(12) UK Patent Application (19) GB (11) 2 456 577 (13) A

(43) Date of A Publication 22.07.2009

(21) Application No: 0801059.7

(22) Date of Filing: 21.01.2008

(71) Applicant(s):
NRC Group PLC
Brickfield Business Centre, High Road,
Thornwood, EPPING, Essex, CM16 6TH,
United Kingdom

(72) Inventor(s):
Ronald Chalmers

(74) Agent and/or Address for Service:
Harrison Goddard Foote
40-43 Chancery Lane, LONDON,
WC2A 1JA, United Kingdom

(51) INT CL:
A63F 5/02 (2006.01) *A63F 5/00* (2006.01)

(56) Documents Cited:
GB 2363735 A **GB 1544962 A**
WO 2004/094013 A1 **WO 2001/030469 A1**
JP 090276477 A **US 3386740 A**
US 20070246883 A1

(58) Field of Search:
UK CL (Edition X) **A6H**
INT CL **A63F**
Other: **WPI, EPODOC, TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1, TXTWO1, TXTAU1.**

(54) Abstract Title: **Roulette wheel with ball return trapdoor**

(57) A roulette wheel apparatus includes a wheel 108 having compartments (not shown) around its circumference for receiving a ball 109, a floor 103 under the ball-receiving compartments, a motor 105 for rotating the wheel, a ball firing mechanism (114, 120, fig. 9), and a mechanism (113, fig. 9) for returning the ball from a particular compartment to the firing mechanism comprising a closable opening (103b, fig. 11) at a set location in the floor 103 arranged above the firing mechanism. The closable opening may comprise a rotatable flap or trapdoor (103b, fig, 11) with a motorised hinge, and the firing mechanism may comprise a firing chamber (114, fig. 9) with the flap or trapdoor forming a side wall of the firing chamber. The firing chamber may include a sensor 111 for detecting when the ball has been returned from the wheel 108. The wheel may include a datum sensor 107 and an additional sensor (111b, fig. 9) for detecting which compartment the ball has been received in. A roulette gaming system including wireless remote player terminals in communication with an automated wheel, and a biasing means for levelling a roulette wheel assembly, are also disclosed.

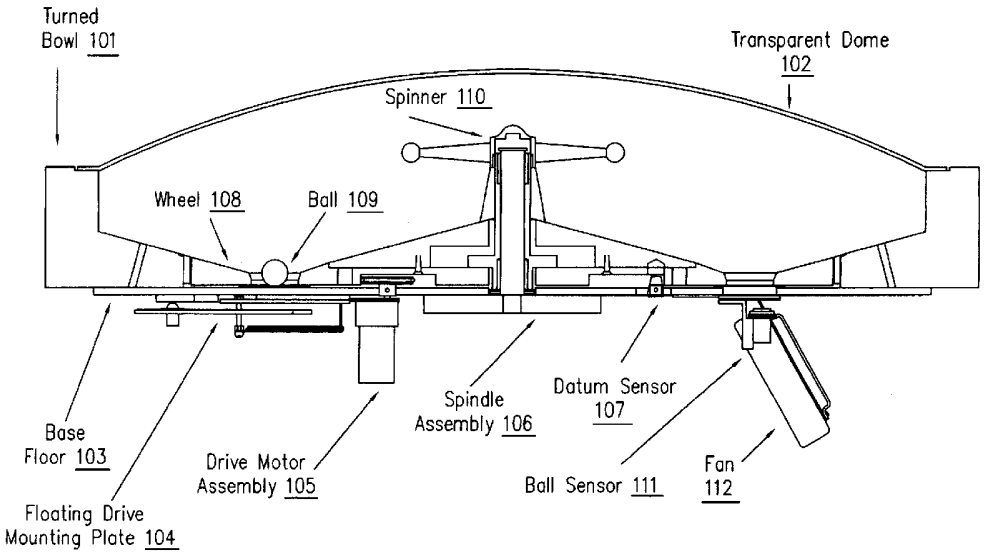


Figure 8

GB 2 456 577 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

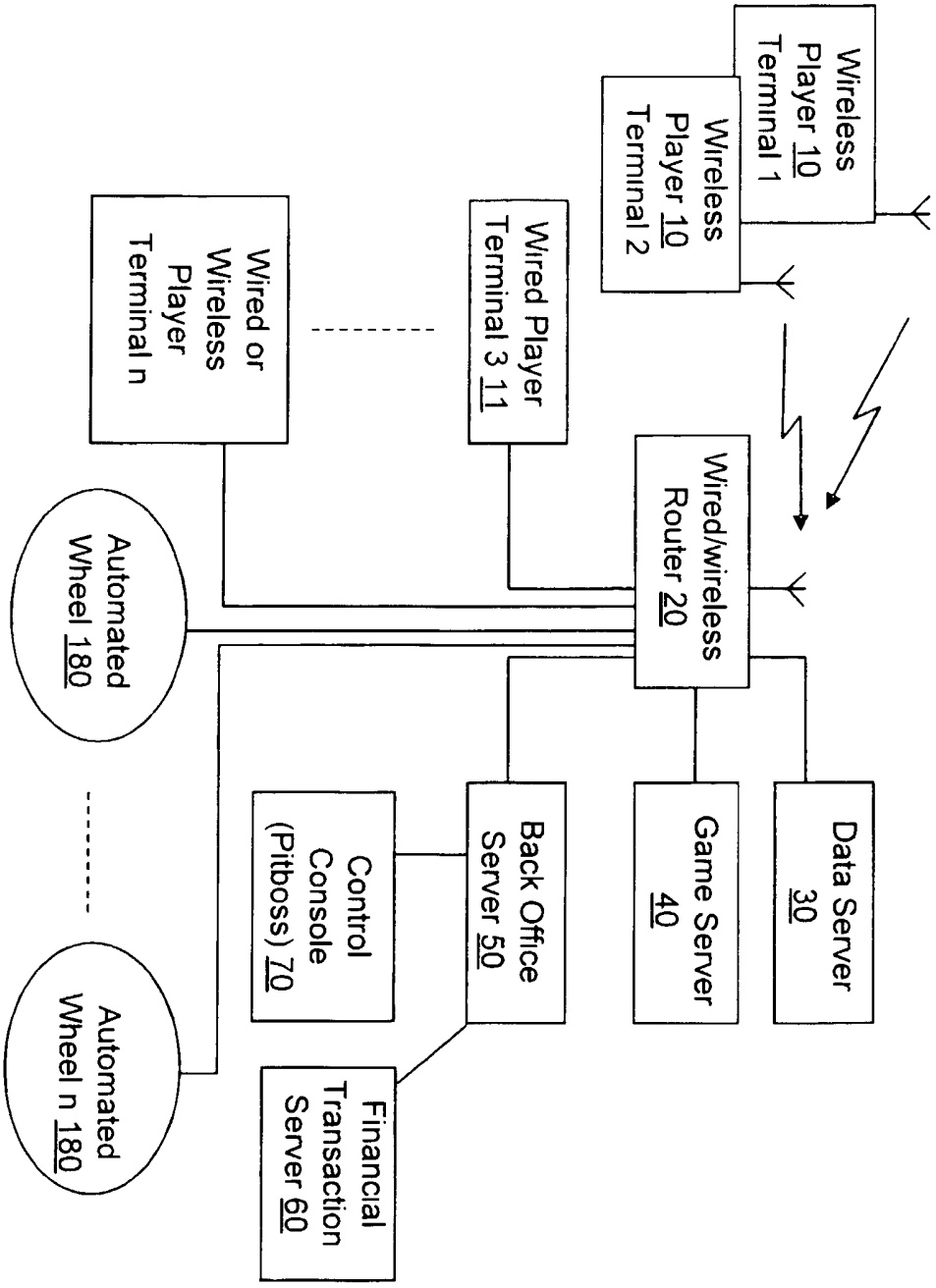

Wireless Player 10 Terminal 1
Wireless Player 10 Terminal 2
Wired Player Terminal 3 11
Wired or Wireless Player Terminal n
Wired/wireless Router 20
Automated Wheel 180
Automated Wheel n 180
Control Console (Pitboss) 70
Back Office Server 50
Financial Transaction Server 60
Game Server 40
Data Server 30

