Interactive Fighting Apparatus

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INTERACTIVE FIGHTING APPARATUS

The present invention relates to an interactive fighting apparatus, and to associated methods of manufacture and operation of said apparatus. Particular embodiments of the invention are particularly suitable for, but not limited to, use in fitness applications such as martial arts and combat sports training, as well as in games machines.

Martial Arts and combat sports such as boxing are popular leisure activities, allowing participants to both keep-fit and learn self-defence skills in a stimulating and entertaining environment. Many such activities include competitive sparring sessions, in which two participants fight each other with opponents typically being of approximately equal weight and experience. Training must be performed on a regular basis to effectively develop the skills to defend oneself in potentially life-threatening situations, or to perform optimally in organised sparring competitions.

A variety of training apparatus is available to enable practitioners to develop the precision and speed of their techniques, as well as enhance their physical fitness and condition their bodies.

Punching bags, kicking pads and large stuffed, punching dummies exist that are used by practitioners as targets to improve the delivery of their strikes. The strikes may be performed by any portion of the human body e.g. hand, arm, elbow, legs, feet, knees, fingertip and knuckle.

To allow practitioners to practice/ improve the speed of their strikes, dummies such as the "Slam Man™" exist. Such dummies consist of a human torso made from a material such as high-density plastic, and mounted on a solid base filled with sand. A number of target lights are located at different positions on the dummy, and are arranged to flash (either at random or in predetermined patterns). The user then punches the relevant areas as the lights flash, potentially resulting in an improvement of the hand-eye coordination and the reaction speed of the user.

A dummy popular in Chinese martial arts training is the "wooden man post" (Muk Yan Jong). The dummy can be made of wood, steel or plastic. Typically, the dummy includes a central post, to which are affixed various protrusions representing arms and legs of an opponent. For example, the Wing Chun version of the dummy has three protrusions representing arms, and one protrusion representing a leg. Martial artists can practice a variety of hand and foot techniques on such a dummy, including not only strikes but also blocks. However, such a dummy does not provide any feedback regarding the efficacy of the techniques performed on it.

In many martial arts techniques, it is desirable that a practitioner is able to demonstrate the force with which a strike can be performed. It is also desirable that the practitioner trains so as to be able to effectively deliver powerful strikes. Breaking, in which an object is struck, is a common action used to both develop and demonstrate the power of strikes. For example, the practitioner may break wooden boards. The force needed to break a board of wood can vary, depending upon the type, grain pattern, age and humidity of the wood. Further, once a wooden board has been broken, it can typically not be re-used. To overcome such disadvantages, breaking boards have been developed that consist of two pieces of material such as plastic. The two pieces of material are arranged to be coupled together (e.g. by a tongue and groove joint), such that the two pieces will separate under a pre-determined force when struck. To separate the two pieces of the board, the correct amount of force needs to be applied in both the correct direction, and at the correct location on the board. A range of breaking boards are produced, each being arranged to "break" under a different, pre-determined load.

A variety of games have also been produced, which allow a user to measure the linear force of punch or strike. Examples of such games include "Real Punch" and "Sonic Blastman", both of which were manufactured by the company Taito.

It is an aim of embodiments of the present invention to substantially address one or more problems of the prior art, whether described herein or otherwise. It is an aim of particular embodiments of the present invention to provide an improved interactive fighting apparatus.

In a first aspect, the present invention provides an interactive fighting apparatus comprising: a dummy comprising at least one sensor arranged to measure the force of a blow incident to the dummy and to provide a sensor signal indicative of the measured force of said incident blow; a display device arranged to display information to a user for indicating when a user might strike the dummy; and an output device arrange to receive said sensor signal, and to output information to a user indicative of the measured force of said incident blow,

wherein said at least one sensor is arranged to measure at least two separate vector components of the force of said blow.

Many known prior art gaming and training apparatus do not make any measurement of the force of a blow or strike to the apparatus, but often only measure that a blow has struck a particular area on the apparatus. If the force of a blow is measured, then it is done so in only one direction i.e. only one vector component of the force is measured. The present inventor has realised that measuring only one vector component does not provide an accurate measurement of the total force of the blow, which may land at an angle to the direction of force measurement. The present inventor has realised that providing an apparatus that measures vector components of the force with which the apparatus is being hit greatly increases the accuracy of the force measurement. Preferred embodiments combine such force measurement with the capacity to provide graphical feedback of the effects of multiple strikes or simultaneous strikes to different strike targets. Such information can be used in training, to allow a user to understand precisely how much force has been generated by the blow, and in what directions relative to the intended main direction of the blow. Equally, such information can be used to enhance the realism in fighting games, by using the information to, for instance, calculate the likely damage to an opponent or calculate the likely effect on an opponent. For example, if the blow includes a rotational component, then the likely effect might be that an opponent is spun around by the blow.

Said at least one sensor may be arranged to measure both translational and rotational components of the force of said blow.

Said dummy may comprise a head portion and a torso portion, each portion comprising at least one respective sensor.

Said head portion may be coupled to said torso portion by a flexible neck portion.

Said head portion may be rotatable relative to said torso portion.

The dummy may further comprise a jaw portion pivotally mounted to the head portion.

Said dummy may comprise a torso portion and at least one arm portion extending longitudinally from the torso portion.

Said arm portion may be rotatably mounted relative to said torso portion.

Said dummy may comprise a torso portion and at least one leg portion extending longitudinally downwards from the torso portion, said leg portion comprising at least a first section and a second section, the second section extending at an angle from said first section.

At least one of said portions may be coupled to another of said portions by a resiliently biased joint.

At least one of said portions of the dummy may comprise at least one area of relatively resilient material positioned to correspond to a vulnerable area of the human body, surrounded by an area of less resilient material.

At least one of said portions of the dummy may comprise a contact sensor positioned to determine if contact is made with a predetermined area on the dummy.

Said dummy may comprise a plurality of said sensors, each located at a respective different position.

The apparatus may further comprise a stand arranged to hold said dummy in a substantially upright configuration.

Said stand may be resiliently biased to hold said dummy in said substantially upright configuration.

Said stand may be arranged to hold said dummy in said substantially upright position with the torso of the dummy leaning forwards at an angle between 10° and 45° relative to the vertical.

