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5 **OERLIKON CONTRAVES AG, Birchstrasse 155, 8050 Zürich, Switzerland**

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Case 00-OC091/SG
SINGAPUR

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INTERROGATION AND RESPONDER SYSTEM

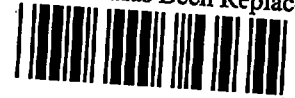
FIELD OF THE INVENTION

The invention relates to an interrogation and responder system.

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BACKGROUND OF THE INVENTION

A laser identification/simulation system with a laser device for identifying a responder device is known from European Patent Application **97 120818.6**
30 (Publication No. EP **0 859 243 A1**). The laser device is designed for transmitting a coded laser beam, wherein the responder device has sensor means for detecting the laser beam and for converting it into electrical signals, which are passed on to an evaluation unit, as well as transmitting means for returning messages in accordance with decisions made in the evaluation unit to receiving means located
35 inside or outside of the interrogation system. This interrogation system is designed to send a tight directional laser beam and contains chopping means for sending out a laser beam which is not only coded, but also chopped with a predetermined frequency. The sensor means of the responder device include means for obtaining an electrical signal from the received chopped laser beam,



which is supplied to a pre- amplifier, which is connected upstream of the discriminator.

Such a system is mounted in weapons which are normally used by soldiers, wherein all participants in an exercise, both persons and objects, can be equipped with detectors, which register a possible weapons effect on the participant. The functioning of such known systems represents the basis of a friend-foe identification system (IFF), which can also be used in accordance with the present invention.

OBJECT AND SUMMARY OF THE INVENTION

It is now the object of the present invention to create a further system of this type, which avoids or reduces the disadvantages of known systems.

In accordance with the invention, this object is advantageously attained by means of a system in accordance with claim 1.

Further advantageous embodiments of the invention ensue from the further dependent claims.

The invention will be explained in greater detail in what follows by means of different drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a schematic representation of a transmitting device (interrogation system) in accordance with the invention,

Fig. 2 shows a schematic representation of a receiving device (responder device) in accordance with the invention,

Fig. 3 represents a diagram for explaining the information signals used.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The interrogation system **10** in accordance with **Fig. 1** comprises a circuit **11**, which can be mounted on a weapon and which has an antenna **12**, which can be integrated into the circuit **11**, and a modulator **13**, to which at least one terminal **14**, as well as a central unit **15** can be connected. The terminal **14** is, for example, provided with a keyboard and/or a display and/or a microphone and/or a headset, etc. The circuit **11**, which is designed as an active transmitter, can generate



single pulses or short bursts of pulses (for example by means of an oscillator), which are very short but nevertheless have relatively large energy. Receiving means **16, 17** are connected to the central unit **15** of the interrogation system **10**, which are located inside or outside of the actual interrogation system **10**. The receiving means **16, 17**, which can also be connected to one of the mentioned terminals **14** and/or also to other terminals, comprise a receiver device **16** and an antenna or a sensor **17**, for example. In place of the structure represented in Fig. 1, the interrogation system **10** can have a communications bus, for example.

The responder system **20** in accordance with Fig. 2 comprises a circuit **21** with an antenna **22**, which can be integrated into the circuit **21**. The responder system **20** can contain a demodulator or evaluation unit **23**, for example, for evaluating the received electromagnetic waves, to which at least one terminal **24** and a central unit **25** are connected. The terminal **24** can be provided, for example, with a display and/or a headset and/or a microphone. The circuit **21**, which is designed as a receiver, can for example comprise a detector and, if required, an amplifier, which process pulses or bursts of pulses received by the antenna **22**. Transmitting means **26, 27** are connected to the central unit **25** for returning messages in accordance with decisions made in the evaluation unit to receiving means **16, 17** (Fig. 1) of the interrogation system. The transmitting means **26, 27**, which can also be located inside or outside of the actual responder system **20**, for example comprise a transmitting device **26** and a transmitting antenna **27**.

The system in accordance with the invention now functions as follows:

The persons and objects (tanks, etc.) participating in an exercise can carry at least one receiver **21, 22**, preferably with the aid of a harness system in accordance with European Patent Applications EP 0 859 243 A1 and/or EP 0 836 068 A1 and/or EP 0 836 069 A1. Incidentally, the subject of the present invention can comprise all means mentioned in the above patent applications for carrying out all functions known from these patent applications in the same or similar manner.

Three pulses **31, 32, 33** on the order of picoseconds are represented in Fig. 3 by way of example. This corresponds to an oscillation frequency of 10 to 1000 GHz and a wave length of 30 to 0.3 mm. Since, because of this, the required antenna **12** need only have relatively small dimensions, it can be designed in such a way that it can be mounted on the weapon. Moreover, if desired, the antenna **12**, together with an oscillator, can be integrated in the circuit **11**. Signals delivered from a terminal **14** cause a modulation and/or a coding in the modulator **13** of the control signals for the oscillator in such a way, that the pulses **31, 32, 33**

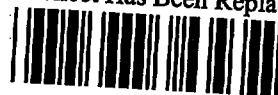
are triggered at different intervals. Thus, these pulses contain the information to be transmitted. With an appropriate shaping of the antenna 12 it is possible to transmit the pulses 31, 32, 33 in a directed, or respectively directional manner. The manner of transmission employed here is also known as ultra-wide spread spectrum transmission. It has been found that this type of transmission has various properties, which make the advantageous realization of the systems in accordance with the invention possible. Such systems can be constructed to be small and energy- saving. With this type of communications it is also possible to determine the distance to the target (responder device). A further important advantage is that the communications principle employed here is difficult to detect for third parties.

