

(19)



(11)

EP 3 939 674 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.01.2022 Bulletin 2022/03

(51) International Patent Classification (IPC):
A63B 43/00 ^(2006.01) **A63B 57/00** ^(2015.01)
A63B 24/00 ^(2006.01)

(21) Application number: **20186382.6**

(52) Cooperative Patent Classification (CPC):
A63B 43/00; A63B 24/0021; A63B 57/00;
A63B 60/46; A63B 2024/0034; A63B 2024/0053;
A63B 2220/12; A63B 2220/30; A63B 2220/35;
A63B 2220/36; A63B 2220/40; A63B 2220/833;
A63B 2225/50; A63B 2225/54

(22) Date of filing: **17.07.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Stima Innovations GmbH**
6642 Stanzach (AT)

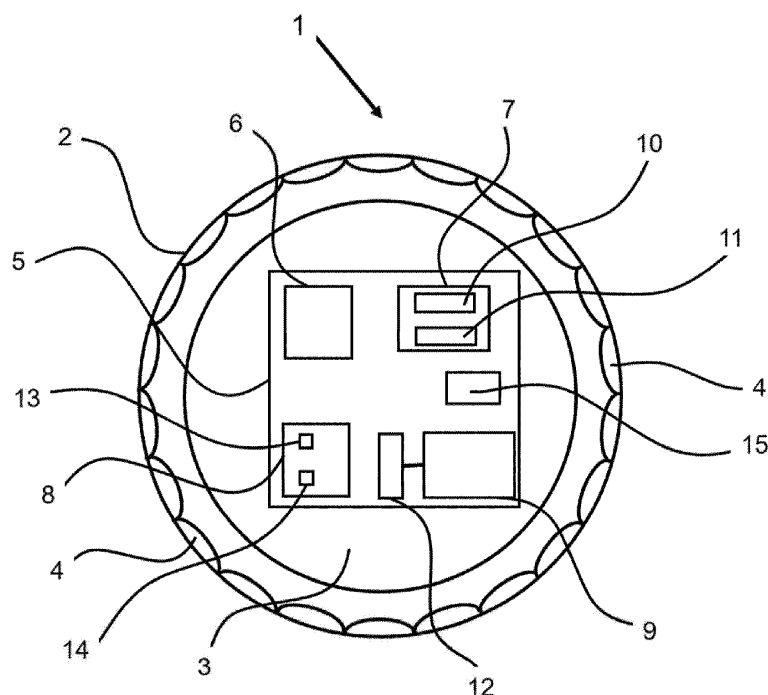
(72) Inventors:
• **Kathrein, Martin**
6642 Stanzach (AT)
• **Keller, Stefan**
6677 Schattwald (AT)

(74) Representative: **Kador & Partner PartG mbB**
Corneliusstraße 15
80469 München (DE)

(54) **GOLF BALL AND GOLF BALL ANALYZING SYSTEM**

(57) Disclosed is a golf ball (1) comprising:
- a GPS sensor (6) adapted to determine a location data of the golf ball (1),
- a flight data module (7) adapted to determine flight data of the golf ball (1),

- a transmitter (8) adapted to transmit the location data and flight data, and
- a rechargeable battery (9) adapted to be charged wirelessly.



EP 3 939 674 A1

Description

[0001] The present invention relates to a golf ball and to a golf ball analyzing system.

[0002] Smart golf balls that can be tracked and corresponding systems are already known from the prior art. Such golf balls and systems are used to locate the golf balls, because it is often very difficult to find the golf ball when the player hits the golf ball into a hazard on the course such as water hazards, sand traps, tall grass and so on. The document US 2015/0094167 A1 discloses a golf ball locating system that includes a golf ball having a control circuit therein. The control circuit includes a global positioning system (GPS) chip, a radio frequency transmitter, one or more antennas, and a rechargeable battery.

[0003] The golf ball is capable of transmitting a signal to a smartphone or similar mobile electronic device having a related software application thereon. The software application indicates the position of the golf ball relative to the user. The software application preferably displays a map of the golf course and indicates the position of the ball on the course. As the user approaches the golf ball, the mobile electronic device will produce an audible alert, such as a tone, with increasing frequency as the golfer nears his or her golf ball. In this way, a user can easily locate his or her golf ball while golfing.

