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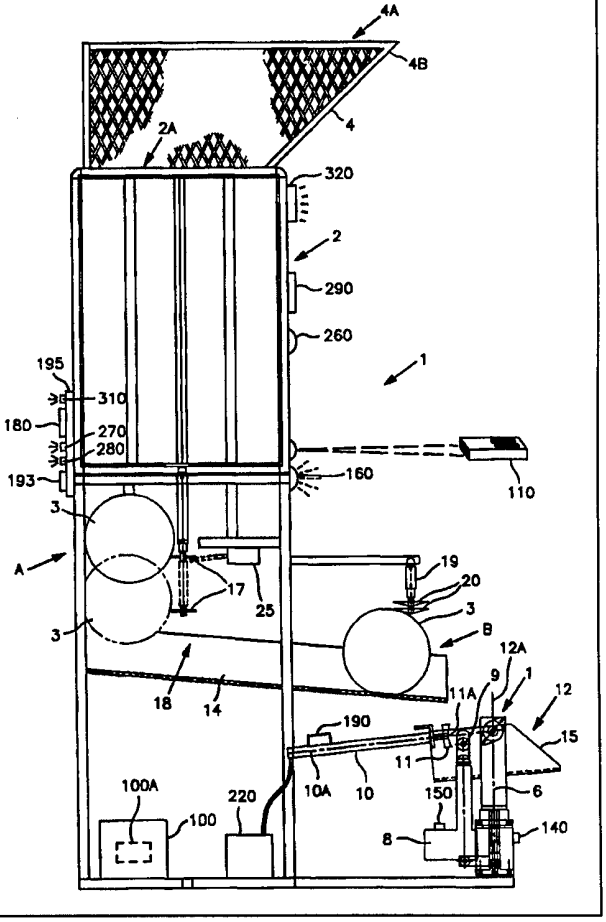
(54) Title: PROGRAMMABLE BALL EJECTION MACHINE

(57) Abstract

A ball ejection apparatus is provided. Balls are released from a ball storage means and positioned into a ball ejection means (5) where they are launched at a selected velocity and trajectory. The ejection means (12) is capable of a sweeping motion both horizontally and vertically in order to determine the ejection direction and azimuth, the ejection means (12) is capable setting the ejection speed. The balls are released to a ball holder (15) out of a ball storage means (2) and through a ramp (14) and then singly through a release system (19, 20). The ejection direction and ejection speed can be controlled through an instruction set program or through the remote control unit (110). The system offers various possibilities for the training or for the practice of a ball sport, in particular, basketball.



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TITLE: PROGRAMMABLE BALL EJECTION MACHINE

FIELD OF THE INVENTION

This invention relates generally to a ball ejection machine and more particularly to a basketball ejection machine designed to automatically shoot balls to a player at locations on a basketball court in accordance with an instruction set program, thereby increasing the efficiency of a practice session of basketball or possibly other games where proficiency can be improved by a programmed ball return system.

BACKGROUND OF THE INVENTION

The present invention is used to shoot balls to a player at selected locations on a practice court. The invention is particularly useful in returning basketballs to a player on the court during a practice session. Invention and use of such ejection machines is known to the public.

As for example, patent U.S. 4,579,340 to Craig and Scott Jenkins in 1986 details a portable basketball return device to be positioned on a basketball court underneath a basket into which shooting practice is to be conducted. The device includes a base with a ball-return mechanism and a vertically extending chute projecting upwardly from the base and terminating in a hoop-like top opening, to be positioned directly beneath the basket. The ball-return mechanism includes a horizontal ball-collection

and dispersion tube mounted in the base for swinging movement about a vertical axis so that the tube may be positioned to direct balls through an open end thereof to a required location on the court. The ball-return mechanism includes a solenoid operated plunger carried at the back of the tube for projecting balls therethrough. The device may further include various electrical controls for automatically and semi-automatically operating the ball return mechanism.

Similarly, patent U.S. 4,714,248 issued to Richard Kloss in 1987 details a ball return device that returns balls to a player in order to perform repetitive practice routines. The device comprises a receiving basket which may be placed under a basketball hoop and which directs a ball to a pair of rotating heads operable to propel the ball toward the player. A detection apparatus on the return device is operable to sense the distance between a player and the return device. When the distance between the player and the return device is within a zone of acceptable distances, an output signal is generated which causes the return mechanism to eject a ball toward the player.

While Kloss' invention improves upon that of Jenkins, both patents, which constitute the present state of the art, lack several features desirable in such a machine. One of the biggest disadvantages of the prior art is that that they are only effective if the player makes the shot. The intention of each a machine is to eliminate time spent retrieving balls, but both of these machines limit their benefits to returning balls only when a shot is successful, i.e., placing the ball into the basket, as it is only

then that a ball is able to be captured by the device and ejected to the player. Thus, when a player misses a shot, the ball must be manually retrieved as usual. This greatly diminishes the benefits of the prior art devices.

Kloss' invention attempts to remedy this weakness by providing an alternate method of use for the device. In this use, several balls can be stored in the mechanism for delivery to a player at timed intervals. This option could potentially increase the invention's benefits, except that the device can hold only a limited number of balls at a time. Thus, even if the invention can eject a series of balls, the number of balls in each series is relatively small, thereby requiring that the player more frequently stop practicing, retrieve balls and replace them in the machine. Additionally, this invention makes no provision for placing the ball at any particular location, but rather merely returns the ball to the sensed position of the player. This does not readily lend the machine to being used in drills when it is desired to shoot a series of shots from a plurality of particular locations.

Jenkins' invention, on the other hand, refers to optional equipment that could be added to automatically return balls to certain designated locations on the court. However, a significant problem is, once again, that the device is capable of housing only a limited number of balls. In addition, the device makes no allowances for returning balls at a certain interval, and, as such, balls would not be ejected at regular intervals. As a result, the ejection time of each ball would likely vary slightly, and thus could potentially catch a player off guard and lead to injuries. This possibility of

injury is compounded by the fact that the invention fails to provide a safety feature that ensures that a ball will not be ejected when a player is too close to the ejection unit.

SUMMARY OF THE INVENTION

The present invention is a programmable ball ejection machine that shoots balls to a player at either a designated single location or at a preprogrammed set of locations using an instruction program. The program directs the setting of ball speed, angle of loft and direction, and further sets the frequency of ball ejection. The invention has a wide range of uses, and is especially beneficial for improving basketball training. Therefore, it is an object of the invention to provide a ball ejection machine for multiple and optimal use, especially, but not limited to, basketball training.

The machine has an adjustable ejection means and a ramp to feed balls to the ejection mechanism. The machine is fully automatic and it ejects balls in various selectable directions over a range of speeds, according to any one of a plurality of instruction sets or programs. Therefore, it is an object of the invention to more effectively simulate actual game conditions and passes by providing broad freedom in the selection of ejection speeds and directions.

It is another object of the invention to provide programs that automatically direct a series of balls to various specified locations at specified time intervals. This provides

for improved training by conditioning the player to achieve accuracy from a wide variety of different court locations.

