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(71) Applicant and
(72) Inventor: **BRAGA DE OLIVEIRA, Carlos Décio** [BR/BR]; Rua Piaui- Quadra G- N° 51, Cep: 17013-600 Jardin Brasil, BAURU- S.P. (BR).

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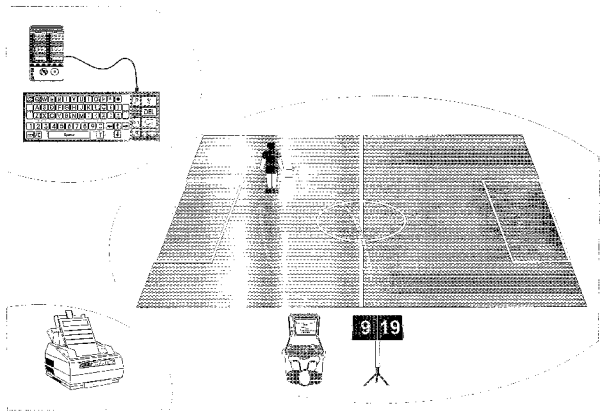
(54) **Title:** ELECTRONIC CARD FOR FOOTBALL, FUTSAL AND SIMILAR SPORTS' REFEREE



(57) **Abstract:** Invention patent of a Electronic Card for football, futsal, and similar sports' referee consisted of an enlightened signaling system (1) composed by two lamps of high intensity in the yellow (1.2) and red (1.3) colors, an alphanumeric crystal liquid monitor (2), an events and conditioned events' registration system (3), an interface for Peripheric Station and Printer (4), a switcher to start/stop the chronometer (5), and a RF transmitter system (6). The card also contains a Peripheric Station composed by a programming system (1), an function's operation system (2), an alphanumeric monitor system (3), and an interface for the electric card (4) that operates based on events and constant exchange of information between the Electronic Card and the Peripheric Station. It has capability to register in a nonvolatile memory the following events: athletes' substitution, goal, counter goal, yellow card foul, red card foul, and penalties dispute. The Electronic Card's system is conditioned in a hermic and antithermic box, molded in rigid PVC, which is impact and waterproof. The Peripheric Station system is conditioned in a suitcase of rigid PVC, similar to a "laptop". The electric system's operation is based on microprocessor of 8 bits that incorporates a digital clock. The clock works as a chronometer that provides the time (minute) in which the events are registered. Besides its specific function, the Electronic Card presents the same capacity of a data logger, providing all the necessary data to the elaboration of reports or summaries after the matchess.

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ELECTRONIC CARD FOR FOOTBALL, FUTSAL AND SIMILAR SPORTS' REFEREE

The present patent is related to a Electronic Card model created for referee of football, futsal and the like. For now it will be simply called "Electronic Card" for matches of both categories, professional and amateur. This electronic card was given original and exclusive constructive characteristic in order to facilitate its use and efficiency compared to the conventional existent cards.

TECHNICAL STATE

The cards traditionally utilized by the referee of square football, futsal and similar are made of materials such as paper and plastic, which contain spaces designed to the notes taken by the referee during the matches. The notes are related to the occurrences that happen with both teams playing the matches such as red card and yellow card infractions, and score. Figure 1 shows a model of this type of card. For each event there is a field designed to register a variety of events that occur during the matches. For example, there is a space on the left side to register the number of the player involved in a given event, another space to register the type of event, and still a last space to register the time in minutes of the occurrence of the event.

Although the utilization of such card is broad, some drawbacks can be associated to its use. For example, certain difficult experienced by the referee to handle his tools, which are consisted of a yellow card, a red card, one or two pens or pencils, watch, chronometer, vibrator call, spray, and the back of the conventional cards to take a variety of notes.

All of these accessories frequently leads to technical mistakes resulted from precipitation, waist of time, and inattention by the time the referee registers his notes. This gear is essential to the achievement of the

referee's precision and thus demonstration of his competency on the art of arbitrament.

Another problem frequently detected with the regular cards consists of the fact that on days in which the weather is unfavorable, such as rain, fog, and cold, the pen or pencil used by the referee can become faulty during important moments of the matches. Moreover, such an upsetting and unusual situation can lead to serious consequences in the exercise of the referee's profession. Still, another difficulty can be pointed out with the use of the regular card on days of bad weather or fields with weak illumination. This is related to the visualization of the card during the matches, not only to the referee but also to the watchers that are trying to follow the matches either by TV or at the field. Both can have problems keeping track of the matches.

Based on the problems brought out by the use of the conventional cards, an electric version of the card has been created to be used on square football, futsal and the like with the purpose of enhancing its use. The electrical card presents an usuary's interface designed to its operation, and contains a lightened display on the top. The display is filled with high intensity red and yellow lights of repetitive and continuous action when activated in order to sign the type of incident during the matches. This electronic card operates based on the occurrences during the matches, especially field football, which follows rules such as yellow and red card infractions, goal, counter goal, player replacement, second screen for matches extension, third monitor for penalty kick, as well as chronometer/timer for all of these events.

The structure choused to be used on this electrical card comes to solve the draw backs existent with the conventional cards, preserving the characteristics of the teamwork, and utilizing an area similar to the conventional card. Moreover, the electrical card promotes a more dynamic, fast, and easier manipulation in conjunct with a more precise diagnostic and larger amount of information to the referee during the

matches at any time it is needed. For example, during the course of a football matches, in which many yellow cards have been applied to different players and a determined player is given a yellow card twice, automatically, as is established by the rules, the referee is notified of the expulsion of the player through the monitor of the electronic card and the red light is activated. Another example has to do with the occurrence of a goal (score), which recalls that the referee simply press the GOAL key. Based on this, the operational system of the card displays the number of the players of both teams that are on the field so that the referee must activate the key representing the player that has been scored the goal and then press OK. This procedure registers the event into the permanent memory of the card that consists of the following fields: GOAL type, team, player number, player name, and time/minute of the occurrence of the GOAL. All of the events that have been registered into the memory of the card can be reviewed at any time. In order to do that, the events can be reviewed through the key CONSULT. This practicality of easy use allows the visualization of all types of events that have happened during the matches.

The electric card is designed and prepared to be used with the same efficiency and practicality during eventual extension of the matches and/or penalty dispute. According to its conception, its manipulation is very simple, for with only one touch many functions are made available and executed. On the same manner, after the use with only one touch of the user, all of the information available in the permanent memory can be erased in order to make the card free to be reused in a new matches. Obviously, such electrical card can be obtained in different sizes and capabilities in order to attend a diverse of necessities of the users in the most different sports categories.

The use and operation of the Electronic Card can be better understood through the description of the two *usuaries interfaces* and *operation based on events*.

1. USUARY'S INTERFACE OF THE ELECTRIC CARD

The interface of the present patent is presented on figures 2 and 3, and consists of the following modules: lightened signaling system (1), alphanumeric screen system (2), event's system and conditioned event's system (3), peripheric station and printer interface (4), starter/stop the chronometer's system (5), and RF transmission system (6).

Lightened signal system (1): This module consists of a compartment containing a multidirectional lightened panel. This panel is transparent, mirrored bottle, water and impact proof, and internally coated. It also has two high intensity lamps in red (1.1) and yellow (1.2) colors respectively, which blinks repetitively and continuously when activated.

Alphanumeric screen system (1): This module consists of a hermitic compartment, water and impact proof, anti-thermic internal coating that keeps a liquid crystal monitor (2) designed to promote the alphanumeric visualization of the data contained into the permanent memory. The monitor contains two columns of 11 (eleven) keys (2.2), (2.3), which are aligned either on both sides, or on one side and at the center of the screen. They have the function of signaling the events related to the players of the teams participating on the current matches. The crystal liquid screen is subdivided into two distinct parts: one on the left side that keeps track of the data related to the team A (2.4), and another on the right side that keeps track of the data related to team B (2.5). Each of these parts has a line on the top to be filled with the names of the team A or B. Under each of the top lines, other 11 (eleven) lines are available to be filled with the numbers engraved on the T-shirts of the team players. These two distinct areas also have the ability to display other events of the two teams involved in a given matches.

