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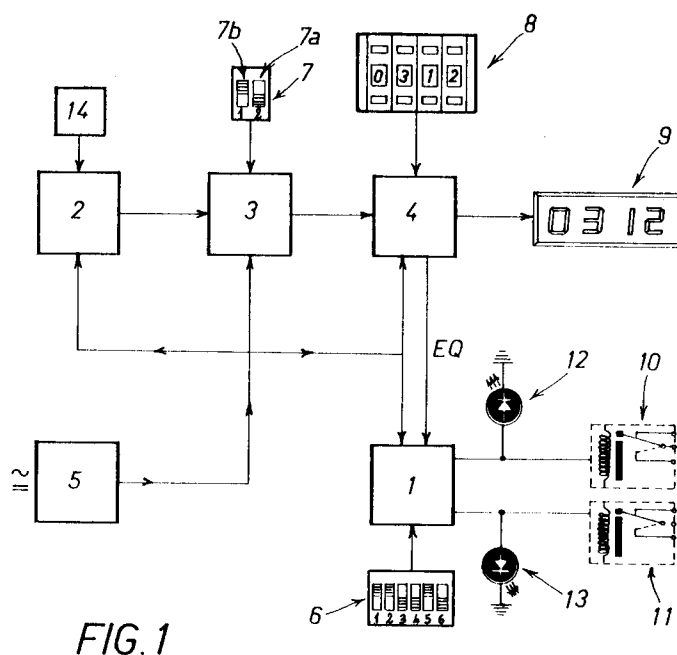
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I-10129 Turin(IT)(54) **Multifunction timer control device.**

(57) Multifunction time control device composed of a first programmed circuit (1) with programs selected by microswitches (6); of a second oscillator circuit (2) generating a fixed frequency of 32.768 Hz afterwards divided by a couple of counters in order to obtain a 1 Hz frequency and by further counters to furtherly divide said frequency and obtain signals with 1 minute and 1 hour pulses; of a third circuit (3) equipped with trigger and logic comparators to select time scales, of a fourth circuit (4) equipped with a programmable counter selected by preselectors (8) and of a supply circuit (5) generating different voltage values.

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The present invention refers to an electronic time control device suitable to be employed as timer in different industrial automation applications.

Different types of electronic devices for time control and command are known; they can usually be divided into two types: electromechanical and electronic ones. These devices are usually composed of a first, mechanical or electronic, part that performs the control functions, that is coordinates the different stages of energization, deenergization, delay, timing, etc., and of a second interface part to transfer actuation signals for relays or other actuator devices provided for the control of equipment, machines, tools, etc. that are commonly used in industrial processes.

The main inconvenience that occurs with this type of so far known devices is their incapability of carrying out different functions from the ones for which they were built, according to the employment needs. These devices, in fact, owing to their own building structure, are able to execute one or some predefined functions, but anyway in a limited number, that is usually less than ten.

These functions, moreover, are carried out through complex circuits that occupy wide rooms and require heavy modifications in case of variation in their developed function properties in order to satisfy new needs.

The operative limit embedded into the known types of time control devices forces to use different devices, often with different operative properties, for each required operation, with the inconvenience that the same device cannot be used any more during evolution and updating of the various industrial processes, because it is not able to suit itself to the new operative situations with different functions from the ones for which it had been built.

The last, but not least, inconvenience is that in an industrial process, owing to the above-mentioned reasons, more than one time control devices must be used, often coming from different manufacturers, thus forcing operators, maintenance technicians and every person linked to the project to learn and remember their operation with obvious waste of resources.

Object of the present invention is to realize a multifunction time control device that allows carrying out all the functions commonly used by control devices in industrial processes and furthermore is easily programmable to carry out new functions according to users' requests.

Another object of the present invention is to obtain a multifunction time control device with high electronic and mechanical integration scale, in order to reach a high compactness that allows its easy insertion into the equipment for which it is aimed.

