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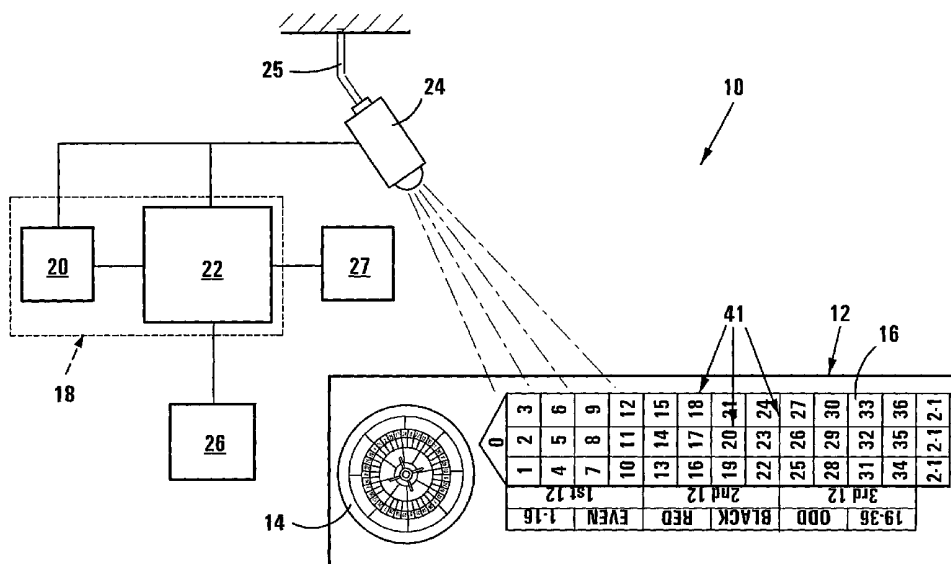
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(54) Title: A PAYOUT SYSTEM FOR CALCULATING PAYOUTS IN A GAME OF ROULETTE



(57) Abstract: A payout system (10) for calculating payouts in a game of roulette played at a roulette table (12) having a roulette wheel (14) and a betting area (16), comprises a computer (18) comprising a processor (22) and a memory (20), a video camera (24) and display monitors (26 and 27). The following is stored in the memory (20) of the computer: digital reference images of the layout of the betting area; odds corresponding to various betting positions on the betting area; and digital reference images of the different types of gaming chips. The video camera captures video images of the roulette table and is connected to the processor (22) which is operable to identify the winning chips and their positions on the betting area, from the video images. By applying the odds corresponding to the positions of the winning chips, the payouts for the winning chips are calculated by the processor and displayed on the monitors (26 and 27).



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

## **A PAYOUT SYSTEM FOR CALCULATING PAYOUTS IN A GAME OF ROULETTE**

### **FIELD OF INVENTION**

THIS INVENTION relates to a payout system for calculating payouts in a game of roulette. It also relates to a method of calculating payouts in a game of roulette.

### **SUMMARY OF INVENTION**

According to a first aspect to the invention, there is provided a payout system for calculating payouts in a game of roulette played at a roulette table having a roulette wheel and a betting area on which gaming chips of different types having visibly distinguishable features, can be placed, the payout system comprising

memory means in which is stored:

- a) digital reference images of the layout of the betting area including the relative positions of line markings on the betting area, demarcating separate betting regions, and of alpha-numeric markings in the betting regions;
- b) odds corresponding to possible betting positions on said line markings and in said betting regions of the betting area;

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- c) digital images of the different types of gaming chips;

at least one video camera that is operable to capture at least one video image of the betting area, including winning chips located on the betting area after the end of a game of roulette, the video camera being operable to generate a digital output signal of the video image;

computer processing means having data entry means for entering a winning number in a game of roulette, the processing means being linked to the memory means and being connected to the video camera so as to receive output signals therefrom, the processing means having image processing software executable thereon and being operable to:

- a) identify from the video image, the winning chips located on the betting area after the end of a game of roulette;
- b) ascertain by a comparison of the video image with the reference images of the betting area stored in the memory means, the position of each winning chip on the betting area;
- c) ascertain from the video image, the number of winning chips of each type;
- d) calculate the payout for the winning chips by applying the odds corresponding to particular positions of the winning chips on the betting area, to the winning chips;

display means for displaying the payouts in relation to the winning chips.