Figure 1

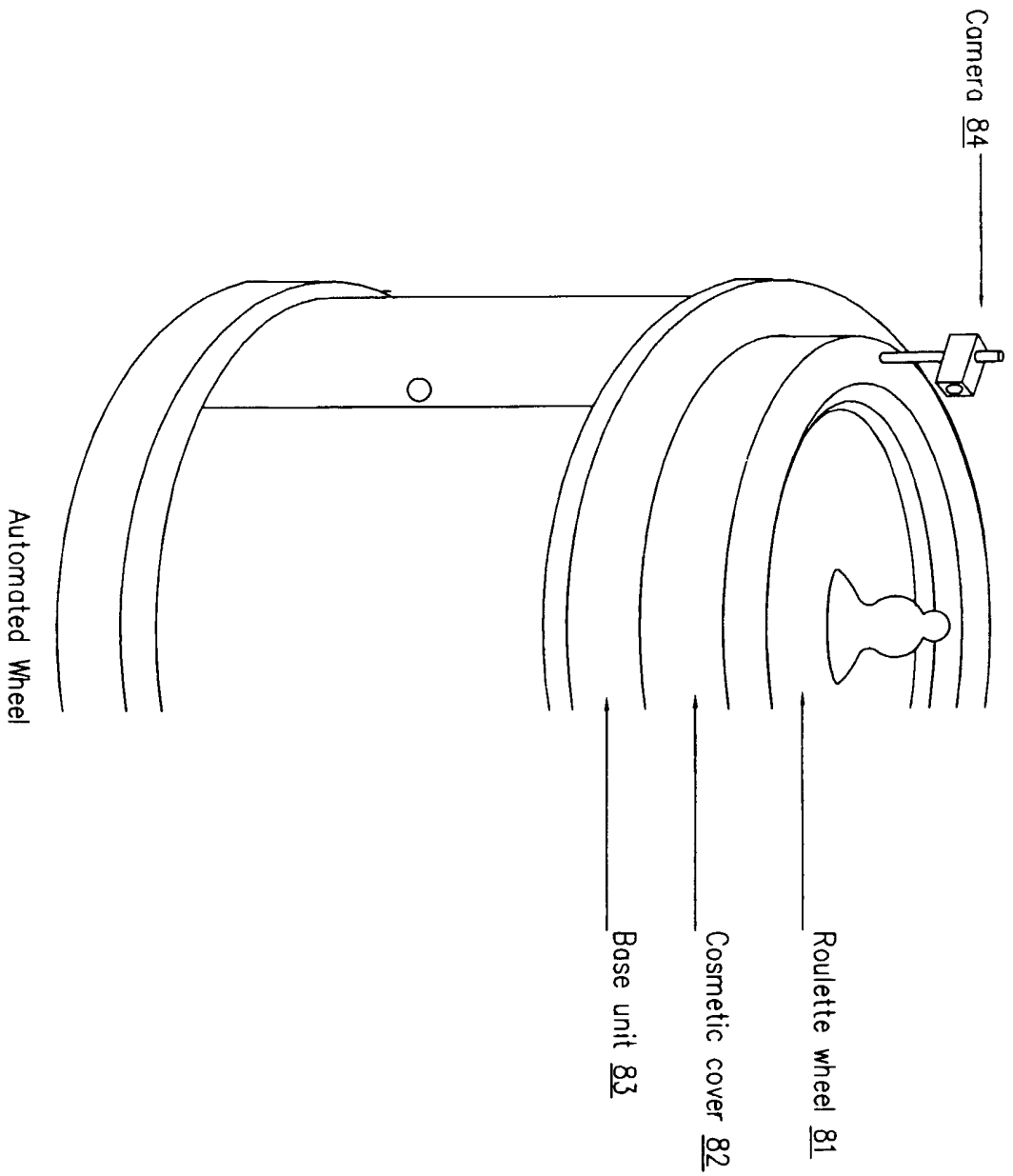

Camera 84
Automated Wheel 80
Roulette wheel 81
Cosmetic cover 82
Base unit 83

Figure 2

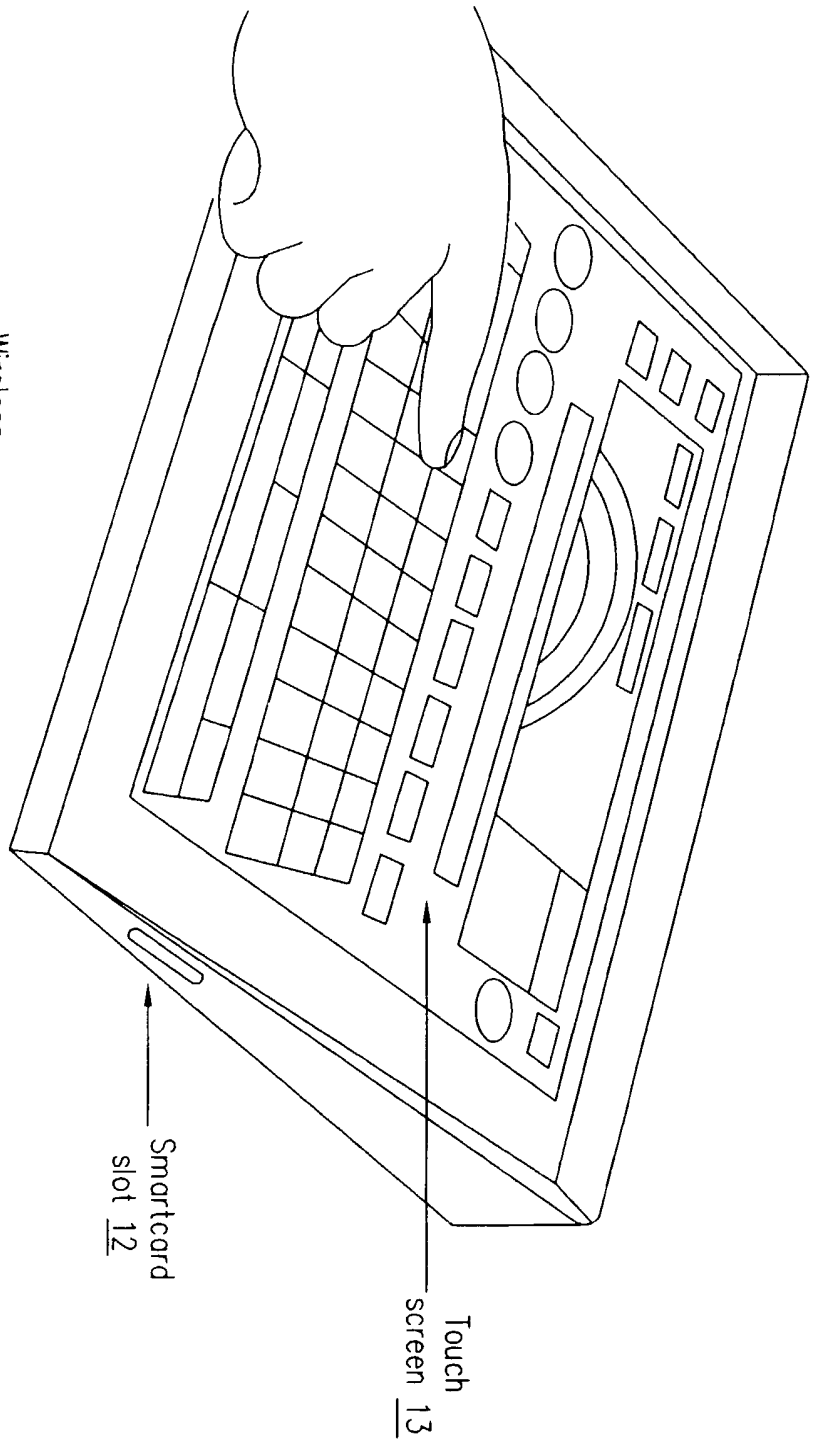

Wireless
Player
Terminal
10
Smartcard
slot 12
Touch
screen 13

Figure 3

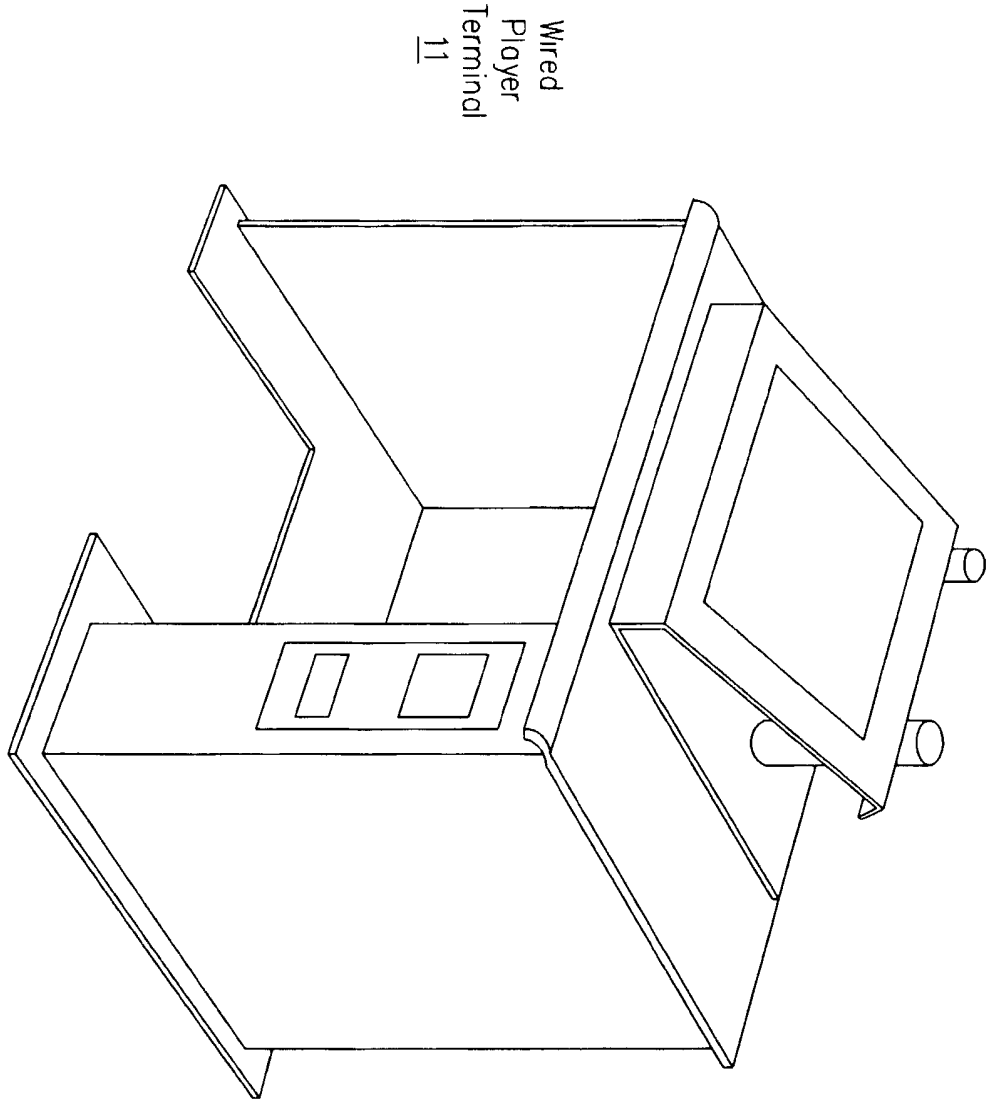


Figure 4

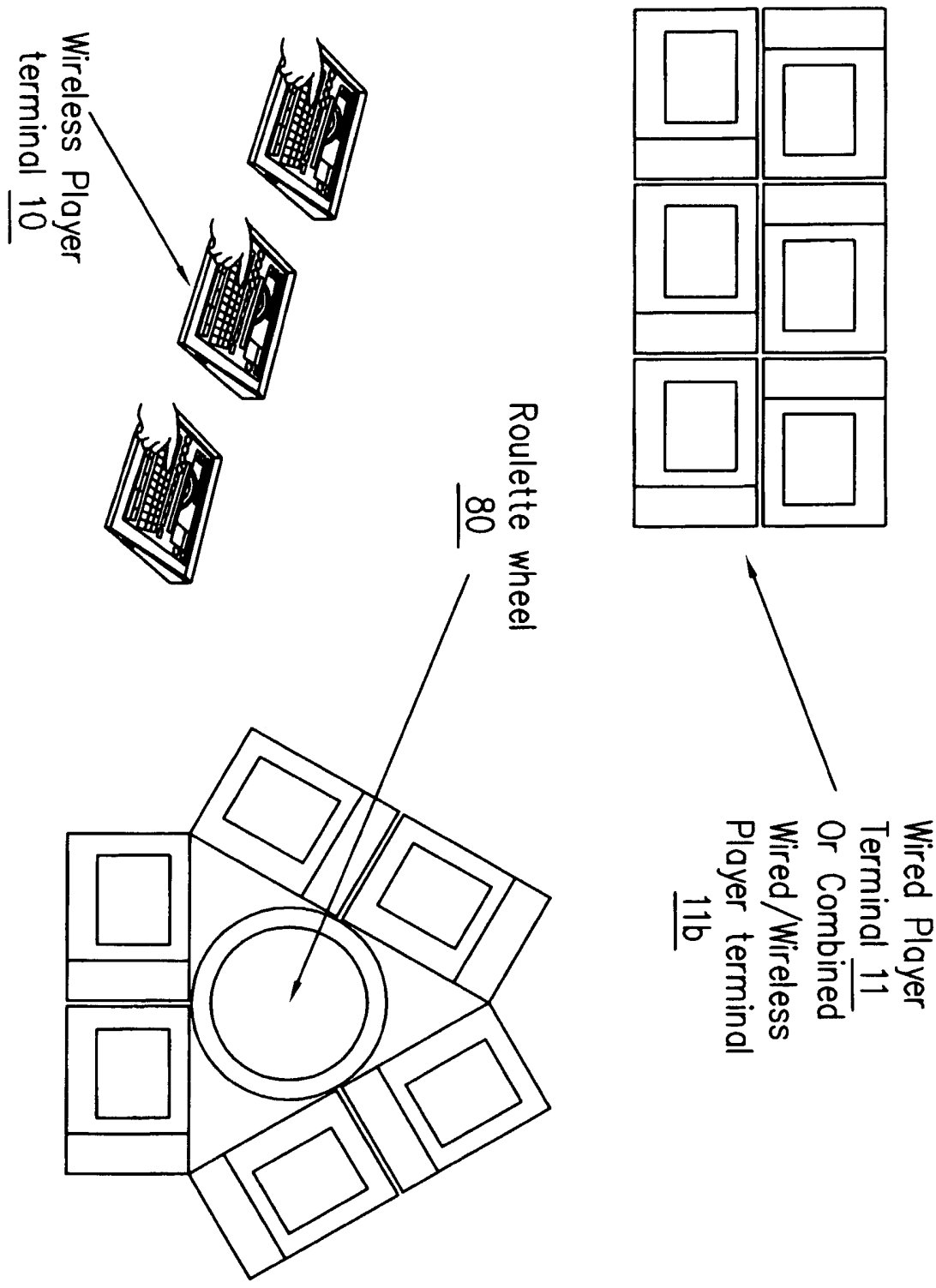

Wireless Player terminal 10
Roulette wheel 80
Wired Player Terminal 11 Or Combined Wired/Wireless Player terminal 11b