These and other objects will be reached by the device according to the invention including a first circuit containing a programmable logic that can be selected with a manual selection device, dip-switch type, said logic being activated when a time value inserted in a register connected to a programmable counter is reached; a second circuit to generate the time base, a third supply circuit, a fourth display circuit and actuator means receiving control signals from said programmed logic.

Further properties and advantages of the invention will be better shown by the description of a preferred but not exclusive embodiment of the multifunction time control device disclosed as a non limiting example by the drawings in which:

Fig. 1 is a schematic block diagram of the circuits composing the device according to the invention.

Fig. 2 is the diagram of the time base evolution when passing through the different stages of the device according to the invention.

Fig. 3 is the front view of a time control device according to the invention.

Fig. 4 is the rear view of a time control device according to the invention.

The device described by the drawings includes a first programmed circuit 1 substantially defined by an EPLD type memory, adequately programmed, where the initially stored programs are selected through microswitches 6.

Said programs are originally inserted once and for all and represent a complete range of the main functions that can be carried out by the time control devices used in industrial processes: said functions are a total of 42.

A second circuit 2 including a quartz oscillator operating at the frequency of 32.768 Hz, a first couple of counters where the frequency of the signal coming from the oscillator is brought at first to 128 Hz and then to 1 Hz, a second couple of counters where the signal frequency is brought at first to 1/60 of an Hz and then to 1/3600 of an Hz in order to generate signals whose period is 1", 1' and 1 h, said circuit 2 also includes a test circuit 14 to check, through an external reference oscillator, the correct operation of the device itself.

A third circuit 3 includes a list of triggers and logic comparators to select the time scales.

Manual preselectors 7 are provided for the choice of the operating time scale: seconds/hours (7a) and minutes/hours (7b); said scales are from 1 to 9999 seconds, from 1 to 9999 minutes and from 1 to 9999

hours.

The selection of the above-mentioned times is therefore defined by a combination of positions in the preselectors (dip-switches) 7a and 7b, as included in the following table:

5	SEC/HOURS (7A)		MIN/HOURS (7B)
	SECONDS	ON	OFF
10	MINUTES	OFF	ON
	HOURS	ON	ON

15 A fourth circuit 4 includes a programmable counter where the desired time limit is inserted into a register through preselectors 8, said circuit having also the function of driving a series of displays 9 of the seven-segment type. An EQ signal, activated when the counter reaches the value included into the register, is sent to the programmed circuit 1 and used to start the procedure previously selected through microswitches 6. A couple of relays 10 and 11 is, in the end, provided, whose type is suitable to the use to which they are aimed, that are able to act following the control needs they must satisfy.

Said relays being operated by signals coming from the programmed circuit 1. Two leds 12 and 13 are also provided to signal the performed activation of relays 10 and 11; moreover, a potentiometer 15 (fig. 4) allows modifying the energizing time for one of the relays, if required by the selected program.

20 The device is further equipped, to display the selected scale, with three leds 16, 17, 18 (fig. 3) respectively indicating a selection of seconds, minutes or hours.

A fifth circuit 5 including a supplying section with network alternate current and a battery supplying section in order to avoid, when the relay current stops, the loss of the data memory set into the device.

30 In the end, a RESET command 20 to activate the cycle and a STOP command 21 for its interruption, connected to a terminal board 19 placed on the rear side of the container (fig. 4), are provided, said commands able to be sent both manually through a mechanical command and automatically through electric signals coming from the outside.

35 The other connections to the terminal board are composed, one after the other, of a "COMMON" 24 for RESET AND STOP commands, of a "normally open" contact 23, of a "COMMON" contact 24 and of a "normally closed" contact 25 for relay 10; of a "normally open" contact 26, of a "COMMON" contact 27 and of a "normally open" contact 28; the last three terminals 29, 30, 31 are used for the supply voltage: 0 V common, 110 V or 220 V.