Control panel events' system and Conditioned events (3): This antithermic, water and impact proof module contains a group of keys that

generates the events that will be registered into the data memory of the Electronic Card in order to conclude the registration of the event. When one of these keys is pressured, a sequence of other keys also needs to be pressured before the confirmation **"C"** key concludes the event. The sequence of keys available in the program are: **"G"** (3.1) key, designed to register the Goal and/or Counter-goal scored by a player of a given team, **"Red Card"** (3.2) key, designed to register an expulsion of the matches represented by the red card given to a player of one team or two players from different teams, **"Yellow Card"** (3.3) key, designed to register a warning of an infraction represented by the yellow card applied to a player of one team or two players from different teams, **"A"** (3.4) key, utilized either to void commands entered through the alphanumeric keyboard or to delete some event's registration, and **"C"** (3.5) key applied to confirm the conclusion of keyboard entrance operation or to register an event.

Conditioned events system (4): This is composed of a group of 6 (six) keys, which after generating an event such as red card (3.2) or yellow card (3.3), must be pressured in order to select a conditioned event. After the referee has chosen a key, the card classifies the event as being 3.2 or 3.3 following the football's rules, and determines the type of infraction committed by a player who had either the yellow or red card given to himself. The (6) six options available in the electronic card that characterizes the conditioned system are:

- **"JB"** (3.6) key, Seriously violent matches - designed to classify and condition an event 3.2 or 3.3 in order to register the infraction of a matches considered seriously violent. Considering that this type of conditioned event is statistically one of the most frequent occurrences within the football, the fact that it is already available in the program, makes the referee's performance easier and much more precise, since he only needs to type the event along with the player's number, and press the "C" key to confirm the action.

Based on this procedure, the electronic card processes the event as being "JB" conditioned.

- **"DR"** (3.7) key, Misconduct of the matches' rules – designed to classify and condition an event 3.2 or 3.3 in order to register defiant behaviors such as constant braking the matches' rules, delay the restarting of the matches, ignores the distance established for a corner kick or free kick, enter or reenter the matches without the referee's permission, intentionally destroys a goal opportunity through his hands (except for the goalkeeper within his own penalty area), interrupts an adversary who is approaching the goal area to take a free kick or a penalty.
- **"RC"** (3.8) key, Complaint – created to classify and condition a 3.2 or 3.3 event to register an infraction characterized by spitting at either an opponent or any other person, or behaving in an anti-sportive manner such as disagreeing with the referee through words or actions, depending on the intensity of his behavior. The player can also employ offensive or obscene language and/or gesture, try to mislead the referee through tricking the rules while the ball is on the matches or while runs a free kick. In sum, any behavior that has the intention of contradicting the referee's decision during the matches is considered as complaint.
- **"V"** (3.10) key, Violence – designed to classify or condition a 3.2 or 3.3 event in order to register a violent conduct infraction.
- **"OU/CT"** (3.11) key, Others/Consult – doubled function key, which classifies and conditions firstly a 3.2 or 3.3 event in order to register rare and isolated infractions that do not meet any of the infractions described in the conditioned events system, and are not even established by the rules of the matches. Secondly, it activates the "consult" event by being pressed twice and displays on the card's screen all the occurrences happened during the matches until the moment of the consultation. Also, the second function is

independent, which means that it does not have a relation to the 3.2 and 3.3 events and is not a conditioned event, so it can be directly activated.

- **"Reset Key"** (3.12) - A key not elevated on the surface of the electronic card's system that has the function of erasing the information contained in the system's memory, so that it becomes ready to a new program entrance of a different matches. This key can also be located at the Peripheric Station.

Peripheric Station and Printer Interface (4): This module consists of a connector (4.1) that provides the connection between the Electronic Card and the Peripheric Station, in order not only to transmit the data to both systems, but also to recover the data that has been imputed into the permanent memory, as well as to help the referee to elaborate a report or statement about the matches (Fig. 5).

Start/Stop the system's chronometer and turn on and off the electric card (Power) (5): This is an interrupter (5.1) that is activated by pressure and has the function of initiating and interrupting the system's internal clock (5.2). In addition, it has the function of turning the card on and off. The internal clock (5.2), located at the side of the interrupter (5.1), is used to provide the exact time in which the events occur and have been registered into the card's permanent memory.

R.F. transmission system (6): This module consists of an antenna of branding iron, which is inserted internally in the box of the Electronic Card. This antenna is part of a R.F. (frequency radio) messages' transmitter of events that have been stored into a R.F. device station located inside of the Peripheric Station and consists of a peripheric assembly.

2. USUARY'S INTERFACE OF THE PERIFERIC STATION

The usuary's (referee) interface of the present patent is presented on Figure 4 and consists of the following modules:

- *Program System* (1): This module consists of an alphanumeric keyboard (1.1) that is used by the referee to enter the data relevant to both teams playing the matches. The data consists of number, name or nickname of the players including the substitute athletes. The "reset" (1.2) key is not raised on the surface of the Peripheric Station as well, and its function is to erase the data contained in the memory of the Peripheric Station, preparing it for new entrances of a different matches. The "screen" key (1.3) activates or shuts down the information contained in the Peripheric Station such as yellow and red cards, goal, athlete substitution, penalty dispute, and consult. "Vibrating call" key (1.4) promotes the direct communication between the Peripheric Station and the Electric Card through vibrating pulses. "T" key (1.5) activates the transmission of R.F. in order to register the extra time that might be added at the end of the matches (time).
- *Operation System Functions* (2): This module consists of a group of 8 (eight) keys designed to the fourth officer, judge or fiscal of the matches and is part of the alphanumeric keyboard, situated at its right side.

  The keys and operations that are associated to the operational functions system are: **"P"** (2.1) – Penalties collection', **"S"** (2.2) – Player Substitution, **"E"** (2.3) – Data Entrance, **"DEL"** (2.4) – Data Delete, **"PRINT"** (2.5) – Start Printing the data related to the matches, **"CT"** (2.6) – Consult the registered events, **"A"** (2.7) – Void a data entrance operation, and **"C"** (2.8) – Confirm the data entrance operation.
- *Alphanumeric Screen System* (3): This module consists of a liquid crystal key (3.1), designed to visualize all the data and events confirmed by the referee, either inside or outside the field, and to

monitor of all of the data and events of the operation functions system (2) performed by the fourth officer, judge or fiscal of the matches.

Power (3.2) – turn on/off the peripheric station

Screen's contrast (3.3) – control

Screen's shine (3.4) – control

EVENTS BASED OPERATION

The electronic card operation is based on events that are imputed into the data permanent memory and can occur before, during, or after the matches.

Before the matches events: There are two types of such events: 1) events to initiate an "Reset" operation, and 2) events to initiate the card's program operation.

The event that initiates a "Reset" operation is activated by pressuring the $^{a}/_{c}$ key (4.1) of the Electronic Card. When this key is pressured, the operational system of the card displays a "prompt" or notification "S/N?" message line on its crystal liquid monitor (2.5). Then, if the user presses the "C" key (3.5), the data contained in the card's permanent memory will be erased. However, if the referee or user presses the "A" key (3.4), the "Reset" operation will be voided.

The event of initiating a "Reset" operation on the Peripheric Station is activated by pressuring the $^{a}/_{c}$ key (1.2) on the alphanumeric keyboard of this station. When this key is pressured, the operational system of the card shows to the fourth officer a prompt or notification line on its crystal liquid monitor the "S/N?" message. If the fourth officer presses the "C" key (2.8) located at the Peripheric Station, the data contained in the permanent memory will be erased. On the other hand, if the fourth officer presses the "A" key (2.7) of this station, the "Reset" operation will be voided.

The event to initiate an operation to program the electronic card is generated by pressuring the "E" key (2.3) of the Peripheric Station. When this key is pressured, the card's operational system enters into the program mode and then the usuary or referee must insert the data through the Peripheric Station's alphanumeric keyboard (1.1). The data is based on the information related to both teams in the following order: a) name of the team A, b) player's number and name (former and substitute) of the team A, c) name of the team B, d) player's number and name (former and substitute) of the team B. Each entrance needs to be confirmed through the "C" key (2.8) of the Peripheric Station. Following the card's program, a copy of the data is created in the Peripheric Station's memory in order to be utilized simultaneously with the Electronic Card.

The "DEL" key (2.4) of the Peripheric Station erases all the entrances already confirmed, opening space for a new data entrance.

During the matches events: There are seven types of events registrations: 1) player replacement before or after the matches, 2) yellow card application, 3) red card application, 4) goal, 5) counter goal, 6) consult the data contained in the permanent memory, and 7) penalty taken.