Figure 5

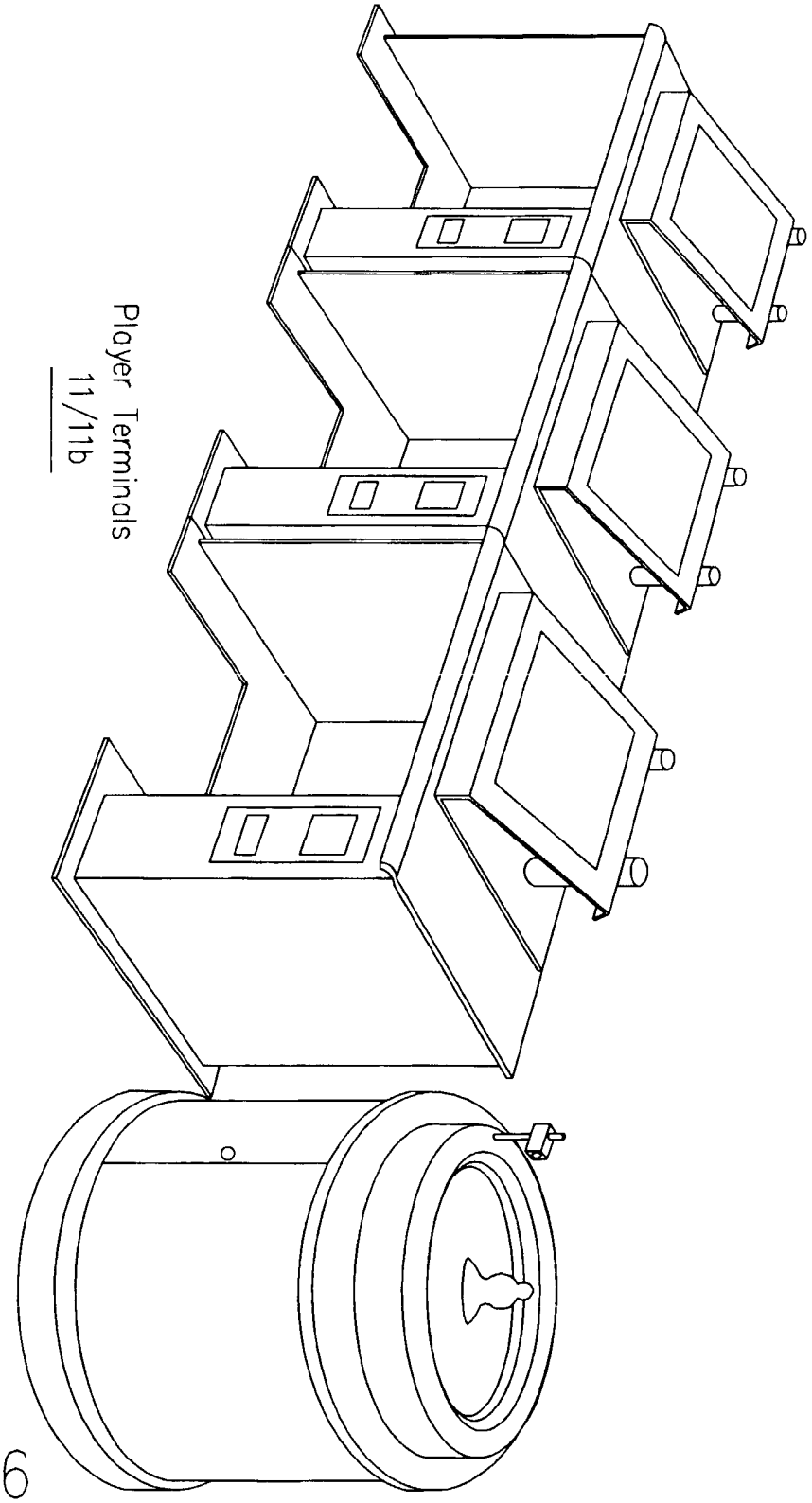


Figure 6

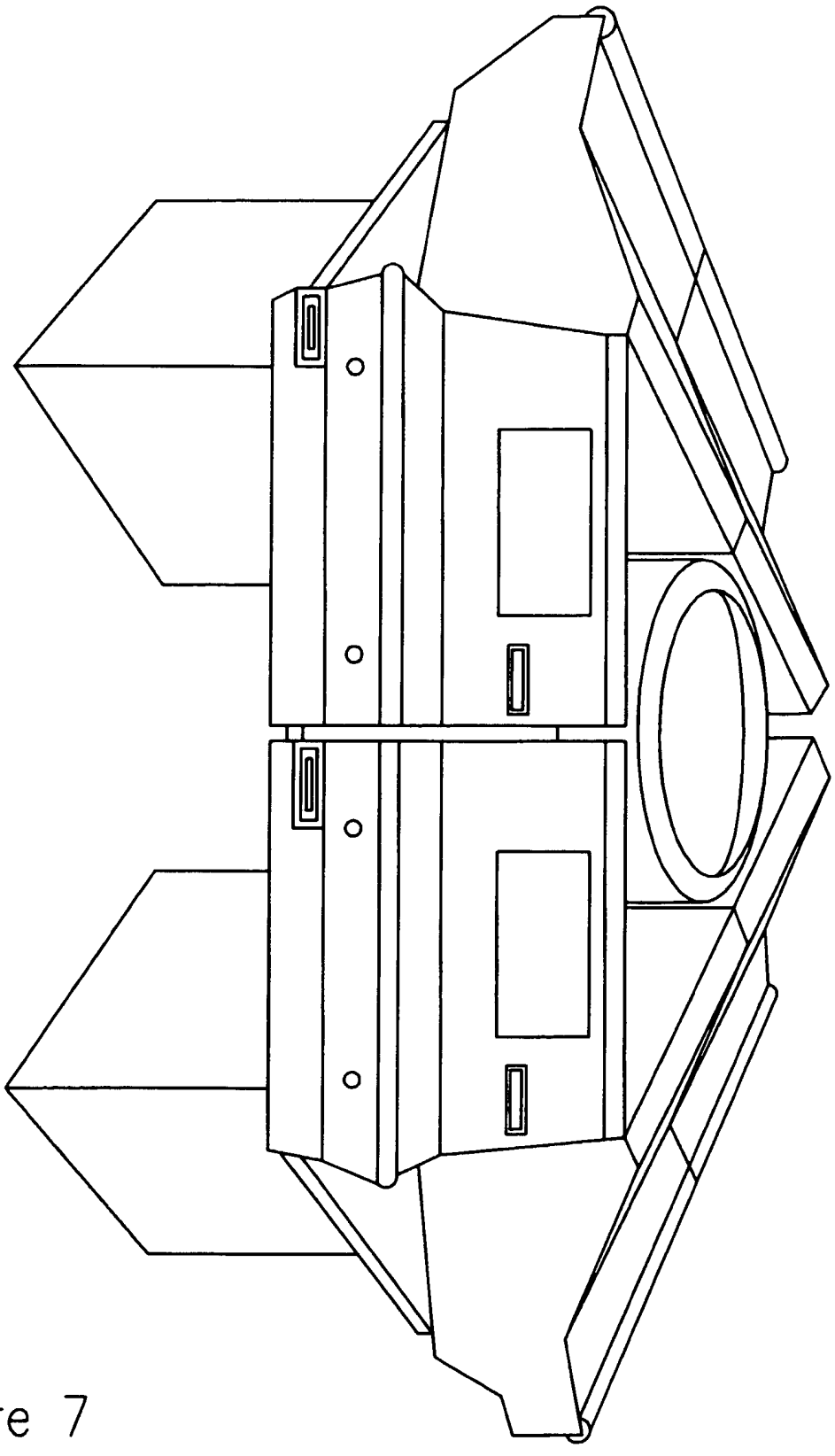


Figure 7

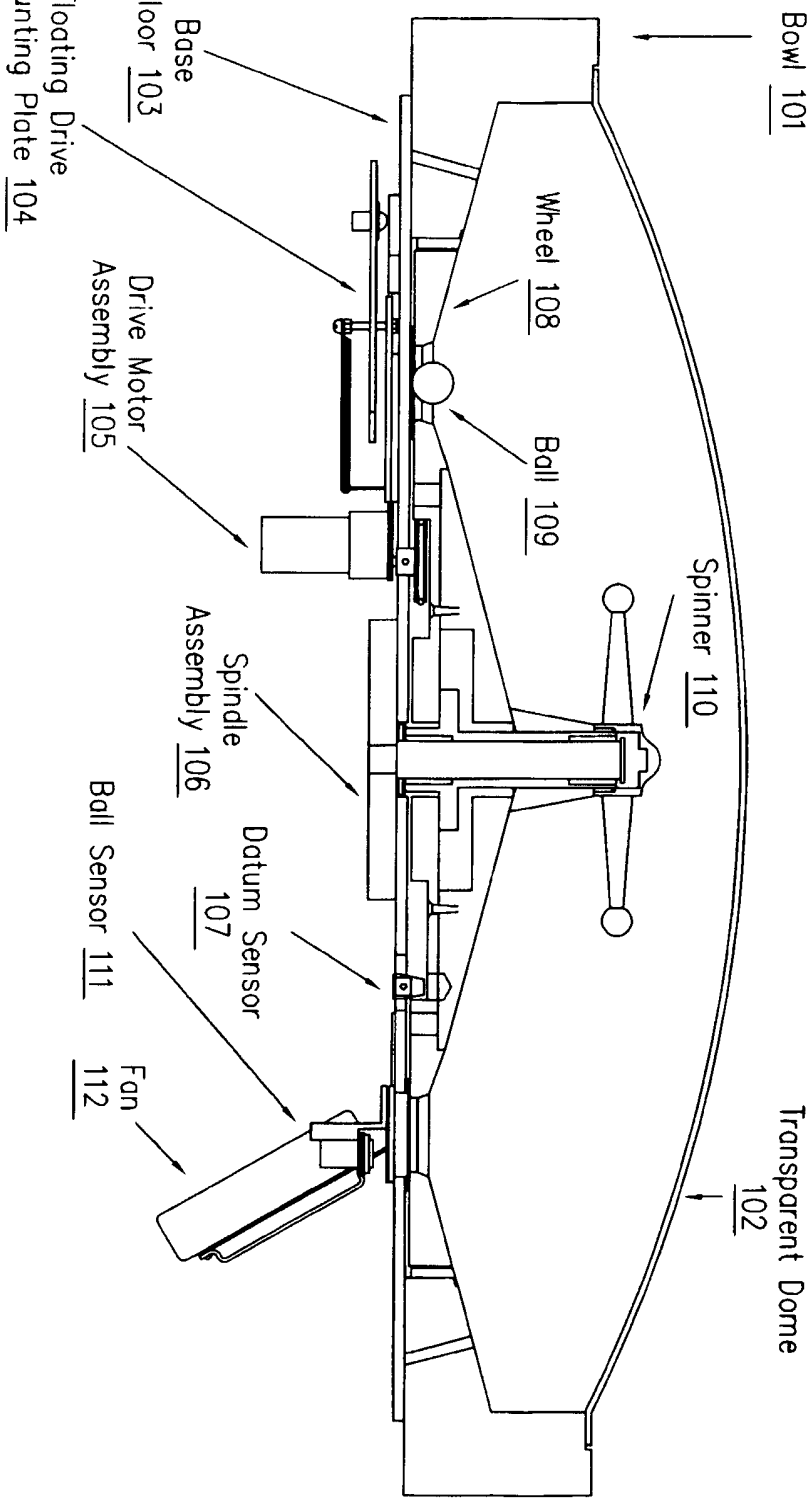

Turned Bowl 101
Base Floor 103
Floating Drive Mounting Plate 104
Drive Motor Assembly 105
Spindle Assembly 106
Datum Sensor 107
Ball Sensor 111
Fan 112
Wheel 108
Ball 109
Spinner 110
Transparent Dome 102

Figure 8

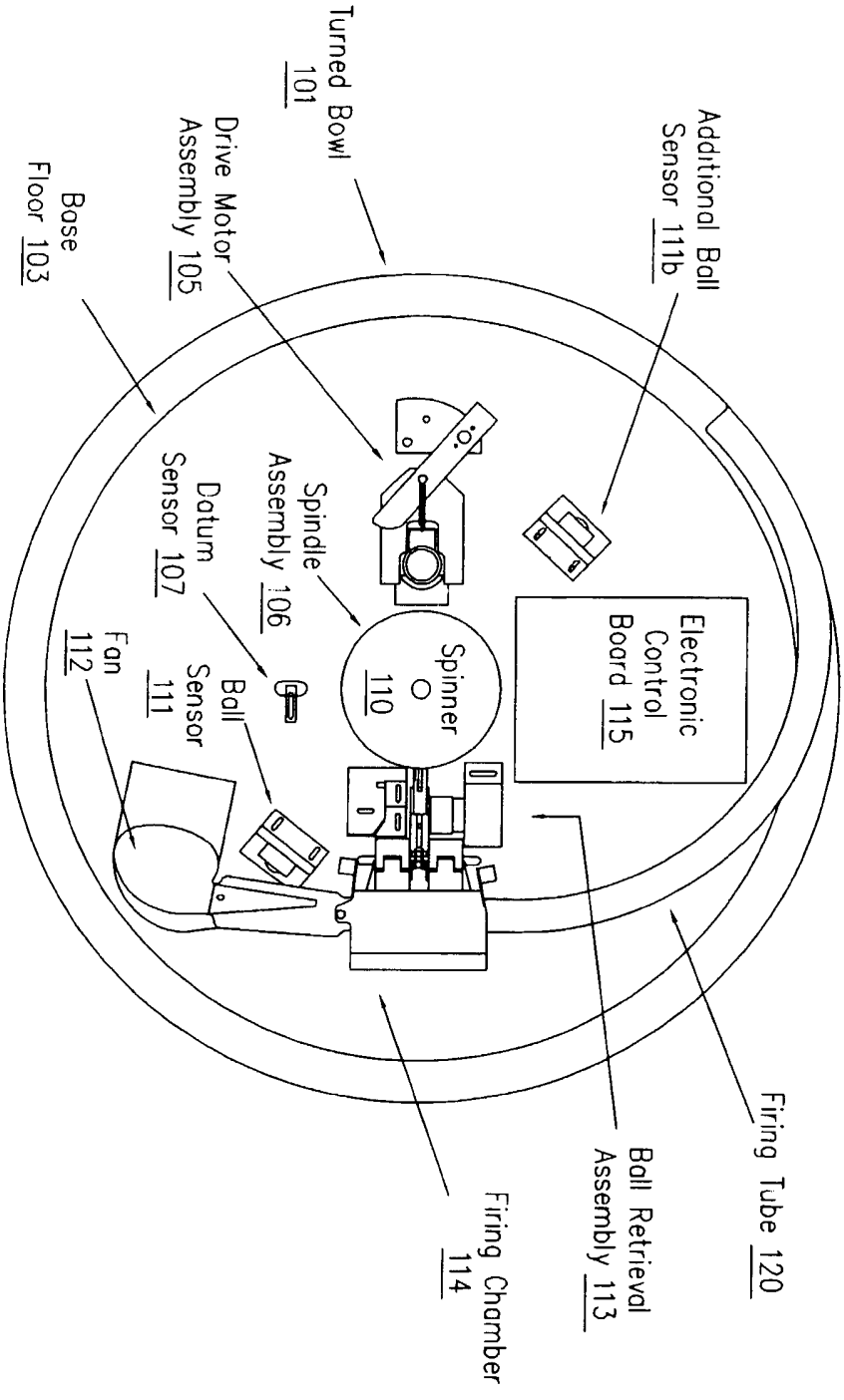

Turned Bowl 101
Additional Ball Sensor 111b
Drive Motor Assembly 105
Base Floor 103
Spindle Assembly 106
Datum Sensor 107
Spinner 110
Electronic Control Board 115
Fan 112
Ball Sensor 111
Ball
Firing Tube 120
Ball Retrieval Assembly 113
Firing Chamber 114

Figure 9

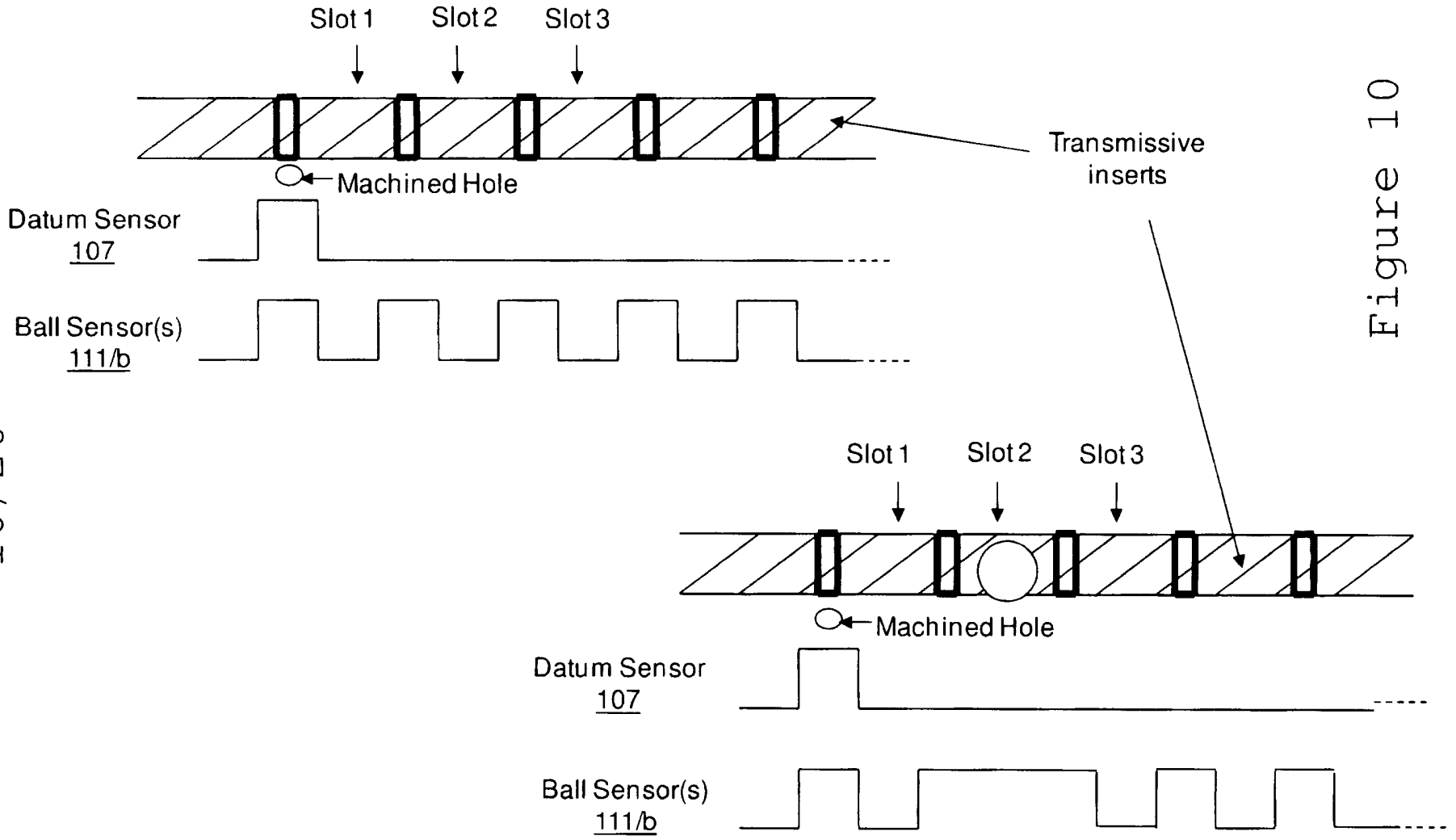

Slot 1
Slot 2
Slot 3
Machined Hole
Transmissive inserts
Datum Sensor 107
Ball Sensor(s) 111/b
Slot 1
Slot 2
Slot 3
Machined Hole
Datum Sensor 107
Ball Sensor(s) 111/b

Figure 10

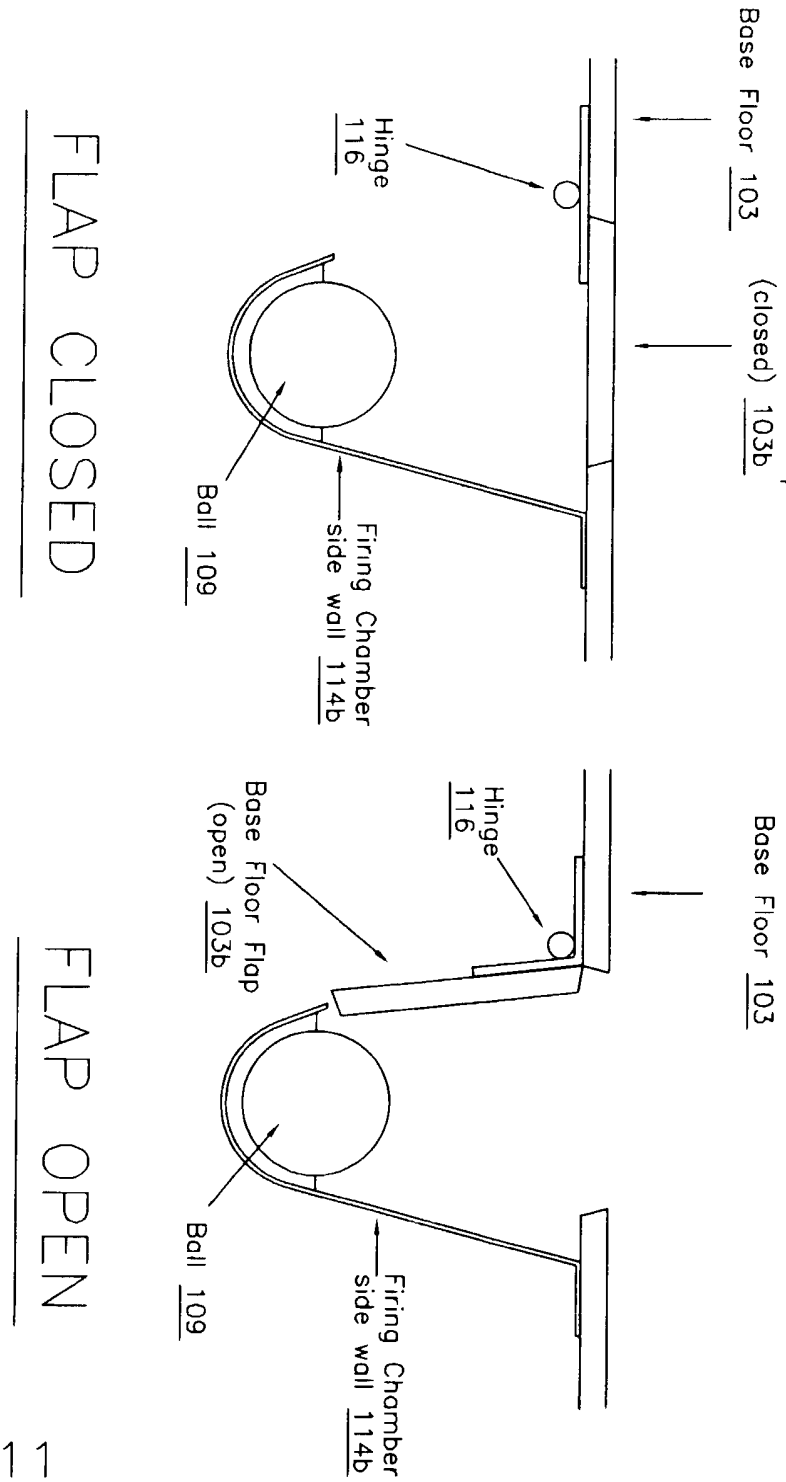

Base Floor 103
Base Floor Flap (closed) 103b
Hinge 116
Ball 109
Firing Chamber side wall 114b
FLAP CLOSED
Base Floor 103
Hinge 116
Base Floor Flap (open) 103b
Ball 109
Firing Chamber side wall 114b
FLAP OPEN

