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(54) Remote-control home electronics device.

(57) The invention relates to a remote-controlled home electronics device (6) equipped with a monitoring circuit (3, 4) for the condition of the battery of the remote-control device (1). As the battery state is thus monitored by the receiving end, the extra load to the battery caused by the monitoring process is avoided. The transmitting circuit of the remote-control device (1) is designed so that the signal form, e.g. the durations and/or the spaces of the transmitted control pulses will essentially change when the battery is weakening.

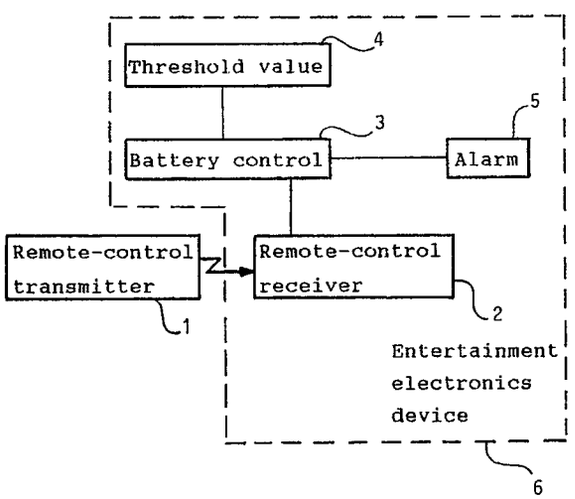

Fig. 1

EP 0 453 957 A2

The present invention relates to a remote-control home electronics device and to the remote-control device connected with it.

Remote-control home electronics devices, such as e.g. television sets, videorecorders, and sound reproducers, are more and more left without any local keyboards and then it is important that the remote control device is operating reliably and without any surprises. The most harmful problem in this connection is that the battery of the remote-control device will weaken and lose power when just in operation so that the use of the device to be controlled may even become impossible. The problem is deteriorated by the fact that the device itself may often operate so well that the battery of the remote control device may become exhausted without any gradually occurring symptoms to be identified.

In general, for observing the state of the battery of a portable device like a remote-control device the known arrangement is to provide e.g. a light emitting diode (LED) in connection with the battery but the disadvantage of this arrangement is that it will also add to the loads effecting the battery.

The aim of the present invention is to eliminate these problems and provide such a battery state monitoring method that is able to indicate on time how the battery is weakening, and that will not create any extra load the battery.

To achieve this aim the invention is characterized in that the home electronics device is provided with a condition monitoring circuit for the battery of the remote-control device, said circuit observing the condition of the battery of the remote-control device on the basis of the signal transmitted by the remote-control device.

Thus, it is essential in this invention that the battering condition monitoring is carried out at the receiving end whereby the extra load to the battery caused by the monitoring will be eliminated. The most suitable way for the monitoring circuit to observe the the battery condition is to monitor the form of the signal transmitted by the remote-control device and/or the durations of the transmitted pulses and/or the spaces between the pulses. Naturally, the remote-control device is designed so that the transmitted signal will enable this type of monitoring.

The invention is described in the following in more detail and by using an example, with reference to the annexed drawings where

Fig. 1 shows a block diagram of the arrangement according the invention;

Figs. 2a-e show the dependence of the transmitted pulses of the condition of the battery, and

Figs. 3 and 4 show the operations of the monitoring circuit processor in the form of a flow chart diagram.

In Fig. 1 the reference number 1 indicates a remote control transmitter operating with infra-red light, the number 2 indicates a respective remote-control receiver that is a part of a home electronics device 6. The receiver 2 additionally comprises, included in the device itself, an observing circuit 3 for the battery having threshold value setting means 4 and alarm means 5.

It is obvious that the battery condition cannot be monitored e.g. by observing the amplitudes of the transmitted signal, as the amplitude or the strength of the signal is depending on the respective distance between the remote-control device and the remote-controlled electronics device. Instead, the transmitting circuit of the remote-control device 1 may be carried out so that the relative form of the signal or its relative timing, as e.g. the duration of the pulse or the spaces between the transmitted pulses etc., is changing when the input voltage is changing, i.e. depending on the condition of the battery.