It is another object of the invention to significantly decrease the amount of time the player must spend retrieving balls. This is accomplished by providing a storage means with sufficient storage space to hold approximately 25 balls, so that the device can eject balls according to a specified program without necessitating that the player reload balls.

It is another object of the invention to provide greater efficiency by allowing the direction, speed and program pattern of each ejected ball to be regulated with a hand-held remote control unit. This advantageously allows a coach or the like a wide range of freedom to control the ball ejection machine from any chosen location in order to train the player more effectively. Additionally, everything that can be controlled from the remote control unit can also be regulated from a control panel at the rear of the machine.

Additional features might include infrared and/or laser sensors in order to detect the player's position and return a ball to the player wherever the player may be on the court, a net extension which may be raised by pneumatic cylinders to a position under the net, in order to better catch balls missing the hoop, and an air hose with an inflation needle attached to the back of the machine in order to properly inflate balls.

Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the invention. In such drawings:

FIGURE 1 is a side elevational illustration of the invention showing the movement of a ball from a hopper (A) into a position ready to enter an ejection means (B);

FIGURE 2 is a front elevational illustration thereof, showing the placement of the ball in an ejecting position (C);

FIGURE 3 is a top plan view thereof;

FIGURE 4 is a is a side elevational view of a mechanical schematic showing the components and their relationship in the ejection means thereof;

FIGURE 5 is a plan view of a portion of the diagram of Fig. 4 taken along line 5-5 and providing further details of the ejection means thereof;

FIGURE 6 is a block diagram defining the interrelationship of input elements relative to a control device thereof; and

FIGURE 7 is a block diagram defining the interrelationship of the output elements relative to the control device thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figures 1-7 define a ball ejection machine apparatus 1, herein referred to as the "machine 1". Although the machine 1 is primarily defined herein for the game of American basketball, it is potentially useful for other ball games such as baseball, football, and tennis, as well as games that do not use balls per se, such as hockey and badmitten.

The machine 1 is used for increasing the efficiency of a practice session of basketball. The machine 1 simultaneously holds a plurality of a ball 3 and may be used to return a ball 3 to a player (not shown) after a shot is made, thus saving the player valuable practice time that is normally consumed by retrieving ball 3. The machine 1 automatically collects ball 3 when it is shot into or, in one embodiment, near, a basketball goal hoop 5 (Fig. 2) above the machine 1, thereby decreasing the frequency of replenishing the ball 3 inventory within the machine 1.

As shown in Fig. 2, the apparatus includes a ball storage means 2 designed to receive and retain a plurality of the ball 3. The ball storage means 2 has a first aperture 2A positioned horizontally, at an upper distal end 2B of the storage means 2. In one embodiment, shown in Fig. 1, a funnel structure 4 is engaged within and extends upwardly from the first aperture 2A. A second aperture 4A defines the upper terminal end 4B of the funnel structure 4, the second aperture 4A having a horizontal girth large enough so that with the funnel structure 4 positioned and centered under a

regulation basketball backboard and basket hoop, the majority of ball 3 projected at the hoop will enter the funnel structure 4, regardless of whether or not they pass through the hoop. Alternately, as illustrated in Fig 2, the storage means 2 may be coupled to at least one upwardly extending support arm 7A which holds a basketball backboard 7 and hoop 5 above the first aperture 2A, thus providing for the machine 1 to be used anywhere that appropriate electrical power is provided, and not just on a basketball court.

As shown in Fig. 3, the ball storage means 2 includes a means for aligning 14 a plurality of said ball 3 into at least one vertical stack 14A, and preferably four vertical stacks 14A positioned in mutual adjacency. Preferably, as shown in FIG. 3, the aligning means 14 consists of vertical partitioning walls placed so that each ball 3 entering the first aperture 2A is diverted into only one of the vertical stacks 14A defined by vertical channels 18 which are sized so that each ball is positioned directly above the next so that jamming of one ball 3 with another ball 3 cannot occur upon release from the storage means 2. This is accomplished by sizing each of the channels 18 only slightly larger then the diameter of the ball 3, so that two of said ball 3 cannot compete for the same vertical position in the stacks 14A. It should be noted that basketballs tend to jam when more than one ball 3 attempts to move through a space where only one ball 3 will pass. This most often occurs when the space is at least 1-1/2 ball 3 diameters in girth, but does not occur when the space is less than 1-1/8 ball 3 diameters in size. The latter dimension is utilized in the machine 1 wherever more than one ball 3 is handled, such as in the storage means 2.

A ball load means 16 is provided so as to dispense said ball 3 from the vertical stacks 14A. There are numerous possible embodiments of the ball load means 16 well known in the art. In one preferred embodiment, used because of its simplicity and because it completely avoids ball jams, as illustrated in Figs. 2 and 3, the ball load means 16 consists preferably of pneumatic cylinders positioned at the bottom of the storage means 2. The pistons of each of the two cylinders each control a plate 17 which can dispense ball 3 from two stacks 14A depending upon the cylinders positioning of the plate 17. These plates move between an upper position wherein space is not sufficient for the next ball 3 to drop, so that the ball is retained at position A, as shown in Fig. 1, and a lower position where enough space is available between the plates 17 and the sidewalls of each of the vertical channels 18 for at least one ball 3 to drop. Preferably, each plate 17 controls the ball 3 in two of the channels 18 of the storage means 2. The plate is controlled to snap back into the upper position immediately in order to prevent a further ball 3 to drop. Generally, two ball 3 at a time are dropped onto ramp 14. A retractable locking means 25 is positioned and supported near the plates 17. This device is able to lock the plates 17 in the upward position in order to lock-out operation of the machine and to prevent all of the balls from dropping out of the ball storage means when air pressure is lost, whereupon the plates 17 would slowly move to the lower position when the cylinders that control them are exhausted of air pressure.

Once dispensed from the vertical stacks 14A, each ball 3 is delivered from the storage means 2 to an ejection means 12 via the ramp 14. The ramp 14 includes a ball load means 19, preferably another pneumatic cylinder which drives a second release plate 20 between a lower position and an upper position, as best seen in FIG. 1. In the lower position, the ball 3 that is closest to the ejection means 12 is prevented from entering the ejection means 12, and in the upper position the same ball 3 is allowed to roll forward and fall into the ejection means 12, i.e., the ball holder 15. It has been found by experimentation that the ability to hold more than one ball 3 on the ramp 14 is necessary to providing a steady stream of ball 3 for ejection without jamming and in such readiness that the repetition rate of ball 3 ejection may be quite rapid.

The ejection mechanism 12 includes a propelling means 10 positionable with the ball holder 15 to an inclination angle of between about five degrees and about 46 degrees. Accordingly, ball 3 may be ejected in a steep or level trajectory, by propelling means 10, preferably an air driven cylinder (Fig. 1), which provides injection plate 11 for actually contacting and pushing the ball 3. The front surface 11A of the ejection plate 11 is spherical in shape so as to contact the ball 3 over a desired surface area, the radius of curvature of the front surface 11A being approximately equal to the that of the ball 3.