Said stand may be arranged to hold said dummy at a height corresponding to that of a standing person.

The height of said stand may be adjustable.

The weight of said stand may be adjustable.

In a second aspect, the present invention provides a method of manufacturing an interactive fighting apparatus, comprising: providing a dummy comprising at least one sensor arranged to measure the force of a blow incident to the dummy and to provide a sensor signal indicative of said measured force; providing a display device arranged to display information to a user for indicating when a user might strike the dummy; and providing an output device arrange to receive said sensor signal, and to output information to a user indicative of the force of said incident blow,

wherein said at least one sensor is arranged to measure at least two separate vector components of the force of said blow.

In a third aspect, the present invention provides a method of operation of an interactive fighting apparatus comprising a dummy, the method comprising: displaying information to a user for indicating when a user might strike the dummy; measuring the force of a blow incident to the dummy; and outputting information to a user indicative of the force of said incident blow,

wherein said measuring step comprises measuring at least two separate vector components of the force.

Said measuring step may comprise measuring both translational and rotational components of the force of said blow.

The method may further comprise measuring the position of the incident blow on the dummy.

Said displaying step may comprise displaying instructions to a user indicative of at least one of: the type of strike that should be performed by the user, a sequence of strikes that should be performed by the user, and the position or positions on the dummy that the user should strike.

Said displaying step may comprise displaying an image of a moving opponent.

Said displaying step may comprise determining the motions of a second user, and displaying an image representing the determined motions.

The method may further comprise analysing the measurements as a function of time to determine the type of blow.

The method may further comprise analysing the measurements and determining the likely effect of the blow on an opponent, said outputting step comprising outputting information indicative of the determined likely effect of the blow.

Said information may be output as an image of an opponent, with damage of the opponent illustrated on the image.

The method may further comprise calculating, and outputting information indicative of, at least one of the rate of blows provided by the user, and the calories expended by the user in providing said blows to the dummy, from said measurements.

In a fourth aspect, the present invention provides a device for controlling an interactive fighting apparatus, the device comprising: a program memory containing processor readable instructions; and a processor configured to read and execute instructions stored in said program memory,

wherein said processor readable instructions comprise instructions configured to control said apparatus to carry out a method described above.

In a fifth aspect, the present invention provides a carrier medium carrying computer readable code configured to cause a computer to carry out a method described above.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of an interactive fighting apparatus in accordance with a first embodiment of the present invention;

Figure 2 is a schematic diagram of an alternative embodiment of an interactive fighting apparatus;

Figure 3 is a schematic diagram of an embodiment of a head for use in an interactive fighting apparatus in accordance with an embodiment of the present invention;

Figure 4 is a schematic diagram of a further embodiment of a head; and

Figure 5 is a three dimensional perspective view of an embodiment of a dummy for use in an interactive fighting apparatus in accordance with an embodiment of the present invention.

Figure 1 illustrates an interactive fighting apparatus 10 in accordance with an embodiment of the present invention.

The apparatus 10 includes a dummy 20 for receiving blows from a user. In this embodiment, the dummy 20 is formed in the general shape of a human. The dummy 20 includes a head portion 30 mounted on a torso portion 40. The head portion 30 is rotatable relative to the torso portion 40.

Arm portions 42a, 42b and 42c extend from the torso portion 40. The arm portions 42a-c extend from the torso portion 40, and are configured to simulate the positions of human arms.

Preferably, the arms are positioned to simulate a fighting posture or stance. For example the arms may be raised, preferably with a bend in the arms corresponding to an elbow joint, e.g. to simulate a guard position or block.

Preferably, the different body portions are coupled together so as to simulate the biomechanical range of motion and isometric muscle tension of a human being. For example, the isometric muscle tension can be simulated using resilient couplings (e.g. rubber or spring systems) so that a user wanting to move portions of the dummy relative to other portions (e.g. either by striking, pushing, pulling or twisting the dummy) has to work to create that movement.

In the particular illustrated embodiment, the dummy 20 comprises three arm portions, in the same configuration as used in the arms used in the "wooden man post". However, it should be appreciated that in alternative embodiments, two arm portions may be utilised, each consisting of two sections to simulate the human arm.

Each arm portion 42a-b is rotatably mounted to the torso portion 40. In this embodiment, all three arm portions 42a-42c are coupled to a common section (as indicated by the dotted lines) that is coupled to, and rotatable relative to, the torso portion 40. This rotatable mounting allows a user to more realistically interact with the arms when performing techniques such as "sticking hands".

At least one leg portion 50 extends from the base of the torso portion 40. In this embodiment, the dummy 20 comprises two leg portions 50. Each leg portion 50 consists of two sections 52, 54 for simulating respectively the upper and lower sections of a human leg. The second, lower section 54 extends at an angle from an end of the first section 52, so as to simulate the position of the knee.

The dummy is held in an upright position by a stand 60. The stand 60 comprises a base section 62 which, in use, sits on the ground or floor. A member 64 extends from the base section 62 to the dummy 20, so as to hold the dummy 20 in an upright, or at least a substantially upright, position. The member 64 is coupled to the dummy 20 by a resilient coupling e.g. by a joint made of, or comprising, rubber.

Preferably, the torso of the dummy is configured to move so as to extend nearly horizontal (e.g. at an angle of 70° to the vertical or more), as well as to bend to either side (i.e. laterally, relative to the posture of the dummy) to at least some extent (e.g. by at least about 10°). This resilient biasing of the dummy can be performed either by a coupling of the stand to the dummy 20, and/or by a portion of the dummy being formed of resilient material, such as rubber, to allow the dummy portion to have the predetermined range of movement. For example, the lower portion of the dummy torso 40 may be formed so as to act as a hip, either due to the hip portion being formed of resilient material, or due to the hip portion being coupled to the remainder of the torso by appropriately biased resilient couplings.

Allowing the torso of the dummy to move to such a degree allows the dummy to simulate grappling. For example, a user could pull the upper section of the dummy downwards, and/or to either side e.g. to perform a knee strike to the head 30 of the dummy 20. The resilient biasing of the dummy allows the dampening out of some of the impact forces that may arise from strikes to the dummy. Such resilient biasing (e.g. by spring systems or rubber) is arranged such that the dummy 20 returns to the predetermined position (e.g. in a fighting stance) after being struck by a user.

