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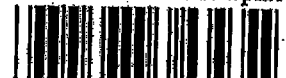
Harness System for Identification Purposes

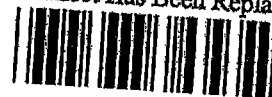
The present invention relates to a harness system for identification purposes, having at least two harnesses.

A harness system for combat purposes is known from **EP 0 836 069 A1**, having a plurality of elements, such as light detectors, a laser transmitter and a control unit. This system comprises several harnesses provided with electric components, which exchange information signals with a central unit by means of ultrasound or radio, and it is the object of the present invention to improve such a system.

This object is attained in an advantageous manner by a harness system in accordance with claim 1.

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

The invention will be explained in greater detail by way of example in what follows, making reference to the drawings. Shown are in:

Fig. 1, a schematic representation of a total harness system in accordance with the invention,

Figs. 2 to 4, various harness arrangements of such a harness system,

Fig. 5, a schematic representation of a helmet harness for this harness system,

Fig. 6, a simplified representation of a mask,

Fig. 7, a sketch for explaining the functioning of the detectors of such a system,

Fig. 8, several detectors, linked in accordance with the invention,

Fig. 9, a schematic representation of snap fasteners and amplifiers connected therewith, and

Fig. 10, or respectively **11**, a snap fastener head, or respectively snap fastener cover, mounted on a harness.

The harness system in accordance with **Fig. 1** comprises various harness arrangements, such as body harnesses, arm harnesses, leg harnesses and/or a head or helmet harness for a soldier. The human body **1** is divided into several regions for this purpose. Twelve visible regions **11**, **12**, **13**, ... **23** are represented in **Fig. 1**. However, up to sixteen regions are preferably used. These harness arrangements, which are releasably connected with each other by complementary connecting elements, preferably by snap fasteners, are equipped



with light detectors, which provide electric signals to a central unit. Such a system can also comprise further harness arrangements, not represented in Fig. 1, as well as an electrical control unit, also called tracking unit or SimCity. The system also comprises a transmitting/receiving unit or communications unit 25, also called master unit, which could possibly also be only a transmitter unit.

Fig. 2 shows a harness arrangement having not only harnesses designed in a strip-shape, but also one-piece branched harnesses. For example, two longitudinal harnesses 33, 34, which are permanently connected with transverse harnesses 31, 32 in corner sections, are represented in Fig. 2, which in this way form a large opening 35, through which a soldier can insert his head and neck. In this case, the longitudinal harnesses 33, 34 are shoulder harnesses, and the transverse harnesses a chest harness 32, or respectively a back harness 31. A small housing 36 for a central unit and/or for batteries is mounted in the transverse harness 31. A plurality of detectors 37 and groups of respectively two snap fasteners 38, 39, 40, 41, 42 and 43 are mounted on the longitudinal harnesses and transverse harnesses.

A loin harness 44 and an abdominal harness 45 are also represented in Fig. 2. The ends of the loin harness 44 can be connected with the aid of snap fasteners 46 and 47 with the snap fasteners 43, or respectively 42, of the longitudinal harnesses. The abdominal harness 45 can also have snap fasteners which permit it to be connected to the longitudinal harnesses. Such snap fasteners consist, for example, of a pressure part and a hollow part. These parts are also called head, or respectively cover. In accordance with the present invention, they are not only used for the mechanical fastening of the various harnesses, or respectively belts, to each other, but also for providing electrically conductive contacts for various signals, so that they are employed in pairs in accordance with the electric positive or negative poles. Groups of respectively four snap fasteners 48, 49, 50 and 51 are also arranged on the longitudinal harnesses and the transverse harnesses.

Without a loin harness 44, the harness arrangement in accordance with Fig. 2 represents the minimal equipment of a harness system for training purposes, so to speak. Thus, a harness system comprises at least two harness arrangements, or respectively at least two harnesses.

Fig. 3 shows a simple harness arrangement 52, consisting of an upper arm and a thigh



harness, and an optional additional harness 53.

Fig. 4 shows a lower leg or forearm harness 54 and an optional additional harness 55. The harnesses in Figs. 3 and 4 are respectively embodied to be T-shaped with a longitudinal harness and a transverse harness, which are provided with a so-called Velcro connector 56, or respectively 57. Some harnesses in Figs. 2, 3 and 4 have at least one intermediate piece 58, 59, or respectively 60, 61, made of an elastic, or respectively stretchable material, for improved adaptation to the anatomical dimensions of the soldier. The harness in Fig. 3 has four upper snap fastener heads 62 and two lower snap fastener covers 63. In contrast to this, the harness in Fig. 4 only has two upper snap fastener heads 64.

