United States Patent

[11] 3,628,153

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[33] Japan
[31] 43/93381

[54] RECEIVING DEVICE FOR CONTROL INFORMATION
3 Claims, 6 Drawing Figs.

[52] U.S. Cl. 325/395, 325/64, 343/228
[51] Int. Cl. H04b 1/16
[50] Field of Search 325/55, 392, 64, 395, 364, 478; 343/225, 228

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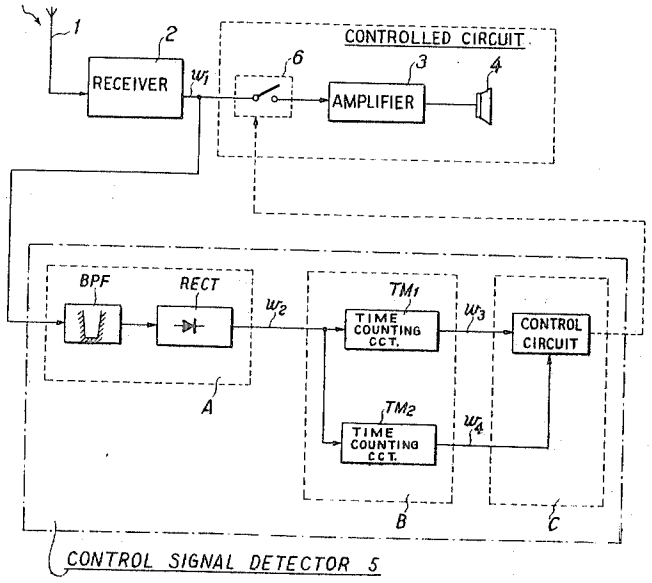
ABSTRACT: A receiving device for control information formed by a first control signal and a second control signal transmitted after the first signal and having a duration less than the duration of the first signal, where the durations of received signals having the same frequency as the control signals are measured to generate a first output when the duration exceeds a predetermined time Ts and to generate a second output when the duration exceeds predetermined time Tc less than the time Ts. The duration of the first control signal is longer than the time Ts, and the duration of the second control signal is less than the time Ts and more than the time Tc. A controlled circuit is triggered to and self-held in the switching-in state in response to the first output and restored in response to the second output.