Figure 11

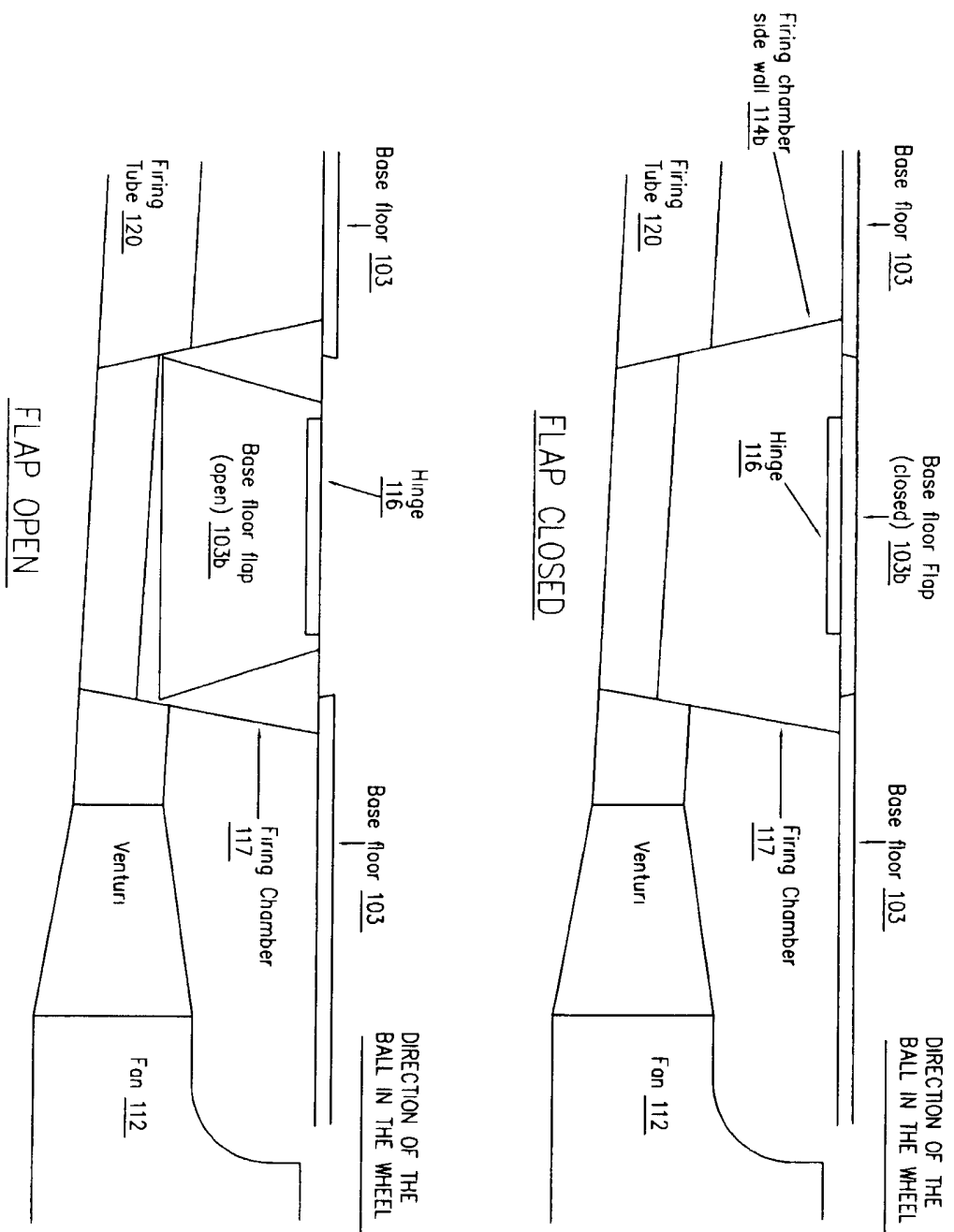

FLAP CLOSED
Base floor 103
Base floor Flap (closed) 103b
Firing chamber side wall 114b
Firing Tube 120
Hinge 116
Firing Chamber 117
Venturi
Fan 112
DIRECTION OF THE BALL IN THE WHEEL
FLAP OPEN
Base floor 103
Hinge 116
Base floor flap (open) 103b
Firing Tube 120
Firing Chamber 117
Venturi
Fan 112
DIRECTION OF THE BALL IN THE WHEEL

Figure 12

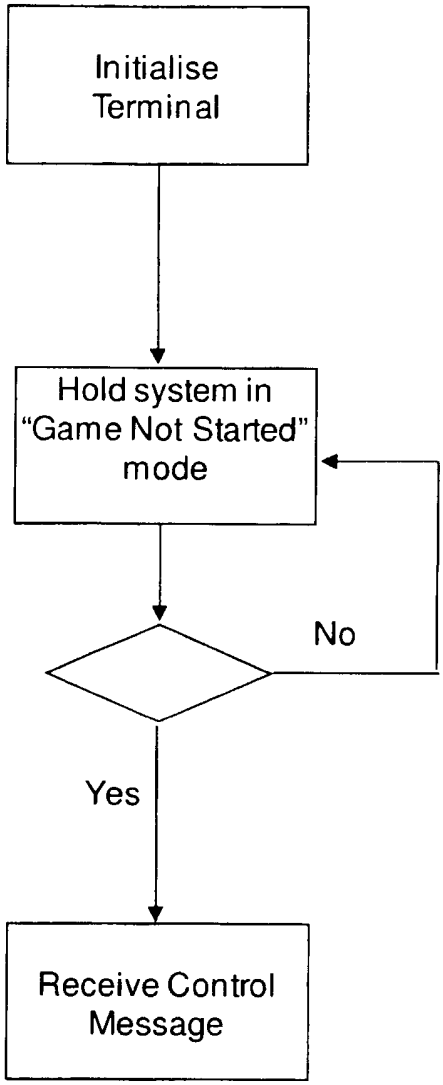

Initialise Terminal
Hold system in "Game Not Started" mode
No
Yes
Receive Control Message

Figure 13

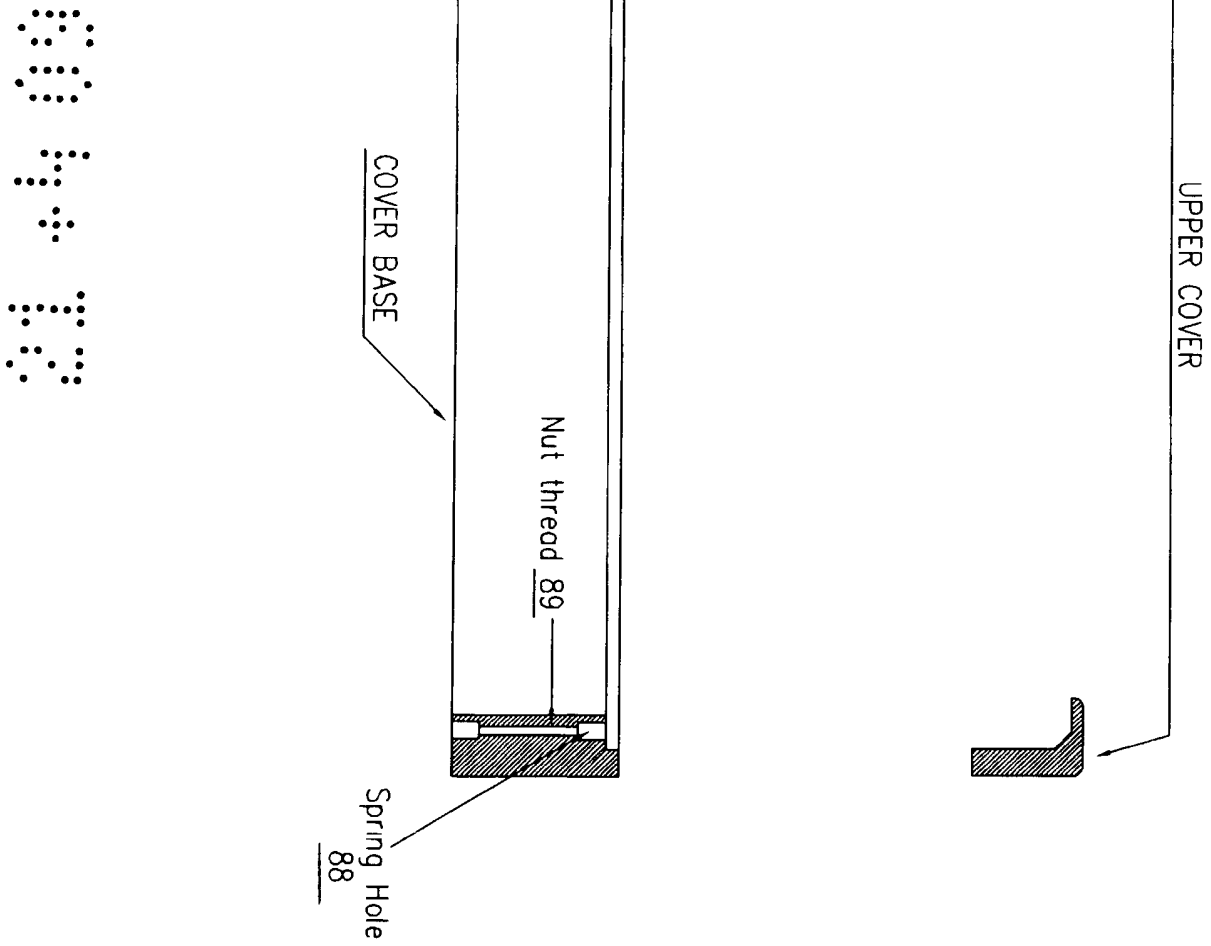

Upper Cosmetic cover 82a
UPPER COVER
Cosmetic cover Base portion 82b
COVER BASE
Nut thread 89
Spring Hole 88

Figure 14

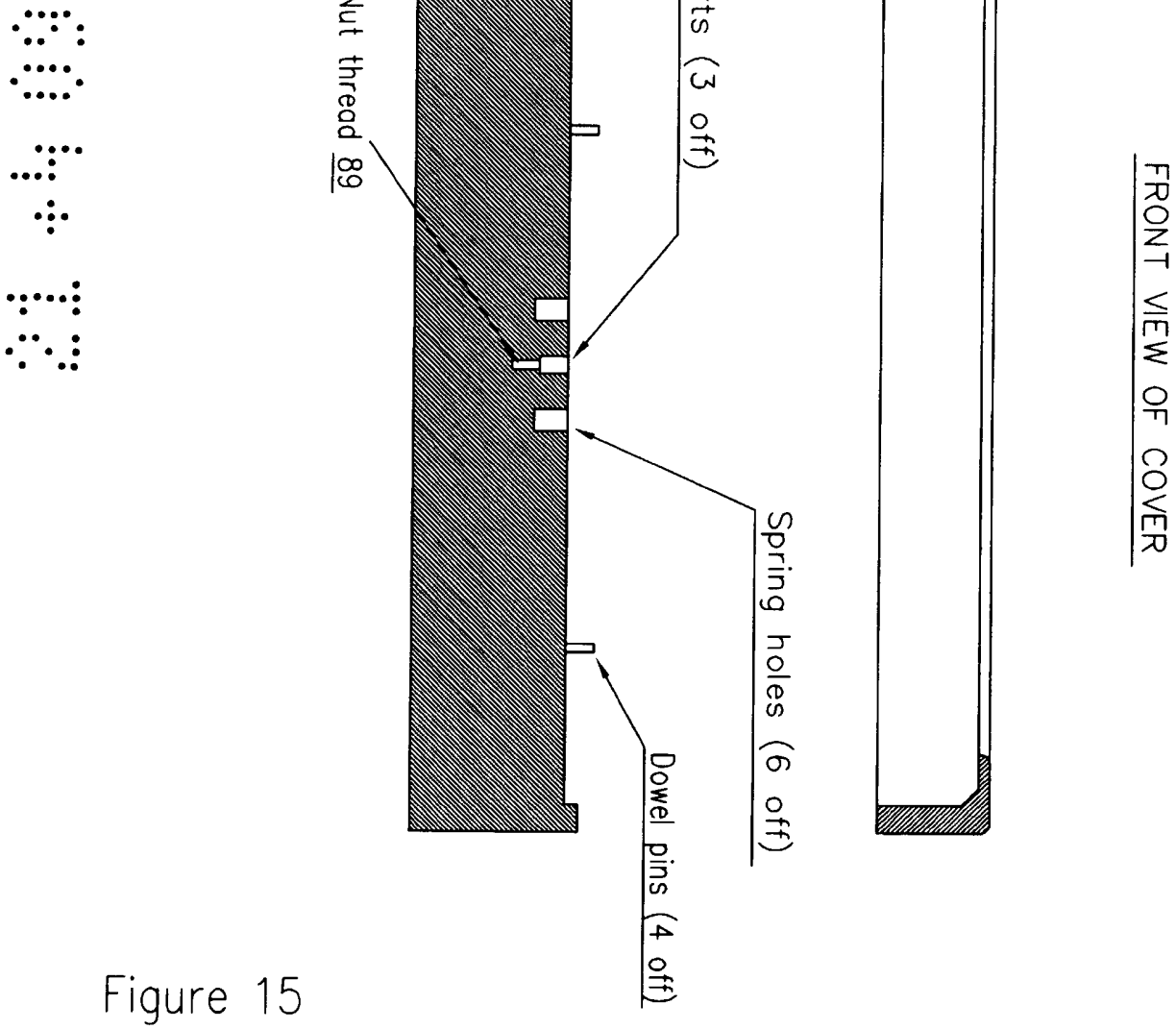

FRONT VIEW OF COVER
Upper Cosmetic cover 82a
Cosmetic cover Base portion 82b
Wood inserts (3 off)
Nut thread 89
Spring holes (6 off)
Dowel pins (4 off)

