US 20060147887A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0147887 A1**

Greenwood (43) **Pub. Date: Jul. 6, 2006**

(54) **HORSE SIMULATOR**

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(21) Appl. No.: **11/294,334**

(22) Filed: **Dec. 6, 2005**

(30) **Foreign Application Priority Data**

Dec. 6, 2004 (GB) 04 26734.0

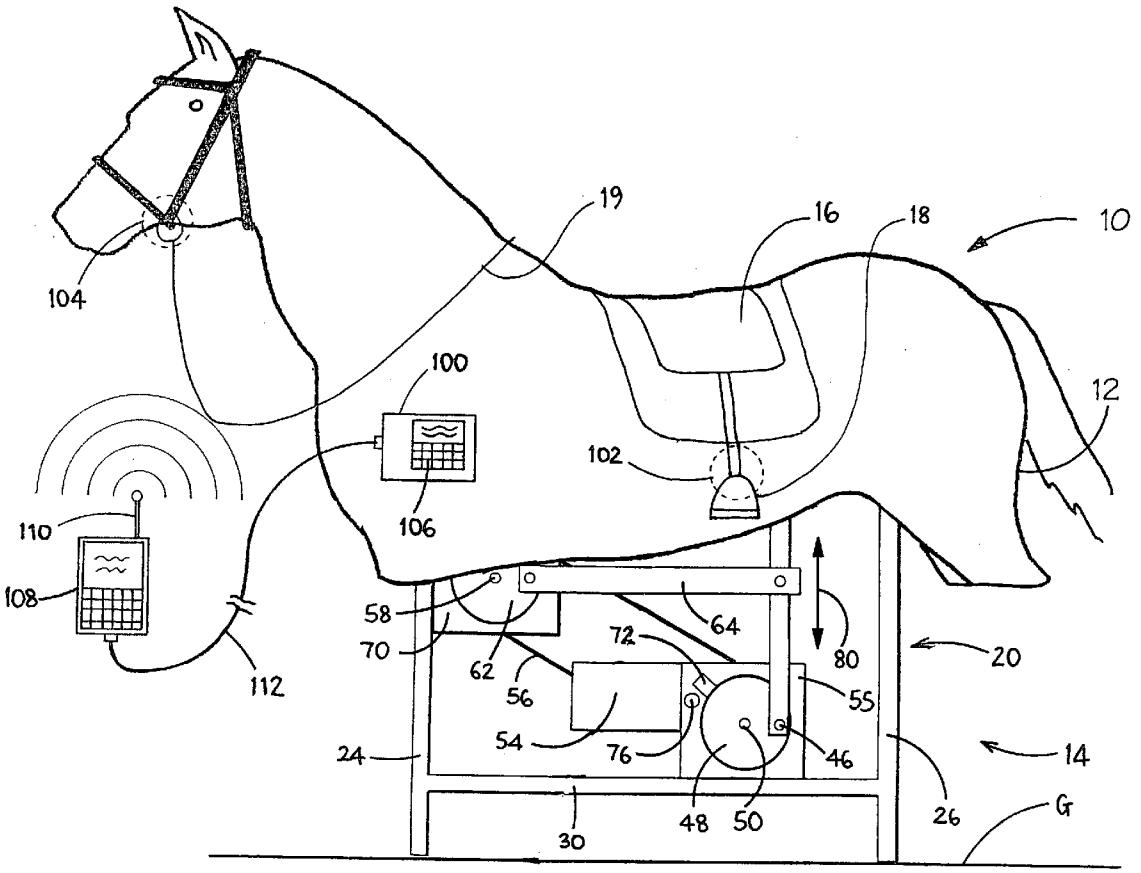
Publication Classification

(51) **Int. Cl.**
A63G 13/08 (2006.01)
A63B 69/00 (2006.01)
G09B 19/00 (2006.01)

(52) **U.S. Cl.** **434/247**; 472/104

(57) **ABSTRACT**

The present invention relates to a simulator for simulating the movement of a horse comprising: a base; a body portion for receipt of a rider and having a longitudinal axis corresponding to the simulated forward and backward movement of a horse; a first linkage extending between said body portion and said base; a second linkage extending between said body portion; and a mechanism capable of providing vertical and horizontal movement to the longitudinal axis of the body portion. The present invention also relates to a kit of parts for producing the simulator. The simulator is particularly useful as a training aid for people to ride horses, in addition to improving stamina and general fitness.



