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WO 87/01486 A US 4088315 A

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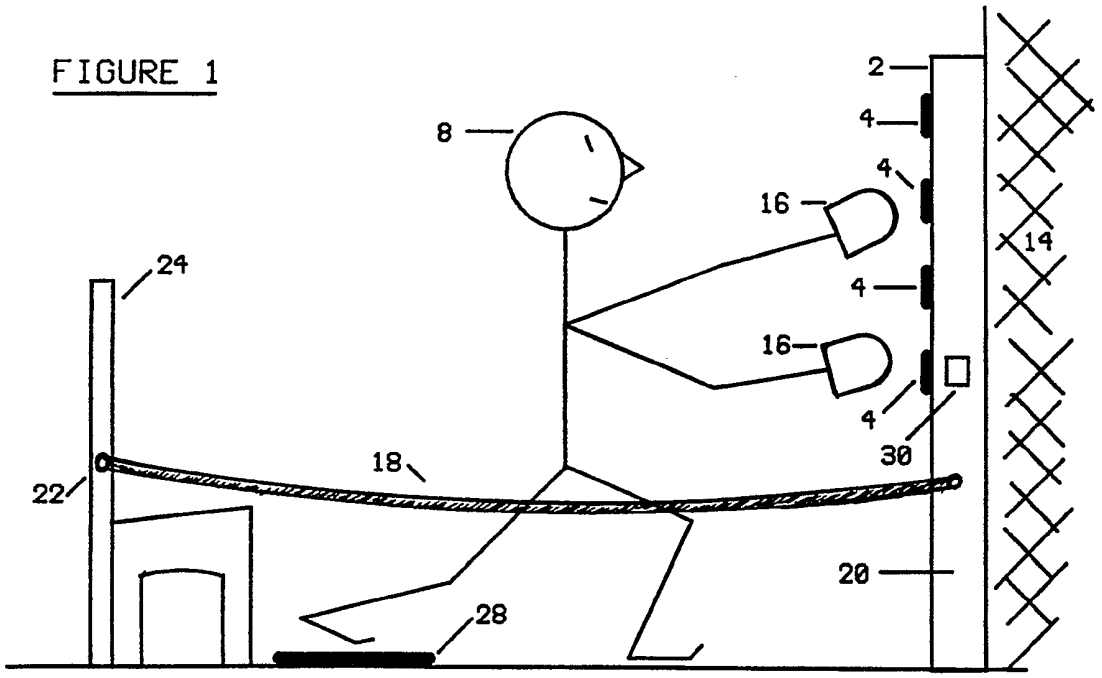
INT CL[5] A63B 69/32 69/34 71/00

(54) Physical exercise apparatus

(57) Physical exercise apparatus (2) comprises a plurality of target members (4), signal means for indicating target members to be struck by a player (8) in a playing sequence, control means for controlling operation of the signal means, and switch means which are responsive to striking of the target members in order that the player's performance can be determined. The control means may set a minimum value for the striking force. Position determining detectors (18) may be provided for the player.