Ball 3 of different diameters may be ejected from the machine 1. This is easily accomplished by changing the size of the vertical channels 18, and the plates 17, and release means 20. Ball holder 15 is used preferably to hold the ball 3 just

prior to ejection. This holder 15 presents a concave surface, as seen in Fig. 2, to the ball 3 so that a ball 3 having a diameter different from a standard basketball is still automatically centered in the holder. Preferably, the longitudinal axis 10A of the propelling means 10 is positioned slightly higher then the axis 15A of the ball 3 so that the ball 3 tends, during ejection, to be lifted slightly off the ball holder 15 and in this way, friction and jamming is diminished.

As best illustrated in Figs. 4 and 5, the propelling means 10, together with the ball holder 15, and an angle drive means 8 is driven as a unit by a direction drive means 6, preferably a linear motor, so as to sweep left and right about a vertical axis 12A. The sweeping movement of this unit about the vertical axis 12A is enabled by the direction drive means 6 in that the unit is mounted upon a vertically oriented rotational shaft 6A having a sprocket 6B engaged with the shaft 6A. A drive chain 6C engaging the sprocket 6B, is connected at one of its ends 6C' to the linear motor of the directional drive means 6, and at the other one of its ends 6C'' to a linear spring 6D, which, in turn, is fixed at its distal end 6D'. To enable rotation of the unit in a first rotational sense, the linear motor 6 releases the chain drive 6C against tension from the spring 6D, thereby turning the sprocket 6B and vertical axle 6A in the first rotational sense. To enable rotation in the second (opposing) rotational sense, the linear motor 6 draws the chain 6C toward it, thereby extending the linear spring 6D, and again rotating the sprocket 6B, this time in the opposing direction. The use of linear motors has been found to be more precise and rugged, then using motors having rotating shafts.

The inclination of the ball holder 15 is changed by pivoting one end 15A, about a pivot rod 15B. Preferably the forward end 15A of the ball holder 15 is driven by a second linear motor. The propelling means 10 is preferably attached to the ball holder 15 so that its angle of inclination is changed with the ball holder 15. The direction drive means 6 positions the ball holder 15 and propelling means 10 at any horizontal position over a span of 180 degrees. With the machine 1 positioned under the basket on the basketball court, 180 angular horizontal degrees enables placement of an ejected ball 3 in any direction of play on the court. With the angle of ejection with respect to the horizontal adjustable within a range of about 45 angular degrees, the ball 3 may be projected with any selected trajectory desired. With the force of ejection set over a range of choice, the ball 3 may be projected to a corresponding desired distance. With full control over the above described variables, plus the repetition rate of ball 3 release, i.e., the time delay between releases, a single, or many of the ball 3 can be ejected as necessary to complete a simple or complex ball release program of practice in accordance with a control instruction set 100B. The machine 1 may contain a variety of such program sets 100B so as to be varied from one practice session to the next or in accordance with the needs of various players having varying needs or proficiencies.

Overall operation of the machine 1 is controlled by a master control device herein referred to as "program logic controller" or PLC 100, preferably a computer based, digital device capable of executing a program set 100B of play instructions as

well as preprogrammed operational instructions. Such a PLC 100 could be a general purpose microcomputer as is well known for many similar applications. In Fig. 6 is shown a block diagram of the interconnection of several devices providing status and event signals to the PLC 100. From the upper left in the diagram, we find that a hand held remote control device 110, see Fig. 1, may be used with the PLC 100 to provide directions and instructions during startup and operation of the machine 1. Such a system is not described in detail here as it is well known in the art, as in remote control device technology used in consumer television, stereo systems and toys. Further, two sensors 120, 130, "Sensor-Ball Load", and "Sensor -Ramp", see Fig. 2, respectively, are used to determine if a ball 3 is in the ball holder 15 ready for ejection, and on the ramp 14 ready for dropping into the ejection means, respectively. These signals might be produced by light beam sender and receiver devices which are in common use on assembly lines and other application, or these devices may be other sensors well known in the field of feedback control. Two additional sensors are used in providing information to the PLC as to direction of ejection and angle of release, referred to as "Sensor-Direction" 140 and "Sensor-Azimuth" 150 respectively, see Fig. 1. These sensors might be rheostats or equivalent devices within any of a large number of well known circuits for providing an analog signal which could be converted to a digital signal by a common D/A circuit. "Sensor-Proximity" 160 refers to a device positioned at the front of the machine 1, see Fig. 1. Such a device senses the presence of an individual near the front of the machine 1 especially when a ball 3 is ready for release. Such a situation is dangerous since ball 3 is released, at times, with considerable velocity. Such a sensing device is most effectively deployed as an

infrared heat sensing device or sonar motion detector in a circuit for producing a signal compatible with the PLC. These devices and their attendant circuits are notoriously well known in the art. The "Sensor-Goal" 170 is a sensor, preferably similar to the "Sensor-Ramp", such as a light or sonar device, for instance, that is positioned on the basketball hoop ring or goal 5 so as to detect a ball 3 moving through the hoop 5, see Fig. 2. This information is transmitted to the PLC. The "Card reader" 180 is a standard credit card reading device as is found at banks and in supermarkets and is very well known. In the present case, the card reader is functionally set up to read a card of a coach or a player, for instance, and to set an amount of time the player is permitted, or to allow the coach, by virtue of his identification, to reprogram the machine 1 via a control panel 195 mounted to, and hard-wired to, the machine 1, preferably at the rear, see Fig. 1. The "Sensor-air pressure" 190 is a standard air pressure sensing device with a pressure-to-electrical conversion signal circuit, providing air pressure level information to the PLC, see Fig. 1. Air pressure information is necessary so as to control the pressure delivered to the ejection means. The "Modem Control" 193 consists of a device for receiving a phone line and, further, for receiving a data transmission over the phone line from a remote modem. Such a transmission may consist of machine 1 set-up instructions, or other data, and may include inquiry to the PLC for uploading data retained in a memory device 100A (Fig. 1), within the PLC 100. Machine 1 data acquisition technique and hardware are well known in the art. Generally, all of the input devices 110-195, as well as the controller 100 are well established in the prior art, but the combination of

these building blocks and their manner of use in the machine 1 is novel in the field of application, and first described herein.

In Fig. 9 is shown the output devices and their interconnections with the PLC 100. Starting at the upper left in this figure, we find that the PLC controls the direction drive means 6 for left and right scan of the ejection means 12, and the angle drive means 8 for up and down scan of the ball holder 15. Also controlled is the velocity control 220, a means for changing the air pressure delivered to the propelling means 10, preferably an air cylinder device as shown in Fig 1. Additionally, the PLC controls a shot warning signal 260 which may be a warning light or a warning buzzer or both, and also generates a problem light 270 to indicate that there is a machine 1 problem, and a ready condition light 280 to indicate that the machine 1 is operable see Fig. 1. The machine 1 also includes a score board or score display 290 controlled by the PLC. The score display 290 displays the number of shots made successfully, or the percentage thereof, or other progress information, depending upon selection preferences programmed into the PLC 100 and selected through the control panel 300. As well, the PLC 100 controls validation of the user through a card validation device or reader 180 and displays status of the validation system through a light display 310 located on the control panel 300. The machine 1 includes a sound or music generating device 320 which is controlled by the PLC 100. This is used to automatically announce that a good or bad score has been reached by the present player. The announcement may be a prerecorded verbal message or a piece of appropriate music, etc. Finally, the PLC 100 controls a printer port 330 for local

downloading of statistical information relative to previous play as well as other information concerning the status of the machine 1 itself. Generally, all of the output devices, as well as the controller are well established in the prior art, but the combination of these building blocks and their manner of use in the machine 1 is novel in the field of application.

