Description

[Title of Invention] Card Shoe Apparatus and Game System

[Technical Field]

[0001]

The present invention relates to a card shoe apparatus having a function of preventing cheating in card games such as baccarat that are played using playing cards (hereinafter simply referred to as "cards"), a table game system and a method.

[Background Art]

[0002]

Conventional card shoe apparatuses that are suitable for use in card games played in casinos or the like have been proposed. For example, a card shoe apparatus is disclosed in Patent Literature 1. In the card shoe apparatus of Patent Literature 1, a CCD image sensor and the related optical system components are incorporated in the card shoe. Also, a card reading window is provided in the exit of the card shoe. When a card passes through the exit of the shoe, the suit (type) and the rank (number) of the card are read through the card reading window.

[Citation List]

[0003]

Patent Literature 1: JP 1998-508236A (page 12, Fig.1)

[Summary of Invention]

[Technical Problem]

[0004]

However, such a conventional apparatus could not prevent a fraudulent act such as the insertion of false cards from the exit of the card shoe.

[0005]

The present invention has been made in view of the above problem, and aims to provide a card shoe and a table game system with which it is possible to prevent the fraudulent insertion of cards into a card shoe used in the card game or the fraudulent dealing of cards, as well as the dealing of any card that should not be dealt onto the game table.

[0006]

[Solution to Problem]

To solve the above conventional problems, the present invention

provides a card shoe apparatus including:

a card housing unit for housing a plurality of cards;

an opening unit for manually taking out cards one by one from the card housing unit;

a card reading unit that reads information of a card that is manually drawn out from the card housing unit onto a game table from that card;

a control unit that stores rules of a card game and determines the winning/losing of the card game according to the rules of the card game based on the information of a card read by the card reading unit;

a display unit that outputs a winning/losing result as determined by the control unit; and

a card entry/exit restriction means that is provided in the opening unit and restricts the entry/exit of a card from the card housing unit,

the card housing unit, the card reading unit, the control unit, the display unit and the card entry/exit restriction means being configured as a single unit,

wherein the card entry/exit restriction means includes:

1) a function of prohibiting the insertion of a card that is inserted from the exterior toward the card housing unit via the opening unit in an opposite direction ; and

2) a function of prohibiting, based on the information of a card read by the card reading unit, the drawing out of any additional card in a case where no additional card needs to be drawn out from the card housing unit.

[0007]

[Advantageous Effects of Invention]

With the present invention, it is possible to provide a card shoe apparatus and a table game system capable of preventing, on site, any fraudulent act such as the fraudulent insertion of cards into a card shoe apparatus, false or inappropriate dealing of cards, or the like.

[0008]

[Brief Description of Drawings]

[Fig. 1] Fig. 1 is a block diagram illustrating the entirety of a card shoe apparatus according to an embodiment of the present invention.

[Fig. 2] Fig. 2 shows an example of a card according to the embodiment of the present invention.

[Fig. 3] Fig. 3 is a plan view of a main portion of a card guide of the card shoe apparatus, with the card guide partially broken.

[Fig. 4] Fig. 4(a) is a cross-sectional view illustrating a main portion of a card entry/exit restriction means that restricts the entry/exit of cards from a card housing unit of the card shoe apparatus as viewed from the side, and Fig. 4(b) is a cross-sectional view illustrating a main portion of a variation of the card entry/exit restriction means that restricts the entry/exit of cards from a card housing unit of the card shoe apparatus as viewed from the side.
[Fig. 5] Fig. 5 is a diagram illustrating the relation between output waves from sensors and marks with the card shoe apparatus.
[Fig. 6] Fig. 6 is a side view illustrating of a card shoe apparatus according to an embodiment of the present invention.
[Fig. 7] Fig. 7 is a diagram illustrating irregularity in the arrangement order of the cards
[0009]
An embodiment of a table game system of the present invention will be described below in detail. Fig. 1 is a block diagram illustrating a card shoe apparatus, generally designated by reference number 304, for use in a table game system according to an exemplary embodiment of the present invention. Fig. 2 illustrates a card 301 that may be used in the table game system according to an exemplary embodiment of the present embodiment. The card 301 may be used in a table game such as baccarat. A code 302 may be disposed at the upper side and the lower side of the face of the card 301 in a point-symmetric manner. The code 302 may be composed of marks M that are invisible to the naked eye. Also, the card 301 includes an authenticity determination code 303 made up of coded information that indicates the authenticity of the card. The authenticity determination code 303 is arranged by printing or the like so as to be invisible to the naked eye, using, for example, ultraviolet reactive ink.
[0010]
The card shoe apparatus 304 includes a card guide unit 307 that guides cards 301 that are manually drawn out one by one from a card housing unit 305 onto a game table 306, a code reading unit 308 that reads, when a card 301 is manually drawn out from the card housing unit 305 by a dealer or the like of a casino, the code 302 that indicates a figure (number, rank) of that card 301, a winning/losing determination unit 310 that determines the winning/losing of the card game based on the numbers of the cards 301 sequentially read by the code reading unit 308, and an output means 311 that outputs the result of the