The data entry means of the computer processing means, may be in the form of a manual keypad device for entering a winning number in a game of roulette.

In another embodiment, the memory means may have stored therein, a digital reference image of a pocket of the roulette wheel, having a ball located therein, the video camera being operable to capture successive video images of the roulette wheel after a ball is put into play on the roulette wheel, and to send a digital output signal of the video images to the computer processing means

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which is operable to compare the video images captured by the camera with said reference image and using a pattern matching technique, the processing means being operable to detect the presence of the ball in a pocket when a match is found between the reference image and one of the video images captured by the video camera, the processing means being operable to identify the number associated with the pocket in which the ball comes to rest from reference images of the roulette wheel.

According to a second aspect of the invention there is provided a method of calculating payouts in a game of roulette played at a roulette table having a roulette wheel and a betting area on which gaming chips of different types having visibly distinguishable features, can be placed, the method including the steps of:

providing memory means in which is stored::

- a) digital reference images of the layout of the betting area including the relative positions of line markings on the betting area, demarcating separate betting regions, and of alpha-numeric markings in the betting regions;
- b) odds corresponding to possible betting positions on said line markings and in said betting regions of the betting area;
- c) digital images of the different types of gaming chips;

recording a winning number in a game of roulette;

capturing at least one video image of the betting area, including winning chips located thereon after the end of a game of roulette, by means of a video camera and generating a digital output signal of the video image;

identifying the winning chips on the betting area after the end of a game of roulette,

ascertaining, by comparing the video image with the reference image of the betting area stored in the memory means, the position of each winning chip on

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the betting area;

ascertaining from the video image, the number of winning chips of each type;

calculating the payouts for the winning chips by applying the odds corresponding to particular positions of the winning chips on the betting area, to the winning chips; and

displaying the payouts in relation to the winning chips.

### BRIEF DESCRIPTION OF THE DRAWINGS

Further features of the invention are described hereinafter by way of a non-limiting example of the invention, with reference to and as illustrated in the accompanying diagrammatic drawings. In the drawings:

Figure 1 shows a schematic block diagram of a payout system in accordance with the invention;

Figure 2 shows a flow chart illustrating the operation of the payout system in accordance with the invention; and

Figure 3 shows a schematic top plan view of a typical roulette wheel.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings, a payout system for calculating payouts in a game of roulette, is designated generally by the reference numeral 10. The payout system 10 is used for calculating payouts in a game of roulette played at a roulette table 12 having a roulette wheel 14 and a betting area 16.

The payout system 10 comprises a computer 18 comprising a memory 20 and a processor 22, a video camera 24 for capturing colour video images of the roulette wheel 14 and the betting area 16 of the roulette table and display

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means in the form of a croupier monitor 26 having a touch screen display. A further player monitor 27 is provided for displaying information that can be seen by players in a game of roulette. The display screen of the monitor 26 is visible to the croupier in charge of the game.

The gaming chips are of different colours as is dictated by convention, so as to distinguish between the chips of different players. Peripheral edges of all of the chips for use at a particular roulette table have distinctive patterns, for distinguishing between the chips of different tables. The chips have a marking in the form of a centrally-positioned circle on the upper and lower sides thereof. Typically, a logo of the casino is imprinted in the circle.

The video camera 24 is positioned above the roulette table and is moveable so as to capture images of the roulette wheel 14 and of the betting area 16. The payout system includes a motor for moving the camera so as to permit panning of the camera between the roulette wheel 14 and the betting area 16. The camera is also mounted to a mounting support 25 in an arrangement wherein the camera can revolve so as to track a ball spinning in the roulette wheel 14 during a game of roulette. This feature of the camera will be described in further detail hereinafter.

