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/GOLF BALLS/

The present invention relates to balls, especially golf balls, incorporating an identification device.

U.S. patent 5,743,815 discloses such an arrangement, in which a passive transponder is surrounded by elastic material and a rigid housing to produce a coded golf ball. GB patent 1,172,449 discloses a radio emitter arranged in the liquid composition at the centre of a golf ball. U.S. 5582550 discloses a golf ball having embedded therein an identification device and an aerial.

U.S. 3,782,730 also shows a golf ball with an oscillator circuit which is surrounded by a resilient sphere and which is to aid location of the ball. The circuit is set in a resin mass which is located in a rubber core. The disclosure of this document corresponds generally to the introduction of claims 1 and 8.

Coded golf balls are necessary in order to efficiently run golf driving ranges such as those disclosed in our co-pending patent application PCT/GB99/00883.

A problem with prior arrangements is to provide a sufficiently reliable identification device which is robust enough to withstand the shock of repeated impacts with a golf club. Another problem is the need to withstand the extreme conditions of temperature and pressure required during the manufacture of golf balls. In addition the identification device should have no effect on the performance of the golf ball in use.

The present invention seeks to overcome or reduce one or more of the above problems.

According to a first aspect of the present invention, a golf ball comprising a core with an identification device embedded in the core, the identification device comprising a coded element and an aerial characterised in that the identification device further comprises a spring or diaphragm and in that the coded element and/or the



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aerial, to dampen mechanical shocks thereto, are connected to the spring or diaphragm.

The identification device is preferably a radio frequency identification device.

The coded element may be mounted in or on a plate with the aerial being formed by a coil arranged on one face of the plate and the diaphragm being arranged on the opposite face of the plate.

In preferred arrangements the coded element, in the form of a chip, is connected to the diaphragm. The aerial coil is separately connected to the diaphragm, so that the diaphragm may also serve to electrically connect the chip and the aerial coil.

The spring or diaphragm is preferably made of a heat conductive material so that it can serve as a heat sink during subsequent manufacturing stages of the golf ball to prevent overheating of the coded element and/or the aerial.

According to a second aspect of the present invention, there is provided a method of manufacturing a golf ball incorporating an identification device, the method including the steps of moulding the identification device in a disc or capsule member, placing the member between two parts of a ball core, adhering the core parts to each other around the member, and then subjecting the thus-formed core to further processing steps, including providing it with a covering, characterised in that means for protecting the identification device from the effects of impacts are also moulded in the disc or capsule member.

The core parts are preferably symmetrical and may be hemispherical or cuboid shape (to form a cuboid core which is subsequently processed to have a spherical shape).

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 shows a top plan view of an identification device for use in an embodiment of the present invention;

Figure 2 shows a bottom plan view of the device of Figure 1;

Figure 3 shows the device of Figures 1 and 2 encapsulated in a capsule;

Figure 4a and 4b show the device of Figure 3 is embedded in a core of cuboid shape; and

Figure 5 shows the core of Figure 4 after a further processing step.

Referring to the drawings, Figures 1 and 2 show an identification device 10 comprising a substrate formed by an insulating plate 11 e.g. of a plastics material such as any polyvinyl chloride product with the necessary temperature characteristics. The identification device is a passive device and includes an ASIC chip 12 with a 64 bit memory which can be read only or may have both read and write functions. The device operates at radio frequency preferably in the range 66kHz – 13.56 MHz. It also comprises a generally circular copper coil aerial 14 and arranged to receive interrogation signals from external readers and to transmit an appropriate response. The code within the coded response of the aerial 14 is stored in the memory of chip 12.

On the opposite major surface of plate 11, there is provided an annular or coiled shock absorbing member in the form of a steel diaphragm 16. Diaphragm 16 has a tongue 18 and a meandering section or castellation 19 which assists in bonding to the plate 11. The diaphragm is resiliently mounted, e.g. on a spring part, so as to protect the identification device from the impact of a golf club.

