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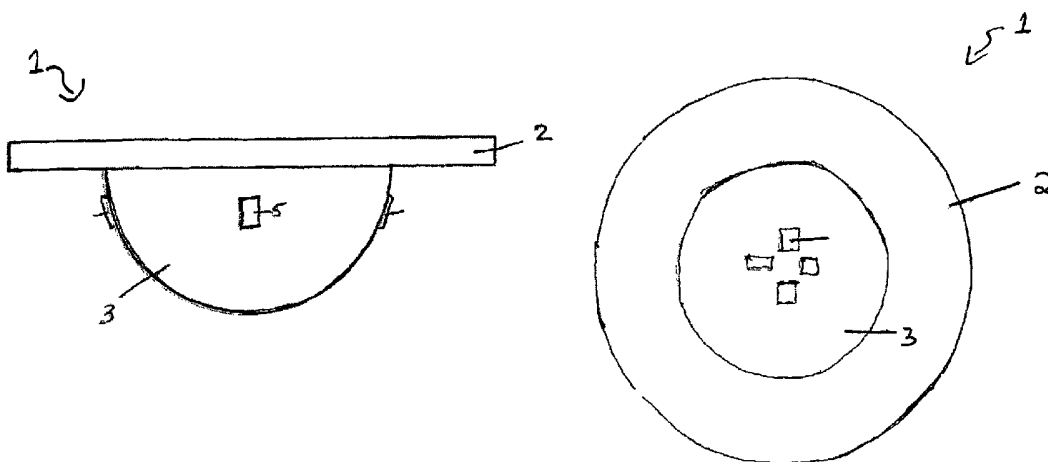
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(54) Title: DYNAMIC BALANCE BOARD



(57) Abstract: A dynamic balance board is described that incorporates a means for providing objective measurements on a user's dynamic balance. The balance board comprises a top board, a rocker base and a plurality of force sensitive transducers strategically positioned on the rocker base. When a user stands on the top board the rocker base permits the oscillation of the top board about an equilibrium position. The force sensitive switches then provide output information regarding the angle of the top board and the rotational movement of the balance board relative to the equilibrium position. By monitoring the output information the dynamic balance board provides an objective measurement of the user's ability to balance on the top board.

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1 **Dynamic Balance Board**

2

3 The present invention relates to the field of balance
4 boards. In particular, it relates to a balance board for
5 the automated measurement of dynamic balance.

6

7 Wobble or rocker style balance boards are commonly used
8 by physiotherapists in the rehabilitation of patients
9 with a variety of diagnoses and within a range of
10 clinical specialisms. Such boards are purported to
11 improve dynamic balance, range of movement, co-
12 ordination, proprioception (joint position sense) and
13 confidence. They comprise a non-flexing piece of plywood
14 on a rocker base that provide approximately 10-20 degrees
15 of tilt. If the range of motion over which this tilt is
16 exhibited is 180 degrees then the board is referred to in
17 the prior art as a rocker board. If such a range is 360
18 degrees then the board is refereed to as a wobble board,
19 and as such, wobble boards offer a greater challenge to a
20 patient.

21

22 Wobble and rocker boards are routinely used for patients
23 with ankle and knee ligament injuries to improve a
24 patient's proprioceptive ability. They also help

1 increase the available range of movement of the ankle and
2 foot so improving movement and a patient's perception of
3 stiffness. A third area where such devices are commonly
4 employed is in helping patients with balance problems
5 arising as a result of neurological, orthopaedic problems
6 or normal ageing.

7

8 Such devices are suitable for use across the whole
9 spectrum of patients. For example they may be employed
10 in the rehabilitation of children or athletes as well as
11 to improve independent mobility in the elderly.

12

13 Wobble and rocker boards are popular because they are
14 cheap, portable easy to use and are understood by both
15 clinicians and patients alike. They are designed to be
16 used independently by patients and are easily graded so
17 as to progress difficulty. However, the devices are
18 limited when it comes to the provision of an objective
19 measurement on a patient's progress. There is an
20 increasing movement for physiotherapists to formally
21 audit the outcome of their work with patients by showing
22 what progress has been made. Although there are some
23 balance monitor systems available on the market they do
24 not directly measure performance in a manner familiar to
25 the patient. Also such devices tend not to be portable
26 and are considerably more expensive than traditional
27 wobble or rocker boards.

28

29 It is an object of an aspect of the present invention to
30 provide a balance board that incorporates a means for
31 providing objective measurements on a user's dynamic
32 balance, thereby permitting an objective measurement of
33 progress to be made.

1

2 A further object of an aspect of the present invention is
3 to provide a balance board capable of producing dynamic
4 balance measurements that is highly portable and cost
5 effective to produce.