The event to initiate the register of a player replacement is generated when the "S" key (2.2) of the Peripheric Station is pressed. Then, the Peripheric Station's operational system registers the time marked on the chronometer (lap) in a temporary internal variance, in order to display on the screen, the players' numbers and their respective names. In cases which a team member is replaced, the fourth officer must use the arrow keys (up, down, right, left) until he is able to select the line containing the number and name of the player to be replaced . Done this, the system displays on the screen, the numbers of the substituting players of both teams so that the referee must choose one of the players, track down his number with the arrow key, and press the confirmation "C" key

(2.8). Thus, the event corresponding to a player's replacement is registered into the permanent data memory.

The following information is associated to this type of event: team, substitute player's name and number, replaced player's name and number, and time of the replacement event. Since then, the substitute athlete is integrated into the former team, and the player who has been replaced is kept into the memory along with his data, so that his information can be latter consulted. The summary of his performance on the matches is also available to the referee through the occurrence of a substitution event because the data of the involved players are transmitted by R.F. signal. to both the Peripheric Station and the Placard (Fig. 5), which is located outside, about the center of the field, next to the lawn. The placard is fixed on a pedestal of either stainless steel or rigid PVC, rubberized with high regulation and centrally leveled into the ground, supported by an adjustable tripod in order to stay in a vertical position. The pedestal is adjustable among 2 and 2,5 meters high. A small starter motor is located at this pedestal to prompt a turn of 360° degrees around itself when receives the R.F. sign from the Peripheric Station.

The event of initiating the Extra Time is generated when the "T" key (1.5) of the Peripheric Station is pressured. Then, the operational system makes the Peripheric Station's numeric keyboard available for data entrance. In order to proceed with the matches's extra time registration, the fourth officer must press the key correspondent to the number of minutes to be added to the matches (defined by the referee, as established by the rules) and then press the "C" key (2.8) to confirm the event. Consequently, the electronic placard signal's displays on its enlightened numeric screen, the number of minutes to be added to the matches, followed by a turn of 360° degrees around itself.

The event of initiating the register of a yellow card application is provoked when the "Yellow Card" key (3.3) is pressed. This key is not raised on the surface of the Electronic Card. Based on a yellow card's

event, the card's operational system registers on an internal variance, the time marked on the chronometer (lap) and then turns the yellow light on (1.1) in a repetitive manner until the referee stops pressing the "Yellow Card" key (3.3). As soon as the yellow lamp is shut down, the monitor of the card's operational system displays the players' numbers of both teams involved in the matches (2.4) and (2.5), so that the referee must choose the number of the player who has received the yellow card infraction; then, select the line containing his name and numbers, and finally press one of the 6 (six) options available into the conditioned events module (3.6, 3.7, 3.8, 3.9, 3.10, and 3.11). The events are: (3.6) "J.B." seriously violent matches, (3.7) "DR" misconduct, (3.8) "R.C." complaint, (3.9) "C.A." anti-sportive conduct, (3.10) "V" violence, and (3.11) "OU/CT" rare and isolated cases infraction, which do not feet any of the actions discriminated above. The event's sequence is finalized by pressuring the "C" (3.5) Confirmation key; then, the operational system checks if another event of this type has already been applied to the same player in order to either releases or applies the red card. In cases that the player receives the red card, the program switches the last operation from a yellow to a red card event. The data associated to this type of event are registered event code (yellow or red card), number of the penalized player(s), as well as type and time/minute of the infraction. As soon as the event is confirmed, the operational system turns the red light (3.2) on, in case is one of a "Red Card". The lamp will keep blinking until the referee releases the "Red Card" key (3.2).

The event that initiates the registration of a red card is generated when the "Red Card" key (3.2) is pressured. This key is also not raised on the card's surface. Facing a case of red card application, the electronic card's operational system registers the time marked on the chronometer (lap) in a temporary internal variable and then turns the red light on (1.2) of the module (1). As the yellow light, the red light blinks repetitively until the referee stops pressuring the "Red Light" key (1.2). As soon as the yellow

lamp is shut down, the monitor of the card's operational system displays the players' numbers of both teams involved in the matches (2.4) and (2.5), so that the referee must select the number of the player who has received the yellow card infraction, the line containing his name and number, and finally press one of the 6 (six) options available into the conditioned events module. The events are: (3.6) "J.B." seriously violent matches, (3.7) "DR" misconduct, (3.8) "R.C." complaint, (3.9) "C.A." anti-sportive conduct, (3.10) "V" violence, and (3.11) "OU/CT" rare and isolated cases infraction, which do not feet any of the actions discriminated above. The event's sequence is finalized by pressuring the "C" (3.5) confirmation key; then, the operational system checks if another event of this type has already been applied to the same player in order to either releases or applies the red card. In cases that the player receives the red card, then the program switches the last operation from a yellow to a red card event. The data associated to this type of event are registered event code (yellow or red card), number of the penalized player(s), as well as type and time/minute of the foul. The physical disposition (hard) of the (3.2) and (3.3) keys can be arranged on horizontal, vertical, and diagonal positions (Figure 2).

The procedure to register a Goal event is generated when the "G" key (3.1) is pressured. This key is not raised on the card's surface as well. Occurring a goal, the card's operational system registers within a temporary internal variable, the time marked on the chronometer (lap) and then shows on the monitor the athletes of both teams in the (2.4) and (2.5) areas. The referee thus must press the key respective to the line that contains the number of the player who marked the goal and then press the confirmation "C" key (3.5). With the confirmation, the operational system continues to register the event into the permanent memory. The data involved with this event type are Goal event code, awarded team, number of the player who kicked the goal, and time of the event.

The event of initiating a counter goal is generated through the double press of the "G" key (3.1). Therefore, the register of a counter goal starts off with a register of a regular goal. By pressuring twice the "G" key (3.1), the event switches from a "regular goal" to a "counter goal" and the operational system of the Electronic Card registers the time marked on the chronometer in a temporary internal variable. Next, the operational system, displays on the screen, the numbers of both teams in the (2.4) and (2.5) areas, so that the referee can select the line that contains the number of the player who marked the counter goal and then press the confirmation "C" key (3.5). With the confirmation of the event, the operational system continues to register it into the permanent memory. The data involved with this event type are Goal event code, awarded team, number of the player who kicked the goal, and time of the event.

The operation of consulting an event that has been registered into the permanent memory is generated when the "OU/CT" key (3.11) is pressed twice. Occurring such an event, the Electric Card" operational system shows on the (2.4) and (2.5) areas of the screen all the events occurred until that moment. The data involved with this event's type are yellow card, red card, goal, counter goal, and substitution. All of the events are registered along with the time of the occurrence (in minutes) and are available to the fourth officer as well through the "CT" gray key (2.6) of the Peripheric Station.

The event that initiates a direct free kick of a penalty, or simply "Penalty Dispute" is generated through pressing the "P" key (2.1) of the Peripheric Station. When this key is pressed, the operational system of this station shows on its monitor, on the area reserved to the team A, the message "Ending by Penalty [S/N]?". If the fourth officer presses the "A" key (2.7), the operation is voided; however, if the fourth officer presses the confirmation "C" key (2.8) of the Peripheric Station, the operational system initiates the procedure of data entrance (Program) of penalty dispute, which is characterized by the following sequence:

1. Entrance of the players' numbers of the team A in the order that the penalty will be taken. The finalization of the data entrance of the team A, occurs in an automatic manner after the 5th register of the player's number is entered and the confirmation "C" key (2.8) is pressed.

2. Entrance of the players' numbers of the team B in the order that the penalty will be taken. The finalization of the data entrance of the team B, occurs in an automatic manner after the fifth register of the player's number is entered and the confirmation "C" key (2.8) is pressed.

In order to correct the register entrance of the data after confirmation, the fourth officer needs to press the "A" key (2.7) or the "DEL" key (2.4). After entering the players of both teams that will perform the penalty taken, the operational system of the Peripheric Station transmits all the data related to this event to the Electronic Card through a frequency radio (RF). Thus, the card will be ready to monitor this type of event. The removal of the "Penalty Dispute" mode of the Electronic Card will be done automatically following the end of the monitory of this event's routine.

The monitory of the "Penalties Dispute" is realized through the following routine: When the 1st player (team A or B) realizes the collection of the penalty and this is converted to a goal, the referee should press the "G" key (3.1) of the Electronic Card followed by the confirmation "C" key (3.5). If the penalty collection is not converted into a goal, the referee then must press only the "C" key (3.5) of the card.

