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(54) **MACHINE FOR COMPETITION AND ENTERTAINMENT BY IMPULSE ACTION ON AN OBJECT WITH THREE-DIMENSIONAL MOVEMENT FREEDOM**

(57) Machine for competition and entertainment through impulse of an object with three-dimensional freedom of movement where two teams of participants play a game, one team on either side shooting an object with three-dimensional freedom of movement (1.3) to one another. The object moves on a gameboard (1.1) until one team fails to repel it, thus scoring points for one of the participants. Repulsion of the object originates from a repulsion sector (1.9) from which, by working a group of controls (1.7 and 1.8), movement can be provoked. The mobile object (1.3) has freedom within a zone where it is controlled by a mechanical system (1.6) where the movements are produced as a result of the action of motive elements which are governed by a control unit according to the position of the mobile object, the position of the repulsion sector and the operation of the controls.

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Description

OBJECT OF THE INVENTION

The object of the invention is a competition and entertainment game functioning through activation of an object with three-dimensional freedom of movement, specially conceived for sporting competitions between two teams, formed of one or more players depending on the game mode. A team is situated on either side of the gameboard, shooting a mobile object, spherical or otherwise but with a similar function, which has three-dimensional freedom of movement and can be moved three-dimensionally over a gameboard until one of the teams fails to repel it, from inside or outside the marked zones of the gameboard depending on the rules established for the game mode in use, in this way scoring points for one of the competing teams. This may either be when the mobile game element touches the gameboard outside the zones permitted by the selected game mode and marks points against the team which hit the ball, or when the mobile element lands within the permitted zones and, after not being repelled by the other player, points are scored by the team which hit the ball.

Through activation of the controls each team can control the position of a repulsion sector which performs the function of a racquet as well as controlling the direction, effect and strength of the repulsion that we wish to apply to the mobile game object in such a way that the object is repelled out of the repulsion sector towards the desired part of the gameboard with the desired effect.

The action of repulsion of the ball or mobile object of competition with three-dimensional freedom of movement is performed by specific electromechanical means whose performance is commanded from a control centre as the controls are activated so that, depending how the aforementioned controls are operated and the positions of the mobile object and of the authorized repulsion sector that performs the function of the racquet, they cause the control centre, according to the way it has been programmed, to produce the appropriate operation of the electromagnetic elements in order to produce a controlled impulse directed at the object with three-dimensional freedom of movement.

The detection of both positions and of the intention of effect with which the action of repulsion is to be produced is carried out in the electronic control centre, by means of readings of particular data available to the control centre and of data supplied by other elements with the capacity to detect position. These elements are located in the machine's mechanical system and in the control unit which governs and manipulates the repulsion zones, or racquets, which are used in the competition.

More specifically, the invention concentrates on the way the operations of controlling the position and movement of the element with freedom of three-dimensional

movement and that of controlling the position and the intention of impulse production from each repulsion zone or racquet are carried out; the physical system used to perform the aforementioned operations; and the actual constitution of the machine used for the competition, with the arrangement of the elements of which it is composed.

ANTECEDENTS OF THE INVENTION

Fundamentally, existing sports competition and entertainment machines are usually limited to a few types of these, some are machines consisting of a gameboard where the two sides compete for a ball which can be moved around the field of play where different elements are situated, governed by the players through the controls, with the aim of getting the ball into the opposing goal.

Another type of existing machine is designed so that the players shoot a chip or ball to each other from one side to the other of a gameboard until one of the players scores a point by introducing the chip or ball into the opposing goal. In these machines the movement of the ball or chip is two-dimensional. The machine described in document PCT/ES94/00024 by the same inventor can be taken as a reference of the aforementioned machine type.

To consider the type of machine in which characteristically the gameball moves three-dimensionally around the field of play; in some types of the aforementioned machines already in existence the gameball is usually able to move completely freely placing itself in certain pockets from which it can be expelled towards a basket or goal. In the type of machine in question, even a gameball with three-dimensional freedom of movement is not permanently controllable in terms of movement and position. This therefore means that three-dimensional games like tennis, which to be played properly within the limited space of a machine require total control over the position and movements of the ball, cannot be played correctly.

At present there are no machines comparable to that described herein for sports competitions like tennis, table-tennis, volleyball or others where the ball in play must have three-dimensional movement, the three-dimensional movement of the gameball is subject to total control from a control and securing system which allows it three-dimensional movement, and the trajectories are defined by the limits of a volume of space determined by the system itself. This means that by being able to limit the game space it is possible to prevent the mobile element, spherical or otherwise, with which the game is played, from going out of the players' control in terms of the field of play of the apparatus or game machine.