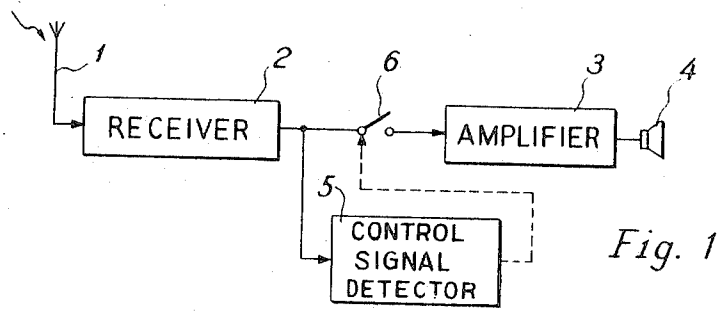


Fig. 1

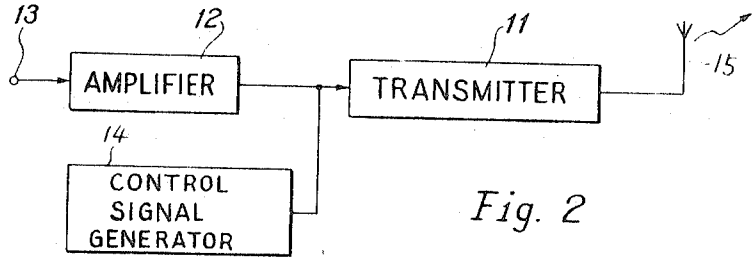


Fig. 2

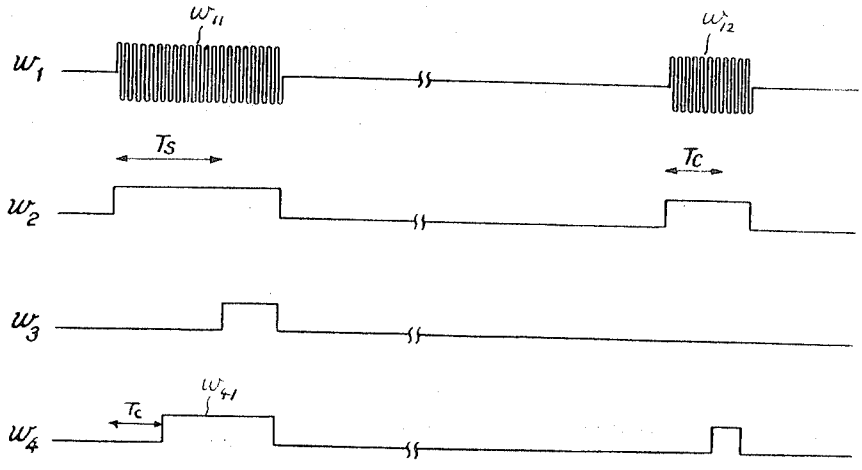


Fig. 4

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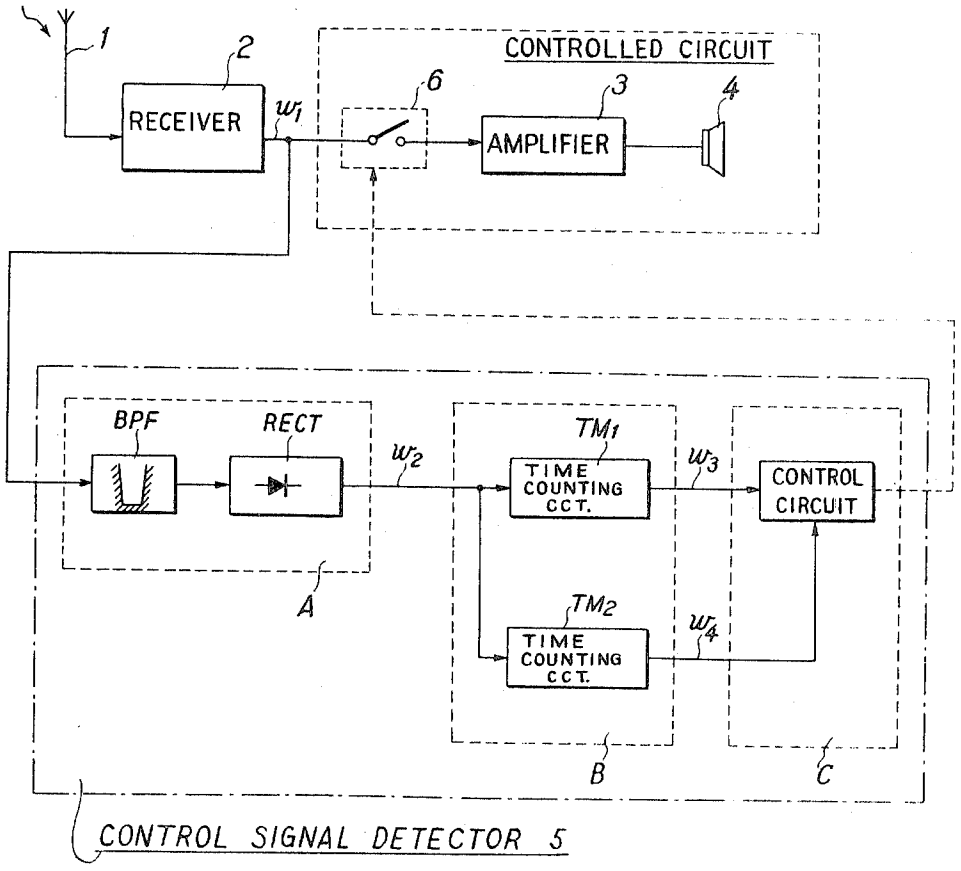

