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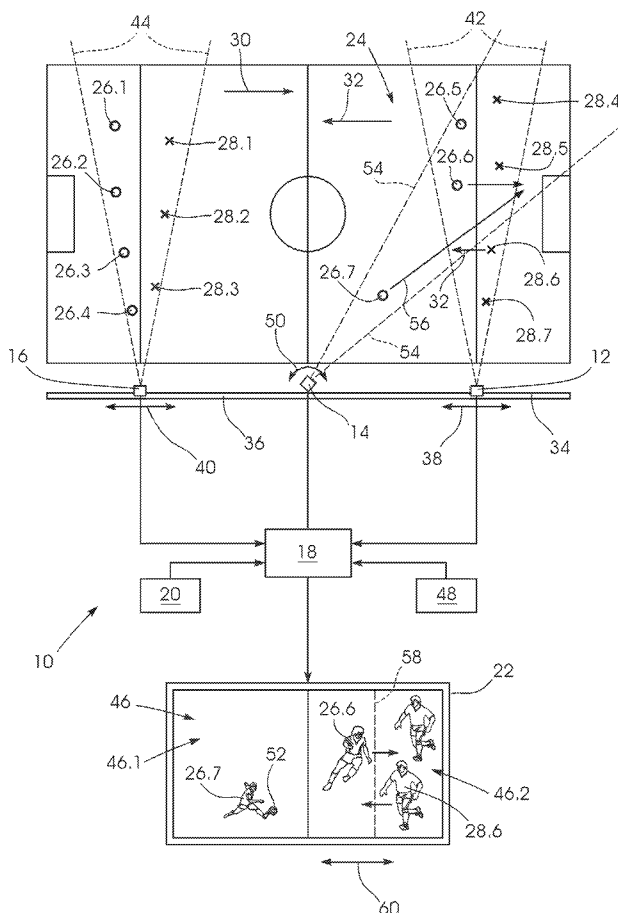
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- Published:**
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[Continued on next page]

(54) Title: SPORT DECISIONS



(57) Abstract: A method of making a sport ruling in a game where a first team plays a ball against a second team and in which the first team can be caught offside, which method includes capturing an image of a first player in the first team playing the ball at the instant when a ball is played by the first player, capturing an image of a second player in the first team whose offside position is to be determined at the instant when the ball is played by the first player and determining whether the second player in the first team is offside relative to at least one player in the second team by analyzing the position of the second player relative to the position of the at least one player in the second team with reference to the captured image of the second player.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## **SPORT DECISIONS**

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THIS INVENTION relates to sport decisions. In particular, the invention relates to a method of method of making a sport ruling and to a judging system.

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### **BACKGROUND OF THE INVENTION**

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The inventor is aware of ball games in which electronic equipment is used to make judgements on certain aspects of the game. For example, in cricket, video equipment is used to make judgements on whether a player has been run out or has been caught in a "legs before wickets" situation. However, in certain sports, technological aids are yet to be implemented. In particular in a game where an offside ruling is to be made, the actions of at least two players in a particular situation is of importance, for example in soccer the player playing the ball and the player who's offside status is to be determined have to be monitored at the exact moment that the ball is being played. It is often difficult for a referee on the field to determine with certainty the position of the two players at the moment that the ball is played by the first player as his perspective may be prone to parallax errors. It is an object of the invention to address some of these problems.

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### **SUMMARY OF THE INVENTION**

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According to one aspect of the invention, there is provided a method of making a sport ruling in a game where a first team plays a ball against a second team and in which the first team can be caught offside, which method includes

capturing an image of a first player in the first team playing the ball at the instant when a ball is played by the first player;

capturing an image of a second player in the first team whose offside position is to be determined at the instant when the ball is played by the first player; and

determining whether the second player in the first team is offside relative to at least one player in the second team by analyzing the position of the second player relative to the position of the at least one player in the second team with reference to the captured image of the second player.

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In this specification the term "ball" is to be interpreted widely, so as to include an ice hockey puck, a hockey ball, a soccer ball, a ruby ball, or the like.

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The description of the method is to cover any game where a sport ruling is determined by the position of a player of one team relative to at least one player of another team at the instant that the ball is played.

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The method may include drawing an imaginary offside line on the image of the second player.

Drawing an imaginary offside line may include displaying the image of the second player to a referee to enable the referee to determine where the offside line is to be drawn.