For training purposes, a program set 100B may be chosen that shoots ball 3 at pre-programmed settings and in directions unpredictable to the player. The speed by which the ball 3 is ejected is controlled by a variation of the air input into the propelling means 10. Further an optical and/or acoustical enunciator 320 is employed to indicate when each goal is made. The PLC 100 calculates and displays a players shooting percentage. In order to minimize injuries, one or more proximity sensors 160 are positioned on the front of the machine 1, the purpose of which is to disable the projection means 10 if there is a person in danger of being hit by an ejected ball 3.

Thus, in order for the player to utilize the present invention in the preferred method, the player must first push a start button to power up the machine 1. The player then uses up and down arrow keys on the control panel 195 to choose a program, and only one program lights up at a time, indicating the program to be activated. The player then pushes an "enter" key to activate the selected program. The scoreboard counts down ten seconds, and indicates each second with a chirp. When the ten seconds have passed, the first ball 3 is launched in the first position programmed.

There are numerous program instruction sets that can be incorporated into the present invention to provide maximum training benefits to the player. Each program set of instructions is defined for directing and controlling the machine for accepting input signals from the input devices and for controlling the machine for generating output signals for controlling the output devices, said devices being defined in Figs. 6 and 7.

The following are examples and descriptions of such programs. For program purposes, position numbers are given in terms of degrees. For each program, the user selects both the azimuth and the air power with which the balls are propelled, thus determining the approximate distance balls will be launched. The following programs include recommended launching distances. However, these distances may be increased when the player wishes to practice outside shots or decreased when the player wishes to practice inside shots. It should be noted that, unless otherwise indicated, the projection means rotates between positions automatically and immediately, thus allowing balls to be launched from a variety of different positions without interrupting the launch frequency.

PROGRAM 1 WARM UP

Recommended Distance: Set air power and azimuth to 14 feet.

Launch Frequency: One ball is launched every four seconds.

Description: Three balls are launched from each of nine different positions for a total of 27 launched balls, one ball being launched every four seconds. The first three balls

are launched from position 0. The propelling means then rotates to position 22.5 and launches the next three balls. The propelling means continues to rotate to positions 67.5, 90, 112.5, 157.5 and 180 after three balls have been launched from each preceding position.

PROGRAM 2 PASS AND MOVE

Recommended Distance: Set air power and azimuth for a distance of 17 feet.

Launch Frequency: One ball is launched every six seconds.

Description: 12 balls are launched from 5 different positions for a total of 60 launched balls. The first ball is launched from position 0. The propelling means then rotates to position 45 and a ball is launched. The propelling means then rotates to position 90, launches a ball, rotates to position 135, launches, and rotates to position 180 and launches. This cycle is then repeated, launching a ball from position 180, then 135, 90, 45 and 0. When the ball storage means is empty, the machine goes into pause mode to allow the player to retrieve and balls not captured by the ball storage means.

PROGRAM 3 FOUL SHOOTING

Recommended Distance: Set air power and azimuth for a distance of 15 feet.

Launch Frequency: One ball is launched every five seconds.

Description: 50 balls are launched from position 90.

PROGRAM 4 AROUND THE WORLD

Recommended Distance: Set air power and azimuth for a distance of 20 feet.

Launch Frequency: One ball is fired every four seconds.

Description: Five balls are launched from each of five different positions for a total of 25 balls. Five balls are launched from position 0, then the propelling means rotates and five balls are launched from position 45. This continues until the invention has launched five balls at position 0, 45, 90, 135 and 180.

PROGRAM 5 LOW POST

Recommended Distance: Set air power and azimuth for a distance of 7 feet.

Note: The purpose of this program is to practice short, inside shots such as lay-ups and dunks. Therefore, the air cylinder should be set at maximum elevation so that the player is able to catch the ball when it is approximately 9 feet above the ground.

Launch Frequency: One ball is launched every ten seconds.

Description: 25 balls will be launched from each of two positions for a total of 50 launched balls. The first 25 balls are launched from position 45. When the 25th ball has been launched, the machine goes into pause mode while the player fills the storage means with any missed balls that were not automatically funneled into the storage means. To re-activate the program, the pause button is simply pressed. The scoreboard gives a ten second countdown, and then proceeds to launch 25 balls from position 135.

CLAIMS

What is claimed is:

1. A ball ejection apparatus comprising:

a ball storage means having a first aperture positioned for receiving a plurality of a ball used for sport, the first aperture positioned appropriately for receiving the ball during play, and further including a means for aligning the plurality of said ball in at least one vertical stack with each said ball directly above one another within the storage means;

a ball release means for dispensing at least one said ball from the at least one vertical stack;

an ejection means communicating with the storage means for receiving one of said at least one said ball dispensed from the storage means, the ejection means including a means for propelling said ball in a selected direction, at a selected angle with respect to the horizontal, and at a selected velocity.

2. The apparatus of claim 1 wherein the propelling means selected angle is between 5 angular degrees and 45 angular degrees above the horizontal, and the propelling means selected direction includes all angles in a range of 180 angular degrees.

3. The apparatus of claim 1 further including a ramp positioned and set at an angle for moving said ball from the storage means to the ejection means.

4. The apparatus of claim 1 wherein the means for aligning the plurality of said ball in at least one vertical stack within the storage means, results in four vertical stacks of said ball positioned in mutual adjacency.

5. The apparatus of claim 1 wherein the first aperture is positioned horizontally at an upper distal end of the storage means, the storage means further including at least one upwardly extending support arm holding a basketball backboard and hoop above the first aperture and in alignment thereto so as to receive said ball passing through the hoop.

6. The apparatus of claim 1 wherein the first aperture is positioned horizontally at an upper distal end of the storage means, the storage means further including a funnel structure engaged within the first aperture and extending upwardly therefrom, the funnel structure having a second aperture defining the upper terminal end of the funnel structure, and of such horizontal girth, that with the funnel structure positioned and centered under a regulation basketball backboard and hoop, a majority of basketballs projected at the hoop, but missing the hoop, enter the funnel structure.

7. The apparatus of claim 4 wherein the ball release means is positionable between an upper position preventing said ball from dropping from the storage means, and a lower position releasing at least one of said ball;.

8. The apparatus of claim 3 wherein the ramp includes a ball load means positionable between a position holding said ball from entering the ejection means, and a position wherein said ball is allowed to move into the ejection means.