40 The device operation according to the invention provides a first selection step (time scale, delay limit and desired function), a second activation step (RESET) where the time computation is set to zero and the relay is deactivated and following steps that depend on the selected function and that are automatically carried out by the device according to the invention up to the following RESET signal.

As an example, here following the different steps of one program function of the 42 programmable ones in the device according to the invention are described.

Said function provides that, when the set time has been reached:

- 45 a) the time computation is interrupted and therefore the set time is displayed on the display
b) the output relay is energized.

The activation of the reset signal, then, operates to deenergize the output relay and to set the counter to zero, while the computation will start again only at the reset signal release.

50 Obviously, a preferred embodiment of the multifunction time control device has been described, but this one is not limited to the above-mentioned example: any other equivalent circuit or circuit component always remains within the range of the same inventive idea, as defined by the enclosed claims.

Claims

- 55 1. Multifunction time control device characterized in that it includes a first circuit (1) containing a programmable logic, that can be selected with a manual selection device, dip-switch type (6), said logic being activated when a time value contained in a register connected to a programmable counter (4) is reached; a second circuit (2) to generate the time base; a third supply circuit (5), a fourth display circuit (9), and actuator means receiving control signals from said programmed logic.

2. Multifunctional time control device according to claim 1 characterized in that said programmable logic is of the EPLD type and adequately programmed.
- 5 3. Multifunctional time control device according to claim 1 characterized in that the counting limit for the desired time is performed through the insertion, in said register of said programmable counter (4), of a selection of values set with a preselector (8).
- 10 4. Multifunctional time control device according to claim 1 characterized in that said second circuit (2) to generate the time base is composed of a quartz oscillator generating a signal whose frequency is 32.768 Hz; of a first couple of counters suitable to divide said signal bringing it at first to 128 Hz and then to 1 Hz; of a second couple of counters provided for the further division of said signal and for the generation of 1/60 of an Hz pulses corresponding to a 1 minute time and of 1/3600 of an Hz pulses corresponding to a 1 hour time.
- 15 5. Multifunctional time control device according to claim 1 characterized in that the programs inserted into the circuit (1) can be externally selected by microswitches (6) for a total of 42 different possibilities.
- 20 6. Multifunctional time control device according to claims 1 and 2 characterized in that it includes a series of displays (9) to instantaneously display the occurred time.
7. Multifunctional time control device according to claim 1 characterized in that said actuator means are composed of a couple of control relays (10, 11) whose energization is signalled by leds (12,13).
- 25 8. Multifunctional time control device according to claim 1 characterized in that said supply circuit includes a double network and battery supply.
9. Multifunctional time control device according to any one of the previous claims characterized in that it includes a test contact (14) to verify the frequency generator operation.
- 30 10. Multifunctional time control device according to any one of the previous claims characterized in that it includes a potentiometer (15) which can be externally accessed to adjust the energizing time of the relay.
- 35 11. Multifunctional time control device according to claim 1 characterized in that the function reset for circuit (1) with the programmed logic is composed of an EQ signal sent by circuit (4) with the programmable counter when the time value included into the register of said counter is reached.