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Drawing an imaginary offside line may include displaying a line on a display so as to determine whether a player is ahead of the offside line, the line being transversal to the line of play.

25

The imaginary offside line may be drawn with the aid of video processing equipment by superimposing a line over the image of the second player to assist in determining his position relative to the position of the players in the second team, the line being transversal to the line of play.

30

The method may include the prior step of capturing a series of images of the first player and the second player and selecting from the series of images the image at the instant that the ball is played by the first player of the first team.

The series of captured images may be stored on a storage arrangement.

The method may include capturing the images with at least two imagers.

The captured images originating from the at least two imagers may be synchronized with each other, for example by time-stamping each image.

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Broadly, according to another aspect of the invention, there is provided a judging system which includes at least one imager operable to capture an image of a second player in a first team at the instant that a first player of a first team plays a ball.

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More specifically, according to another aspect of the invention, there is provided a judging system for making a sport ruling in a game where a first team plays a ball against a second team and in which the first team can be caught offside, which system includes

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a first imager arranged in visual proximity to a sporting zone, operable to capture an image of a second player in a first team playing in the sporting zone;

selection means connected to the first imager operable to select an image of the second player at an instant that a first player in a first team plays the ball.

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The selection means may be operable to trigger the capturing of the image at an instant selected by an operator.

The system may include a second imager arranged in visual proximity to the sporting zone operable to capture an image of a first player of a first team.

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The second imager need not be directed at the sporting zone in a particular fashion provided that the exact instant that the ball is played by the first player, can be determined.

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The second imager may be synchronised with the first imager so as to capture the position of the second player of the first team and the position of at least one player of the second team at the moment at which the ball is played by the first player of the first team.

The system may include a storage arrangement connected to at least the first imager for storing the image of the second player at the instant that a ball is played by the first team.

5           The storage arrangement may be operable to store a series of images originating from the first imager.

The storage arrangement may be operable to store a series of images of both the first imager and the second imager in synchronisation with each other.

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The selection means may be operable to select an image from the series of images at an instant at which the ball is played by a particular player.

15           Preferably the first imager may be arranged to introduce minimal parallax error on the image captured of the second player. For example, the first imager may be positioned to capture an image of the second player substantially at a right angle to the line of play so as to introduce a minimal parallax error, i.e. across the sporting zone.

20           Advantageously when an image is captured by the first imager and the image includes minimal parallax error relative to the line of play, the position of the second player of the first team relative to the players of the second team can be determined more accurately.

25           The first imager may have a long focal length, operable accurately to capture the position of the second player of the first team relative to the at least one player of the second team.

30           In one embodiment, the system may include a number of imagers positioned along at least a portion of the playfield, the imagers directed substantially at a right angle to the line of play and arranged to capture the offside line on at least one of the imagers, being the first imager.

In another embodiment, the first imager may be moveable along the line of play, the imager directed substantially at a right angle to the line of play the imager

being steerable along the line of play, in operation to capture an image of the second player of the first team.

5 The invention will now be described, by way of example only, with reference to the following drawing.

## DRAWING

In the drawing:

10 Figure 1 shows a schematic block diagram of a judging system, in accordance with the invention.

## EMBODIMENT OF THE INVENTION

15 In Figure 1, reference numeral 10 refers to judging system in accordance with the invention. The system includes a first imager 12, a second imager 14 and a third imager 16. The imagers 12, 14, 16 are in the form of digital video cameras. The imagers 12, 14, 16 are connected to a storage arrangement 18, in the form of a video data processor. Selection means 20 in the form of a trigger device and joystick is provided and connected to the storage arrangement 18. The video processor 18 is  
20 connected to a video display 22.

A sporting zone 24, in the form of a soccer field is shown on which soccer players 26.1 to 26.7 (indicated as circles) of a first team and soccer players 28.1 to 28.7  
25 (indicated as crosses) of a second team are shown in position on the soccer field 24.

Players 26 play in the direction indicated by arrow 30 and players 28 play in the direction indicated by arrow 32.

30 The imagers 12 and 16 are mobile cameras mounted on rails 34, 36, respectively and are movable in the directions of arrows 38, 40 on the rails parallel to the lines of play 30, 32.

The view angles of the imagers 12, 16 are indicated in broken lines 42, 44 respectively. The focal lengths of the imager lenses (not shown) are relatively narrow so as to create large images of players as can be seen on the image 46.2. The movement of imagers 12, 16 are controlled by a camera control 48 to drive them along the tracks 34, 36.