Fig. 3

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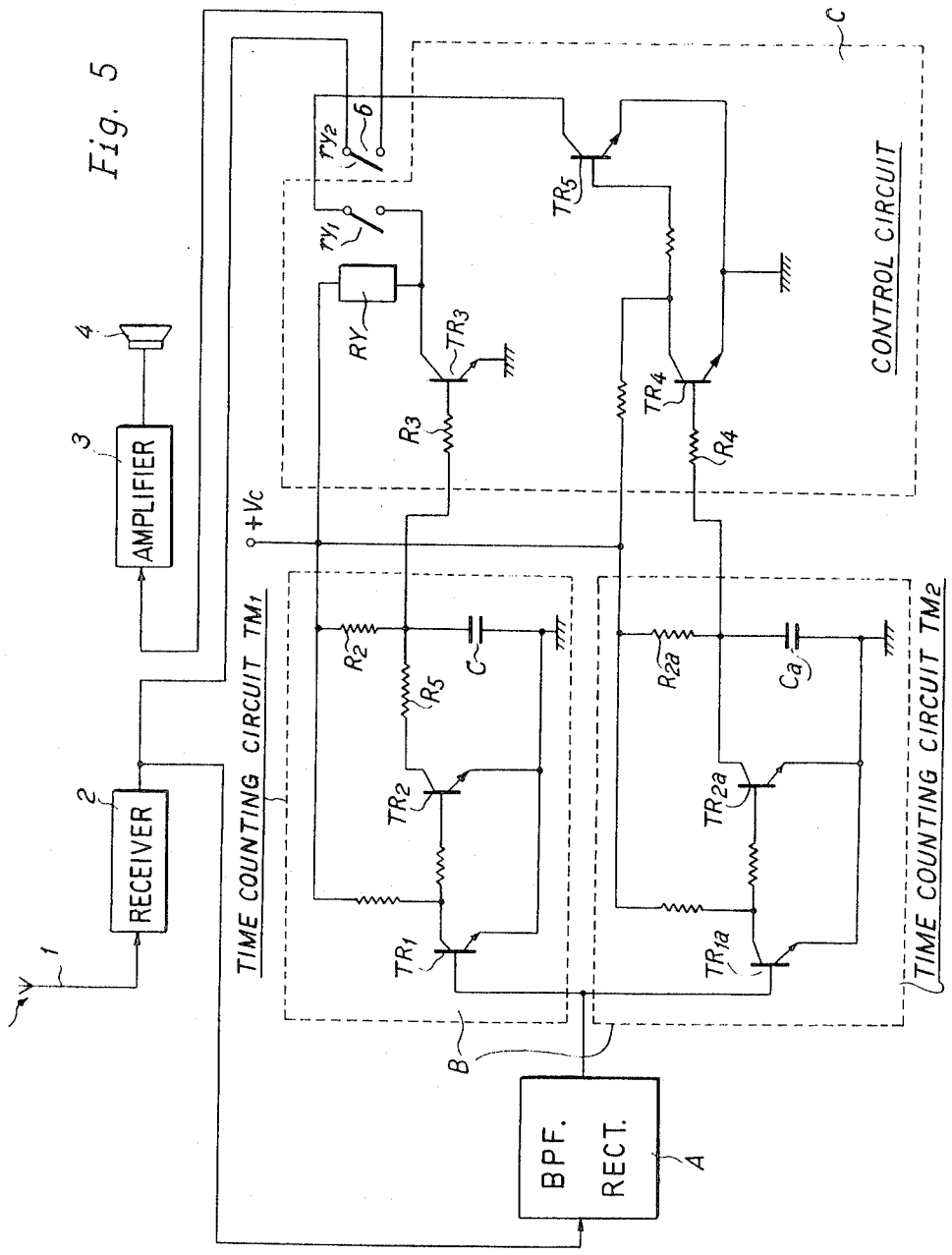
Fig. 5