In contrast to models currently on the market, the machine described herein permits competition through the activation of a mobile object or gameball, where this

gameball or mobile element can be moved freely three-dimensionally within a limited volume of game zone; where both the position of this gameball within the limits of the volume of space of free movement determined by the machine's systems, its position in relation to the zones of the field of play which the player wishes to control and the authorized repulsion sectors which perform the function of racquets, depending on the kind of game, are all controlled at all times.

Construction of the invention described herein produces an automatically-controlled machine. This machine is made all the more attractive by the wide variety of possible operations in a game, the fact that it is possible to play games like tennis and volleyball and the fact that using the machine requires physical exercise, training and use of the reflexes.

For the above reasons, learning to master and enjoy the game will appeal to a very wide sector of the public. Basically, the machine is a new product concept with better commercial prospects than existing machines along the same lines. The new design of the machine allowing new kinds of competition, the easily-understood operation of the games and the accessible production costs result in a product of great commercial potential on both domestic and international markets.

The result of the above is a world novelty with many market options due to the scarcity of novelty products in the sports competition market. Therefore, the creation of manufacturing structures and the generation of these new products is viable. In commercial terms it is necessary to produce a new generation of sports competition and entertainment games using an object with three-dimensional movement. The range of game options presently available in the machines currently on the market can be widened by incorporating new inventions with game possibilities that make machines simpler and more reliable, comfortable, entertaining, educational and, above all, safe.

EXPLANATORY DESCRIPTION OF THE INVENTION

The invention centres on a new configuration of machines for competition and entertainment through activation of a mobile object. The object moves with three-dimensional freedom of movement. Its relative position within a sector of space over a gameboard is controlled at all times. The object in question moves across the gameboard depending on its own position, the position of an authorized repulsion sector and also on the handling of the sets of game controls belonging to each side.

The aforementioned three-dimensional sector is located over a gameboard in such a way as to allow different types of competition, in particular: tennis, volleyball, table-tennis and other similar games. The games are played by producing the three-dimensional movement of the gameball over the aforementioned gameboard. The gameboard may be equipped with a net to

separate the two halves of the gameboard, the height of which will vary according to the game.

According to this invention, each of the control systems is formed of a set of mechanical organs equipped with elements that allow them to be held manually. These elements allow the players on the one hand to modify the position of the activated repulsion sector, commonly referred to as a "bat" or "racquet", and on the other, to shoot the gameball according to the desired speed, direction and effect.

Fundamentally, the means used to move the ball or game element which moves three-dimensionally around a sector of space located above the gameboard, the movement of this element being subject to space limitations imposed by the supports system which allows it to move three-dimensionally, are a group of mechanisms which hold the ball. The way these mechanisms are grouped allows the three-dimensional movement of the ball or body as a result of the sum of the contributions of each of the three axes of coordinates of the different types of independent movements of the ball that the group of mechanisms allows. The different effects of movement desired can be obtained by appropriate control of the various motive elements which provoke the movement of those elements with independent movement.

The group of mechanisms consists of a conjunction of systems of linear guides for linear movement and of radial guides for radial movement. These permit the gameball to make composite movements which are the results of two-dimensional movements in relation to the two horizontal coordinates axes parallel to the plane of the gameboard and of vertical movements in the dimension perpendicular to the plane of the gameboard, in this way making any kind of three-dimensional movement possible, within the external limits marked by the mechanical and dimensional characteristics of the elements which comprise the afore-mentioned mechanical system.

Essentially, the above-mentioned group is formed by the perpendicular arrangement of a mechanical sub-set structured on a main axis, attached by one or both ends to a two-dimensional displacement system and mounted parallel to the plane and transversal to the gameboard. It incorporates the gameball in such a way as to allow it to move linearly in parallel to the axis and turn around it within a fixed radius. This sub-set essentially consists of a linear guide, which may be equipped with systems for producing linear displacement along the guide-rail of an element which acts as a carrier device, but if not, will always be equipped to produce this movement by other means. The carrier device holds the gameball, maintaining a fixed radius with the axis of rotation, in this way allowing the radial turn of the gameball around the axis which determines the linear guide itself.

