspondingly the user can insert more switching on and off times which are also stored in a memory and displayed on the time scale, and that the control circuit is adapted in such a manner that after having encoded the desired number of switching on and off times in the memory of the control circuit the user can transfer the control circuit to a mode of automatic operation by pressing one or more times on the function shift key, the control circuit automatically switching on and off the electrically activated apparatuses at the set times in said automatic mode.

As a result, the handling of the timer is so simple that without the assistance of directions for use the user can use the timer correctly and set a desired programme subsequently appearing on the time scale provided. In this manner the user can always check the programme and for instance see whether a specific apparatus is to be switched on or off. In other words the timer is so to speak "self-explanatory" as the user can determine the function and operation of the timer by the method of trial and error by pressing experimentally the three keys based on the reactions directly appearing on the time scale of the timer.

In a preferred embodiment according to claim 2 the user keeps the switching on and off key pressed down while he lets the graphic time indication pass through the desired switching on interval by means of the advancing key. As he observes the time scale with the graphic indication of the times simultaneously, the user has the feeling of "drawing" the desired programme because on the display he draws so to speak a line corresponding to the desired switching on intervals.

The remaining sub-claims deal with advantageous embodiments
the advantages of which appear immediately from the subject matter of the claims.

**Brief Description of Drawings**

The invention will be described more detailed below with reference to the accompanying drawing, in which

Fig. 1 illustrates substantially by way of a flow chart the main components of a timer according to the invention,

Fig. 2 illustrates an advantageous outline of the display and function keys of the timer,

Fig. 3 illustrates an example of the display at an initial stage of the programming of the timer,

Fig. 4 illustrates an example of the display at a terminating stage of the programming of the timer,

Fig. 5 illustrates an example of the display when the programme has been encoded and the timer set for automatic operation, and

Fig. 6 illustrates an example of the display when the timer is to be manually set.

**Best Mode for Carrying Out the Invention**

The flow chart of Fig. 1 illustrates an advantageous embodiment of the timer according to the invention. It comprises a single-chip microprocessor generally designated 10 and provided with the necessary number of inputs with a set of key means 14 actuating the functions implemented in the timer as well as a necessary number of outputs 16 controlling a display 18.
Before the explanation of the flow chart of Fig. 1 is proceeded reference is made to Fig. 2 for a more detailed explanation of the geometric elaboration of the timer and especially of the display. The major portion of the front of the apparatus constitutes the display 18 which is a "liquid crystal" display or in short an LCD-unit. The display shows a time scale 20 with time indications for all 24 hours of the day and a dot or line indication for every 15 min. The scale 20 is associated with a movable scale cursor 22. Incidentally the time scale need not cover all 24 hours of the day in all cases. Often it is only necessary to cover the usual working hour for instance from 7 a.m. to 5 p.m., and in the latter case it is possible to achieve a greater resolution of the indications of the scale and consequently a greater accuracy for the graphic indication than in the 24 hours case.

Above the time scale 20, a symbol field 24 associated with a movable symbol field cursor 26 as well as a digital clock display 28 is present, said display showing the hours and minutes.

The symbol field includes four symbols, viz. a time symbol 32, a programming symbol 34, a symbol of the automatics 36, and a manual-symbol 38.

Below the display 18, three function keys appear, viz. a function shift or MODE key 40, an IN/OUT or ON/OFF key 42, and an advancing key 44/46.

The above function keys appear again in Fig. 1 on the inputs 14 of the microprocessor 10. It appears from this Figure that the microprocessor or rather the chip comprises a ROM-unit 50 and a RAM-unit 52. The permanent programme for carrying out the various functions of the timer is encoded in the ROM-unit 50, and the functions applying here appear from the explanation stated below of the handl-
ing and operation of the timer. The microprocessor comprises furthermore an LCD-driver 54 and a timer 56 with an interrupt-function. The four latter units can be established by mask programming the chip whereby it is possible to minimize the costs of the apparatus because unnecessary facilities usually present in a microprocessor can be omitted. Nothing, however, prevents the ROM, RAM, and said remaining units from being present as discrete outer units.

