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(71) Applicant(s):
Metrika Limited
16 Hay Street, Marshfield, Chippenham, Wiltshire, SN14 8NL, United Kingdom

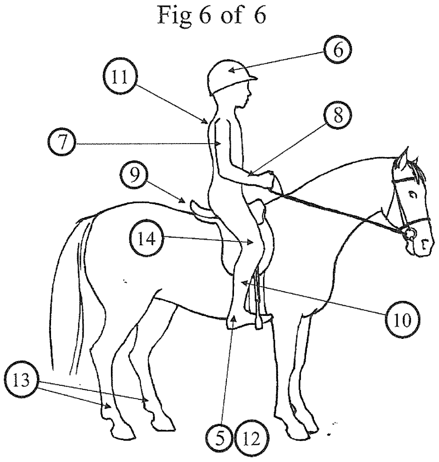
(72) Inventor(s):
Charles Gerard Harris

(74) Agent and/or Address for Service:
Alpha & Omega
Chine Croft, East Hill, OTTERY ST. MARY, Devon, EX11 1PJ, United Kingdom

(54) Title of the Invention: **means for improving equestrian rider safety and effectiveness**
Abstract Title: **Equestrian monitoring system**

(57) Means for improving equestrian rider safety and effectiveness comprising one or more monitoring devices 5-14 mounted, in use, on the body of the rider. The or each monitoring device includes means for determining the orientation of the part of the rider's body on which it is mounted and transmitting data concerning