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(54) Impact measuring target/ergometer for contact sports

(57) An impact measuring target/ergometer includes a mannequin 20 which has an upper portion 22 representative of a person's head, a narrower portion 24 representative of a person's neck and a lower portion 26 representative of a person's torso. The mannequin 20 is provided with twelve impact zones numbered 1 to 12, which are each oriented at specific angles intended to replicate the angles of received punches or other hits from a user from different directions. The mannequin 20 is intended to be fixed to a wall 28 or similar immovable structure and for this purpose is provided with suitable securing means. Within the mannequin 20 there is provided one or more accelerometers 38 intended to obtain a measure of an impacting force on the mannequin 20. The signal from the accelerometer(s) can then be processed to obtain an indication of the force of an impact and of the direction of impact. The mannequin may represent any one of more parts of a target intended to be hit.

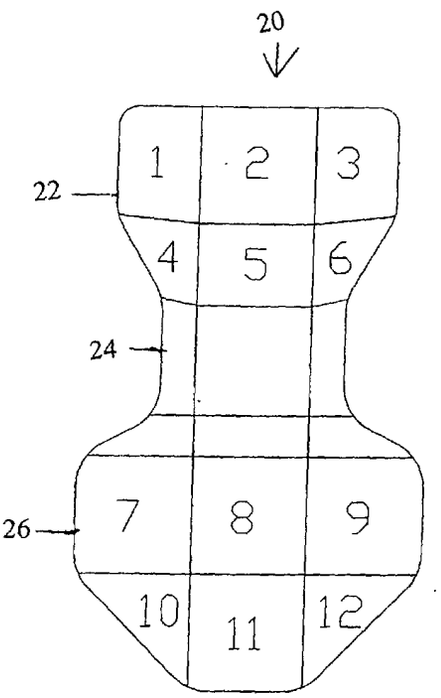

FIGURE 2

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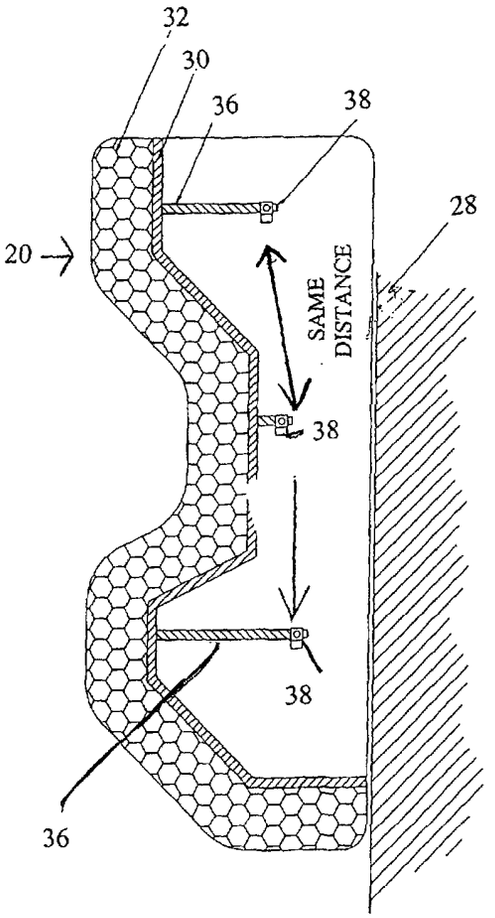

FIGURE 4

Description

[0001] The present invention relates to a system for measuring impacting forces, such as those produced in contact sports.

[0002] Within the world of contact sports (for example boxing and martial arts), there is a need to be able to quantify the impacts associated with these activities. The two main reasons for being able to do so are, first, as an aid to analysing and rating athletic performance and, secondly, to investigate safety issues within these activities and related objects.

[0003] Equipment exists which seeks to provide such measurements. Such equipment typically falls into one of two groups, the first being pendulum type "punch bags" and the second being stationary "pads".