The microprocessor is supplied with current from a battery 58 or a grid connected power supply 60 connected through a relay unit 62 to a driver 64 for the microprocessor 10.

The presence of the timer/interrupt unit 56 ensures the least possible consumption of current, and the unit is controlled by a timer/clock unit 66, the basic frequency of which for instance is about 1 MHz. The above interrupt unit 56 counts pulses and releases an interrupt signal to the microprocessor at suitable intervals, for instance every second and half-second. In this manner the microprocessor performs part of a function in response to the performing programme encoded in the ROM unit 50 and the programme encoded in the RAM unit 52 inter alia including information on the switching on/off times defined by the user in question of the apparatus. On a plurality of outputs the timer unit 56 releases signals controlling the switching on and off of the electrically activated apparatuses.

The microprocessor is controlled by a CPU-clock unit 68, the basic frequency of which in this connection can be as low as 75-100 kHz. The lower the frequency is the lower the current consumption is.

When the apparatus is connected to a current source, the symbol field cursor 26 automatically positions below the
time symbol 32, while the scale cursor 22 positions below the clock zero on the time scale 20. Simultaneously with the latter, the clock display 28 shows the time 00. By pressing down the advancing key 44/46, the clock can be set on the actual time. The advancing key 44/46 is adapted to advance the time shown slowly or quickly, which appears clearly from the symbols used.

A pressure on the function shift key or MODE key 40 implies that the microprocessor 10 is shifted into a programming mode which allows an encoding of the desired switching times or switching intervals in the RAM unit 52. Simultaneously the symbol field cursor 26 moves and positions below the programming symbol 34. In this mode the user can advance the time scale cursor 22 by a pressure on the advancing key 44/46 until the first switching time has been reached. It should be noted here that the time scale cursor moves stepwise - with the indicated resolution covering 15 minutes each time - whereas the exact time is shown with a minute's accuracy on the clock display 28. When the first switching time has been reached, the IN/OUT key 42 is activated at the same time as the advancing key 44/46 is pressed down. At the simultaneous pressing down of the two keys, the drawing of a black line on the display is initiated, cf. thus Fig. 3. It appears from the indication of Fig. 3 that the first switching time has been set to 6.30 a.m. and that the scale cursor 22 has advanced to the time 6.45 a.m., cf. the clock display 28. The latter procedure continues until the switching off time has been reached, whereafter the pressing down of the keys is stopped. As an alternative it is possible to design the IN/OUT key as a push-push key in such a manner that a continued pressing down of this key is not necessary during this procedure.

Subsequently, the situation of Fig. 4 appears, where the switching off time has been set to 8.00 a.m. It appears
clearly from the indication of the display that the switching interval marked by a black line lasts from 6.30 a.m. to 8.00 a.m. The above procedure can be repeated for arbitrary time intervals during the 24 hours in question, and when said programming phase has been completed, the MODE key 40 is again activated so as to transfer the microprocessor to the automatic mode. The latter is indicated on the display by the symbol field cursor 26 now being located below the symbol of automatics 36.

Now the timer operates automatically and reacts on the encoded switching intervals in accordance with their encoding during the programming phase. At 1.30 p.m. the display appears for instance as shown in Fig. 5 wherein the symbol field indicates that the timer operates in the automatic mode, and where it is readable on the time scale that the time is now about 1.30 p.m. - the exact time is readable on the clock display 28 - and further that the switching interval lasts from about 6.30 a.m. to about 8.00 a.m. The indications on the time scale can only be given with an accuracy of about 15 minutes depending on the extent of the control period on the display.

If it is desired that the switching times are informed with a greater accuracy a pressing on the advancing key causes the scale cursor 22 to jump forwards to the first switching time, which appears on the clock display with an accuracy of 1 minute. Another pressing on the advancing key 44/46 causes the scale cursor 22 to move to the next switching time, which also appears on the clock display 28 with an accuracy of 1 minute. In this manner the exact switching times can be quickly provided. This procedure can also be performed in the manual-position.