the postural angle of said part of the body. Means are provided for receiving the transmitted data and comparing the transmitted data with stored data relating to ideal postural angles, together with means for communicating the result of the comparison such that the rider is alerted to deviations from ideal postures. Additional monitoring devices may also be provided on the horse. The alert may be a personalised sound or custom voice message. Alerts specifically for the horse and means for recording the number and severity of kicks or nudges given to the horse during a riding session may also be provided.

Fig 6 of 6



Typical Application points for Monitoring devices

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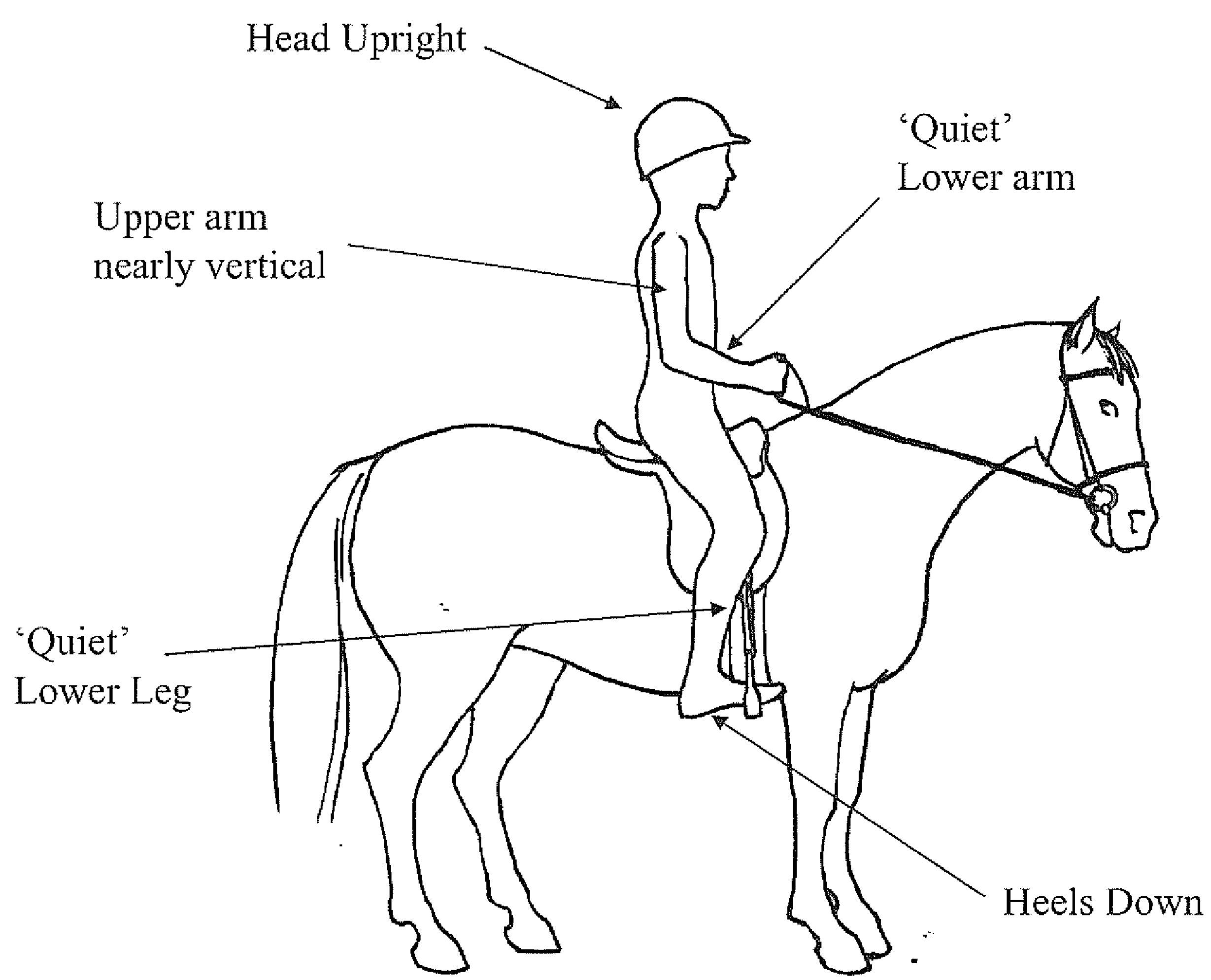
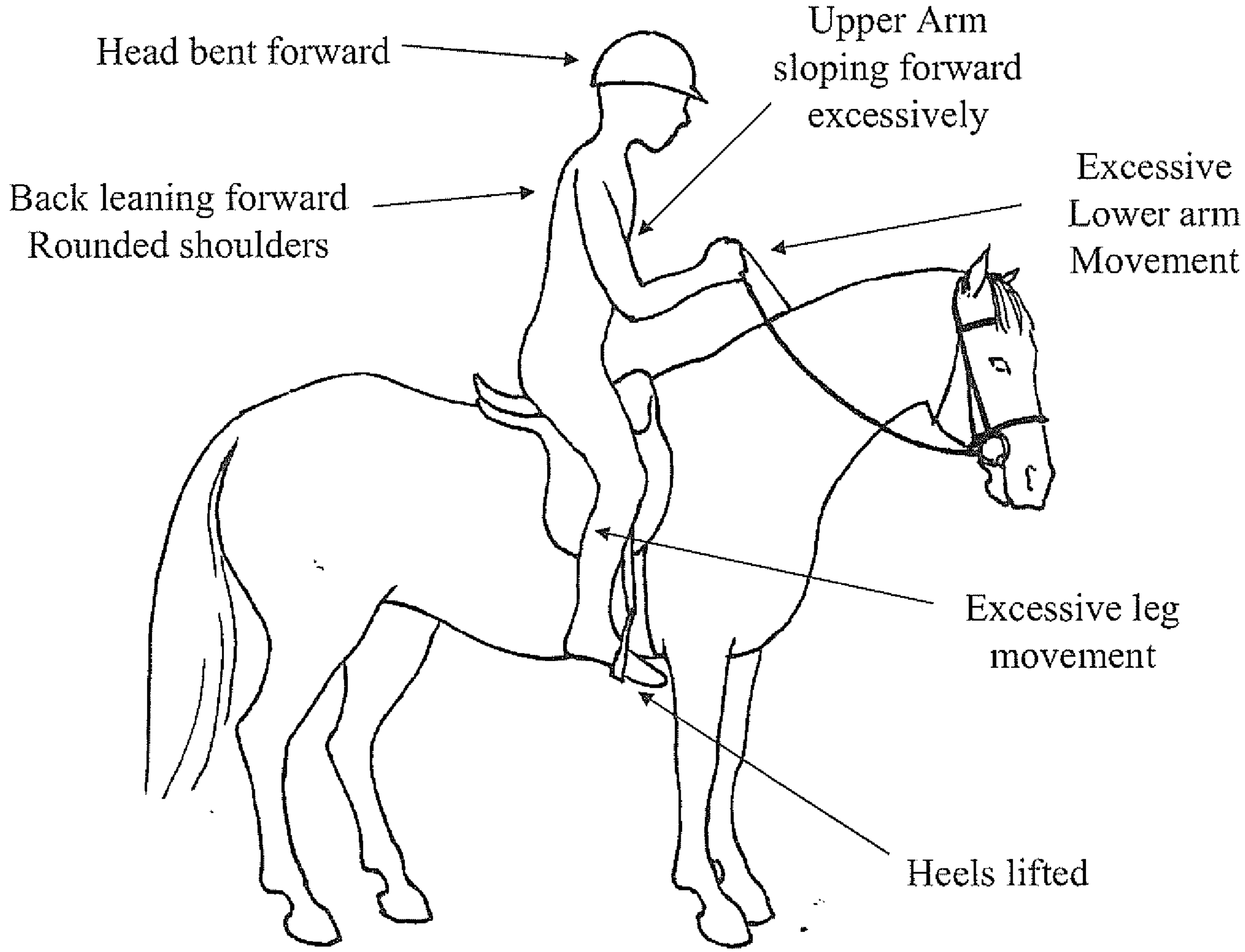
Figure 1 of 6