[0004] A further locating system is disclosed in US 2010/0151955 A1. Said document describes a system and methods for integrating a transmitter into an object, such as a golf ball, that becomes active upon the motion of the object. This transmitter sends a signal to a receiver that is configured to determine the location of the golf ball. The receiver is able to determine the location of the golf ball and outputs the location to a display.

[0005] Patent application US 2017/0368411 A1 discloses a positioning system that includes a golf ball and a mobile terminal. The golf ball includes a battery and a transmitter configured to operate with electric power supplied from the battery and transmit a radio signal to outside of the golf ball. The mobile terminal includes a receiver configured to receive the radio signal from the golf ball and a processor configured to measure the position of the mobile terminal, and to measure the position of the golf ball based on the strength of the radio signal received by the receiver at two or more points at which the measured position of the mobile terminal differs.

[0006] A further smart golf ball is also known from US 2018/0236303 A1. The golf ball has at least one transmitting and receiving antenna and a position determination unit, which has a communicative connection to the transmitting and receiving antenna and is designed to receive GPS data, which specify the position of the golf ball. Furthermore, the golf ball has a communication unit, which has a communicative connection to the transmitting and receiving antenna and is designed to transmit radio data, in particular the position of the golf ball. In addition, the golf ball has at least one charging coil, which

is connected to an energy store and is designed to charge the energy store by means of inductive energy transmission.

[0007] The German utility model DE 20 2011 051 355 U1 discloses a golf ball with position data acquisition means for acquiring position data and communication means for transmitting the acquired position data or a data value derived therefrom to a receiving unit, and a system with said golf ball.

[0008] Although state of the art provides adequate golf balls and systems, there is a further need for improved golf balls and corresponding systems.

[0009] An object of the present invention is therefore to provide an improved golf ball and according to a second embodiment to provide an improved golf ball analyzing system.

Description of the invention

[0010] This object is solved by a golf ball according to claim 1 and a golf ball analyzing system according to claim 7. The dependent claims display advantageous embodiments.

[0011] In a first aspect, the present invention provides a golf ball comprising a GPS sensor adapted to determine a location data of the golf ball, a flight data module adapted to determine flight data of the golf ball, a transmitter adapted to transmit the location data and flight data, and a rechargeable battery adapted to be charged wirelessly.

[0012] The proposed golf ball combines different properties of the golfers needs. On the one hand, the golf ball allows to be easily located after the stroke, so that the time-consuming search of the golf ball that slows down the round of golf will be superfluous. As the golf ball provides further a flight data module adapted to determine flight data of the golf ball, the golfer obtains also the possibility of analyzing the stroke via the golf club. All the data can be transmitted to a smartphone or other mobile device, which includes a software application that displays the location of the golf ball on a map and provides different analytic tools to analyze the stroke.

[0013] In a preferred embodiment, the flight data module comprises an Inertial Measurement Unit (IMU) and/or an Attitude Heading Reference System (AHRS) that determines the flight data of the golf ball. Typical flight data that are determined via the flight data module, preferably the Measurement Unit (IMU) and/or an Attitude Heading Reference System (AHRS) are selected from the group comprising roll-pitch-yaw angles, accelerations, the track, the spin, velocities, like start-velocity, end-velocity and/or maximum- and/or minimum-velocity, the force and/or the position, at which the golf club has hit the golf ball. For this purpose, the Measurement Unit (IMU) and/or the Attitude Heading Reference System (AHRS) may comprise different sensors selected from the group comprising three-dimensional acceleration sensors, three-dimensional gyroscope sensors, three-dimensional magnetic field sensors, temperature sensors, high-

precision timers, signal generators, clock generators and/or quartz oscillators. Based on these flight data the golf player obtains relevant information of the stroke and the flight curve of the golf ball and can therefore optimize his personal handicap.