determination made by the winning/losing determination unit 310. The card guide unit 307 includes a card movement restriction means 330, 340 (to be described later) that restricts the movement of the card 301 from the card housing unit 305.

[0011]

Next, the code reading unit 308 that reads, from a card 301, the code 302 that indicates a figure (number, rank) of the card 301 when the card 301 is manually drawn out from the card housing unit 305 will be described in detail with reference to Fig. 3. The code reading unit 308 is provided in the card guide unit 307 that guides the cards 301 manually taken out one by one from an opening 313 onto the game table 306, with the opening 313 provided in a front portion of the card housing unit 305. The card guide unit 307 includes an inclined surface and a card guide 314 attached at an edge portion of each of both sides of the inclined surface, with the card guide 314 also serving as a sensor cover. The card guide 314 is configured to be attachable/detachable with screws or the like (not shown) so as to be replaceable. When a card guide 314 is removed, a sensor group 315 of the code reading portion 308 is exposed. The sensor group 315 is composed of four sensors, including two ultraviolet reactive sensors (UV sensors) 320 and 321, and object detection sensors 322 and 323.

[0012]

The object detection sensors 322 and 323 are optical fiber sensors that each detect the presence of the card 301, and are capable of detecting movement of the card 301. The object detection sensor 322 is placed in the upstream side of the card guide unit 307 with respect to the travel direction of the card 301 (indicated by the arrow S in FIG. 3) , and the object detection sensor 323 is placed in the downstream side of the card guide unit 307 with respect to the travel direction of the card 301. As shown in Fig. 3, the object detection sensors 322 and 323 are respectively provided in the upstream side and the downstream side of the UV sensors 320 and 321. The UV sensors 320 and 321 each include an LED (UV LED) that emits an ultraviolet ray and a detector. The marks M are printed on the card 301 in UV luminescent ink that emits color when UV ray is applied. The card 301 is irradiated with the UV ray (black light), and the detector detects the light reflected by the marks M of the code 302 of the card 301. The UV sensors 320 and 321 are connected to a control apparatus 312 of the code reading unit 308 via a cable. In the code reading

unit 308, the arrangement patterns of the marks M are determined based on the output signals from the detectors of the UV sensors 320 and 321, such that the number (rank) corresponding to the code 302 is determined.

[0013]

In the code reading unit 308, the start and end of the reading performed by the UV sensors 320 and 321 are controlled by the control apparatus 312 based on the detection signals from the object detection sensors 322 and 323. Also, the control apparatus 312 determines whether the card 301 has normally passed through the card guide unit 307 based on the detection signals from the object detection sensors 322 and 323. As shown in Fig. 2, the rectangular marks M are arranged within a framework of two rows with four columns on each of the upper and bottom edges of a card, and the arrangement of such marks indicates the rank (number) and the suit (Heart, Spade or the like) of the card. According to an exemplary embodiment, for each card, a mark M may either be present or absent at each of the predetermined locations within the framework of rows and columns depending on the particular mark and suit to be encoded. When the UV sensor(s) 320 and/or 321 detect(s) a mark M that is filled in, such UV sensor(s) output(s) an on signal, and when the UV sensor(s) 320 and/or 321 do not detect a mark M, an on signal is not generated. . In this way, the code reading unit 308 identifies the code based on the relative difference or the like between the two marks M detected by the two UV sensors 320 and 321, thereby identifying the number (rank) and the type (suit) of the corresponding card 301.