After this procedure, the system registers an event of penalty collection, containing the team's player name and number. Then, if the penalty is converted into a goal, the system registers an event of a goal type with the area related to the time of the goal equal to zero. At the screen level, when the athletes are registered to the Penalties' Dispute, the symbol "(X)" is displayed in front of their numbers. If an athlete converts his collection into a goal during the dispute, the system will show the symbol "O" or "ball" in front of his number. In case the collection is not

converted to a goal, the system will display the "X" symbol in front of his number.

When the player taking the penalty belongs to the team B (random definition), the referee simply presses the 1st key equivalent to the team B, which is pertinent to the 1st player of the electronic card. This procedure makes the operational system of the card to perform the monitory of the Penalties Dispute of the team B, that is, from the left to the right of the Electronic Card's Screen.

Nonetheless, when there is a matches of the number of goals still after 5 penalties have been taken by both teams, the program starts over the dispute among the two teams but this time it is done in an individual and alternated manner. This occurs when the fourth referee activates the program. The routine of this program will totally end when the alternating closure (one kick of the team A and B) of one of the players do not convert his penalty taken into a goal. With this, the referee receives the information about the final diagnostic of the matches from the Electronic Card's placard with one of the two teams as being the winner.

After the matches events: These events are related to the data pertaining to the teams and events related to them that were collected during the matches. These events are triggered through the "PRINT" (2.5) key of the Peripheric Station followed by the "C" key (2.8) of the same station. Occurring this event, the card's operational system sends all the data available in the permanent memory in a formatted manner through the serial communication gate.

ELECTRONIC CARD'S HARDWARE COMPONENETS

The diagram of blocks of the Electronic Card's hardware (electronic circuit) is presented on Figure 7. It consists of 6 (six) modules: principal module, luminary signaling module, alphanumeric monitor module,

keyboard module, serial communication module, and RF communication module.

Principal Module (6): This module is responsible for controlling the Electronic Card. It is implemented by a micro-control, which has the card's operational system inserted into its program's permanent memory. When the principal module receives signals coming from both, the keyboard and serial communication modules, it realizes its functions through the exchange of control signals with the pertinent modules.

Luminary signaling module (1): This module consists of two DC/DC tension converters used to activate 2 (two) high-tension lamps. One lamp has a red frontal mask, and the other a yellow frontal mask. The converter operators are either inhibited or activated through two control lines, which signal is provided from the principal module. When one of the two control lines is triggered, the corresponding converter releases the necessary signal to activate the lamp associated to it.

Alphanumeric screen module (2): This module consists of a screen that contains a crystal liquid technology. It is also consisted of a matrix of dots that are activated by a micro-control of specific utility to this mean. The message's composition of the crystal liquid monitor is based on commands originated on the parallel communication between this module and the principal module of both the Electronic Card and the Peripheric Station. These commands are sent through the routines associated to the monitor and are inserted in the operational system.

Keyboard module (3): This module consists of 2 (two) keyboard matrixes that are composed by an interface which connects 8 (eight) lines, 5 (five) columns, and 2 (two) control lines designed to keyboard selection. The latter are composed by bits of 2 (two) gates of the principal module's micro-control. Each key is linked to a line and a column of the keyboard's interface, so that when it is pressed, makes the interconnection between the line and the corresponding column possible. The interconnection is detected by the principal module through a keyboard routine, which

codifies the pressed key into an ASCII appropriate code. This module allows a virtual version through a software supplied with a "touch screen" monitor.

Serial communication module (4): This module consists of an integrated circuit converter of TTL level for RS-232 level and the opposite. Also, it has a connector of 4 (four) pivots designated to the following signals: RX, TX, GND, and AGND. The RX signals correspond to the signals of the same name available in the interface SPI of the main micro-control. Through the 4 (four) connectors' pivots, it is possible to interconnect the Electronic Card to the Peripheric Station. The serial communication inserted by this module is asynchronous and full duplex, which is set at 9600 bauds. The transmission format is of 1 start bit, 8 data bits, and 1 stop bit.

RF communication module (5): This module consists of a low potency miniature FM transmitter, which is employed to transmit in a serial manner the digital data originated from the TX pivot to the principal module's micro controller. The transmitted signals are codified into the ASCII format and are related to the data linked to the events that are registered into the permanent memory during the matches. The digital communication used through this module is asynchronous and half-duplex. The digital communication's velocity is set at 1200 bauds and the transmission format is 1 start bit, 8 data bits, and 1 stop bit.

PERIPHERIC STATION'S HARDWARE COMPONENT

The hardware's blocks diagram (electric circuit) of the Peripheric Station is presented on Figure 8. It is composed of 5 (five) modules: 1) principal module, 2) alphanumeric monitor module, 3) keyboard module, 4) serial communication module, and 5) RF communication module.

Principal module (5): It is responsible for the Peripheric Station's control. This module is implemented by a digital processor that has the Peripheric Station's operational system downloaded into its program memory. Through the reception of events' signals originated on both the keyboard and the serial communication modules, the Electronic Card's principal module realizes its function through the exchange of controlling signals with the corresponding modules.

Alphanumeric monitor module (1): This module consists of a monitor that contains a crystal liquid technology. It also consists of a matrix of dots that are activated by a micro-control of specific use to this mean. The messages composition of the crystal liquid monitor is based on commands originated from the parallel communication between this module, the keyboard module, and the principal module. These commands are sent through the routines associated to the monitor and are inserted in the operational system.

Keyboard module (2): This module consists of 1 (one) appropriate alphanumeric keyboard matrix and 1 (one) matrix of special keys, which is composed by 1 (one) interface that connects 10 (ten) lines, 7 (seven) columns, and 2 (two) lines of control selection. The latter is composed by 2 (two) gates that are located at the principal module's digital processor. Each key has a specific function, which makes possible for the principal module to detect the interconnection through a keyboard routine that codifies the pressed key into an ASCII appropriate code. This module allows the installation of 2 (two) nominal keys containing the following descriptions: TEAM A and TEAM B. These keys are directly linked to the operational system of the Peripheric Station and correspond to the ***n*** (number) of infractions committed by both teams. They are monitored in order to release a conclusion in cases that a consult is necessary. For example, when new rules need to be elaborated by the International Board (FIFA). This module permits the installation of a virtual version through a software that contains a "touch-screen".

Serial communication module (3): This module consists of an integrated circuit converter of TTL level for RS-232 level and the opposite. Also, it has a connector of 4 (four) pivots designated to the following signals: RX, TX, GND, and AGND. The RX signals correspond to the signals of the same name present in the SPI interface of the principal micro-control. Through the 4 (four) pivot's connectors, it is possible to interconnect the Peripheric Station to a Printer and/or the Electric Card. The serial communication inserted by this module is asynchronous and full duplex, which is set at 9600 bauds. The transmission format is of 1 start bit, 8 data bits, and 1 stop bit.

RF communication module (5): This module consists of a low potency miniature FM transmitter, which is employed to transmit the digital data originated from the TX pivot in a serial manner to the principal module's micro-control. The transmitted signals are codified into the ASCII format and are related to the data linked to the events that are registered into the data's permanent memory during the matches. The digital communication used through this module is asynchronous and half-duplex. The digital communication's velocity set at 1200 bauds and the transmission format is 1 start bit, 8 data bits, and 1 stop bit.

RF communication module (5): This module consists of a low potency miniature FM re-transmitter, which is employed to transmit the digital data originated from the TX pivot to the principal module's micro-control in a serial manner. The transmitted signals are codified in the ASCII format and are related to the data linked to the events that are registered into the data permanent memory during the matches. The digital communication used by this module is asynchronous and half-duplex. The digital communication's velocity set at 1200 bauds and the transmission format is 1 start bit, 8 data bits, and 1 stop bit.