The roulette wheel 14 comprises an annular casing 28 containing a static inwardly sloping rim 30 within which is mounted a rotatable cylinder 32. The cylinder 32 includes an outer ring 34 that is marked with numbers and an inner ring 36 that defines a number of pockets. The inner and outer rings are arranged concentrically and each pocket 36 is individually numbered by the numbers of the outer ring 34. The roulette wheel includes a central domed area 38.

In a game of roulette, the cylinder 32 is spun in a particular direction and a ball is then caused to run along the rim 30. The ball is projected in the same direction as the direction of rotation of the cylinder 32. As the ball slows down, the force of gravity overcomes the centrifugal forces acting on the ball and it consequently falls down the rim 30 over the outer ring 34, before coming to rest in one of the pockets in the inner ring 36. The ball coming to rest in the pocket signifies the end of the game and the pocket in which the ball lands then becomes the winning pocket and the number in the outer ring, associated therewith becomes the winning number.

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As dictated by convention, the numbers in the outer ring 34 are each shown against an alternating black and red background. The number zero is, however, shown against a green background. The ball is white and is thus contrasted against the colours of the outer ring 34. Concentric circles 40a, 40b, 40c, and 40d can be identified on the roulette wheel. More particularly, the rim 30 is bounded by the circles 40a and 40b, the outer ring 34 is bounded by the concentric circles 40b and 40c and the inner ring is bounded by the concentric circles 40c and 40d.

Prior to operating the payout system, the system is set up for operation. Firstly, a number of video images of the roulette wheel 14 are captured. Digital output signals of these images are sent to the processor 22 which has image processing software executable thereon that is operable to record the relative positions of the concentric circles 40a, 40b, 40c and 40d and hence, of the annular areas bounded by the concentric circles. Using the image processing software, the position of the centre of the roulette wheel is determined from the digitised video images. Furthermore, each number in the outer ring 34 and the relative positions of the numbers is ascertained from the digitised video images of the roulette wheel. In addition, a digital image of a ball in a pocket in the inner ring 36, is record. This is known as a pocket image template. The above information is then stored in the memory 20 of the computer.

The rate of decay of the ball, i.e. the rate at which the balls drops from concentric circle 40a along the rim 30, is monitored. The speed of the ball as it begins its descent is monitored and the speed at which the camera revolves is matched to the speed of the balls as it begins decaying. The frame speed and the rate of revolution of the camera is setup so that it will be unable to detect the ball until it commences its descent. The speed of decay of the ball will vary for different balls. As such, this set up procedure is performed for each roulette wheel at a roulette table. In addition, the speed of decay of the ball across the rim 30 is monitored and the speed of revolution of the camera 24 matched to the slowing of the ball as it decays further along the rim. In this way, the camera is set up to track the ball from the moment it commences its descent across the rim 30. The speed of revolution of the camera for tracking the ball as it decays, is stored in the memory 20 of the computer.

The camera 24 is caused to pan to the betting area 16 of the roulette table. A



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number of video images of the betting area are captured by camera and sent in the form of digital output signals to the processor 22 for processing. Using the image processing software, the layout of the betting area is "mapped" by recording the relative positions of line markings on the betting area demarcating separate betting regions and the numbers associated with each of the demarcated betting regions. The line markings are designated by reference numeral 41. This information is stored in the memory 20 of the computer.

Video images of each of the different gaming chips are captured by the video camera 24. Sufficient video images of the gaming chips are captured and sent to the processor for image processing so as to determine the red, green, blue, hue, saturation, luminance, pixel value and intensity of each colour of each gaming chip. This information is then stored in the memory 20 using caliper and pattern matching tools which form components of the image processing software executable on the processor 22. The shape and thickness of the chips and the patterns on peripheral edges of the chips are also measured, recorded and stored in the memory 20 using the image processing software. It will be appreciated that the image processing software that is executable on the processor 22, is commercially available and is thus not described in any further detail hereinafter.

In addition, odds corresponding to possible betting positions on the line markings and in the betting regions of the betting area, are entered into the computer and stored in the memory 20.