9. The apparatus of claim 1 further including a control means in communication with the ball release, ball load and the ejection means for controlling same in accordance with at least one instruction set program, the control means receiving information and control instructions from a hand held remote control device, a first ball sensor positioned at the ball load means sensing the presence of a ball, a second ball sensor positioned at the ejection means sensing the presence of a ball, a direction sensor, an angle sensor, a modem control, an air pressure sensor, a card reader, a goal sensor sensing a ball moving through a hoop, and a proximity sensor sensing the presence of a person too near the ejection means so as to halt operation until said person is no longer too near the ejection means.

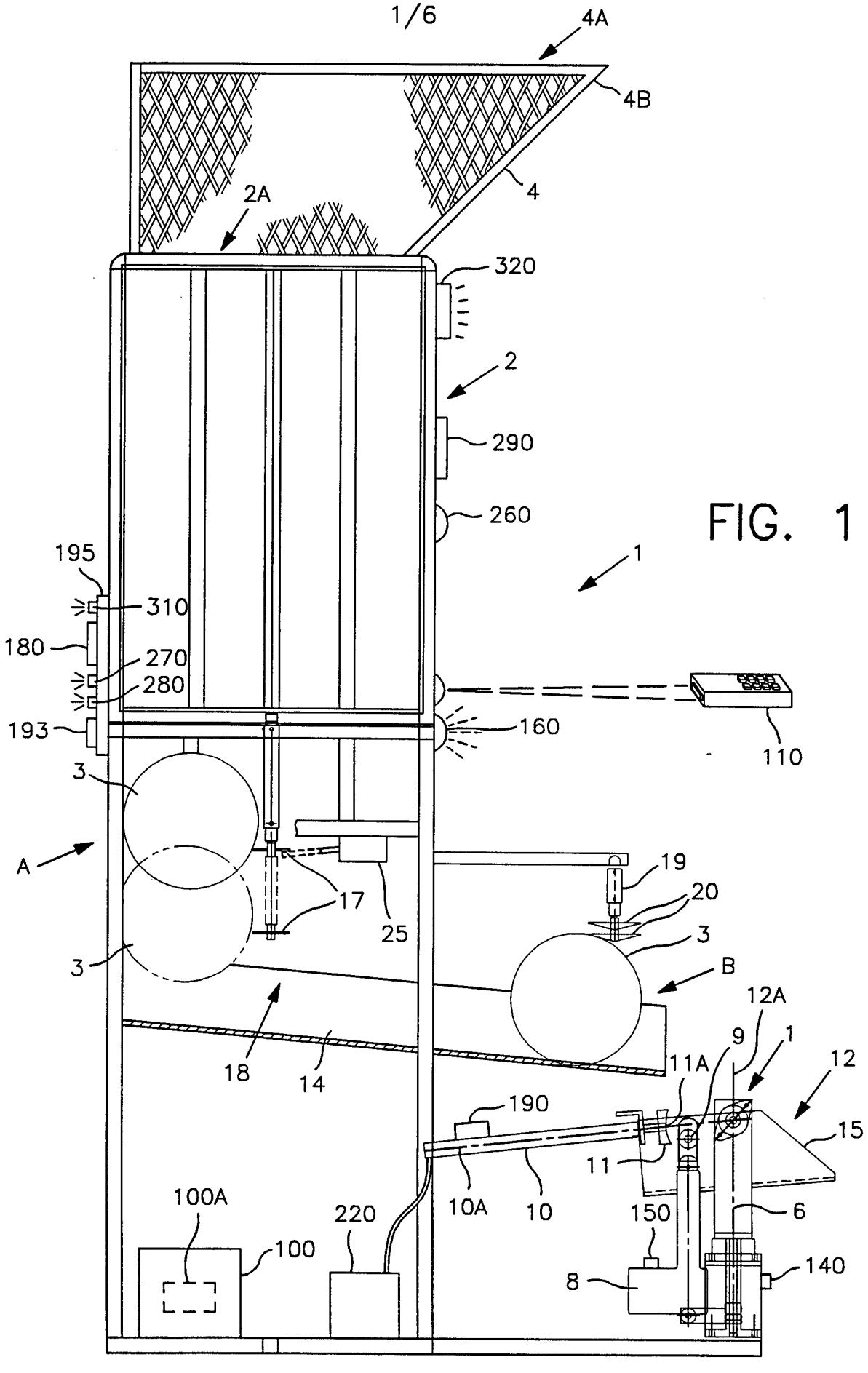
10. The apparatus of claim 9 wherein the control means is in communication with the direction drive means, the angle drive means, a shot warning means, a problem light, a ready condition light, a score board, a control panel, a printer port, a sound and music output means, a card validation light, a velocity control, a ball load means, and a ball release means.

11. The apparatus of claim 2 wherein the longitudinal axis of the propelling means is positioned slightly higher then the axis of the ball in the holding means, so that the

ball tends, during ejection, to be lifted slightly, and in this way, friction and jamming is diminished.

12. The apparatus of claim 7 further including a retractable locking means, the control means programmed for preventing the ball release means from moving into the lower position when air pressure is not conducted to the ball release means..

13. The apparatus of clam 9 further including at least one program set of instructions directing and controlling the machine for accepting input signals from the input devices and for controlling the machine for generating output signals for controlling the output devices.


4A
4B
4
2A
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2
290
260
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195
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180
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193
160
110
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A
19
20
17
25
3
B
12A
9
1
12
18
14
11A
15
190
11
10A
10
150
6
100A
220
100
8
140