The imager 14 is a single camera mounted on a pan drive (not shown) which can pan the imager along the direction of arrow 50. The focal length of the imager lens (not shown) is relatively wide so as to create an image which can be used to determine when a soccer ball 52, is played. The view angle of imager 14 is indicated in broken line 54. The movement of imager 14 is controlled by the camera control 48 to pan it in the direction of arrow 50.

In operation, the players 26, 28 play a game of soccer while an operator aims the camera 14 at the player playing the ball, while driving the cameras 12, 16 up and down along the line of play 30, 32. In other embodiments more than one operator may be controlling the cameras 12, 14, 16 to reduce the workload of a single camera operator.

The cameras 12, 14, 16 feed synchronized digital video frames to the video processor 18, which stores the images and which displays the synchronised images as a composite image 46. The images are all time-stamped and can thus be synchronized with each other. The composite image 46 consists of an image 46.1 originating from camera 14 on the left hand side 46.1 of the image 46 and an image 46.2 originating from either one of cameras 12, 16 on the right hand side 46.2 of the image 46.

The selection means 20, which include a trigger button (not shown) is operated by a referee. When the trigger button is pressed the composite image 46 is frozen to show an instant at which a player plays the ball 52. If the button is pressed before the ball is played or after the ball has been played, the image displayed may indicate an instance before of after the ball 52 has been played. The selection means 20 is then operable via the joystick to select synchronized images in the series of captured images before or after the button has been pressed so as to select the composite image 46 at the instant that the ball has been played.



Referring to the composite image 46 on the display 22, there is shown the image 46.1 and 46.2, being synchronized with each other.

5 The referee may now select the composite image 46 in which the image 46.1 shows the instant that the ball 52 is being kicked. Then, looking at image 46.2, the referee can determine the position of players at the instant that the ball 52 was kicked.

10 In this example a first player 26.7 of a first team is kicking the ball in the direction of arrow 56, while a second player 26.6 of the first team is moving forward in the direction of arrow 30. A player 28.6 is moving in the direction of arrow 32.

The composite image 46, indicates the ball 52 being kicked by player 26.7 and the position of player 26.6 relative to player 28.6.

15 A vertical broken line 58, superimposed on the image 46.2 by the video processor 18 is moveable with the joystick of the selection means 20 in the direction of arrow 60.

20 The referee steers the line to the front of player 26.6 to determine the relative position of any one of the players 28. If the player 26.6 is to the right of the line 58 the player 26.6 was offside when the player 26.7 kicked the ball.

The above description describes a method of making a sport ruling, which in this instance is an offside ruling.

25 In another embodiment of the invention, not indicated here, the two cameras 12, 16 can be replaced with a series of cameras next to the field 24, which create overlapping images of the field 24. The images can all be stored in the processor 18 and can then be selected to find an image displaying the position of player 26.6. The  
30 judgement is then performed in a similar fashion by use of the image 46.2 on the display 22.

The inventor believes that the invention as described and illustrated herein provides a new method of making a sport ruling and a new judging system which can be

used to assist referees to make accurate sport rulings, and in particular offside judgements.

5 It is to be appreciated that this example has been used to describe an offside ruling in a soccer game. This method can also be implemented in any other game in which offside rulings are made on the same principle.

10 However, it is further to be appreciated that the method of using two synchronised events which can be captured on video and which are then used to determine a particular outcome may find wider application than the making of offside rulings. This description is also intended to cover such applications.

CLAIMS:

1. A method of making a sport ruling in a game where a first team plays a ball against a second team and in which the first team can be caught offside, which method  
5 includes  
capturing an image of a first player in the first team playing the ball at the instant when a ball is played by the first player;  
capturing an image of a second player in the first team whose offside position is to be determined at the instant when the ball is played by the first player; and  
10 determining whether the second player in the first team is offside relative to at least one player in the second team by analyzing the position of the second player relative to the position of the at least one player in the second team with reference to the captured image of the second player.
- 15 2. A method as claimed in claim 1, which includes drawing an imaginary offside line on the image of the second player.
3. A method as claimed in claim 2, in which drawing an imaginary offside line includes displaying the image of the second player to a referee to enable the referee to  
20 determine where the offside line is to be drawn.
4. A method as claimed in any one of claims 2 and 3 in which drawing an imaginary offside line includes displaying a line on a display so as to determine whether a player is ahead of the offside line, the line being transversal to the line of play.  
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5. A method as claimed in claim 4, in which the imaginary offside line is drawn with the aid of video processing equipment by superimposing a line over the image of the second player, the line being transversal to the line of play.
- 30 6. A method as claimed in any one of claims 1 to 5, which includes the prior step of capturing a series of images of the first player and the second player and selecting from the series of images the image at the instant that the ball is played by the first player of the first team.

