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(54) **Swimming starting block**

(57) The invention relates to a swimming starting block comprising a push-off plate for supporting at least feet of a swimmer during a start, as well as a sensor device which is connected to the push-off plate and which serves to detect at least changes in pressure on the push-off plate induced by the swimmer. The sensor device comprises a substantially elongated conductor for electromagnetic signals, which is connected with a first circumferential side to the push-off plate and with a second circumferential side, situated substantially opposite the first circumferential side, to a sensor-support plate ar-

ranged at a distance from the push-off plate and extending substantially parallel thereto. The push-off plate, in operation, is movable with respect to the sensor-support plate, under the influence of pressure changes induced by the swimmer, to induce a disturbance into electromagnetic signals sent through the conductor. The elongated conductor can be connected, at an end thereof, to a signal source for transmitting the electromagnetic signals through the conductor. The conductor can be connected, with a second end situated opposite the first end, to a signal detector, wherein the signal detector is arranged to detect disturbances in the electromagnetic signal.

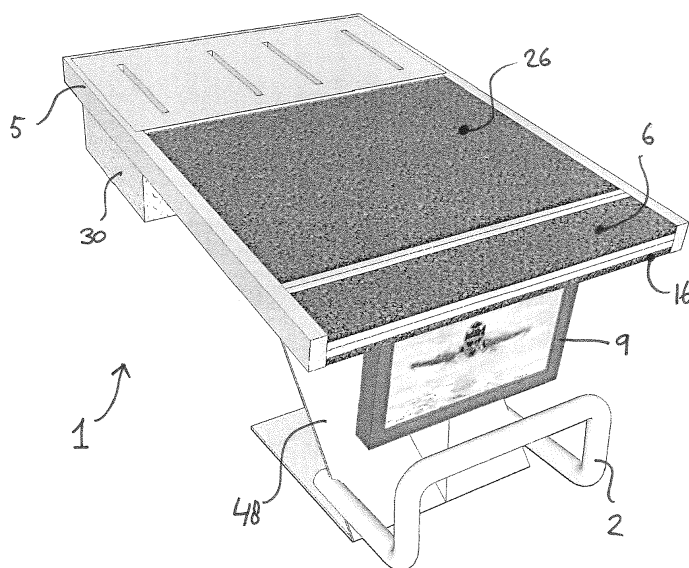


Fig. 1.

Description

[0001] The invention relates to a swimming starting block comprising a push-off plate for supporting at least feet of a swimmer during a start, as well as a sensor device which is connected to the push-off plate and which serves to detect at least changes in pressure on the push-off plate induced by the swimmer.

[0002] Such a swimming starting block is generally known and is used at swimming competitions to detect the moment at which the feet of the swimmer leave the starting block. The starting block comprises pressure-sensitive sensors. The sensors detect the moment at which the swimmer leaves the starting block, and this information is used to detect reaction times, push-off times and push-off delay time. It is a drawback of the known device that it is relatively inaccurate.

[0003] It is an object of the present invention to provide a swimming starting block having improved accuracy. A further object of the present invention is to provide a swimming starting block which can be used by the swimmer, for example during training, to improve his starting technique.

[0004] To achieve this, the invention provides a swimming starting block of the type mentioned in the opening paragraph, wherein the sensor device comprises a substantially elongated conductor for electromagnetic signals, which is connected with a first circumferential side (circumferential part) to the push-off plate and with a second circumferential side, situated substantially opposite the first circumferential side (circumferential part), to a sensor-support plate arranged at a distance from the push-off plate and extending substantially parallel thereto, wherein the push-off plate, in operation, is movable with respect to the sensor-support plate, under the influence of pressure changes induced by the swimmer, to induce a disturbance into electromagnetic signals sent through the conductor, wherein the elongated conductor can be connected, at an end thereof, to a signal source for transmitting the electromagnetic signals through the conductor, and wherein the conductor can be connected, with a second end situated opposite the first end, to a signal detector, wherein the signal detector is arranged to detect disturbances in the electromagnetic signal. The signal may consist of electromagnetic radiation in the visible spectrum, but also of signals with radiation of other wavelengths. An above described conductor with signal source and signal detector is available, for example, under the name of Lightspeed Optical Detection System, OSP.01.03, from the firm of Lightspeed Systems, Astén, The Netherlands. The conductor may be a synthetic resin optical cable through which light can be sent. Such a conductor is also described in NL 1024456, which publication is incorporated by reference. The push-off plate is movable relative to the sensor support plate to induce, for example, a micro bend or micro stretch into the conductor. A micro bend or micro stretch is a very small deformation which leads to a noticeable disturbance of the