Preferably, the stand is arranged to hold the dummy 20 in a position corresponding to that of a standing person. Most preferably, the dummy and stand are arranged to simulate a fighting stance. For example, this could occur with the torso of the dummy leaning forwards, at an angle of about 30° (e.g. between 10° and 45°) to the vertical. Preferably, the head 30 of the dummy (along with any associated portion of the dummy corresponding to a neck) is configured so as to be positioned at an angle relative to the torso. For example, a portion of the head corresponding to the chin could be position "tucked into" the chest e.g. with the chin either adjacent to (within 4cm, or even 4cm, of the closest portion of the chest), or touching the chest.

The stand is typically arranged to hold the dummy at a height corresponding to that of an average, standing human. The length of the member 64 can be varied, so as to adjust the height of the dummy. Thus, the dummy can be lowered for smaller users, or raised in height for taller users (or to simulate taller opponents). During use, the dummy is struck by user, which can result in movement of both the dummy 20 and the stand 60. To adjust the apparent "weight" of the dummy (i.e. the amount by which the dummy/stand combination moves when struck), the weight of the stand is adjustable. In this particular embodiment, this is achieved by loading different weights 68 onto a weight holder 66 (shown as a pole) coupled to the base 62 of the stand 60.

At least one portion of the dummy comprises a sensor arranged to measure the force of a blow incident to the dummy, in at least two different directions. Thus, at least two separate vector components of the force of the blow are measured. The vector components could be orthogonal vector components i.e. along directions perpendicular to each other. Alternatively, one vector component could be a linear or translational component (i.e. the force along one particular direction), while the other vector component could be a rotational component of the force of the strike. Any number of such sensors could be included within the dummy. For example, a separate sensor could be incorporated within each portion or section of the dummy 20.

In the particular embodiment illustrated in Figure 1, the dummy 20 includes two force sensors. One sensor is located in the head portion 30, and the other sensor is located in the torso portion 40. The force sensors are arranged to measure the force of a blow in three orthogonal linear directions (e.g. along a nominal x-axis, y-axis and z-axis), as well as the corresponding rotational components relative to each axis.

Various known accelerometer packages are available that are capable of determining such forces. Typically, such sensors are formed of an array of accelerometers. For example, a nine-accelerometer package arranged in a Padgoankar 3-2-2-2 pattern has been proven to be one of the most reliable arrangements. The article by Newman J.A., *et al.* "Verification of biomechanical methods employed in a comprehensive survey of mild traumatic brain injury and the effectiveness of American football helmets", Journal of Biomechanics 38 (2005), describes such an arrangement. The sensor consists of a set of triaxial accelerometers positioned amid three sets of tangentially positioned bi-axial accelerometer pairs

The dummy 20 further comprises at least one contact sensor, arranged to determine if contact is made with (e.g. a blow is landed on) a pre-determined area of the surface of the dummy 20. A single sensor, arranged to determine a contact position, could be used to monitor the position of any blows to the dummy 20. Alternatively, a series of discrete contact sensors could be positioned, each arranged to simply determine if contact is made with a particular predetermined region or area of the dummy.

In the particular embodiment illustrated in Figure 1, the dummy 20 comprises a plurality of contact sensors. Each contact sensor is located at a respective different position, and is arranged to determine when contact is made with that sensor. In particular, the contact sensors are positioned at locations on the dummy 20 that correspond to vulnerable areas of the human body e.g. a separate contact sensor is provided for the head 30, ribs 44, solar plexus 46, groin 48 and knee 56.

In the embodiment of the dummy 20 illustrated in Figure 1, these vulnerable areas are covered by an area of relatively resilient or soft material (indicated in the Figure by a hatched pattern). For example, the bulk of the dummy 20 could be made of a material that is compressible such as wood or plastic. The areas of the dummy surface corresponding to more vulnerable areas would then be covered by a more resilient and/or a softer material such as rubber. Preferably, the more vulnerable areas are also coloured or patterned differently, so as to allow a user to readily identify the vulnerable areas on the body.

The apparatus 10 further includes a computational device 70. The device 70 includes a programme memory containing processor readable instructions, and a processor configured to read and execute instructions stored in the programme memory. The device 70, which in the figure is illustrated as a personal computer, is arranged to control the operation of the interactive fighting apparatus.

In particular, the device 70 is coupled to each of the sensors of the dummy, and is arranged to process the output signals from the sensors. For example, the device 70 is coupled to the accelerometers used to measure the force of blows that strikes the dummy. The device 70 is arranged to calculate the different translational (i.e. linear) and rotational components of the force of blows, from the signals output by the accelerometers, as well as the total force of such blows.

The apparatus also includes a display device arranged to display information for indicating when a user might strike the dummy, and an output device arranged to output information to a user indicative of the measured force of a blow (and preferably also the relative components of the force of the blow) incident to the dummy 20.

The display device is arranged to display information to a user for indicating when the user should strike the dummy. For example, such information could simply be an output that the apparatus is ready to use. Alternatively, the display device could comprise a series of lights arranged at different locations around or on the dummy 20, with each light arranged to light up in a random sequence or pattern, to indicate that a user should strike that portion of the dummy.

The display device could be arranged to provide instructions to facilitate the training of a user e.g. instructions to perform a pre-determined sequence of moves (i.e. strikes to the dummy at pre-determined areas, using pre-determined techniques). Such instructions could be provided diagrammatically by showing the representation of a fighter conducting the relevant move on an image of the dummy, or as text.

In the particular embodiment shown in Figure 1, the computational device 70 is also coupled to contact sensors, and arranged to determine when contact is made with a contact sensor, and with which contact sensor i.e. arranged to determine the position of the blow. The computational device is arranged to correlate the contact/position information with the force information e.g. so as to determine how strong a blow was landed by the user, and on what portion of the body. For example, this could then be utilised by the computational device to calculate (either using a predetermined algorithm, or based upon a look-up table) the likely effect of the blow e.g. to determine whether the blow would disable, hinder the function of, or brake a particular limb, or body portion of a real human (or at least a predetermined computer model of an opponent). The calculated likely effect of the blow can then be displayed (e.g. on the output device). For example this information could be output as a written message on the output device, or could be shown as a graphical representation on the output device e.g. by illustrating damage to an image of the body of an opponent. As an alternative to, or in conjunction with, displaying information indicative of the likely effect, an audio signal could be provided (e.g. from a speaker coupled to the computational device 70) representative of the likely effect of the blow e.g. a voice could provide a commentary, or make groaning sounds corresponding to the likely effect of the blow.