FIGURE 1



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

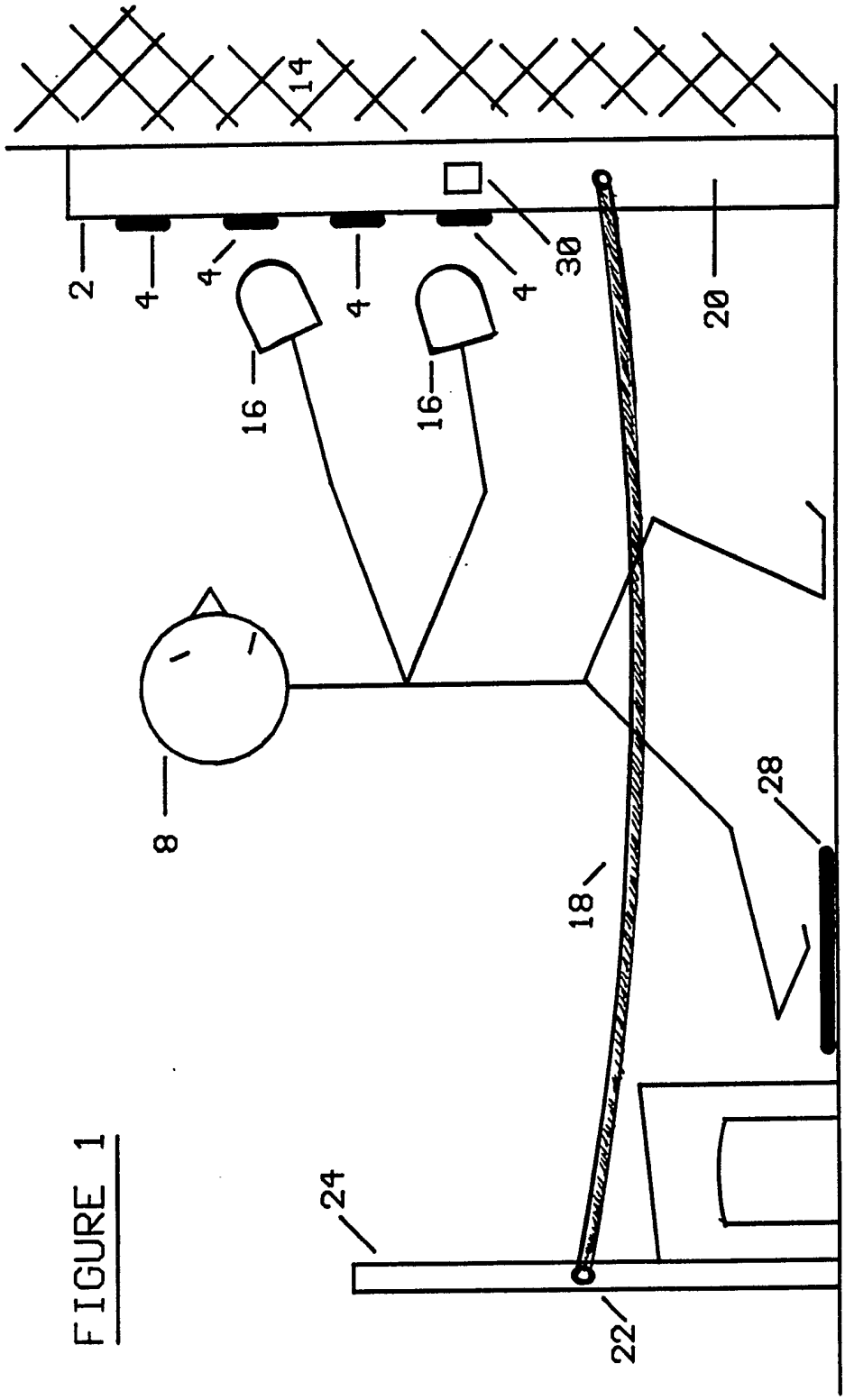


FIGURE 1