6

7 According to the present invention there is provided a
8 dynamic balance board comprising a top board, a rocking
9 means and one or more detection means, whereby the
10 rocking means permits the oscillation of the top board
11 about an equilibrium position and the detection means
12 provides output information regarding the angle of the
13 top board relative to the equilibrium position.

14

15 Preferably the detection means provides output
16 information regarding the rotation of the dynamic balance
17 board relative to an equilibrium position

18

19 Most preferably the output information of the detection
20 means is binary, whereby the output is off when the top
21 board is substantially horizontal and on when the top
22 board rotates through a predetermined angle.

23

24 Preferably the predetermined angle is determined by the
25 location of the detection means on the rocking means.

26

27 Preferably the rocking means comprises a dome.

28

29 Preferably the dome is substantially hemispherical.

30

31 Preferably the detection means comprises one or more
32 force sensitive switches.

33

1 Preferably the force sensitive switches comprise active
2 transducers mounted on the dome at predetermined
3 locations, whereby when a force, greater than a critical
4 magnitude, is applied to the transducer a resultant
5 output voltage from the transducer is produced.

6

7 Preferably the transducers are mounted on the dome in a
8 substantially radial manner.

9

10 Most preferably transducers on different radii are
11 located on the dome at predetermined latitudes, defined
12 by the diameter of a horizontal chord of the dome,
13 whereby when the top board tilts through the
14 predetermined angle a force applied to the transducer is
15 greater than the critical magnitude.

16

17 Preferably the output signals from the transducers are
18 transmitted to a recording and processing means that
19 provides a time dependent profile of the angle of the top
20 board. Optionally the recording and processing means
21 provides a time dependent profile of the rotational
22 movement of the dynamic balance board.

23

24 Preferably the dynamic balance board comprises a
25 biofeedback device capable of relaying information
26 regarding the user to the recording and processing means.

27

28 Optionally the recording and processing means is a
29 microcomputer. Alternatively the recording and
30 processing means is a computer.

31

1 Embodiments of the present invention will now be
2 described, by way of example only, with reference to the
3 accompanying drawings, in which:

4

5 Figure 1 illustrates a side elevation of a dynamic
6 balance board;

7

8 Figure 2 illustrates a bottom elevation of a rocker
9 base of the dynamic balance board of Figure 1;

10

11 Figure 3 illustrates a top elevation of a force
12 sensitive switch of the dynamic balance board of
13 Figure 1;

14

15 Figure 4 illustrates a side elevation of the force
16 sensitive switch of the dynamic balance board of
17 Figure 1; and

18

19 Figure 5 illustrates an alternative embodiment of
20 the rocker base of the dynamic balance board of
21 Figure 1.

22

23 Referring initially to Figure 1 a dynamic balance board 1
24 is generally depicted and can be seen to comprise a top
25 board 2 and a rocker base 3 in the shape of a hemisphere.

26

27 Figure 2 presents a bottom view of the rocker base 3. As
28 can be observed the force sensitive switches 4 are
29 mounted on the rocker base 3. Figure 3 and Figure 4 show
30 further detail of the force sensitive switches 4. Each
31 switch 4 can be seen to comprise an active transducer 5
32 and an electrical connector 6. The force sensitive
33 switches 4 operate in a binary mode. When no external

1 force is applied to the active transducer 5 the force
2 sensitive switch 4 remains in an off position. However,
3 the application of a force to the active transducer 5,
4 greater than a critical magnitude, activates the force
5 sensitive switch 4.

6

7 With the force sensitive switches 4 mounted on the rocker
8 base 3 they operate in conjunction with the angle of the
9 top board 2. When the top board 2 is substantially
10 horizontal the force sensitive switches 4 are all off and
11 so provide no output. However, when the top board 2
12 tilts more than an angle as determined by the location of
13 the force active switches on the rocker base (for example
14 10 degrees relative to horizontal) a force of sufficient
15 magnitude is applied to the active transducer 5 so
16 activating the switch 4.

17

18 The output from each force sensitive switch 4 is
19 connected to an electronic comparator (not shown) that
20 produce TTL (transistor-transistor logic) pulses that
21 form the digital input for an electronic display (not
22 shown). The period of time that any force sensitive
23 switch 4 is activated can then be calculated, hence the
24 period of time that a patient spends at 10 degrees or
25 more from the horizontal equilibrium position can be
26 recorded. The time and direction of tilt can then be
27 expressed as a percentage of the overall test duration,
28 therefore producing a dynamic measurement of a patient's
29 ability to balance the board 1.

30

31 In an alternative embodiment, shown in Figure 5, the
32 rocker base 3 is populated with force sensitive switches
33 4 located at two separate diameters on the rocker base 3.

1 The mounting of the force sensitive switches 4 at a
2 second diameter provides means for taking secondary
3 angular measurements of the tilt angle of the top board,
4 as described previously. However, in this embodiment an
5 additional signal is produced by the force sensitive
6 switches corresponding to what diameter the switch is
7 located. Therefore, employment of this second embodiment
8 provides greater information on the angle of tilt and the
9 time spent at these angles.