In the particular embodiment illustrated in Figure 1, both the display device and the output device are combined in a single display are combined in a single display 80, which is coupled to the computational device 70. The computational device 70 controls the information displayed by the display 80.

Alternatively, rather than providing instructions, or a predetermined sequence of images to a user, the display device could display an image of an opponent performing a series of combat techniques e.g. strikes and/or blocks. The user could then react to such strikes and/or blocks e.g. if the image shows the opponent as performing a punch, then the user might only be allowed to "score", or have their strike/blow registered as a good or valid hit, if they perform a pre-determined action e.g. a blow to the dummy that the device 70 is arranged to recognise as an appropriate block to the strike performed by the image of the opponent.

Using such a principle, the interactive fighting apparatus can be implemented as a game, with the dummy acting as an input device, allowing the user to fight with an imaginary opponent. Martial arts fighting games are well known, and typically include two or more combatants, with each combatant having a representative amount of energy. In such games, the aim is for a user (e.g. games player) to minimise the energy extended or taken from his combatant whilst decreasing the energy of the opponent combatant(s) to be zero. Such a game could be implemented using the present apparatus.

Preferably, the computational device 70 is arranged to determine the cumulative effects of various blows, and to display the relevant results. For example, the computational device could model a combatant of the user and model of a combatant of the opponent, with each model having an energy associated therewith. The energy of the opponent could be depleted by an amount dependent upon the total force, and /or particular force components, and/or location, of each blow. The output device (e.g. display 80 or corresponding audio output) could output information indicative of the energy of the opponent at any given moment.

It should be appreciated that the above embodiment is described by way of example only, and that various other implementations will be apparent to the skilled person as falling within the scope of the claims.

For example, in the above embodiment described with reference to Figure 1, the user is described as undergoing a training routine, conducting strikes (either at random or following a set of instructions) to the dummy, or having a simulated fight (using the dummy as an input device) with a computer controlled image of an opponent.

In an alternative embodiment, the user conducts a simulated fight (using strikes on the dummy to control the blows and/or conduct blocks) against one or more human controlled opponents. The actions of the human controlled opponent can be displayed to the user by a display device displaying a computer-generated image of the opponent. The other user controlling the human controlled opponent could perform the control operations using a normal game controller e.g. a controller for an X-box™ or Playstation™. More preferably, each user uses an interactive fighting apparatus 10 as a control device. In such instances, the opponent image provided to the user by the display device could be a real image of the other human, e.g. captured by one or more image capture devices such as cameras.

Various modifications could be made to the apparatus 10. For example, Figure 2 illustrates a further interactive fighting apparatus 10', suitable for (but not restricted to) use in human vs. human simulated combat. Within the figures, identical reference numerals represent similar features. The apparatus 10' can thus be seen to share many of the features of the apparatus 10 shown in Figure 1. In addition, the apparatus includes two image capture devices 92, positioned to capture the image of a first user striking the dummy 20. The captured images could be transmitted to a further user operating a similar apparatus, and displayed to that further user on a display device. Thus, the further user could see, and respond to, the movements of the first user.

The apparatus 10' also includes an additional input device in the form of a contact mat 94. The mat 94 is positioned on a surface adjacent (e.g. on the floor in front of) the dummy 20. The mat includes a plurality (e.g. an array) of sensor portions 96, each arranged to output a signal when a user stands on that portion. The computational device 70 is arranged to receive signals from the mat 94 indicative of the relevant portion(s) of the mat on which the user is standing. Preferably, the signals are also indicative of the weight placed by the user on each portion. Such signals can be processed by the device 70 to provide further information regarding the techniques being performed by the user e.g. the stances performed by the user, the relative weight placed on each leg, the rate at which the legs are moved to a different position or weight transferred between legs etc. Such information can be provided as feedback to a user, or used to more accurately monitor and model the actions performed by the user, including more accurately determining the likely effect of the actions/ blows of the user on an opponent.

The apparatus 10' also has a torso 40' from which only two arm portions 42a, 42b, extend. Preferably, the arm portions are removably mounted to the torso 40', so as to allow the torso 40, 40' to be swapped between different configurations of arms (e.g. between the three arm configuration shown in Figure 1 and the two arm configuration shown in Figure 2), or to have completely different types of arm portion attached to the dummy.

Other portions of the apparatus may also be implemented differently. For example, Figure 3 shows an alternative head portion 130. The head portion 130 comprises an image capture device 192. In this embodiment, the image capture device 192 is a camera, and is mounted in the forehead of the head portion 130. The image capture device 192 can be used in conjunction with, or as an alternative to, the image capture devices 92 illustrated in Figure 2.

The head portion 30 illustrated in Figures 1 & 2 can be regarded as comprising a single, vulnerable area, having a single contact sensor arranged to determine when the head portion is contacted by a blow. However, for increased realism, the head portion 130 is divided up into a number of different areas, with specific vulnerable areas being indicated as comprising the jaw 138, nose 136, eyes 132, and temples 136. Each can have a corresponding contact sensor, arranged to determine when that area is contacted by a blow (e.g. and to pass such information on to the device 70)

The head portion 130 is coupled to a neck portion 123, which is suitable for being rotatably mounted on a torso portion. Further, for increased realism, the neck portion is formed of a number of discrete sections 125a, 125b, 125c. Each section 125a-c is shaped as a ring. Each section 125a-c is resiliently coupled to the adjoining section, thus allowing the neck portion 123 to flex e.g. when the head is struck by a blow. Preferably, the head is coupled to the neck in such a manner that the neck has freedom to both flex backwards and forwards (relative to the posture of the dummy), bend laterally, rotate, and extend or protract. Such a range of movements allows the head/neck combination to respond realistically to strikes from all angles.

The neck portion 123 also comprises a vulnerable area (corresponding to the adams apple 127), with a corresponding contact sensor.