An Efficient Riding Posture

Figure 2 of 6



An example of inefficient posture

Fig 3 of 6

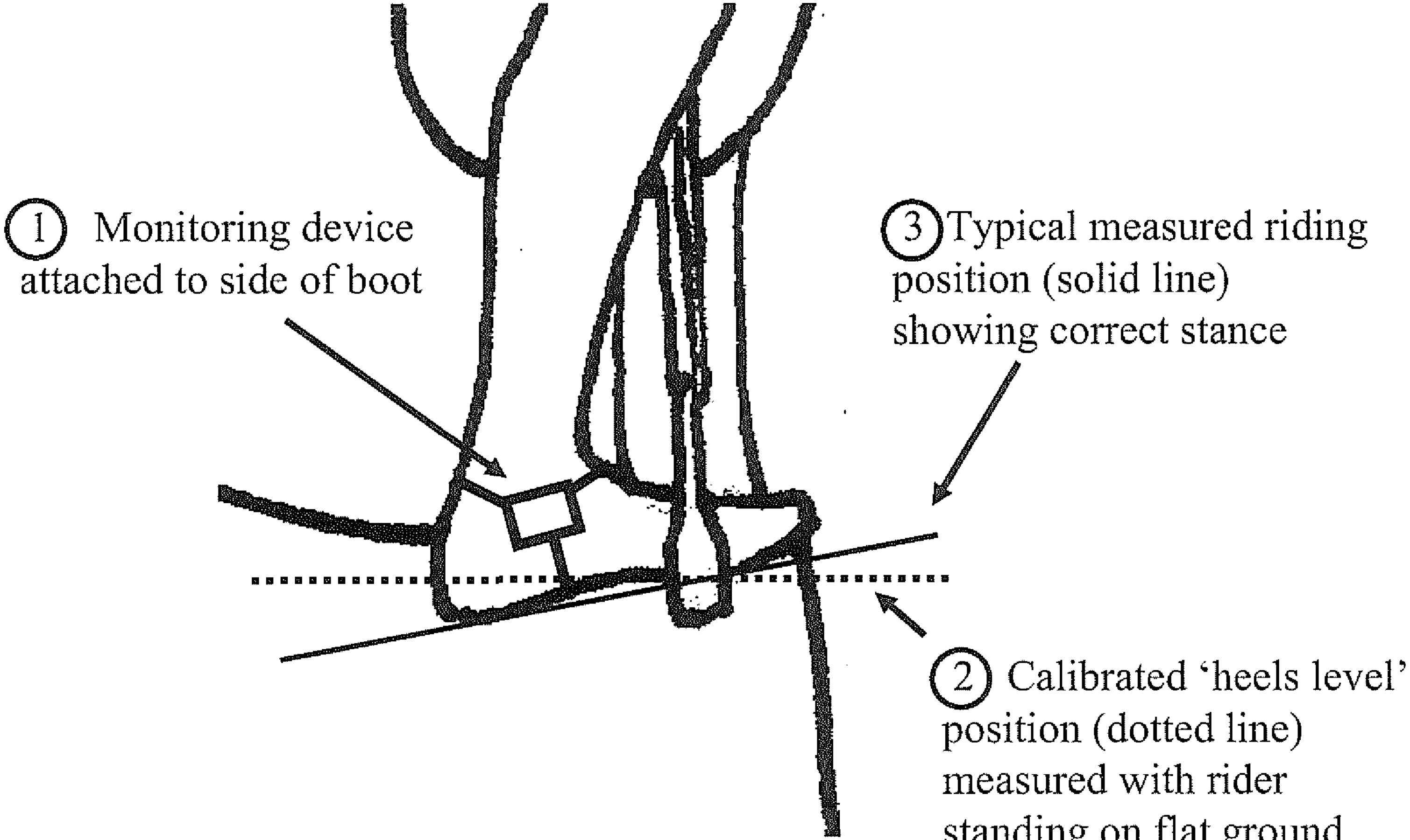
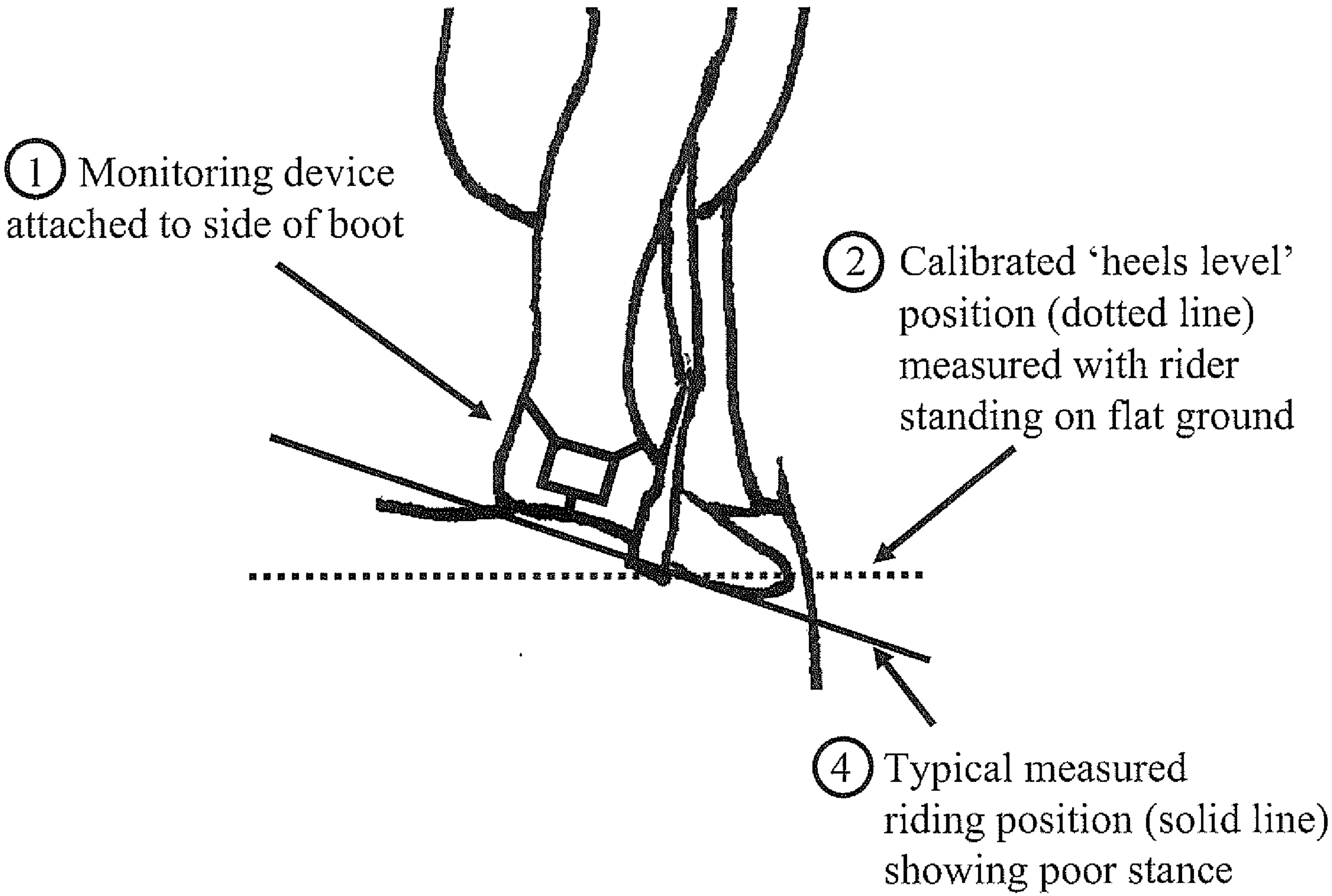