signal sent through the conductor. When pressure is exerted on the cable, mechanical kink points are responsible for deformations in the cable. The signal detector is arranged to detect these disturbances in the electromagnetic signal caused by the micro bend. The light changes caused by mechanical kink points, when pressure is exerted, eventually lead to a noticeable change. In other words, a relative movement of the push-off plate and the sensor support plate leads to a noticeable deformation in the electromagnetic signal sent through the conductor. The signal detector is further capable of detecting the degree of micro bending or micro stretch. These deformations in the cable result in a change of the spectral distribution of light, leading to a change in values. If these new values fall outside the set detection limits, then a signal will be produced. The swimming starting block according to the invention enables the push-off time, the reaction time and the push-off delay time to be measured very accurately. It is additionally possible to determine the push-off force, thus enabling the swimming starting block according to the invention to be used also for improving the start technique of the swimmer.

[0005] The conductor is preferably direction-sensitive. The conductor such as, for example, the one forming part of the above-described detection system OSP.01.03, is sensitive to micro bends and or micro stretches in different directions, and the detector is capable of detecting said micro bends or micro stretches in the different directions. Consequently, the conductor is capable of distinguishing between relative changes in pressure in different directions, and therefore can be used to calculate and determine push-off force, push-off direction, time, reaction time, weight, etc. The swimming starting block according to the present invention thus enables the swimmer to develop an optimum start technique. In order to protect the conductor from external influences, the sensor device preferably comprises a mat, which is provided between the push-off plate and the sensor support plate. The conductor is arranged in the mat. The mat is preferably a flexible mat such as, for example, a rubber mat. By virtue thereof, micro bends in different directions are permitted.

[0006] The direction-sensitivity of the sensor device can be set by using a rigid construction or mechanical boundary, so that micro bending or micro stretch can take place only in one direction. The rigid construction should preferably counteract twisting of the conductor. The rigid construction may comprise a pressure plate and a support plate. The pressure plate is arranged on a first side of the conductor. The support plate is arranged on the opposite side. The conductor is arranged such that micro bends and stretch can take place only in the direction between the support plate and the pressure plate. In this manner, the sensor device is rendered direction-sensitive. By means of a number of sensor devices, each being direction-sensitive in a different direction, the forces occurring can be divided, for example, into orthogonal components.

[0007] In order to further increase the accuracy of the swimming starting block, the sensor device comprises a plurality of individual, elongated conductors for electromagnetic signals, which are each connected to a signal source and a signal detector. By virtue thereof, different parts of the push-off plate can be provided with different conductors, enabling said different parts to be separately monitored. This enables a distinction to be made in push-off time, push off force, push-off direction and the like between a left foot and a right foot of the swimmer. It is also possible to make a distinction between push-off force of a front part of the foot and a heel of the foot.

[0008] A further improvement of the accuracy is achieved when, in total, four individual, elongated conductors are arranged according to a regular pattern between the sensor support plate and the push-off plate. Said four elongated conductors can subdivide the push-off plate into, for example, four surfaces, thus enabling a distinction to be made, for example, between pressure influences of the front part of the foot and the heel of the foot for both the left foot and the right foot.

[0009] In a further embodiment, the swimming starting block is provided with at least one additional push-off plate and one additional sensor support plate, wherein the device also comprises an additional elongated conductor, with additional signal source and additional signal detector, arranged between the additional push-off plate and the additional sensor support plate. The additional push-off plate can be arranged at an angle with respect to the push-off plate. The additional push-off plate is, for example, a comparatively frontmost part of the swimming starting block. This push-off plate is used to detect and determine the push-off force and the push-off direction, etc, of the hands of the swimmer. A subdivision into different surfaces, as described hereinabove, is conceivable of course.

[0010] A further improvement of the accuracy is achieved when the swimming starting block comprises a support block on which the sensor support plate is provided, said support block being manufactured substantially from a composite material. The support block provides the swimming starting block with the necessary height. By manufacturing the support block from a composite material, a comparatively rigid support block is achieved, which adds to the accuracy of the conductors. In addition, the composite material is comparatively insensitive to the influences of the water-rich environment and possible chlorine vapours.