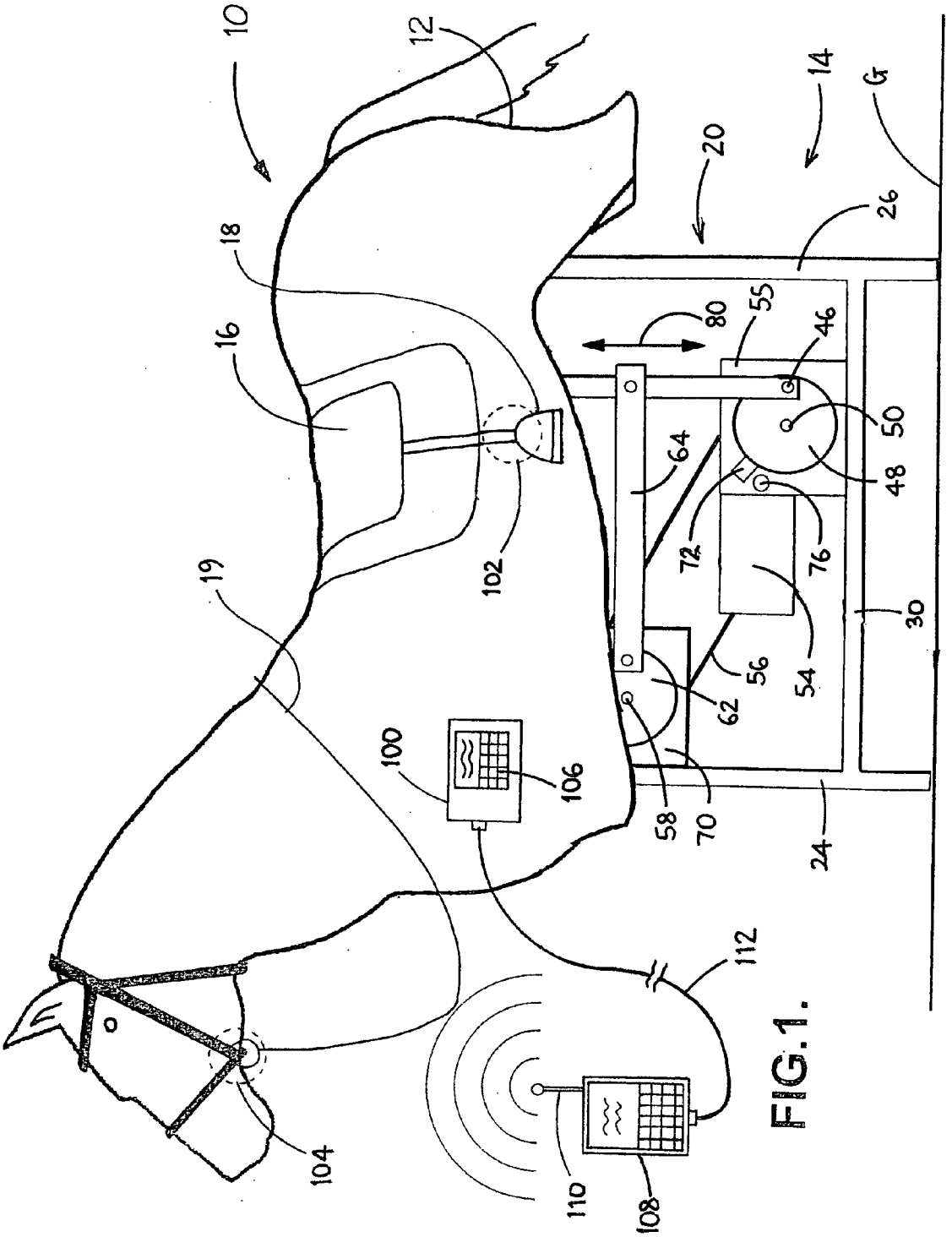

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FIG. 1.