This is illustrated by Fig. 2. The figure a) only shows in principle the transmission of the control signal in pulse form from the battery-driven remote-control device to the receiving apparatus. The figure b) shows the dependence of the relative pulse duration of the battery voltage and the figure c) the dependence between the battery voltage and the code length of the transmitted control message. The figure d) shows the dependence between the relative pulse duration and the code length and, finally, the figure e) shows the change of the pulse error in time when the battery is losing power.

Thus, according to the invention, the receiver, in addition to the normal receiving operations, also observes the changes caused by the ageing of the battery in the received signal and compares the measured changes with the advancement of a standardized change pattern, based on the known changes in the battery caused by its ageing. When the measured change exceeds a preset threshold value of the standardized change in circuit 4, and when the battery condition can be assumed to be near the maximum operative age, the user will receive an alarm by circuit 5 indicating the low battery condition. This alarm may be e.g. a visual display by a warning light or on a display screen or, in the case of a television set, on the television screen or by e.g. a sound signal.

Fig. 3 shows the operations of the processor of the monitoring circuits 3, 4 in the form of a flow chart. The monitoring circuit observes a selected signal parameter dependent on the voltages of the battery and gives an alarm if the parameter exceeds the permitted limit.

Fig. 4 shows the corresponding flow chart in the case when the bit durations of the transmitted

control signals are under specific monitoring.

Thus, it is essential in the present invention that the indication will take place before the battery power is so low that the remote-control device will no more operate reliably. This enables the user to provide a new battery on time and assure the operation of the remote-control device without problems.

Claims

1. A remote-control home electronics device, **characterized** in that it is provided with a condition monitoring circuit (3, 4) for the battery of the remote-control device (1) said circuit observing the battery power condition on the basis of the signal transmitted by the remote-control device.

2. A home electronics device according to claim 1, **characterized** in that the monitoring circuit (3, 4) monitors the form of the signal of the remote-control device and/or the durations of the trans- mitted pulses and/or the spaces between the pulses.

3. A home electronics device according to one of the claims 1 or 2, **characterized** in that it comprises a visual display showing too low battery voltage.

4. A home electronics device according to one of the claims 1 or 2, **characterized** in that too low battery voltage is indicated by a sound signal.

5. A remote-control device for a home electronics device, **characterized** in that the signal transmitter circuit thereof is designed so that the signal form, e.g. the durations of and/or the intervals between the transmitted control pulses, varies with the voltage of the battery of the remote-control device (1).

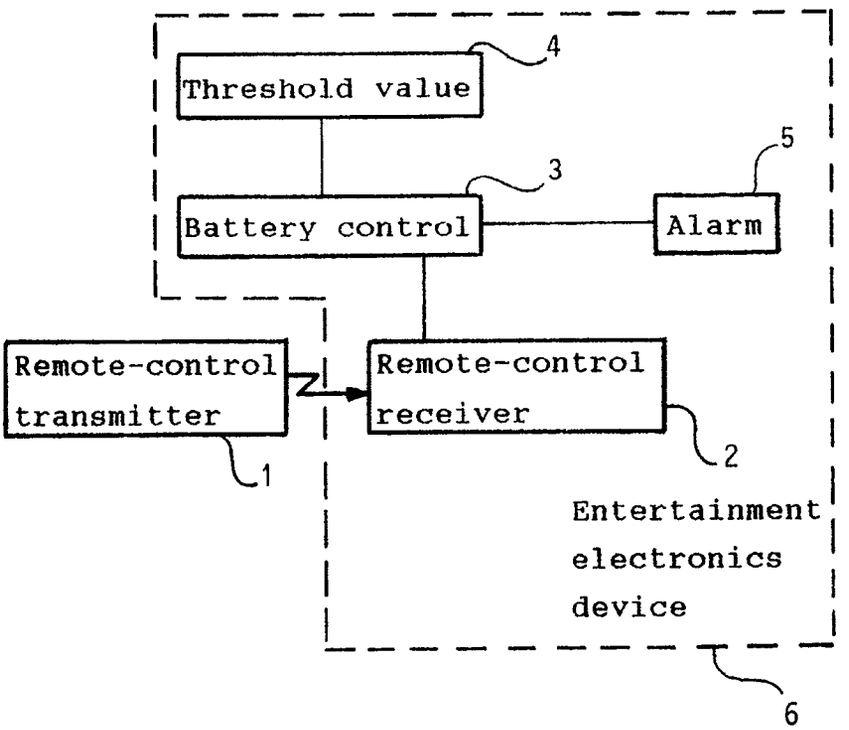
Threshold value
4
5
3
Battery control
Alarm
Remote-control transmitter
Remote-control receiver
1
2
Entertainment electronics device
6

