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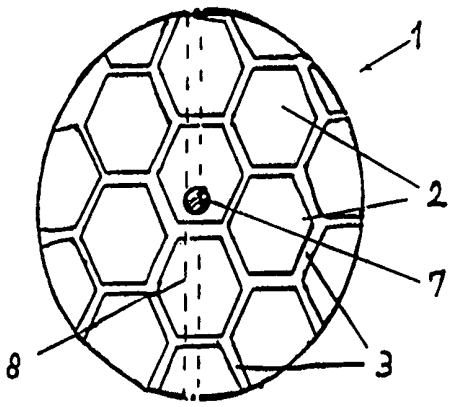
(54) Title: BALL WITH INFRARED SENSITIVE SENSORS AND GOAL WITH INFRARED EMITTERS

(57) Abstract

Ball for sports use comprising an enclosure (1) with uniform distribution of one or more portions (4) transparent to infrared rays and in optical communication with one or more sensors (5) sensitive to infrared rays and electrically connected with signalling means (7) fixed to the ball.



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Description

BALL WITH INFRARED SENSITIVE SENSORS AND GOAL WITH INFRARED EMITTERS

1. Field of the invention

The present invention relates to a sports ball whose position can be automatically determined with millimetric accuracy.

The invention also relates to a device used to determine the position of the ball with respect to a defined alignment.

2. State of the art

Currently, optical systems are known in which a defined alignment - such as the line that marks the soccer goal - is monitored by several cameras. The cameras shoot and analyse the area near the line and in particular observe the passage of the ball beyond the line in order to determine whether the goal is valid or not.

However, these systems do not offer a solution when the ball is covered (for instance when the goalkeeper holds the ball next to the goal line) and are extremely expensive, both for what regards the cameras and the image processing necessary to determine the position of the ball with accuracy.

3. Purpose of the invention

The purpose of the present invention is to find a solution to the above inconveniences and offer a ball and a device to detect its position, which can be easily and conveniently installed, although characterised by high accuracy.

4. Summary of the invention

This purpose has been achieved with a ball that is at least partially transparent to infrared rays and provided with sensors which are sensitive to infrared rays, as well as with signalling means activated by the reception of the infrared rays.

Furthermore, the invention relates to a device consisting in several emitters of infrared rays that are oriented as to define the alignment used to

determine the position of the ball. In the case of a soccer goal, the alignment is composed of a continuous field or "gate" of infrared rays projected in the proximity of the goal.

The advantages of the present invention mainly consist in the possibility of immediately and accurately determining the position of the ball with respect to the alignment of the emitters.

5. Detailed description of the invention

The advantages of the invention appear obvious from the description below and the enclosed drawings, which are intended for illustration purposes, and not with limiting sense, in which:

- figure 1 shows a soccer ball according to the invention;
- figure 2 is an enlarged view of the ball shown in figure 1;
- figure 3 is a transversal cross-section of the detail shown in figure 2;
- figure 4 is a lateral view of the detail shown in figure 2.

With reference to the embodiment shown as an example in the enclosed drawings, the ball according to the present invention is made up of an enclosure (1) obtained by sewing together various hexagonal pieces (2).

As shown in figures 3 and 4, some strips (3) are located on the stitching of the pieces (2) which feature an external portion (4) made of material transparent to infrared rays, equipped with several sensors or photodiodes (5) sensitive to infrared rays. The diodes are preferably located inside the portion (4), for instance during the production stage of the strips (3).

The sensors (5) are connected by means of wires (6) to an active signalling element (7), preferably located in the centre of the bladder of the ball (1), inside a sheath in diametral position. The wires (6) go through the strips (3), reach the ends of the sheath (8) and continue along it up to the active element.

In a preferred form of embodiment, the sheath is located between the bladder valve and the diametrically opposite point with respect to the valve.

According to the invention, the transparent strips are uniformly distributed on the entire surface of the ball so that the first point of the ball

that enters the alignment defined by the infrared rays is of no relevance.