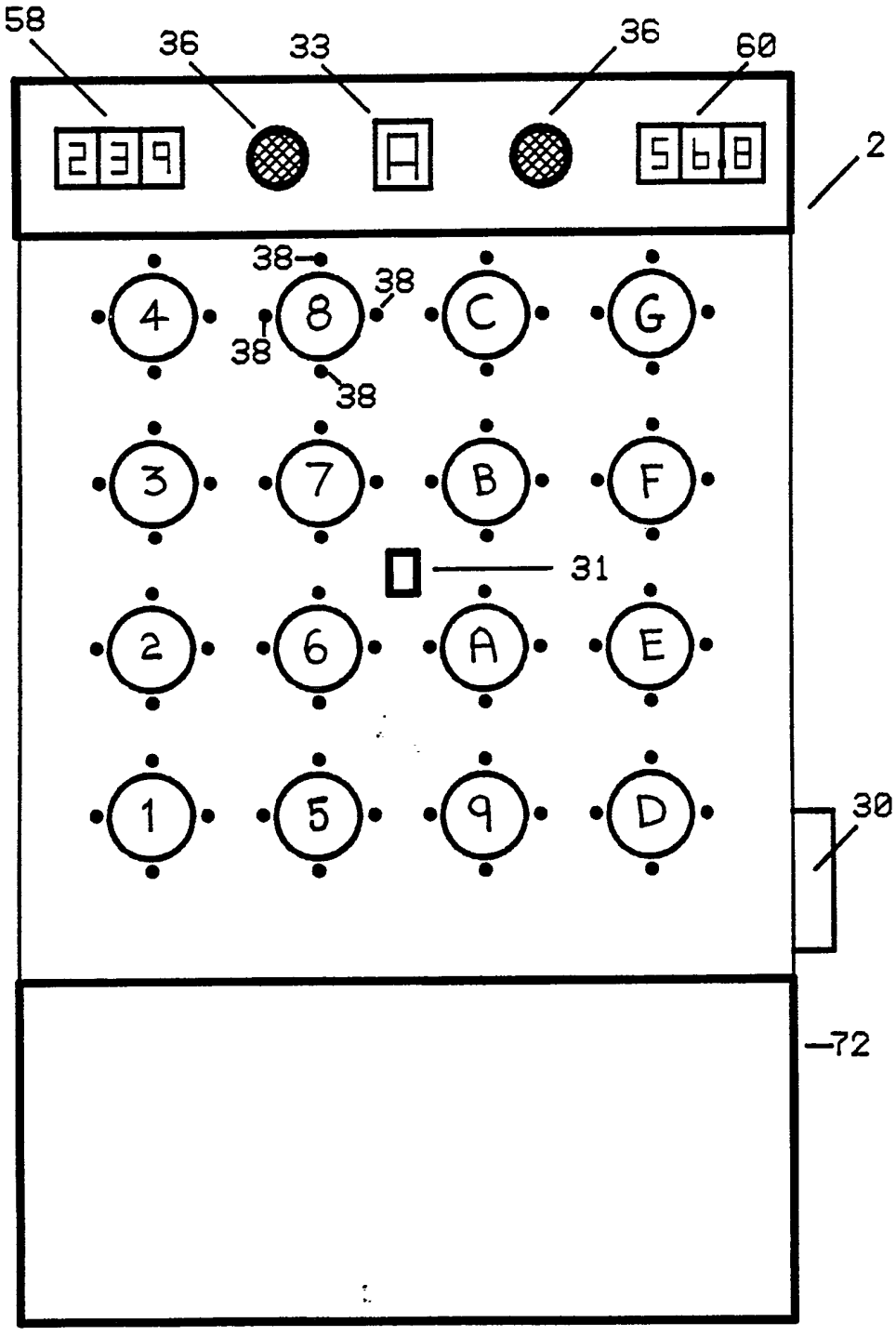


FIGURE 2

FIGURE 3

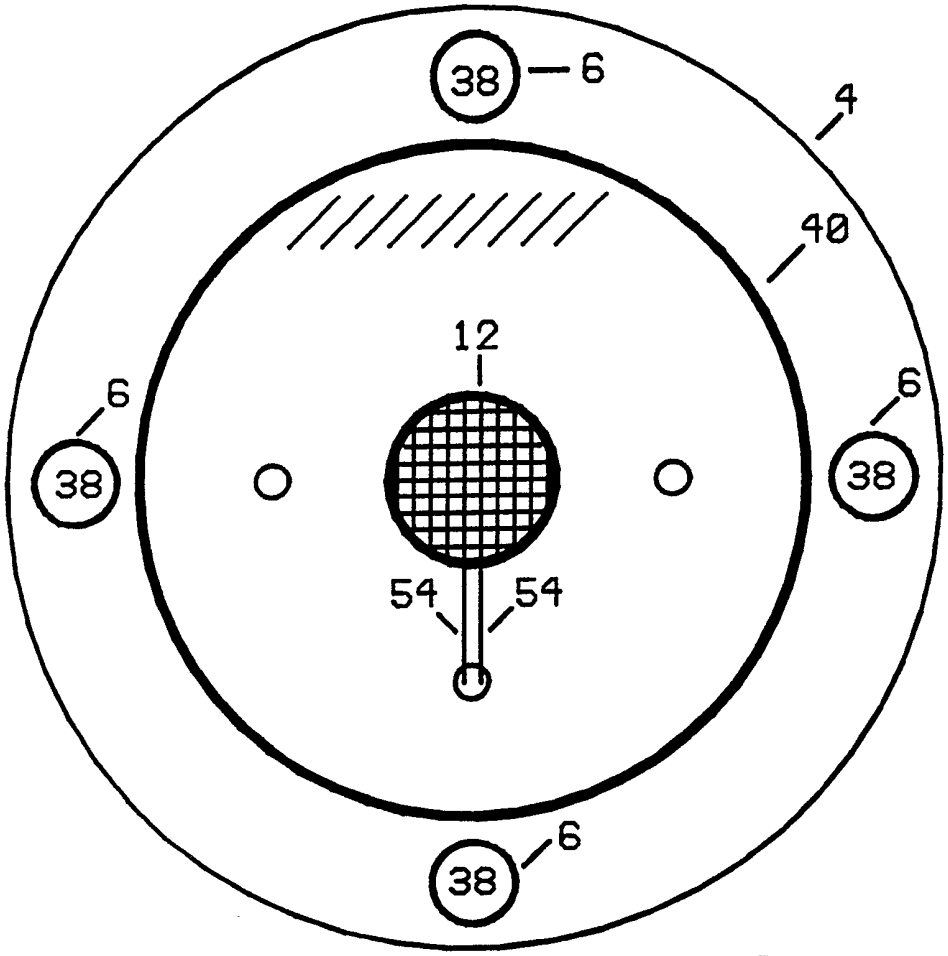
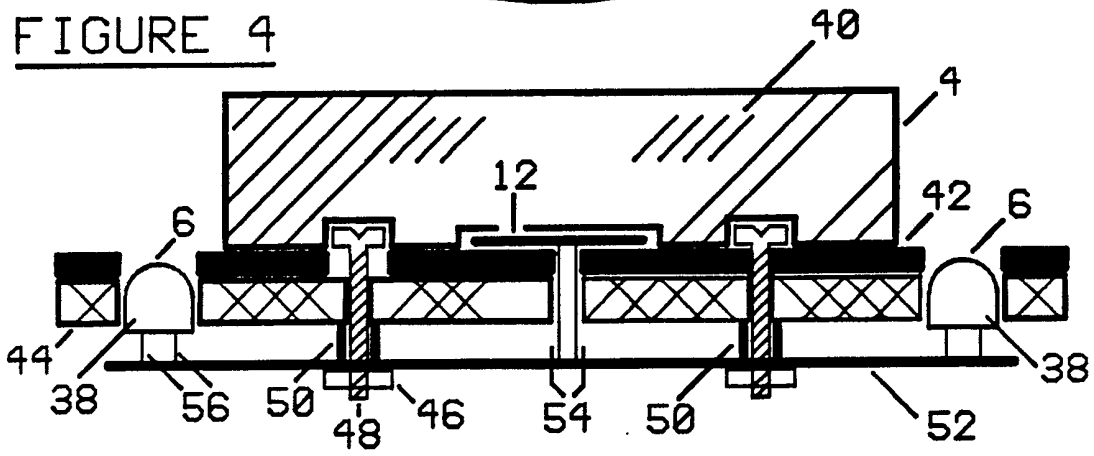