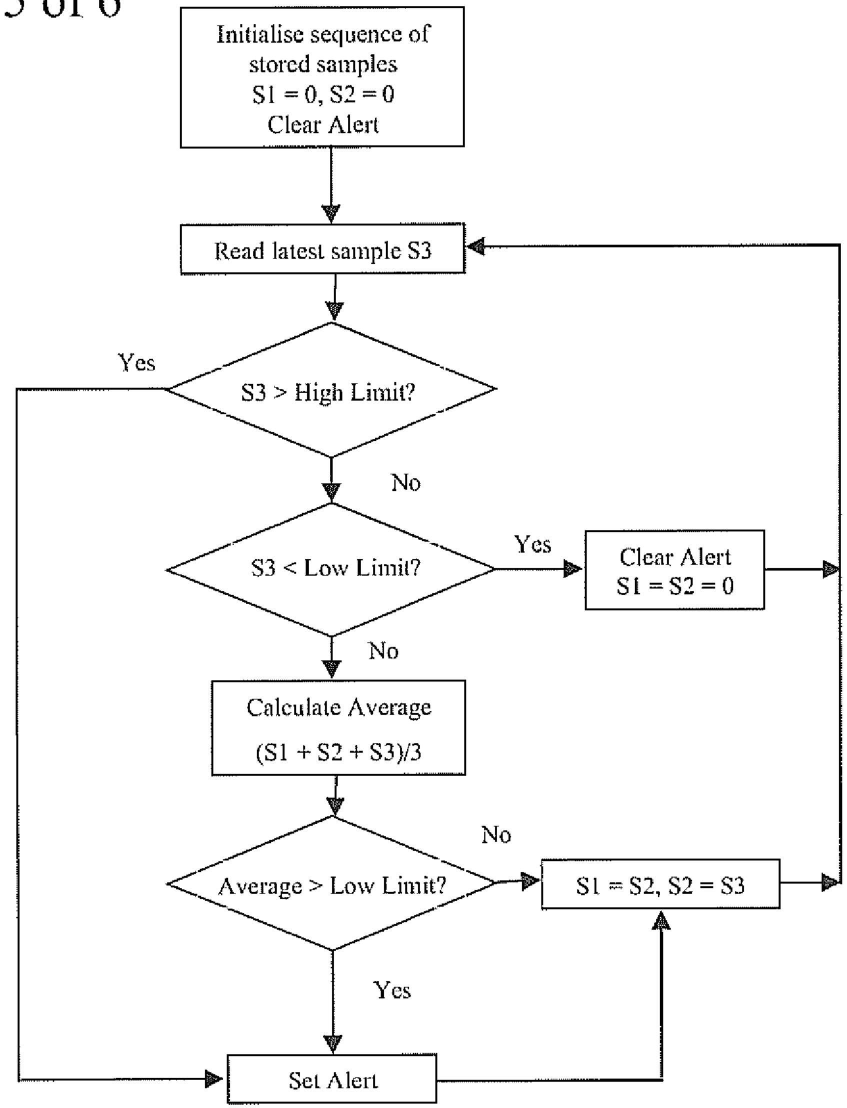
Illustration of monitoring device attached to boot

Fig 4 of 6



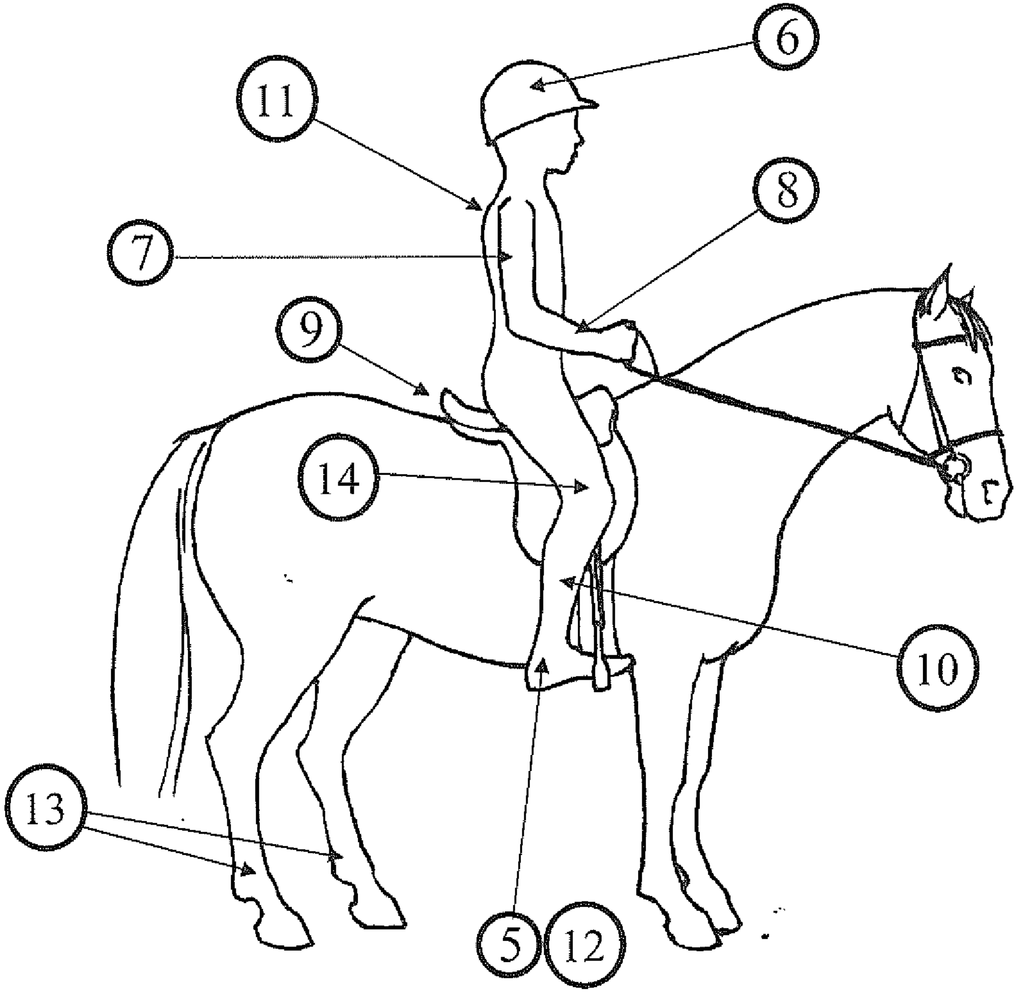
Monitoring device detecting 'Heels Up'

Fig 5 of 6



Algorithm for comparing measured angles with datum values

Fig 6 of 6



Typical Application points for Monitoring devices

Means for improving equestrian rider safety and effectiveness

Field of the invention

This invention relates to means for improving equestrian rider safety and effectiveness by monitoring an equestrian rider's posture. It may be used as a teaching aid to help riders learn to ride more safely and effectively. It may also be used as a practical tool to assist with everyday riding.

Summary of the invention

According to the present invention there is provided means for improving equestrian rider safety and effectiveness as claimed in Claim 1.

Brief Description of the Drawings

Fig 1 shows a typical efficient riding posture,
Fig 2 shows by way of contrast a poor riding posture,
Fig 3 shows a monitoring device attached to a rider's foot,
Fig 4 shows a monitoring device detecting, by way of example, a 'Heels Up' condition,
Fig 5 shows an algorithm for detecting significant changes in posture,
Fig 6 shows locations where monitoring devices may be placed.

Description of the Preferred Embodiments

The main objectives of the invention are as follows:

a) To assist a rider to adopt a safe riding posture

Horses have a range of controllable paces such as walking, trotting, cantering, galloping and jumping but, being prey animals, they also react instinctively when frightened - often taking rapid avoiding action. During such 'spooks', their movements can be unpredictable and, initially, largely uncontrollable.