[0011] The swimming starting block is preferably provided with a display screen for displaying images, such as images giving information. The display screen can be used, for example, to show video recordings of an element of swimming. For example, the swimmer can watch his latest start and analyse it together with his coach. Additionally, or alternatively, the various information acquired by the sensor device and/or specific information can be displayed on the display screen. Thus, the swimmer immediately gets feedback on his start, thereby bet-

ter enabling the swimmer to improve his start procedure during a training session. Additionally, the display screen can be used to display advertisements, for example during races.

[0012] It is also conceivable that a number of display screens are provided on the swimming starting block. These display screens can be arranged in different positions, such that the information can be viewed from different directions. It is also conceivable that a display device is connected to the sensor device, but not to the starting block itself, for example because the display screen is arranged at a distance from the starting block.

[0013] The invention will now be explained with reference to some figures. In the figures:

Figure 1 is a perspective view of a swimming starting block according to the present invention;

Figure 2 is a sectional view, in perspective, of a swimming starting block according to the present invention;

Figures 3A and 3B show diagrammatically, in outline, embodiments of the sensor device and the starting block.

[0014] Figure 1 is a perspective view of a swimming starting block 1 according to an embodiment of the present invention. The swimming starting block comprises a frame 48. On an upper side of the frame 48, there is provided a push-off platform 5. The swimming starting block 1 comprises two push off plates 6, 26 arranged on the upper side to support at least feet of a swimmer during a start. The frontmost push-off plate 6 is intended for the front part of the foot, the rearmost push-off plate is intended to support the heel of the foot. In a certain start position, the frontmost push-off plate 6 may be intended for the frontmost foot, and the rearmost push-off plate 26 may be intended for the rearmost foot. A front side of the frame 48 is provided with a handgrab for starts in the water. A housing 30 for, for example, a processing unit of the sensor device, or other parts thereof, such as a signal source and/ or signal detector, is connected to the frame 48. In addition, a display screen 9 is provided in between the push-off platform 5 and the handgrab 2. Information can be displayed on the display screen 9, as will be explained hereinbelow.

[0015] Figure 2 shows the swimming starting block 1 of figure 1 in greater detail. Underneath push-off plate 6, there is arranged a sensor device, which is not shown in greater detail, for detecting at least pressure changes on the push-off plate 6, 26 induced by the swimmer. The sensor device comprises a substantially elongated conductor 4, 4', 24 for electromagnetic signals, which conductor is connected with a first circumferential side (or part of the circumference) to the push-off plate 6, 26. The conductor is connected with a second circumferential side (or part of the circumference), opposite the first circumferential side, to a sensor support plate 7, 27 arranged at a distance from the push-off plate. The sensor

support plate extends substantially parallel to the push-off plate. The conductor 4, 24' is provided in an elastic, flexible layer of a material such as, for example, a rubber mat. For this purpose, apertures are provided in the mat, through which apertures the conductor is passed. The conductor can describe a zigzag-like pattern through the mat. The push-off plate 6, 26 is movable relative to the sensor support plate 7, 27 to induce a micro bend or micro stretch in the conductor 4, 24'. The movement may comprise a component in the normal of the plane formed by the push-off plate 6, 26. The elongated conductor can be connected, at an end thereof, to a signal source, not shown here, to transmit electromagnetic signals through the conductor. The conductor can be connected, with a second end situated opposite the first end, to a signal detector, which is not shown here. Said signal detector is arranged to detect disturbances in the electromagnetic signal caused by micro bending, as already described hereinabove.

[0016] Figures 1 and 2 show that the swimming starting block 1 is provided with, in total, three push-off surfaces 6, 16, 26, each having associated conductors 4, 14, 24 and sensor support surfaces 7, 17, 27. Each conductor is provided with a signal source of its own and a signal detector of its own, but combined embodiments are also conceivable. An additional push-off surface 16 is provided on the front side of the starting block 1. This push-off surface is also provided with a conductor 14 in a mat 13, and a sensor support surface 17 situated at a distance from the push-off surface 16. By virtue thereof, it is possible to determine also push-off times etc, and push-off forces of hands of the swimmer. It is also possible to provide a plurality of conductors underneath each push-off surface, such that each push-off surface is pressure-sensitive in several parts. For this purpose, preferably use is made of a regular pattern.