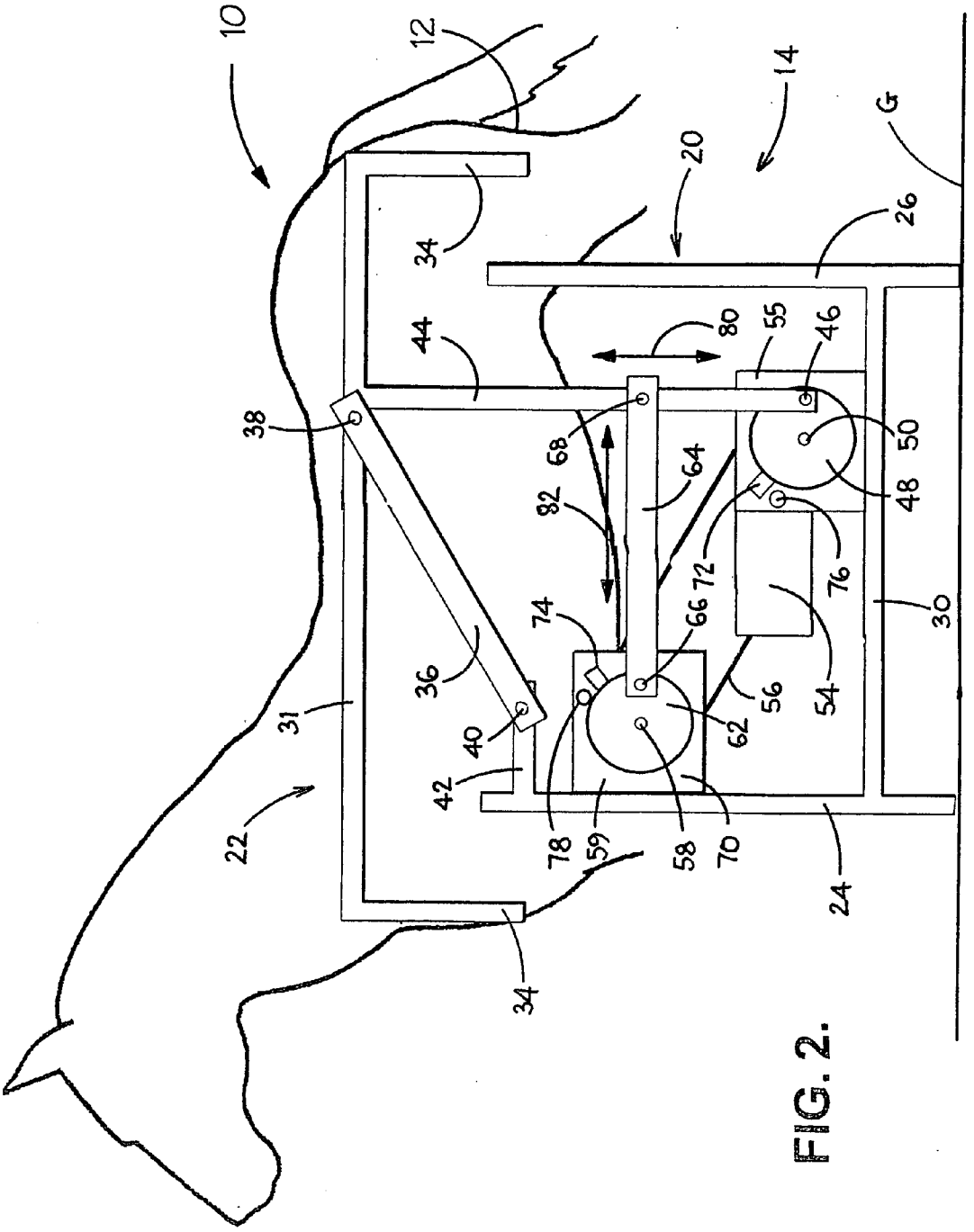
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FIG. 2.