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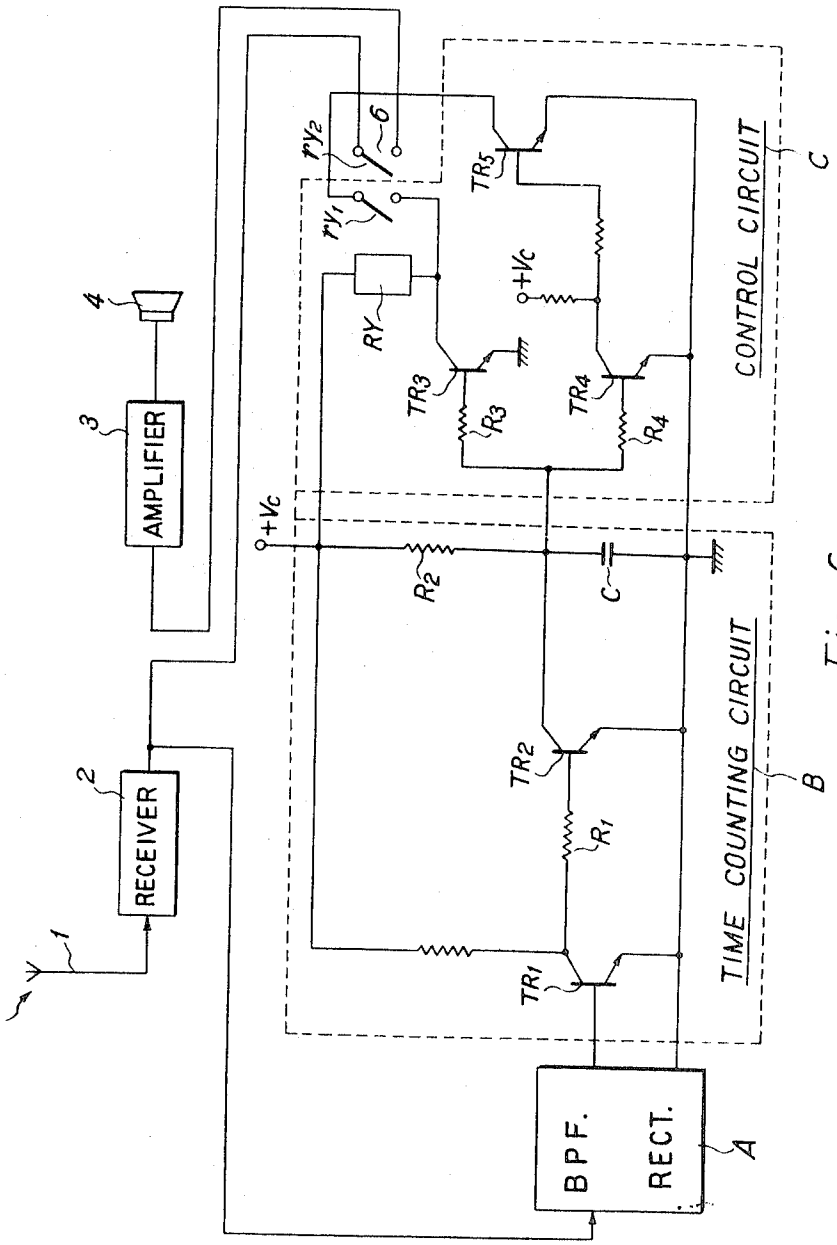

Fig. 6

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RECEIVING DEVICE FOR CONTROL INFORMATION

BACKGROUND OF THE INVENTION

This invention relates to receiving devices used in a system for controlling, from the sending side, the receiving side in a broadcast system, such as (1) an emergency broadcast system for transmitting emergency information, such as information of a natural disaster etc., from the broadcast station to the receivers, (2) a recorder-control broadcast system for causing recorders of the receivers, such as tape recorders, to record the broadcast information in accordance with the control of the broadcast station, or (3) a broadcast system for a control signal transmitted to control the switch operation of each of various kinds of apparatus at the receiving side.