[0014] Said flight data can be transmitted via the transmitter to an analyzing unit to analyze the location data and the flight data of the golf ball. The transmitter comprises preferably a Bluetooth-Low-Energy module, an Ultrawide Band module and/or a Long-Range module (LoRa) to determine the location of the golf ball and/or to transfer the collected flight data of the golf ball wirelessly.

[0015] In a further preferable embodiment, the rechargeable battery is adapted to be charged inductively, and/or capacitively, for instance when the golf ball is placed on an inductive and/or capacitive charging station, and/or via Power-over-WiFi. The Power-over-WiFi technology allows to harvest existing wireless signals and convert them into direct current voltage to charge the golf ball while playing without the need for a plug-in charger, all without affecting communication performance.

[0016] In a further preferable embodiment, the golf ball comprises a power generator that transfers a kinetic energy of the golf ball into electrical energy to recharge the rechargeable battery. The power generator may be a coil assembly that transfers the kinetic energy caused by the stroke and used to move the golf ball into electrical energy to recharge the battery. Such a coil assembly may comprise a transmitter and a receiver coil.

[0017] The golf ball may further comprise an RFID chip and/or an NFC chip to personalize the golf ball with individual data, for example identification numbers, serial number, pairing information and/or customer data. RFID and NFC chips provides a convenient contact-free data exchange between a transponder and a writer/reader device.

[0018] In a second aspect, the present invention provides a golf ball analyzing system comprising said golf ball, at least three antennas adapted to receive the location data and the flight data, and an analyzing unit adapted to analyze the location data and the flight data of the golf ball.

[0019] The at least three antennas are preferably arranged stationary around a golf course and are preferably electronically connected among each other. The antennas allow to triangulate the final location of the golf ball on the course. The antennas may comprise beacons. The beacons contain a CPU, radio, and batteries, and works by repeatedly broadcasting out an identifier that can be picked up by the golf ball, especially if the golf ball provides the Bluetooth-Low-Energy module, the Ultrawide Band module and/or the Long-Range module (LoRa). Such a system allows an exceptionally accurate localization of the golf ball and communication performance.

[0020] The beacons may further comprise a multiphase Array antenna and/or a multisectoral Ultrawide Band module and/or transceivers, a WiFi-module pref-

erably with a Bluetooth-Low-Energy module, and/or a Long-Range module (LoRa). To achieve a 360° coverage, the beacons may comprise a plurality of said modules. The plurality of said modules may also be split into smaller segments to gain a broader range.

[0021] Usually, the antennas may be formed by high frequency antennas providing different polarizations and directions.

[0022] In a preferred embodiment, the golf ball analyzing system is using a low-power wide-area network protocol.

[0023] Usually, the beacons may comprise an amplifier and matching networks to amplify the signals of the specific transceiver systems.

[0024] The CPU-module uses preferably a network-interface over Ethernet and/or an optical fiber connection. The CPU-module may further comprise floating point unit (FPU) and/or a time-base generator, especially a high precision time-base generator.

[0025] Usually, the golf ball analyzing system may be run via a real-time operating system (RTOS). This is an operating system (OS) intended to serve real-time applications that process data as it comes in, typically without buffer delays. Processing time requirements (including any OS delay) may be measured in tenths of seconds or shorter increments of time. A real-time system is a time-bound system which has well-defined, fixed time constraints.

[0026] Usually, all the different devices and hardware components of the golf ball analyzing system may be designed as grade parts and may be used at different weather conditions.

[0027] Usually, the antennas and/or beacons may be disposed on masts, on buildings, on trees, on lanterns and/or other useful locations.

[0028] The beacons may also be arranged independently within the golf course. In a further preferable embodiment, the beacons are further adapted to be used as an internet hotspot. They may also be used as a local navigation system and/or a communication network that provides a WIFI support.

[0029] In a further preferred embodiment, the antennas and/or the beacons are solar-cell powered and/or powered over Power over Ethernet.

[0030] The golf ball analyzing system may also comprise a golf club. The golf club can further comprise a RFID chip and/or an NFC chip, an Inertial Measurement Unit, an Attitude Heading Reference System, a camera sensor and/or a Bluetooth module.

[0031] In an alternative embodiment, a conventional golf club may be used, preferably in combination with a mobile electronic device providing a Ultrawide Band module. The mobile electronic device may be a smartphone, a handheld and/or a smart watch.