CLAIMING

1. ELECTRIC CARD FOR FOOTBALL, FUTSAL, AND SIMILAR SPORTS' REFEREE to be used during such matches in order to replace the traditional cards. The electronic card's main function is to improve the task of registering the occurrences such as yellow and red card fouls, goal, counter goal, athletes replacement, and matches ending by penalty. The Electric Card is characterized by the following modules:

a) *Luminary signaling module* (1): water and impact resistant, antithermic coated, multidirectional luminary panel, mirrored bottle (photographic camera's flash alike), two high capacity lamps (xenon and/or similar) in red (1.2) and yellow (1.1) colors.

b) *Alphanumeric screen module* (2): water and impact resistant, antithermic coated, crystal liquid screen (2.2) subdivided into two areas (2.4) and (2.5), containing two columns filled with 11 (eleven) keys (2.2) and (2.3).

c) *Keyboard module* (3): water and impact resistant, consisted of generating events keys (3.1), (3.2), (3.3), (3.4), and (3.5) that are arranged into a vertical or horizontal line. This module represents the control panel of the electronic card, which directly interfaces the micro-control of the principal module (6) and codifies the keys pressed on the ASCII format.

d) *Keyboard module* (3): is characterized by being water and impact resistant, containing antithermic coating, and holding the conditioned events' system. This module is composed by the (3.6), (3.7), (3.8), (3.9), (3.10), and (3.11) keys, which are interconnected only and directly to the (3.2) and (3.3) events, as well as directly interfaces the principal module's (6) micro-control that codifies the keys pressed onto the ASCII format.

e) *Serial communication module* (4): provides the interconnection between the Electronic Card and the Peripheric Station (Figures

4 and 5) and/or printer through either the connector (4.1) or wireless/ blue tooth/ wi-fi technology. The communication is asynchronous, full duplex, 9600 bauds set velocity, and 1 start bit, 8 data bits and 1 stop bit transmission.

f) *"Momentary closure switcher"* types of key created to start/stop (5.1) the system's chronometer and simultaneously turn on/off the timer of the principal module's micro-control.

g) *RF communication module* (5) is a frequency radio transmitter of "FM" modulation for serial transmission of the digital data from the principal module's (6) micro- control. The codified signals are transmitted into the ASCII format respective to the events registered into the memory. The digital communication is asynchronous, half-duplex, 1200 bauds of communication's velocity, and 1 start bit, 8 data bits, and 1 stop bit transmission format.

2. PERIPHERIC STATION is a station separated from the Electronic Card that promotes the register of occurrences such as players replacements, ending the matches by penalty taken, as well as reporting, programming, and printing the matches's occurrences. The Peripheric Station is characterized by the following modules:

a) *Alphanumeric monitor module* (1): consists of a crystal liquid monitor (3.1)

b) Keyboard module (2): is formed by a group of event generating keys (1.1), (1.2), (1.3), (1.4), (1.5), (2.1), (2.2), (2.3), (2.4), and (2.5), which directly interfaces the micro-control of the principal module (5) that codifies the keys pressed onto ASCII format.

c) Keyboard module (2): characterized by containing the cumulative sequential infractions performed by players of either team A or B into its operational system. This module makes

such information visually available through the electronic placard.

d) *Serial communication module* (3): provides the interconnection between the Peripheric Station and the Electronic Card (Figures 4 and 5) and/or printer through either the connector (4.1) or wireless/ blue tooth/ wi-fi technology. The communication is asynchronous, full duplex, 9600 bounds set velocity, and 1 start bit, 8 data bits and 1 stop bit transmission.

e) *RF communication module* (5) is a frequency radio transmitter of "FM" modulation for serial transmission of the digital data from the principal module's micro-control. The codified signals are transmitted into ASCII format respective to the events registered into the memory. The digital communication is asynchronous, half-duplex, 1200 bounds of communication's velocity, and 1 start bit, 8 data bits, and 1 stop bit transmission format.

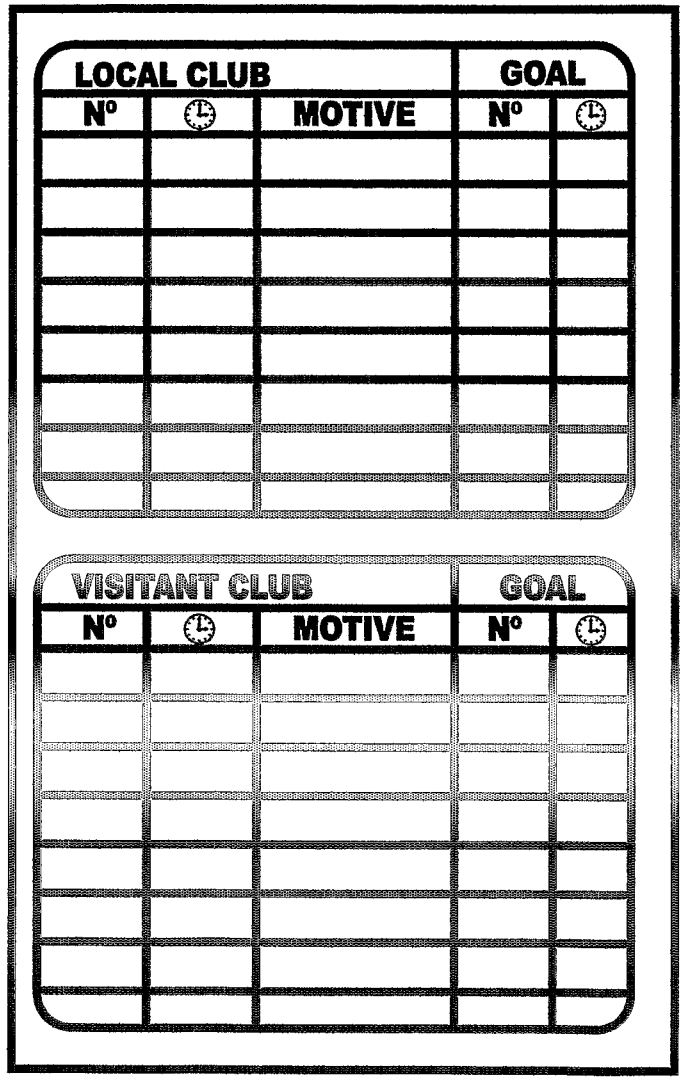

Figure 1

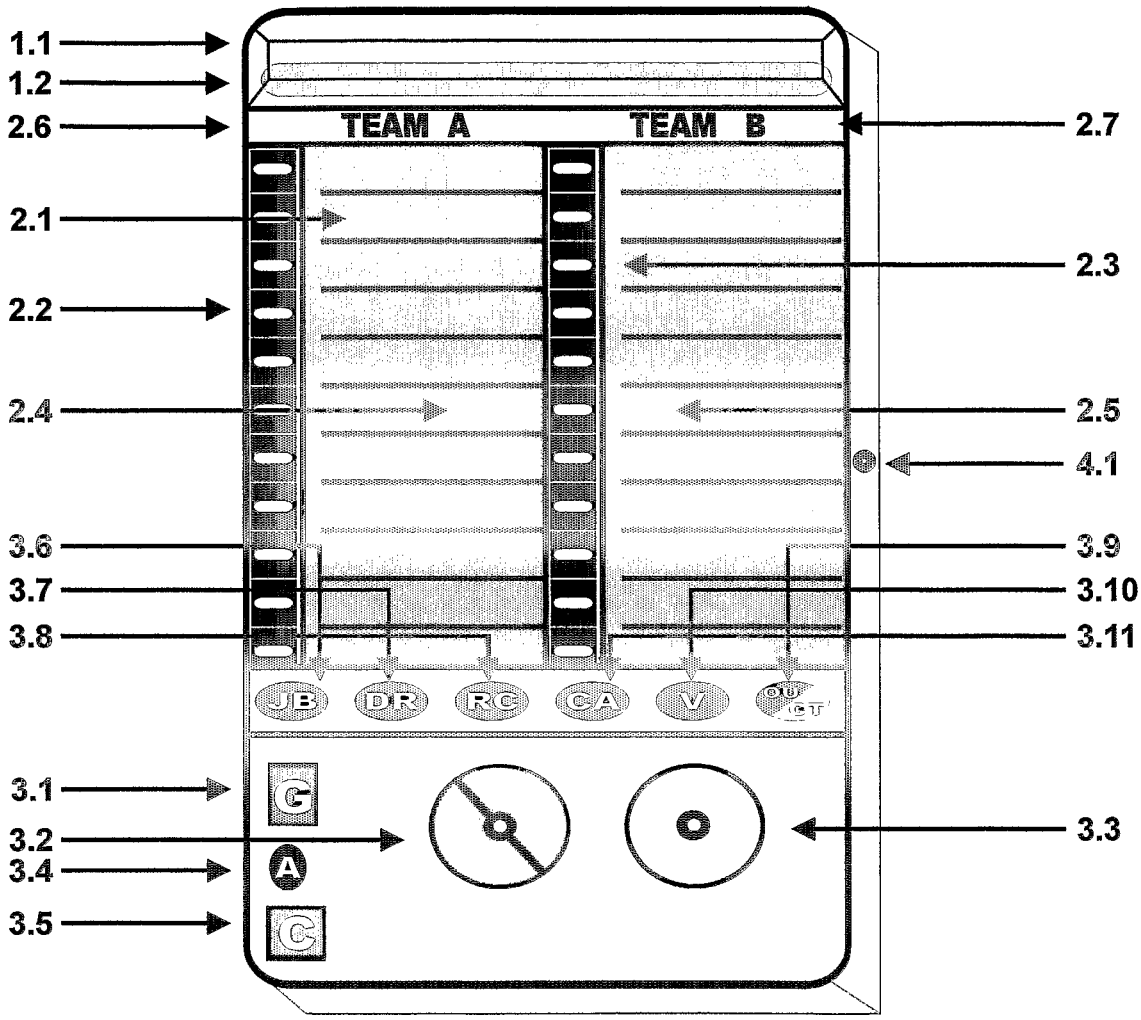
1.1
1.2
2.6
TEAM A
TEAM B
2.7
2.1
2.3
2.2
2.4
2.5
4.1
3.6
3.9
3.7
3.10
3.8
3.11
JB
DR
RC
CA
V
OUT
3.1
G
3.2
3.3
3.4
A
3.5
C