[0014]

The relation between the code 302 and the output of the on signals from the two UV sensors 320 and 321 are shown in Fig. 5. It is possible to identify a predetermined arrangement pattern of the marks M based on the comparison results of the relative changes in the output of the on signals from the UV sensors 320 and 321. As a result, in two rows (the upper and lower rows), four types of arrangement patterns of the mark M are possible, and since patterns are printed in four columns, it is possible to form 256 types of codes (4 x 4 x 4 x 4). Fifty two (52) playing cards are each assigned to one of the 256 codes, and the relations of such assignment are stored in memory 12M as an association table. A configuration is thereby adopted in which the card reading unit 308 can, by identifying the code 302, identify the number (rank) and the type (suit) of the card 301 based on that predetermined association table (not shown). It

should be appreciated that the assignment of a specific code of the 256 codes to each playing card does not need to be fixed, and in other exemplary embodiments of the invention each of the 52 cards can be freely associated with 52 codes out of the 256 codes to be stored in the association table, and thus a variety of associations are possible. Therefore, it is possible to change the associations between the 256 codes and 52 cards depending on the time or place. Preferably, the code is printed with a paint material that becomes visible when irradiated with UV ray, and placed in a position where it does not overlap the indications of the card types or indexes 402.

[0015]

An association table may be prepared by freely associating 52 codes out of the 256 codes with 52 cards, and a plurality of different association tables (ex. 1 to 10 or more tables) may be prepared in advance. If the code 302 does not match the code defined in the applicable association table, an error is detected and it is determined that cheating may have occurred.

[0015]

Next, the configuration of the control apparatus 312 will be described. The control apparatus 312, the code reading unit 308, the winning/losing determination unit 310 and the like are realized by a computer apparatus, and in particular a computer apparatus including at least a memory, at least a processor, and at least a non-transitory computer readable medium on which may be stored instructions that are read by the at least one processor to perform algorithms according to various exemplary embodiments of the present invention. . The numbers of cards sequentially taken out onto the game table 306 are acquired using the UV sensors 320 and 321 in the code reading unit 308, and the numbers of cards thus acquired are sequentially stored in a memory. At this time, information on which card 301 is dealt to which player is also stored. The number of each card is stored in association with the player to whom that card was dealt. In baccarat, there is a player and a banker. The rank (number) of the card dealt is stored in the memory in association with the player to whom it was dealt, and the ranks (number) of the cards dealt are added for each player, and the winner is determined based on the programmed rules. A "tie" is also judged. The winning/losing determination unit 310 determines the winning/losing of the card game based on the numbers of the cards 301 sequentially read by the code reading unit 308 and whether the game of this round is over. When the game of this round is over, an operator or

dealer is required to push a result key 360 on the side of a card shoe apparatus 304 to let the output means 311 output the result of the game.

[0017]

Next, the card movement restriction means 330 that restricts the movement of the card 301 to/from the card housing unit 305 will be described with reference to Figs. 4(a), 4(b) and 6. In Fig. 4(a), the card movement restriction means 330 is provided in the card guide 314 of the card guide unit 307 that guides the cards 301 taken out one by one from the opening 313, which is provided in a front portion of the card housing unit 305. The card movement restriction means 330 has a structure by which when a card 301 passes through a slot 333 between the card guide unit 307 and the card guide 314, a lock member 334 presses the card 301 to prohibit the movement of the card 301 within the slot 333. The lock member 334 is capable of moving in the direction indicated by the arrow M by a driving unit 335 composed of an electromagnetic solenoid, a piezoelectric device or the like, such that it can take two positions, namely, a position where the card 301 is pressed (restricted position) and a position where the card 301 is allowed to pass through. The driving unit 335 is controlled by the control apparatus 312, and causes the lock member 334 to move to two positions, namely, a position where the card 301 is pressed and a position where the card 301 is allowed to pass through. The rules of the baccarat game are programmed and stored in advance in the control apparatus 312.