Figure 4 shows an alternative embodiment of a head portion 230, the features of which can be combined with the features of the embodiments of any of the previous head portions. For increased realism, this head portion 230 comprises a movable jaw portion 238. The movable jaw portion 238 is pivotally mounted 239 to the remainder of the head portion. Preferably, the jaw portion 239 is resiliently biased to return to a predetermined position relative to the remainder of the head portion 230, after it has been struck. As per head 130, a flexible neck portion 223 is coupled to the head 230, and comprises a plurality of segments 225a, 225b, 225c. To resiliently bias the neck portion, a spring 228 extends from a first mount 226a connected to the head 230, to a second mount 226b (which would be connected to a torso portion).

The stand supporting the dummy may also be implemented in various ways. For example, Figure 5 shows a dummy 320 in accordance with an embodiment of the present invention. The dummy 320 comprises a head portion 330 and a body portion 340. Arm portions 342a, 342b, 342c extend from the torso portion 340. A stand portion 360 (which also functions as a lower body portion) extends from the base of the torso portion. A stand member 363 extends centrally from the base of the body portion, to the floor. A plurality of (here, three) equally sized and shaped legs portions 361 extend from the stand/ lower body portion 360. Preferably the leg portions are positioned equidistantly around the lower body portion.

The stand member 363 is of sufficient length that, in normal use, the leg portions 361 are positioned a predetermined distance from the ground or floor. As previously, the leg portions can be struck by a user, and the force / position of strikes thereon may be measured. Further, in this embodiment, the leg portions also act as auxiliary supports, limiting the angle from which the dummy can be displaced from the normal equilibrium position when struck (as the leg portion(s) will contact the floor/ ground, and prevent further movement of the dummy).

Various alternatives implementations will be apparent to the skilled person, as falling within the scope of the appended claims.

CLAIMS

1. An interactive fighting apparatus comprising:

a dummy comprising at least one sensor arranged to measure the force of a blow incident to the dummy and to provide a sensor signal indicative of the measured force of said incident blow;

a display device arranged to display information to a user for indicating when a user might strike the dummy; and

an output device arrange to receive said sensor signal, and to output information to a user indicative of the measured force of said incident blow,

wherein said at least one sensor is arranged to measure at least two separate vector components of the force of said blow.

2. An apparatus as claimed in claim 1, wherein said at least one sensor is arranged to measure both translational and rotational components of the force of said blow.

3. An apparatus as claimed in claim 1 or claim 2, wherein said dummy comprises a head portion and a torso portion, each portion comprising at least one respective sensor.

4. An apparatus as claimed in claim 3, wherein said head portion is coupled to said torso portion by a flexible neck portion.

5. An apparatus as claimed in claim 3 or claim 4, wherein said head portion is rotatable relative to said torso portion.

6. Any apparatus as claimed in any one of claims 3 to 5, wherein the dummy further comprises a jaw portion pivotally mounted to the head portion.

7. An apparatus as claimed in any one of the above claims, wherein said dummy comprises a torso portion and at least one arm portion extending longitudinally from the torso portion.

8. An apparatus as claimed in claim 7, wherein said arm portion is rotatably mounted relative to said torso portion.

9. An apparatus as claimed in any one of the above claims, wherein said dummy comprises a torso portion and at least one leg portion extending longitudinally downwards from the torso portion, said leg portion comprising at least a first section and a second section, the second section extending at an angle from said first section.

10. An apparatus as claimed in any one of claims 3, 7 or 9, or any claim dependent thereto, wherein at least one of said portions is coupled to another of said portions by a resiliently biased joint.

11. An apparatus as claimed in any one of claims 3 to 10, wherein at least one of said portions of the dummy comprises at least one area of relatively resilient material positioned to correspond to a vulnerable area of the human body, surrounded by an area of less resilient material.

12. An apparatus as claimed in any one of claims 3 to 11, wherein at least one of said portions of the dummy comprises a contact sensor positioned to determine if contact is made with a predetermined area on the dummy.

13. An apparatus as claimed in any one of the above claims, wherein said dummy comprises a plurality of said sensors, each located at a respective different position.

14. An apparatus as claimed in any one of the above claims, further comprising a stand arranged to hold said dummy in a substantially upright configuration.

15. An apparatus as claimed in claim 14, wherein said stand is resiliently biased to hold said dummy in said substantially upright configuration.

16. An apparatus as claimed in claim 14 or claim 15, wherein said stand is arranged to hold said dummy in said substantially upright position with the torso of the dummy leaning forwards at an angle between 10° and 45° relative to the vertical.

17. An apparatus as claimed in any one of claims 14 to 16, said stand is arranged to hold said dummy at a height corresponding to that of a standing person.

18. An apparatus as claimed in any one of claims 14 to 17, wherein the height of said stand is adjustable.

19. An apparatus as claimed in any one of claims 14 to 18, wherein the weight of said stand is adjustable.

20. A method of manufacturing an interactive fighting apparatus, comprising:

providing a dummy comprising at least one sensor arranged to measure the force of a blow incident to the dummy and to provide a sensor signal indicative of said measured force;

providing a display device arranged to display information to a user for indicating when a user might strike the dummy; and

providing an output device arrange to receive said sensor signal, and to output information to a user indicative of the force of said incident blow,

wherein said at least one sensor is arranged to measure at least two separate vector components of the force of said blow.

21. A method of operation of an interactive fighting apparatus comprising a dummy, the method comprising:

displaying information to a user for indicating when a user might strike the dummy;

measuring the force of a blow incident to the dummy outputting information to a user indicative of the force of said incident blow, wherein said measuring step comprises measuring at least two separate vector components of the force.

22. A method as claimed in claim 21, wherein said measuring step comprises measuring both translational and rotational components of the force of said blow.

23. A method as claimed in claim 21 or claim 22, further comprising measuring the position of the incident blow on the dummy.

24. A method as claimed in any one of claims 21 to 23, wherein said displaying step comprises displaying instructions to a user indicative of at least one of: the type of strike that should be performed by the user, a sequence of strikes that should be performed by the user, and the position or positions on the dummy that the user should strike.

25. A method as claimed in in any one of claims 21 to 24, wherein said displaying step comprises displaying an image of a moving opponent.

26. A method as claimed in claim 25, wherein said displaying step comprises determining the motions of a second user, and displaying an image representing the determined motions.