The helmet or mask harness 65 represented in Fig. 5 has, for example, a Velcro connector 66, two stretchable intermediate pieces 67, two pairs of snap fasteners 68, an electronic unit 69 and a plurality of detectors 70. This harness can be used, for example, together with a mask 72 in accordance with Fig. 6 having a plurality of detectors 71.

Fig. 7 partially shows a detector 73 in section, which has four photodiodes 74, for example, only one of which is represented in the drawing. A laser shot 75 hitting the clothing 76 of the soldier, is reflected in all directions 77, 78, 79 on the surface of the clothing, so that a reflected, but weak, laser beam 79 reaches the photodiode 74 through the wall of the detector 73, which is transparent to this radiation, and which detects the radiation. Direct beams 80 can also be detected by the photodiode 74.

The photodiodes located in the detectors 81, 82, 83 in Fig. 8 are connected in parallel. The connection between the detectors, for example between the detectors 82 and 83, is preferably provided by means of cables 84, which have a central lead 85 and a conducting shielding 86. The last sensor 83 of a chain is preferably connected by means of such a cable with a miniaturized amplifier circuit 87, which can include a digital converter 88, for example a Schmitt trigger, or a simple comparator, for providing a defined output signal S1 to an ASIC (Application-Specific Integrated Circuit) 89 located, for example, in a small print plate 90, wherein P1 is the supply voltage and G the ground.

Fig. 9 shows an end 91 of a harness with four snap fastener heads and/or covers 92, 93, 94, 95, to which two miniaturized amplifier circuits 96, or respectively 97, have been connected in pairs. During operation, a signal, for example from the harness arrangement in Fig. 4, reaches the amplifier circuit 96, which is provided with power through a cable P2, via the direct connection between the snap fasteners 64 and 63 and via cables which, in the



harness arrangement in Fig. 3, connect the snap fasteners 63 with two of the snap fasteners 62, and via the connection between the latter and the snap fasteners 92, 93 (Fig. 9). In this case a signal generated by the detectors of the harness arrangement in Fig. 3 reaches the amplifier circuit 97, which is provided with power through a cable P3, via the direct connection between the two other snap fasteners 62 and the snap fasteners 94, 95 connected with them. The amplified signals S2 and S3 from the amplifier circuits 96, or respectively 97, are fed to the ASIC of the print plate 90, or to another evaluating unit, for example.

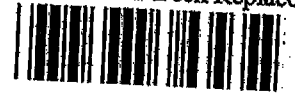
Fig. 10 shows a snap fastener head 102 mounted on the outside of a harness 101, having a rivet 103 protruding from the inside of the harness 101, with which an end 104 of a cable 105 is electrically connected. With snap fasteners such as the pair 64 in Fig. 4, the one end of the cable 104 as the central lead is connected with the one snap fastener, and as the other end the sheathing of the cable 104 is connected with the other snap fastener. The rivet 103 is separated by an insulation 106, which can be a thin foil made of metal, aluminum, copper or a copper alloy, from the shielding 107.

Fig. 11 shows a snap fastener cover 112, mounted on the outside of a harness 111 and having a rivet 113 projecting from the inside of the harness 111, with which one end 114 of a cable 115 is electrically connected. The rivet 113 is protected by an insulation 116 and is shielded by the shielding 117. The shieldings 107 and 117 are large enough so that they shield the area where several cooperating snap fasteners are located. The snap fastener cover 112 has a spring 118, which stabilizes the mechanical connection between the head and cover and at the same time assures an electrical contact.

The system of the invention in accordance with Figs. 1 to 11 functions as follows:

All detectors of a defined region or zone, such as represented in Fig. 4 by way of example, are interconnected in such a way that a signal appears at the two snap fastener heads 64, even if only one of the detectors of the zone detects a laser beam. By means of this it can be determined whether a defined body zone of the soldier was hit by a laser beam. During operation, the snap fastener heads 64 are pressed into the snap fastener covers 63, or vice versa, so that the mentioned electrical signal reaches the central unit 90 or 36 through two of the snap fastener heads 62 and via two of the snap fastener covers 51. In this way signals from the various zones can be identified and evaluated in the central unit.

Corresponding information can be stored in the central unit or can be passed on from there to a central or command station, for example via radio. The shieldings 107 and 117



protect the circuit against the effects of electromagnetic waves, which could induce interference voltages.

In accordance with another embodiment of the invention, the information stored in the central unit can be transmitted electro- magnetically Sm (Fig. 8) or by means of ultrasound Su to the transmitting/receiving unit 25, and transmitted from there to the central or command station.

In accordance with another embodiment of the invention, each zone can have its own sub-unit, for example in the form of a chip, in such a way that, if all sub-units are connected to a common bus via the snap fasteners, protocolled signals from the sub-units reach the central unit and, if desired, via the latter the transmitting/receiving unit.

The ASIC is preferably constructed in such a way that it understands the following codes: combat-simlas, basic miles, standard miles PID (Player Identification Code) and enhanced miles PID.