To stay balanced on a horse during all these motions, riders must learn to adopt special body postures. Sometimes these seem counter-intuitive. For instance, when a horse spooks, a novice will often crouch forward with his or her head down and heels up – the very worst possible stance as it may encourage the horse to go faster and increases the likelihood of the rider falling off. The correct posture is to sit upright with a secure lower leg. The means described herein alerts the rider of the need to rectify his or her posture when elements of his or her position (for instance, head, upper body, and foot angles) become unsafe.

b) To assist a rider to adopt an efficient riding posture

In normal riding, the rider's posture greatly influences how the horse responds. A good posture (See Figure 1) interferes as little as possible with the horse's movements allowing the horse to be directed humanely and efficiently. The means described herein alerts the rider when aspects of his or her position become less efficient. Bad positions can include the rider's head being bent forward, upper body crouching, heels up, upper arms too far forward, arms and lower legs moving excessively, elbows sticking out, knees gripping, wrists rotated incorrectly, legs too far forward or backward, See Figure 2.

c) To help the rider improve effectiveness

Effective riding appears effortless, the rider's signals being so subtle they are practically invisible to the casual observer. This co-operation between horse and rider is typically attained only after many hours of practice. For instance, the horse must learn to carry out some manoeuvres by responding to quiet squeezes of the rider's lower leg at various positions near the girth. Poorly trained horses may become 'dead to the leg', meaning that they do not respond when the rider squeezes the horse. This often arises when the animal is incessantly kicked. Not only is this unpleasant for the horse, but it is hard work for the rider because the horse ignores the leg signals. The means of the present invention is able to monitor the amount of kicking the rider does – thus providing what may be termed a 'kickometer'. The rider can thus be made aware of his or her habits and make improvements.

d) To provide horse posture feedback to the rider

Expert riders learn to know the disposition of a horse's legs by feeling its leg movements through the saddle. This is an important skill to master as it enables the rider to give signals to the horse when its legs are in just the right position to respond. Because equine leg motions are complex and are not directly visible from the saddle, this skill is hard to acquire without the assistance of a teacher. The training system described herein enables a rider to acquire the skill without needing the constant presence of a teacher.

The means of the present invention comprises a single monitoring device or a network of monitoring devices for checking one or more elements of a rider's and/or horse's posture. When measurements of these elements deviate from the ideal, alerts may be sent to the rider or other person in real time or the data may be recorded for later analysis.

The system thus comprises the following:

a) Monitoring devices distributed about the rider's and horse's body to directly or indirectly measure postural angles of the head and/or body and/or limbs. The devices, at least one of which is mounted on the helmet of the rider, may also measure accelerations, velocities or positions of these body parts.
b) A means of recording optimum angle and/or acceleration and/or velocity and/or position limits calibrated for a particular rider and/or horse combination
c) A means of comparing the measured angles and/or accelerations and/or velocities and/or positions with the optimum values
d) A means of alerting a rider and/or other person when optimum limits are exceeded

The system may be implemented using autonomous monitoring devices wherein some or all of the above functions are carried out by each unit. Alternatively, a supervisory device may be employed. In this arrangement, the supervisory unit may control the operation of the devices it is supervising.
The supervisory device may itself carry out monitoring functions. In a practical implementation, the supervisory device may be a mobile computing device such as a smart phone.

Additional supervisory devices may be installed on the network to enable other persons (a teacher, for example) to remotely control the function and calibration of monitoring devices.

Monitoring Devices

The monitoring devices may comprise one or more sensors, a microprocessor and a communications device. The sensors may include accelerometers, gyroscopes and/or angle measuring devices. The microprocessor may be included to set up and read sensors and to control information flow to and from the communications device. The communications device (which may be a radio system) may be used to transfer data from the monitoring device to other devices or supervisory units.

The monitoring devices preferably measure accelerations along one, two or three orthogonal axes. In the absence of significant extraneous non-gravity related accelerations, the data may be processed to estimate angles of axis inclination with respect to the direction of the local gravity vector. This is the direction of the earth's local gravitational field pointing from the surface of the earth at the location of the measurement to the centre of the earth. The known art of inclination measurement using accelerometers is described in Analog Devices Application Note AN-1057 'Using an Accelerometer for inclination Sensing' by C J Fisher. Data processing may take place in the monitoring device or the data can be passed to the supervisory unit where calculations may be more conveniently executed.

Compensating for background accelerations and determining the gait of the horse

Angle measurement with respect to the gravity vector may be confounded when significant non-gravity-related forces produce additional accelerations. The effect is mitigated in the invention by

a) recording average accelerations in each axis whereby the substantially bi-directional extraneous accelerations caused by, for instance, the motion of the horse in trotting and cantering are averaged to zero.
b) using a monitoring device mounted on the saddle or girth strap or other location on the horse to separately measure horse

motion. Data from this device may be combined with rider data to determine net rider acceleration or other motions and thereby deduce rider sensor angles.

Data from the horse mounted monitoring device may also be analysed to determine the current gait of the horse. In the walk, acceleration data will show four distinct beats of moderately low amplitude. At the trot, the data will show two distinct beats at moderate amplitude. In the canter, there will be a pattern of three distinct beats with high levels of acceleration.

Attachment and inter-connection of monitoring devices

In a typical application, monitoring devices are attached to a plurality of boots, helmets, riders' limbs and bodies, saddles, bridles, reins and horses' legs. Attachment may preferably be by means of de-mountable straps (for instance elasticated or non-elasticated Velcro (RTM) webbing) wrapped round for instance the limb, body, boot or helmet of the rider at the monitoring point, to which the monitoring devices attach by means of mating Velcro (RTM) pads. This requires no permanent fixings on or adaptation of any type of the rider's apparel.

However, in the case of boots, helmets, saddles and bridles, monitoring devices may be built-in at manufacture, if so required. Alternatively, purpose-designed mounting pockets or lugs may be incorporated at manufacture. In the case of riding jackets, body protectors and jodhpurs, hook or loop fastener pads or purpose designed pockets may be pre-sewn onto the garments. In the case of attachment to horse's legs, mounting pockets may be built in at manufacture into exercise or brushing boots. Alternatively, the devices may be securely attached using standard exercise bandage wraps.

Supervisory devices may be attached to riders' arms or thighs using similar means of attachment as for monitoring devices. Alternatively, a supervisory device may be carried in a rider's pocket or in a bag.