27. A method as claimed in any one of claims 21 to 26, further comprising analysing the measurements as a function of time to determine the type of blow.

28. A method as claimed in any one of claims 21 to 27, further comprising analysing the measurements and determining the likely effect of the blow on an opponent, said outputting step comprising outputting information indicative of the determined likely effect of the blow.

29. A method as claimed in claim 28, wherein said information is output as an image of an opponent, with damage of the opponent illustrated on the image.

30. A method as claimed in any one of claims 21 to 29, further comprising calculating, and outputting information indicative of, at least one of the rate of blows provided by the user, and the calories expended by the user in providing said blows to the dummy, from said measurements.

31. A device for controlling an interactive fighting apparatus, the device comprising:

a program memory containing processor readable instructions; and

a processor configured to read and execute instructions stored in said program memory,

wherein said processor readable instructions comprise instructions configured to control said apparatus to carry out a method according to any one of claims 21 to 30.

32. A carrier medium carrying computer readable code configured to cause a computer to carry out a method according to any one of claims 21 to 30.

ABSTRACT

An interactive fighting apparatus, and associated methods of manufacture and operation of the apparatus are described. The apparatus includes a dummy having at least one sensor arranged to measure the force of a blow incident to the dummy and to provide a sensor signal indicative of the measured force of the incident blow. A display device is arranged to display information to a user for indicating when a user might strike the dummy. An output device is arranged to receive the sensor signal, and to output information to a user indicative of the force of the incident blow. The sensor is arranged to measure at least two separate vector components of the force of said blow.

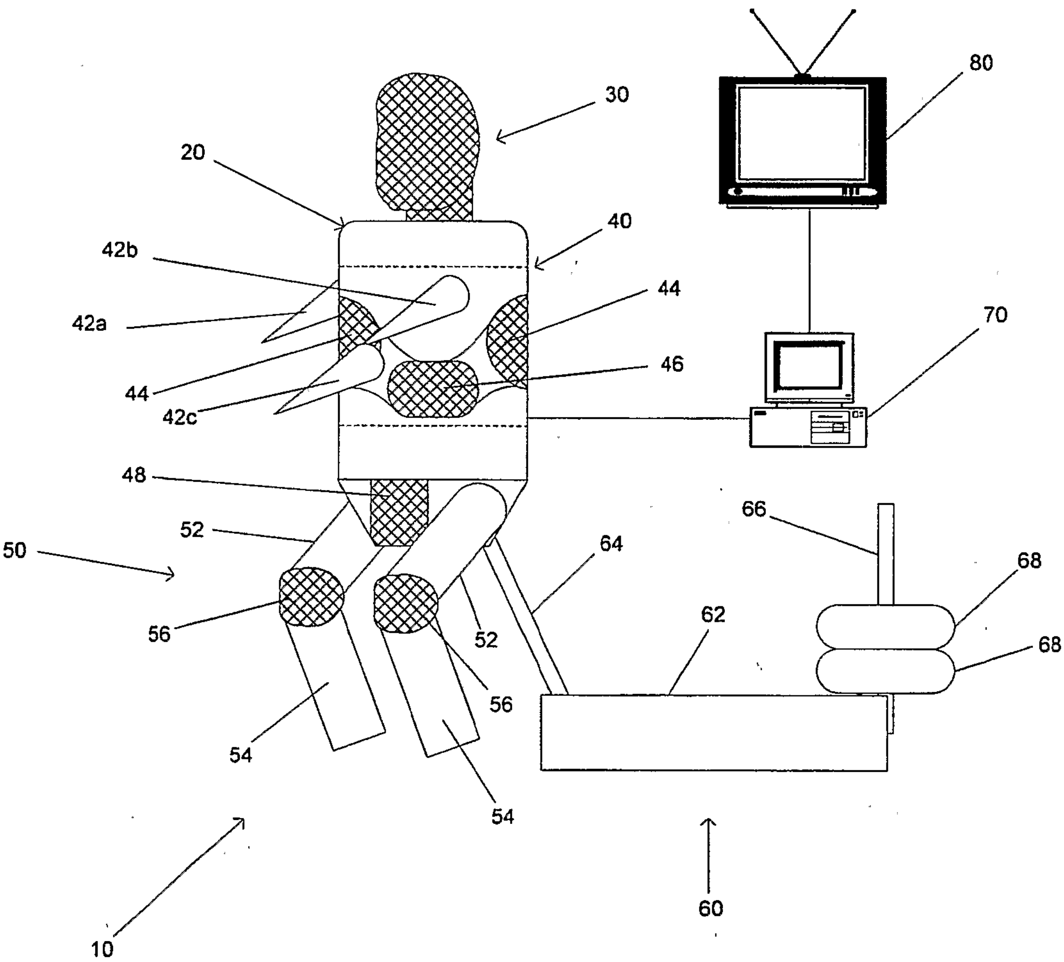
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FIG 1

