

INTERROGATION AND RESPONDER SYSTEM

FIELD OF THE INVENTION

The invention relates to an interrogation and responder system.

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** (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 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 an interrogation system in accordance with the invention,

Fig. 2 shows a schematic representation of a responder system 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 transmitter 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 receiver 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 demodulator or evaluation unit **23** 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 interrogation and responder systems (**10, 20**) 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 (including receiver circuit **21**, and antenna **22**), preferably with the aid of a harness system in accordance with European Patent Applications EP 0 859 243 AI and/or EP 0 836 068 AI and/or EP 0 836 069 AI. 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 circuit **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 d_1, d_2 between the individual pulses **37, 38, 39** is deciphered in the demodulator or evaluation unit **23** and is provided in a suitable electrical form to at least either one of the terminal **24** or central unit **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 antenna or sensor **17** and receiver device **16** 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.

WHAT IS CLAIMED IS:

1. A communication system (10, 20) for use with a hand-held weapon, using ultra-wide spread spectrum transmission, comprising a hand-held weapon, an interrogation system (10) and a responder system (20), wherein
 - the interrogation system (10) comprises
 - a circuit (11) having
 - a transmitting antenna (12) for transmitting pulses (31, 32, 33) in a directional manner ,
 - a modulator (13),
 - a terminal (14),
 - being connected to the modulator (13),
 - a receiver device (16) of receiving means (16, 17),
 - a sensor (17) of the receiving means (16, 17), wherein
 - the receiving means (16, 17) are connected to the central unit (15), the interrogation system (10) being adapted
 - to transmit an inquiry to the responder system (20) in the form of directionally specific single electromagnetic pulses or short bursts of electromagnetic pulses which are staggered with different distances between said pulses or short bursts of pulses, in order to transmit coded information, and being adapted to
 - to receive a response from said responder system (20),
 - the responder system (20) comprises
 - a circuit (21) having
 - an receiving antenna (22),
 - a demodulator or evaluation unit (23),
 - a terminal (24) and
 - a central unit (25), the terminal (24) and the central unit (25) being connected to the demodulator or evaluation unit (23),
 - a transmitting device (26) of transmitting means (26, 27),
 - a transmitting antenna (27) of the transmitting means (26, 27), the responder system (20) being adapted
 - to detect said electromagnetic pulses or short bursts of electromagnetic pulses transmitted by the interrogation system (10) and
 - to send back said response to the interrogation system (20).

2. The interrogation/responder system in accordance with claim 1, wherein the transmitter circuit (11) and the transmitter antenna (12) of the interrogation system (10) are placed in a housing which is designed for being mounted on a weapon.

3. The interrogation/responder system in accordance with claim 1 or 2, wherein the transmitter antenna (12) of the interrogation system (10) is integrated in the transmitter circuit (11).

4. The interrogation/responder system in accordance with any one of claims 1 to 3, wherein the frequency of the pulses (31, 32, 33) transmitted by the interrogation system (10) has a value by means of which, using the transmitter antenna (12) of the interrogation system (10), a strongly directional radiating characteristic with a radiated lobe having an angle below 50 mrad, preferably 30 mrad, is achieved.

5. The interrogation/responder system in accordance with any one of claims 1 to 4, wherein the pulses transmitted by the interrogation system (10) have a modulation frequency which lies in the range between 10 and 1000 GHz, or 100 to 1000 GHz.

6. The interrogation/responder system in accordance with any one of claims 1 to 5, wherein the transmitter device (26) and the transmitter antenna (27) of the responder system (20) are designed to transmit response signals which can be received by the interrogation system (10) in order to also make possible a distance measurement between the interrogation system (10) and the responder system (20) in the central unit (15) of the interrogation system (10).

7. The interrogation/responder system in accordance with any one of claims 1 to 6, wherein at least the receiver circuit (21) and the receiver antenna (22) of the responder system (20) are designed to be carried in a portable harness system.

8. The interrogation/responder system (10, 20) in accordance with any one of claims 1 to 7, wherein the interrogation system (10) can be integrated in a weapon, preferably a portable firearm, or can be mounted on such.