Fig. 1

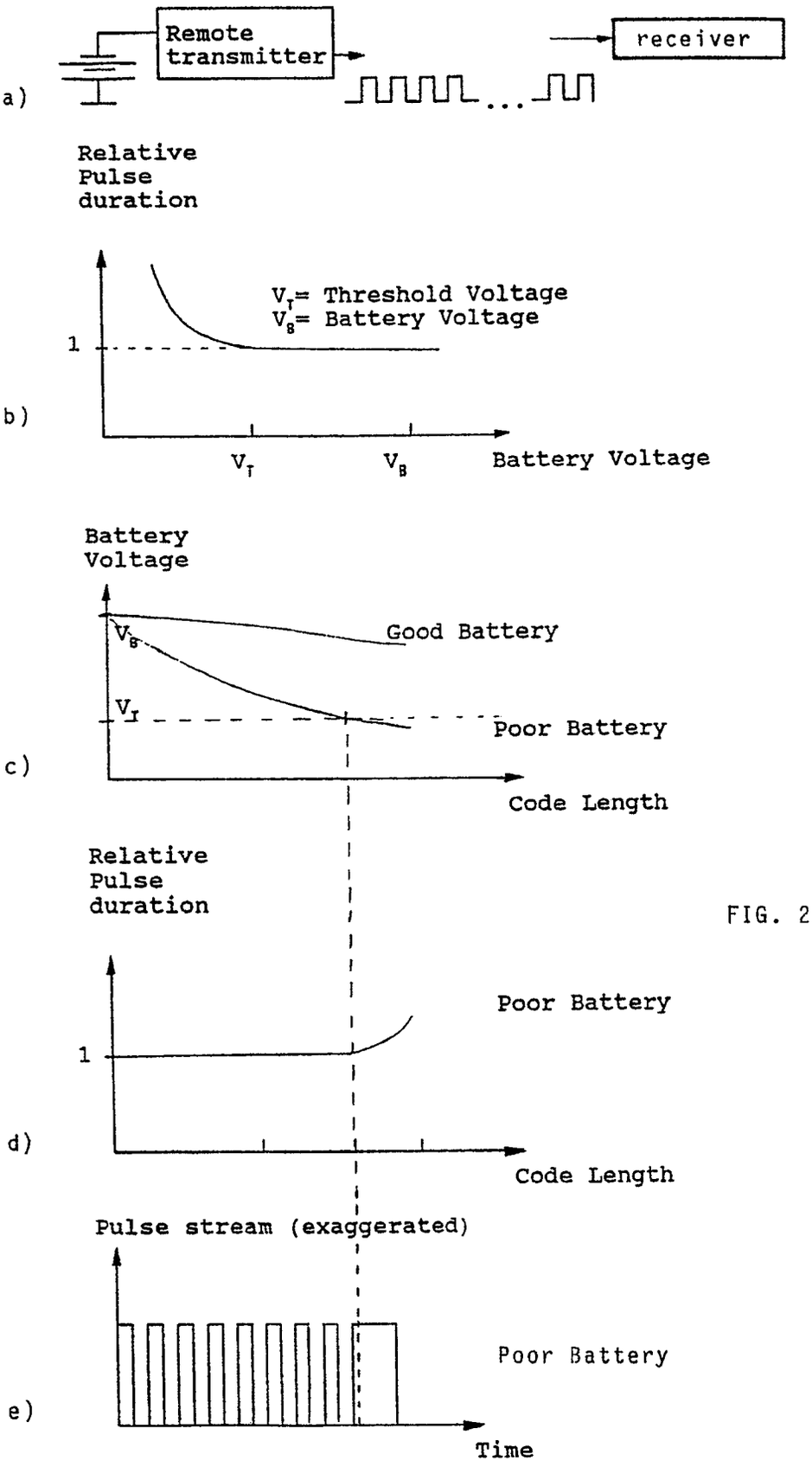
a)
Remote transmitter
receiver
Relative Pulse duration
b)
V_T= Threshold Voltage
V_B= Battery Voltage
1
V_T
V_B
Battery Voltage
Battery Voltage
c)
V_B
Good Battery
V_T
Poor Battery
Code Length
Relative Pulse duration
d)
Poor Battery
1
Code Length
Pulse stream (exaggerated)
e)
Poor Battery
Time