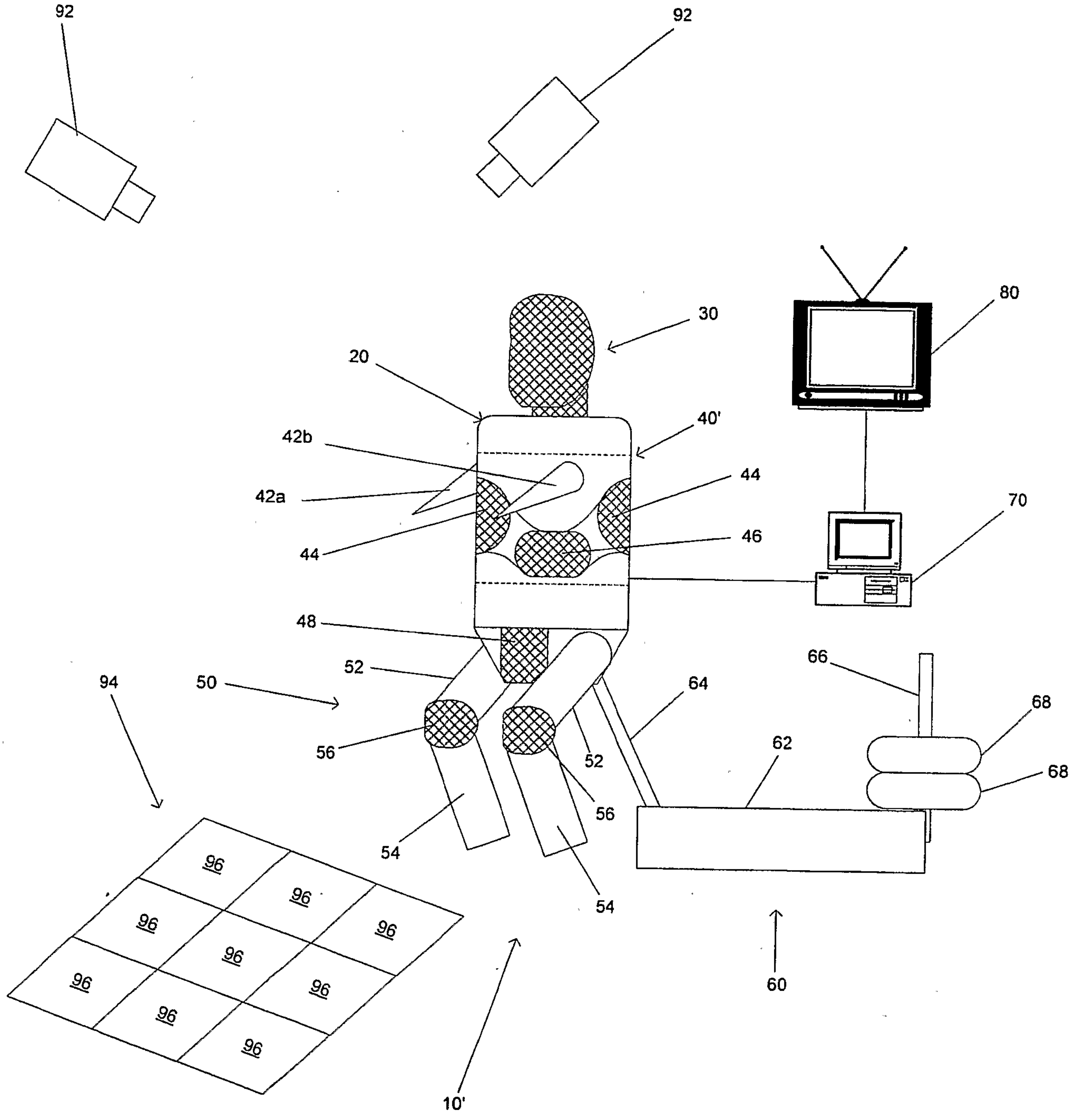
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FIG 2