FIGURE 4



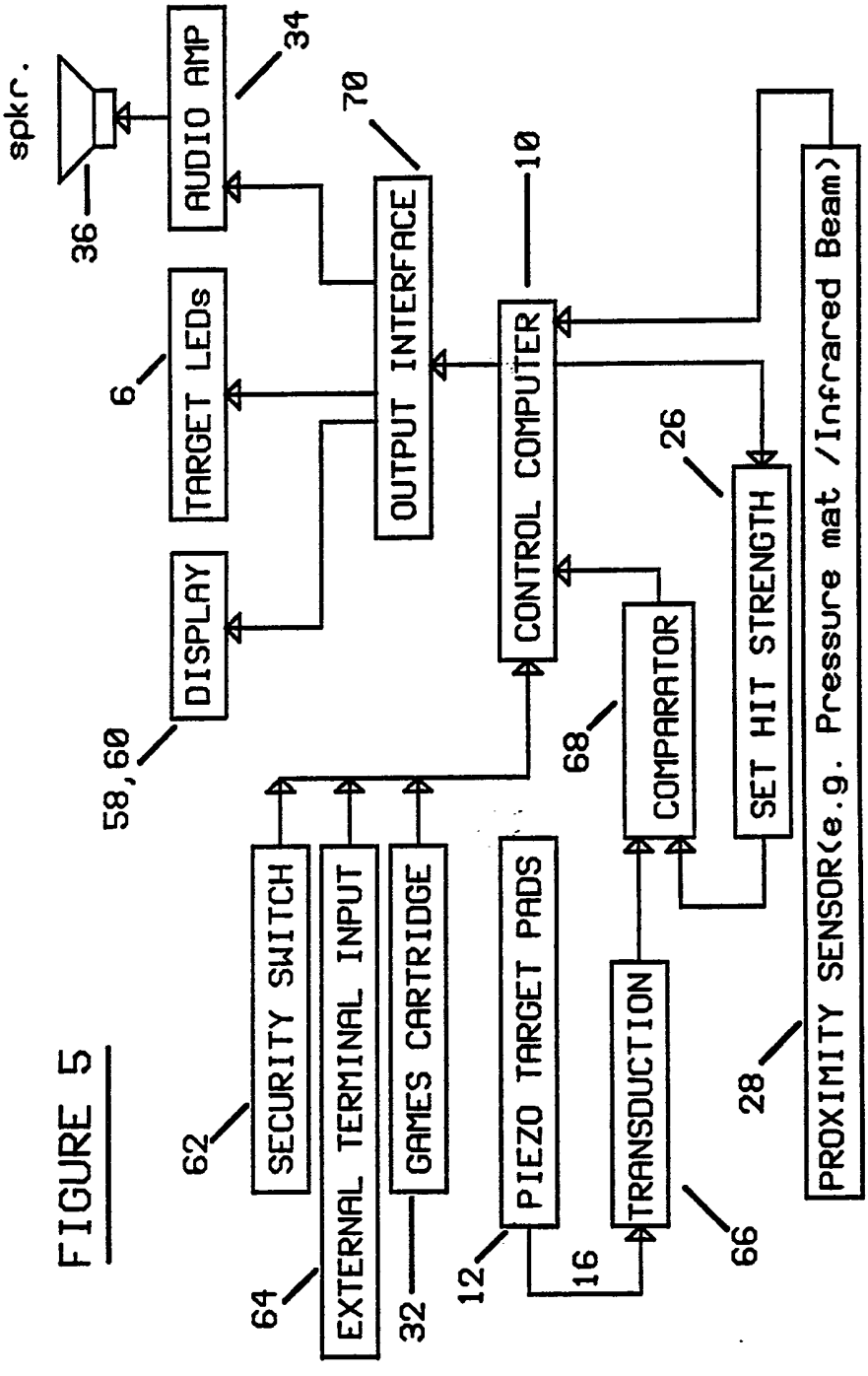

spkr.
36
AUDIO AMP
34
70
6
TARGET LEDs
OUTPUT INTERFACE
10
CONTROL COMPUTER
58,60
DISPLAY
68
COMPARATOR
26
SET HIT STRENGTH
62
SECURITY SWITCH
64
EXTERNAL TERMINAL INPUT
32
GAMES CARTRIDGE
12
PIEZO TARGET PADS
16
TRANSDUCTION
66
28
PROXIMITY SENSOR(e.g. Pressure mat /Infrared Beam)

FIGURE 5

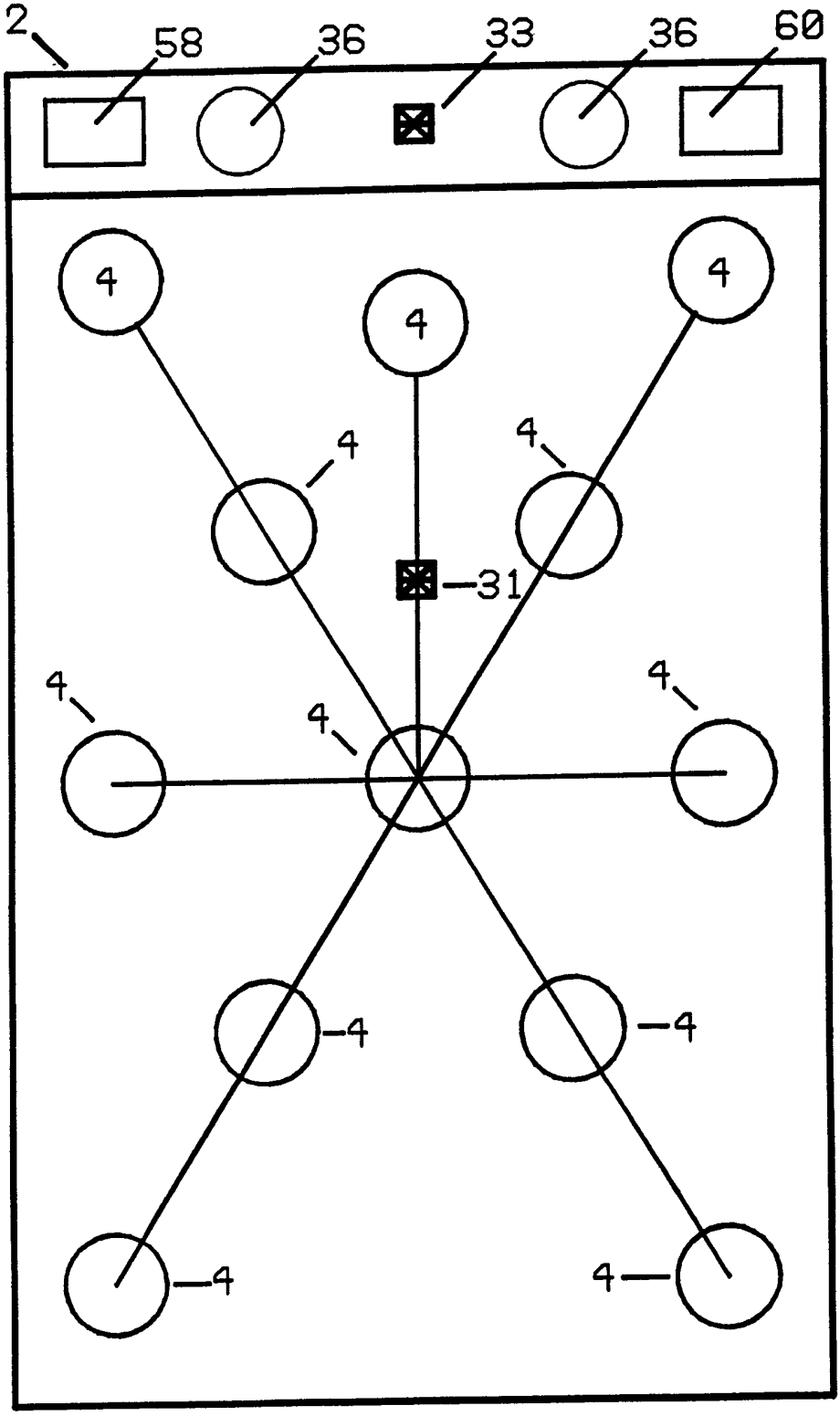


FIGURE 6

PHYSICAL EXERCISE APPARATUS

This invention relates to physical exercise apparatus.