[0004] "Punch bags" fail to offer a quantifiable method of measuring force since their swinging movement absorbs some of the impact and they may rely on water mass transfer or the raising of weights to deduce the magnitude of the impact. They are also of limited use when a sequence of impacts is to be measured because they take too long to return to their starting position. On the other hand stationary "pads" attempt to record the energy of the impact, or its force, through a system of energy transfer of measurement in a uniaxial nature. Both types of equipment fail to provide apparatus which can appropriately measure force applicable to a dynamic activity.

[0005] Within sport, such as boxing, there are three major types of punch which can be delivered to either the head or torso regions (e.g. straight, hook and uppercut), addressed to the left, right or centre of an opponent. The present invention seeks to provide a system which can quantify such types of impact.

[0006] The present invention seeks to provide a system which can quantify impacts.

[0007] According to an aspect of the present invention, there is provided a system for obtaining a measure of an impact as specified in claim 1.

[0008] The transducer means is preferably able to detect one or more of uniaxial, biaxial and triaxial impacts. Advantageously, the transducer means includes at least one accelerometer.

[0009] The structure is preferably in the form of a mannequin. The mannequin is preferably provided with a plurality of facets for receiving impacts from different directions.

[0010] There is preferably provided a covering over the substantially rigid structure for user protection purposes. The covering preferably damps impacts in a measurable manner. This may be achieved, for example, by choice of material for the covering, by the thickness of the covering and so on. The covering preferably has a recovery time suitably short to allow the monitoring of repeated dynamic human derived impacts on the structure.

[0011] The covering may be a solid structure or a composite structure, the latter preferably having an outer surface textural interface covering a rigid shell, possibly with an internal infrastructure.

[0012] Embodiments of the present invention are described below, by way of example only, with reference to the accompanying drawings, in which:

Figures 1 to 3 are, respectively, right side, front and left side elevational views of a preferred embodiment of impact receiving mannequin;

Figure 4 is right side elevational view in partial cross-section of the embodiment of mannequin of Figures 1 to 3; and

Figure 5 is a front elevational view of the mannequin of Figures 1 to 4 showing in dotted outline a central spine and radial spars.

[0013] Referring to Figures 1 to 3, the embodiment of structure shown is in the form of a mannequin 20 which has an upper portion 22 representative of a person's head, a narrower portion 24 representative of a person's neck and a lower portion 26 representative of a person's torso. The mannequin 20 is provided with, in this embodiment, twelve impact zones numbered 1 to 12, which are each oriented at specific angles intended to replicate the angles of received punches or other hits from a user from different directions.

[0014] The shape of the mannequin, the number and orientation of zones can be chosen in dependence upon the particular application to which the device is intended to be used, for example the type of impacts to the detected and measured.

[0015] Referring now also to Figure 4, the mannequin 20 is intended to be fixed to a wall 28 or similar immovable structure and for this purpose is provided with suitable securing means (not shown). These means may provide for the mannequin 20 to be removable from the wall for transportation purposes.

[0016] As can be seen in Figure 4, this embodiment of mannequin 20 is hollow and is formed of a substantially rigid shell 30 having a shape which provides the contact zones 1 to 12. Overlying the shell 30 is a covering layer 32 which is intended to dampen impacts to the shell 30 to reduce the possibility of injury to a person hitting the mannequin 20. The covering 32 is preferably of a type and structure which does not immeasurably affect the measurements of impacts, the specific materials and characteristics being readily selectable by the skilled person.

[0017] Within the cavity formed by the shell 30 there are provided a central spine 34 and one of more radial spars 36, in this example three spars 36 being shown. On each spar 36 there is shown provided a transducer, in this example accelerometers 38. The spars 36 are dimensioned such that the accelerometers 38 are located at substantially the same distance from the zones 1

to 12 from which they are to take readings. The number of spars 36 and the number of transducers 38 can be chosen as desired and it is envisaged that the system could work solely with the central transducer 38.