In an automated process incorporating the payout system in accordance with the invention, a croupier commences a game of roulette by pressing a button marked "next game" on the touch screen of the monitor 26. A message "next game" is displayed on the player monitor 27. A reference number unique to the game is generated and stored in the memory 20. The croupier then spins the cylinder 32 of the roulette wheel 14 and causes the ball to run along the rim 30. The camera 24 at this stage is activated to pan onto the roulette wheel and more specifically to revolve at a rate wherein the speed of revolution is substantially equivalent to the speed of the ball as it commences its decay. Digital video images of the roulette wheel are sent to the processor which records successive images of the rim 30 of the roulette wheel defined by concentric circles 40a and 40b. As soon as the ball is detected from the aforesaid images, the processor sends a signal to the camera motor to slow the

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revolutions of the camera in accordance with the set up for the camera, stored in the memory. The ball is thus detected as it is about to descend from the outer concentric circle 40a of the rim 30. When the ball decays to a predetermined position along the rim 30, a signal is sent to the croupier monitor 26 and the player monitor 27 causing a screen display "No More Bets" to be displayed on the screens of the monitors. Simultaneously with the screen displays, an audio message is also generated warning players that no further bets will be permitted.

Using a pattern matching technique, the processor 22 then compares successive digital images obtained by the camera 24, of the roulette wheel 14, with the pocket image template stored in the memory. When a matching pattern is found, i.e. between an image of a ball in a pocket and the pocket image template, the ball is deemed to have come to rest in a pocket. The position of the ball is determined from the digital images, together with the number associated therewith. This number, being the winning number, is displayed on the croupier monitor 26 and the player monitor 27. The croupier then enters an instruction to the processor to calculate the payout, if any, by pressing on a "calculate winnings" button on the touch screen of the monitor 26. It will be appreciated that in another embodiment of the invention, the payout system may include data entry means for manually entering the winning number into the processor to allow calculation of the payouts to players having winning chips, to proceed.

At this stage, the croupier removes all non-winning bets from the betting area, leaving behind only the winning chips. The camera 24 pans to the betting area 16 of the roulette table and sends a digital image of the winning chips and their positions on the betting area, to the processor 22. The processor 22 is operable to convert the digitised colour image into an 8-bit greyscale image. Using pattern matching techniques, the processor 22 compares the greyscale image with the reference image of the same location without any chips on the betting area, that is stored in the memory 20. In this manner, the position of each winning chip on the betting area is determined. The processor is then operable to convert the 8-bit greyscale image into a binary image and performs a morphological transformation on the image so as to determine the circle marked on the uppermost circle in, for example, a stack of winning chips on the betting area. In this manner, the top of the stack can be determined. From the image, the pixel locations of both the top and bottom of a particular stack of winning

chips, can be determined. Hence, with the thickness of each chip being known, the number of chips in a particular stack of chips can be determined.

Using pattern matching techniques, the individual chips of the different players in a stack of winning chips can be identified and distinguished by their colour. By measuring the red, green, blue, hue, saturation, luminance, pixel value and intensity of the pixels of the image of the chips and by using colour matching techniques, the particular type of each winning chip can be determined. This process is repeated for each winning location on the betting area of the roulette table. The number of chips, including information on the particular type of chip detected in each winning location on the betting area, is stored in the memory 20. For future reference, each digital video image is saved either to disk or to the memory together with the following information: date, time, table number, game number, session number, winning number, bet location and number of each type of chip, i.e. red -10, blue - 20, etc. and the total number of chips found in each stack. For security purposes or to resolve disputes concerning payouts, reference can be had to the stored video images of the winning chips.

The processor then extracts the odds stored in the memory 20 corresponding to the position of the winning chips on the betting area. The processor then applies the odds to the winning chips and calculates the payouts payable in relation to the different types of winning chips.