The two-dimensional displacement system that holds, by one or both ends, the sub-set formed of the lin-

ear guide with accesories and gameball, is a system that allows the aforementioned guide set to move perpendicular to the main axis of rotation determined by the guide itself. These movements are mainly longitudinal and horizontal in relation to the gameboard. They may have a vertical component of varying importance depending on how the system is manufactured and on the game mode desired. The mechanical system used as lateral support can be manufactured using a combination of linear displacement systems so that, if there are two supports, they move in unison and the mechanical system supports both ends of an element which moves in two dimensions, to which the two ends of the linear bar that performs the function of the axis of rotation are attached. In a more simplified version of the above, the lateral support system can be made using a single line of linear displacement on each side, with the line following either a straight path or a radial path with a projected curvature, using a linear displacement guide for this purpose or a supporting arm in line with an axis, situated at the desired distance from the turning circle.

The transversal linear guide is a mechanical group where the gameball is attached by means of an arm to a carrier device that holds the ball whilst allowing it to turn, within a radius defined by the dimensions of the support elements, on an axis constituted by the guide itself and by which the ball is guided and the linear displacement of the carrying device may be produced. The linear guide mentioned, that also fulfils the function of axis of rotation, may contain a threaded endless screw which on turning produces the linear displacement of the carrying device and therefore of the gameball. For this, the carrying device has a rolling ring, or some similar device to connect it to the endless screw, that makes it possible for the carrying device to move to the left or right at a certain speed, depending on the speed and direction of the rotation of the endless screw.

The set of mechanisms that control the movements of the ball originated by electromagnetic motive elements and the control group contain various detector devices. By reading these, it is possible to detect the relative position of the mobile object or gameball on the gameboard and the situation of the activated repulsion area, or racquet, in relation to the ball in order to discover whether it is possible to repel the ball and, if not, whether a point is to be awarded in favour of one of the sides according to the game mode in use. The sets of controls on either side of the machine are to be activated by the players in order to situate the authorized repulsion zone, or racquet, in the position selected from among those possible in the field of play. In this way the players can situate the authorized repulsion zone so as to receive the gameball and produce a movement with an effect which will depend on how the controls have been handled. Each group of controls is equipped with handling devices, the purpose of which is to allow the player, through manipulation of these, to control on the one hand the position of the repulsion zone and on the

other, the behaviour of the motive elements that produce the movement of the gameball starting from the repulsion zone governed by this same group of controls. By working these controls the player can select the action of the impulsors independently of the position of the repulsion zone. Depending on whether or not the gameball is inside their field of action, they can either be manipulated manually or, automatically, by detecting the presence of the gameball in their field of action through sensors.

DESCRIPTION OF THE DRAWINGS

In order to illustrate what is set out in this document, this descriptive record is accompanied by various pages of drawings which show clarifying parts of the invention in an illustrative, rather than a limitative, way.

Figure 1 gives a simplified view of the outline of the machine described in this document. It is equipped with a gameboard (1.1) with a separation net (1.2). The mobile object or gameball (1.3) is attached by an arm (1.4) to a carrier device (1.5) which forms part of the mechanical support and control group of which a part can be seen (1.6) and the two sets of controls (1.7 and 1.8) from which the position of the activated repulsion zone and the characteristics of the repulsion to be produced are controlled.

Figure 2 shows a mechanical system used for the function of supporting and controlling the movement of the gameball, and with which it is possible both to produce and control its movements. The drawing indicates the mechanical elements which constitute the aforementioned group for support and control of the mobile object and we can observe the main axis of rotation, which on the outside is formed of a tube (2.2) with a longitudinal opening. This tube permits the linear displacement of the carrier device (2.3) and when it turns, causes the carrier device to execute an identical turn. We can also observe the endless screw (2.4) inside the tube. On turning, the endless screw causes the linear displacement of the carrier device. Figure 2 also shows how the mobile object, in this case a ball (2.5), is attached to the carrier device by an arm (2.6). We can observe how the main axis of rotation is attached to a support (2.7) which moves in two dimensions orthogonal to the aforementioned axis. This movement is possible as the support is attached to a linear displacement carriage (2.8) mounted on a linear guide (2.9) which in turn can move perpendicularly due to the fact that it is attached by two linear bearings (2.10 and 2.10a) to the linear guides (2.11 and 2.11a).