[0018] The preferred embodiment, the rigid shell 30 has an internal connecting framework based upon a central longitudinal spinal plate (for the mounting of accelerometers at the focus of the head, torso, and midway between these two positions) and also for connecting transverse bracing plates in the head and body, and the interconnecting spars 36 from these plates to the inner surface of the rigid shell 30.

[0019] Preferably, the longitudinal spine 34 is in the form of a machined plate because the head and torso are different depths, and so the focus of the head and torso are not on a single spinal line in terms of depth from the front to the back of the mannequin 20. Hence, Figure 4 shows three possible mounting positions of the accelerometers 38, on the spars 36 from the inner surface of the rigid shell 30.

[0020] For the best measurements, it is envisaged that there should be provided one accelerometer 38 in each of the head and torso sections 22, 26, although the device could also work satisfactorily with only one accelerometer 38 located in the central position 24. Similarly, it is possible that the mannequin could be provided as only a head or a body (or an object) with a single accelerometer.

[0021] The mannequin 20 is mounted on a solid surface, as shown in Figure 4, at a height to suit the user. The accelerometer(s) 38, fixed within the mannequin 20, detect one or more of the uniaxial, biaxial and triaxial impacts. The accelerometer(s) 38 used for the preferred embodiment are of piezoelectric composition and are robust, reliable, with good repeatability and are also very stable with respect to drift, temperature and humidity. The accelerometer(s) 38 detect impacts which are transmitted to an integral, adjacent or remote electronic processor (not shown) in the form of electrical signals in proportion to the magnitude of the impacting force. These signals are processed and computed by the electronic hardware to give the operator a measure of the impact, or impacts, to be evaluated in real time or stored for review at a later date. The structure and operation of the processing system will be evident to the skilled person. In practice the calculation of the impact will be determined by vectorial profiles of the signals from the accelerometer(s).

[0022] The mannequin of the preferred embodiment has been found to address all the punch variations by means of the twelve target facets or zones 1-12 at the mannequin interface and be used as an aid in developing punch and footwork technical skills. For example, the target zones 1-12 within the head and torso 22, 26 parts of the mannequin 20 can in one plane accommodate hook punches and then in another, as the boxer moves around the device 20, accommodate straight punches. The combination of features incumbent in the detail design of this mannequin 20, such as a uniform thickness of impact damping at the interface, twelve target zones 1-12 and two accelerometers 38 rigidly fixed to the mannequin's rigid structure at the focus point of the head and torso regions, ensures that an impact to any one of the twelve zones 1-12 is detected uniformly by one of the accelerometers 38.

[0023] The preferred embodiment provides with one or more of the following features:

1) the ability to measure uniaxial, biaxial and triaxial forces;
2) a relatively short recovery time between impacts;
3) a visual and/or audio cue to stimulate a response to a set, variable or learned routine; and
4) a kinaesthetic impact interface to allow an athlete to commit totally to the impact he/she delivers.

[0024] The preferred apparatus is also intended to minimise injury to the user such that the user will not be nervous about performing the dynamic physical contact activity to his/her full ability.

[0025] The outer cover 32 may be illuminated to provide a visual cue to localised areas and may also be connected to an audio system which may provide an audio cue. The accelerometer(s) 38 and illuminated areas are preferably linked to a computer or a dedicated electronic selection and display system to provide any number of interactive or data storage/evaluation features. These may include total impact, single axis impact, vectorial resolution (all related to time) including data storage/evaluation. Similarly, the illuminated and speaker areas, providing a visual and/or audio cue respectively, may be controlled manually or automatically to provide a set, variable or learned response sequence.

[0026] The control system preferably provides a measurement and scoring system, an example being disclosed below.

[0027] The integral head and/or torso mannequin 20 of the preferred embodiment is designed to enable an amateur boxer to throw any single or series of punches, to the head or lower body region, with either hand. This is made possible by identifying that for either the head or torso regions 22, 26 six target zones 1-6, 7-12 are required in order to facilitate an amateur boxer's repertoire of punches. This explains the twelve target zones 1-12 provided in the preferred embodiment.