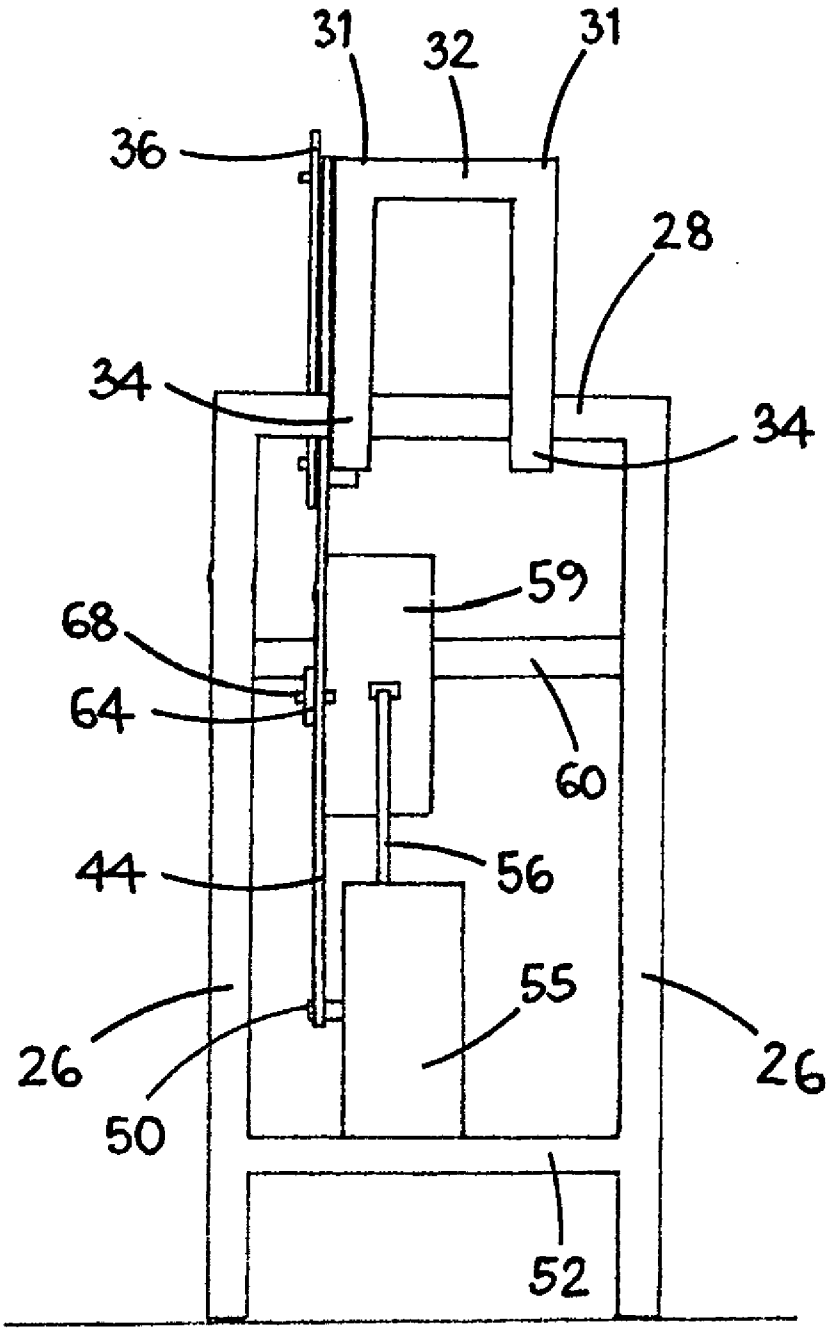

FIG. 3.

HORSE SIMULATOR

[0001] The present invention relates to horse simulators and in particular, but not exclusively, to simulators which confer a realistic motion of a horse that a rider may experience.

[0002] Horse simulators can be used for a number of applications, such as sports training for equestrian sports, assisting people with co-ordination difficulties and novelty fun rides, to name a few. Whilst there are a number of horse simulators currently available, their motion is often unlike that of a true horse and they are therefore not a true representation on which how a rider should position himself or herself.

[0003] The horse simulators that are currently available rely upon hydraulics to actuate the various movements of the horse body. The hydraulics can be controlled by a central processing unit (CPU) which actuates a pre-programmed movement of the horse and such movement is controlled by an operator. A number of problems are associated with such simulators, for example the hydraulic rams have a limited life span, resulting in a potential leakage of fluid. These simulators therefore require an extensive servicing regime. DE199112281 discloses a riding simulator relying upon a pneumatic system which removes the risk of fluid leakage, although the pneumatic rams also have a limited life span. In addition, both simulators tend to have a disjointed motion which is unlike a real horse due to the number of rams involved.

[0004] A number of other 'hobby horse' type simulators have also been disclosed (such as in U.S. Pat. No. 4,957,444 and U.S. Pat. No. 6,264,569), although they do not provide enough variation in movement to simulate the difference between walking, trotting or cantering. WO 01/89649 discloses a more complicated racing horse simulator, but again it is not able to simulate the different motions of the horse and only simulates the motion of a horse galloping.

[0005] It is therefore an object of the present invention to alleviate one or more of the problems associated with the prior art simulators. It is also an object of the present invention to provide a horse simulator that simulates a realistic motion of a horse for an individual. Furthermore, it is another object of the present invention to provide a simulator that is capable of simulating a number of different movements of a horse, such as a walk, a trot and a canter and for the smooth sequential transition from one movement to another.