Where monitoring or supervisory devices need to communicate with each other, wireless connections are preferably used.

Calibration

Every horse and rider combination is posturally unique. A method is therefore provided to record or set a datum representing the optimum or the limit of optimum posture for a particular feature on each combination. Alerts may be triggered when this datum is exceeded by a programmable amount and/or for a programmable amount of time.

The calibration method is illustrated by reference to the 'heels down' posture as follows:

Referring to Figures 3 and 4, the rider attaches a monitoring device 1 (if it is not already built into the boot) to the top or side of his or her weakest foot. (Although the method allows two sensors to be attached – one for each foot – typically this is unnecessary as, in practice, the desired effect can be attained by monitoring the rider's weakest foot only.)

Next, the rider stands in an upright posture on flat ground. Using the monitoring device 1 alone or in combination with a supervisory device, approximately 15 seconds worth of angle data is recorded. This amounts to some 30 measurements at 2Hz. Other quantities and frequencies may be used. This data is averaged to form the angle value of the 'heels level' position 2. Depending on orientation, exceeding or falling short of this angle while the device is monitoring heel posture during riding indicates that the rider has a correct 'heels down' posture 3 or an incorrect 'heels up' posture 4.

The method described above may be extended to other postures such as head carriage, upper arm position, lower arm position or any other limb or body posture.

When attaching a monitoring device to the rider or horse, none of the orthogonal axes of the sensor need be parallel or otherwise aligned with the ground. The calibration procedure takes any misalignment into account.

Datum values may be stored on monitoring devices or on the supervisory device. In most postures, datum values may also be set with the rider mounted on the horse. Although it is convenient to record datum values before riding, the values can be recorded or reset at any time.

Means may be provided for a teacher (or other person) to control the calibration process using an additional supervisory unit.

Comparing measured angles with datum values

After calibration, a datum value representing the optimum limit relevant to a particular posture is stored on the monitoring device or supervisory unit. When the rider activates monitoring, the monitoring devices collect posture measurements regularly and comparisons take place with datum values stored in these devices or in a supervisory unit, if measurements are being sent to it. Measurements exceeding their respective datum values indicate potential posture problems.

The comparison method may take account of both the magnitude of the excess difference between measured values and datum values of posture characteristics and the times for which these differences persist. Thus the method may be configured to tolerate small excess errors, which persist only for short periods, but not tolerate large excess errors under any circumstances. This feature is useful because, occasionally, the rider may have to fleetingly adopt a technically weak position in order to accomplish an extraneous task. The method stops an alert from triggering under such circumstances. The method allows magnitude and time limit tolerances to be adjusted to suit the riding style or the rider's level of expertise.

One possible algorithm is shown in Fig 5. This shows a system handling three sequential samples S1, S2, S3 (S3 being the most recent measurement) and two error limits, i.e. High Limit and Low Limit. Any S3 value exceeding the High Limit immediately triggers an alert. Any S3 smaller than the Low limit immediately cancels any existing alert. Any S3 value between the two extremes only triggers an alert if the average of the two previous samples and S3 exceeds the Low Limit. After S3 has been processed, the algorithm shuffles the queue of values so that S1 takes the value of S2, S2 takes the value of S3 whilst S3 takes the value of the next available measurement. Scaling factors may be applied to the samples. The method allows the number of samples, the scaling factors and the High and Low error limits used in the evaluation to be varied. This enables riders of different abilities to set alert thresholds appropriate to their skills. The method allows combinations of measurements to be checked against multiple criteria in order to determine whether an alert should be issued. For instance, the acceptable magnitude of the deviation of a posture from the ideal may vary according to the pace at which the horse is moving.

The method allows for different alerts to be issued depending on the magnitude and/or persistence of deviations from pre-calibrated posture limits.

The allowable magnitude and/or persistence of deviations from pre-calibrated posture limits may be varied according to the gait and/or activity of the horse. For instance, wider tolerance on limits may be programmable if the horse and rider are jumping.

Alerting the rider

When the system detects that one or more elements of a rider's posture has deteriorated, an alert is issued. Alternatively, messages may be sent to the rider when measured elements are within tolerance.

Alerts or messages may use any of the following media:
a) Sound - for example, synthesised or recorded human speech clips or musical tones,
b) Light – for example, Light Emitting Diodes attached to the rim of the rider's helmet in a position visible to the rider, or symbols projected onto a head-up display or digital glasses,
c) Mechanical – vibration.

When sound is used, the alert may be generated at the monitoring device where the deviation is detected, at another monitoring device, at the supervisory unit (for example, a mobile phone) or at a dedicated transducer. The alerting device may be positioned anywhere convenient, such as on the rider's arm, upper leg or upper body, or carried in a rider's pocket or bag. The alerting device may be carried on the horse or on its saddle or other tack. Different sounds may be associated with different monitoring devices. Different sounds may be associated with different levels or persistence of error.

A means may be provided to enable a user to record custom alert messages or sounds for association with monitoring functions.

A means may be provided for playing alerts or messages to the horse to accustomise it to sound, vibration or other signals generated by monitoring or supervisory devices.

Alert or message sounds may be broadcast via loudspeaker or via earphones. Alerts or messages may be sent to a ground helper or teacher instead of, or in addition to, the rider.

Applications of the system

Monitoring heel position

When using stirrups, a heels-down position encourages the rider to let their weight ‘drop into their heels’ which helps to keep their centre of gravity as low as possible and thus maintain a secure position. The heels-down position is where the heel is slightly lower than the ball of the foot when the rider is sitting in an upright posture.

A monitoring device is attached to the side, top or rear of the foot. See Fig 6 item 5. It may measure accelerations in horizontal and vertical directions (as defined on the sensor module) and from these deduce the angle of the sole of the foot relative to the direction of the gravity vector. An alert is generated when the rider’s sole angle is flatter than the current calibration value.

Monitoring rider’s head position

Keeping the head vertical or near vertical encourages the rider to sit upright and keeps the significant weight of the head balanced over the rider’s seat. This contributes towards a secure position.

A monitoring device is attached to the side, front or rear of the rider's helmet to measure accelerations in horizontal and vertical directions (as defined on the sensor module) and from these to deduce head angle relative to the direction of the gravity vector. See Fig 6, item 6.