[0028] The preferred head/torso mannequin is that it can easily be scaled, then constructed to accommodate the anthropometric variation in boxers between each weight category.

[0029] This mannequin 20 with the rigid shell 30 (but without any accelerometers 38) could also be connected to a force or load measuring plate device located between the supporting wall 28 and the Mannequin 20. For this purpose, any impact on the mannequin would be transferred to the force or load measuring plate device to collect impact measurement data. It will be appreci-

ated that this alternative would measure substantially unidirectional impacts but can do so at higher accuracy than prior art devices.

[0030] The movement to accelerometers provides one example of transducer which can provide a relatively portable, cheaper device to allow the measure of relative impacts in contact sports.

[0031] When accelerometers 38 are provided which are able to measure impacts in a plurality of directions, it is possible to determine the type of impact, such as the type of strike on the mannequin 20. This can be detected by the signal from the accelerometer(s), for example, a clean direct hit on the mannequin will produce a congruent signal from the accelerometer(s) while a hit which moves across the mannequin will produce an incongruent signal.

[0032] Where just one accelerometer 38 is provided in the mannequin, this is preferably equidistant from the zones of the mannequin.

[0033] The shell 30 is shown open at its top. This facilitates location of and connection to the accelerometer (s). However, the top of the shell could be closed if desired.

[0034] The angles of the zones 1-12 can be chosen by experimentation. It is preferred that they are chosen to optimise the likelihood of getting a correct measurement at the transducer focus point and on the basis of what is determined to be a reasonable strike by the intended user. In the preferred embodiment described above, the internal angles between zone 8 and zones 7 and 9 may be 135°± 5-10°. Similar relationships could exist for the other zones.

[0035] The disclosures in British patent application no. 0100509.9, from which this application claims priority, and in the abstract accompanying this application are incorporated herein by reference.

Claims

1. A system for obtaining a measure of an impact including a substantially rigid structure for receiving impacts, mounting means for mounting the structure to a substantially immovable support in a manner to fix the structure in a substantially immovable manner, and transducer means mounted on or in the structure so as to generate an output signal representative of an impact on the structure.

2. A system according to claim 1, wherein the transducer means is able to detect one or more of uniaxial, biaxial and triaxial impacts.

3. A system according to claim 1 or 2, wherein the transducer means includes at least one accelerometer.

4. A system according to any preceding claim, wherein the structure is in the form of a mannequin.

5. A system according to any preceding claim, wherein the structure is provided with a plurality of zones for receiving impacts from different directions.

6. A system according to any preceding claim, including a covering over the substantially rigid structure for user protection purposes.