Figure 2

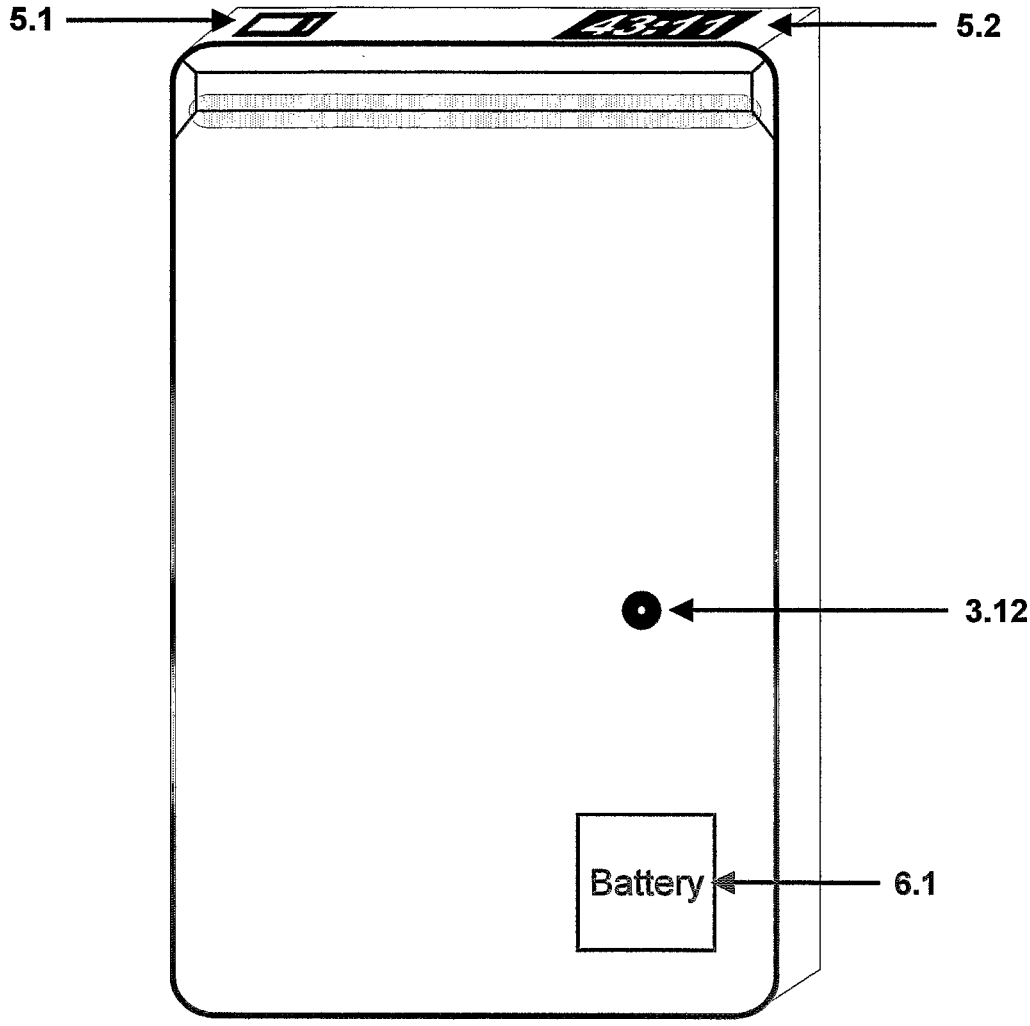

Figure 3

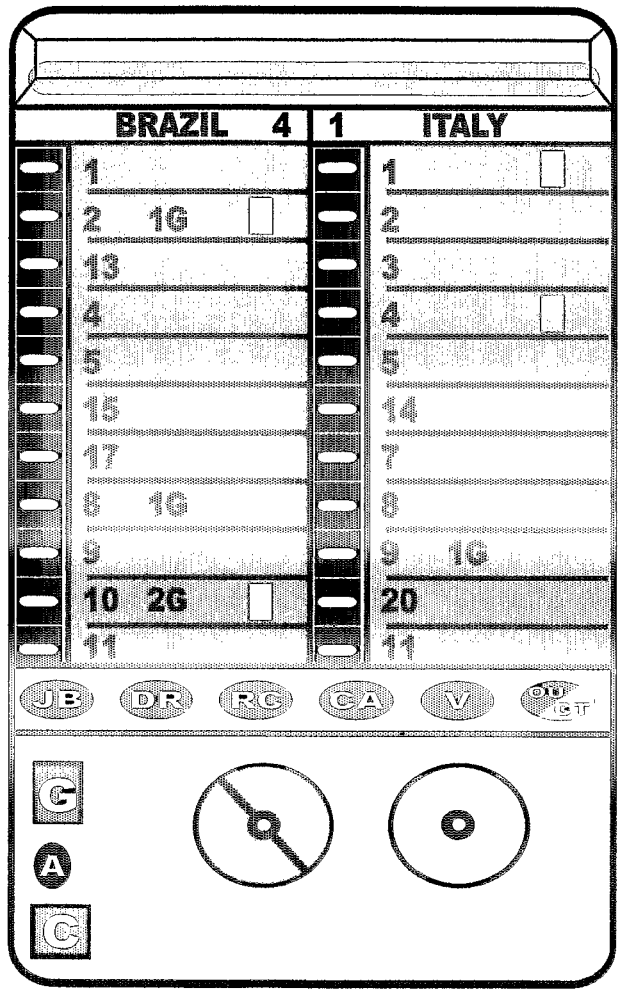
BRAZIL 4
1
2 1G
13
4
5
15
17
8 1G
9
10 2G
11
1 ITALY
1
2
3
4
5
14
7
8
9 1G
20
11
JB
DR
RG
CA
V
G
A
C