Figure 3 shows a view of the mechanical support and control group, fitted with different motive elements which produce the movement of the different elements that are activated by the movement of the gameball. We can also observe the motive element (3.1) that produces the rotation of the endless screw which, on turning, produces the linear displacement of the carrier

device to which the game element is attached, showing the motive element (3.2) that produces the rotation of the transmitter element (3.3) which transmits the turn to the carrier device. In this drawing the transmitter is a tube with a longitudinal opening which permits linear movement and also transmits the turn to the ball-carrier device and therefore to the ball itself in the form of a radius. We can also observe that on the support base to which the axis of rotation and displacement of the ball is attached, a motive element (3.4) is incorporated that produces the linear displacement of this base. The base, as can be appreciated in the drawing, can be displaced transversally along the linear guides (3.5 and 3.6), moved by the two motive elements (3.7 and 3.8), which in this case are two electrical coils, that regulate its elevation.

Figure 4 shows a diagram of the connection of the different elements of the machine to the electronic control system. The diagram shows how the detectors of the control groups (4.1 and 4.2), the motive elements (4.3, 4.4, 4.5, 4.6), the detectors of the mechanical group (4.7 and 4.8) and the position indicators of the authorized repulsion area, of which a part is shown (4.9), are connected to the control centre (4.10).

DESCRIPTION OF A PRODUCTION METHOD AS AN EXAMPLE

In accordance with the drawings described, it is foreseen that the machine for competition which is the object of invention will, as can be appreciated in Figure 1, be a machine with a gameboard (1.1), a mobile object for the game which in this case is a ball (1.3), and two sets of controls (1.7 and 1.8). For this machine a gameboard has been created where, depending on the game being played, the gameball can travel in different directions and hit the surface with an effect similar to the bounce produced when a ball hits the ground on a court. Effects similar to those of the behaviour of a ball on a tennis court can also be produced, thus permitting tennis or table-tennis matches, or, alternatively, of the behaviour of the ball on a volleyball court making possible the kind of competition where the ball must be prevented from touching the surface without having been repelled by the racquet. The function of the racquet is performed by an activated repulsion zone which, as illustrated in Figure 1, is determined by illuminated luminous indicators (1.9) which are illuminated on reception of a command from the control centre activating the repulsion capacity of the sector indicated. The position of this sector can be altered by manipulation of the controls using the handling devices.

In this case, the dimensions of the main body of the machine produced are 1600mm by 1000mm by 1400mm, with a flat gameboard of 1200 by 900mm and a net of 160mm in height. The board has the line markings of a tennis court.

The position of the authorized repulsion zone on

either side can be modified in this case by moving in stages around a certain area of its side of the gameboard, which in this case is a rectangle measuring 700mm by 500mm. The authorized repulsion sector, which in this case measures 80mm by 80mm can move around the rectangular area in jumps of 10mm and this is indicated by the illumination of a series of electroluminescent diodes or LEDS which indicate the edges of the authorized repulsion square. In order to allow this indication, the area where the authorized repulsion zone can be situated is full of electroluminescent diodes that form a grid of dots 10mm apart on which, when the appropriate LEDS are illuminated, it is possible to visibly indicate the position of the authorized repulsion zone.

The mechanical group used in this example for controlling and producing the movement of the object is equipped with different motive elements that act to produce the movement of the different elements that act to produce and control the movement of the ball. These motive elements are servo controlled so that, besides being used to produce the movement of the ball, they are also used to read its position and as a result, to produce the turn of the endless screw (2.4) which by turning causes the linear displacement of the carrier device (2.3), to which the game element, in this case a ball (2.5), is attached. A servo controlled motor which can be turned, whose radial position can be detected and with which it is therefore possible to produce the displacement of the carrier device and detect its linear position, is used. To produce the rotation of the ball-carrier device (2.3), a rotation transmitter (2.2) is used, which in this case is a tube with a longitudinal opening, which is connected at one end to a servo controlled motor (3.2) which produces the rotation that the transmitter transmits to the ball-carrier device, in this way controlling its radial position and therefore that of the ball itself.

To produce displacement along the linear guide (2.9), along which moves the carriage (2.8), to which the base (2.7) supporting the main axis is attached, in this case a servomotor is used. It is attached to the support itself, and when used produces the movement and control of the linear position of the aforementioned support in relation to the guide. The aforementioned support is able to move perpendicular to its own axis, in this case guided by the two linear guides (2.11 and 2.11a), using the coils (2.10 and 2.10a) and (3.5 and 3.6) as motive elements. By creating a magnetic field of variable strength, depending on the strength of the current with which it is supplied, the servomotor produces a strength proportional to the current and moves the guide variably and transversally.