An alert is generated when the rider's head angle exceeds the current calibration value.

Monitoring position of rider's upper arms and elbows

Keeping the upper arms hanging down substantially vertically also encourages the rider to sit upright. It also brings the weight of the upper arms rearwards over the rider's seat. This improves security.

A monitoring device may be attached to the side or the front of the rider's upper arm to measure accelerations in horizontal and vertical directions and from these to deduce upper arm angle relative to the gravity vector. See Fig 6, item 7.

Excess movements away from the vertical – upper arm too far forward or elbows sticking out (as judged relative to the current calibration value) may be programmed to generate rider alerts. The current horse gait may be taken into account in determining the allowable level of excess arm motion. For instance, extra movement may be allowed in the walk and canter. The horse gait may be determined automatically by analysing vibration data recorded by a horse-mounted monitoring device. The extra movement allowance for each gait may be programmable.

If required, sensors may be placed on both rider's arms if there is a significant tendency for these to move independently.

Monitoring movement of arms/hand – 'quiet' arms/hands

Good riding requires the rider to maintain a gentle but firm contact through the reins with the horse's mouth. There must be no jabbing. The hands and arms must therefore remain substantially still as measured *relative to the horse.* Monitoring excess arm motion therefore needs to account for arm movement net of background horse motion. This may be accomplished by using two monitoring devices: one attached to the side or top of the lower arm (Fig 6, item 8) and a second mounted on the saddle, girth strap or other location on the horse (see Fig 6, item 9) to separately record horse-related acceleration data. Data from the arm and horse motion sensors are combined to determine the net arm motion. Excess levels of net arm motion may be programmed to generate rider alerts. The current horse gait may be taken into account in determining the allowable level of excess arm motion. For instance, extra movement may be allowed in the walk and canter. The horse gait may be determined automatically by analysing vibration data recorded by the horse-mounted monitoring device. The extra movement allowance for each gait may be programmable.

If required, sensors may be placed on both the rider's arms if there is a significant tendency for these to move independently.

Monitoring position of rider's wrists

Effective riding posture requires that the wrists be rotated so that the rider's thumbs are on top of the hand. A monitoring device can be carried by the rider on the wrist to monitor the wrist rotation angle. An alarm may be generated when the wrist rotation angle exceeds a programmable margin away from a previously recorded datum setting.

Monitoring movement of rider's lower leg – 'quiet' legs

There can be a tendency with weaker riders for the lower leg to swing back and forth while the horse is moving. To detect this, a similar method to the arm motion monitor may be used. A monitoring device is located on the side, front or back of the weaker leg or on the top, side or back of the boot to measure accelerations in the horizontal and vertical directions (see Fig 6, item 10). Background horse motions in the same axes are also monitored and subtracted from the leg motion data (see Fig 6, item 9). Pre-set levels of excess leg motion cause alert messages to be issued.

Monitoring of average position of rider's lower leg

Some riders on average carry their legs too far forward or backward. Carrying them too forward makes it difficult to rise from the saddle in gaits such as trotting without pulling on the reins to maintain balance. This can be painful for the horse, discourages forward motion and should be avoided at all costs.

Likewise, the rider's leg should not be carried too far backwards as this will encourage the body to tip forward away from the ideal upright balanced posture.

In both situations, a monitoring device may be attached to the side, front or rear of the rider's lower leg to measure accelerations in horizontal and vertical directions (as defined on the sensor module) and from these to deduce leg angle relative to the direction of the gravity vector. Comparison with a pre-recorded ideal datum setting enables an alarm to be generated when either an excessive leg forward or leg backward position arises.

Detecting knee gripping

Gripping a horse with the knees is undesirable as it makes it difficult for the rider to follow the horse's movement. It also works against the correct disposition of the rider's lower legs. To detect this defective posture, a monitoring device may be attached to the rider's leg above or below the knee joint, (Fig 6, item 14) so that, when gripping occurs, the axes of a given pair of orthogonal acceleration sensors tilt away from a previously calibrated non-gripping knee position. Exceeding pre-set levels of tilt cause alert messages to be issued.

Upper body monitoring

In most equine paces, the rider should maintain an upright posture for secure and effective riding. There can be a tendency for weaker riders to ride slightly slouched forward. To detect this defective posture, an additional monitoring device may be located on the front or rear of a rider's shoulder (Fig 6, item 11) so that, when slouching occurs, the axes of a given pair of orthogonal acceleration sensors tilt away from the upright calibration position. Exceeding pre-set levels of tilt cause alert messages to be issued.

‘Kickometer’

It has been stated above that it is undesirable for the rider to handle a horse roughly by repeatedly kicking it. It is also undesirable to constantly nudge the horse as it may deaden the horse to leg signals. The “Kickometer” feature is designed to record the number and severity of kicks or nudges given to a horse during a riding session. Being made aware of the true extent of these bad habits enables a rider to improve their riding practice.

The method preferably uses a monitoring device attached to the side or back of the rider’s leg or alternatively the side or top of the rider’s foot (see Fig 6, item 12). The device is set up to record accelerations normal to the horse’s flank. This data is processed in either the monitoring or supervisory device to calculate the average absolute magnitude or the root mean square value of the acceleration values occurring within a programmable time interval. The lower the calculated value, the better the riding. Means may be provided for indicating the latest value to the rider so that timely corrective action can be taken if required. Means may be provided to alert the rider when the latest calculated value exceeds a programmable level.

Monitoring the positions of horse legs

Experienced riders recognise the disposition of their horse’s legs by feel. Because hooves cannot be seen from the saddle, novice riders need to be told how the legs are being placed while they are carrying out exercises. The invention may thus assist with the following exercises:

A) Learning to identify correct ‘diagonals’

When executing a rising trot on a curved path (such as when trotting round the edge of a riding arena), the rider must be on the correct ‘diagonal’. The rider should lower when the horse’s outside foreleg and inside hind leg are on the ground and rise when the other legs are on the ground. Experienced riders learn to recognise these diagonals by feel. The method described herein expedites the learning process.

A monitoring device is placed on each hind leg (Fig 6, item 13) so that a designated sensor axis approximately aligns with the gravity vector. Each monitoring device is set to measure acceleration levels on all three of its orthogonal axes at an appropriate rate. The data samples are transmitted to the supervisory device which is programmed to detect changes in acceleration data on any axis or combination of axes caused by the monitored hind hoof striking the ground.