[0018]

Next, an alternative embodiment of the card movement restriction means 330 will be described with reference to Fig. 4(b). According to this embodiment, a card movement restriction means 340 has a structure by which when a card 301 passes through the slot 333 between the card guide unit 307 and the card guide 314, a lock member 336 protrudes into the slot 333 to prohibit movement of the card 301. The lock member 336 is capable of moving in the direction indicated by the arrow M by a driving unit 337 composed of an electromagnetic solenoid, a piezoelectric device or the like, such that it can take two positions, namely, a position where movement of the card 301 is prohibited (restricted position) and a position where the card 301 is allowed to pass through. The driving unit 337 is controlled by the control apparatus 312, and causes the lock member 336 to move to two positions, namely, a position where movement of the card 301 is prohibited and a position where the card 301 is allowed to pass through.

[0019]
The card movement restriction means 330 (340) is caused to function as a result of the driving unit 335 or 337 being controlled by the control apparatus 312 to prevent the fraudulent movement of the card 301. The card movement restriction means 330 (340) is provided with the object detection sensors 322 and 323 as sensors for detecting movement of the card 301, and has a function of detecting movement of the card 301 with these sensors 322 and 323 to restrict the erroneous or fraudulent movement of a card. In this regard, the card movement restriction means 330 (340) may be controlled to prevent the movement of the card 301 in at least the following situations.
[0020]
1) When there is an attempt to draw a card at an inappropriate time. For example, the drawing of a card 301 from the card housing unit 305 may be prohibited when such drawing should not be allowed based on the information from the winning/losing determination unit 310. The winning/losing determination unit 310 determines the winning/losing of the card game based on the numbers of the cards 301 sequentially read by the code reading unit 308 and whether the game of the particular round is over. When the round is over, the dealer must push a result key 360 on the side of a card shoe apparatus 304 to instruct the output means 311 to output the result of the game. However, the dealer may attempt to withdraw a card after the round is over and before pushing the result key 360, in which case an overdraw error may be detected and the attempted withdrawal of the card may be prohibited by the card movement restriction means 330(340). In particular, when the object detection sensors 322 detects a card (Fig. 3), the card movement restriction means 330 (340) may be controlled to prohibit the drawing of a card 301 from the card housing unit 305 when such drawing should not be allowed. Since there is some distance between the position of the object detection sensors 322 and the position of the card movement restriction means 330 (340), there is enough time between when the object detection sensors 322 detects erroneous movement of a card and when the driving unit 335 or 337 begins operation to restrict the card from drawing further.
[0021]
2) When the card stands still (stops) at predetermined period of time at the opening of the card housing unit. For example, when the object detection sensors 322 detects a card is being held in the card guide unit 307 for longer

than a predetermined time, an error signal may be generated and, based on the error signal, the card movement restriction means 330(340) may prohibit further movement of the card. In this regard, a timer (not shown) may be activated when the object detection sensors 322 detect the card, and once the timer reaches a predetermined count, the card movement restriction means 330(340) may be controlled to prohibit further card movement.

[0022]

3) When a card 301 is inserted from the exterior toward the card housing unit via the opening unit in a reverse direction, opposite to the direction of the arrow S, namely, from the exterior toward the card housing unit 305 via the opening 313. In this case, although the card 301 inserted for the purpose of cheating passes through the slot 333 between the card guide unit 307 and the card guide 314, the movement of the card 301 in a direction opposite to the normal direction (the direction opposite to the arrow S in Fig. 3) is detected based on the detection signals from the object detection sensors 322 and 323. The driving units 335 or 337 may then move their corresponding lock members 334 or 336 to their respective positions of pressing or blocking the card 301, respectively.

[0023]

4) When a card is misread. For example, the card movement restriction means 330(340) may be controlled to prohibit movement of a card when the code reading unit 308 is unable to identify a code 302 on the card, such as when a code is not present on the card or when the code is present but does not correspond to any code within a code association table. A misreading error may also occur when it is detected that the card has not normally passed along the card guide unit 307 or has slipped back.