7. A method as claimed in claim 6, in which the series of captured images is stored on a storage arrangement.
8. A method as claimed in any one of claims 1 to 7 which includes capturing the  
5 images with at least two imagers.
9. A method as claimed in claim 8 in which the captured images originating from the at least two imagers are synchronized with each other.
- 10 10. A judging system for making a sport ruling in a game where a first team plays a ball against a second team and in which the first team can be caught offside, which system includes  
a first imager arranged in visual proximity to a sporting zone, operable to capture an image of a second player in a first team playing in the sporting zone;  
15 selection means connected to the first imager operable to select an image of the second player at an instant that a first player in a first team plays the ball.
11. A judging system as claimed in claim 10, in which the selection means is operable to trigger the capturing of the image at an instant selected by an operator.  
20
12. A system as claimed in any one of claims 10 and 11, which includes a second imager arranged in visual proximity to the sporting zone operable to capture an image of a first player of a first team.
- 25 13. A system as claimed in claim 12 in which the second imager is synchronised with the first imager so as to capture the position of the second player of the first team and the position of at least one player of the second team at the moment at which the ball is played by the first player of the first team.
- 30 14. A system as claimed in any one of claims 10 to 13, which includes a storage arrangement connected to at least the first imager for storing the image of the second player at the instant that a ball is played by the first team.

15. A system as claimed in claim 14, in which the storage arrangement is operable to store a series of images originating from the first imager.

5 16. A system as claimed in claim 14, in which the storage arrangement is operable to store a series of images of both the first imager and the second imager in synchronisation with each other.

10 17. A system as claimed in claim 16, in which the selection means is operable to select an image from the series of images at an instant at which the ball is played by a particular player.

15 18. A system as claimed in any one of claims 1 to 17 in which the first imager is arranged to introduce minimal parallax error on the image captured of the second player.

19. A system as claimed in claim 18, in which the first imager is positioned to capture an image of the second player substantially at a right angle to the line of play.

20 20. A system as claimed in any one of claims 10 to 19, in which the first imager has a long focal length, operable accurately to capture the position of the second player of the first team relative to the at least one player of the second team.

25 21. A system as claimed in claim 10, which includes a number of imagers positioned along at least a portion of the playfield, the imagers directed substantially at a right angle to the line of play and arranged to capture the offside line on at least one of the imagers, being the first imager.