On detecting such a change in the data from a particular monitoring device, the supervisory unit issues a message to the rider indicating which monitored leg has struck the ground. The message may comprise, for example, a synthesised voice saying ‘left’ or ‘right’ as appropriate or synthesised sounds.

The changes in acceleration levels used to detect hoof strike may be programmable. Means may be provided to set appropriate levels calibrated to particular horse and rider combinations. Means may be provided to delay the sending of the alert signal by a programmable amount.

The alerts are used as follows:
When correctly riding a clockwise turn, the rider should sit when the right hand hind monitoring device issues an alert and vice versa. These signals tell the rider which hind leg is striking the ground and the rider can then learn to associate identified hoof strikes from the feel of the horse’s upper legs through the saddle.

In another configuration, the front hooves may be monitored in like manner. In this configuration, when correctly riding a clockwise turn, the rider should sit when the left hand front leg monitoring device issues an alert and vice versa.

In another configuration, the method may exploit the symmetry of the trot gait to identify hoof strikes using just one sensor. In this mode, a device is attached to one leg – for example the left hind. Clearly, the device will directly identify left hind hoof strikes. However, while the horse is trotting, it may also in this example estimate when the right hind hoof strikes by detecting when the left hind hoof starts lifting from the ground.

Learning how to ask for canter at the correct time

The correct time for the rider to ask a horse for canter is when the outside hind leg is 'engaged' i.e. going forward under the horse's body. This is just after the inside hind leg has struck the ground. In like manner to the method described for checking diagonals, monitoring devices placed on the hind legs alert the rider when each hind hoof strikes the ground. If the rider wishes to initiate canter with the left hind leg striking off, the right hind leg alert tells him precisely when he should signal the horse. Similarly with the right leg. When following a curved path, the rider should identify which hind leg is on the 'outside' and act on the appropriate left or right alert.

An alternative to issuing an alert just after the inside hind leg strikes the ground, is to check for the outside hind leg lift off. An alert can be issued when the sensor device detects the appropriate acceleration.

Means may be provided to delay the sending of an alert signal by a programmable amount.

The method of training described above is useful because it greatly improves the likelihood of a novice rider executing clean canter strike-offs. This has two benefits: First the novice gets to experience the correct feel of the manoeuvre more reliably – and, in particular, how the horse feels through the saddle when each leg is called. Second, the horse has less opportunity to become confused by poor signalling.

Monitoring positions of the hind hoofs at the halt

In dressage it is desirable that, at the halt, both rear hoofs are aligned squarely under the body of the horse rather than having one trailing out behind the other. Experienced riders learn to know the feel of correctly aligned hoofs, initially using a helper on the ground to tell them when the horse's legs are square.

The present invention enables a rider to practice the skill without the assistance of a ground helper. A monitoring device is deployed on each hind leg (on the cannon bones) with both devices' same x, y or z axes aligned along the cannon bones. In combination with the supervisory device, one monitoring device is designated as the right hoof, and the other as the left hoof. At the halt, both leg angles measured relative to the earth's gravitational vector direction should be the same (within a programmable tolerance limit). An alert can be issued if the cannon bone angles are not aligned within the tolerance limit and by comparing the two reported angles, the trailing hoof can be identified and made known to the rider via the supervisory unit. Knowing the nature and extent of the fault, the rider can then learn the feel of it through the saddle and the seat adjustments required to correct the problem.

Recording and analysing data

In any of the above applications, measurements (or values derived from them) collected by a monitoring device may be collated, preferably in the supervisory device, and analysed to show average values or the frequency of values occurring within programmable ranges. This data may be displayed as a histogram. Other derived data may be displayed or stored, such as the percentage time spent or not spent in a compromised posture. Means may be provided to allow recently acquired data or derived values to be compared with historical data. Using this information, a rider may thus track his or her improvements.

Data collected from monitoring devices may be used to display the kinematics of a rider's head and/or body and/or limbs and/or of the horse's head and/or body and/or limbs.
The kinematic or other postural data may be displayed in conjunction with Geographical Positioning System information describing how the posture of the rider and/or horse varies along a route, for example, whilst negotiating a show jumping course, an event course, a dressage test or a hack.

Claims:-

1. Means for improving equestrian rider safety and effectiveness comprising one or more monitoring devices mounted, in use, on the body of the rider, the or each monitoring device including means for determining the orientation of the part of the rider's body on which it is mounted and transmitting data concerning the postural angle of said part of the body, means for receiving the transmitted data and comparing the transmitted data with stored data relating to ideal postural angles, and means for communicating the result of the comparison such that the rider is alerted to deviations from ideal postures.

2. Means for improving equestrian rider safety and effectiveness as claimed in Claim 1, in which any alerts are communicated to the rider using personalised sounds and/or custom voice messages.

3. Means for improving equestrian rider safety and effectiveness as claimed in either of the preceding claims, which includes means for recording the number and severity of kicks or nudges given to a horse during a riding session.

4. Means for improving equestrian rider safety and effectiveness as claimed in any one of the preceding claims, which includes a monitoring device for mounting on each rear leg of the horse.

5. Means for improving equestrian rider safety and effectiveness as claimed in any one of the preceding claims, which includes means for playing alerts or messages to the horse to accustomise it to signals generated by monitoring or supervisory devices.

Intellectual Property Office

Application No:	GB1714780.2	**Examiner:**	Mrs Nicola Payne
Claims searched:	1-5	**Date of search:**	1 November 2017

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,P	1 and 4	WO2013/163204 A1 (RAYTHEON) See especially figures, page 7 line 31 to page 9 line 6, page 18 line 27 to page 19 line 2 and page 21 line 27 to page 28 line 8
X	1 and 2	WO2009/040947 A1 (PANASONIC) See especially figure 7
X	1 and 2	KR 1020120105315 A (AJIN) See especially figures and EPODOC abstract

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

Worldwide search of patent documents classified in the following areas of the IPC

A01K; A61B; A63B; A63K; B68B; B68C; G09B

The following online and other databases have been used in the preparation of this search report

WPI & EPODOC

International Classification:

Subclass	Subgroup	Valid From
A63B	0071/06	01/01/2006
A01K	0029/00	01/01/2006
A61B	0005/103	01/01/2006
A63K	0003/00	01/01/2006