[0024]

5) When an authenticity determination code detected by authenticity determination code sensor placed in the card guide unit 307 does not match the predetermined proper authenticity determination code. In this regard, a card 301 may be provided with an authenticity determination code 303 that is configured by encoding information that represents the group of the card. For example, card sets may be assigned a group code depending on the particular casino, casino group, casino location, geographical areas or countries in which the cards are intended for use. The authenticity determination code may be printed using, for example, UV ink, so as to be invisible to the naked eye, and is

provided in the same position in at least the cards of the same set (i.e., all cards to be used at the same casino). The authenticity determination code 303 is made of a substance or material itself that emits, as a code, light rays of different wavelength spectra when irradiated with light rays. An authenticity determination code corresponding to a particular set of cards used in a card game may be stored in the memory unit and referred to by the control unit 312. Accordingly, the authenticity determination code 303 on a card can be read by the code reading unit 308 (sensor 324) and compared to the stored authenticity determination code. If there is a mismatch between the stored code and the code on the card, the card movement restriction means 330(340) may be activated to prohibit further movement of the card.

[0026]

5) when an authenticity determination code detected by authenticity determination code sensor placed in the card guide unit 307 does not match the predetermined proper authenticity determination code. In this regard, a card 301 may be provided with an authenticity determination code 303 that is configured by encoding information that represents the group of the card. The authenticity determination code may be printed using, for example, UV ink, so as to be invisible to the naked eye, and is provided in the same position in at least the cards of the same set. The authenticity determination code 303 is made of a substance or material itself that emits, as a code, light rays of different wavelength spectra when irradiated with light rays. An authenticity determination code corresponding to a particular set of cards used in a card game may be stored in the memory unit and referred to by the control unit 312. Accordingly, the authenticity determination code 303 on a card can be read by the code reading unit 308 (sensor 324) and compared to the stored authenticity determination code. If there is a mismatch between the stored code and the code on the card, the card movement restriction means 330(340) may be activated to prohibit further movement of the card.

[0027]

The drawing of a card 301 from the card housing unit 305 may be prohibited when (1) the code 302 read by the code reading unit 308 does not match the code defined in the association table and (2) the authenticity determination code 303 detected by the authenticity determination code sensor 324 placed in the upstream side of the card guide unit 307 does not match the predetermined proper authenticity determination code. The presence of at least one of these

conditions may be indicative of cheating, and an error signal may be generated so that the card movement restriction means 330 (340) is operated to prevent further movement of a card.

[0028]

Upon operation of the card movement restriction means 330(340), an error signal output means 350 disposed on the card housing unit 305 may provide an external signal indicating that an error has occurred. The error signal output means 350 may include, for example, a lamp and/or an audible alarm.

[0029]

According to an exemplary embodiment of the present invention, the card shoe apparatus 304 may detect an irregularity in the manner in which the cards are shuffled and in some cases generate an alert and/or prohibit removal of cards from the card housing unit 305 based on the detected irregularity. In this regard, the information collected by the card reading unit 308 as the cards are drawn from the card housing unit 305 may be used to determine whether the cards have been shuffled improperly. An irregularity in the arrangement order of the cards will be described with reference to Figs. 7(a) and 7(b). Fig. 7(a) shows an example where the cards 301 drawn from the card housing unit 305 have the same suit (Clubs) with sequential figures (number, rank) beginning from Ace. Fig. 7(b) shows an example where the cards 301 drawn from the card housing unit 305 consist of 9 cards with the same rank (3). Generally, the cards 301 are shuffled by a random number generator or the like so as to be arranged in a random order. The arrangement of the cards 301 shown in Figs. 7(a) and 7(b) is substantially non-random, thus indicating an irregular shuffling of the playing cards 301.

[0030]

Other examples of card arrangements which may indicate a shuffling irregularity include:

(a) a case in which a predetermined number of cards within a set of cards exhibit a pattern in which the rank of a card is larger (or smaller) by one as compared to compared to the rank of the preceding card (for example, 1, 2, 3, 4, ---, K) (as shown in Fig. 7(a));

(b) a case where a predetermined number of cards in sequence have the same rank (for example, A, A, A, A, ---) (as shown in Fig. 7(b));

(c) a case where the same sequence is repeated throughout a predetermined number of cards (for example, A, Q, 10, A, Q, 10, ---);