On either side of the gameboard are the two control systems (1.2.1 and 1.2.2). As can be observed in Figure 3, these are composed in this case of an organ for producing the movement of the activated repulsion zone. In this case, the organ is a trackball, as it is known in the

trade, and consists of a ball which can rotate freely in any direction that transmits signals of the movement produced in it. To determine the intention of effect of repulsion a joystick is used. The aforementioned set of controls is equipped with buttons to permit the "serve" of the mobile object after a point has been scored and the powerful shot, or "smash", as it is known in tennis terminology. These components have not been fully represented in order to simplify the drawings and due to the fact that they are well-known in the trade.

The lines in Figure 4 indicate the direction of the various signals emitted and received among the different elements such as the control groups (4.1 and 4.2), servomotors (4.3, 4.4 and 4.5), coils (4.6), detectors (4.7 and 4.8) and the set of luminous dots (4.9) that display the repulsion sector, towards a conventional control centre designed with a microprocessor and peripherals.

In the technique described, modifications within the reach of any expert are possible which, being common knowledge, do not constitute inventive activity or development.

Any modification of the control system worked by the players will not be significant as it will tend to emulate what has been described here.

It is not considered necessary to make this document more extense in order for any expert in the subject to be able to construct the object of the invention by keeping within the essence described in the following pages in the claims.

Claims

1. **Machine for competition and entertainment through impulse of an object with three-dimensional freedom of movement** distinguished because being of the type in which two teams of participants play a game, one team at either end of the gameboard, they shoot a spherical or similar object with three-dimensional freedom of movement back and forth between them until one of the teams fails to repel the object. It distinguishes itself because the repulsion of the object originates from a sector with authorized repulsion that performs the function of a racquet when the positions of the mobile object and the sector with authorized repulsion coincide. By working a set of controls, it is possible to move the repulsion sector around certain areas of the gameboard belonging to each side, depending on the order of a control and command circuit.
2. **Machine for competition and entertainment through impulse of an object with three-dimensional freedom of movement, according to the first claim** distinguished because the mobile object has three-dimensional freedom of movement within the limits of a three-dimensional zone determined by the dimensions of the gameboard and of a

mechanical group, where the relative position and the movement of the aforementioned object are controlled at all times by use of the mechanical group referred to above whose organs of movement are displaced due to the action of motive units which are controlled from a control unit. The control unit activates the motive units depending on how it is programmed according to the position of the sector of authorized repulsion and on the working of the groups of controls.

3. **Machine for competition and entertainment through impulse of an object with three-dimensional freedom of movement, according to the previous claim** distinguished because the base system used to support and control the gameball consists of a mechanical system structured around a main axis determined by an axis of rotation which at the same time is a linear guide attached to a support system with displacement possibilities, which allows it to move in one or two dimensions perpendicular to its own axis. A unit of rotation and displacement which holds the mobile game object is able to both turn and move linearly on the aforementioned guide-axis.
4. **Machine for competition and entertainment through impulse of an object with three-dimensional freedom of movement, according to the previous claim** distinguished because the movements of the mobile object are produced as a result of the action of motive organs arranged outside the mechanical group that supports and controls the object in order to be able to move the object directly through use of the racquet or authorized repulsion sector, or, they are arranged inside the mechanical group forming part of it in order to be able to control and move the different organs of the group that in their turn control and move the game object.
5. **Machine for competition and entertainment through impulse of an object with three-dimensional freedom of movement, according to the previous claim** distinguished because in order to produce the linear displacement and rotation of the carrier device that holds the game element, as a component of the mechanical group for the functions of linear guide which performs the function of axis of rotation, a linear guide can be used which on the outside has a tube with a longitudinal opening which contains a threaded endless screw whose rotation causes the linear displacement, along the aforementioned guide, of the carrier device to which - a radial turn of the mobile object being facilitated, the turn being determined by the support elements - the mobile object is attached by means of an arm which is attached to an external rolling system which turns independently of the linear displacement.