[0006] In accordance with an embodiment of the present invention, there is provided a simulator for simulating the movement of a horse comprising:

[0007] (a) a base;

[0008] (b) a body portion for receipt of a rider and having a longitudinal axis corresponding to the simulated forward and backward movement of a horse;

[0009] (c) a first linkage extending between said body portion and said base;

[0010] (d) a mechanism capable of providing vertical and horizontal movement to the body portion with respect to said base; and

[0011] (e) a second linkage extending between said body portion and said mechanism.

[0012] The present invention therefore provides for a simple mechanism which may be employed to provide a simulator that has a number of effective and realistic movement. Such a simulator will be applicable in a number of applications, such as a training individuals to ride a horse and for experienced riders to further develop their riding skills and/or stamina. The simulator may also be used to assist those recovering from injury and/or muscular diseases, but may equally be used as a novelty simulator.

[0013] The said first and second linkage may comprise elongate members and such members may be arms produced from a suitably rigid material such as metal. Preferably, the mechanism is driven by a motor which is electric, although the mechanism could also be driven manually or powered by a number of sources. Should an electric motor be used, it is preferred that the motor is of a size in the region of 1.5 kW and is powered by mains electricity. The mechanism may also employ electromagnetic actuators or hydraulic/pneumatic rams if required.

[0014] The said motor may drive a first pulley connected to a first crank which in turn is pivotally connected to the second linkage so as to effect a vertical movement of said body portion. Furthermore, the motor may further drive a second pulley connected to a second crank which in turn is pivotally connected to a middle portion of the second linkage so as to effect a horizontal movement of said body portion. The mechanism therefore provides for the movement required by the body portion so as to simulate the movement of a horse.

[0015] A gearing means may be located between said motor and said first and/or second pulley and it will be apparent to one skilled in the art that such a gearing will allow the rotation of the pulley (and therefore cranks) to be controlled, in addition to the use of a motor of a reduced size. The first pulley and/or the second pulley may be driven from the engine by means of toothed belt, although a smooth drive belt, chain or direct drive may also be employed. The second pulley may be connected to a clutch and/or a brake for selectively preventing or allow the rotation of the crank. The engagement of the clutch or brake may be actuated automatically when different movements of the body portion are required. When the crank attached to the second pulley is static, the body portion can only move in a vertical manner, simulating a walk or a trot. Whereas when the crank is rotating, the body portion can move in a vertical and horizontal manner in order to mimic a canter and/or a gallop. Additionally, the crank may have a sensor attached thereto to sense the rotation and/or rotation speed of the crank in addition to the position of the crank. The sensing means can be used to assess when and when not to allow rotation of the crank attached to the second pully, so as to allow for a smooth transition between movements.

[0016] A covering may be placed over the body portion, which may be in the shape of a horse. The covering may be constructed out of a number of materials, such as fibreglass and other composite materials. Preferably, the covering also has a portion (corresponding to the back of a horse), which may be used for an individual to be seated and may also comprise or allow for a saddle to be placed thereon. The simulator may also allow for the covering and/or the cov-

ering to lean either to the left or the right so that an individual can also use the simulator to practice riding when cornering etc. Alternatively, the whole simulator may be able to lean.

[0017] The action of the mechanism may be controlled by a central processing unit (CPU). The CPU may have any number of input and/or output sensors, such as a sensor located near to a crank and/or pulley to assess the rotation speed. The information from the sensors can then be relayed to the central processing unit. The CPU may control the engagement of the clutch and/or the brake of the crank attached to the second pulley so as to allow the differential movement between a trot and a canter. Alternatively, a pre-determined rotation speed of the second pulley may determine whether a clutch (such as a centrifugal clutch) is engaged to rotate the crank. The speed of the cranks can therefore be controlled and the movement of the simulator controlled accordingly. The position of the cranks may be synchronised relative to one another prior to engagement or disengagement of the clutch and/or brake. Preferably, the cranks will synchronise at a 3 o'clock position prior to engagement or disengagement. It is also preferred that when the clutch is disengaged, that a brake is applied so as to steady the second linkage. The action of the mechanism may be controlled by a control panel and such a control panel may be located on the simulator or located remotely from the simulator.