The total payout for each of the differently coloured winning chips is displayed on the monitor 26. In order to verify the number of winning chips of each colour, the croupier stacks the winning chips of each colour at a preselected location on the betting area. The camera 24 is instructed to capture an image of the stack and using the image of the stack and the image processing technique described hereinabove, the number of chips in the stack is compared to the number of chips determined in the preceding calculation of the payouts in relation to the winning chips.

The Applicant believes that the payout system in accordance with the invention will speed up the time taken to manually calculate bets. As a result, the turnover from roulette games will increase.

The payout system will also eliminate errors by croupiers in calculating payouts to players. As video images of winning chips and their location on the betting

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area for a particular game of roulette, are either saved to disk or stored in the memory of the computer, disputes can be resolved quickly and easily by referring to these images.

**CLAIMS**

1. A payout system for calculating payouts in a game of roulette played at a roulette table having a roulette wheel and a betting area on which gaming chips of different types having visibly distinguishable features, can be placed, the payout system comprising

memory means in which is stored:

- a) digital reference images of the layout of the betting area including the relative positions of line markings on the betting area, demarcating separate betting regions, and of alpha-numeric markings in the betting regions;
- b) odds corresponding to possible betting positions on said line markings and in said betting regions of the betting area;
- c) digital images of the different types of gaming chips;

at least one video camera that is operable to capture at least one video image of the betting area, including winning chips located on the betting area after the end of a game of roulette, the video camera being operable to generate a digital output signal of the video image;

computer processing means having data entry means for entering a winning number in a game of roulette, the processing means being linked to the memory means and being connected to the video camera so as to receive output signals therefrom, the processing means having image processing software executable thereon and being operable to:

- a) identify from the video image, the winning chips located on the betting area after the end of a game of roulette;
- b) ascertain by a comparison of the video image with the reference images of the betting area stored in the memory means, the position of each winning chip on the betting

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area;

- c) ascertain from the video image, the number of winning chips of each type;
- d) calculate the payout for the winning chips by applying the odds corresponding to particular positions of the winning chips on the betting area, to the winning chips;

display means for displaying the payouts in relation to the winning chips.

2. A payout system as claimed in Claim 1, wherein the data entry means of the computer processing means, is in the form of a manual keypad device for entering a winning number in a game of roulette.
3. A payout system as claimed in Claim 1, wherein the memory means has stored therein, a digital reference image of a pocket of the roulette wheel, having a ball located therein, the video camera being operable to capture successive video images of the roulette wheel after a ball is put into play on the roulette wheel, and to send a digital output signal of the video images to the computer processing means which is operable to compare the video images captured by the camera with said reference image and using a pattern matching technique, the processing means being operable to detect the presence of the ball in a pocket when a match is found between the reference image and one of the video images captured by the video camera, the processing means being operable to identify the number associated with the pocket in which the ball comes to rest from reference images of the roulette wheel.
4. A method of calculating payouts in a game of roulette played at a roulette table having a roulette wheel and a betting area on which gaming chips of different types having visibly distinguishable features, can be placed, the method including the steps of:

providing memory means in which is stored:

- a) digital reference images of the layout of the betting area including the relative positions of line markings on the

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betting area, demarcating separate betting regions, and of alpha-numeric markings in the betting regions;

- b) odds corresponding to possible betting positions on said line markings and in said betting regions of the betting area;
- c) digital images of the different types of gaming chips;

recording a winning number in a game of roulette;

capturing at least one video image of the betting area, including winning chips located thereon after the end of a game of roulette, by means of a video camera and generating a digital output signal of the video image;

identifying the winning chips located on the betting area after the end of a game of roulette,

ascertaining, by comparing the video image with the reference image of the betting area stored in the memory means, the position of each winning chip on the betting area;

ascertaining from the video image, the number of winning chips of each type;

calculating the payouts for the winning chips by applying the odds corresponding to particular positions of the winning chips on the betting area, to the winning chips; and

displaying the payouts in relation to the winning chips.

5. A new method of calculating payouts in a game of roulette, substantially as described in the specification.
6. A method of calculating payouts in a game of roulette, substantially as described in the specification with reference to and as illustrated in the accompanying diagrammatic drawings.
7. A new payout system, substantially as described in the specification.

