estimate the deck penetration to increase bets if the last portion of the shoe is rich in high value cards.

Automatic card shufflers that process relatively large groups of cards, such as eight or more decks, in a single shuffling cycle suffer from having long duration shuffling cycles as compared to a single deck, hand-forming shuffler, for example. For this reason, it is common for a casino to use two complete sets of cards on games administered from a shoe. The casino typically uses a batch-type card shuffler to prepare cards for loading into the shoe while the other set of cards is in play. Even though there is typically sufficient time to perform a shuffle using two sets of cards, it is desirable for the shuffler to perform its operations as swiftly as possible so that the next set of cards is ready for use in the event that the house requires the dealer to change shoes on short notice. The dealer also may decide to change cards long before the cut card is drawn if he or she suspects players have been counting cards or cheating in other ways. If the next group of cards is not yet completely shuffled, the game may be delayed. Any delay in shuffling can cause a revenue loss for the casino, and should generally be avoided.

Modern shufflers contain many security features to assure that the set of shuffled cards is complete and adequately shuffled. For example, modern shufflers perform a count of shuffled cards to verify the set is complete. Some newer shufflers read the rank and suit of each card shuffled to verify that the card set composition is correct. If the shuffler stops shuffling for any reason, such as detecting extra or fewer cards in the set, or due to a shuffler malfunction, the game may be delayed, and revenue can be lost. Although it is desirable to stop a game that is using an invalid set of cards for security reasons, there are other reasons why a game might be delayed, such as when a shuffler malfunctions, or the shuffler aborts the shuffle because of unreadable cards. When a shuffler with card recognition is employed in a casino, it may have a card recognition system that is trained to only read card faces. If the card reader attempts to read a flipped card that exposes the card back to the reader, the card reader may fail to recognize the card. Other card reading systems may be trained to recognize a card back so that when a card is flipped and the card back is read, the system may generate a signal indicating that a card is flipped over. Flipped cards and unrecognized cards typically cause the machine to abort the entire shuffle. Any time a shuffle is aborted, the game can be delayed, causing revenue loss for the casino.

Summary

In an aspect, there is a card-handling device comprising:

a card intake configured to receive one or more playing cards;

a card output configured to provide at least one of the one or more playing cards;

a playing card-shuffling apparatus positioned along a card path through the card-handling device and configured to randomize at least some of the one or more playing cards; and

a card rotation device configured to rotate at least one of the one or more playing cards about a minor axis of the one or more playing cards to randomly alter an orientation of lateral width edges of the one or more playing cards, the minor axis of the one or more playing cards extending through a thickness of the at least one of the one or more playing cards in a direction transverse to a longitudinal axis and a lateral axis thereof.

In an aspect, there is a card-handling device comprising:

a card intake configured to receive one or more playing cards;

a card output configured to provide at least one of the one or more playing cards; and

a card rotation device positioned in at least one location selected from the group consisting of a card intake, a card output, or along a card path between the card intake and the card output and configured to rotate at least one of the one or more playing cards about a minor axis of the one or more playing cards to randomly alter an orientation of one or more lateral width edges of the one or more playing cards, the minor axis of the one or more playing cards extending through a thickness of the one or more playing cards in a direction transverse to a longitudinal axis and a lateral axis of the one or more playing cards.

In an aspect, there is method of deterring card edge pattern cheating, comprising:

receiving cards in a card-handling device;

transporting the cards between a card rotation device and a card-shuffling apparatus;

rotating the cards with the card rotation device from a first, initial orientation to a second orientation about a minor axis of the cards after one or more cards are received in the card rotation device to alter an orientation of lateral width edges of the cards, the minor axis of the cards extending through a thickness of the cards in a direction transverse to a longitudinal axis and a lateral axis of the cards to randomize the orientation of the lateral width edges of the cards;

shuffling an order of the cards in the card-shuffling apparatus; and

outputting at least one card to a card output area after the at least one card has been transported through both the card rotation device and the card-shuffling apparatus.

There is a method of altering an orientation of cards being shuffled in an automatic card shuffler, comprising:

providing an automatic card shuffler with a card intake, a card outlet, a card shuffling apparatus, a card path between the card intake and the card output, a card imaging system, at least one processor configured to control the card imaging system, and to operate the card shuffler, wherein the card shuffling apparatus comprises multiple compartments;

receiving a plurality of cards in the card intake, the cards arranged in a stack wherein cards are generally arranged with card faces in a face to back orientation;

automatically feeding each card individually from the stack along the card path and inserting the card into one of the multiple compartments of the card shuffling apparatus;

reading card face information of each card as the card is being fed with the card imaging system;

identifying unreadable cards, wherein unreadable cards include cards that lack card face information from the card imaging system;

inserting the unreadable cards into at least one designated compartment in the card shuffling apparatus;

randomly inserting each card not identified as unreadable into a randomly selected compartment;

unloading all cards except the cards in the at least one designed compartment into the card outlet, forming a stack of cards, wherein each card in the stack of cards is oriented in the face-to-back orientation; and

unloading the unreadable cards from the at least one designated compartment.