[0017] In order to further improve the rigidity of the starting block and hence the accuracy thereof, the swimming starting block can be manufactured substantially of a composite material.

[0018] Figure 1 and figure 2 also show that the swimming starting block is provided with a display device 9. Said display device 9 enables images to be shown. The display device 9 may be connected to the sensor device, such that also information acquired by means of the sensor device can be shown on the display screen 9.

[0019] Figures 3a and 3b diagrammatically show embodiments of the swimming starting block 101, 201 comprising the sensor device 102, 202, in which, in particular, the configuration of the sensor device is elucidated.

[0020] Figure 3A shows an embodiment comprising a signal source 111 for transmitting the electromagnetic signals through a conductor 104. The conductor is connected with a first end to the signal source 111. The conductor 104 is connected with the other end to a signal detector 113. By virtue thereof, disturbances in the electromagnetic signal can be detected. The signal detector is connected to a processing unit 115, such that the signal

can be converted or processed. In the embodiment shown, the processing unit is further connected to a display device 109, which, as described hereinabove, may be connected to the swimming starting block 101. The swimming starting block 101 is diagrammatically shown. It comprises, inter alia, the pushoff plate 106 to which the conductor 104 of the sensor device is connected, as has been described in greater detail with reference to figure 2. The push-off action from the push-off plate 106 will cause a disturbance in the electric signal, which can be measured and determined by the signal detector 113. By means of the processing unit, the signal can be converted or recalculated into useful data, such as, for example, push-off force, start time, etc.

[0021] Figure 3B shows an alternative embodiment in which the swimming starting block 201 is provided with two individual push-off plate portions 206a and 206b. An individual conductor 204a and 204b extends through each push-off plate portion 206a and 206b, respectively. The conductors are each connected to a signal source 211. A number of signal sources may be provided. The conductors 206a and 206b are additionally each connected to an associated signal detector 213a and 213b, respectively. Said signal detectors are connected to a signal processing unit 215. By means of this embodiment, data of two different parts 206a and 206b of the starting block 201 can be determined. By virtue thereof, the push-off force, reaction time etc, for the various parts can be determined, thus enabling an even more accurate result to be achieved. Of course, a plurality of conductors may be arranged in the starting block 201. In addition, it is conceivable that additional signal sources 211 and/or additional signal detectors 213 and/or additional processing units 215 are present. In addition, a display screen may also have been provided.

[0022] The figures shown and the description given above relate only to a few embodiments of the present invention. However, it will be obvious to those skilled in the art that many variants, whether obvious or not, are possible within the protective scope of the present invention as defined by the appended claims.

Claims

1. A swimming starting block comprising a push-off plate for supporting at least feet of a swimmer during a start, as well as a sensor device which is connected to the push-off plate and which serves to detect at least changes in pressure on the push-off plate induced by the swimmer, wherein the sensor device comprises a substantially elongated conductor for electromagnetic signals, which is connected with a first circumferential side to the push-off plate and with a second circumferential side, situated substantially opposite the first circumferential side, to a sensor-support plate arranged at a distance from the push-off plate and extending substantially parallel thereto,

wherein the push-off plate, in operation, is movable with respect to the sensor-support plate, under the influence of pressure changes induced by the swimmer, to induce a disturbance into electromagnetic signals sent through the conductor, wherein the elongated conductor can be connected, at an end thereof, to a signal source for transmitting the electromagnetic signals through the conductor, and wherein the conductor can be connected, with a second end situated opposite the first end, to a signal detector, wherein the signal detector is arranged to detect disturbances in the electromagnetic signal.

2. A swimming starting block according to claim 1, wherein the conductor is direction-sensitive. 5
3. A swimming starting block according to claim 1 or 2, wherein the sensor device is provided in a mat, preferably a rubber mat, which is arranged between the push-off plate and the sensor support plate. 10
4. A swimming starting block according to one or more of the preceding claims, wherein the sensor device comprises a plurality of individual, elongated conductors for electromagnetic signals, which are each connected to a signal source and a signal detector. 15
5. A swimming starting block according to claim 4, comprising a number, preferably four, individual, elongated conductors, which are provided between the sensor support plate and the push-off plate according to a regular pattern. 20
6. A swimming starting block according to one or more of the preceding claims, comprising at least one additional push-off plate and one additional sensor support plate, wherein the device also comprises an additional elongated conductor, with additional signal source and additional signal detector, arranged between the additional push-off plate and the additional sensor support plate. 25
7. A swimming starting block according to one or more of the preceding claims, comprising a support block on which the sensor support plate is provided, said support block being manufactured substantially from a composite material. 30
8. A swimming starting block according to one or more of the preceding claims, comprising a display device which is connected to the swimming starting block. 35
9. A swimming starting block according to claim 8, wherein the display device is connected to the signal detector. 40