The physical arrangement is such that the chip 12 is mounted on the back of tongue 18 of the diaphragm 16 as seen in Figure 2; this enables the diaphragm to act as an effective heat sink for chip 12 during processing of the core. The chip 12 extends through a hole 22 in the plate 11 but without being directly attached to the plate. The aerial coil 14 is separately attached to the diaphragm 16 by a connection passing through the plate 11; this means that the diaphragm can serve as a conductive link for signals passing between aerial 14 and chip 12.

The plate 11, with the various components mounted thereon, is then located in a mould, and epoxy resin material 17 is then cast around it to form a disc member or capsule 20, Figure 3. The capsule provides high impact absorption and bonding for the plate arranged substantially along its central plane. As the material of the capsule sets, the difference between the thermal setting properties of the different materials enables the diaphragm to "set-back", giving room for relative movement after setting. Typical maximum dimensions of the capsule are diameter 17mm and depth 3.5mm.

As shown in Figures 4a and 4b, the capsule 20 is then positioned within a pre-manufactured soft synthetic rubber billet or core 35 of generally cuboid shape. This is done by slicing the billet in half, cleaning the cut surfaces with solvent, coating the capsule with a bonding solution to improve adhesion and to prevent delamination, placing the capsule carefully at the centre of the billet 35, and bonding the two halves of the billet together again. Here, it is important that the capsule 20 is located centrally of the loaded synthetic rubber/chalk pre-manufactured core 35. This can be done manually or automatically with a specially-designed tool. The capsule 20 should be oriented with its major surfaces parallel to the major surfaces of the core 35.

The accurate location of the capsule 20 within each billet half, can be assisted by cutting or machining an appropriately shaped recess.

The billet is then subjected to a conventional manufacturing process during which it reaches temperatures of 200°C and pressures of up to 15.4 MN/m² (1ton/square inch) as the rubber compound vulcanises and adopts a spherical form 35', Figure 5. During the heating process, the diaphragm 16 further serves as a heat sink for the chip 12 and the rest of the identification device, which is thus prevented from thermal damage. A conventional dimpled cover of material sold under the trade name of Surlyn or similar material is subsequently applied as the outer layer of the ball.

A ball manufactured as above is within the normal weight specification (maximum 45.93 grams) and performs exactly as a normal ball, i.e. it looks and feels the same and the

presence of the identification device does not affect the flight, trajectory, run, distance or dispersion of the ball in use.

In addition, alternative arrangements may be provided for absorbing shocks. For example, in one modification, electronic circuitry is mounted on an aerial coil which in turn is mounted on a spring.

The identification system could be used in other sorts of balls, e.g. tennis balls, or any other type of object which undergoes rough treatment.

Instead of uniquely identifying the ball or other object, the device may simply be part of a presence-sensing system, e.g. as an aid to locating lost golf balls.

CLAIMS

1. A golf ball comprising a core (35) with an identification device (10) embedded in the core, the identification device comprising a coded element (12) and an aerial (14) characterised in that the identification device (10) further comprises a spring or diaphragm (16) and in that the coded element (12) and/or the aerial (14), to dampen mechanical shocks thereto, are connected to the spring or diaphragm(16).
2. A golf ball according to claim 1, wherein the identification device (10) is a radio frequency identification device.
3. A golf ball according to claims 1 or 2, wherein the coded element is mounted in or on a plate (11), with the aerial being formed by a coil arranged on one face of the plate and the diaphragm (16) being arranged on the opposite face of the plate.
4. A golf ball according to any preceding claim, wherein the coded element is a chip (12) which is connected to the diaphragm (16).
5. A golf ball according to claim 4, wherein the aerial (14) is separately connected to the diaphragm (16).
6. A golf ball according to any preceding claim wherein the spring or diaphragm (16) is heat conductive.
7. A golf ball according to claim 6, wherein the material is steel.
8. A method of manufacturing a golf ball incorporating an identification device (10), the method including the steps of moulding the identification device in a disc or capsule member (20), placing the member (20) between two parts of a ball core (35), adhering the core parts to each other around the member (20), and then

subjecting the thus-formed core to further processing steps, including providing it with a covering, characterised in that means (16) for protecting the identification device from the effects of impacts are also moulded in the disc or capsule member.

9. A method according to claim 8, wherein the core parts form a core (35) of cuboid shape and are subsequently processed to have a spherical shape (35').