In the manual-"mode" the contact function can be handled like a trigger-action relay by pressing the IN/OUT key 42, said situation appearing in Fig. 6.
A timer of the above type provides a novel general view of the approximate switching times and switching intervals and simultaneously it is easy to use because the programming of the timer is self-evident and does not imply a thorough study of accompanying directions for use.

Though the invention above has been explained exclusively by way of a description of a timer based on a 24 hours cycle, modifications, alterations or supplements obvious to a person skilled in the art can be carried out within the scope of the present invention as it is defined and disclosed by the following patent claims.

Variations can be performed which are based on a weekly programme allowing a leafing through thereof from one day of the week to the following, or an annual programme allowing a leafing through from one week to the next, and further from one day of said week to the following day. It is also possible to connect the display with more channels allowing a leafing through the various channels, as well as all possible combinations of the above possibilities. These possibilities have been indicated by a dotted line in Fig. 1 by additional key means for "week", "day", and "channel".

Under all circumstances the graphic indication of the programme encoded of switching intervals is maintained.
Claims:

1. An electric timer for an automatic time-control of the switching on and off of one or more electrically powered apparatuses and comprising an electronic clock having a time scale (20) with a graphic indication and a digital display (28) and connected to a control circuit (10) capable of actuating switching means so as to open and close an electric circuit and with memory means (50, 52) connected to the control circuit (10) and a keyboard (14) for setting the electronic clock and for setting the on and off times, characterized in that the keyboard (14) comprises a combination of

   a) a function shift key (40) allowing the user to choose between a number of various mode functions of the control circuit (10),

   b) a switching on and off key (42) allowing a switching on and off of the electric apparatus, and

   c) an advancing key (44, 46) for the time-setting,

said keys being adapted to actuate the control circuit,

and that the control circuit (10) is adapted in such a manner that the user can transfer the control circuit into a so-called programming mode by pressing the function shift key one or more times, whereby the control circuit is adapted simultaneously to provide a graphic indication of said mode,

that the control circuit is adapted to provide a graphic indication of a time on the time scale and simultaneously display said time on the digital display (28),

that the control circuit is adapted in such a manner that
the user can advance the time shown on the time scale to a desired switching on time by means of the advancing key (44, 46), said time being displayed during the entire setting procedure both "analogously" on the time scale (20) and digitally on the digital display (28),

that the control circuit is adapted in such a manner that the user can transfer data for the set switching on time to the memory means (52) of the control circuit by pressing the switching on and off key (42), the switching on time still being displayed on the time scale (20),

that the control circuit is adapted in such a manner that the user can advance the time shown on the time scale (20) further to a desired switching off time by pressing the advancing key (44, 46) until the desired switching off time has been reached,

and that the control circuit is adapted in such a manner that by activating the switching on and off key (42) the user can imply that the switching off time set is transferred to the memory (52), both the previously set switching on time and the just set switching off time being displayed on the time scale (20),

that the control circuit is adapted in such a manner that the time interval between the set switching in time and the set switching off time is graphically shown on the associated time scale (Fig. 4), and

that the control circuit is adapted in such a manner that correspondingly the user can insert more switching on and off times which are also stored in a memory and shown on the time scale (20), and that the control circuit is adapted in such a manner that after having encoded the desired number of switching on and off times in the memory of the control circuit the user can transfer the control
circuit (10) to an automatic mode by pressing the function shift key (40) one or more times, the control circuit automatically switching on and off the electrically activated apparatuses at the set times in said automatic mode.

2. An electric timer as claimed in claim 1, characterized in that the control circuit is adapted in such a manner that the user can keep the switching on key pressed down while he lets the graphic time indication pass through the desired switching on interval by pressing down the advancing key too.