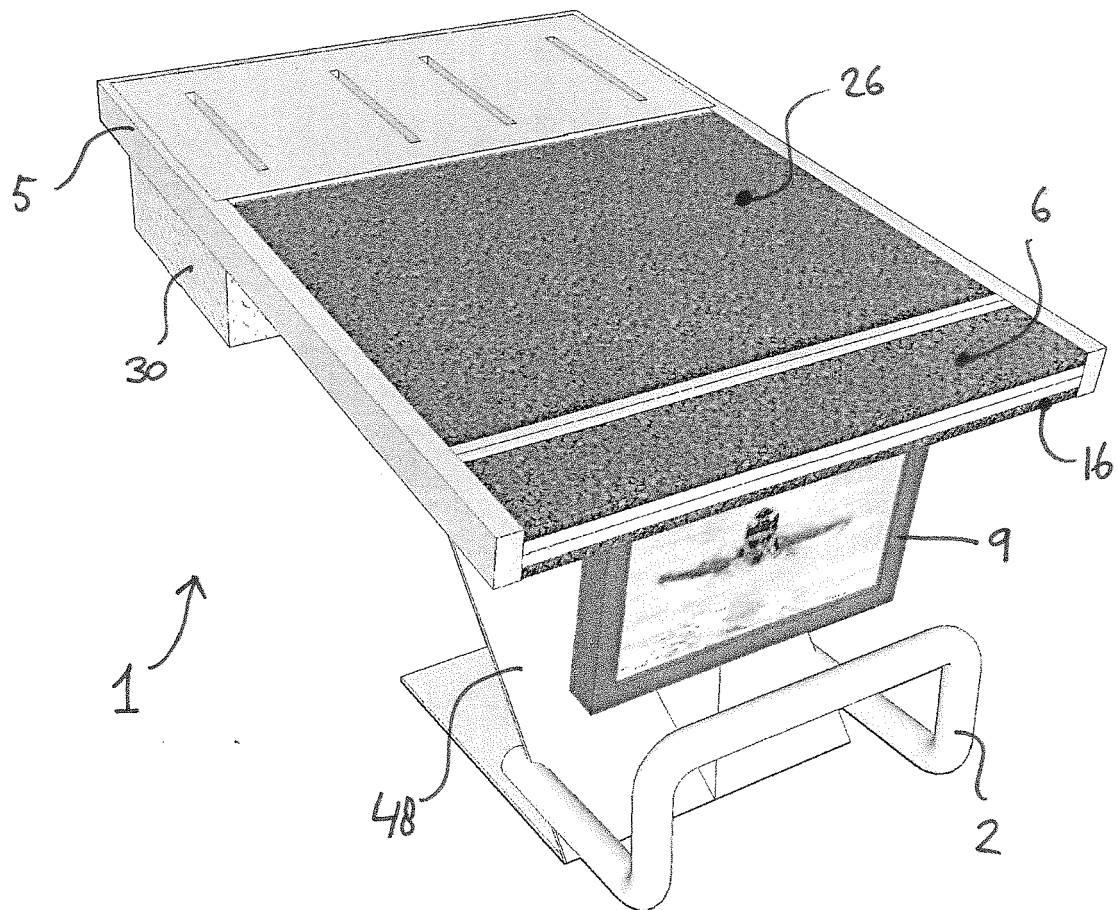


Fig. 1.

