

DESCRIPTION

The invention relates to a random time fuze in accordance with the definition of the species of claim 1.

In the article by Wolfgang Flume "MW-1 - the multi-purpose weapon system" Military technology No. 2/1985, page 64 (centre of the right-hand column of page 70), the tactical importance of randomly or at any rate quasi-randomly detonating scatter munition is known. Other possibilities of using such random time fuzes are, for instance, runway bombs, the drilling charges of which are intended to detonate upon impact, but the explosive charges of which are intended to detonate only unforeseeably on the other hand in a time-delayed manner; or deception bodies which are launched into the sea and which are to become active for the irritation of a sonar location installation in different positions at points in time which are not foreseeable; or self-destruction devices on bombs and projectiles which for some reason have not detonated as a function of the approach to or impact on a target.

The problem underlying the invention is to indicate such random time fuzes which, with very little circuitry expenditure, have high operational reliability and within for instance the period of time between the ejection and the ground impact of scatter munition furnish the widest possible random distribution of the periods of time until the issuance of the respective detonating signal within a delay time which is presettable in a maximum manner in circuitry respects.

In accordance with the invention this problem is solved in that the time fuze in accordance with the species is designed in accordance with the characterising part of claim 1.

The solution is based on the realisation that, for a sufficiently wide random distribution, the circuitry expenditure for the generation of stochastic numbers (see e.g. DE-PS 31 29 550) for specification of counting end positions (upon the achieving of which the detonating signal is issued) is not needed; rather that it is sufficient, within a period of time which is not exactly fixed in an operationally-dictated manner (such as the expiry of time between the ejection and the impact on the ground of scatter munition), to act on a counter of restricted counting capacity with counting impulses of such high-frequency pulse repetition frequency that it is run through cyclically very frequently. In the different scatter munitions which are delivered approximately simultaneously, upon the ground impact different random counting end positions are therefore reached; and these are not concentrated on a specific sector of the counting capacity, but, by reason of the cyclic repetition of the counting procedure, are scattered over the entire width of the counting capacity. Thus, in good approximation a statistical distribution of the counting end positions over the ejected submunition batch is achieved, for which in any submunition substantially only one cyclical

counter with timing generator and a switch circuit for starting and finishing of the counting procedure has to be realised. If, now, in the respective scatter munition, out of this individual counting end position, until the issuance of a detonating signal upon achieving of a (uniformly or differently predetermined) triggering counting position further counting is effected, at the individual scatter munitions at quasi-statistically different points in time, within a maximum period of time limited circuitrywise by the counter- and timing-frequency specification, the individual detonating signals appear, in order to initiate the respective effective charge. The maximum delay time as from stopping of the rapidly cyclically running-through counter is thus presettable by the subsequently effective counting timing frequency and the maximum available counting volume.

The realisation of such a time fuze is particularly simple in circuitry respects if the function of the cyclical counter is combined with that of the counting timing generator, by two consecutive inverter stages being wired up as an R-C-oscillator; as explained in more detail for a special exemplified embodiment in DE-AS 28 01 278.

For the expiry of the remaining period of time from the randomly achieved counting end position until the triggering of the detonating signal, upon further use of the same counter a switch-over can be made to a lower repetition frequency of the counting impulses and/or with an identical or varied repetition frequency of the counting impulses a switch-over can be made to a larger counting capacity (or respectively a further counter). More especially when a minimum number of further counting steps after reaching the random counting end position is ensured, the counter outputs controlled prior to achieving the detonating-signal triggering position can also be utilised for initiating programme-controlled functions such as arming measures in the individual scatter munition.

Additional alternatives and further developments as well as further features and advantages of the invention will become apparent from the dependent claims and from the following description of preferred examples of realisation with regard to the solution in accordance with the invention which are shown in the drawings along with a restriction to that which is essential in a highly abstracted way in the manner of electrical block wiring diagrams.

Fig. 1 shows a circuit for a quasi-stochastic electronic time fuze with a counter which is controllable successively from differently designed timing generators
AND

Fig. 2 shows in a modification as compared with Fig. 1 a circuit arrangement with counter switch-over and additional tapping of time control signals.