Description of the Figures

[0032] The subject-matter according to the present ap-

plication is intended to be explained in more detail with reference to the subsequent figures and examples without wishing to restrict said subject-matter to the special embodiments.

[0033] Fig. 1 shows, in a schematic cross-sectional view, a golf ball according to one embodiment of the present invention.

[0034] The spherical golf ball 1 in figure 1 is composed of materials commonly used to construct golf balls and includes an outer shell 2 defining an interior volume 3. The outer shell 2 provides a plurality of circular dimples 4 on the exterior surface to improve the aerodynamics of the golf ball 1 while in flight.

[0035] The interior volume 3 is composed of any suitable material used to fill golf balls, including synthetic rubber or resin, among others and substantially fills the interior volume 3 of the golf ball 1. Within the interior volume 3, the golf ball 1 may comprise a circuit board 5 comprising different sensors and modules. The golf ball 1 shown in figure 1 comprises a GPS sensor 6 adapted to determine a location data of the golf ball 1, a flight data module 7 adapted to determine flight data of the golf ball 1, a transmitter 8 adapted to transmit the location data and flight data, and a rechargeable battery 9 that can be charges wireless. All the sensors and modules does impact the weight or weight distribution of the golf ball 1, so that said golf ball 1 provides substantially a similar weight to conventional golf balls.

[0036] The determined location of the golf ball 1 can be wirelessly transmitted to the user's mobile electronic device (not shown) using a Bluetooth-Low-Energy module 13, or an Ultrawide Band module 14, that forms a part of the transmitter 8, to determine the location of the golf ball and/or to transfer the collected flight data of the golf ball wireless. Such a device may comprise a related software application on the mobile electronic device to display the location of the golf ball 1 as determined by the GPS sensor 6 on a map of the golf course. In this way, the user can visualize the location of the golf ball 1 on the golf course.

[0037] The flight data module 7 comprises in the present embodiment an Inertial Measurement Unit (IMU) 10 and an Attitude Heading Reference System (AHRS) 11 that determines the flight data of the golf ball 1. Said flight data, like roll-pitch-yaw angles, accelerations, track, spin, velocities, like start-velocity, end-velocity and/or maximum- and/or minimum-velocity, force and/or the position, at which a golf club has hit the golf ball 1 can also be wirelessly transmitted to the user's mobile electronic device. Based on these flight data the user obtains relevant information of the stroke and the flight curve of the golf ball 1 and can optimize his personal handicap.

[0038] The rechargeable battery 9 within the golf ball 1 is adapted to be charged inductively, when positioned on an inductive charging station (not shown) so as to charge the battery 9 therein. Additionally, the present golf ball 1 comprises a power generator 12 that is electrically connected to the battery 9 and that transfers a kinetic

energy of the golf ball 1 into electrical energy to recharge the battery 9. The power generator 12 may be a spring.

[0039] Further, the golf ball 1 comprise an RFID chip 15 to personalize the golf ball 1 with individual data of the golf course or the user.

References

[0040]

- | | |
|----|-----------------------------|
| 1 | Golf ball |
| 2 | Outer shell |
| 3 | Interior volume |
| 4 | Dimples |
| 5 | Board |
| 6 | GPS sensor |
| 7 | Flight data module |
| 8 | Transmitter |
| 9 | Battery |
| 10 | IMU |
| 11 | AHRS |
| 12 | Power generator |
| 13 | Bluetooth-Low-Energy module |
| 14 | Ultrawide Band module |
| 15 | RFID chip |

Claims

1. Golf ball (1) comprising:
 - a GPS sensor (6) adapted to determine a location data of the golf ball (1),
 - a flight data module (7) adapted to determine flight data of the golf ball (1),
 - a transmitter (8) adapted to transmit the location data and flight data, and
 - a rechargeable battery (9) adapted to be charged wireless.
2. The golf ball (1) according to claim 1, wherein the rechargeable battery (9) is adapted to be charged inductively, capacitively and/or via Power over WiFi.
3. The golf ball (1) according to claim 1 or 2, further comprising a power generator (12) that transfers a kinetic energy of the golf ball (1) into electrical energy to recharge the rechargeable battery (9).
4. The golf ball (1) according to anyone of the preceding claims, wherein the flight data module (7) comprises an Inertial Measurement Unit (10) and/or an Attitude Heading Reference System (11).
5. The golf ball (1) according to anyone of the preceding claims, wherein the transmitter (8) comprises a Bluetooth-Low-Energy module (13) and/or an Ultrawide Band module (14) to determine the location of the

golf ball (1) and/or to transfer the collected flight data of the golf ball (1) wireless.