FIG. 1

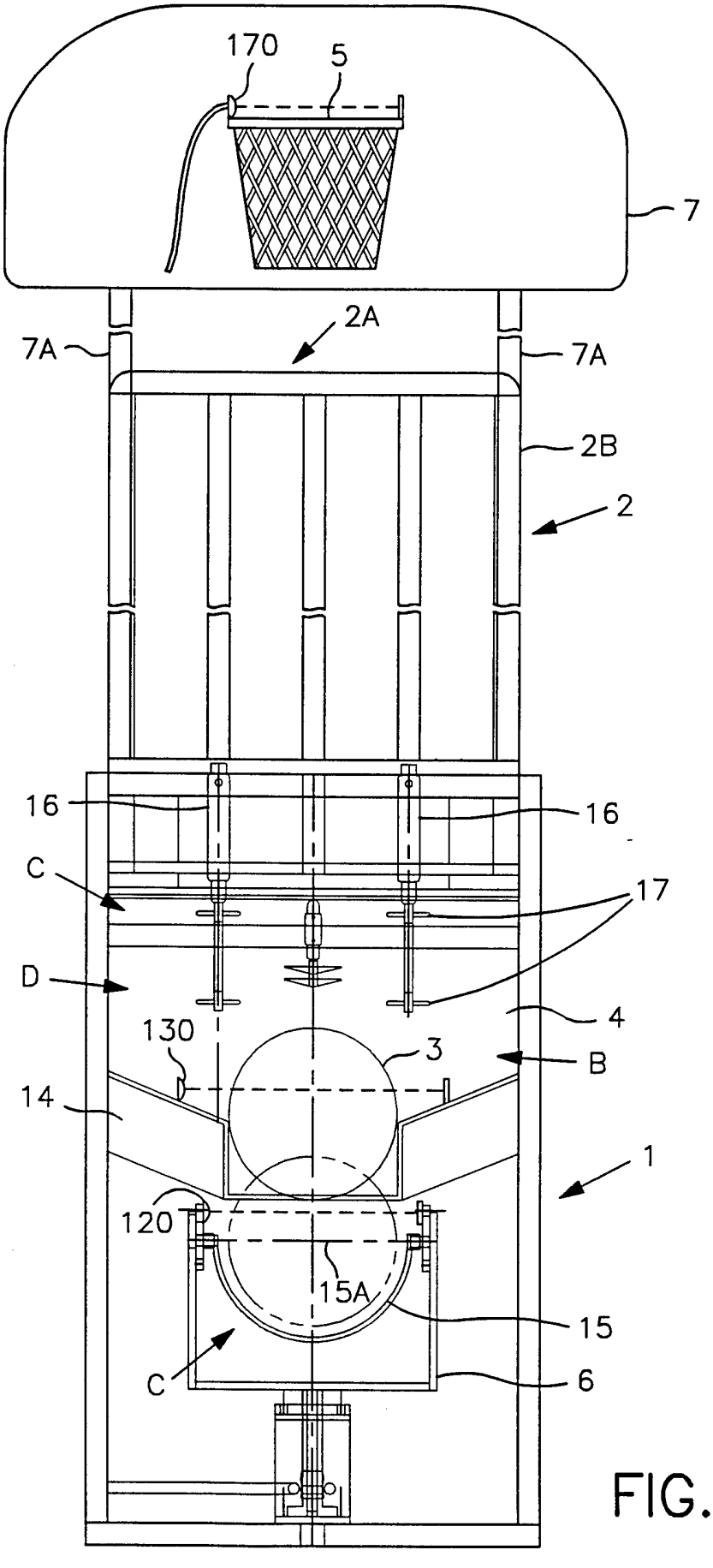

FIG. 2

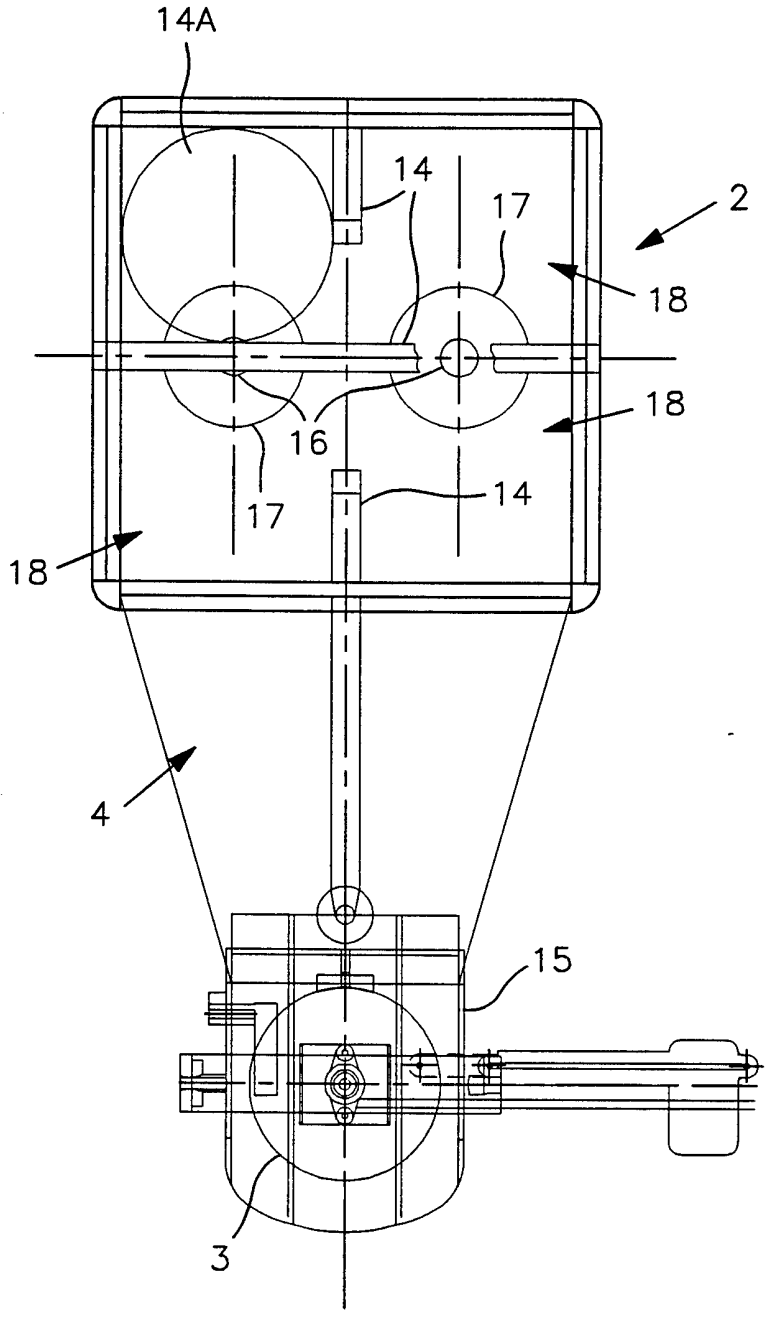

FIG. 3

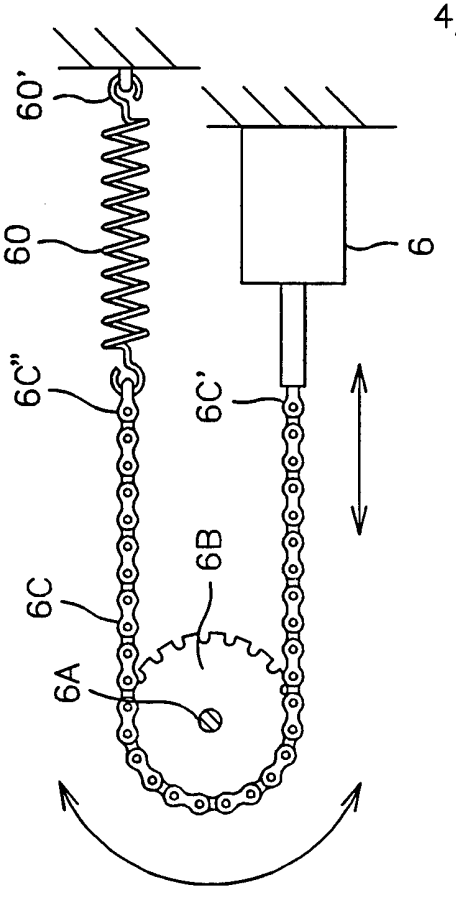

FIG. 5

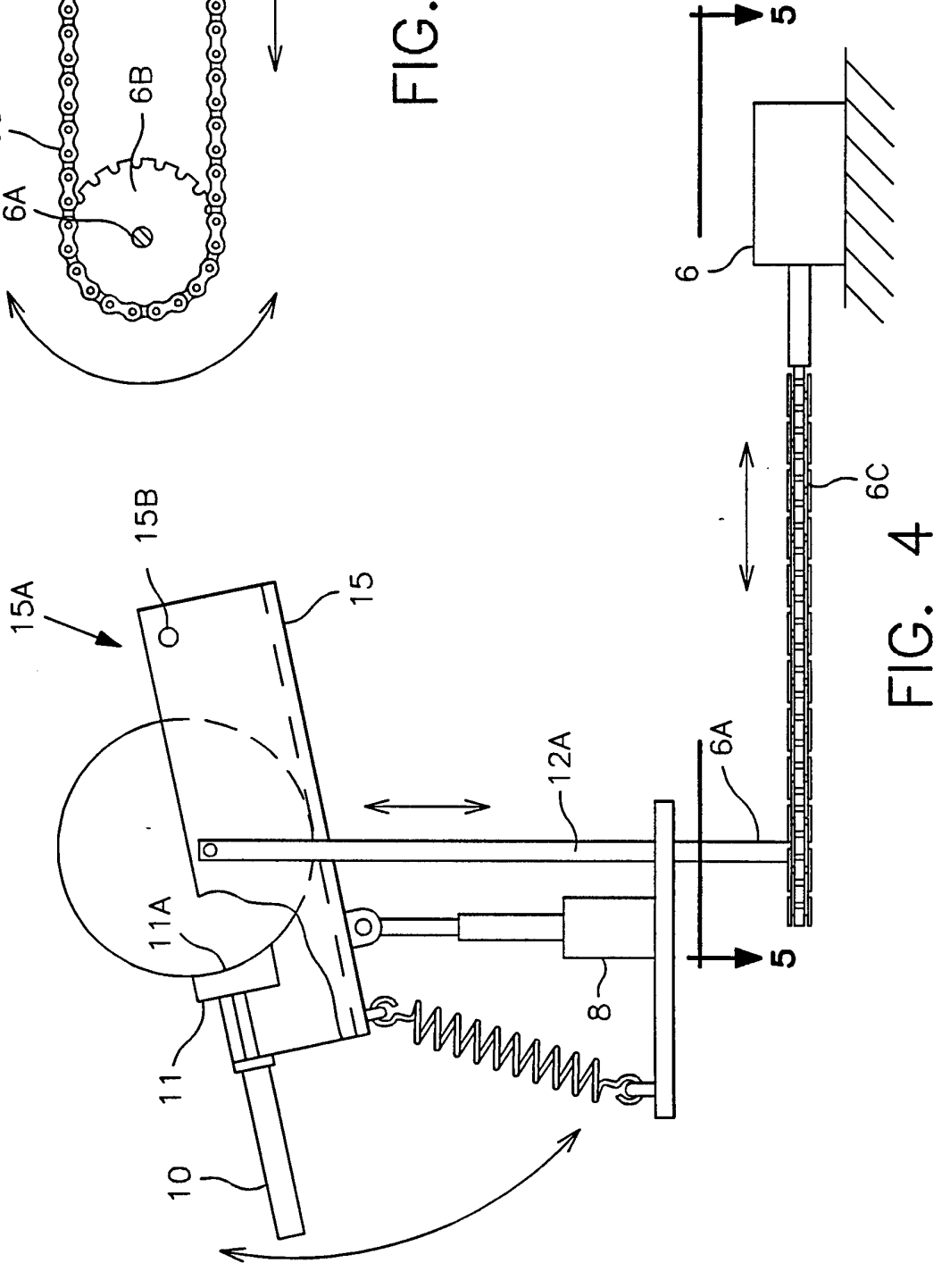

FIG. 4

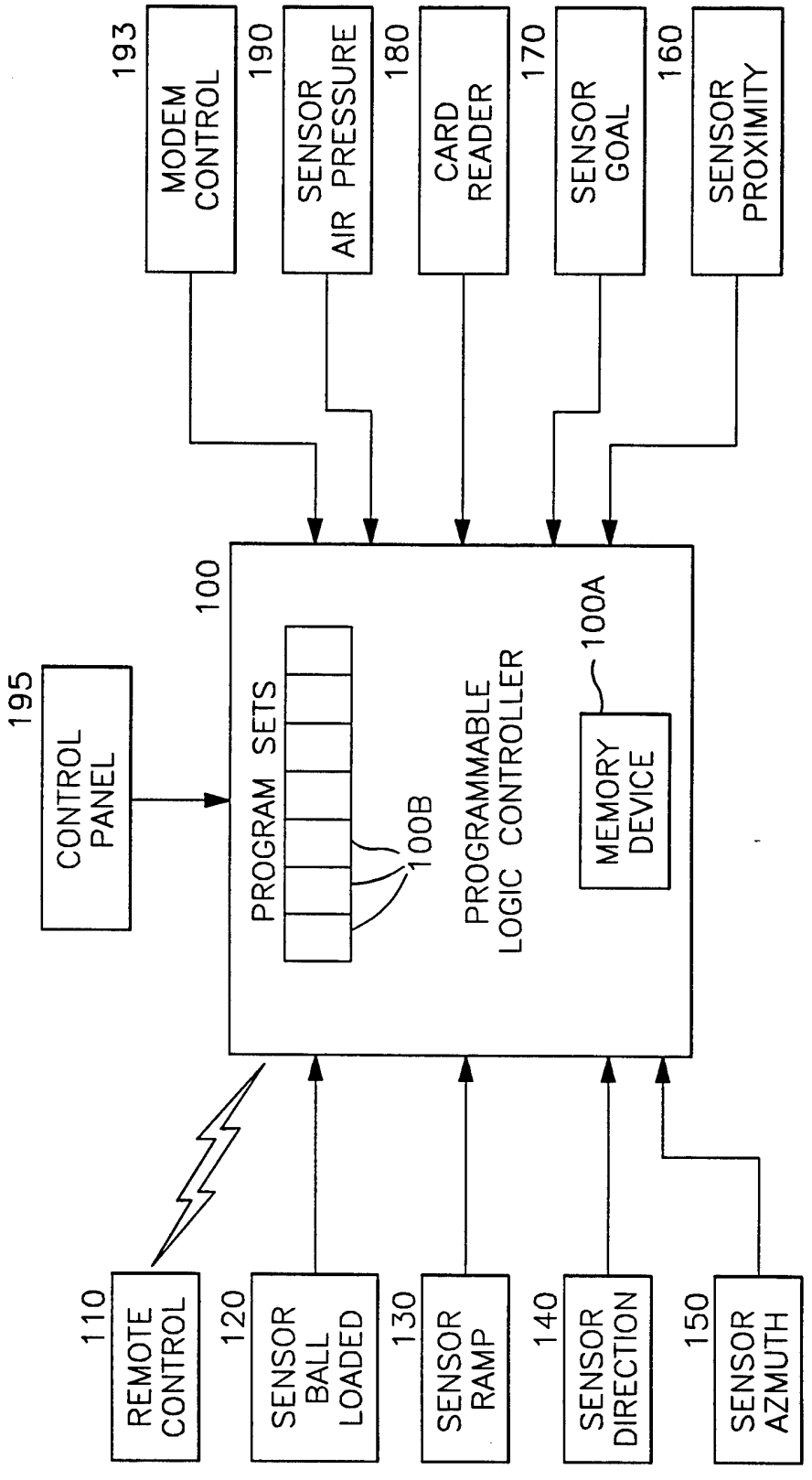
193
MODEM CONTROL
190
SENSOR AIR PRESSURE
180
CARD READER
170
SENSOR GOAL
160
SENSOR PROXIMITY
100
PROGRAM SETS
100B
PROGRAMMABLE LOGIC CONTROLLER
100A
MEMORY DEVICE
195
CONTROL PANEL
110
REMOTE CONTROL
120
SENSOR BALL LOADED
130
SENSOR RAMP
140
SENSOR DIRECTION
150
SENSOR AZMUTH