The time fuze 11 shown in the drawing as an electrical block wiring diagram is intended for scatter munition which is ejected by means of a stationary delivery device or e.g.

one which can be carried along on an aircraft and is to be detonated on the ground within a predetermined period of time at a non-foreseeable point in time - thus not initiated by relative approach to a target object - , because the time fuze 11 supplies a detonating signal 12 to, for example, an electrical detonator (not taken into account in the drawing).

For this, the circuit of the time fuze 11 is put into operation by means of an item of start information 13 e.g. as a function of leaving the delivery device, for example by take-over of the operating voltage from an on-board mains of an aircraft or by switching-on of an entrained voltage source by means of the ejection acceleration or the release of a barrel sensing pin (not elaborated upon in more detail in the drawing). So long as an item of switch-over information 14 (see below) does not yet appear, the item of start information 13 brings about the operation of a timing generator 15 for the relatively high-frequency control of a cyclical counter 16. This is, in view of the high counting impulse frequency 17.1, so dimensioned that it counts very frequently right up to the end of its capacity and then in each case begins a new counting cycle. In the drawing this is illustrated in that periodically time and time again a resetting impulse 18 is generated, in order to begin the next counting cycle; although this resetting procedure takes place in the case of binary counters without the need for such an external control impulse (namely internally, with exhaustion of the counting capacity).

If after a, not exactly predeterminable, period of time as from appearance of the item of start information 13 the item of switch-over information 14 occurs, the counter 16 has therefore reached some kind of instantaneous counting position within its counting capacity.

The item of switch-over information 14, with the appearance of which the cyclical counting in this counting end position is interrupted, preferably appears as a function of a specific approach to a target, e.g. of the impact of the delivered munition on the ground and triggered for instance there by a switch responding to the landing jolt or to the stationary weight (not elaborated upon in the drawing). Since several even simultaneously ejected scatter munitions by virtue of the environmental influences land on the ground only after in any event slightly different times, particularly since the timing generator 15 in circuitry respects does not have to be designed for delivery of a stabilised counting impulse frequency 17, a batch of delivered scatter munition after landing on the ground displays in practice a random distribution of the instantaneous counting end positions of the individual counters 16, without any kind of circuitry expenditure for the enforcing of a random distribution being necessary. On the ground, with the appearance of the item of switch-over information 14, the counter 16 is thereupon no longer stepped-on out of the instantaneous counting position with the high-frequency counting-impulse repetition frequency 17.1, but with a by comparison very slow timing frequency

17.2, until a predetermined counting position - in the example of Fig. 1 the counter overflow signal 19 - appears. Depending on the initial position of this slow further counting (thus depending on the counting end position which has been reached with the high counting-impulse repetition frequency 17.1) it thus takes a differently long time as from appearance of the item of switch-over information 14 until, with the low counting frequency 17.2, for the first time the overflow signal 19 appears; in which respect, the greatest period of time, through the counting capacity of the counter 16 and the low counting-impulse repetition frequency 17.2, in circuitry respects is presettable, for example, to several hours or several days.

Controlled by way of a switch circuit 20 for the switch-over between a high-frequency and a low-frequency timing generator 15.1-15.2 as a function of the appearance of the item of switch-over information 14 an output gate 21 is freed, in order to deliver the detonating signal 12 as soon as, after appearance of the item of switch-over information 14, the overflow signal 19 occurs.

Contrary to the simplified representation in the drawing separate timing generators 15.1 and 15.2 do not need to be provided in order to ensure, on the one hand, the quasi-random counting end position within the counting capacity of the counter 16 upon appearance of the item of switch-over information 14 and, on the other hand, after that the slow stepping-on until the issuance of the detonating signal 12. Instead e.g. also the items of information 13/14 can be applied directly or by way of a switch circuit 20 to a timing generator 15 for the internal change-over of its frequency-determining circuit.

