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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**.

-2.-

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

-3.-

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

-4.-

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

-5.-

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**

-6.-

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**.

-7.-

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, wherein the connecting elements are snap fasteners with respectively one head element (**102**) and one hollow element (**112**).
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 one of claims **1** to **2**,
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**).

-8.-

4. The harness system in accordance with claim 3,
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.
5. The harness system in accordance with one of claims 1 to 4,
characterized in that
the electrical conductors (84) are realized as shielded cables or wires or flexible cords, or in the form of shielded busses.
6. The harness system in accordance with one of claims 1 to 5,
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.
7. The harness system in accordance with claim 6,
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.-

8. The harness system in accordance with one of claims **3** to **7**,
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.
9. The harness system in accordance with one of claims **1** to **8**,
characterized in that
some harnesses have elastic intermediate pieces (**58, 59, 60, 61**), into which flexible and/or stretchably arranged electrical conductors have been placed.
10. The harness system in accordance with one of claims **1** to **8**,
characterized in that
several connecting elements (**51, 52, 64**) are commonly shielded.
11. The harness system in accordance with one of claims **1** to **10**,
characterized in that
amplifier circuits (**87**) are provided which have a particularly high amplification factor for electrical signals resulting from indirect laser beams (**75**).
12. The harness system in accordance with claim **11**,
characterized in that
this high amplification factor results from a resonance effect of the amplifier circuits (**87**) in connection with an optical modulation of the laser radiation (**75**).

-10.-

- 13.** The harness system in accordance with one of claims **1** to **12**,
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.