Figure 15

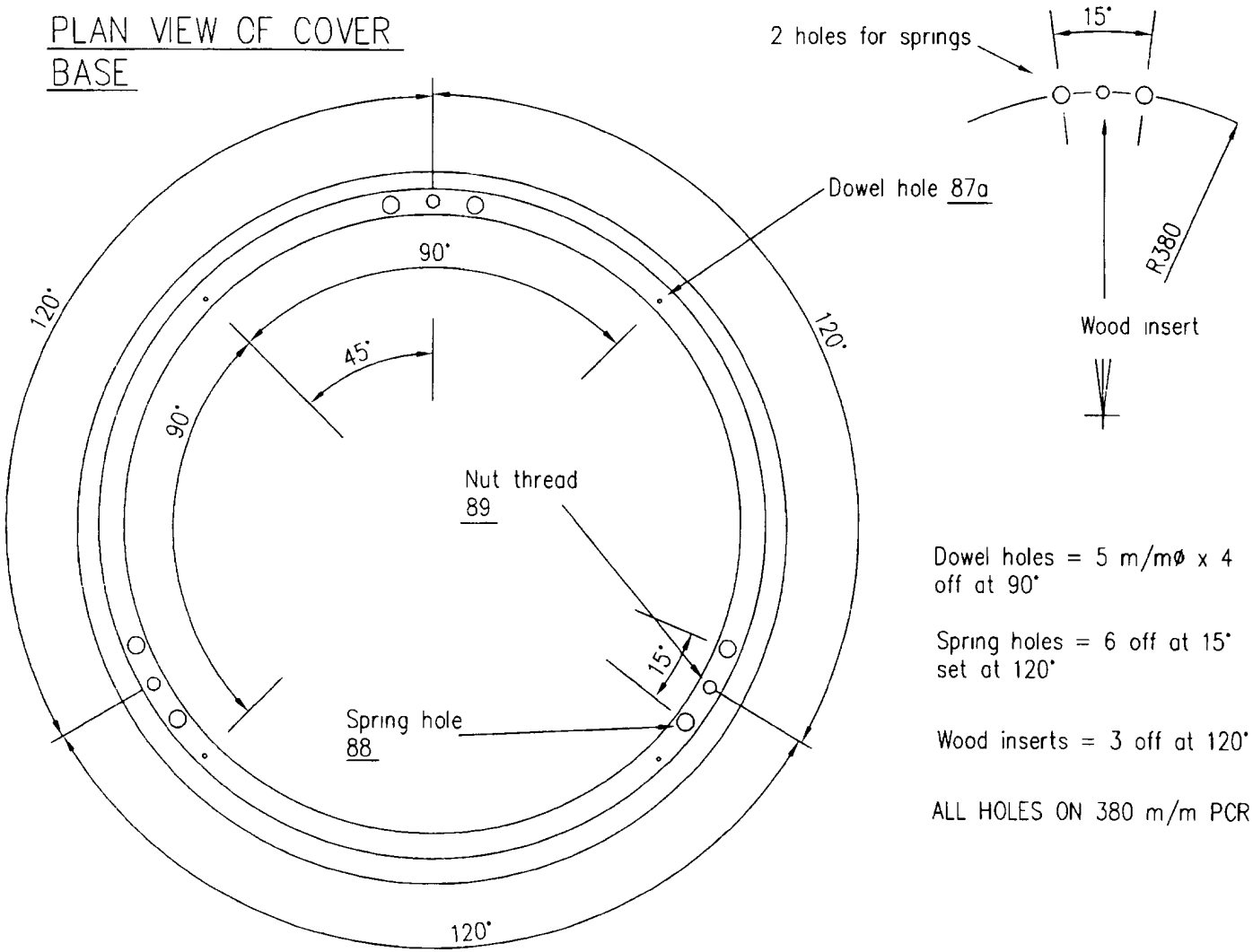
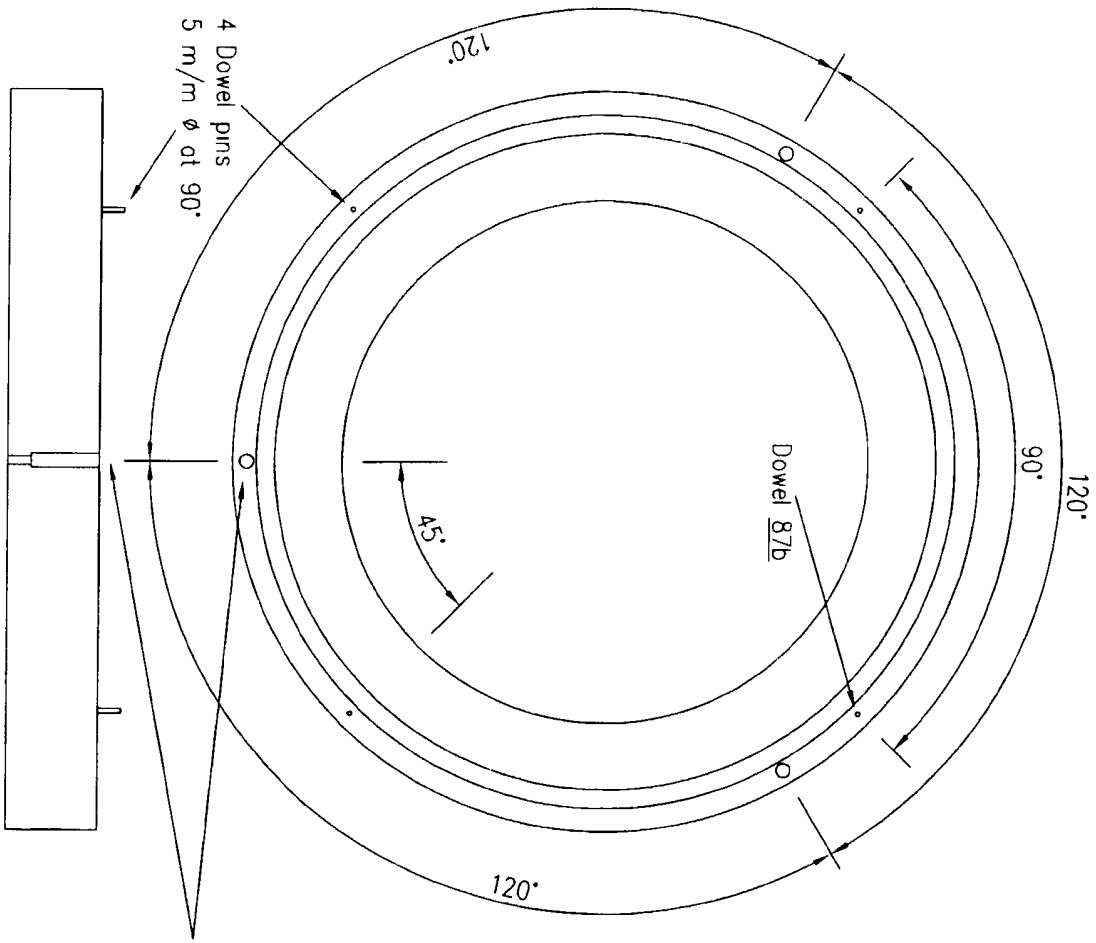


Figure 16



PLAN VIEW OF WHEEL

ALL HOLES ON
380 m/m PCR

Figure 17

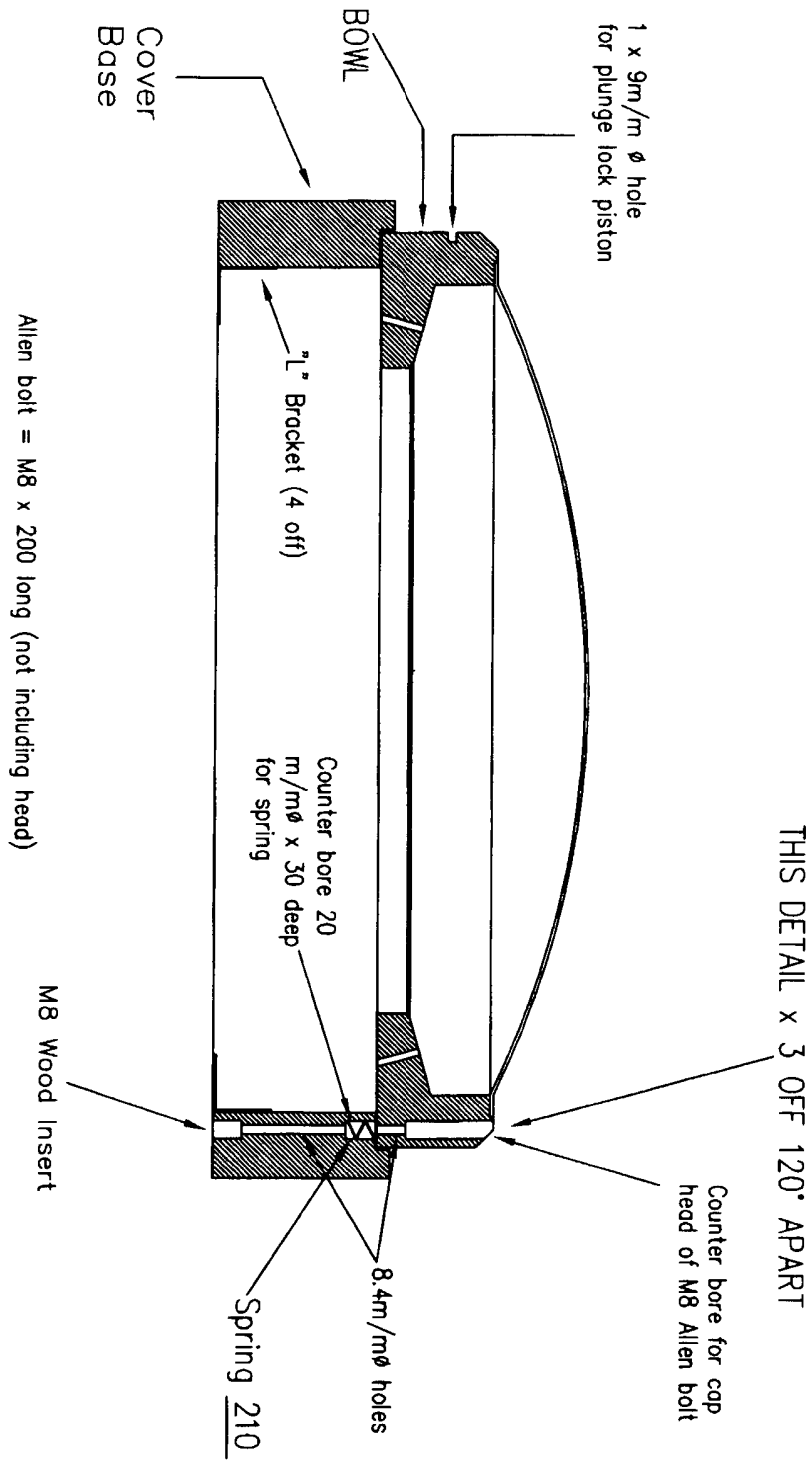

THIS DETAIL x 3 OFF 120° APART
1 x 9m/m ø hole for plunge lock piston
BOWL
Cover Base
"L" Bracket (4 off)
Allen bolt = M8 x 200 long (not including head)
Counter bore 20 m/mø x 30 deep for spring
M8 Wood Insert
Counter bore for cap head of M8 Allen bolt
8.4m/mø holes
Spring 210

Figure 18

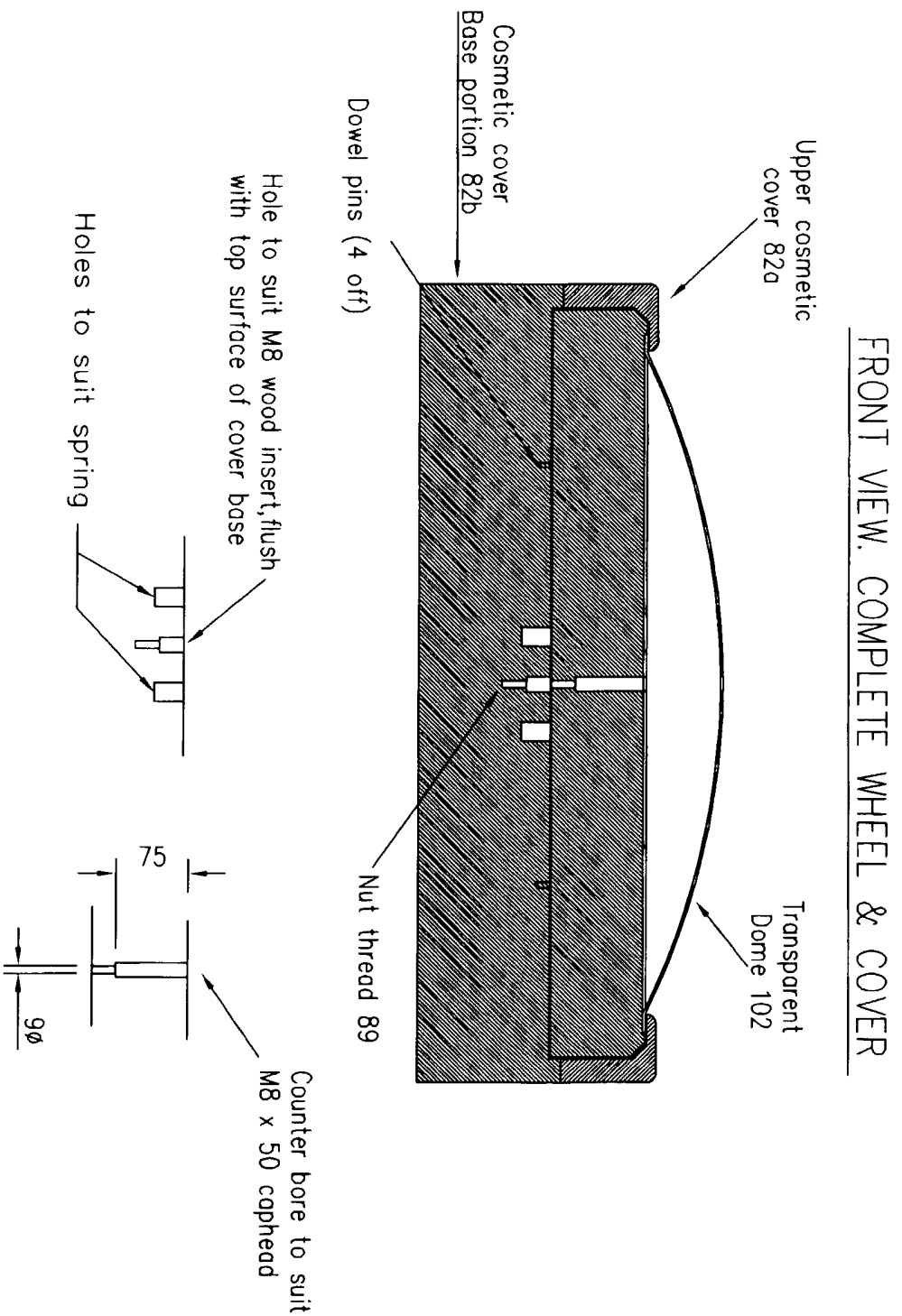

FRONT VIEW. COMPLETE WHEEL & COVER
Upper cosmetic cover 82a
Cosmetic cover Base portion 82b
Dowel pins (4 off)
Nut thread 89
Transparent Dome 102
Hole to suit M8 wood insert, flush with top surface of cover base
Holes to suit spring
75
9ø
Counter bore to suit M8 x 50 caphead

Figure 19

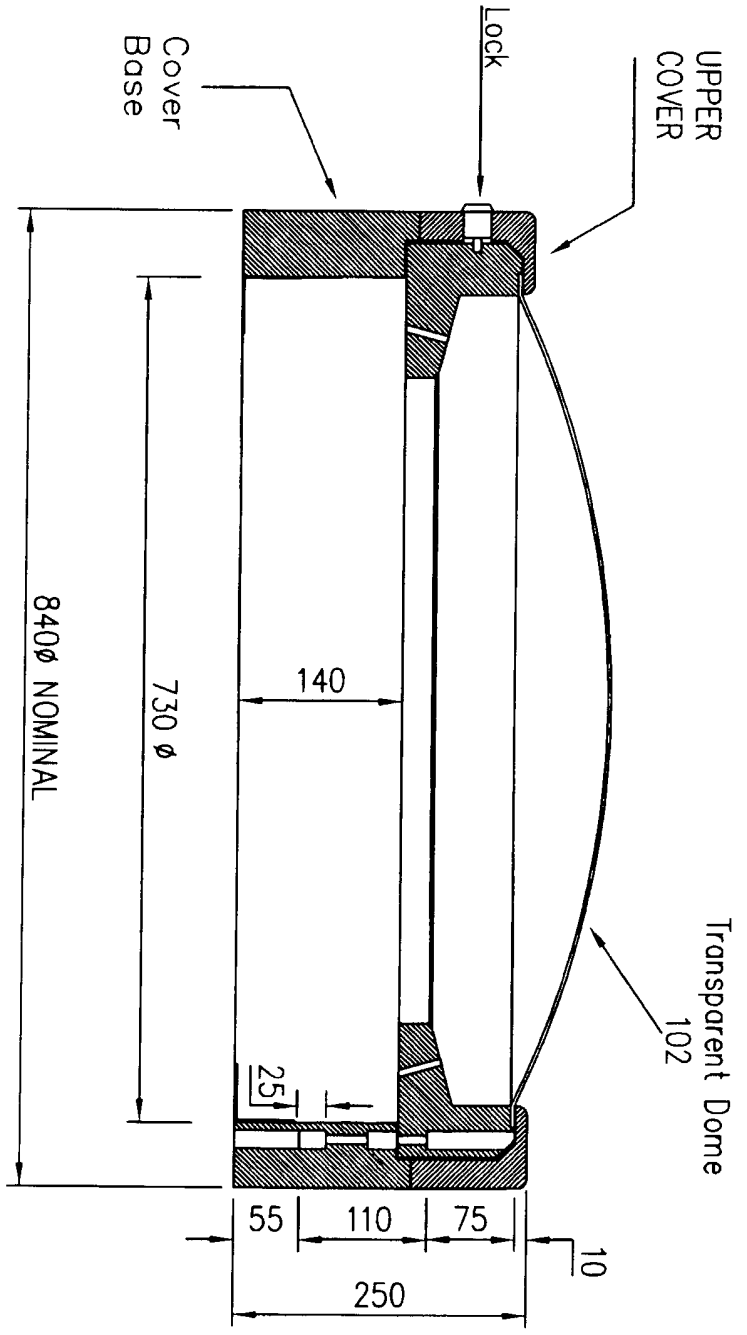

Cover
Base
Lock
UPPER
COVER
840ø NOMINAL
730 ø
140
25
Transparent Dome
102
55
110
75
10
250

Figure 20

2456577

Roulette Wheel Apparatus

Field of Invention

The present invention relates to roulette wheel apparatus and supporting equipment.