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8. A payout system, substantially as described in the specification with reference to and as illustrated in the accompanying diagrammatic drawings.



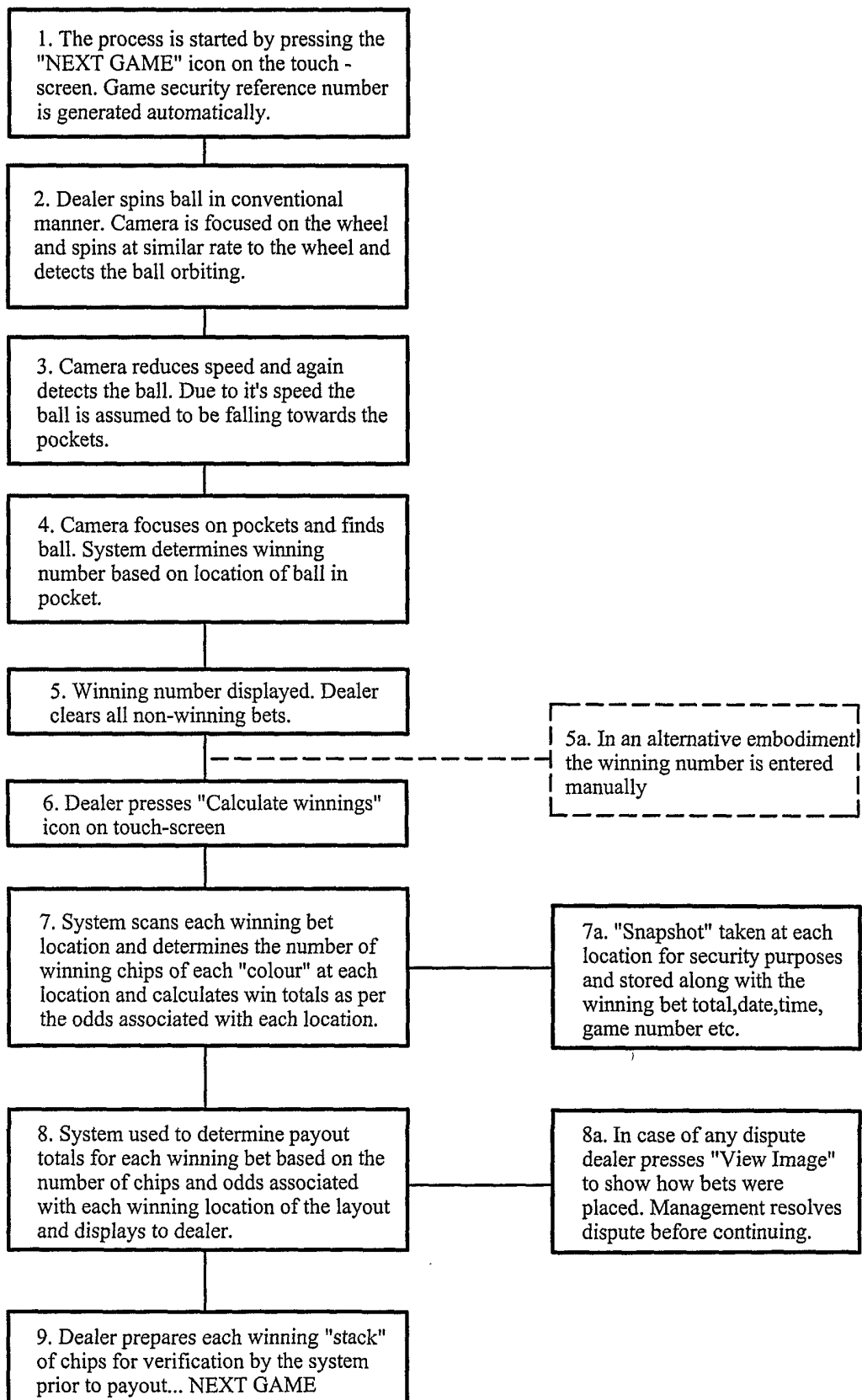
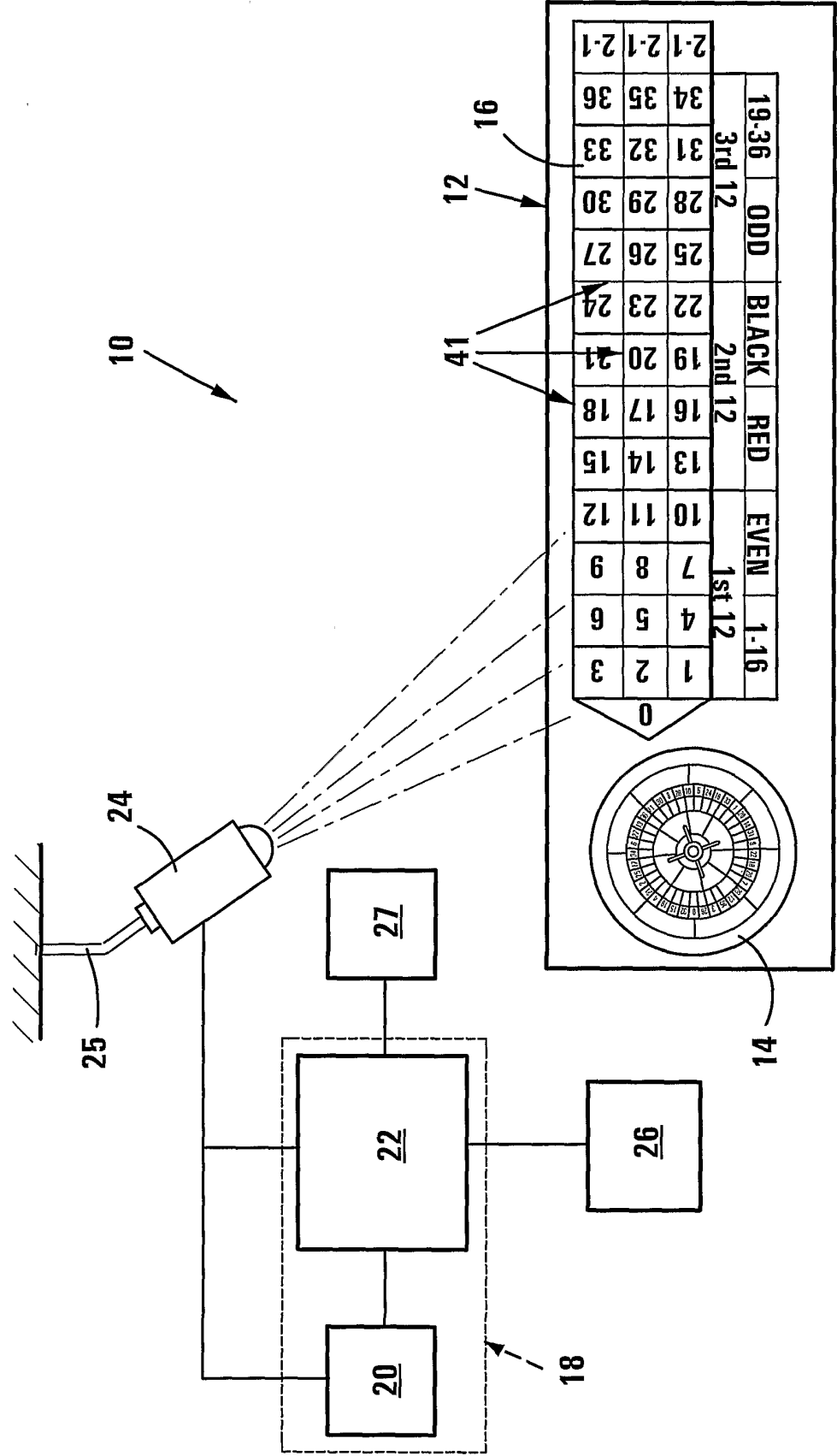