The radiation characteristics of the interrogation system 10 can be directed as desired by means of a suitable antenna 12. With an appropriate antenna 12 it is possible to achieve an angle of the radiated lobe of up to 30 mrad. The layout and the dimensioning of antennas is sufficiently known to one skilled in the art.

The pulses 31, 32, 33 received via the antenna 22 in the receiver 21 are detected and preferably also amplified. It is then possible to generate from the detected pulses 31, 32, 33 information pulses 37, 38, 39 (for example in rectangular form), which can easily be much longer than the pulses 31, 32, 33, and can also be chronologically displaced. Information provided in coded form by means of the different spacing d1, d2 between the individual pulses 37, 38, 39 is deciphered in the demodulator 23 and is provided in a suitable electrical form to at least one of the terminals 24, 25. The responder system 20 can be designed, for example, for radiating response signals and/or echo signals via the transmitting means 26, 27, which can be received by the sensor means 11, 12 of the interrogation system 10. A distance measurement between the interrogation system 10 and the responder system 20 is made possible by this. This means that the marksman performing the interrogation can even measure the distance to his target (the responder system 20). This has the advantage that, in case two objects located behind each other are illuminated, the soldier has the additional possibility of estimating which signal is more realistic.

In place of individual pulses 31, 32, 33 it is also possible to transmit bursts of pulses which, if necessary, are damped and/or harmonic and/or inharmonic, for the purpose of interrogation.

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WHAT IS CLAIMED IS:

1. An interrogation system containing a transmitting device (10) for the
5 interrogation of a responder device (20), and receiving means (16, 17), wherein
the transmitting device (10) is designed in such a way that modulated and/or
coded electromagnetic radiation (31, 32, 33) can be transmitted, that the
transmitting device (10) is located inside or outside of the transmitting device (10),
and wherein the responder device has sensor means (21, 22) for receiving this
10 radiation and for converting it into electrical signals (34, 35, 36), an evaluation unit
(23) for processing the electrical signals (34, 35, 36), as well as transmitting
means (26, 27) in order to return, in accordance with a decision made by the
evaluation unit (23), a reply signal to the receiving means (16, 17), characterized
in that the transmitting device (10) contains a control circuit (11) and an antenna
15 (12) which are designed in such a way that individual electromagnetic pulses (31,
32, 33), or short bursts of pulses, can be generated in the giga-frequency range,
which are radiated by the antenna (12) in a chronologically modulated and
directional manner.
- 20 2. The interrogation system in accordance with claim 1, characterized in that
the control circuit (11) and the antenna (12) are placed into a housing, which is
designed for being mounted on a weapon.
3. The interrogation system in accordance with claim 1 or 2, characterized in
25 that the antenna (12) is integrated into the control circuit (11).
4. The interrogation system in accordance with one of claims 1 to 3, characterized
in that the frequency of the pulses (31, 32, 33) transmitted by the transmitting
device (10) has a value, by means of which, using the antenna (12), a strongly
30 directional radiating characteristic with an angle of the radiated lobe below 50
mrad, preferably 30 mrad, is achieved.
5. The interrogation system in accordance with one of claims 1 to 4,
characterized in that the modulation frequency of the transmitting device (10) lies
35 in the range between 10 and 1000 GHz, or 100 to 1000 GHz.
6. The interrogation system in accordance with one of claims 1 to 5,
characterized in that the sensor means (21, 22) of the responder device (20) are



designed to transmit response signals, which can be received by the transmitting device (10) in order to also make possible a distance measurement between the transmitting device (10) and the responder device (20) in a central unit (15) of the transmitting device (10).

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7. The interrogation system in accordance with one of claims 1 to 6, characterized in that at least the sensor means (21, 22) of the responder device (20) are designed to be received in a portable harness system.

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8. The interrogation system in accordance with one of claims 1 to 7, characterized in that it can be integrated into a weapon, preferably a portable firearm, or can be mounted on such.

9. A system with

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- an interrogation system containing a transmitting device (10) for the interrogation of a responder device (20) and receiving means (16, 17), wherein the transmitting device (10) is designed in such a way that modulated and/or coded electromagnetic radiation (31, 32, 33) can be transmitted, and with

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- a responder device (20), which has sensor means (21, 22) for receiving this radiation and for converting it into electrical signals (34, 35, 36), an evaluation unit (23) for processing the electrical signals (34, 35, 36), as well as transmitting means (26, 27) in order to return, in accordance with a decision made by the evaluation unit (23), a reply signal to the receiving means (16, 17),

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characterized in that the transmitting device (10) contains a control circuit (11) and an antenna (12) which are designed in such a way that individual electromagnetic pulses (31, 32, 33), or short bursts of pulses, can be generated in the giga-frequency range, which are radiated by the antenna (12) chronologically modulated and directionally.