FIG. 2

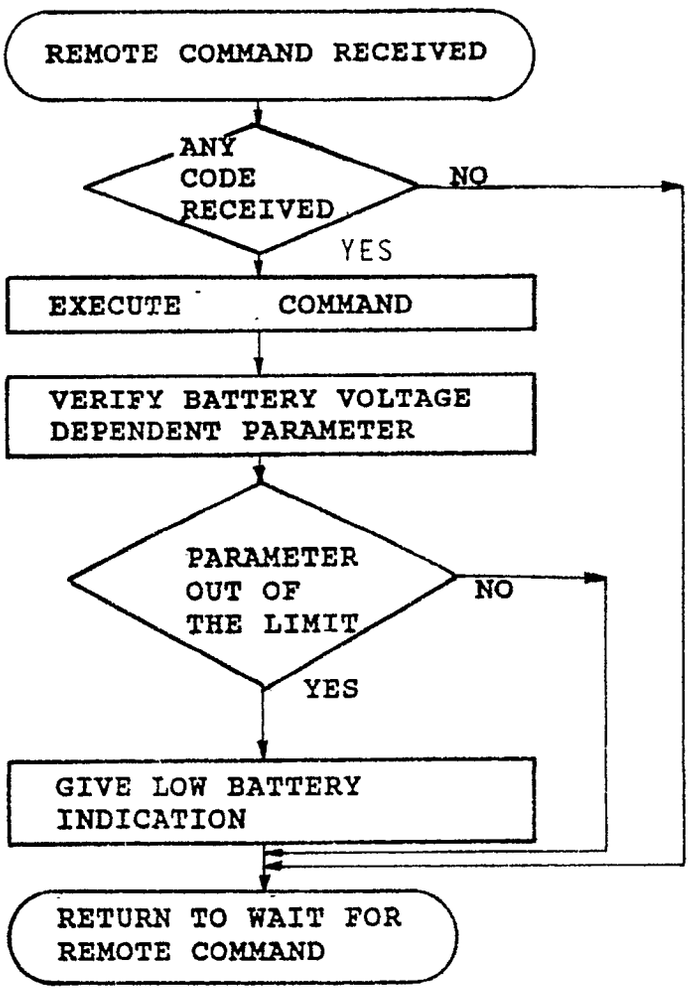
REMOTE COMMAND RECEIVED
ANY CODE RECEIVED
NO
YES
EXECUTE COMMAND
VERIFY BATTERY VOLTAGE DEPENDENT PARAMETER
PARAMETER OUT OF THE LIMIT
NO
YES
GIVE LOW BATTERY INDICATION
RETURN TO WAIT FOR REMOTE COMMAND