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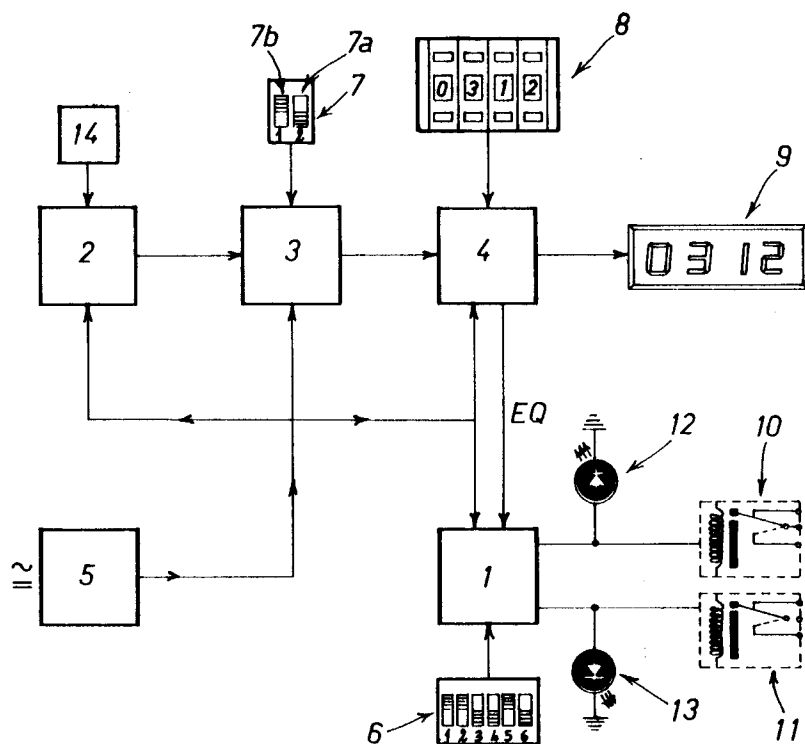


FIG. 1

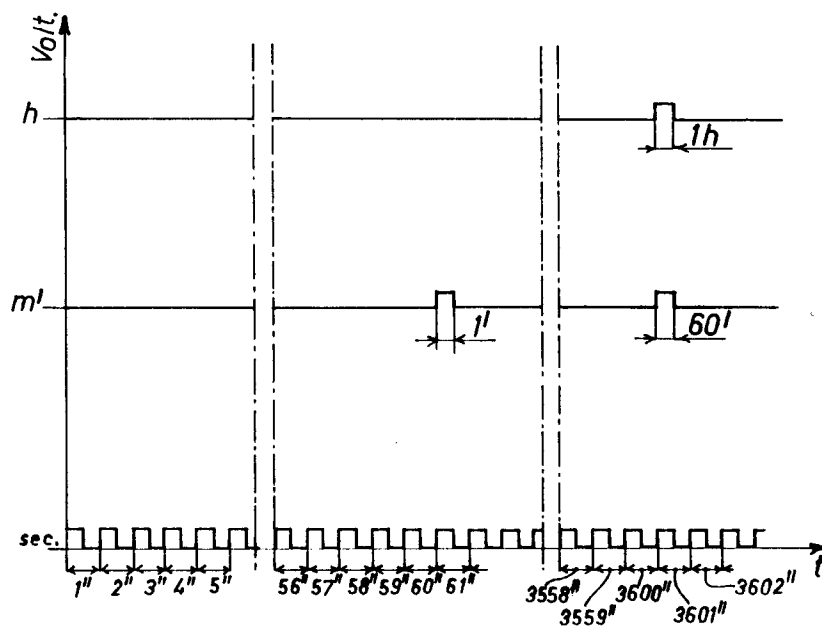
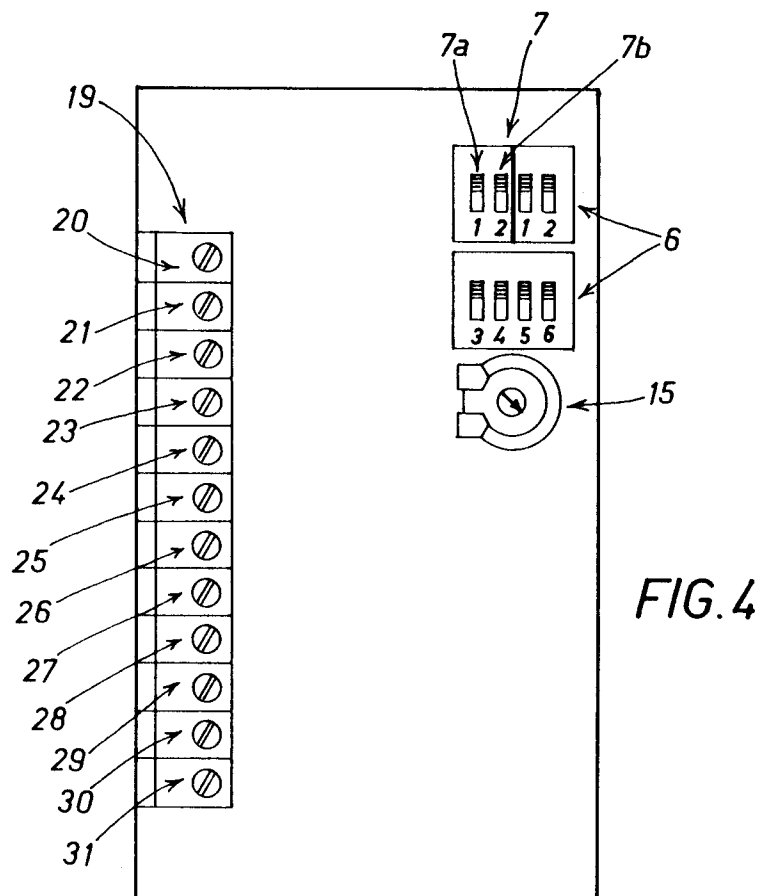
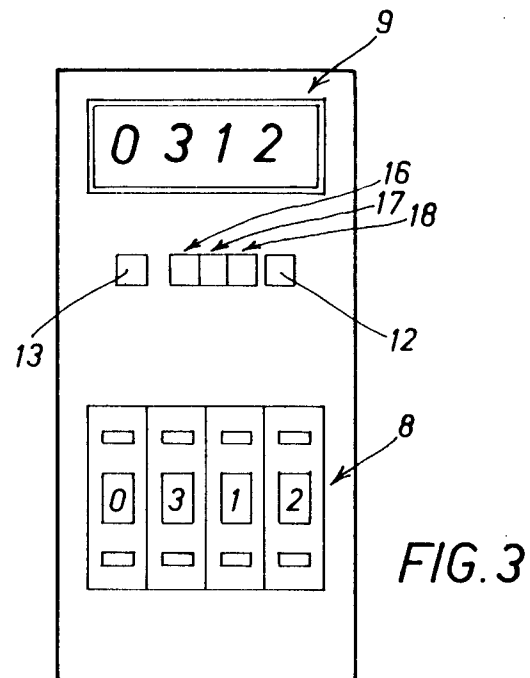


FIG. 2





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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 3630

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	JOURNAL OF ELECTRONIC ENGINEERING vol. 19, no. 181, January 1982, TOKYO pages 76 - 79; T. OHASHI: 'DIN-SIZED MICROCOMPUTER-BASED DIGITAL TIMERS AND COUNTERS' * page 78, column 1, paragraph 1 - page 79, column 1, last paragraph; figure 1; table 1 ** - - -	1,3,6,8	G 04 G 15/00
Y	US-A-4 093 997 (W. R. GERMER) * abstract; figures 1,2 ** - - -	1,3,6,8	
A	ELEKTOR ELECTRONICS vol. 15, no. 165, March 1989, LONDON pages 60 - 61; J. VINCKIER: 'EPROM-CONTROLLED TIME SWITCH' * page 60, left column, paragraph 1 - page 61, left column, paragraph 1; figure 1 ** - - -	2,7	
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 415 (P-781)4 November 1988 & JP-A-63 153 602 (MATSUSHITA ELECTRIC WORKS LTD) 27 June 1988 * abstract ** - - - - -		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G 04 G
Place of search		Date of completion of search	Examiner
The Hague		13 November 91	EXELMANS U.G.J.R.
CATEGORY OF CITED DOCUMENTS			
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