There is a need for physical exercise apparatus which can easily be utilised in a wide variety of venues such for example as sports complexes, leisure complexes, health clubs, holiday camps, hotels, theme parks, conference centres, gymnasiums, cruise liners, public houses and night clubs. There is also a need for such physical exercise apparatus to be compact in size so that it does not take up too much room in the chosen venue. The physical exercise apparatus should also be such that it can be manufactured at a price which enables the physical exercise apparatus to become commercially viable. Known physical exercise apparatus is often too expensive to be purchased by many persons and organisations. Still further, the physical exercise apparatus should be such that it can be manufactured in a robust manner so that it will not prematurely fail during use.

It is an aim of the present invention to provide such physical exercise apparatus.

Accordingly, in one non-limiting embodiment of the present invention there is provided physical

exercise apparatus comprising a plurality of target members, signal means for indicating target members to be struck by a player in a playing sequence, control means for controlling operation of the signal means, and switch means which are responsive to striking of the target members in order that the player's performance can be determined.

The physical exercise apparatus of the present invention is able to use computer based technology in order to enable the control means to cause the physical exercise apparatus to operate in a wide variety of playing sequences. Thus the physical exercise apparatus can be played at varying speed and/or varying skill levels according to age and fitness of the players. Different programmes can be used for enabling the physical exercise apparatus to be used for various training purposes, warm-up sessions, therapeutic purposes, and weight loss purposes.

The physical exercise apparatus may include force-varying means for varying the force with which the target members need to be struck in order to operate the switch means.

The force-varying means thus provides for sensitivity control over the target members. The force-varying means may be means for setting a different level

of voltage for the target members and below which the target members will not operate the switch means.

The physical exercise apparatus may include force measuring means for measuring the force with which the target members are struck. The force measuring means may be in the form of a crystal arrangement which emits a voltage dependent upon the force with which the target members are struck.

The physical exercise apparatus may include position-determining means for determining the position of a player using the physical exercise apparatus and for allowing the operation of the control means to be modified in dependence upon predetermined positions of the player by the position-determining means.

The position-determining means may be positioned on the remainder of the physical exercise apparatus, or it may be positioned remote from the remainder of the physical exercise apparatus. Where the position-determining means is positioned remote from the remainder of the physical exercise apparatus, then the position-determining means may be linked to the remainder of the physical exercise apparatus by a cable link or a radio link.

The position-determining means may be a pressure sensitive mat. Alternatively, the position-

determining means may be a proximity sensor. The proximity sensor may be an infrared proximity sensor or an ultrasonic proximity sensor. The infrared proximity sensor may be an infrared beam or a passive infrared detector.

The physical exercise apparatus may include auxiliary control means for allowing a non-player to control operation of the signal means. The auxiliary control means may be a hand-held auxiliary control means which is operated, for example, by a coach to the player. Thus the coach or other person operating the auxiliary control means may use it to operate the signal means by overriding the normal control means, or with the normal control means in an off condition.

The physical exercise apparatus may include a cartridge-receiving device for receiving an external memory cartridge, and memory means which forms part of the control means and which is provided with instructions for operating the signal means in at least two different playing sequences which will always be contained in the memory means, and the memory means also having a capacity for receiving a program for at least one further different playing sequence from the external memory cartridge whereby the player can override the said at least two different playing sequences that will always be contained in the memory means and the player

can programme the physical exercise apparatus to operate with the player's own chosen playing sequence from the external memory cartridge. In such an embodiment of the invention, the control means may be provided with, for example, three of the different playing sequences.

The physical exercise apparatus may include sound-generating means for generating sounds consequent upon striking of the target members and/or sounds which are appropriate to the type of exercise being performed on the physical exercise apparatus. Thus, for example, if the physical exercise apparatus is to be used for boxing exercises, then the sound-generating means may generate the sound of a bell for indicating the beginning and end of rounds, and the sound-generating means may also generate the sound of a boxing glove striking a boxing bag when the target members are struck. Obviously, the precise type of sounds generated by the sound-generating means can be varied. The sounds may be reaction-requiring sounds and/or commands.

The physical exercise apparatus may be one in which the target members each comprise a displaceable housing, and in which the switch means is responsive to displacement of the housing consequent upon the housing being struck.

The signal means may comprise at least one light for each target member. The lights may be light emitting diodes.

The control means may include a switching circuit operable to switch in sequence the signal means of individual target members or groups of the target members from a first condition to a second condition in accordance with a playing sequence.

The control means may include means for generating a random playing sequence for the selective switching of the signal means.

Embodiments of the invention will now be described solely by way of example and with reference to the accompanying drawings in which:

Figure 1 is a side view of first physical exercise apparatus in use;

Figure 2 is a front view of second physical exercise apparatus;

Figure 3 is a front view of a target member used in the physical exercise apparatus shown in Figure 1 or Figure 2;

Figure 4 is a cross sectional side view of the target member shown in Figure 3;

Figure 5 is a schematic block diagram illustrating the electronic operation of the physical exercise apparatus ; and

Figure 6 illustrates a preferred pattern for

the target members.

Referring to Figure 1, there is shown physical exercise apparatus 2 comprising a plurality of target members 4, signal means 6 for indicating target members 4 to be struck by a player 8 in a playing sequence, control means 10 for controlling operation of the signal means 6, and switch means 12 which are responsive to striking of the target members 4 and which allow a record of the player's performance to be made.

As can be seen from Figure 1, the physical exercise apparatus 2 is secured to a wall 14. The physical exercise apparatus 2 is operating in a boxing playing sequence and thus the player 8 has boxing gloves 16 (or other hand protection means) for striking the target members 4. In order to give the physical exercise apparatus 2 authenticity, the physical exercise apparatus 2 is provided with a rope 18 which extends from a side 20 of the physical exercise apparatus 2 back to a side 22 of a stool 24.