In these prior art system, a device at the receiving side is automatically triggered by a control signal transmitted from the sending side. However, restoration to the standby condition on the device of the receiving side is usually performed by manual operation (hereinafter referred as "semicontrol system"). If the customer of the receiving set is absent, the receiving set of the semicontrol system remains in an unmuted condition after completion of a desired operation. This will cause unnecessary power consumption or unnecessary loud noise from the speaker which is uncomfortable to the neighborhood. This defect tends to prevent popularization of the broadcast system of this type.

To eliminate the above difficulty, another prior art system has been proposed in which the triggered device of the receiving side is automatically restored by the control from the sending side (hereinafter referred as "full-control system"). In this full-control system, two control signals having different frequencies from each other are employed. Two control signals A and B are simultaneously transmitted to the receiving side. The received control signals *a* and *b* are applied to an AND gate, so that a desired control is effected at the output of the AND gate. Thereafter, one of the two control signals *a* and *b* is ceased while the other is further transmitted without interruption to hold the triggered condition of the controlled device. When the other of the two control signals *a* and *b* is ceased, the controlled device is restored to the initial condition. However, if this full-control system is applied to an emergency broadcast system, coexistence of the broadcast program and one of the signals *a* and *b* is offensive to the ear. To avoid such discomfort, the modulation rate of the carrier in transmitting the two control signals *a* and *b* is reduced as low as possible. This causes deterioration of the reliability of the control operation of this full-control system. With respect to some of receiving sets, normal triggering and normal restoration in these receiving sets will not be performed at all.

An object of this invention is to provide receiving devices free from the above defects.

The principle of this invention will be understood from the following detailed discussion taken in conjunction with the accompanying drawings, in which the same or equivalent parts are designated by the same reference numerals, characters, and symbols.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a block diagram for illustrating an example of conventional receiving devices used in the broadcast system for control information;

FIG. 2 is a block diagram for illustrating an example of conventional sending devices used in the broadcast system for control information;

FIG. 3 is a block diagram for illustrating the theory of operation of this invention;

FIG. 4 shows time charts explanatory of the operation of some embodiments of a control device; and

FIG. 5 and 6 are each block diagram for illustrating an actual embodiment of one control receiving device.

To afford a better understanding of this invention, a conventional broadcast system for control information will first be described.

FIG. 1 is an example of a receiving set which comprises a receiving antenna 1, receiver 2 receiving a transmitted signal from the antenna 1 and amplifying the received signal and further demodulating the received signal, a control signal detector 5 for detecting a transmitted control signal from the received and demodulated signal, a switch 6 controlled by the output of the control signal detector 5, an amplifier 3 amplifying the demodulated signal obtained at the output of the receiver 2, and a speaker connected to the output of the amplifier In this receiving set, the switch 6 is opened in the normal case, so that the speaker 4 is muted. When a control signal is transmitted from the sending side of the broadcast system, it is detected by the control signal detector 5, so that the switch 6 is closed and the broadcast program transmitted after the control signal can be heard from the speaker 4.

FIG. 2 is an example of the sending side of the broadcast system to control the receiving sets as shown in FIG. 1. Broadcast program signals are applied from a terminal 13. A control signal generator 14 generates a predetermined control signal. The control signal generated from the control signal generator 14 is applied to the transmitter 11. The output of an amplifier 12 amplifying the broadcast programs supplied from the terminal 13 is also applied to the transmitter 11. The output of the transmitter 11 is connected to an sending antenna 15. When a program is to be transmitted to the receiving sets, the control signal is at first transmitted to unmut the receiving sets and then the broadcast program is thereafter transmitted.