Background of Invention

It has previously been proposed to produce a machine for a fully automatic game of roulette that corresponds to the real game as played in casinos.

In the real game of roulette, the wheel has appropriately numbered and coloured slot compartments around its circumference. The table is arranged so that there are 152 choices of bet that can be placed by each player.

It has previously been proposed to provide a roulette wheel assembly comprising a rotatable roulette wheel having a plurality of slot compartments around its circumference, a drive motor to rotate the roulette wheel, a firing mechanism to propel a roulette ball onto the rotating roulette wheel, which is shaped so that the ball finally lands in a slot compartment, and return mechanism to return the ball from the slot to the firing mechanism characterised in that the floor of the slot compartments is linearly movable between a raised position to retain the ball in the slot compartment and a lowered position to allow the ball to be received by the return mechanism.

It has also been previously proposed to provide a sensor mechanism to identify the slot compartment containing the roulette ball, comprising a zero sensor to indicate when the roulette wheel is in the start position, a compartment sensor on a radial axis of the wheel to count the number of slot compartments passing the start position using location slots positioned around the wheel rim for every slot compartment, a ball sensor on the same radial axis as the compartment sensor to detect when the ball is located on said radial axis.

Summary of Invention

Embodiments of the present invention provide a roulette wheel apparatus, comprising a rotatable roulette wheel having a plurality of slot compartments around its circumference, a floor of the slot compartments, a drive motor to rotate the roulette wheel, a firing mechanism to propel a roulette ball onto the rotating roulette wheel such that a ball finally lands in a slot compartment, and a return mechanism to return the ball from a particular slot compartment to the firing mechanism, characterised in that the return mechanism comprises a closable opening at a set location on the floor of the slot compartments, arranged above the firing mechanism

The present invention relates to a roulette wheel assembly, gaming management control system and remote player terminals for playing what will be referred to as the real game of roulette which comprises use of all available bet scenarios as opposed to a discreet subset of them.

The remote player terminals may be configured to play a number of other typical gambling games.

Embodiments of the present invention also provide the following:

A fully automatic game of real roulette where all of the wheel actions, placing of bets, and dealing with winning players can be carried out without the need of a croupier.

A semi-automatic game of roulette, with a fully enclosed wheel where the croupier may initiate ball firing by use of a button either remote to, or attached to, the wheel assembly. In this arrangement the croupier, for example, would deal with betting on a live roulette table and other players could participate remotely at player stations both inside the casino and at other establishments electronically linked to the game via a wide area network, such as the internet.

A method to facilitate switching between the operational modes of the system to allow the casino operators to use the system as fully automated, semi-automated or live to allow the system to be multipurpose. Currently, systems must co-exist in a casino that are either automatic or live. The present invention provides a considerable saving in capital equipment and allows, for example, the casino to run the system with reduced staffing to suit the player demand For example, the system would be run in fully automatic mode when the casino has a small number of players.

Remote player terminals with facilities to place all possible roulette bets; accept cash, smart card (or other payment methods such as token or voucher); pay out via cash, voucher, ticket or smart card; display the player betting information; display the selected wheel when the terminal is not within viewing distance of the wheel in use; communicate data to other parts of the system to ensure secure operation of the overall system; and facilities to play additional games.

A method whereby, the remote player terminals will have the facility to select from various wheel sources that can either be fully automated, semi-automatic or fully live games.

An automatic wheel mechanism that occupies a similar volume and looks cosmetically identical to a standard manual live wheel, whereby a live game maybe played where the croupier operates to spin the wheel and throw the ball, as in a normal game, but the system makes use of the wheel's detection apparatus. Thus, by virtue of its detection facilities, the wheel can provide information to the gaming control system including winning number details and synchronisation signals to a database/management system and other remote player terminals. In this way, there is provided a means to supply the following information: winning number indication either at the table or remotely; detailed information on the operation of the wheel and the croupier such as number of games played per hour, ball speeds, wheel speeds, direction of wheel travel and winning number distribution. This information would be of value to the casino management and gamblers alike.

Improvements to the wheel design to offer the above features which provide cost, reliability and performance enhancements.

A monitoring system that provides comprehensive control and information to casino management and security staff. This would include the following. player winning tickets generated at the player terminals verified against the system database, review of player game-play to allow for dealing with disputes and allow for monitoring of player activity; preset alarm for duplicate tickets; preset alarm for money laundering; review of system and individual terminal cash performance; control of chip values, control of betting limits; control of game cycle time; controlled shutdown, restart and start of the system or individual components of the system; audit trail summaries of cash in and cash out, historical cash transaction information.

The present invention relates to a system for playing automated roulette. The system would comprise a wheel assembly (or a number of wheel assemblies), remote player terminals for playing what will be referred to as the real game of roulette (the remote player terminals may be configured to play a number of games including roulette), system servers and a cash office interface.

The system can employ a number of "live" wheels and/or a number of "automated" wheels. An "automated" wheel is a fully automatic wheel where all of the wheel actions, placing of bets and playing winning players can be carried out without the need of a croupier. The "live" wheel is croupier controlled and will be sited on a standard casino roulette wheel. The "live" wheel will have some form of monitoring to determine betting times and winning numbers etc. It is possible to also employ a semi-automatic wheel with a fully enclosed wheel where the croupier initiates ball firing by use of a button either remote or attached to the wheel assembly. In this arrangement the croupier, for example would deal with betting on a live roulette table and other players could participate remotely at player stations both inside the casino and at other establishments electronically linked to the game.

A communications control system that transparently accommodates combinations of wheel sources as follows: a group of asynchronous "automatic" wheels, a group of asynchronous "live" wheels; a mixed group of asynchronous "live" and "automated" wheels. The before mentioned combinations may be synchronous instead

System servers to control and monitor the game play. The system servers therefore provide a control and monitoring system that provides comprehensive control and playing information to casino management and security staff. This would include the following: player winning tickets generated at the player terminals verified against the system database; review of player game-play to allow for dealing with disputes and allow for monitoring of player activity; preset alarm for duplicate tickets; preset alarm for money laundering; review of system and individual terminal cash performance; control of chip values; control of betting limits; control of game cycle time; controlled shutdown, restart and start of the system or individual components of the system; audit trail summaries of cash in and cash out, and historical cash information.

Brief description of the Drawings

A roulette gaming system including roulette wheel apparatus will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG 1 is a schematic diagram of an embodiment of the present invention showing a complete roulette gaming system including roulette wheel, player terminals and control management system;

FIG. 2 is a perspective view of a roulette wheel according to an embodiment of the present invention;

FIG. 3 is a perspective view of a wireless remote player terminal according to an embodiment of the present invention;

FIG. 4 is a perspective view of a wired remote player terminal according to an embodiment of the present invention;

FIG. 5 is a first exemplary configuration of an embodiment of the present invention;

FIG. 6 is a second exemplary configuration of an embodiment of the present invention;

FIG. 7 is a third exemplary configuration of an embodiment of the present invention;

FIG. 8 is a side view schematic diagram of a rotating portion of a wheel assembly according to an embodiment of the present invention;

FIG. 9 is a plan view schematic diagram of a fixed portion of the wheel assembly according to an embodiment of the present invention;

FIG. 10 is a schematic diagram detailing a ball detection method according to an embodiment of the present invention;

FIG. 11 is side view schematic diagram of the return mechanism according to an embodiment of the present invention;

FIG. 12 is a further side view schematic diagram of the return mechanism according to an embodiment of the present invention;

FIG. 13 is a flow diagram of a control protocol according to an embodiment of the present invention;

FIG. 14 is a side view cross section diagram of a cosmetic cover unit for housing the rotating portion of a wheel assembly according to an embodiment of the present invention, showing the spring holes on end;

FIG. 15 is a side view cross section diagram of the cosmetic cover taken at 90 degrees to FIG. 14;

FIG. 16 is a plan view of the cosmetic cover base portion according to an embodiment of the present invention;

FIG. 17 is a plan view of the roulette wheel base according to an embodiment of the present invention,

FIG. 18 is side view cross-section schematic of the cosmetic cover base unit supporting the roulette wheel assembly including a transparent dome, according to an embodiment of the present invention;

FIG. 19 is a side view cross-section schematic of the cosmetic cover base unit supporting the roulette wheel assembly including a transparent dome and the upper cosmetic cover, according to an embodiment of the present invention,

FIG. 20 is a side view cross-section schematic of the cosmetic cover base unit supporting the roulette wheel assembly as shown in FIG. 19 and including a lock;

Detailed description of the specific embodiments

In the simplest embodiment the system would consist of a single automatic wheel. The timing between key events is known and to a certain extent controllable.

However, with a live wheel, the timing of major events is governed by the several factors: the number of players at the live table; the complexity of dealing with winning chips; player disputes; accidental movement of chips; void games. This is to say, how the players and croupier/operator interact with each other during the course of the playing session

On a live table, once the winning number is declared, the croupier (i.e. dealer) must remove all of the losing chips and payout any against any winning chips before betting on the next game can commence. In contrast, on the player terminal, betting can commence as soon as the winning number is declared. The length of the game is often not known. A signalling protocol that addresses these issues is described below.

FIG. 1 shows a schematic diagram of the roulette gaming apparatus system of an embodiment of the invention. The connections shown are only exemplary, and as such are not to be considered limiting. There is shown: multiple wireless player terminals 10 or wired player terminals 11 (or combined wired/wireless terminals 11b, not shown in this figure) connect to a central wired/wireless router 20. Also connected to the router 20 are the other components of the overall system such as: Data server 30; Game Server 40, Back Office Server 50; Automated wheel 80; Control Console 70 (also known as the "Pit Boss"); and Financial Transaction Server 60 (also known as the cash desk or office function). The above is called the gaming platform.

Player terminals 10 or 11 may connect to multiple roulette wheels 80 via the system, if extra roulette wheels are connected. This is to be expected in a full casino environment.

The wired/wireless router 20 may form part of any of the other components instead of being a discreet component as shown. Equally the separate servers may instead be run on a single multifunction server.

The specific connections show in lines may be wireless or wired. Connections between particular devices may be made through intervening devices instead of by direct connection as shown. The connections are typically network connections.

FIG. 2 shows an exemplary embodiment of the roulette wheel housing 8, while FIG. 3 shows an exemplary embodiment of the wireless player terminal 10 and FIG. 4 shows an exemplary embodiment of the wired 11 or combined

wired and wireless player terminal 11b. In the case of a combined wired/wireless player terminal 11b, a modified form of the wireless terminal 10 is detachably mounted to a similar base/case unit to the wired player terminal. Thus the wireless terminal can be easily detached for portability

The wired player terminal 11 is constructed out of an industrial personal computer (PC) running an embedded operating system The PC is attached to a stylised chassis, suitable for the environment of a casino. The chassis supports all the peripherals required, such as voucher printer, bill (financial note) accepter, smartcard/swipecard reader, biometric sensors, power supply, security keypad and locking mechanisms. These are connected to the PC as appropriate for control and operation purposes. The chassis also supports a touch screen 13 LCD (or similar flat panel technology such as OLED, SED etc) for the player to interact with the gaming platform.

Biometric sensors may be used instead of smartcards or swipecards, in the case where there is a centralised player database that can be freely accessed and the relevant data looked up by any of the equipment requiring account access.

The voucher printer may utilise encrypted barcodes, or similar two dimensional and scannable coding to store information on vouchers in a secure way, in order to track financial transactions involved in during the game, if vouchers are enabled. Smartcards may be used as the data carrying element instead, where security is considered more important that cost.

The secure keypad allows the operator secure access to additional features on the player terminal, such as auditing of vouchers, voucher reprinting and terminal maintenance and shutdown. The secure keypad may be invoked on the touch screen 13 instead of having a separate hardware keypad.

The wireless player terminal 10 has all the same, or similar, features enabling it to carry out substantially the same operations as the wired player terminal 11. It is preferably implemented as a industrial (i.e. manufactured to withstand

higher tolerances) tablet PC, with an application specific housing, such that the wireless terminal is ruggedized and able to be mounted onto any choice of furniture, in a bar, outside in a smoking area, or stand on a stylish plinth.

The above described gaming platform is designed to fit into any gaming environment, due to the modular nature of the equipment and the wireless connectivity between them. Touch screen technologies are combined with custom software running on the processors within servers and terminal hardware to produce a fully flexible gaming platform with the capability of creating uninterrupted roulette gaming, as a well as other gambling games.

FIGs 5 to 7 shows different potential configurations or layouts of the hardware described.

The game server 40 controls all the game events by transmitting command messages across the network connection interfaces, and sending other required data at key points in the game cycle, as described in more detail below. In particular, in the example of roulette, the server sends and receives data from the automated wheel that determines the play cycle, betting times, winning number notification, and other key information. The game server 40 will interrogate the roulette wheel 80 to check for proper functioning of the wheel 80 at the start of play and has the facility to reset the wheel in the event that a parameter of the wheel moves outside specification, or move to an alternative wheel 80 if a fatal error occurs

The roulette wheel 80 is prompted by the game server 40. In turn, the wheel contains a bespoke firmware to control all its operational aspects such as motor speeds, sensors, etc.

The data server 30 contains a database with a complete historical archive of all data pertaining to the activities carried out by the gaming platform on a game by game, wheel by wheel, player by player, etc basis. Data logged includes winning number, game number, session number, play credit, play stake, player winnings, bet (chip) placement, voucher generation, voucher

cashing and the like. The back office server provide the front end analysis and access functions to the data server 30

Each element of the gaming platform also may have local memory to store its portion of the overall data set, such that in the event of a catastrophic error at the server side or a network connection error occurs, data can still be recovered manually or semi-automatically by the operating casino management. In the case of a wireless system, a hot swappable redundant wired connection may be provided for a data download in the event of an error in the normal running of the wireless network.

Financial transaction server 60 provides the monitoring of all the financial transactions. For example, it validates vouchers generated by the player terminals against the data server 30, to check that a particular voucher was validly generated, adheres to the necessary security protocols, and has not yet been cashed. The financial transaction server may also analysis cash transactions for evidence of money laundering, which is an issue of great concern to casino managements and governments alike. The financial server may generate summaries by player terminal, player account, or otherwise, of the amounts being cashed and still outstanding at any one time.

Control console 70 (otherwise known as Pit Boss console) allows the pit boss of a casino to remotely administer the gaming platform, for example, switch off and on parts of the entire system, to change bet limits, stake values, etc. The gaming platform also has powerful review packages, utilising the above mentioned data server 30, that allows the pit boss to review play on any selected player terminal 10 or wheel 80 in the event of a player disagreement or in the general course of managing the gaming floor.

FIGs 8 and 9 show differing views of an embodiment of the present invention, whose operation will be described below. There is provided: a turned bowl 101 that comprises the outer stationary rim of a traditional roulette wheel; an optional transparent dome 102 to cover the roulette wheel; a base floor of the slot compartments 103; a floating drive plate 104, to engage with the roulette

wheel, in order to drive it around using the drive motor assembly 105; a spindle assembly 106 to mount the roulette wheel upon; a datum sensor 107; a roulette wheel 108 with numbered slot compartments separated using slot compartment dividers (not separately shown), a typical roulette wheel manual spinner 110, for live use; one or more ball sensors 111; a fan 112 for blowing the ball 109 back into the roulette wheel at the start of a new game; a ball 109 retrieval assembly 113 in communication with the firing chamber 114, itself in communication with a firing tube 120; and an electronic control board (PCB) 115.

The slot compartments located around the circumference of the roulette wheel 108 are identified by means of numbers, words, colours, symbols or a combination of any of these so that the wheel 108 corresponds to the wheel used in the real game of roulette.

In a preferred embodiment, the base floor 103 is stationary, with the roulette wheel 108 having the slot compartment dividers rotating freely above the base floor 103. In this way, the base floor acts as a floor for the whole roulette wheel (and the ball 109 merely rotates in the slot compartment whilst not being forced out).

FIG. 10 shows how the ball 109 is detected. This portion of the present invention is described in more detail below.