There is a card-handling device comprising:

a card intake configured to receive playing cards;

a card output configured to provide at least one of the playing cards;

a playing card-shuffling apparatus positioned along a card path through the card-handling and configured to randomize at least some of the playing cards, the playing card-shuffling apparatus comprising multiple compartments; and

a card-imaging system positioned along the card path and configured to image a surface of the playing cards;

wherein the card imaging system is configured to recognize card face information and identify one or more unreadable playing cards, wherein the one or more unreadable playing cards comprise playing cards that do not include card face information on the surface of the playing cards oriented toward the card imaging system;

wherein the playing card-shuffling apparatus is configured to receive the one or more unreadable playing cards in at least one designated compartment selected from the multiple compartments.

DISCLOSURE

CLAIMS

What is claimed is:

1. A card-handling device comprising:

a card intake configured to receive one or more playing cards;

a card output configured to provide at least one of the one or more playing cards;

a playing card-shuffling apparatus positioned along a card path through the card-handling device and configured to randomize at least some of the one or more playing cards; and

a card rotation device configured to rotate at least one of the one or more playing cards about a minor axis of the one or more playing cards to randomly alter an orientation of lateral width edges of the one or more playing cards, the minor axis of the one or more playing cards extending through a thickness of the at least one of the one or more playing cards in a direction transverse to a longitudinal axis and a lateral axis thereof.

2. The card-handling device of claim 1, wherein the location of the card rotation device is selected from the group consisting of a card intake, a card output, or along the card path between the card intake and the card output.

3. The card-handling device of claim 1, wherein one of the card intake or the card output comprises the card rotation device.

4. The card-handling device of claim 1, wherein the one or more playing cards each comprise first lateral width edges and second, parallel and opposing lateral width edges, and the card-handling device is configured to position the card rotation device in a first orientation with the first lateral width edges of the one or more playing cards facing the playing card-shuffling apparatus and a second orientation with the second lateral width edges of the one or more playing cards facing the playing card-shuffling apparatus.

5. The card-handling device of claim 1, wherein the card path is partially defined by a series of rollers.

6. The card-handling device of claim 5, wherein the card rotation device comprises at least two rollers of the series of rollers, wherein the at least two rollers are separated by a distance less than a width of the one or more playing cards and the at least two rollers are configured to each contact a surface of a playing card of the one or more playing cards as the playing card passes through the card rotation device and rotate the at least two rollers in opposing directions causing the playing card to rotate about the minor axis of the playing card.

7. The card-handling device of claim 1, wherein the card rotation device is configured to receive the one or more playing cards after the one or more playing cards have been randomized by the playing card-shuffling apparatus.

8. The card-handling device of claim 1, wherein the card rotation device is controlled by an algorithm configured to initiate rotation of the card rotation device 180 degrees after a specified interval.

9. The card-handling device of claim 8, wherein the algorithm is configured to change the specified interval after each rotation.

10. The card-handling device of claim 8, wherein the algorithm is configured to retain the specified interval at a same value after each rotation.

11. The card-handling device of claim 8, wherein the specified interval is a number of playing cards between about 1 playing card and about 10 playing cards.

12. A card-handling device comprising:

a card intake configured to receive one or more playing cards;

a card output configured to provide at least one of the one or more playing cards; and

a card rotation device positioned in at least one location selected from the group consisting of a card intake, a card output, or along a card path between the card intake and the card output and configured to rotate at least one of the one or more playing cards about a minor axis of the one or more playing cards to randomly alter an orientation of one or more lateral width edges of the one or more playing cards, the minor axis of the one or more

playing cards extending through a thickness of the one or more playing cards in a direction transverse to a longitudinal axis and a lateral axis of the one or more playing cards.

13. The card-handling device of claim 12, further comprising a playing card-shuffling apparatus positioned along the card path between the card intake and the card output and configured to randomize at least some of the one or more playing cards.

14. A method of deterring card edge pattern cheating, comprising:

receiving cards in a card-handling device;

transporting the cards between a card rotation device and a card-shuffling apparatus;

rotating the cards with the card rotation device from a first, initial orientation to a second orientation about a minor axis of the cards after one or more cards are received in the card rotation device to alter an orientation of lateral width edges of the cards, the minor axis of the cards extending through a thickness of the cards in a direction transverse to a longitudinal axis and a lateral axis of the cards to randomize the orientation of the lateral width edges of the cards;

shuffling an order of the cards in the card-shuffling apparatus; and

outputting at least one card to a card output area after the at least one card has been transported through both the card rotation device and the card-shuffling apparatus.

15. The method of claim 14, further comprising inputting the cards into the card rotation device and transporting the cards from the card rotation device to the card-shuffling apparatus after the cards are handled by the card rotation device.

16. The method of claim 14, further comprising inputting the cards into the card-shuffling apparatus and transporting the cards from the card-shuffling apparatus to the card rotation device after the cards are handled by the card-shuffling apparatus.

17. The method of claim 14, wherein rotating the cards comprises rotating the cards from the first orientation to the second orientation after a first specified number of cards are removed from the card rotation device in the first orientation and removing cards from the card rotation device in the first orientation after a second specified number of cards are removed from the card rotation device in the second orientation.

18. The method of claim 17, wherein the first specified number of cards and the second specified number of cards are substantially the same.

19. The method of claim 14, wherein rotating the cards further comprises rotating the at least one card using one or more sets of opposing rollers.

20. The method of claim 19, wherein rotating the at least one card comprises rotating the opposing rollers in opposite directions and transporting the at least one card between the card rotation device and the card-shuffling apparatus comprises rotating the opposing rollers in a same direction.