10

11 Additional force sensitive switches 4 can easily be
12 incorporated on the rocker base 3. These additional
13 switches 4 would increase the accuracy of the dynamic
14 balance profile obtained since the discrete directions in
15 which the angle of tilt is measured would increase.
16 Therefore, the dynamic balance board 1 could readily be
17 employed to provide information regarding rotational
18 movement as well as that relating to angular tilt.

19

20 A yet further embodiment includes the incorporation of
21 biofeedback devices to the dynamic balance board in order
22 to allow patients to self-monitor their own progress.
23 Such direct feedback has been shown to improve patient
24 recovery as motivation levels to continue with exercise
25 are increased.

26

27 An advantage of the present invention is that it provides
28 a balance board that incorporates a means for providing
29 objective measurements on a user's dynamic balance.

30

31 A second advantage of the present invention is that it is
32 small and portable, not requiring a separate computer to

1 record data, thereby making it easy for user's to deploy
2 and store.

3

4 Further modifications and improvements may be
5 incorporated without departing from the scope of the
6 invention as defined by the appended Claims.

1 **Claims**

2

3 1. A dynamic balance board comprising a top board, a
4 rocking means and one or more detection means,
5 whereby the rocking means permits the oscillation of
6 the top board about an equilibrium position and the
7 detection means provides output information
8 regarding the angle of the top board relative to the
9 equilibrium position.

10

11 2. A dynamic balance board according to Claim 1 wherein
12 the detection means provides output information
13 regarding the rotation of the dynamic balance
14 relative to an equilibrium position

15

16 3. A dynamic balance board according to Claim 1 or
17 Claim 2 wherein the output information of the
18 detection means is binary, such that the output is
19 off when the top board is substantially horizontal
20 and on when the top board rotates through a
21 predetermined angle.

22

23 4. A dynamic balance board according to Claim 3 wherein
24 the predetermined angle is determined by the
25 location of the detection means on the rocking
26 means.

27

28 5. A dynamic balance board according to any of the
29 preceding claims wherein the rocking means comprises
30 a dome.

31

32 6. A dynamic balance board according to Claim 5 wherein
33 the dome is substantially hemispherical.

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7. A dynamic balance board according to any of the preceding claims wherein the detection means comprises one or more force sensitive switches.
8. A dynamic balance board according to Claim 7 wherein the force sensitive switches comprise transducers mounted on the dome at predetermined locations, whereby when a force, greater than a critical magnitude, is applied to the transducer a resultant output voltage from the transducer is produced.
9. A dynamic balance board according to Claim 8 wherein the transducers are mounted on the dome in a substantially radial manner.
10. A dynamic balance board according to Claim 8 or Claim 9 wherein transducers on different radii are located on the dome at predetermined latitudes, defined by the diameter of a horizontal chord of the dome, whereby when the top board tilts through the predetermined angle a force applied to the transducer is greater than the critical magnitude.
11. A dynamic balance board according to Claims 8 - 10 wherein the output signals from the transducers are transmitted to a recording and processing means that provides a time dependent profile of the angle of the top board.
12. A dynamic balance board according to Claims 8 - 10 wherein the output signals from the transducers are transmitted to the recording and processing means

11

1 that provides a time dependent profile of the
2 rotational movement of the dynamic balance board.

3

4 13. A dynamic balance board according to any of the
5 preceding claims comprising a biofeedback device
6 capable of relaying information regarding the user
7 to the recording and processing means.

8

9 14. A dynamic balance board according to Claims 11 - 13
10 wherein the recording and processing means is a
11 microcomputer.

12

13 15. A dynamic balance board according to Claims 11 - 13
14 wherein the recording and processing means is a
15 computer.