With reference to FIGS. 3 and 4, the principle of this invention will be described. Means 1, 2, 3, 4 and 6 other than the control signal detector 5 are the same as those in the receiving set shown in FIG. 1. The control signal detector 5 comprises three means A, B and C in accordance with this invention. The means A comprises a narrow band pass filter BPF for selecting a signal of a predetermined single frequency from the output W, of the receiver 2 and a recifying circuit RECT for converting them to a DC pulse signal W_2. The means B comprises a time-counting circuit TM_1 and a time-counting circuit TM_2. The time-counting circuit TM_1 measures the duration of the DC pulse signal W_2 obtained from the means A so that a first output W_3 is present when the duration of the DC pulse signal W_2 exceeds a predetermined time Ts. The time-counting circuit TM_2 measures the duration of the DC pulse signal W_2 obtained from the means A so that a second output W_4 is present when the duration of the DC pulse signal W_2 exceeds a predetermined time Tc less than the time Ts. The means C is a control circuit for switching-in the switch 6 in response to the first output W_3 and for switching-off the switch 6 in response to the second output W_4 generated after the termination of the first output W_3. Accordingly, the switch 6 is held in the ON-state in a time from the termination of the first output W_3 to the start of the second output W_4.

The operation of the control signal detector 5 shown in FIG. 3 will be further described with reference to FIG. 4. A first mark W_{11} of the signal W_1 is transmitted to switch-in the switch 6, and a second mark W_{12} of the signal W_1 is transmitted to switch-off the switch 6. The mark W_{11} for switching-on the switch 6 has a duration longer than a predetermined time Ts. The mark W_{12} for switching-off the switch 6 has a duration longer than a predetermined time Tc but shorter than a predetermined time Ts which is longer than the time Tc. As understood from FIG. 4, when the first mark W_{11} is transmitted, the time-counting circuit TM_2 generates the second output W_{41} after the time Tc from the start of the first mark W_{11}. However, the control circuit is designed so that the switch 6 is not switched-off in response to the second output W_{41}. This will be clear from actual embodiment described below.

With reference to FIG. 5, an example of the control signal detector 5 is described. The above-mentioned means A, B and C are designated by dotted enclosures. The operation of this example is as follows. When the first mark W_{11} is transmitted to cut off a transistor TR_2 and the duration of the output W_2 of the means A exceeds the time Ts determined in accordance

with a product of values of a resistor R_2 and a capacitor C, a voltage charged in the capacitor C through the resistor R_2 from a source +Vc is discharged through a path comprising a resistor R_3 and a transistor Tr_3. Accordingly, a relay RY is energized so that contacts ry_1 and ry_2 are closed. In response to the close of the contact ry_2, the receiver **2** and the amplifier **3** are connected to each other. Accordingly, program information transmitted after the control signal (w_{11}) can be heard from the speaker **4**. On the other hand, the charging time constant of a capacitor Ca determined in accordance with a product of values of a resistor R_{2a} and the capacitor Ca is smaller than the charging time constant Tc of the capacitor C. Accordingly, transistors Tr_4 and Tr_5 are respectively turned on and off before the above-mentioned turn on of the transistor TR_3. This means that the hold of the relay RY is maintained through the turned-on transistor TR_3 since the transistor TR_5 is cut off.

However, when the first mark w_{11} is terminated, the charged voltage of the capacitor Ca is suddenly discharged through a turned-off transistor TR_{2a} so that the hold circuit of the relay RY is maintained by a path through the contact ry_1 and the transistor TR_5. In this case, the charged voltage of the capacitor C is also discharged through a resistor R_5 and a transistor TR_2. However, since the discharging time constant of the capacitor substantially determined in accordance with a product of values of the capacitor C and the resistor R_5 is larger than the discharging time constant of the capacitor Ca determined in accordance with a product of values of the capacitor Ca and the transistor TR_{2a}, the transistor TR_5 becomes conductive before turnoff of the transistor TR_3. Accordingly, the hold of the relay RY are continuously maintained. This hold of the relay RY can be maintained by the use of a slow-releasing relay as the relay RY.