When part of one or more strips (3) is exposed to the infrared rays, the rays are transmitted by the transparent portion (4) of the strip to the sensors (5). The electronic signal produced by the sensors as a result of the exposure to the infrared rays is transmitted in turn through the wires (6) up to the active element (7) which signals the exposure to the infrared rays.

In an alternative embodiment of the present invention, the transparent portions of the ball can be represented by the pieces (2) or part of the pieces (2), or by the entire enclosure (1), in case of balls without sewn pieces.

Likewise, in view of its limited weight, the sensitive element can be placed anywhere in the ball, i.e. fixed to the internal surface of the enclosure.

Figure 5 shows a device used to create an infrared alignment or "gate" (11).

In this case, the alignment is defined by several emitting diodes (9) located in proximity of the perimeter of a goal (10) with vertical orientation with respect to the goal. The mutual distance between the diodes is determined so that the composition of the emitted ray beams covers a surface that corresponds to the entire goal.

Preferably, the complete coverage of the goal is guaranteed by the diodes located along each individual side of the goal. This ensures the maximum visibility of the ball in any position and situation during the match.

For instance, if the goalkeeper holds the ball, the ball is visible from the diodes (9) located along the lower horizontal line.

As an example, to determine the moment in which the ball has completely passed the goal line, the distance of the gate (11) with respect to the goal line is equal to the ball diameter.

When a transparent part of the ball (1) reaches the gate (11), the signalling indicates that the ball has effectively passed the goal line.

The present invention is described with reference to preferred forms of embodiment. However, it is possible to make equivalent modifications without exiting the protection scope granted by present industrial invention.

Claims

1. Ball for sports use comprising an enclosure (1) with uniform distribution of one or more portions (4) transparent to infrared rays and in optical communication with one or more sensors (5) sensitive to infrared rays and electrically connected with signalling means (7) fixed to the ball.

2. Ball according to claim 1, characterised in that the enclosure is made up of polygonal pieces (2) sewn together, it being provided that strips (3) with transparent portions (4) are inserted along the stitching.

3. Ball according to claim 2, characterised in that the sensors (5) and the wires (6) are contained inside the transparent portions (4).

4. Ball according to claim 2, characterised in that the signalling element (7) is located in a sheath (8) in diametral position inside the bladder.

5. Ball according to claim 1, characterised in that the signalling element (7) is fixed to the internal surface of the enclosure (1).

6. Ball according to claim 1, characterised in that the transparent portions (4) are represented by the pieces (2), or part of the pieces (2).

7. Ball according to claim 1, characterised in that the transparent portions (4) are represented by the enclosure (1).

8. Infrared device for the detection of the ball passing through a goal (10), characterised in that it is composed of a distribution of infrared emitters (9) located at least along one side of the goal.

9. Device according to claim 8, characterised in that the mutual distance of the emitters located at least along one side of the goal is such that the composition of the emitted ray beams covers a surface that corresponds to the entire goal, thus creating a substantially continuous gate of infrared rays (11).

10. Device according to claim 9, characterised in that the emitters are located along the four sides of the goal.

11. Device according to claim 9, characterised in that the gate is located in parallel position beyond the effective goal line, at a distance equal to the diameter of the ball used.

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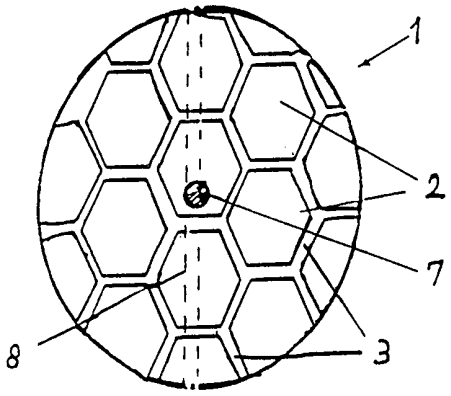