6. The golf ball (1) according to anyone of the preceding claims, further comprising a RFID (15) and/or NFC chip. 5

7. Golf ball analyzing system comprising:
 - a golf ball (1) according to anyone of the preceding claims, 10
 - at least three antennas adapted to receive the location data and the flight data, and
 - an analyzing unit adapted to analyze the location data and the flight data of the golf ball. 15

8. The golf ball analyzing system according to claim 7, wherein the at least three antennas are arranged stationary around a golf course. 20

9. The golf ball analyzing system according to claim 7 or 8, wherein the antennas comprise beacons.

10. The golf ball analyzing system according to claim 9, wherein the beacons are further adapted to be used as an internet hotspot. 25

11. The golf ball analyzing system according to anyone of the preceding claims 7 to 10, wherein the antennas are connected among each other. 30

12. The golf ball analyzing system according to anyone of the preceding claims 7 to 11, wherein the antennas are solar-cell powered and/or powered over Power over Ethernet. 35

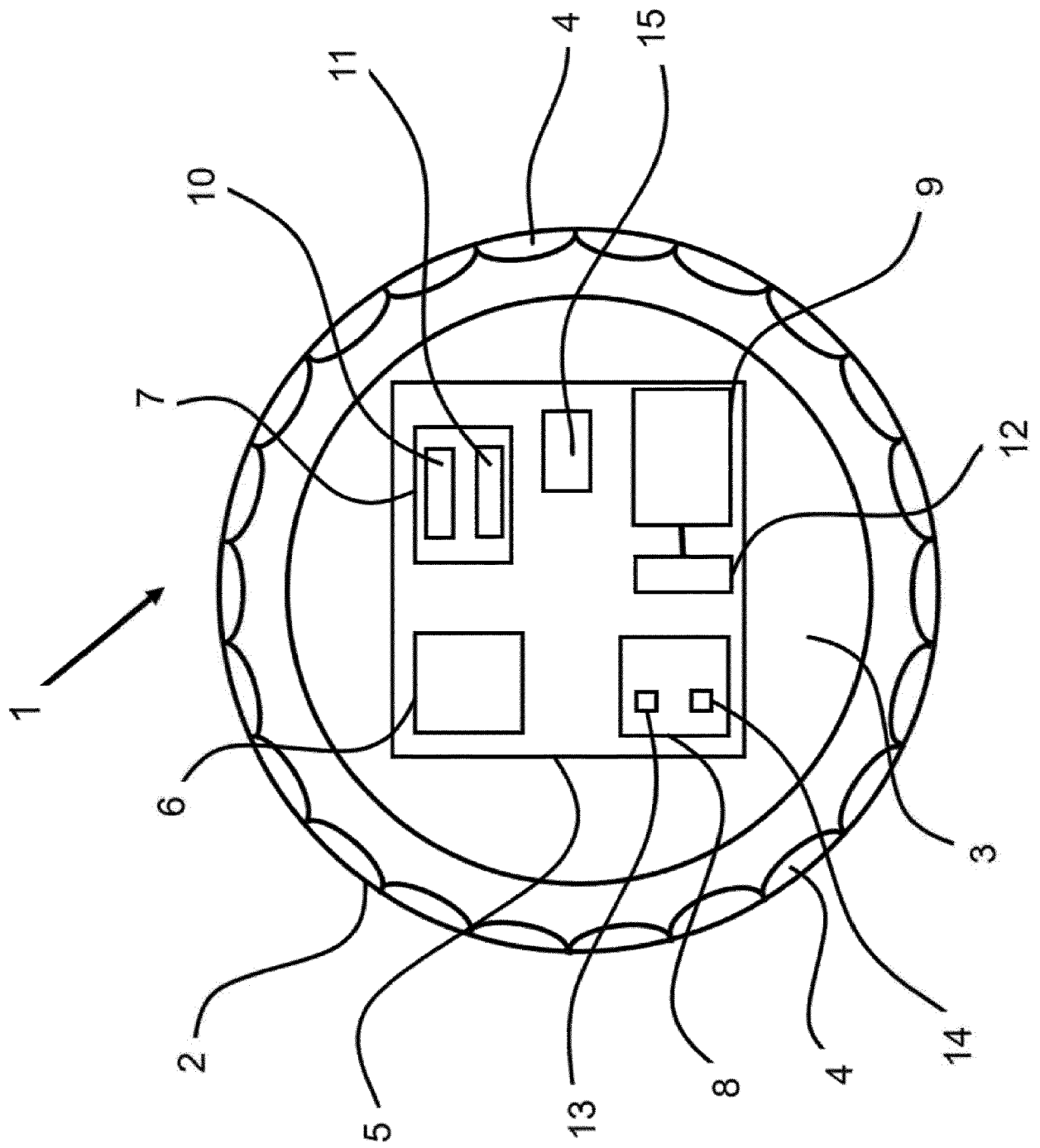
13. The golf ball analyzing system according to anyone of the preceding claims 7 to 12, further comprising a golf club. 40