When the second mark w_{12} more than the time Tc and less than the time Ts is transmitted and received, the transistor TR_4 becomes conductive after the time Tc starting from the start of the second mark w_{12} while the transistor TR_3 is remained in the cutoff state. Therefore, the transistor TR_5 is turned off so that the seld-hold of the relay RY is released. In response to this release of the relay RY, connection between the receiver **2** and the amplifier **3** are cut off. This is the standby condition for receiving a next control signal.

With reference to FIG. **6**, another actural example of the control signal detector **5** is described. In this example, the means B comprises a single time-counting circuit. However, the start to turn on of the transistor TR_3 is determined so that the turn on of the transistor TR_3 starts when the charged voltage of the capacitor C reaches a voltage v_1, while the start to turn on of the transistor TR_4 is determined so that the turn on of the transistor TR_4 starts when the charged voltage of the capacitor C reaches a voltage v_2. In this case, the voltage v_1 corresponds a voltage charged in the capacitor C in the time Ts starting from the start of the first mark w_{11}. The voltage v_2 corresponds to a voltage charged in the capacitor C in the time Tc starting from the start of the first mark w_{11} or the second mark w_{12}.

In addition to the above-mentioned analogue technique, digital technique or mechanical relays may be adopted to form the means B. Moreover, the relay RY of the means C may be replaced by an electronic circuit, such as flip-flop circuit, or by another electronic switching circuit.

In the above examples, it is assumed that the control signal consisting of two mark signals w_{11} and w_{12} has the same frequency. However, these two mark signals w_{11} and w_{12} may have respectively different frequencies from each other, in this case, the means A must be provided two combinations each comprising the filter BPF and the recifying circuit RECT. Moreover, the means B is designed as shown in FIGS. **3** and **5**.

As mentioned above, correct triggering for a controlled circuit, such as the switch **6**, an amplifier **3** and the speaker **4** shown in FIG. **3**, and restoration to the standby state for control information of the control circuit can be performed without spurious operation in accordance with this invention.

If false signals similar to the control signal and included in the transmitted broadcast program signal are eliminated by the use of technique proposed in my U.S. application for patent, Ser. No. 701,031 filed on Jan. 4, 1968, and now U.S. Pat. No. 3,566,270, reliability of in transmitting the control signal will be risen further.

The above examples relate to receiving devices used in an emergency broadcast system. However, it will be readily understood that the devices of this invention can be applied to other control systems, such as control of a tape recorder connected to a receiver or control of a switch or switches of a device provided at the receiving side.

What I claim is:

1. A receiving device for control information formed by a first signal and a second signal transmitted after the first signal and having a duration less than the duration of the first signal, comprising:

selection means for selecting the control information from a transmitted signal to convert it to at least one DC signal;

time-measuring means coupled to the output of the selection means for generating a first output when the duration of the DC signal exceeds a predetermined time Ts and for generating a second output when the duration of the DC signal exceeds a predetermined time Tc less than the time Ts, the duration of said first signal being longer than the time Ts, the duration of said second signal being longer than the time Tc and less than the time Ts;

first control means coupled to the output of the time-measuring means for triggering a control circuit to the switching-in state thereof in response to the first output and for holding the switching-in state of the control circuit;

second control means coupled to the time-measuring means for releasing the hold state of the first control means in response to the second output; and

third control means coupled to the first and second control means for checking the application to the first control means of the second output until completion of said hold state of the first control means.

2. A receiving device for control information according to claim **1**, in which the time-measuring means comprises two capacitors respectively having a charging time constant corresponding to the time Ts and a charging time constant corresponding to the time Tc.

3. A receiving device for control information according to claim **1**, in which the time-measuring means comprises a capacitor, first detecting means for generating the first output when the charged voltage of the capacitor reaches a predetermined first voltage after the time Ts starting from the start of the first control signal, and second detecting means for generating the second output when the charged voltage of the capacitor reaches a predetermined second voltage less than the first voltage after the time Tc starting from the start of each of the first and second control signals.

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