FIGs. 11 and 12 show the ball retrieval mechanism 113 and firing chamber 114 in more detail. The ball retrieval preferable comprises a flap 103b in the base floor 103, connected by a hinge 116. Below the flap is a round bottomed trough that comprises the firing chamber 114, supported on one side by a sidewall 114b, and where the flap 103b forms the other side wall. The firing chamber 114 is connected to the fan 112 via a diameter reduce venture, at one end and to the firing tube 120 at the other end. The firing tube is dimensioned to be a close fit on the ball 109, such that control of the ball 109 speed using fan speed it optimised.

A diverting block (not shown) controls the direction of the firing tube 120, and hence the direction of travel, clockwise or anti-clockwise, of the roulette ball 109 around the wheel bowl. The activating signal for the diverting block is transmitted from the same control that controls the direction of rotation of the roulette wheel 108 because the roulette ball 109 will always need to rotate in the opposite direction to the roulette wheel 108

The firing tube 120 is located outside the wheel bowl so that the roulette ball 109 is propelled radially and inwardly towards the roulette wheel 108.

When the roulette ball 109 is propelled from the firing tube 120, it travels across the wheel bowl on to the rotating roulette wheel 108 and finally lands in a roulette wheel slot compartment.

The wheel floor is has slot compartments that are the same size as the compartments in a real roulette wheel to allow the ball 109 the freedom to move around in a free, natural and unbiased manner. Also, because a number of different ball firing pressures are used it is extremely difficult for a player to predict the path followed by the ball when it is propelled from the firing tube 120

To enable automatic remote gameplay, and to avoid having considerable amounts of money placed on the roulette table the gaming platform uses a smart card or similar data carrier to store a player's account details.

There now follows a detailed description of how embodiments of the invention provide Automatic, Semi-Automatic and Live wheel operation with ball detection.

Automatic Operation:

The automatic wheel is entirely independent of outside influence and is a stand-alone product linked via a router 20 to a game server 40, other servers, and a number of player game terminals 10.

The automatic roulette wheel 80 has 3 main stages:
Stage 1: Ball firing
Stage 2: Ball detection.
Stage 3: Ball retrieval.

Stage 1

The wheel receives a signal from the game server 40 that the game cycle is to begin. The game cycle timer is maintained in the game server 40, with the betting portion of this cycle being visible to the players on the remote player terminals 10. The casino management and local gaming regulations determine the overall game cycle time.

At this point the ball is in the firing chamber 114 where it was deposited upon retrieval A random wheel 108 speed, between minimum and maximum limits, is selected and the wheel 108 accelerated to this speed by means of a variable speed drive motor 105 underneath the wheel 108.

A predetermined period before the ball 109 is fired, for example ten seconds, a "LAST BETS PLEASE" message is sent by the game server 40 to the player terminals and displayed on the player terminal 10 screen 13. The wheel 108 may spin up at this point, if not already spinning.

The ball 109 is then fired by a blast of air from a fan mechanism 112 attached to the firing chamber 114. After ten seconds, the wheel 108 is revolving at the selected speed and a "NO MORE BETS" message is sent by the game server 40 to the remote player terminals 10

At this point, the player terminals 10 prevent further bets from being accepted or bets being removed or altered in any way. A "NO MORE BETS" message is displayed on the terminal screens to indicate this locked down status of the player terminal to the gambler.

The fan mechanism 112 is energised to blow for a randomly adjusted time for each game cycle to enhance the winning number distribution by providing random ball firing thrust levels.

The length of time the fan 112 is on determines the speed of the ball 109 as it leaves the firing tube 120. The sealed dome 102 over the wheel 108 means the air pressure from the fan 112 will continue to push the ball 109 around the inside of the bowl 101 until the fan 112 is shut off. In this way, the number of circuits the ball 109 makes around the inside of the bowl 101 before it starts to drop towards a numbered slot or pocket may be adjusted.

Stage 2

After the fan 112 is shut off, the ball 109 will act the same as on a live wheel ball, in that after a few revolutions, it will start to fall into the wheel 108 where it will hit a ball trip and bounce into a numbered slot.

Once in a particular numbered slot around the circumference of the wheel 108, the ball 109 is detected by two infra-red sensors and 107 111, as described in more detail below. There is a datum sensor 107 to detect a defined start point in the rotation of the roulette wheel 108, and a ball sensor 111 that detects the passing of a slot compartment divider or the ball 109 respectively. These sensors are sited underneath the wheel base plate (floor) 103 and look up through the base at an arc of the wheel containing a machined hole, and the wheel slot compartment dividers, respectively. The datum sensor 107 and its corresponding machined hole are typically located nearer the centre of the roulette wheel 108, while the ball sensor 111 is located nearer the outside edge of the roulette wheel 108.

There may be included a further duplicate ball sensor 111b located at a set degree of rotation around the roulette wheel 108 from the first ball sensor 111, for example 180 degrees away (i.e. diametrically opposite the first ball sensor, which is a preferred embodiment) This is to provide a second data sampling point, which can be compared to the first sampling point, to allow an

averaging out of the results thereby removing spurious detections on any single sensor. For example, when a ball 109 bounces in and then out of a particular numbered pocket, just as that pocket reaches the ball sensor 111 (which would otherwise give a false positive output in a "single shot" sensing system) Multiple revolutions of wheel maybe sampled to increase ball location detection accuracy still further.

The sensors 107 and 111 are typically positioned or covered such that they are not seen from above.

In the case of two ball sensors, both sensors have to detect the ball 109 and confirm detection before the winning number signal is determined to be valid. This usually takes between one and a half to two revolutions of the wheel 108

The wheel firmware is constantly updated as to the position of the wheel 108 via a sensor detecting a datum point on the underside of the wheel.

After a valid winning number is detected, the wheel 108 is slowed to its minimum speed to allow the customers to easily see which slot compartment/ pocket the ball 109 has landed in and simultaneously the game server 40 sends the winning number to the remote player terminals 10 or 11 and the data server, so they can determine the results for the player using the remote terminals 10.

If, for any reason the ball 109 is not detected within a set time (e.g. fan failure, sensor fault etc) a void game message is sent from the game server 40 to the player terminals 10 and all stakes are returned. The ball 109 will be retrieved and a new game cycle begun. If the error has resulted from some fatal interaction between the ball 109 and the wheel 108 mechanism, such that the particular roulette wheel in use is no longer useable, gameplay can be switched over to another backup wheel using a operator smartcard, or specific instructions at the control console 70. Thus gameplay is not halted for very long.

Stage 3

As the winning number is displayed on the remote player terminal 10 screens, any winnings are credited and stakes returned The game server 40 sends a signal to commence the next game cycle and the remote player terminal 10 betting time clocks start to count down.

The ball is left in the wheel 108 for a set amount of time before a signal is sent from the game server 40 to the wheel firmware to retrieve the ball 109. The ball 109 is retrieved through a small flap 103b set in the wheel base 103 between the two ball detector sensors111 and 111b.

Once the ball 109 has passed the first ball sensor 111b, a signal is sent to open the flap 103b to allow the ball 109 to drop through to the firing chamber 114. This ensures that the flap is in its maximum open position before the ball 109 completes the portion of a wheel revolution between the ball sensor 111b and the actual location of the flap 103b. The ball 109 falls through the open flap 103b when it is reached.

In an alternative embodiment, using only one ball sensor 111, the datum sensor 107 can be used instead of the second ball sensor 11b using the calculated position of the ball from a previous revolution of the wheel 108.

In its open position, the flap 103b forms the fourth wall of the firing chamber 114 and the ball 109 is dropped into position ready to be fired on the next game cycle and the flap 103b closes, as shown in the figures.

The whole process from when the wheel 80 receives the signal to open the flap 103b to when the flap is fully closed may take up to just under two revolutions of the wheel and it is very difficult to observe from above the wheel 108, unlike the aforementioned prior art method of lowering the whole wheel base plate. This provides a gambler with the perceived benefit of playing with a "normal" roulette wheel. There is also an increased longevity of the roulette wheel apparatus, since there is reduced risk of cracking of the wheel base

plate (which is often made out of shiny, brittle materials, for cosmetic purposes) during the raising and lowering stages (which are now substantially removed).

Semi-Automatic:

The semi-automatic wheel is similar in operation to the automatic wheel except for the firing process. Like the automatic wheel, it has a ball 109 fired into the wheel 108 by a fan mechanism 112, a ball detection and recovery system and a sealed dome cover. However, the ball firing is initiated by a croupier as opposed to the game server 40 in the fully automated system.

The semi-automatic wheel is set on a live roulette table but linked to player game terminals 10 remote from the live table, enabling the wheel 108 to be used in a live game and played via the remote player terminals simultaneously.

The ball firing signal is controlled by a button operated by the croupier and the game cycle is initiated by the croupier as he or she would on a live table.

When the button is pressed, a signal is sent to the player terminal(s) 10 giving a ten second countdown and a "LAST BETS PLEASE" message is displayed on the remote player terminal screens.

After ten seconds, a "NO MORE BETS" message is displayed on the player terminal screens and no more bets can be placed on the remote player terminals. The ball is fired into the wheel 108. The croupier can call "no more bets" on the live table at his or her discretion.

From this point the wheel 108 acts as a fully automatic wheel. The ball 109 is detected and confirmed by the sensors 107 and 111 and the winning number is sent to the remote player terminals 10. The croupier can call the winning number at the table as in a live game.

The ball 109 is retrieved as described above and dropped into the firing chamber 114 and a "PLACE YOUR BETS" message is displayed on the remote player terminals 10 and bets can be placed for the next game.

The start of the next game cycle is determined by the amount of activity on the live table.

Live wheel with ball detection:

The live wheel option is the standard automatic wheel with the sealed dome removed and the fan 112, wheel motor 105 and ball retrieval system 113 disabled. The wheel motor 105 is disabled/ disengaged in a way which does not hinder free rotation of the wheel 108 For example, the wheel motor 105 may have a clutch system, else a disengagable friction or geared connection to the electric motor.

The croupier manually sends a signal, via a button, to the remote player terminals 10 just before he or she spins the wheel 108 via the spinner 110 such that the message "LAST BETS PLEASE" is displayed on the remote player terminal screens.

The croupier then spins the ball 109 around the bowl and calls "NO MORE BETS" on the live table. Ten seconds after the "LAST BETS PLEASE" message, no more bets would be accepted on the remote player terminals 10 and the message "NO MORE BETS" will be displayed. In this way, the remote player terminals 10 are locked down, preventing bet changes, as described above.

When the ball 109 drops into a particular numbered slot on the wheel 108, the ball detection sensors 111 are used to detect the ball 109 and which slot it is in, and the embedded control system of the roulette wheel sends an appropriate signal to the game server 40 and remote player terminals 10, such that the winning number is displayed on the remote terminal screens. The croupier would call the winning number on the live table, in the usual way.

As soon as the winning number is displayed on the remote player terminal screens, bets can be placed on the next game. The croupier picks the ball 109 out of the pocket and starts a new game cycle at his or her discretion dependant on the amount of activity on the live table.

Ball Detection

As mentioned above, the ball detection system comprises a single reflective datum sensor 107 to give a datum (i.e. zero rotation angle) coupled with one or two reflective sensors 111 or 111b for measuring the presence of slot compartment dividers and the ball 109 itself, hereinbefore referred to as the ball sensor. Both sensors preferably are of the transmission detection type, adapted to detect a particular wavelength of electromagnetic waves, for example infra-red.

The datum sensor 107 gives one pulse per wheel revolution and the ball sensor(s) 111/b gives 37 pulses per wheel revolution for a wheel 108 with a single zero and 38 pulses for a wheel 108 with a double zero both numbers assume no ball 109 is present in the wheel.

The ball sensor views the wheel through an infrared transmissive insert in the wheel floor base plate103. This single ball sensor 11 is used to detect both when the ball 109 is in a pocket and the wheel position by comparing the output waveform of the ball sensor 111 to the expected waveforms of one or both ball sensors when the wheel is ball free.

The particular form of the waveforms are shown in FIG. 10, for the case of no ball sensed, and a ball sensed in slot two, respectively.

These figures clearly show that when the roulette wheel 108 is ball free, a train of identical pulses are produced by the moving of each slot compartment divider across the particular ball sensor's 111/b field of view. These pulses are measured for expected length and counted to indicate to the gaming platform

which numbered slot compartment is currently being viewed, as an offset from the datum point.

Meanwhile, when a ball finally settles in a slot compartment, the usual waveform is interrupted, with the expected output voltage remaining high in an expected trough of the waveform. Accordingly, the extended measured pulse length indicates the present of the ball 109, and the point in the train of pulses (starting from the datum, and cycling round each revolution of the wheel) indicates which numbered slot compartment the ball has landed in.

The outputs of additional ball sensors 111b, or multiple samplings from the same ball sensor 111, are compared and averaged with the output of all other ball sensor readings to provide a robust detection method that mitigates problems associated with ball bounce and the like

Camera based detection may also me employed as well as (as a form of cross check), or instead of the above method.

Ball Recovery

Following detection of the ball 109, the winning number is broadcast to the remote player terminals 10 and control/management system, and stored in a database 30 for game performance analysis purposes. A new game then commences.

The wheel 108 continues to rotate slowly (or is in a stationary state). After the ball 109 is detected passing the sensor near the wheel flap 103b in the base plate (3), the flap is opened by a small motor and is stopped when in the fully opened position.

In this position it forms a part of the firing chamber 114 as shown in Figure 12. The wheel 108 is rotated slowly and the ball 109 falls into the firing chamber 114. There is a detector in the firing chamber 114 to ensure that the ball 109 has left the wheel slot compartment and arrived in the firing chamber 114. The

flap 103b motor is reversed and the flap 103b is returned to be flush with the floor of the slot compartments 103.

The flap 103b is preferably shaped such that it forms an exact surface with the rest of the roulette wheel 108, i.e. completely level, and without any height differences between the flap edges and the flap hole edges.

Preferably, this is accomplished by using a trapezoid side view section for the flap 103b, and a correspondingly shaped recessed side section for the roulette wheel 108, as shown in the figures.

The trapezoid shape may be used for on all edges of the flap 103b, such that the flap forms a thin cut off square pyramid shape.

This form of flap 103b side section results in the natural bedding down of the flap 103b to the correct state, when uniform pressure is applied by the motorised hinge 116. It also prevents over driving the flap 103b, so that it would otherwise go past the top edge of the roulette wheel 108 top face, and potentially cause a fatal jamming of the wheel 108 turning mechanism or other damage to the roulette wheel apparatus as a whole. Furthermore, the reduced top edge length allows a better clearance of the ball 109 when it is in the firing chamber 114.

The wheel 108 will now typically accelerate to the randomly chosen play speed for the next game cycle and after a predetermined time the fan 112 will activate and fire the ball 109 as previously described.

Control Timing

FIG. 13 shows a high level flow chart of the control method.

The control messaging is organised to ensure that at all times the remote player terminals 10 can connect to any wheel 80, either live or automatic, and achieve a synchronised state.

This is described, for convenience, by the following sequence of events from the start of a new game

In a typical embodiment, all messages are sent by a particular wheel every 7 seconds. This has been found to be a particularly advantageous compromise between timely messaging to allow good gaming response, versus system resource consumption (such as power consumption and spectrum usage). Other message timings may be used instead.

The system has a "default" message to send out that is the "CONTINUE BETTING" message The remote player terminals are preferably set to default to a "NO MORE BETS" mode when no messages are received for any reason (e.g. failure of the whole system or only of the link between the particular remote player terminal 10 and the back office server 50, due to it going out of range). Thus in this way, no invalid bets may be placed

The defaults described above are used unless a particular event occurs as described below.

Once a game has finished, and the winning number message is sent along with the new game number and a "CONTINUE BETTING" message (hereafter M1), which is transmitted, say, every 7 seconds.

This continues until a "LAST BETS PLEASE" message (hereafter M2) is sent. This occurs before the ball 109 is fired into the wheel 108. Following this a "NO MORE BETS" message (hereafter M3) is sent every 7 seconds until the ball 109 is detected and the "Winning Number and Start New Game" message is sent (hereafter M4).