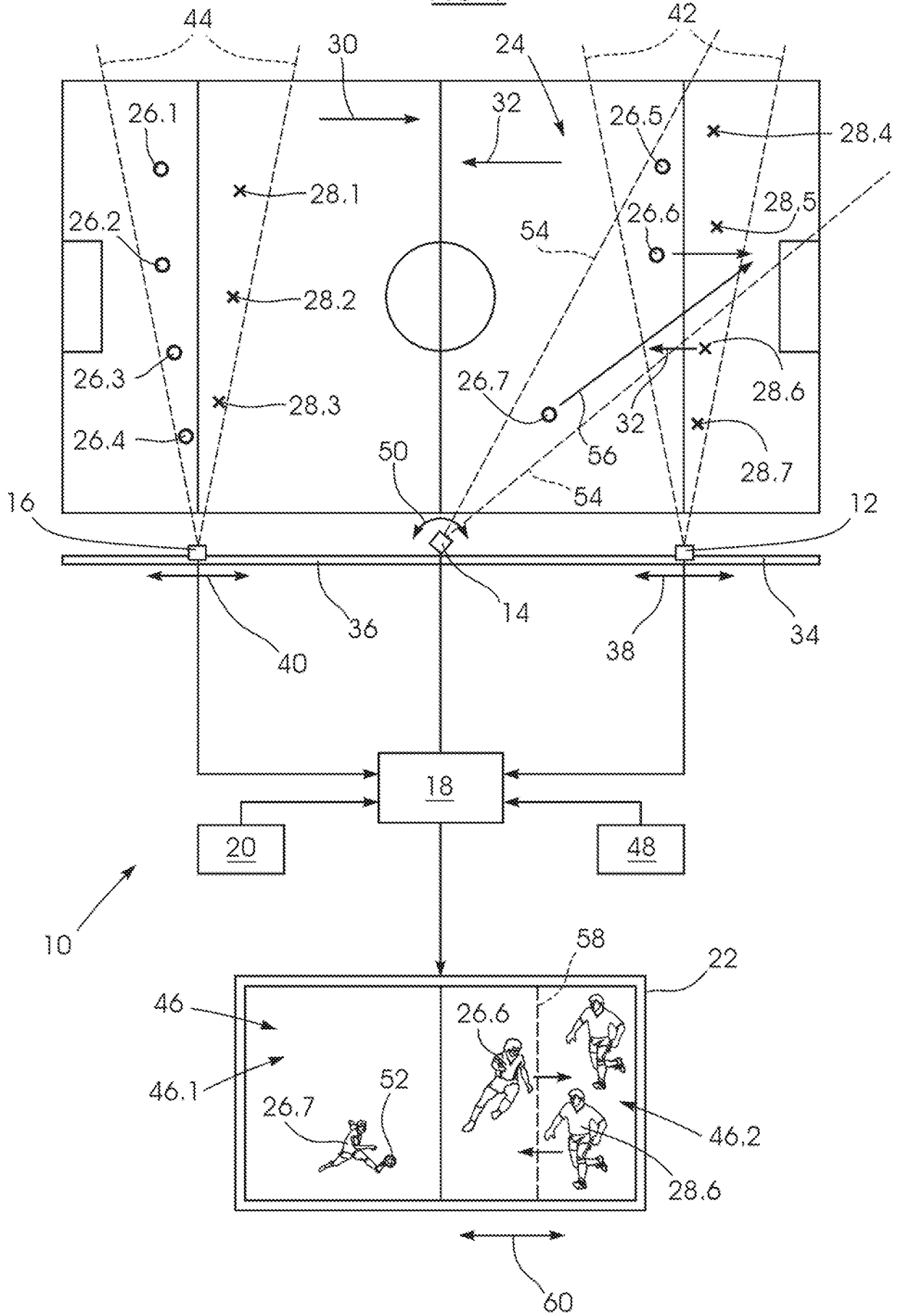
30 22. A system as claimed in claim 10, in which the first imager is moveable along the line of play, the imager directed substantially at a right angle to the line of play the imager being steerable along the line of play, in operation to capture an image of the second player of the first team.

23. A method as claimed in claim 1, substantially as herein described and illustrated.

24. A system as claimed in claim 10, substantially as herein described and illustrated.
  
25. A new method and a new system, substantially as herein described.

1/1

FIG 1



## INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/051794

## A. CLASSIFICATION OF SUBJECT MATTER

INV. A63B71/06

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)

A63B H04N

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)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2006/111928 A (FEDERAZIONE ITALIANA GIUOCO CA [IT]; CONSIGLIO NAZIONALE RICERCHE [IT]) 26 October 2006 (2006-10-26) page 5, line 5 - line 34 page 9, line 20 - line 27 page 10, line 22 - page 12, line 10 page 11, line 19 - page 12, line 10 page 13, line 19 - line 20 page 29, line 7 - line 15 page 50, line 19 - line 26 page 64, line 5 - line 12 page 66, line 5 - page 67, line 1; example 1 ----- -/--	1-22

 Further documents are listed in the continuation of Box C. See patent family annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*&\* document member of the same patent family

Date of the actual completion of the international search

11 October 2007

Date of mailing of the international search report

22/10/2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
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Authorized officer

Michels, Norbert



## INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/051794

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 291 042 A (FELDBAU EITAN [IL]) 12 March 2003 (2003-03-12) paragraph [0012] - paragraph [0014] paragraph [0034] - paragraph [0036]; claims 1,14	1-22
A	FR 2 711 069 A (KLEIN THIERRY [FR]) 21 April 1995 (1995-04-21)	
A	CH 628 192 A5 (KRUSE HELMUT [CH]) 15 February 1982 (1982-02-15)	

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2007/051794

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 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:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
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 III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
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.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2007/051794

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2006111928	A	26-10-2006	NONE	
EP 1291042	A	12-03-2003	GB 2379571 A	12-03-2003
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