7. A system according to any preceding claim, wherein the covering is a solid or composite structure.

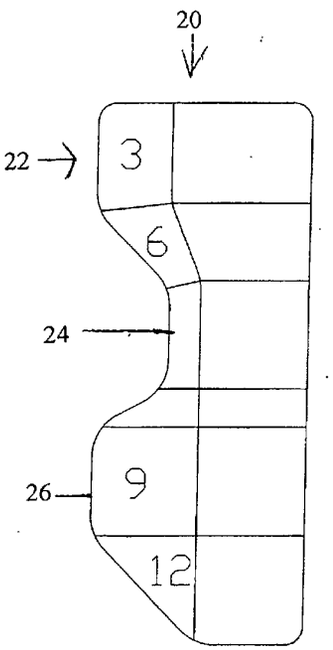

FIGURE 1

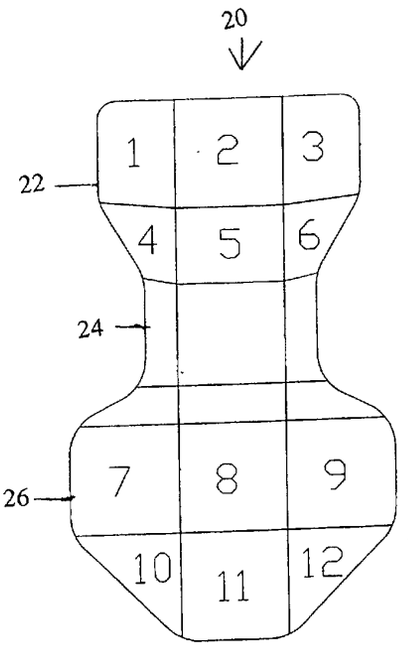

FIGURE 2

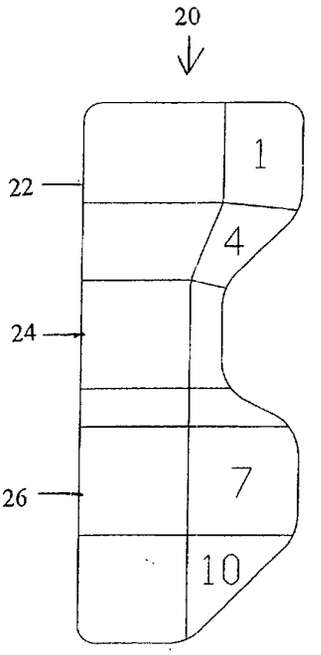

FIGURE 3

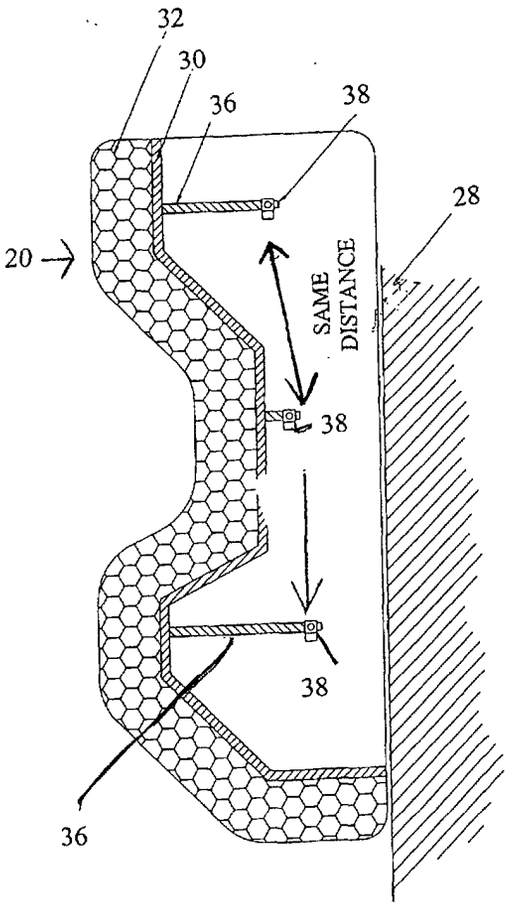

FIGURE 4

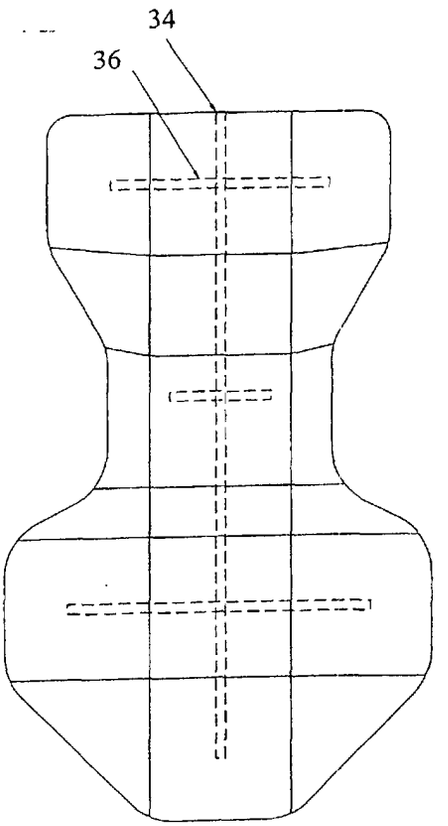

FIGURE 5