[0018] The action of the mechanism may also be controlled by controlling sensors located within the body covering and such sensors may correspond to locations in a horse that are used to control a real horse. For example, the sensors may be located in portions of the covering corresponding to the stirrup and rein area of a horse and a canter may be induced by an individual digging their heel into the stirrup area of the covering. Therefore, a kick sensor in the stirrup area of the covering may be used by an individual to increase the speed of the mechanism, whilst a pull sensor in the reins may be used by an individual to decrease the speed of the mechanism (or indeed to stop it). The kick sensor may also be able to determine whether the individual wishes to go faster, such as a constant pressure applied by the heels, or whether to change from a walk to a trot, such as by means of a kick.

[0019] So as to prevent the simulator from causing injury or an inexperienced rider not being able to control the simulator, an override switch may also be provided which stops the mechanism. Such a switch may also be provided so as to automatically sense if an individual is no longer seated. The simulator may also be turned on or off by means of a key, so that unauthorised use of the simulator is prevented.

[0020] The simulator can therefore simulate a walk, a trot, a canter, a gallop and a halt by varying the speed of the crack attached to the first pulley and whether or not the crank attached to the second pulley is rotating. Furthermore, the simulator can also operate at intermediate speeds so as to simulate a slow trot, a rising trot, a slow canter and a fast canter, for example.

[0021] The present invention also provides for a kit of parts for producing a simulator for simulating the vertical and horizontal movements of a horse, the kit comprising:

[0022] (a) a base;

[0023] (b) a body portion adapted for receiving an individual;

[0024] (c) two or more linkage arms; and

[0025] (d) a mechanism for providing movement to said linkage arms.

[0026] The kit of parts may also comprise a motor for attachment to at least one linkage arm. The kit may also be used to produce a simulator as hereinabove described.

[0027] By way of example only, a specific embodiment of the present invention will now be described with reference to the accompanying drawings in which:

[0028] **FIG. 1** is a side view of an embodiment of horse simulator in accordance with the present invention;

[0029] **FIG. 2** is a cut-away side view of the horse simulator of **FIG. 1**; and

[0030] **FIG. 3** is a cut-away rear view of the horse simulator of **FIG. 1**.

[0031] With reference to the Figures, a horse simulator **10** comprises a moulded glass fibre or plastics shell **12**, having the shape of the exterior of the upper portion of a horse, which is supported on a frame **14** which rests on the ground G (or other surface). **FIG. 1** also shows a saddle **16**, stirrups **18** and reins **19** attached to the horse-shaped shell **12**. As will be explained, the horse-shaped shell is movable with respect to the support frame **14**, which allows a rider seated on the saddle to experience realistic simulated horse movements.

[0032] As best seen in **FIGS. 2 and 3**, the supporting frame comprises a fixed frame portion **20** which rests on the ground and a movable frame portion **22** which is connected to the horse-shaped shell **12** and which is movably connected to the fixed frame portion **20**.

[0033] The fixed frame portion **20** comprises two vertical, parallel front frame members **24** and two vertical, parallel rear frame members **26**. The upper ends of the front frame members **24** and the upper ends of the rear frame members **26** are interconnected by a cross-beam **28** and two parallel longitudinally extending side frame members **30** extend between the front and rear frame members **24**, **26** parallel to, and just above, the ground G.

[0034] The movable frame portion comprises two parallel, elongate, longitudinally extending frame members **31** which are interconnected at their front and rear ends by cross-members **32**. Downwardly extending frame members **34** extend from the ends of the longitudinal frame members.

[0035] The fixed frame portion **20** and the movable frame portion **22** are connected together in several ways.

[0036] Firstly, a first connecting bar **36** is pivotally connected at pivot **38** to one of the longitudinally extending frame members **31** of the movable frame portion **22**, about two-thirds along its length from front to rear, and is also pivotally connected at a pivot **40** to a mounting lug **42** projecting rearwardly from one of the front upstanding frame members **24** of the fixed frame portion.

[0037] A second connecting bar **44** extends downwardly from one of the longitudinally extending frame members **31** of the movable frame portion **22**. The upper end is fixedly secured to the frame member **31** and extends perpendicularly from it at a point just to the rear of the pivotal mounting **38** of the first connecting bar. The opposite end of the second connecting bar is pivotally connected at crank pin **46** to a

first crank **48** which rotates with a first pulley **50** mounted on a further cross-member **52** extending between the two longitudinal side members **30** of the fixed base frame portion. The first pulley **50** is rotatable by means of an electric motor **54** mounted on the pulley housing **55**.