FIG 1



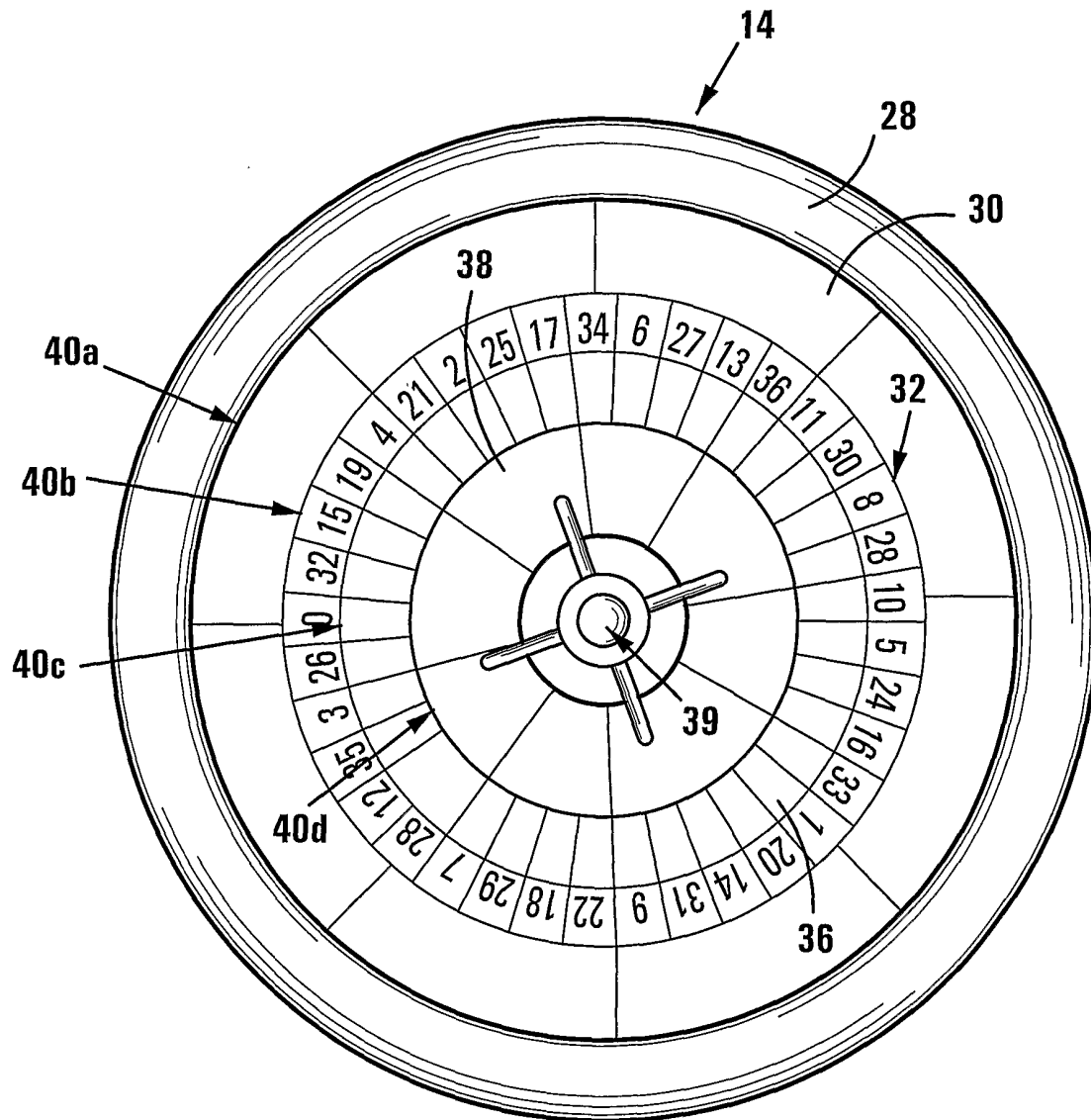


FIG 3