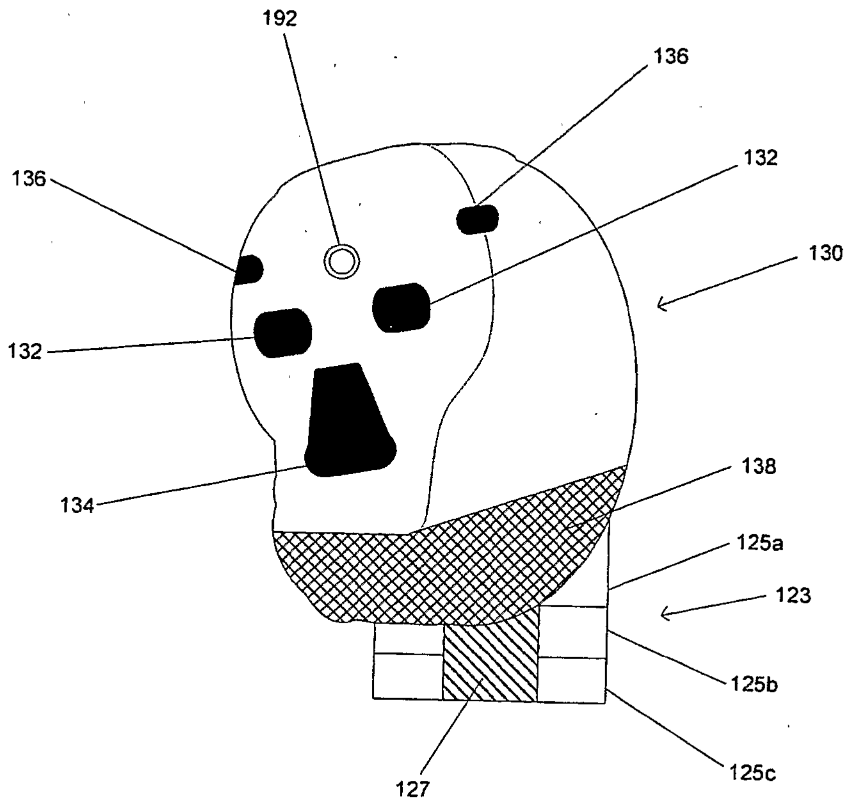

FIG 3

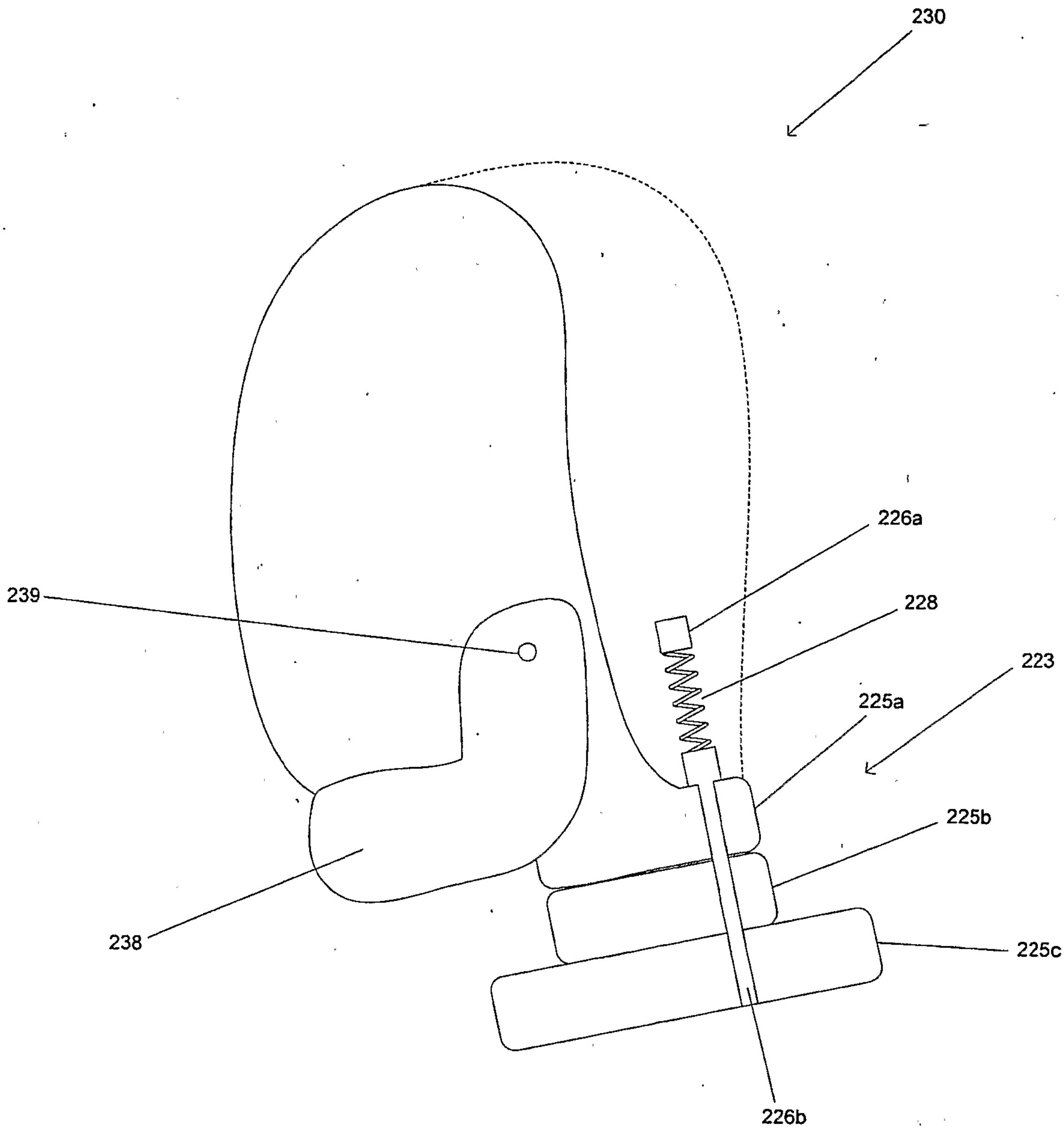

FIG 4

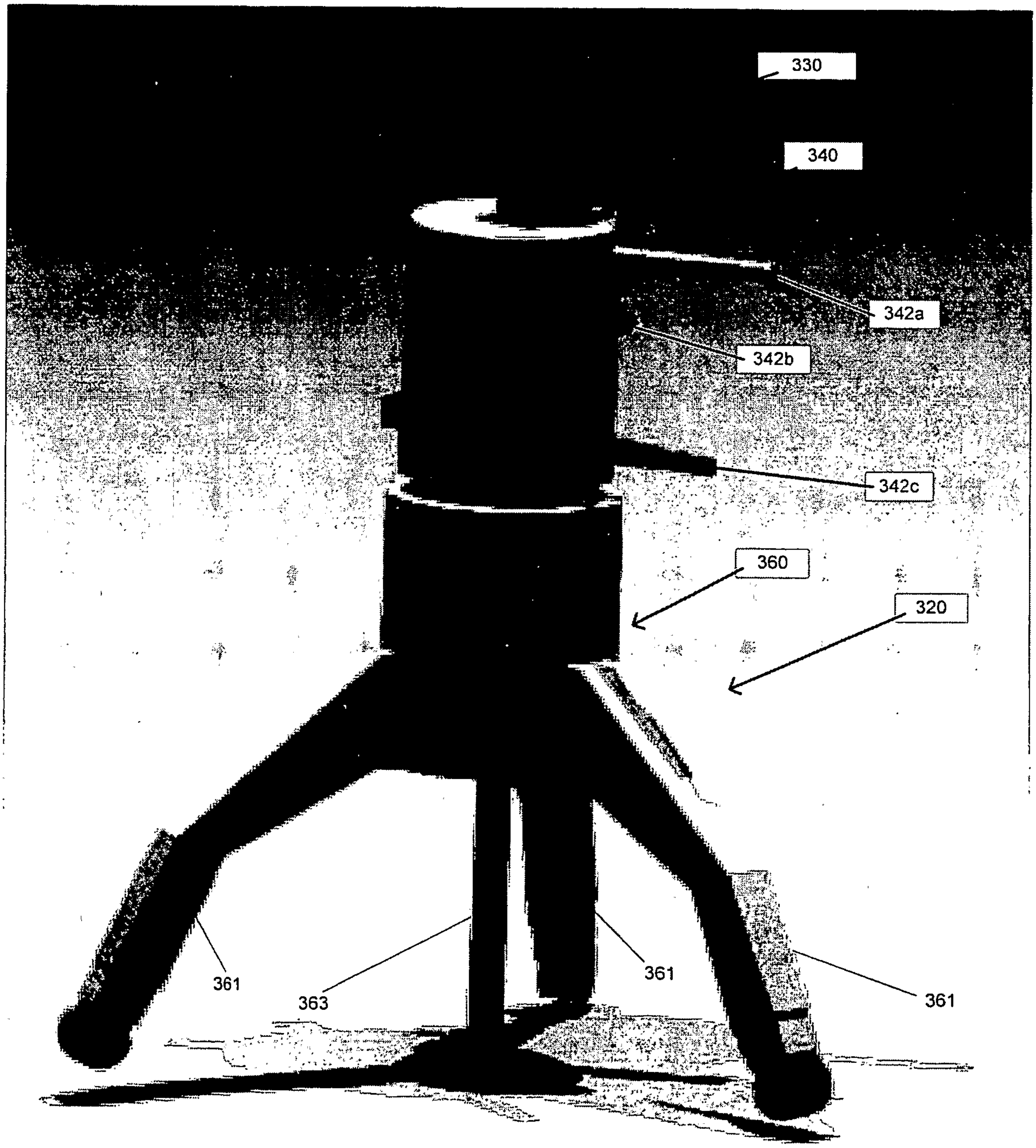

FIG 5