[**0038**] The rotation of the first pulley **50** is transferred by means of a drive belt **56** to a second pulley **58** which is mounted on a further cross-member **60** extending between the front upright frame members **24** of the fixed frame portion. The output of the second pulley **58** in housing **59** is connected to a second crank **62**. A third connecting bar **64** is rotatably mounted at one end to the crank by means of a pivot **66** and is pivotally mounted at the other end to the second connecting bar **44** about one-third of the way from its lower end by means of a pivot pin **68**. The second pulley **58** has an associated combined brake/clutch **70** within the housing **59** of the second pulley, which either allows the second crank **62** to rotate or be stationary. A flag or marker **72**,**74** is also provided on each crank **48**,**62** which allows a reactive sensor **76**,**78** (e.g. a magnetic proximity sensor) to determine the position and speed of the cranks in addition to whether or not they are moving.

[**0039**] In use, an individual would mount the horse simulator **10** and sit on the saddle **16** of the horse shaped shell **12** which is made from a fibre glass or similar durable material. The shell **12** also provides a realistic representation of a horse in size, dimensions and feel so as to provide the most realistic simulation as possible to the rider.

[**0040**] The simulator is controlled by controls which are either located upon the shell **12** (such as areas corresponding to the stirrup and reign) or at a position remote from the simulator such that an individual who is not seated on the simulator may operate it. The simulator can be made to simulate a range of different movements that a horse may make when being ridden, such as walking, trotting or cantering.

[**0041**] In order to actuate the simulator into simulating the horse which is walking, the motor **54** is switched on, which in turn rotates the first pulley **50** and the crank **48**, resulting in reciprocating movement of the second connecting bar **44** up and down in a generally vertical direction, as indicated by arrows **80**. If the simulator is to simulate a trot, the electric motor **54** is separated at a higher speed, which causes the first crank **48** to rotate at an increased velocity. During the time that the simulator is simulating a walk or a trot, the second crank **62** is held stationary by operation of the combined brake/clutch **70**.

[**0042**] For the simulator to simulate a canter, the initial rotation of the first crank **48** is maintained. However, the drive belt **56** is allowed to rotate the second crank **62** by operation of the combined brake/clutch **70**. Rotation of the second clutch **62** results in reciprocating movement of the third connecting bar in a generally horizontal manner, as shown by arrows **82**. The deployment of both cranks **48**, **62** also allows the simulator to simulate a gallop by further increasing the speed of the motor **54**. The sensors **76**,**78** allow the speed/position of the cranks **48**,**62** to be assessed and relayed to a central processing unit **100** in order to determine the correct speed required for both cranks so as to produce the correct motion.

[**0043**] The speed/position flags or markers **72**,**74** allow the second crank **62** to be engaged and disengaged (by means of the brake/clutch **70**) at a pre-determined point relative to the first crank **48**. For example, the second crank **62** may only be allowed to engage or disengage when the first crank **48** is at the 3 o'clock position. Thus, the transition between the vertical movement and the incorporation of a horizontal movement can be brought about in a smooth and controlled manner. The brake/clutch **70** controls the engagement/disengagement of the second crank **62** and can be electrically controlled. Whilst only a clutch may be used to disengage and engage the second crank **62**, the addition of a brake when the clutch has been disengaged further stabilises the crank and ensures that the body portion moves in only the desired manner.

[**0044**] Whilst the simulator may be controlled by either controls **106** located on the horse shaped shell **12** and connected to the central processing unit **100**, it may also be controlled by means of a remote device **108**, that can either be connected to the central processing device **100** by means of an antenna **110**, or a cable **112**. Sensors may also be deployed at various points in the shell **12** so as to replicate those signals an individual would use in practice upon a horse in order to invoke a canter for example after a walk. The shell **12** therefore contains a stirrup sensor **102** and a rein sensor **104** for receiving inputs from the rider. The simulator can automatically change from a trot to a canter just by kicking of the leg in the stirrup area of the shell. As with a real horse, the simulator will go faster with applied pressure from the heels. The first kick will make the simulator simulate a walk, a second kick will result in simulation of a trot and a further kick will result in simulation of a cantering action. The simulator also steadies or stops with a pull on the reins, as with a real horse. There can also be an override switch/button which an individual may deploy if he or she is unable to control the simulator by using the controls alone. A key can be used to activate the simulator and to prevent unauthorised use, if desired.