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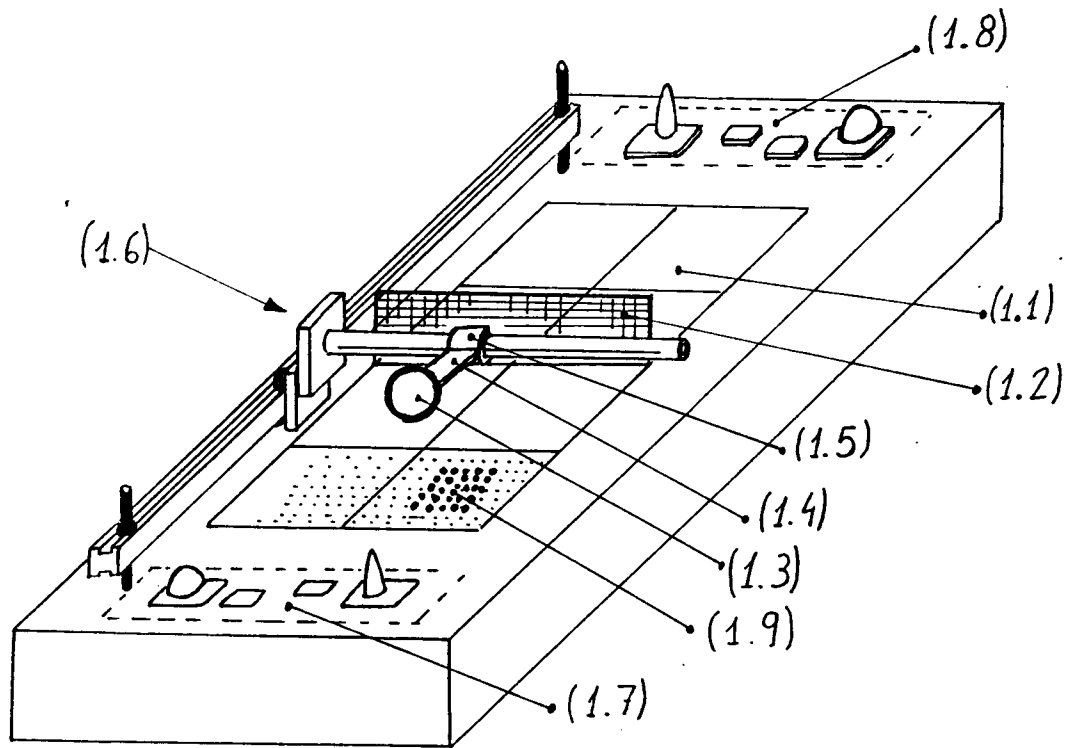
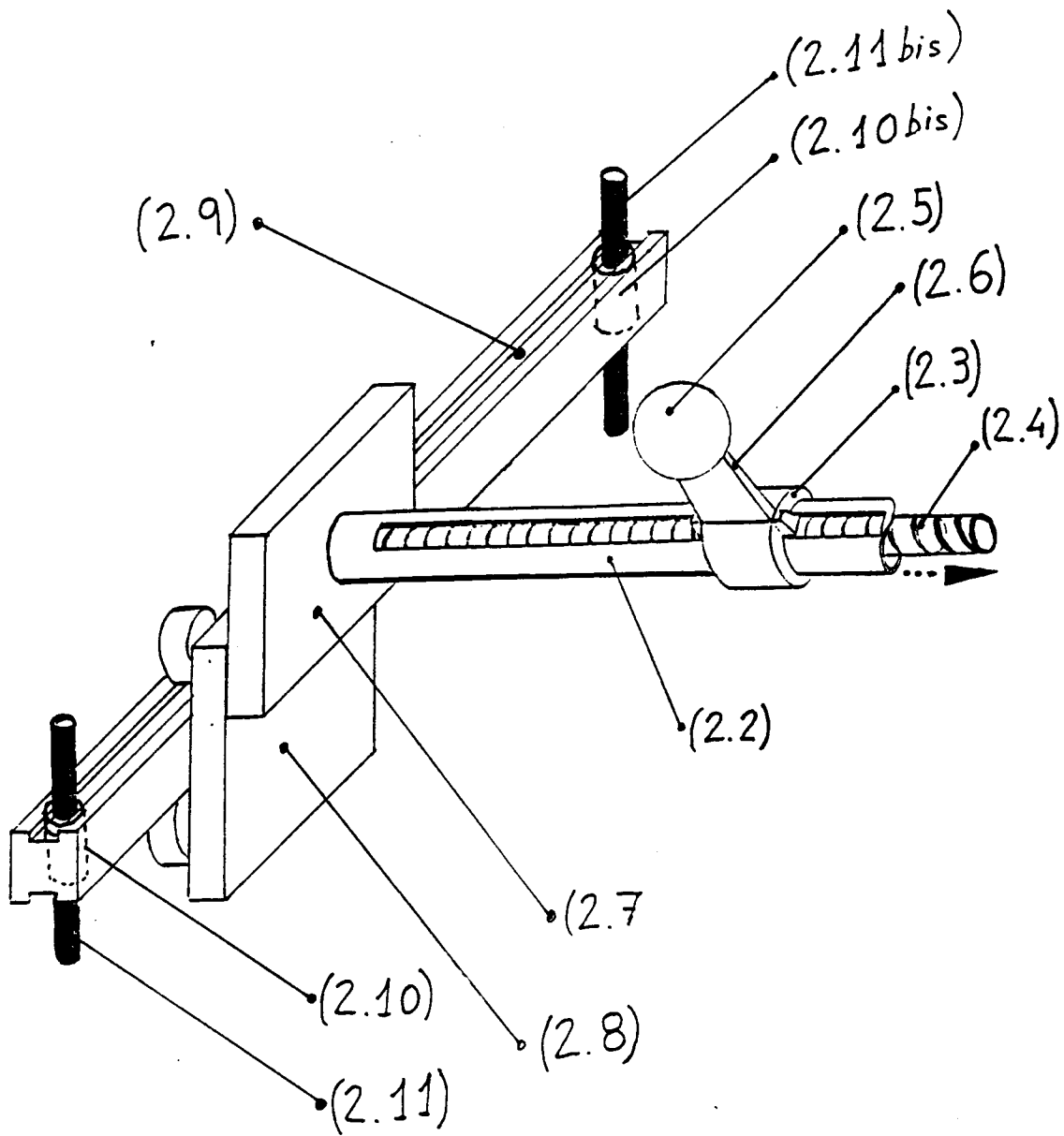