The physical exercise apparatus 2 includes force-varying means 26 (Figure 4) for varying the force with which the target members 4 need to be struck in order to operate the switch means 12. The force-varying means 26 may be means to provide different voltage levels at the target members 4 and below which voltage levels, the target members 4 if struck will not operate the switch

means 12. In Figure 1, there are sixteen target members arranged in four rows of four, but other numbers of target members and different types of positioning for the target members may be employed.

The physical exercise apparatus 2 may also include force-measuring means (not shown) for measuring the force with which the target members are struck.

The physical exercise apparatus 2 still further comprises position-determining means in the form of a pressure mat 28. The pressure mat 28 is for determining the position of the player 8 and for allowing the operation of the control means 10 to be modified in dependence upon determined positions of the player 8 by the pressure mat 28.

The physical exercise apparatus 2 includes a device 30 for receiving a security key and/or an external memory cartridge 32. The physical exercise apparatus 2 still further comprises memory means (not shown) which forms part of the control means 10 (but which could be separate from the control means 10) and which is provided with instructions for operating the signal means 6 in at least two, for example three, different playing sequencies which will always be contained in the memory means. The memory means has a capacity for receiving a programme from the external memory cartridge 32

whereby the player 8 can override the pre-programmed playing sequences in the memory means and the player can programme the physical exercise apparatus 2 to operate with the player's own playing sequence from the external memory cartridge 32.

The physical exercise apparatus 2 includes sound-generating means including an audio amplifier 34 and speakers 36. The sound-generating means can generate sounds consequent upon striking the target members 4 together with sound such for example as a bell to indicate the beginning and/or the end of a round during an exercise session with the physical exercise apparatus 2.

The physical exercise apparatus shown in Figure 2 is like that shown in Figure 1 except that the pressure mat 28 has been replaced by a proximity detector 31 which provides an infrared beam. The infrared beam proximity detector 31 enables the physical exercise apparatus 2 to test the presence of a player. The infrared beam is reflected by the player. The infrared beam can enable the physical exercise apparatus 2 to play the player like an opponent, for example by requiring the player to react in a certain way to hit one or more target members 4 in a given reaction time starting from a starting signal, such as the word STRIKE coming from the speakers 36. Failure

to do this results in the physical exercise apparatus 2 gaining a point, or the player loosing a point.

The physical exercise apparatus 2 also comprises an alphanumeric display window 33 which on its own or together with the scoreboard display windows 58, 60 acts as an alphanumeric display means. The alphanumeric display means may be used to make a player do a mental exercise, for example adding 3 plus 3 as shown in the windows 33, 58, 60, in order to get the number of the target member 4 to be struck. The displays in the windows 33, 58, 60 may be light emitting diode displays.

As can best be seen from Figures 2 and 3, the signal means 6 comprises four light emitting diodes 38 positioned around each one of the target members 4.

The target members 4 are best seen in Figure 4. Thus the target members 4 may comprise a pad 40 stuck to a disk 42. The pad is preferably a foamed plastics pad. The disk is preferably a plastics disk such for example as a disk made of polyvinyl chloride. The disk 42 is mounted on a frame member 44 by means of nuts 46 and bolts 48. The frame member 44 is advantageously made of birch wood but it may be made of other materials including glass fibre materials. The nuts and bolts 46, 48 also serve to

mount, via spacers 50, a printed circuit board 52 to the frame member 44. The sensor 12 is connected by wires 54 to the printed circuit board 52. The light emitting diodes 38 are connected by wires 56 to the printed circuit board 52. The sensor 12 is preferably a piezo electric sensor 12. The disk 42 is preferably 120mm in diameter but it may be of other sizes if desired.

As shown in Figure 5, the physical exercise apparatus 2 may include a security switch 62, an external terminal input 64, transduction means 66, a comparitor 68 and an output interface 70 from the control means 10 which is in the form of a control computer.

The physical exercise apparatus 2 may be used for a boxing sequence as illustrated or it can be used for other types of training or general exercise. Generally, the physical exercise apparatus 2 can be used to test fitness and/or reaction. The physical exercise apparatus 2 is thus a valuable piece of apparatus for training all types of persons including professional sports persons, and also for assessing the potential of young future sports stars.

The physical exercise apparatus 2 can be played so that the player 8 is constantly made to advance, strike and retreat. The physical exercise apparatus 2 may be used for physical exercise training in gymnasiums, and especially boxing gymnasiums, where the physical exercise apparatus 2 can provide precise and accurate evaluation of boxing skills, such for example as speed of punch, hit strength and stamina.

The illustrated physical exercise apparatus 2 can be constructed in any suitable and appropriate sizes. The physical exercise apparatus 2 may be fixed to a plain wall but it may equally be manufactured to be free standing if desired. One presently preferred compact size for the physical exercise apparatus 2 is 6'6" high, 4' wide and 3" thick. As an alternative to the player 8 hitting the target members 4 with the boxing glove 16, the player 8 may use an unprotected hand, knuckle protectors, or a striking member such as a bat.

As can be seen from Figure 1, the physical exercise apparatus 2 has an empty lower part 72. This lower part 72 can be provided with more target members 4 if it is desired that the physical exercise apparatus 2 should be used by children who will of course be smaller than adults.

The foamed plastics target members 4 may be

covered with any suitable and appropriate covering such for example as leather or leather cloth. The foamed plastics material may be of any suitable thickness although, generally, the thicker the pads 40, the more tactile feedback is obtained.

As shown in Figure 2, each target member 4 may contain a number from 0-9 or a letter from A-F. The number or letter may be indented into each pad 40. The numbers and the letters enable easy identification of the various target members 4 and they may be used to aid the development of routines for clinical use or mind games.

The piezo electric switch means 12 are piezo electric sensors which are wafer thin devices which are able to pick up shock and vibration through the foamed plastics material of the pad 40. The piezo electric sensors are then able to deliver a very small millivolt electrical signal to the control electronics for suitable processing.