The player terminal 10, on receipt of M1 will allow the player to carry on playing for, say, 15 seconds. If a subsequent M1 is received the player terminal 10 will allow a further 15 seconds of play, if not, and no other

message is received the player terminal 10 will be placed into "NO MORE BETS" state.

Changing Remote Portable Terminals

The wireless portable terminal 10 may be a wirelessly connected battery powered device. In this case, the cash may be put on the player terminal 10 by means of the player membership card, such as account smartcard Accordingly, the portable player terminals 10 can be used in lounge, bar and external (smoking areas).

A monitor displays the battery status of all terminals 10 or 11 in a casino control room.

As the battery of each player terminal 10 discharges, the power levels are monitored by the back office server 50 with this data being visible to the operator, or pit boss. When the remaining power level reaches a predetermined warning threshold, a warning is sounded in the control room and optionally logged in the database on the data server 30, or on screen to visually warn the operator. This alarm can be postponed or muted by the operator if required.

If no action is taken within a fixed time (for example, 5 minutes) then the alarm sounds again. If this continues, and unit drops below a further lower threshold, the alarm level increases, for example, it becomes more strident.

Once the operator is ready to attend to the low battery of a particular portable gaming player terminal 10, the operator can use a master swipe card to take the currently playing player's gaming details from the portable terminal 10 with the low battery and place the information on to a fully charged replacement terminal 10. This is typically done in a stepped process, where the fully charged replacement player terminal is pre-loaded with the requisite player data (and maintains synchronisation of this data over the wireless links from then on). Meanwhile, the replacement player terminal 10 is taken onto the

gaming floor and given to the player with the low power terminal 10, at which point the smartcard is moved to the replacement player terminal 10 under view of the player, and then authorised by the operator smartcard or other authentication means. In an alternative embodiment, the operator uses a swipecard having a magnetic strip containing encrypted data that is used to access and authorise the player terminal swapout This process ensures no break in play to the benefit of both the player and the operator, and maintains account security at all times.

Wheel Levelling

During installation and daily use there is a requirement to level the roulette wheel 108 playing surfaces to minimise any "wheel bias", which would otherwise affect the outcome of the games played. Thus, it is necessary to ensure that the outer fixed wheel parts and the inner rotating wheel 108 are level.

In the past this has been checked by placing a spirit level on the outer wheel on at least two axes and then the central spindle and ensuring that both are level. Adjustments to the outer wheel are would then be made by shimming the whole unit and the central moving part by adjusting the central bearing.

The present invention removes the need to shim the outer fixed wheel parts or adjust the central bearing.

FIGs 14 to 20 show the how a levelling system is employed between the outer wheel cosmetic cover 82 and the roulette wheel 108 and the mechanisms that operate the wheel 108 house within the cosmetic cover 82

The outer wheel cosmetic cover 82 is placed on the gaming table base unit 83 (which may or may not be level). This cosmetic cover comes in two portions

(upper 82a and base 82b portions) shaped to locate the wheel assembly inside. The shaping is typically done by removing a portion of the inner circumference of the top side of the base portion 82b, and shaping the upper portion 82a to match the shape of the upper side of the main wheel assembly.

The levelling system comprises one or more upwardly biasing means that act to push the roulette wheel up. Meanwhile, an adjustable fastening means is used to compress the upwardly biasing means in order to provide the levelling function.

In a particular embodiment, the upwardly biasing means are formed of springs 210.

The base portion of the outer wheel cosmetic 82b cover has three groups of two springs 210 placed at nominally 120 degree spacing. Other numbers and degree spacings of these springs 210 may be used instead, dependent on the design criteria of the roulette wheel. In the centre of each pair of springs there is a tapped insert to accept a machine bolt as the fastening means.

The main wheel assembly is manufactured to ensure that the wheel central spindle 110 is precisely perpendicular to the horizontal base of the wheel assembly. The base of the wheel assembly has mating holes to accept the six springs 210 and three machine bolts.

Preferably, the base of the wheel assembly also has a set of keyed dowel pins 87b to prevent misalignment of the wheel assembly and base portion of the outer wheel cosmetic cover 82b, which would otherwise cause the springs 210 to buckle sideways when the parts are assembled together.

The base portion 82b of the outer wheel cover has corresponding holes 87a to accept the dowel pins 87b The keying of the dowel pins 87b refers to their offset relative positions around the outer circumference of the wheel assembly, relative to the positions of the three sets of two springs 210 and a machine bolt.

Thus the dowels 87b are purposefully positioned such that the wheel assembly cannot mate with the base portion of the wheel cosmetic cover 82b unless the springs 210 and machine bolt are correctly aligned with their respective mating holes. The dowel pin holes 87a in the base portion of the wheel cosmetic cover are deliberately not a tight fit, so that the dowels may move slightly during levelling. The amount of levelling expected to be required would be in the region of 0.5 to 1 degree, corresponding to only a difference of a few mm between the three machine bolts securing the wheel assembly to the base portion of the wheel cosmetic cover 82b.

The main wheel is placed onto the cosmetic base and the springs 210 are designed to hold the wheel assembly and base apart, while the machined bolts hold it together In this way, the wheel assembly can be levelled, whilst also featuring shock absorption.

The three machine screws are inserted and adjusted to level the wheel 108. Finally, the upper portion of the cosmetic cover is fitted on top so that none of the internal construction is visible from the outside. This top cover is then locked in place, preferably using a cylinder or barrel insert type of lock.

This locking feature, combined with suitable locking mechanisms on any access panels under the roulette wheel prevent any unauthorised access to the roulette wheel components. Hence tampering with the gambling equipment by any unauthorised person is prevented, to maintain the security and un-biased nature of the wheel. This is particularly important to gambling establishments, since such tampering could mean excess losses to the operator.

The server side systems maybe embodied as a computer readable medium containing instructions, which, when executed by a computer, carries out the control management system functions. The instructions would include those required to operate the required specific hardware, such as the network interfaces, embedded roulette control system in the roulette wheel assembly,

as well as general hardware, such as the display screen displaying the control side of the graphical user interface (GUI) or the player terminal side of the GUI.

The networking interfaces may be either wired or wireless, using industry standard network protocols such as Ethernet, 802.11x (x being the indicator of the particular version of the wireless protocol in use - types, a, b, g or n), Bluetooth, zigbee, wireless USB or equivalent.

When wireless interfaces are used in a remote portable player terminal 10, the terminal maybe further adapted to detect and indicate a distance from the roulette wheel 80 or particular gaming table. In this way, the player terminal 10 may be programmed to act according to the measured distance, to allow the system to adhere to any gambling laws in place determining the allowed distance from the roulette wheel 80.

Wireless player terminals 10 are particularly useful in the context of prohibitions on smoking indoors, because the player terminal 10 will still be able to be operated whilst in a nearby designated smoking area that is in line with the local smoking laws. For example, it is in an outside covered area. Gambling is often accompanied by smoking, hence this provides a means for the gambling to continue unhindered while the gambler goes about his personal gambling practices.

The above-described hot swap method maintains the unhindered game play feature using the wireless player terminals 10. This is useful to a gambler who may not wish to stop playing, since he is in a perceived "lucky run".

In some embodiments, a camera focussed on the roulette wheel 108 maybe used to capture image data about the game, for streaming to the remote player terminals 10 or 11 and/or detecting where the ball 109 has landed. This ball detection method may be realised by using appropriately programmed image processing algorithms. Camera detectable only readable symbols may or may not be used, as required.

Some jurisdictions require the players are within a defined gaming floor area. In such instances, the wireless player terminals 10 may use triangulation, or other suitable location detection means to enable a player terminal 10 exiting the gaming floor to be warned, and/or disabled accordingly. A default status may be applied to a player terminal 10 that strays from the gaming floor.

Encryption of network links will be used in most embodiments, to secure the transaction messages against unauthorised tampering. Encryption protocols such as WPA, WEP, and the like may be used.

The wireless protocol used may be adapted to form a mesh network, for example the Zigbee protocol. Other, higher speeds mesh protocols may be used. Equipped with this kind of equipment, the whole network can be de-centralised for better network outage resilience, or gambling locations having radio wave propagation issues that would result in error prone or non-existent network connections is a centrally administered wireless network infrastructure.

The previously described specific embodiments of particular features of the present invention may be combined in many ways, except where the embodiments physically prevent combination.

CLAIMS:

1. A roulette wheel apparatus, comprising:
a rotatable roulette wheel having a plurality of slot compartments around its circumference,
a floor of the slot compartments;
a drive motor to rotate the roulette wheel;
a firing mechanism to propel a roulette ball onto the rotating roulette wheel such that a ball finally lands in a slot compartment; and
a return mechanism to return the ball from a particular slot compartment to the firing mechanism, characterised in that the return mechanism comprises:
a closable opening at a set location on the floor of the slot compartments, arranged above the firing mechanism.

2. The roulette wheel apparatus of claim 1, wherein the closable opening comprises a rotatable flap with a motorised hinge arranged to open or close the flap according to control signals sent to the motorised hinge.

3. The roulette wheel apparatus of claim 2, wherein a sideways section of the flap is a trapezoid shape having the shorter of the two parallel sides at the top when in use and sides slanting outwards on a downward incline and the floor of the slot compartments is conversely shaped to accept the trapezoid flap.

4. The roulette wheel apparatus of claim 3, wherein the trapezoid shape of flap substantially comprises a cut off square pyramid.

5. The roulette wheel apparatus of any preceding claim, wherein the firing mechanism comprises a firing chamber and the flap comprises a side wall of the firing chamber.

6. The roulette wheel apparatus of claim 5, wherein the firing chamber is a round bottomed tubular trough, with a sidewall arranged opposite a wall

comprising the flap, and wherein said sidewall supports the firing chamber below the slot compartment floor.

7 The roulette wheel apparatus of claim 5 or 6, wherein the firing chamber further comprises a ball detection sensor arranged to detect the ball in the firing chamber once returned from the roulette wheel.

8. The roulette wheel apparatus of any preceding claim, further comprising a ball detector mechanism, wherein the ball detector mechanism comprises·

a datum sensor arranged to detect a zero point in the rotation of the roulette wheel;

a combined slot compartment separator and ball detecting sensor arranged below the compartment slots of the roulette wheel such that said combined sensor detects a passing overhead of the compartment slot separators and the ball, and

a processor arranged to detect which slot compartment the ball is located in by comparing the datum sensor output with the combined sensor output, and further adapted to provide a signal indicating which slot compartment the ball is located in.

9. The roulette wheel apparatus of claim 8, wherein the processor is further adapted to detect which slot compartment the ball is located in by determining which two slot compartment divider detection peaks, in the output waveform of the combined sensor, are not distinct from one another due to the ball being located between the slot compartment dividers.

10 The roulette wheel apparatus of claim 8 or 9, wherein the sensors are transmission detection sensors, and the floor of the slot compartments comprises material substantially transparent to the transmission wavelength type in use by the sensors.

11. A roulette gaming system comprising:

at least one roulette wheel having at least ball detection means,

at least one wireless remote player terminal; and

a roulette game control management system in communication with the at least one roulette wheel and the at least one remote player terminal to thereby administer one or more games of roulette.

12. The roulette gaming system of claim 11, wherein the at least one roulette wheel further comprises automatic ball retrieval and firing mechanisms and thereby may operate automatically.

13. The roulette gaming system of claim 11 or 12, wherein the at least one roulette wheel has at least three operating states, wherein the three operating states comprise:

a betting available state;

a betting almost closed state, distinct from the betting available state; and

a no more bets state;

wherein a current state of the at least one roulette wheel is transmitted at predetermined intervals to the remote terminals using a protocol distinguishing between the states for each game played.

14. The roulette gaming system of claim 13, wherein the at least one wireless remote player terminal is adapted to enter a default state when a predefined message type is not received for a predetermined period of time.

15. The roulette gaming system of claim 14, wherein the default state is a no more bets state.

16. The roulette gaming system of claims 11 to 15, wherein the at least one wireless remote player terminal executes a player terminal interface for allowing the player to administer his player's account during gaming, and wherein unique player account information is stored on a data carrier within the remote player terminal.

17. The roulette gaming system of claims 11 to 16, wherein the roulette gaming system further comprises at least one wired remote player terminal in communication with the roulette wheel.

18. The roulette gaming system of claim 17, wherein the at least wireless terminal is a sub part of one of the wired player terminals, the wired player terminal being adapted to release the sub part to allow roaming of the player whilst gaming.

19. The roulette gaming system of claim 11 to 18, wherein the account which the player terminal is administering is moveable between different remote player terminals upon authorisation by the operator or player using a specific data carrier.

20. The roulette gaming system of claim 11 to 19, wherein the roulette gaming system is further adapted to provide battery level warnings for each remote wireless player terminal in use, identifiable by the operators of the roulette gaming system, such that the operator may replace a particular wireless player terminal, upon authorisation, to thereby provide substantially uninterrupted gameplay to the player.

21. The roulette gaming system of claim 11 to 20, further comprising one or more servers for executing, storing and maintaining the game control management system, wherein the servers include any one or more of:

a data server to store all relevant information pertaining to the operation of the gaming system as a whole;

a game server operable to maintain running of each roulette game in operation including timing of particular roulette wheels in respective states of play;

a back office server operable to provide analysis functions to an operator or player;

a financial transaction server to process all financial transactions associated with any game played;

a control console adapted to allow centralised control of the one or more roulette games in progress

22. The roulette gaming apparatus of any of claims 11 to 21, wherein the at least one roulette wheel having at least ball detection means comprises the roulette wheel apparatus of any of claims 1 to 10.

23. A levelling system for levelling a roulette wheel assembly comprising:
a roulette wheel sub assembly to be levelled; and
a base assembly having upwardly biasing means mounted to compress against the roulette wheel sub assembly.

24. The levelling system of claim 23, further comprising;
fixing means adapted to compress the roulette wheel sub assembly against the upwardly biasing means.

25. The levelling system of claim 24, wherein the upwardly biasing means comprises two spaced apart upwardly biasing members; and the fixing means is centrally located between the two upwardly biasing members.

26. The levelling system of claim 25, wherein the upwardly biasing means further comprises two further sets of the two spaced apart upwardly biasing members and fixing means centrally located between the two upwardly biasing members.

27. The levelling system of claim 26, wherein the two further sets of two spaced apart upwardly biasing members are equidistantly radially spaced about the roulette wheel sub assembly circumference.

28. The levelling system of any of claims 23 to 27, wherein the upwardly biasing member is a spring.

29. The levelling system of any of claims 23 to 28 further comprising at least one keyed protrusion and matching recess in the roulette wheel sub

assembly or base assembly, arranged such that the roulette wheel sub assembly mates with the base assembly in a predetermined orientation, such that the upwardly biasing member is not distorted during mating

30. The levelling system of any of claims 23 to 29, wherein the fastening means is a threaded bolt

31. The apparatus or system of any of claims 1 to 22, further comprising the levelling system of any of claims 23 to 30.

32 A roulette wheel apparatus substantially as herein described with reference to the accompanying drawings

33. A roulette gaming apparatus substantially as herein described with reference to the accompanying drawings.

34. A levelling system substantially as herein described with reference to the accompanying drawings.

36

Application No: GB0801059.7 **Examiner:** Mr Brendan Donohoe

Claims searched: 1-10 **Date of search:** 29 April 2008

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-4, 8-10	GB 2363735 A COINMASTER - See whole document, especially figure 4.
A	-	US 2007/0246883 A1 CUDLIPP - See especially paragraphs 0082 & 0097.
A	-	GB 1544962 A MULTI-AUTOMAT - See especially figure 4.
A	-	US 3386740 A NEELY - See especially the figures.
A	-	WO 01/30469 A1 SEGA - See the ENglish abstract and the figures.
A	-	WO 2004/094013 A1 CAMMEGH - See especially page 2 lines 5-9.
A	-	JP 09276477 A TAIHEI - See the WPI English language abstract Accession No. 1998-012702 and the figures.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X}:

A6H

Worldwide search of patent documents classified in the following areas of the IPC

A63F

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1, TXTWO1, TXTAU1.

International Classification:

Subclass	Subgroup	Valid From
A63F	0005/02	01/01/2006
A63F	0005/00	01/01/2006