[**0045**] The simulator can be used in a number of applications, such as used for training purposes for the general riding of horses, polo training and horse racing etc. The simulator could equally be used in order to help those with co-ordination difficulties or as therapy for muscular and skeletal complaints, but could also be used as a novelty simulator. By attaching a calorie counter and other associated fitness measuring devices (such as heart beat monitor), the simulator could also be used as a fitness machine.

1. A simulator for simulating the movement of a horse comprising:

(a) abase;

(b) a body portion for receipt of a rider and having a longitudinal axis corresponding to the simulated forward and backward movement of a horse;

(c) a first linkage extending between said body portion and said base;

(d) a mechanism capable of providing vertical and horizontal movement to the body portion with respect to said base; and

(e) a second linkage extending between said body portion and said mechanism.

2. A simulator as claimed in claim 1, wherein said first and second linkages comprise elongate members.

3. A simulator as claimed in claim 1, wherein said mechanism is driven by a motor.

4. A simulator as claimed in claim 3, wherein the said motor drives a first pulley connected to a first crank which in turn is pivotally connected to the second linkage so as to effect a vertical movement of said body portion.

5. A simulator as claimed in claim 4, wherein the motor further drives a second pulley connected to a second crank which in turn is pivotally connected to a middle portion of the second linkage so as to effect a generally horizontal movement of said body portion.

6. A simulator as claimed in claim 5, comprising gearing means located between said motor and said first pulley and/or second pulley.

7. A simulator as claimed in claim 6, wherein said second pulley is connected to a clutch and/or a brake for selectively preventing or allowing the rotation of the crank.

8. A simulator as claimed in claims 7, comprising a sensor for sensing attached thereto to sense the rotational speed and/or position of a crank.

9. A simulator as claimed in claim 1, wherein said body portion is in the shape of a horse.

10. A simulator as claimed in claim 1, wherein said mechanism is controlled by a central processing unit.

11. A simulator as claimed in claim 10, wherein the information from the sensors is relayed to the central processing unit.

12. A simulator as claimed in claim 11, wherein a predetermined rotation speed of the second pulley determines whether a clutch is engaged to rotate the crank.

13. A simulator as claimed in claim 12, wherein the sensor is used to synchronise the cranks prior to engagement or disengagement of the clutch/brake.

14. A simulator as claimed in claim 1, wherein the action of said mechanism is controlled by a control panel.

15. A simulator as claimed in claim 14, wherein the control panel is located on the simulator.

16. A simulator as claimed in claim 14, wherein the control panel is located remotely from the simulator.

17. A simulator as claimed in claim 1, wherein the action of said mechanism is controlled by controlling sensors located within said body portion.

18. A simulator as claimed in claim 17, wherein said controlling sensors located within said body portion correspond to locations on a horse used to control a real horse.

19. A simulator as claimed in claim 18, comprising controlling sensors located in portions of said body portion corresponding to the stirrup and rein area of a horse.

20. A simulator as claimed in claim 1, wherein said body portion has a seating portion for receipt of a rider and/or a saddle to be placed thereon.

21. A simulator as claimed in claim 1, wherein said simulator further comprises an override switch which stops said mechanism.

22. A simulator as claimed in claim 1, wherein the simulator is operated with a key.

23. A simulator as claimed in claim 1, wherein the simulator can simulate a walk, a trot, a canter, a gallop and a halt and intermediate speeds thereof.

24. A simulator as claimed in claim 23, wherein an individual controls the speed of and the type of walk, trot, canter, gallop and halt and intermediate speeds thereof.

25. The use of a simulator as claimed in claim 1 for training individuals for horse riding.

26. A kit of parts for producing a simulator for simulating the vertical and horizontal movements of a horse, the kit comprising:

(a) a base;

(b) a body portion adapted for receiving an individual;

(c) two or more linkage arms; and

(d) a mechanism for providing movement to said linkage arms.

27. A kit of parts as claimed in claim 26, wherein said kit further comprises a motor.

28. A kit of parts as claimed claim 26, wherein said kit further comprises at least one pulley and at least one crank, wherein the said pulley is capable of being connected to said crank and the said crank is adapted to be connected at least one linkage arm.

29. A kit of parts as claimed in claim 28, wherein the kit further comprises one or more sensors for use in sensing the position said linkage arms and/or said pulley and/or said crank.

30. A kit of parts as claimed in claim in claim 26, wherein said body portion is in the shape of a horse.

31. A kit of parts as claimed in claim 26, wherein said mechanism is controlled by a central processing unit.

* * * * *