FIG. 3

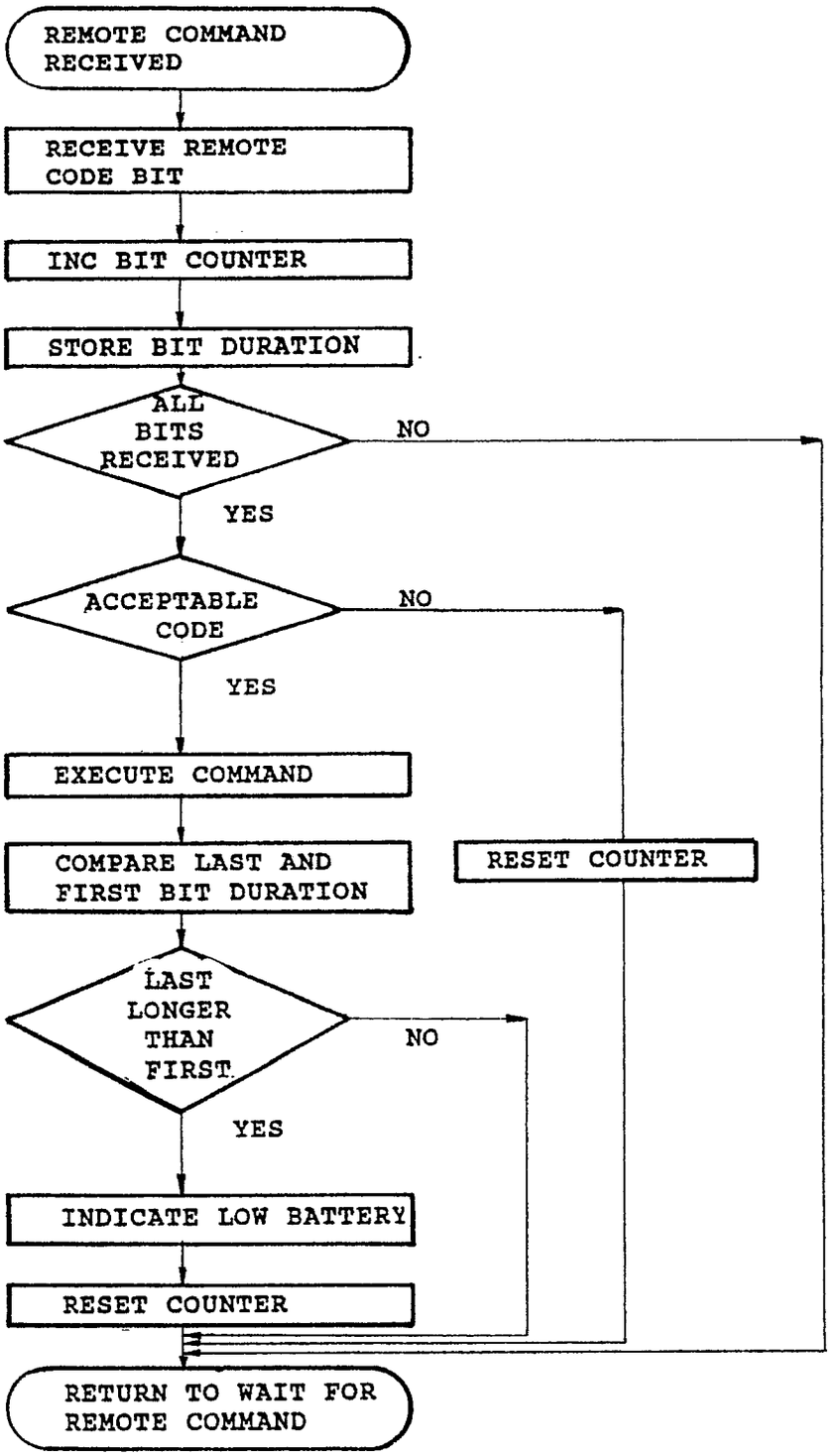
REMOTE COMMAND RECEIVED
RECEIVE REMOTE CODE BIT
INC BIT COUNTER
STORE BIT DURATION
ALL BITS RECEIVED
NO
YES
ACCEPTABLE CODE
NO
YES
EXECUTE COMMAND
COMPARE LAST AND FIRST BIT DURATION
RESET COUNTER
LAST LONGER THAN FIRST
NO
YES
INDICATE LOW BATTERY
RESET COUNTER
RETURN TO WAIT FOR REMOTE COMMAND

FIG. 4