The circuit arrangement in accordance with Fig. 2 is based on the same operating principle as that in accordance with Fig. 1, insofar as a rapidly controlled cyclical counter 16 is counted through repeatedly between the appearance of an item of start information 13 and an item of switch-over information 14, in order then to halt in a random counting position within the entire available counting volume and thereby to define the individual period of time until the triggering of a detonating signal 12. To simplify the representation of a circuitry exemplified embodiment, again two timing generators 15.1, 15.2 are provided, between which as a function of the consecutive control of the switch circuit 20 a change-over is effected. As from appearance of the item of switch-over information 14, the until then rapidly cyclically counted-through counter 16.1 is controlled with counting impulses 17.2 of low pulse repetition frequency, which are supplied by a now additional counter 16.2, which for its part (in the exemplified instance shown, from the timing generator 15.2) is cyclically counted through and in each case at the end of its counting capacity issues a counting impulse 17.2. Depending on the counting capacity of this additional counter 16.2, the counting-up of the first counter 16.1 out of the stop position until the triggering of the detonating signal 12 is now thus effected over a period

of time which is dimensionable in a very long manner: in which respect, independently of the reaching of the counting end position in the first counter 16.1 (thus even when a counting step should still be lacking), previously at any rate at once time at the second counter 16.2 a number of temporally mutually definedly offset control signals 22 can be tapped off. In this way it is ensured that only after the appearance of the item of switch-over information 14, but already prior to the generation of the detonating signal 12, specific auxiliary functions such as an arming by electrical triggering of a pyrotechnical force element take their course. The counter 16.2 is first of all set (by a reset mechanism not shown in more detail) into an initial position. When the stop position of the first counter 16.1 is more than one counting step removed from the counting end position, the then additionally pre-connected further counter 16.2 is indeed repeatedly run through cyclically; in practice, however, it is not disturbing that then the sequence of the control signals 22 occurs repeatedly one after the other, because, for example, a once ignited pyrotechnical force element cannot be controlled for a second time or a for the first time effected control of an electronic circuit can after that be detached and locked at the control side by way of a flip-flop circuit. In any event, it is thus superfluous, for the course of specific procedures between, for example, the impact of a submunition on the ground and the control of its warhead, to incorporate an additional time control circuit and to start it from a detector circuit to be realised separately - such additional functions can be integrated in a functionally extremely reliable manner and without special additional circuitry expenditure into the circuit of the random time fuze.



PATENT CLAIMS

1. A random time fuze (11) for unforeseeably detonating scatter munition (10) which is initiatable by an electrical detonating signal (12), characterised in that a cyclical counter (16; 16.1) having a restricted counting capacity which is cyclically run through very frequently is provided, which is acted upon with counting impulses (17.1) as a function of a period of time which expires upon the delivery of the scatter munition (10), and in that upon the appearance of an item of switch-over information (14) further counting is effected from the counting end position instantaneously achieved in the cyclical counter (16; 16.1) as far as a preset triggering counting position for the issuance of the detonating signal (12).

2. A time fuze according to claim 1, characterised in that prior to the appearance of the item of switch-over information (14) counting is effected with counting impulses (17.1) of higher pulse repetition frequency than after the appearance of the item of switch-over information (14).

3. A time fuze according to claim 1 or 2, characterised in that after the appearance of the item of switch-over information (14) a larger counting capacity is effective than prior to the appearance of the item of switch-over information (14).

4. A time fuze according to claim 3, characterised in that the cyclical counter (16.1) is connected together with a further counter (16.2), effective as a function of the appearance of the item of switch-over information (14), for the issuance of low-frequency counting impulses (17.2) to the first counter (16.1).

5. A time fuze according to claim 4, characterised in that temporally mutually offset control signals (22), more especially for an arming programme course circuit, are tapped from the further counter (16.2).

6. A time fuze according to one of the preceding claims, characterised in that at least one R-C-oscillator circuit of two consecutive inverter stages of a cyclical counter (16; 16.1, 16.2) is provided as the timing generator (15; 15.1, 15.2).