(d) a case where a predetermined number of cards in sequence have the same suit (for example, 13 consecutive cards with Hearts);
(e) a case in which a predetermined number of cards in each of two or more sets of cards have the same sequence of suit and rank (A,5,Q,J,2,8,9,K,---). In particular, for each card game, a different set of cards may be housed in the card shoe apparatus 304. A shuffling irregularity may be detected if a predetermined number of cards in a later-used set match the same predetermined number of cards in an earlier-used set in terms of suit and/or rank sequence; and
(f) a case where the order of a predetermined number of cards matches an order registered in advance (for example, where the order of the cards matches the order of cards used in a separate card manufacturing process).
Irregular shuffling patterns (such as examples (a) - (d)) as well as the sequence of suit and rank (e.g., A,5,Q,J,2,8,9,K,---) of card sets previously housed in the card shoe apparatus 304 may be stored in the memory 312M , and the control unit 312 may use this stored information to determine whether irregular shuffling has occurred. For example, irregular shuffling may be determined if the order of a predetermined number of cards 301 within a set matches at least a portion of the stored patterns . In another example, irregular shuffling may be determined if a number of card sets each used in one of a predetermined number of games include a predetermined number of cards that match the stored patterns.
[0031]
As another example, a shuffling irregularity may be determined when each deck of cards within a set of cards is detected to be shuffled in the same or substantially similar way. For example, a shuffling irregularity may be detected when, for a plurality of cards, the suit and rank of each card drawn are the same as those of the card preceding it by 52 cards. In such a case, shuffling of a plurality of decks has failed for some reason, and instead each of the 52 cards is arranged in the same order.
[0032]
In general, a shuffling irregularity may be detected when a stored pattern continues throughout a predetermined number of cards. In this regard, a preliminary alarm of irregularity may be generated at some point prior to the stored pattern being detected in all of the predetermined number of cards. For example, a preliminary alarm may be generated upon the drawing of a card that

is several cards before the end of a predetermined number of cards. The preliminary alarm may be in a form different from the final alarm, for example, by characters, in a certain color, or with a different lamp. In an exemplary embodiment, if a state does not continue to be irregular throughout a predetermined number of cards and returns to a random state, then the preliminary alarm may be cancelled.

[0033]

If a shuffling irregularity is detected, a final alarm may be generated and the control unit 312 may operate the card movement restriction means 330(340) to restrict movement of the card 301 relative to the opening 313 in the card housing unit 305.

[0034]

The preferred embodiment of the invention has been described hitherto. However, it is natural that the invention is not limited to the above-described embodiment, but persons skilled in the art can alter the above-described embodiment within the scope of the invention.

Claims

1. A method of delivering cards from a card housing unit during a card game, the card housing unit having (i) a guide unit in which the cards are manually moved, and (ii) an opening from which the cards are manually drawn one by one and, the method comprising:

detecting

a card which is located at the opening for a period of time longer than a predetermined period of time, or

a manual attempt drawing of a card from the opening after the card game ends; and

outputting a signal of a result of the detection for preventing further delivery of the cards.

2. The method of claim 1, wherein the card housing unit further has (iii) a lock member selectively restricting the manual movement of the cards in the guide unit near the opening, the method further comprising:

based on the signal of the result of detection, controlling the lock member to restrict the manual movement of the card.

3. The method of claim 2, further comprising:

obtaining card information related to each of the cards manually drawn from the opening; and

based on the detected information, controlling the lock member to restrict the manual movement of the card.

4. The method of claim 2, wherein

the card information includes a code on each of the cards that indicates at least one of a number and a suit of the card.

5. The method of claim 3, further comprising:

comparing the code read in the obtained step with a predetermined code stored in a memory.

6. The method of claim 2, wherein

the card information includes an authenticity determination code on

each of the cards.

7. The method of claim 5, further comprising:

comparing the authenticity determination code read in the obtained step with a predetermined authenticity determination code stored in a memory.

8. A method of delivering cards from a card housing unit during a card game, the card housing unit having (i) a guide unit in which the cards are manually moved, and (ii) an opening from which the cards are manually drawn one by one, the method comprising:

detecting an inappropriate attempt at manually drawing a card from the opening; and

outputting a signal of a result of the detection for preventing further drawing of the card through the opening.

9. The method of claim 8, wherein

the inappropriate attempt is an action of manually drawing a card from the opening after the card game ends.