The light emitting diodes 38 are preferably high intensity light emitting diodes which each have a minimum view angle of 120 degrees so that the player 8 can easily observe which target member 4 to strike. The use of light emitting diodes is preferred since they are long lasting and relatively trouble free. The light

emitting diodes 38 may be rapidly turned on and off or they may be flashed with no thermal delay such as may be experienced by tungsten filament bulbs.

The two light emitting diode displays 58, 60 may be two scoring and timing displays.

The sounds emitting from the speakers 36 may be true sampled sounds so that the impact noise may be heard of a punch bag being struck and/or an end of round bell. Other sounds will be used where the physical exercise apparatus 2 is to be used in other uses, for example clinical uses.

The pressure mat 28 is a pressure sensitive mat which may, if desired, be housed in a shallow wooden platform (not shown).

As an alternative to using a pressure mat 28 or a proximity detector 31, other proximity sensors may be used to indicate to the control means 10 where the player 8 is when the player 8 is using the physical exercise apparatus 2. The control means 10 may thus use this information to try and outwit or get the best out of the player 8.

Preferably, there are two of the ropes 18 extending one from either side 20 of the physical exercise apparatus 2. If desired however only one rope 18 need be employed. The rope or ropes are preferably made of nylon but other materials may be employed. The use

of two ropes 18 is preferred to give an enclosed area which may give the impression of a boxing ring.

The physical exercise apparatus 2 will usually be operated on mains voltage but it could be battery operated if desired.

Preferably, the light emitting diode display 58 typically gives a score and hit strength etc., whilst the display 60 shows a total or response time etc.

One or either side 20 of the physical exercise apparatus 2 is able to hold the security switch 62, a re-set button, and a socket for operation by an external computer terminal or hand controller. The security switch 62 may be a security key switch. The socket may be a 9-way D-type socket. The games cartridge 32 which is inserted into the cartridge-receiving device 30 may be a solid state memory card.

The hand controller forms auxiliary control means for enabling the target members 4 to be lit up via the light emitting diodes 38 in a prescribed way by a player's coach. This may be useful, for example, for a boxer needing to practise a specific sequence of blows.

If desired, the physical exercise apparatus 2 may be arranged to be programmed by authorised personnel themselves, for examples coaches. Such

programming may be via an external input socket. Alternatively, any extra required exercise routines could be devised on the hand held controller and then stored in a memory cartridge if required.

The physical exercise apparatus 2 may be such that three basic games are contained within as standard. As indicated above, these games may be bypassed by the insertion of an external memory cartridge 32 giving a desired game or routine. Each cartridge 32 may, if required, contain for example three games and may be about the size of an ordinary playing card. The game required may be selected by striking the numbered target members 1, 2 or 3. This number would then be seen on either or both of the displays 58, 60. To commence a game, the target pad having the letter "G" (for "go") may be struck. With such a technique of pad striking, even a player 8 wearing boxing gloves 16 is easily able to make a selection.

Because the physical exercise apparatus 2 is computer operated, the number of software routines for use in the physical exercise apparatus 2 are substantially limitless. Programs may be written for any situation whether it be for boxing, reaction timing, cerebral palsy, dyslexia, or any other suitable and appropriate type of exercise. In its basic form, simple routines may be used to ascertain and improve the reaction time

of players. In more complicated programs, the stamina and strength of players may be measured, and the number of hits of a particular strength per minute may be measured. A coach may use the physical exercise apparatus 2 to help to equalise the power behind left and right hand punches.

By way of example only, it is mentioned that the physical exercise apparatus 2 as shown in the drawings may be used as follows. The pressure mat 28 may be activated and the player 8 may then move forward for a single random (or program defined) punch at a target member 4. The player 8 may then return to the pressure mat 28. The pressure mat 28 is then activated, whereupon the player 8 can move forward for a volley of punches. For the volley of punches, the physical exercise apparatus 2 may light up two targets simultaneously. The computer control means 10 may then now either count the number of hits or keep the player 8 at the interface for some length of time. After the volley, a suitable sound is given to require the player 8 to return to the pressure mat 28. The return to the pressure mat 28 causes the illumination of other target member 4 for another volley, and so on. To sharpen up reflexes, the player 8 may lose points if he strikes a flashing target member 4, which could be equivalent to

a punch below the belt.

In another mode of use of the physical exercise apparatus 2, the physical exercise apparatus 2 may be arranged to operate on timed 3 minute rounds with suitable rest periods for the player 8. The apparatus 2 may also be such that the target members 4 give progressively harder hit strengths, with, for example, knockout opportunities being given, count-outs etc.

The physical exercise apparatus 2 may also be used for medical purposes. For example, for clinical use in the field of cerebral palsy, it is a requirement that any progress made by a patient is regularly assessed. This is a diffcult task, especially for children who often have little incentive to take part in boring trials. The physical exercise apparatus 2 helps to overcome this problem by giving enjoyment to a child. For example, a program could be provided such that each target member 4 would be given a number (for example on a stick-on label) and two target members 4 would illuminate. The patient could then be required to add the two numbers together as fast as possible and to strike the answer target member for a suitable audio response.

It is to be appreciated that the embodiment of the invention described above with reference to the

accompanying drawings has been given by way of example only and that modifications may be effective. Thus, for example, the shape of the physical exercise apparatus may be different from that shown in the drawings. Similarly, the target members 4 may be displayed in different patterns. Programmes may be provided for any eye/hand reactive sport in many fields. The physical exercise apparatus can be used for physical training, recreation, stress-releaving purposes and in the treatment of medical complaints such for example as cerebral palsy and dyslexia. Where the physical exercise apparatus is used for entertainment purposes in clubs, public houses and the like, the pressure mats 28 can be omitted and a person playing the physical exercise apparatus can simply directly challenge the machine so that, for example, on the sounding of a bell the person could play three rounds with the machine. The physical exercise apparatus can be arranged to operate consequent upon money being placed in the machine, for example in a money-receiving slot. Thus the physical exercise apparatus will be able to earn money for the owner of an establishment containing the physical exercise apparatus. The target members 4 may be shaped differently than shown so that, for example, the target

members 4 may be domed-shaped with a stem, such as target members being designed for receiving side blows.