14. The golf ball analyzing system according to claim 13, wherein the golf club comprises a RFID chip.

15. The golf ball analyzing system according to claim 13 or 14, wherein the golf club comprises an Inertial Measurement Unit, an Attitude Heading Reference System and/or a camera sensor. 45

50

55





EUROPEAN SEARCH REPORT

 Application Number
 EP 20 18 6382

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2019/175993 A1 (TATTERSFIELD BENJAMIN LUKE [AU]) 13 June 2019 (2019-06-13)	1-3,5-9	INV. A63B43/00 A63B57/00 A63B24/00
Y	* paragraph [0099] * * paragraph [0119] * * paragraph [0123] *	1-15	
X	US 2015/094168 A1 (UNGER SR JEFFERY PHILIP [US] ET AL) 2 April 2015 (2015-04-02) * paragraph [0020] - paragraph [0022] * * paragraph [0035] *	1-5,7-15	
X	US 2005/233815 A1 (MCCREARY IAIN [US] ET AL) 20 October 2005 (2005-10-20) * paragraph [0024] * * paragraph [0025] * * paragraph [0027] *	1-6	
Y	US 2018/214758 A1 (MOSHER ALEC MICHAEL [US] ET AL) 2 August 2018 (2018-08-02) * paragraph [0041] - paragraph [0046] * * paragraph [0027] - paragraph [0031] *	1-15	TECHNICAL FIELDS SEARCHED (IPC)
			A63B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 December 2020	Examiner Lundblad, Hampus
CATEGORY OF CITED DOCUMENTS 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		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	

 1
 EPO FORM 1503 03.82 (P04C01)

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

EP 20 18 6382

5 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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-12-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2019175993 A1	13-06-2019	AU 2017309823 A1	04-04-2019
		CA 3033410 A1	15-02-2018
		CN 109843395 A	04-06-2019
		EP 3496827 A1	19-06-2019
		JP 2019524410 A	05-09-2019
		KR 20190051970 A	15-05-2019
		US 2019168081 A1	06-06-2019
		US 2019175993 A1	13-06-2019
		WO 2018027280 A1	15-02-2018
US 2015094168 A1	02-04-2015	US 2015094168 A1	02-04-2015
		WO 2015051038 A1	09-04-2015
US 2005233815 A1	20-10-2005	US 2005233815 A1	20-10-2005
		WO 2005089890 A1	29-09-2005
US 2018214758 A1	02-08-2018	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20150094167 A1 [0002]
- US 20100151955 A1 [0004]
- US 20170368411 A1 [0005]
- US 20180236303 A1 [0006]
- DE 202011051355 U1 [0007]