Fig- 1



- Fig- 2 -

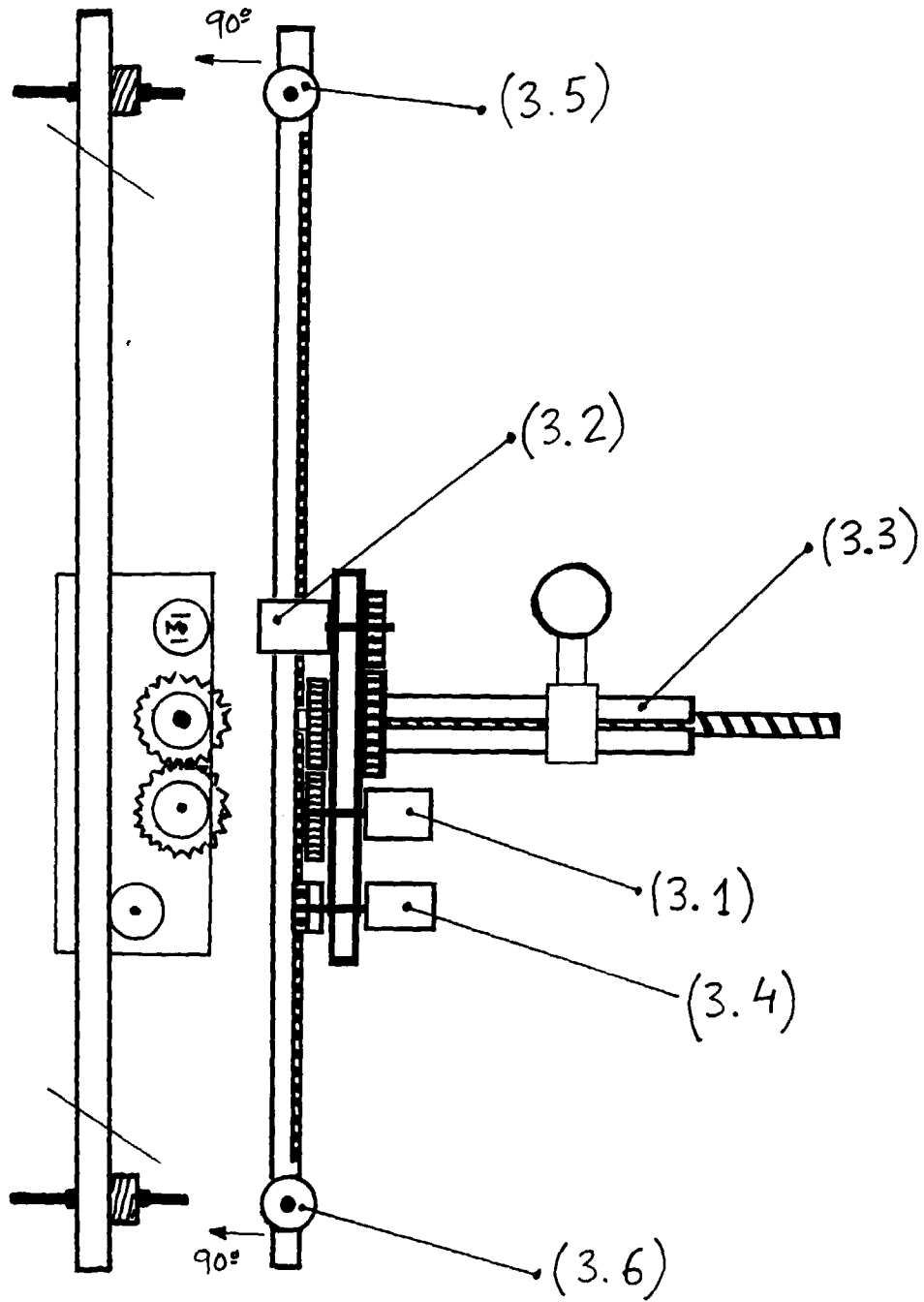


Fig-3-

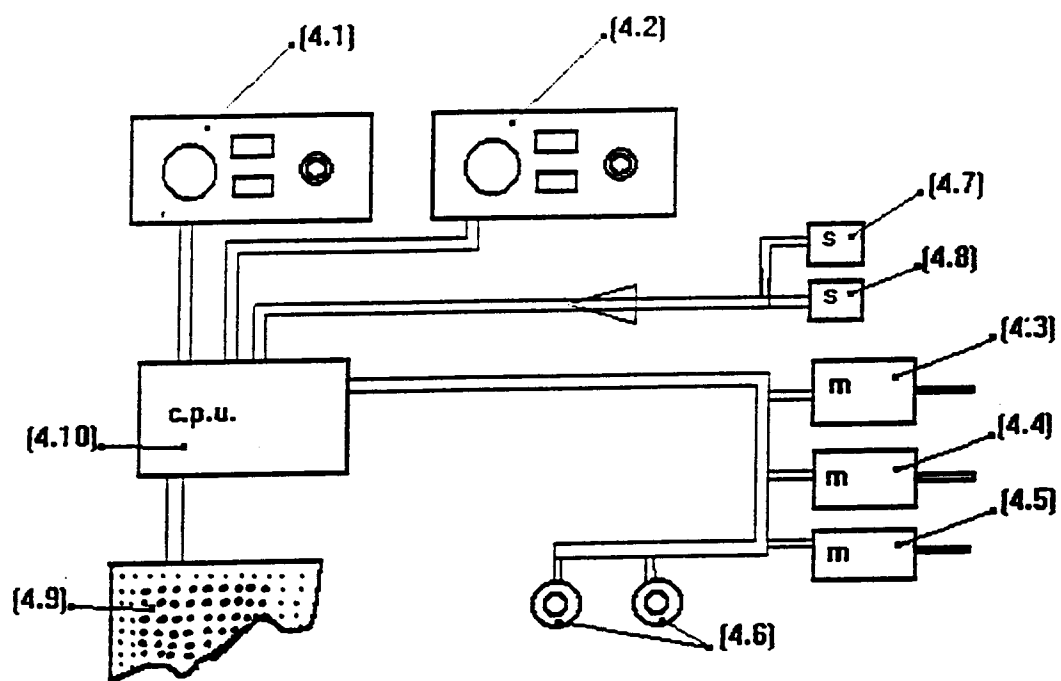


Fig - 4 -

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES 97/00218

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6 A 63 F 7/06		
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)		
IPC6 A63F		
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 practicable, search terms used)		
EPODOC, CIPEPAT, ECLA, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US-4906003-A (OHINATA) 6 March 1990 (06.03.90) column 2, line 56 - column 3, line 18; column 4, lines 14-31; column 5, lines 13-21; figures ---	1
A	US-5297792-A (FRIEDMAN) 29 March 1994 (29.03.94) column 4, lines 3 - 53; column 4, line 66-column 5, line 5; column 5, lines 18 -30; column 6, lines 16 - 26; column 7, lines 3 - 14; column 8, lines 46 - 59, figures 1- 5, 16, 18 ---	2-5
P,A	WO-9628229-A (CARAMES) 19 September 1996 (19.09.96) claims 1-2; figures ---	1
A	US-4040621-A (BARLOW et.al.) 9 August 1977 (09.08.77) abstract; figures ---	1
		-/--
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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		Date of mailing of the international search report
15 December 1997 (15.12.97)		19 December 1997 (19.12.97)
Name and mailing address of the ISA/ S.P.T.O.		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES 97/00218

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO-9524247-A (CARAMES) 14 September 1995 (14.09.95)	
A	US-5344142-A (BARREIRA) 6 September 1994 (06.09.94)	

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