FIG.1

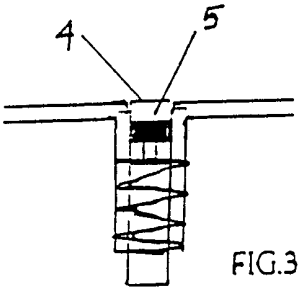

FIG.3

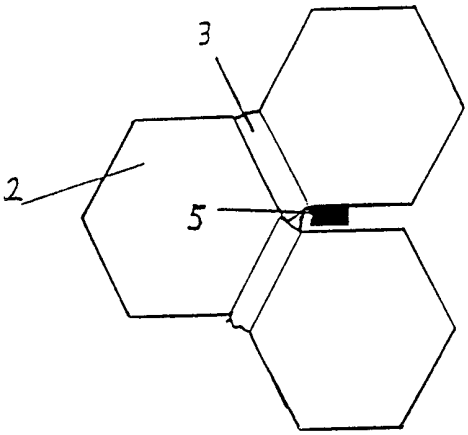

FIG.2

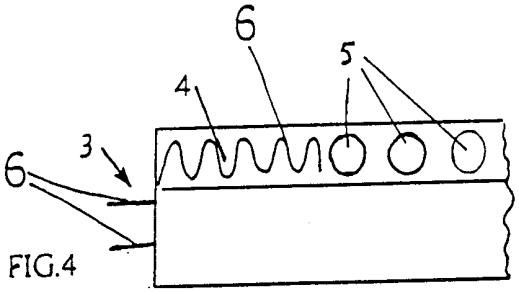

FIG.4

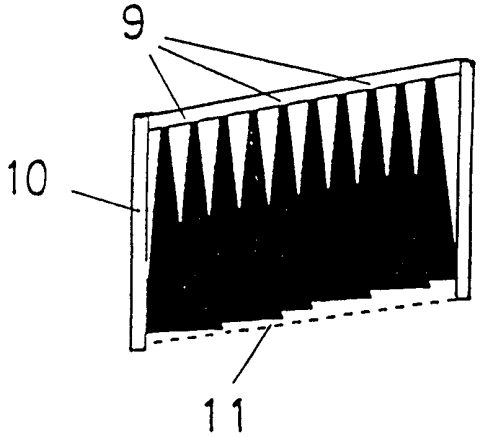

FIG.5

INTERNATIONAL SEARCH REPORT

Inte tional Application No
PCT/IT 99/00134

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A63B43/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 20 51 386 A (RUDAT OTTO; HANKE HERBERT) 27 April 1972 (1972-04-27) page 2, line 12 -page 3, line 20 page 3, line 30 -page 4, line 33; figures 1,2	8,9,11
A	US 5 615 880 A (BOOTH JASON P ET AL) 1 April 1997 (1997-04-01) column 3, line 59 -column 4, line 37; figures 1-4,6	1-11
A	FR 2 667 510 A (COURTY CLAUDE) 10 April 1992 (1992-04-10) page 3, line 26 -page 4, line 28 page 5, line 8 - line 20; figures 1,3,4	1,4,5

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 September 1999	21/09/1999

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 251 903 A (BIXLER DICKIE R ET AL) 12 October 1993 (1993-10-12) column 2, line 22 -column 3, line 30; figures 1-5 -----	1

INTERNATIONAL SEARCH REPORT

ernational application No.
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Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see attached sheet

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2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/ IT 99/00134

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1.- Claims 1-7:
Ball with portions transparent to infrared rays, sensors sensitive to infrared rays and a signalling means.

2.- Claims 8-11:
Infrared device composed of a disribution of infrared emitters located at least along one side of a goal.

INTERNATIONAL SEARCH REPORT

nformation on patent family members

Intr tional Application No
PCT/IT 99/00134

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2051386 A	27-04-1972	NONE	
US 5615880 A	01-04-1997	NONE	
FR 2667510 A	10-04-1992	EP 0560791 A WO 9306894 A	22-09-1993 15-04-1993
US 5251903 A	12-10-1993	NONE	