Figure 5 illustrates a preferred pattern for the target members 4, the pattern being such as to require bending which is advantageous for full body exercises such as aerobics, or for general fitness exercises or specific stretching exercises.

As indicated above, the physical exercise apparatus of the invention may be such that it includes alphanumeric display means for giving a player commands or other information requiring mental agility. The alphanumeric display may be numbers and/or letters. The alphanumeric display may require additions, substractions, divisions or multiplications to be made by a player in order for the player to be able to work out which target members to strike. The required mental exercise may need to be performed in a short period of time, for example 0.5 or 1 second. The alphanumeric display means may alternatively count down lives, ie. playing goes, lost to a player.

The use of a proximity detector 31 using the infrared beam enables the apparatus of the invention to know where the player is in relation to the apparatus. This gives the facility of the apparatus playing a against the player and scoring points against the player. For example, the apparatus could make the sound STRIKE or some other word and then the player would have a predetermined short time to strike one or more of the target members, and if the

strike were not made in time, then the apparatus would score a point or points.

The apparatus of the invention can advantageously be such that the apparatus will not play unless the player is detected by the proximity detector, for example the proximity detector 31. This stops a player trying to cheat by playing outside the proximity detector, for example in order to gain a time advantage in striking the target members after the apparatus has said STRIKE.

The use of a proximity detector in the form of an infrared beam can make players move about in a speedy manner when playing the apparatus of the invention.

The physical exercise apparatus may be sold under the trade mark SPARBOX or REACTON.

CLAIMS

1. Physical exercise apparatus comprising a plurality of target members, signal means for indicating target members to be struck by a player in a playing sequence, control means for controlling the operation of the signal means, and switch means which are responsive to striking of the target members in order that the player's performance can be determined.

2. Physical exercise apparatus according to claim 1 and including force-varying means for varying the force with which the target members need to be struck in order to operate the switch means.

3. Physical exercise apparatus according to claim 2 in which the force varying means is means for setting a different level of voltage for the target members and below which the target members will not operate the switch means.

4. Physical exercise apparatus according to any one of the preceding claims and including force measuring means for measuring the force with which the target members are struck.

5. Physical exercise apparatus according to claim 4 in which the force measuring means is a crystal arrangement which emits a voltage dependent upon the force with which the target members are struck.

6. Physical exercise apparatus according to any one of the preceding claims and including position-determining means for determining the position of a player using the physical exercise apparatus and for allowing the operation of the control means to be modified in dependence upon predetermined positions of the player by the position-determining means.

7. Physical exercise apparatus according to claim 6 in which the position-determining means is positioned on the remainder of the physical exercise apparatus.

8. Physical exercise apparatus according to claim 6 or claim 7 in which the position-determining means is a proximity sensor.

9. Physical exercise apparatus according to claim 8 in which the proximity sensor is an infrared proximity sensor.

10. Physical exercise apparatus according to claim 9 in which the infrared proximity sensor is an infrared beam.

11. Physical exercise apparatus according to claim 6 in which the position-determining means is positioned remote from the remainder of the physical exercise apparatus.

12. Physical exercise apparatus according to claim 11 in which the position-determining means is a pressure sensitive mat.

13. Physical exercise apparatus according to any one of the preceding claims and including auxiliary control means for allowing a non-player to control operation of the signal means.

14. Physical exercise apparatus according to claim 13 in which the auxiliary control means is a hand-held auxiliary control means.

15. Physical exercise apparatus according to any one of the preceding claims and including a cartridge-receiving device for receiving an external memory cartridge, and memory means which forms part of the control means and which is provided with instructions for operating the signal means in at least two different playing sequences which will always be contained in the memory means, and the memory means also having a capacity for receiving a

program for at least one further different playing sequence from the external memory cartridge whereby the player can override the said at least two different playing sequences that will always be contained in the memory means and the player can programme the physical exercise apparatus to operate with the player's own chosen playing sequence from the external memory cartridge.

16. Physical exercise apparatus according to any one of the preceding claims and including sound-generating means for generating sounds consequent upon striking of the target members and/or sounds which are appropriate to the type of exercise being performed on the physical exercise apparatus and/or sounds which are reaction-requiring sounds and/or commands.

17. Physical exercise apparatus according to any one of the preceding claims in which the target members each comprise a displaceable housing, and in which the switch means is responsive to displacement of the housing consequent upon the housing being struck.

18. Physical exercise apparatus according to any one of the preceding claims in which the signal means comprises at least one light for each target member.

19. Physical exercise apparatus according to claim 18 in which the lights are light emitting diodes.

20. Physical exercise apparatus according to any one of the preceding claims and including a switching circuit operable to switch in sequence the signal means of individual target members or groups of the target members from a first condition to a second condition in accordance with a playing sequence.

21. Physical exercise apparatus according to any one of the preceding claims and including means for generating a random playing sequence for the selective switching of the signal means.

22. Physical exercise apparatus according to any one of the preceding claims and including alphanumeric display means.

23. Physical exercise apparatus substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9317878.8

Relevant Technical Fields

(i) UK Cl (Ed.L) A6D (D13C), A6H (H10X27), A6M (MBL)

(ii) Int Cl (Ed.5) A63B 69/32, 69/34, 71/00

Search Examiner
A T BLUNT

Date of completion of Search
4 November 1993

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1-23

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X,Y	GB 2232898 A	(NELSON)	X:1,13-23 Y:4-12
X	GB 1478282	(BRUNSWICK)	1,13-23
X	WO 87/01486 A	(CAIE)	1,13-23
Y	EP 0130238 A	(ERZMONEIT)	4,5
Y	US 4088315	(SCHEMMEL) - Figures 12,13	6-12

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).