FIG. 6

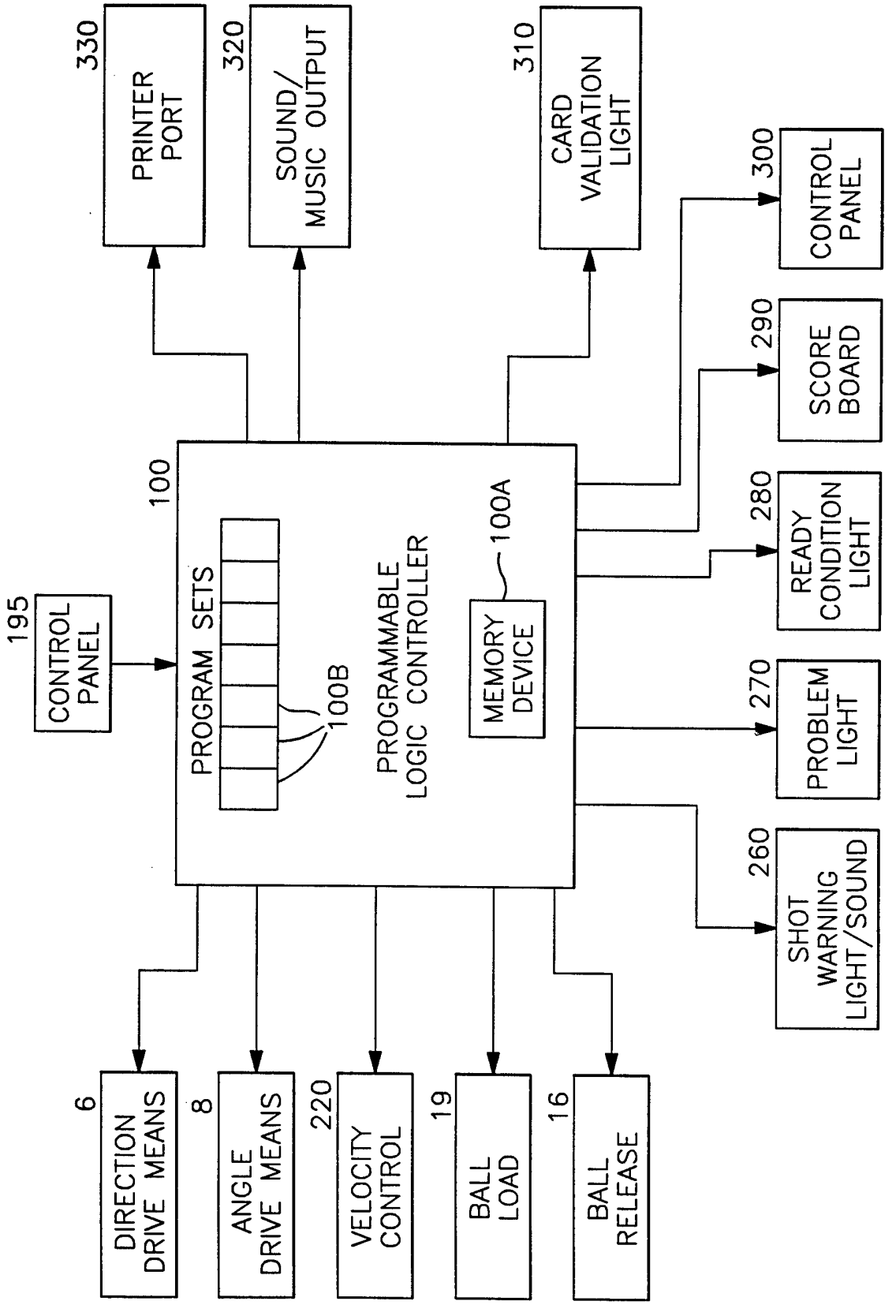
330
PRINTER PORT
320
SOUND/ MUSIC OUTPUT
310
CARD VALIDATION LIGHT
300
CONTROL PANEL
290
SCORE BOARD
280
READY CONDITION LIGHT
270
PROBLEM LIGHT
260
SHOT WARNING LIGHT/SOUND
195
CONTROL PANEL
100
PROGRAM SETS
100B
PROGRAMMABLE LOGIC CONTROLLER
100A
MEMORY DEVICE
6
DIRECTION DRIVE MEANS
8
ANGLE DRIVE MEANS
220
VELOCITY CONTROL
19
BALL LOAD
16
BALL RELEASE

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/06469

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A63B 69/40
US CL :124/34, 50, 61; 273/1.5A
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)

U.S. : 124/34, 48-50, 61, 78; 273/1.5A, 394-396

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

NONE

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

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,579,340 (JENKINS ET AL) 01 April 1986, see entire document.	1-6
Y	US, A, 4,714,248 (KOSS) 22 December 1987, see column 1 lines 13-15, and column 3 line 46 to column 4 line 9.	1-6
Y	US, A, 4,915,380 (ACKERMAN) 10 April 1990, see column 1 lines 48-51.	1-6
Y	US, A, 5,044,350 (IWABUCHI ET AL.) 03 September 1991, see column 4 line 46 to column 5 line 41.	1-6
Y	GB, A, 2 095 565 (CURTAYNE) 06 October 1982, see page 2 lines 33-65.	1-6

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

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 10 AUGUST 1995	Date of mailing of the international search report 21 SEP 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer PAUL E. SHAPIRO Telephone No. (703)-308-1816

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

INTERNATIONAL SEARCH REPORT

Int...ational application No.
PCT/US95/06469

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DT, A, 28 03 929 (KNOOP H) 02 August 1979.	1
A	DT, A, 25 25 974 (STAPELFELDT) 16 December 1976.	1
A	JA, A, 54-46637 (MASAKI TAKEI) 12 April 1979.	14
A	US, A, 3,659,576 (EADE ET AL) 02 May 1972.	1-14
A	US, A, 3,807,379 (VODINH) 30 April 1974.	1, 14
A	US, A, 4,108,432 (CLARK ET AL.) 22 August 1978.	1
A	US, A, 5,125,653 (KOVACS ET AL.) 30 June 1992.	1, 9
A	US, A, 4,122,822 (SCHEIWILLER) 31 October 1978.	11