Figure 6

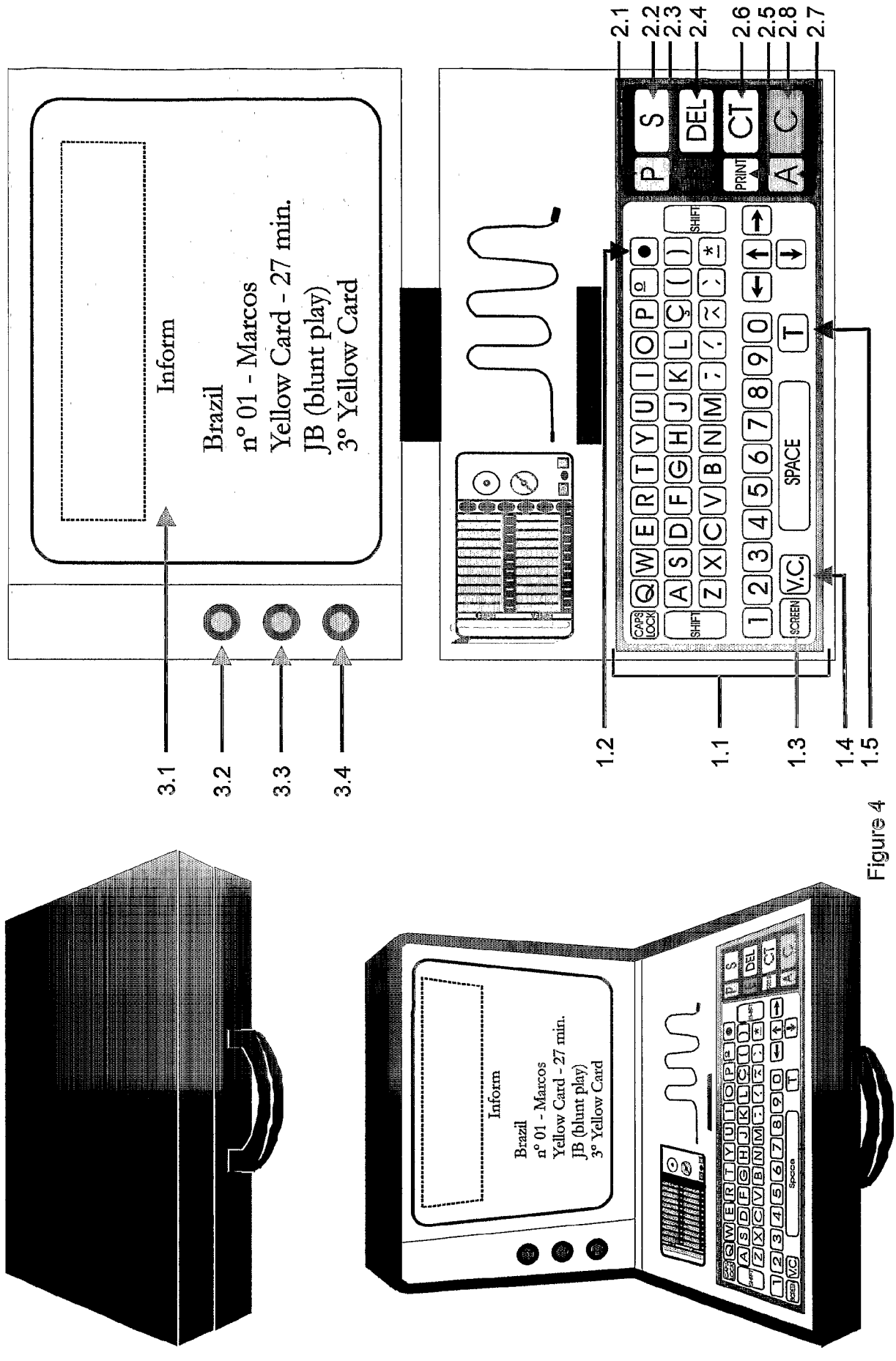
Inform
Brazil
nº 01 - Marcos
Yellow Card - 27 min.
JB (blunt play)
3º Yellow Card
3.1
3.2
3.3
3.4
2.1
2.2
2.3
2.4
2.6
2.5
2.8
2.7
1.2
1.1
1.3
1.4
1.5
SPACE
DEL
CT
PRINT
SHIFT
CAPS LOCK
SCREEN
V.C.

Figure 4

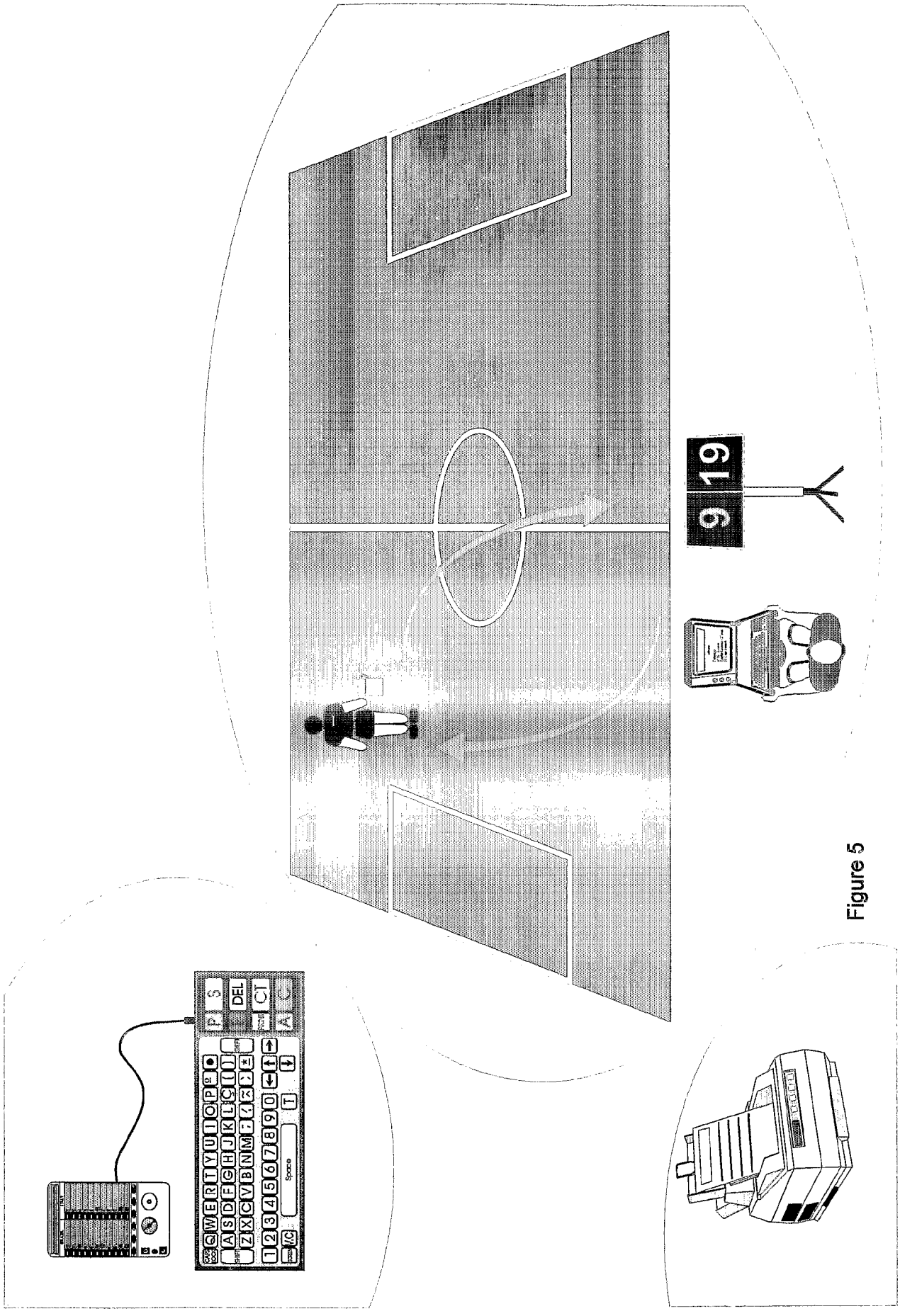

Figure 5

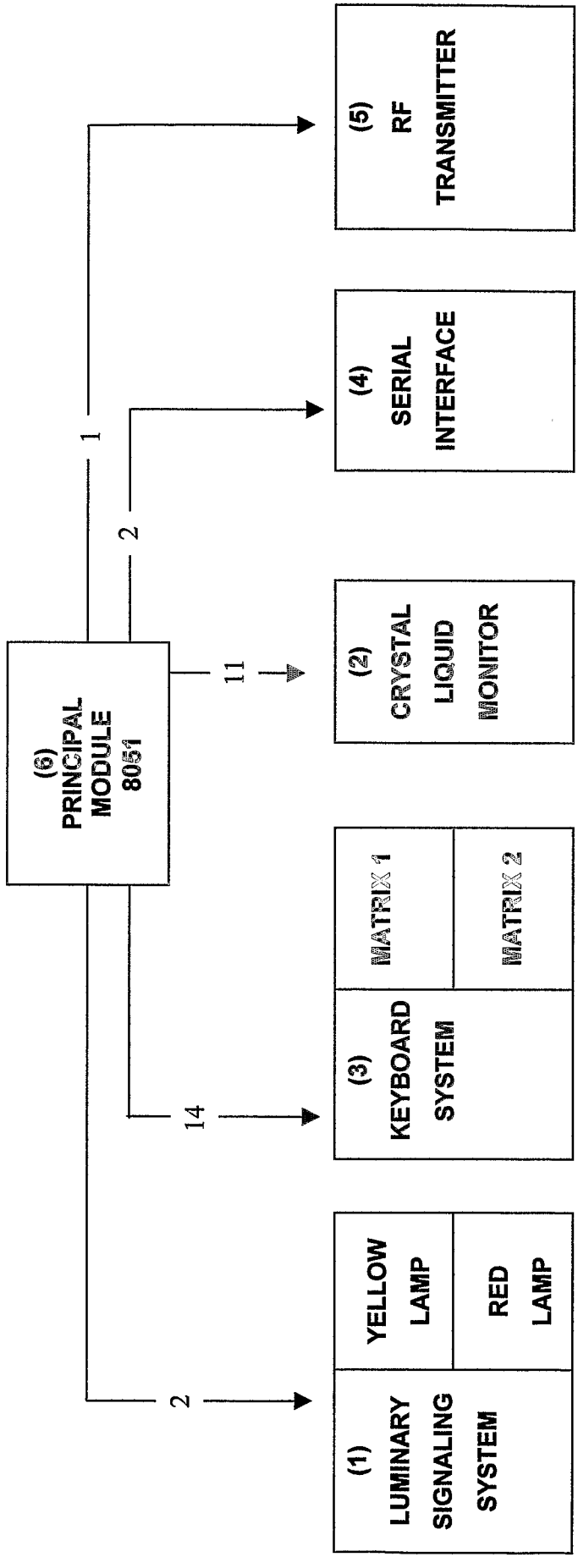
(6) PRINCIPAL MODULE 8051
(1) LUMINARY SIGNALING SYSTEM
YELLOW LAMP
RED LAMP
(3) KEYBOARD SYSTEM
MATRIX 1
MATRIX 2
(2) CRYSTAL LIQUID MONITOR
(4) SERIAL INTERFACE
(5) RF TRANSMITTER
1
2
2
11
14