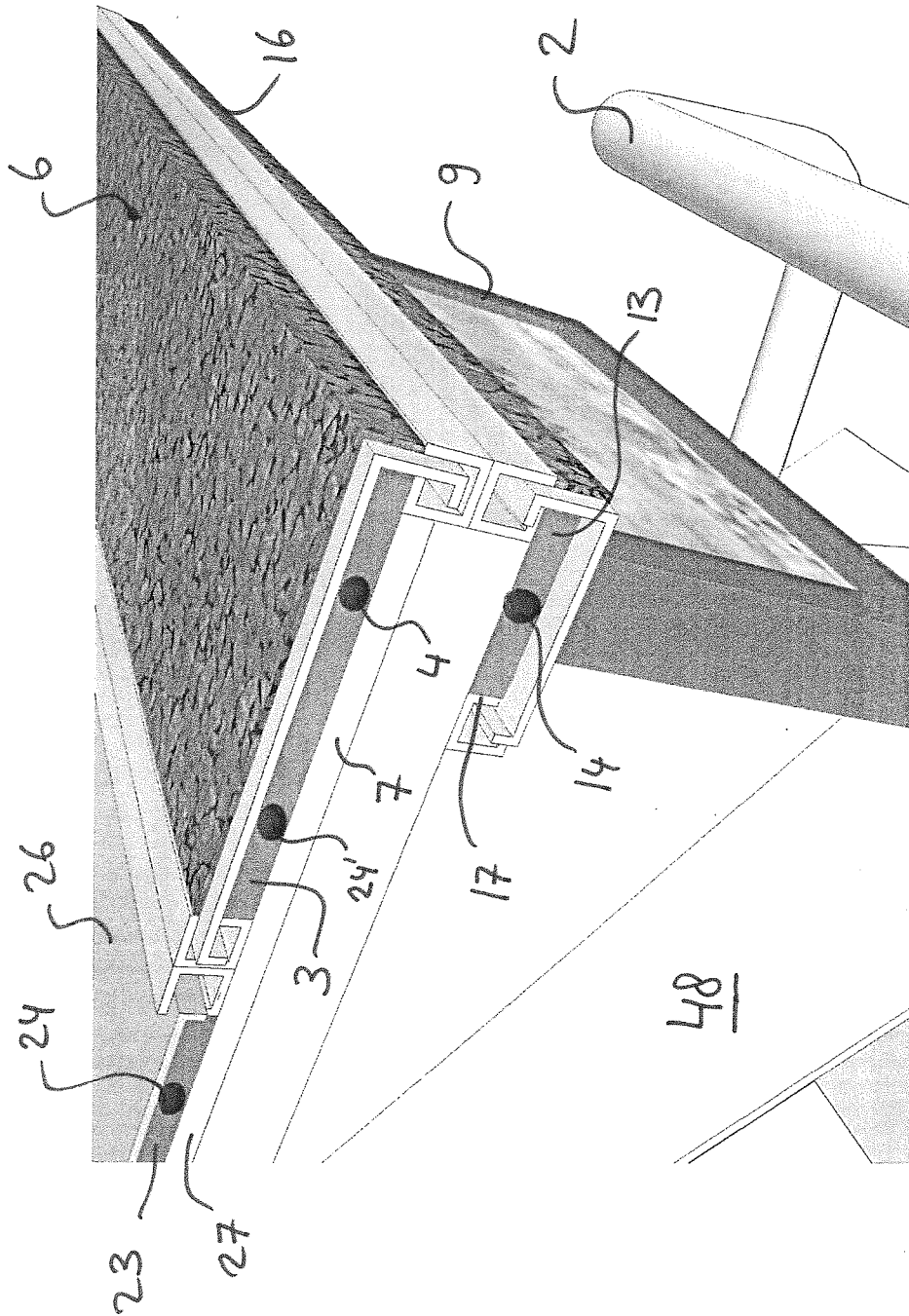
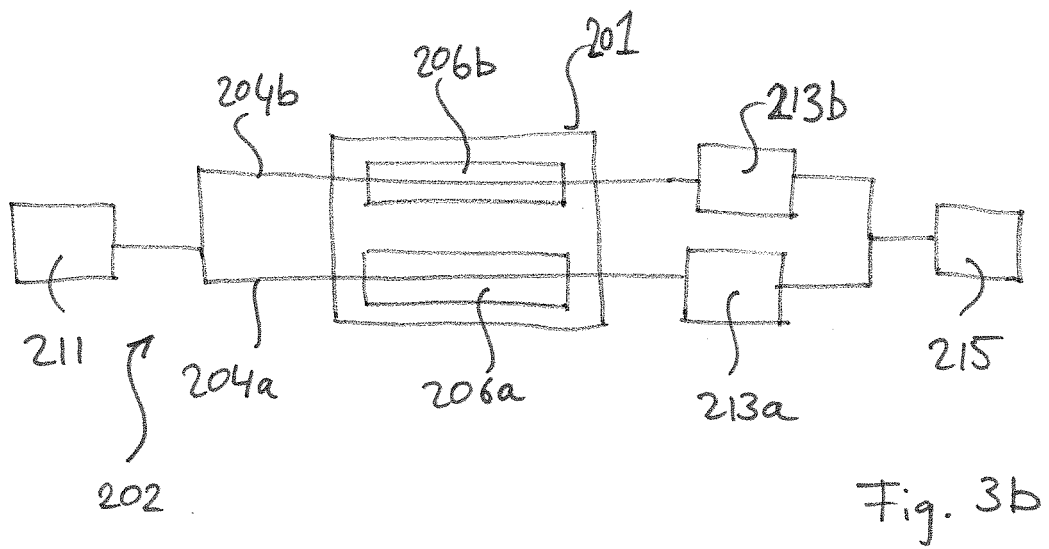
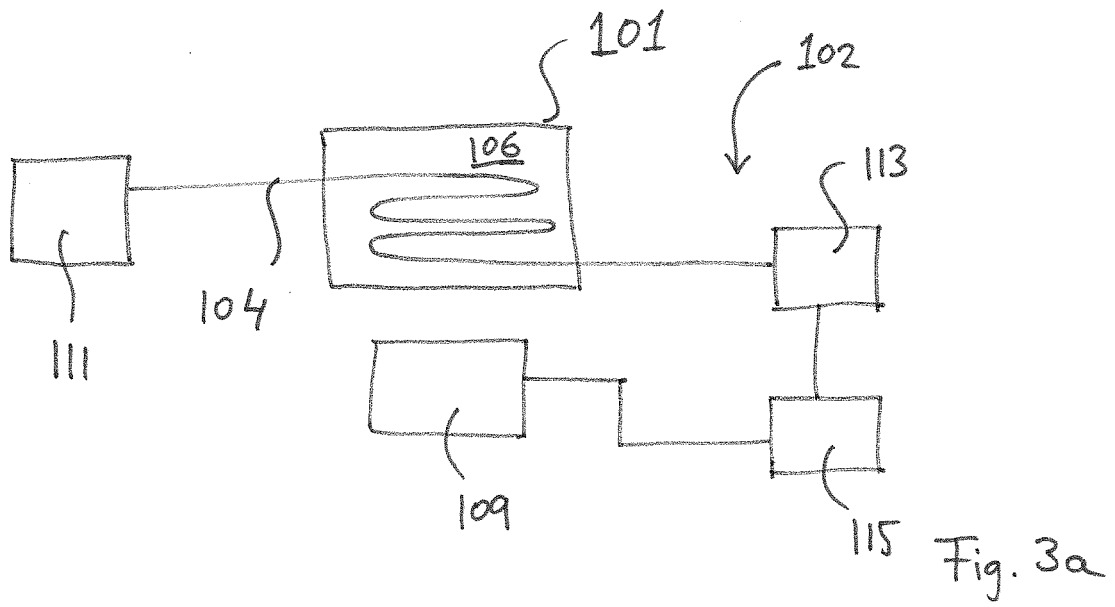


Fig. 2





EUROPEAN SEARCH REPORT

Application Number
EP 11 19 0624

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 2 254 453 A (GANNON GLEN CHARLES; JARVIS STEPHEN KEITH GANNON GLEN CHARLES [AU]; JA) 7 October 1992 (1992-10-07) * page 3, line 11 - page 4, line 4; figures 1-3 *	1-9	INV. A63B71/06 A63K3/02 G07C1/22 A63B69/12 G04F8/08
A	US 7 403 135 B1 (KASKI KURT R [US] ET AL) 22 July 2008 (2008-07-22) * column 2, line 20 - column 3, line 3 * * column 16, line 37 - line 50; claim 1 2 5 8; figures 1,2,4,9-12b *	1-9	
A,D	US 2007/108328 A1 (VAN DE VEN MATHIJS THEODORUS W [NL]) 17 May 2007 (2007-05-17) * paragraph [0002]; figures *	1-9	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A63B A63K G04F G07C G08B
2	Place of search The Hague	Date of completion of the search 1 February 2012	Examiner Faymann, Juan
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 19 0624

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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01-02-2012

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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