3. An electric timer as claimed in claim 1 or 2, characterized in that beyond the already mentioned programming mode (P) for encoding times for switching on and off and the automatic mode (AUT) for automatically controlling the switching on and off of the electrically activated apparatuses the function shift key (40) further includes a manual mode (MAN) for manually controlling the switching on and off as well as a time-setting mode in which the electronic clock can be set on the correct instantaneous time.

4. An electric timer as claimed in claim 3, characterized in that the control circuit is adapted so as to cyclicly displace its mode functions between the number of various mode functions, said displacement being provided by the user activating the function shift key (40).

5. An electric timer as claimed in claim 1, characterized in that the graphic indication comprises a symbol field (24) including a set of function symbols in the form of a symbol for each mode function, and that the control circuit is adapted so as to indicate its mode function graphically by activating a cursor opposite the symbol corresponding to the mode function in
question.

6. An electric timer as claimed in one or more of the preceding claims, and whereby the control circuit in the mode function "automatics" is adapted to compare the passing time with the time-settings stored in the memory for the switching on and off, respectively, characterized in that in the automatic mode the control circuit is adapted continuously to show the instantaneous time on the digital display whereas the set switching on intervals appear from the time scale with the graphic indication.

7. An electric timer as claimed in claim 6, characterized in that the instantaneous time is shown graphically too by means of a cursor.

8. An electric timer as claimed in claim 6, characterized in that the switching on intervals are graphically shown as a line or as a row of points at the portion of the time scale where the apparatus/es is/are connected thereto.

9. An electric timer as claimed in claim 3, characterized in that when a current supply is connected to the timer the control circuit is adapted to zero or reset the clock to a specific time such as for instance 00.00 appearing on the digital display, and that the control circuit is thereby positioned in the time-setting mode in which the user can correct the time shown to a correct instantaneous value by pressing the advancing key (44, 46).

10. An electric timer as claimed in claim 9, characterized in that the graphic symbol of the time-setting mode is a dial.
**INTERNATIONAL SEARCH REPORT**

**I. CLASSIFICATION OF SUBJECT MATTER**

According to International Patent Classification (IPC) or to both National Classification and IPC:
- G 04 G 15/00; H 01 H 43/00

**II. FIELDS SEARCHED**

Minimum Documentation Searched:

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Documented Search other than Minimum Documentation to the extent that such documents are included in the fields searched:

- SE, NO, DK, FI classes as above

**III. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>FR, A, 2 461 972 (FABRIQUE D’HORLOGERIE LAVEDETTE) 6 February 1981 &amp; GB, 2054908 NL, 8004133 DE, 3026128 SE, 8005188</td>
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<td>X</td>
<td>GB, A, 2 019 041 (HORTSMANN GEAR GROUP LIMITED) 24 October 1979</td>
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<td>X</td>
<td>EP, A, 0 092 211 (WESTDEUTSche ELEktrogeräTebau GmbH) 26 October 1983 &amp; WO, 83/03688 DE, 3214372</td>
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<td>X</td>
<td>EP, A, 0 119 312 (VIESSMANN WERKE KG) 26 September 1984 &amp; DE, 3310344</td>
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* Special categories of cited documents: 18
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier document published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral proceeding, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority data claimed

* "T" later document published after the international filing date or priority data and not in conflict with the application but cited to understand the principle or theory underlying the invention

* "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

* "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* "Z" document member of the same patent family

**IV. CERTIFICATION**

Date of the Actual Completion of the International Search: 1986-02-11

Date of Mailing of this International Search Report: 1986-02-14

International Searching Authority: Swedish Patent Office

Signature of Authorized Officer: Harriet Ekdahl

Form PCT/ISA/210 (second sheet) (January 1985)
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II

Fields Searched (cont)

340:309.1-6; 368:223-242

V ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ........... because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ........... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ........... because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple Inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant’s protest.

☐ No protest accompanied the payment of additional search fees.
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<td>Patent Abstract of Japan, Vol 6, nr 129 (P-128), Abstract of JP, A, 57-54891 (HITACHI SEISAKUSHO KK) 1 April 1982</td>
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