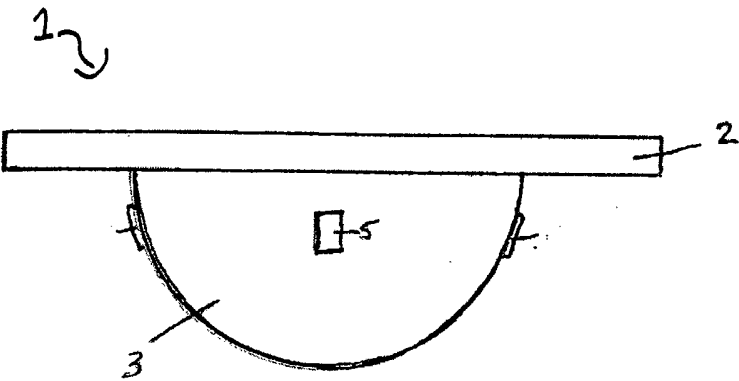


Figure 1

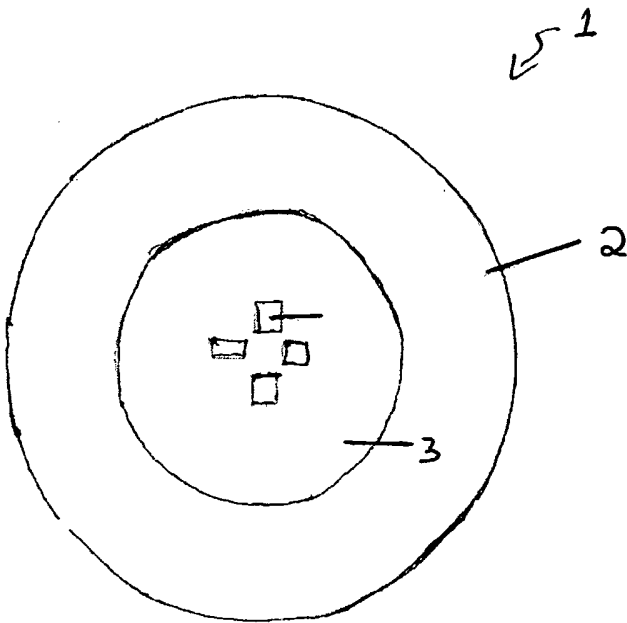


FIGURE 2

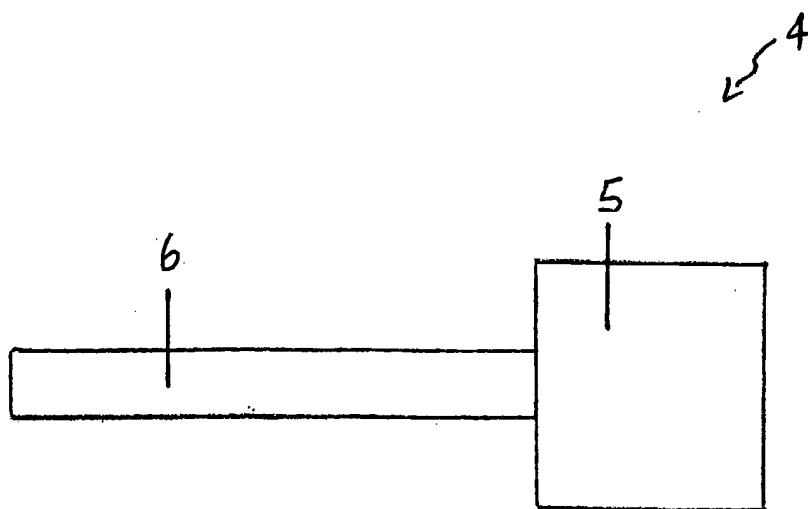


FIGURE 3



FIGURE 4

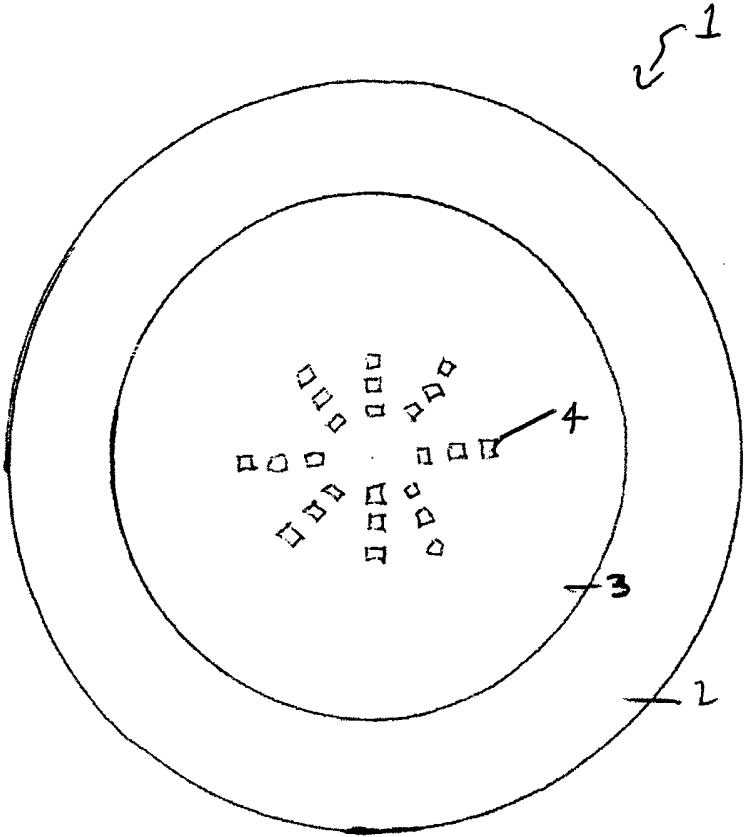


FIGURE 5