Figure 7

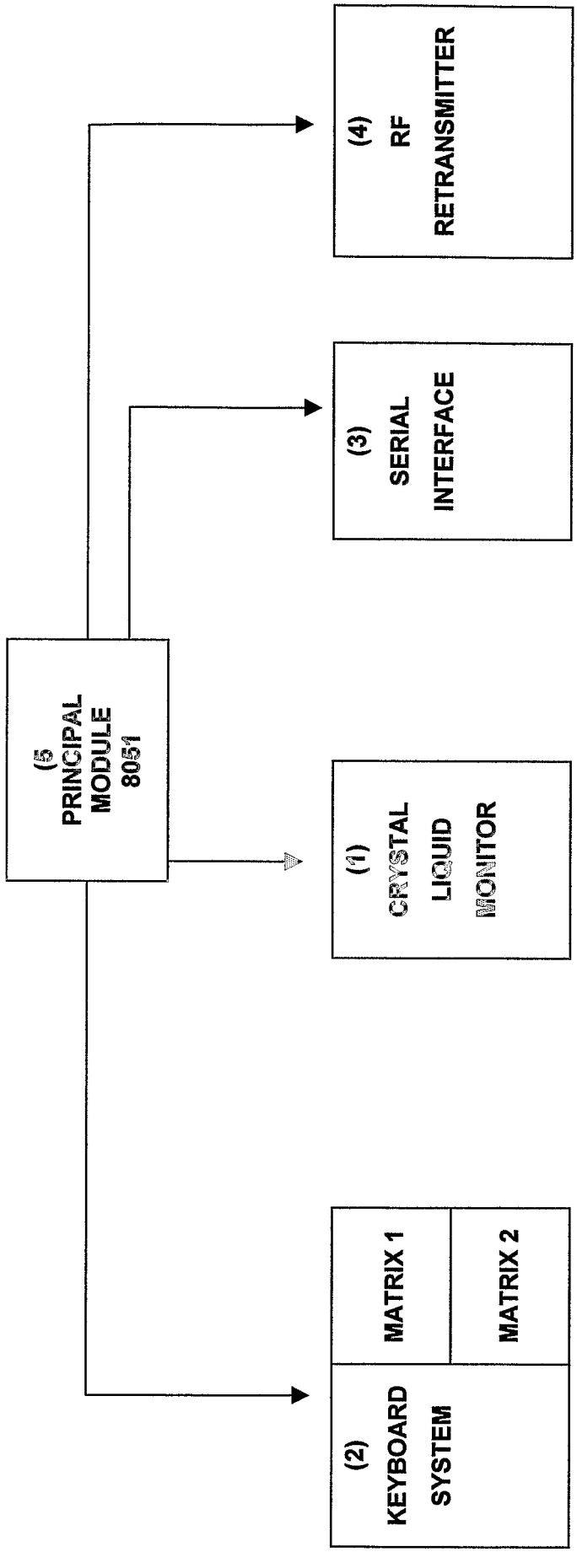
(5 PRINCIPAL MODULE 8051
(4) RF RETRANSMITTER
(3) SERIAL INTERFACE
(1) CRYSTAL LIQUID MONITOR
(2) KEYBOARD SYSTEM
MATRIX 1
MATRIX 2

Figure 8

LEGENDS OF THE ELECTRONIC CARD'S USUARY'S INTERFACE (Figures 2 and 3)

1. Luminary signaling system
   1.1. Yellow card signaling lamp compartment
   1.2. Red card signaling lamp compartment
2. Alphanumeric monitor system
   2.1. Crystal liquid screen
   2.2. Keyboard of 11 keys to enter the player's number of the team A
   2.3. Keyboard of 11 keys to enter the player's number of the team B
   2.4. Crystal liquid screen's left area of the team A
   2.5. Crystal liquid screen's left area of the team B
   2.6. Data entrance field related to the name of the team A
   2.7. Data entrance field related to the name of the team B
3. Events system (control panel) and Conditioned Events system
   3.1. "G" Key to register a goal
   3.2. "Red Card" key to register a red card foul
   3.3. "Yellow Card" key to register a yellow card foul
   3.4. "A" key to abort (void) the last operation
   3.5. "C" key to confirm the operation entered
   3.6. "JB" to qualify a seriously violent matches infraction
   3.7. "DR" key to qualify an infraction of misconduct
   3.8. "RC" key to qualify an infraction of a complaint
   3.9. "CA" key to qualify an antisportive conduct infraction
   3.10. "V" key to qualify a violent action infraction
   3.11. "OU/CT" key to qualify rare and isolated cases infraction that do not meet any infraction discriminated above
   3.12. "a/c" reset key to clear out the electronic card's memory content
4. Peripheric Station and Printer Interface
   4.1. RS-232 serial interface connector
5. Start/Stop the system's chronometer

5.1. Switch to start/stop the system's internal chronometer and turn on/off the Electronic Card

5.2. Chronometer

6. System's feeding source

6.1. Battery compartment (lithium)

LEGENDS OF THE PERIPHERIC STATION'S USUARY INTERFACE (Figure 4)

1. Programming system

1.1. Alphanumeric keyboard

1.2. Reset "$^{a}/_{c}$" key

1.3. "Screen" key activate/deactivate information on the screen

1.4. "Vibrator call" key

1.5. "T" key

2. Operation functions' system

2.1. "P" key to register Penalty dispute

2.2. "S" key to register player's substitution (replacement)

2.3. "E" key to initiate data entrance (programming)

2.4. "DEL" key to delete data entrance operation after confirmation

2.5. "PRINT" key to print the matches' related data

2.6. "CT" key to consult registered events

2.7. "A" key to abort/void data entrance operation before confirmation

2.8. "C" key to confirm data entrance operation

3. Alphanumeric monitor system

3.1. Crystal liquid screen (LCD)

3.2. "Power" key to turn on/off the screen

3.3. Screen's contrast control key

3.4. Screen's shine control key

TABLE OF CONTENTS MODULE OF THE ELECTRONIC CARD

1. Luminary signaling module
2. Alphanumeric monitor module
3. Keyboard module
4. Serial communication module
5. RF communication module
6. Principal module (Winchester)

TABLE OF CONTENTS MODULE OF THE PERIPHERIC STATION

1. Alphanumeric monitor module
2. Keyboard module
3. Serial communication module
4. RF communication module
5. Principal module (Winchester)

INTERNATIONAL SEARCH REPORT

Ir ational Application No
PCT/BR2004/000018

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 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)
IPC 7 A63B G06F

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, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/087707 A (TOMOVSKI DRAGAN) 7 November 2002 (2002-11-07) the whole document	1,2
X	DE 197 18 887 A (HERRMANN OTTMAR ;STUETZER HELMUT (DE); LASCHUETZA MANFRED (DE)) 5 November 1998 (1998-11-05) the whole document	1,2
A	US 5 745 029 A (GARCIA MANUEL) 28 April 1998 (1998-04-28) the whole document	1,2

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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	Date of mailing of the international search report
2 June 2004	11/06/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Knoflacher, N

INTERNATIONAL SEARCH REPORT

Information on patent family members

Ir ıtional Application No
PCT/BR2004/000018

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