The various elements used, which need not be visible like the detectors, are miniaturized and hidden in covers with which the harnesses are provided in order to protect these elements and/or to fasten them together with the harnesses. In actual use, only the battery housing will be visible.

A GPS (Global Positioning System) can be integrated into the transmitting/receiving unit.

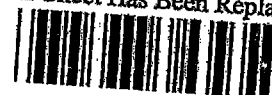
In a further embodiment of the invention the amplifier circuits 87 can be designed in such a way that they can amplify very weak signals resulting from indirect laser beams 75 which are modulated with pulses, for which the amplifier circuits have a particularly high amplification factor, for example by means of a resonance effect.

Narrow laser beams (75) are preferably employed, which therefore can only touch a small area of the target object. This results in an improved accuracy of the impact point over the use of wider laser beams. To increase this accuracy, the harness system can have means for separately processing the signals from different detectors or groups of detectors, which detect a laser beam simultaneously, and one of the central units 90 or 36 can include a microprocessor or a microprocessor function for calculating the geometric center of the position of the various detectors or groups of detectors, or respectively sensors, from these signals, because it can be assumed that this center approximately coincides with the impact point of the narrow laser beam 75.

**WHAT IS CLAIMED IS:**

1. A harness system for identification purposes, having at least two harnesses, characterized in that the harnesses (101, 111) have portions, which are connected to electrical conductors (105, 115), of complementary connecting elements (102, 112) in order to connect the harnesses mechanically with each other and simultaneously to make connections between electronic components fastened on the harnesses by means of the conductors.
2. The harness system in accordance with claim 1, characterized in that at least one harness is an element of a harness arrangement.
3. The harness system in accordance with claim 1 or 2, characterized in that the connecting elements are snap fasteners with respectively one head element (102) and one hollow element (112).
4. The harness system in accordance with one of claims 1 to 3, characterized in that an electronic central unit (90, 36) is mounted on a central harness (31) or a central harness arrangement (31, 32, 33, 34), which is connected by means of electrical conductors (105) placed in the harness system with at least two portions (51) of connecting elements, and that detectors sensitive to laser light, which are connected via installed electrical conductors (115) with complementary elements (52) of these connecting elements, are mounted on a harness or a harness arrangement in order to feed signals from these detectors through these installed electrical conductors directly to the central unit (90, 36).
5. The harness system in accordance with claim 4, characterized in that the central unit (90, 36) mounted in the central harness or in the central harness arrangement is connected via installed electrical conductors with additional portions of connecting elements (51) in order to feed signals from detectors of a second harness or a second harness arrangement (54) via electrical conductors installed in the first harness or in the first harness arrangement (52) and via further connecting element (63, 62) to the central unit.

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6. The harness system in accordance with one of claims 1 to 5, characterized in that the electrical conductors (84) are realized as shielded cables or wires or flexible cords, or in the form of shielded busses.

7. The harness system in accordance with one of claims 1 to 6, characterized in that it comprises harnesses or harness arrangements in such a way that the harness system can be worn by a human being after all provided connecting elements (102, 112) have been closed.

8. The harness system in accordance with claim 7, characterized in that each harness or each harness arrangement is provided with detectors (81, 82, 83) in such a way that by means of this a predetermined zone of the human body can be monitored for impinging laser radiation (75, 80).

9. The harness system in accordance with one of claims 4 to 8, characterized in that the detectors (73) have a housing with at least one part which is transparent to laser radiation (75, 80), and that they comprise at least two photodiodes (74), which are sensitive to this radiation.

10. The harness system in accordance with one of claims 1 to 9, characterized in that some harnesses have elastic intermediate pieces (58, 59, 60, 61), into which flexible and/or stretchably arranged electrical conductors have be placed.

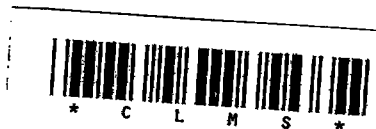
11. The harness system in accordance with one of claims 1 to 9, characterized in that several connecting elements (51, 52, 64) are commonly shielded.

12. The harness system in accordance with one of claims 1 to 11, characterized in that amplifier circuits (87) are provided which have a particularly high amplification factor for electrical signals resulting from indirect laser beams (75).

13. The harness system in accordance with claim 12, characterized in that this high

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amplification factor results from a resonance effect of the amplifier circuits (87) in connection with an optical modulation of the laser radiation (75).

14. The harness system in accordance with one of claims 1 to 14, characterized in that means are provided for separately processing signals from different detectors or groups of detectors, which simultaneously detect a laser beam, and that a central unit (90, 36) is provided, which includes a microprocessor or a microprocessor function in order to calculate the geometric center of the position of the various detectors or groups of detectors from these signals.

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